Toward a global risk map

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BIS

3 Motivating questions

*1, How can a **central bank** monitor the global use of its currency?*

- If there is to be an international LLR, how much of each currency should it pile up?
- If not, what is the size of the funding requests that I would face in a crisis? From whom?

*2, What data could help **financial markets** discipline themselves?*

- Did euro-dollar swap spreads reflect all systemic risks?
- Did interbank funding markets have all necessary information to price loans properly?

*3, What data do **policy makers** need to see cross-border risks to the economy?*

- How reliant on cross-border funds are my corporate borrowers? How stable is it?
- How similar are the portfolios of institutions in my country to those in other countries?
- Are there clustered exposures or crowded trades?

Briefly: What are the BIS international banking statistics?

- Actually, 4 different datasets …
  1. LBSR: Locational by residency
  2. LBSN: Locational by nationality
  3. CBS_IB: Consolidated on immediate borrower basis (IB basis)
  4. CBS_UR: Consolidated on ultimate risk basis (UR basis)

- What's in there (generally speaking)?
  - Banks' on-balance sheet foreign asset and liability positions
    - Aggregated at the "country" level (ie no bank level data)
  - Positions broken down by:
    - Location (country) of counterparty ("Vis-à-vis country")
    - Sector of counterparty (eg bank/non-bank…. differs by dataset)
    - Info on currency, residual maturity, and "off-balance sheet" positions

Question 1: Maturity transformation in each currency

- Components of "effective maturity mismatch"

$$EMM_{i,t} = f(\ell_t, M_t^A, \delta_t, M_t^L, r_t)$$

- Where
  - ℓ = "liquidity" of assets (can they be sold?)
  - M^A, M^L = maturity of assets and liabilities
  - δ = maturity of off-balance sheet hedges (FX swaps)
  - r = "rollover risk"

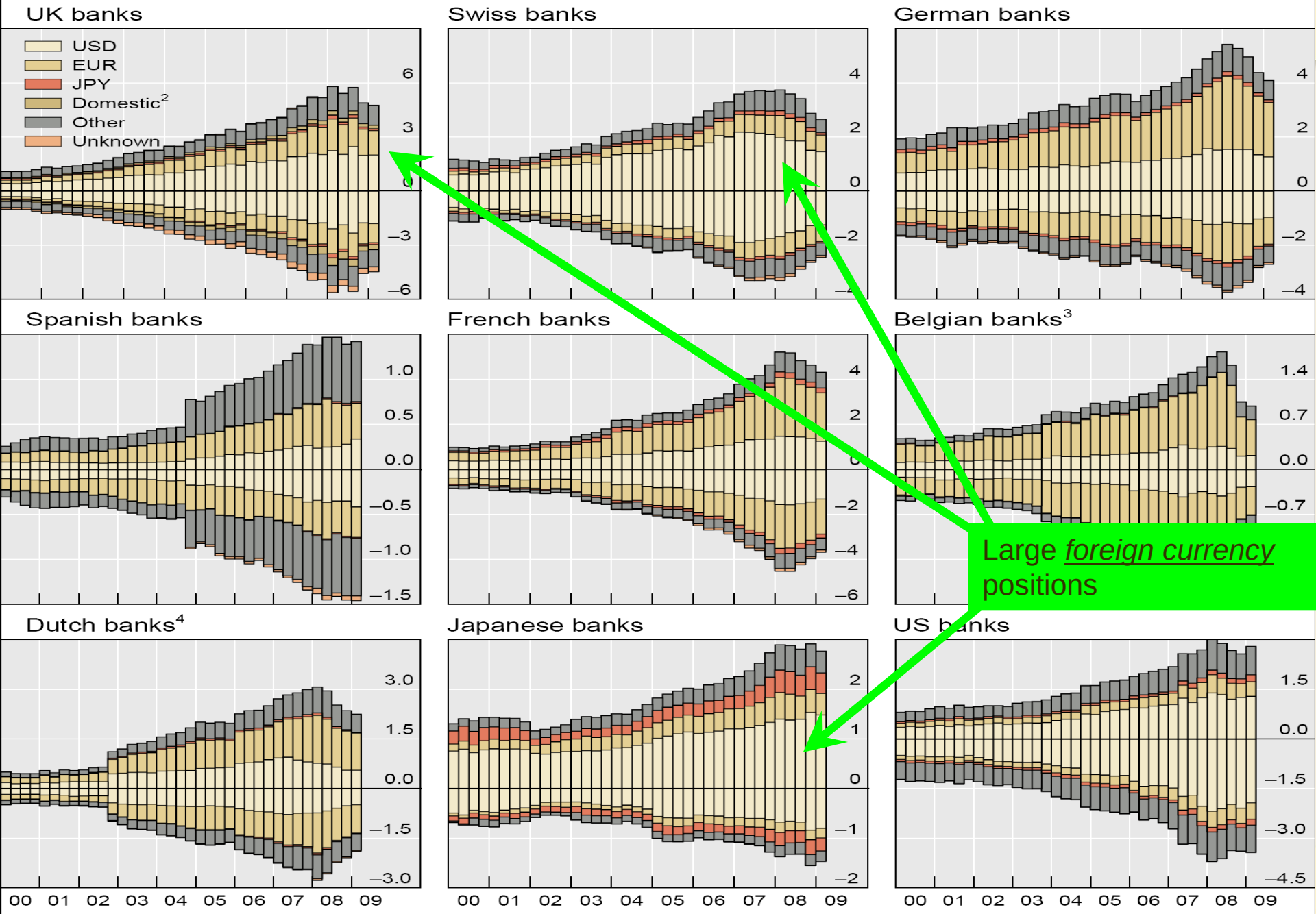
- Measurement at aggregate level requires information on
  - Consolidated balance sheet
  - Currency, maturity, counterparty type, instrument type
  - Full measure requires a *combination* of data

Question 1: Reconstructing banks' global balance sheets

- Splice the BIS *consolidated* and the *nationality* statistics
- Provides for each banking system…
  - Total foreign assets and liabilities
  - Broken down by currency
  - Broken down by counterparty-sector
- Can be used to construct indicators of maturity mismatch
  - For each consolidated banking system
  - In each currency
- What does this look like?

Gross foreign assets and liabilities, by currency[1]

In trillions of US dollars



Question 1: How did banks finance this asset expansion?

- Three ways to finance foreign currency investments

1. Borrow domestic currency → FX spot → buy US dollar asset
   - On-balance sheet mismatch: currency risk

2. Borrow domestic → FX swap → buy USD asset
   - roll over swap at maturity

3. Borrow foreign currency → buy USD asset
   - Reliance on interbank market or funding from non-banks

- Banks needs to **deliver USD** when contractual liabilities come due.

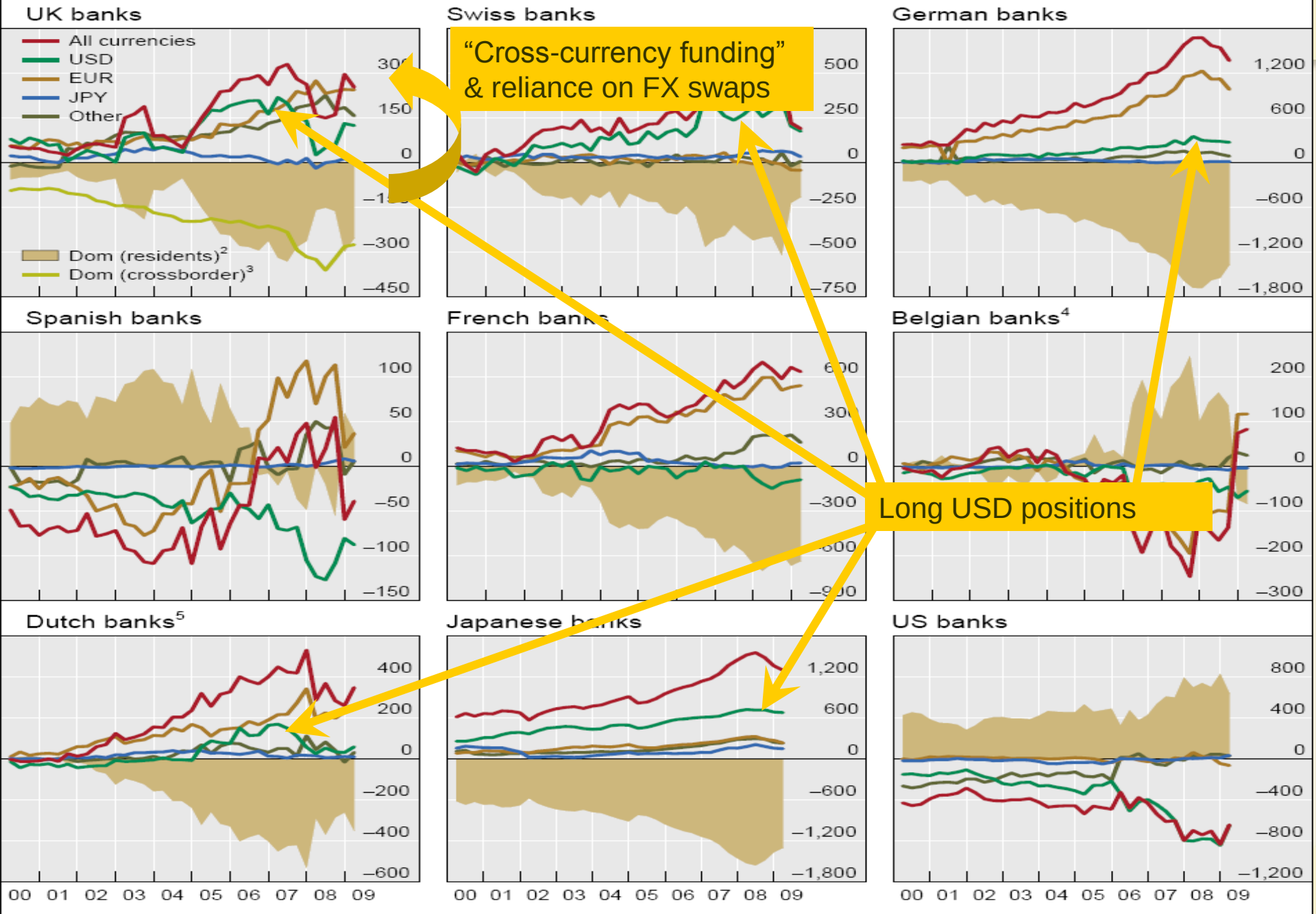
  → Roll over risk

- ***Foreign currency funding gap***

  → if inv. horizon of FX assets > maturity of funding or FX swaps

Net foreign positions, by currency[1]

In billions of US dollars



Question 1: The "US dollar funding gap" as an example

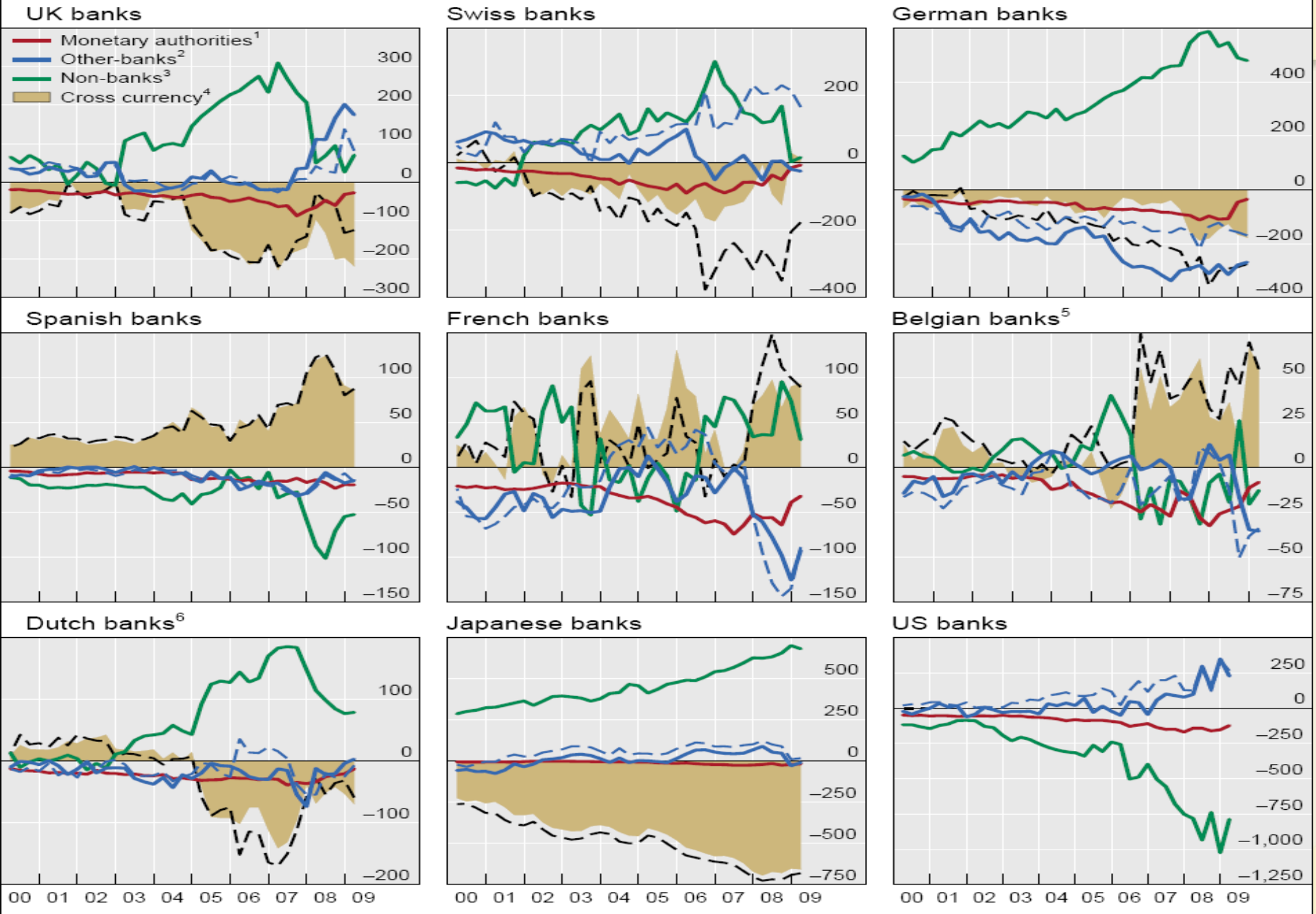
- US dollar funding gap = LT USD assets ***not*** funded by LT USD liabilities
  - …since this is the amount of liabilities that must be rollled over

- Problem: incomplete data on maturity (nothing for liabilities)

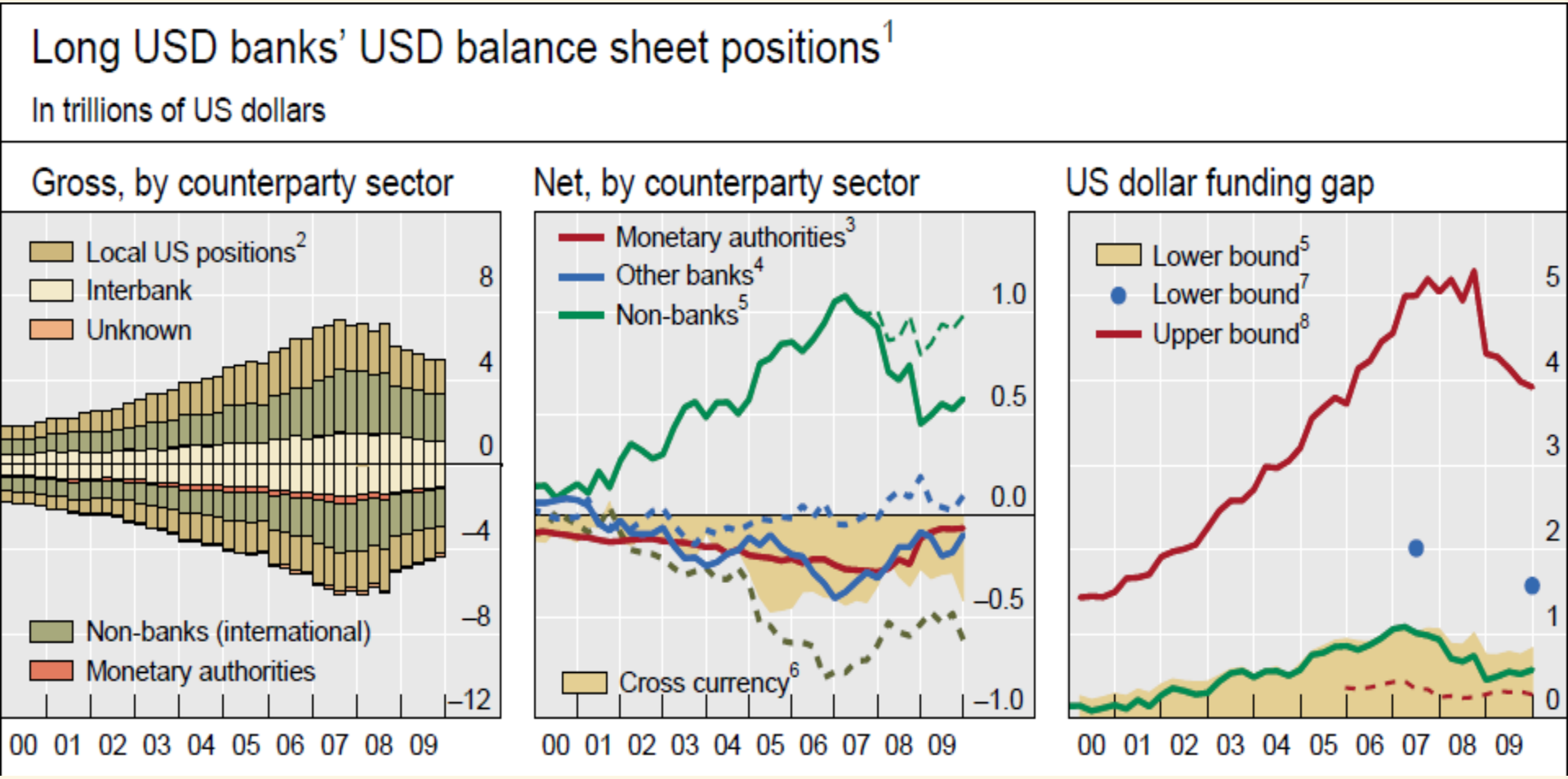
- Solution: Use *counterparty sector breakdown* as proxy for maturity
  - Gross interbank claims/liabilities are short term
  - FX swaps are short term (even if actual liabilities are long term)
  - Funding from OMAs is has unknown maturity
  - Gross ***claims*** on non-banks are long term ("desired investment portfolio")
  - Gross ***liabilities*** to non-banks?
    - If LT ➔ USD funding gap lower bound = ***net claims on non-banks***
    - If ST ➔ USD funding gap upper bound = ***gross claims on non-banks***

Net US dollar-denominated foreign positions, by counterparty sector

In billions of US dollars



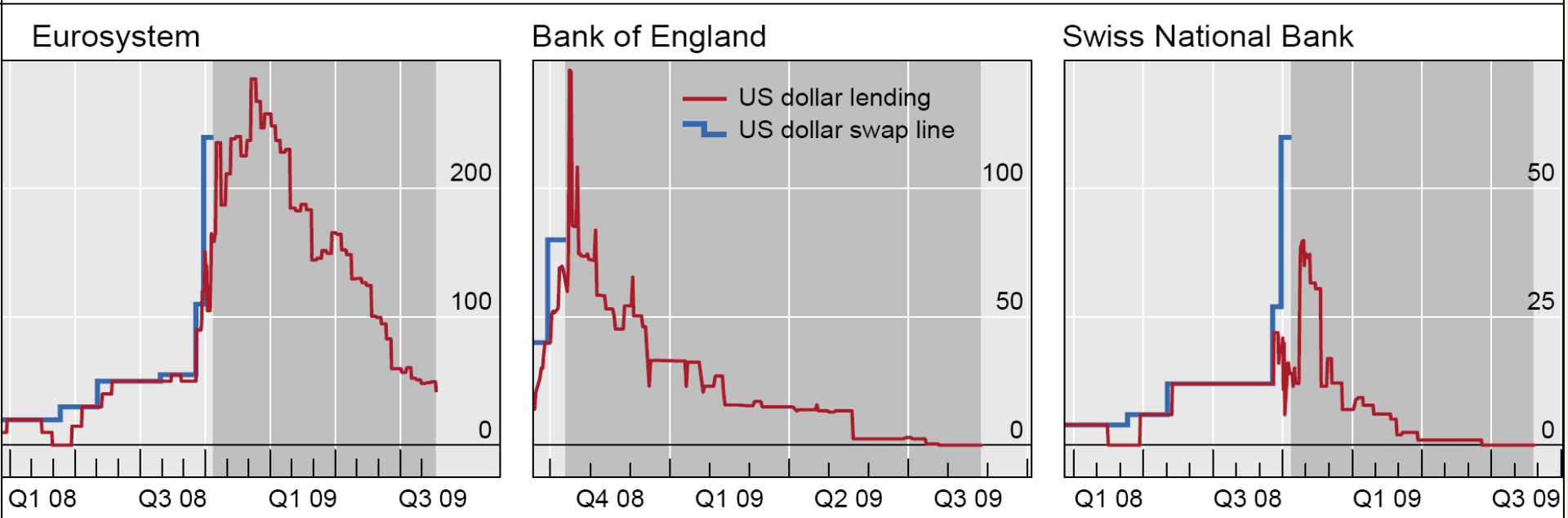
Question 1: Aggregate funding risk in US dollars



Question 1: Central bank swap lines to the rescue

Central banks' US dollar swap lines[1]

In billions



[1] Amounts outstanding are constructed by cumulating US dollar auction allotments, taking into account the term to maturity. The shaded area indicates the period of unlimited swap lines (as of 13 October 2008).

Source: Central banks.

Figure 8

Question 1: Measuring aggregate maturity transformation

$$EMM_{i,t} = f(\ell, M^A, \delta, M^L, r)$$

- Requires a ***combination*** of information on
  currency, maturity, counterparty type, instrument type,

  - Residual *maturity breakdown:*
    at least three buckets: ***<1 year, 1-2 years, >2 years***

  - Refined *counterparty sector breakdown*
    Banks ***Public Sector*** ***Central Banks***
    Non-bank Financials ***Corporate*** ***Households***

  - Even better:

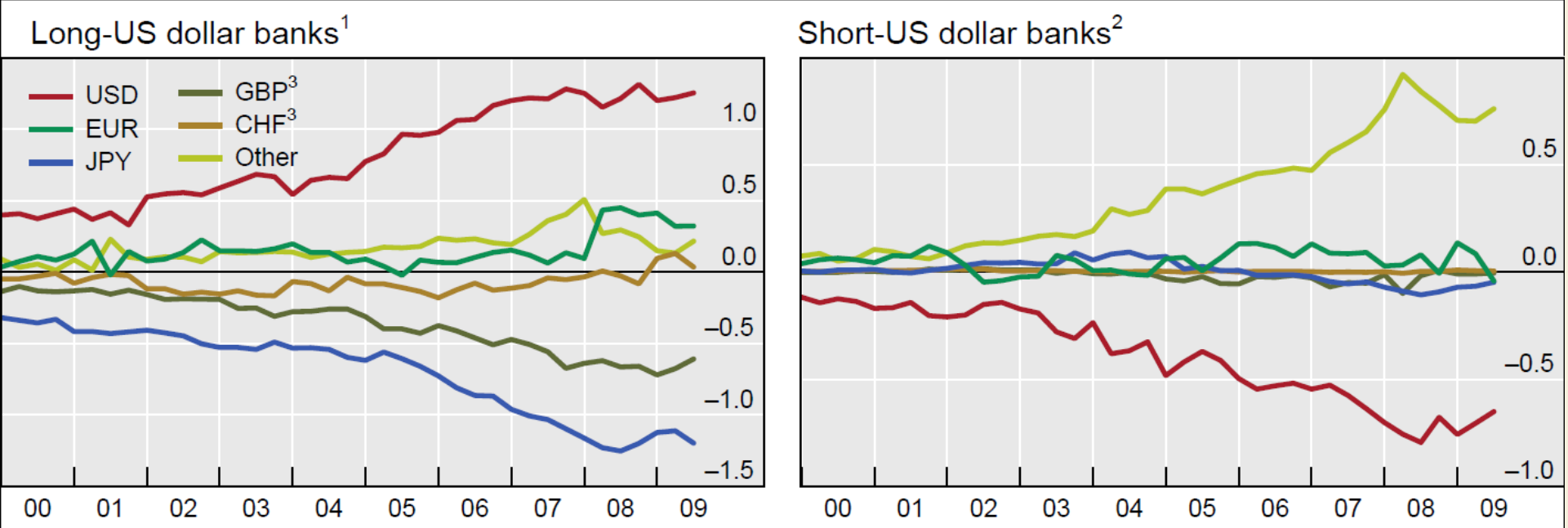
  N*on-bank fin* = hedge funds, insurance, pension funds, other

  - Refined *instrument breakdown:* (loan vs debt security vs equity)

Question 2: How can markets price risks they cannot see?

Short- and long-US dollar banks' net FX swap positions, by currency

In trillions of US dollars



[1] Includes Canadian, Dutch, German, Japanese, Swiss and UK banks. [2] Includes Australian, Belgian, Danish, Spanish, Finnish, French, Italian, Luxembourgian, Norwegian, Portuguese, Swedish, Hong Kong, Greek, Turkish and Taiwanese banks. [3] Positions booked by offices located in Switzerland (for CHF) and in the United Kingdom (for GBP). CHF and GBP positions reported by offices located elsewhere are included in "Other".

Sources: BIS consolidated statistics (immediate borrower and ultimate risk basis); BIS locational statistics by nationality; BIS calculations.

Graph 6

Question 3: International transmission of shocks

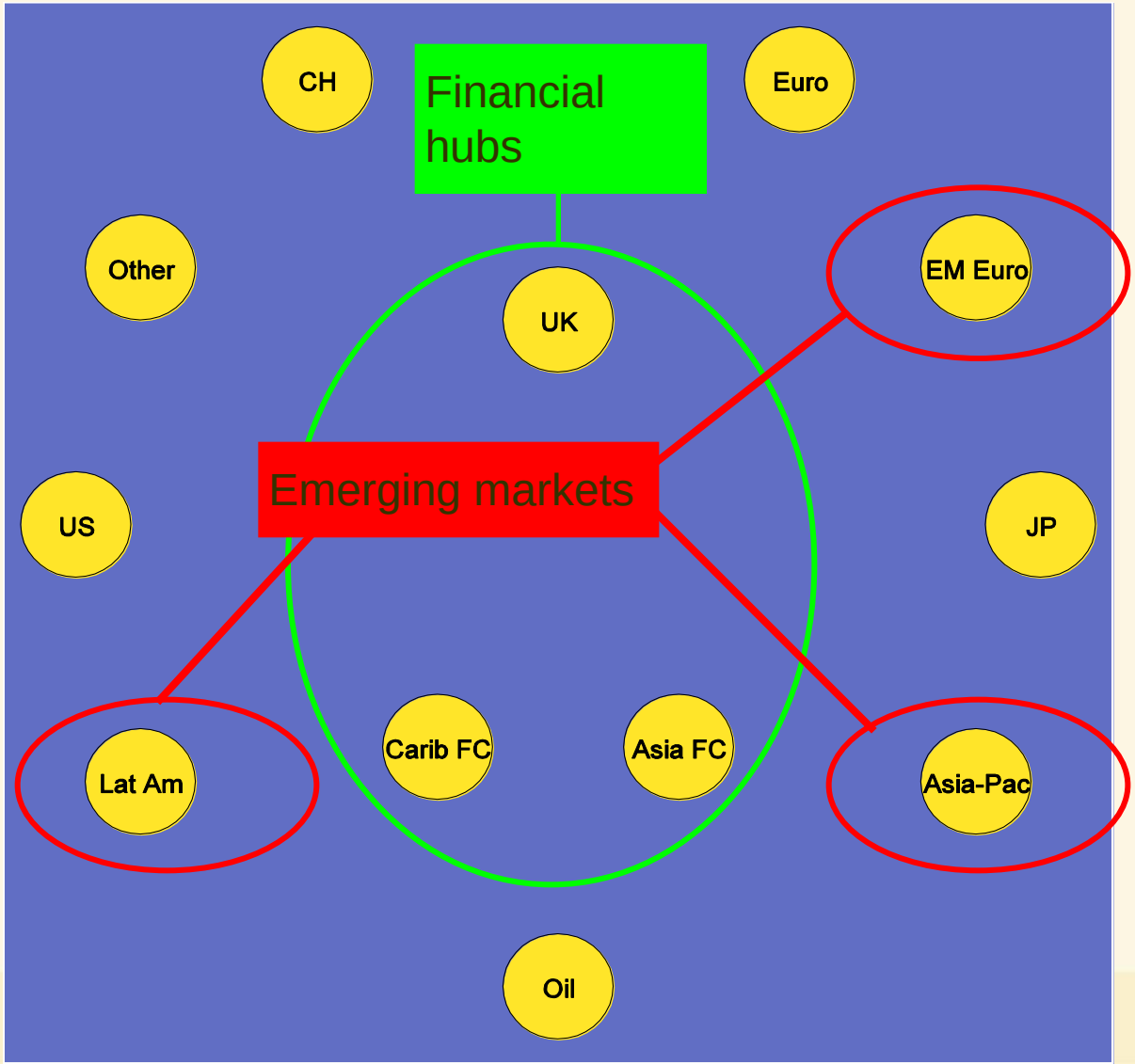
- Suppose a banking system experiences a shock.

- Is transmission through cascading defaults via bilateral exposures?
  - maybe

- Is transmission through a collapse in cross-border lending?
  - definitely

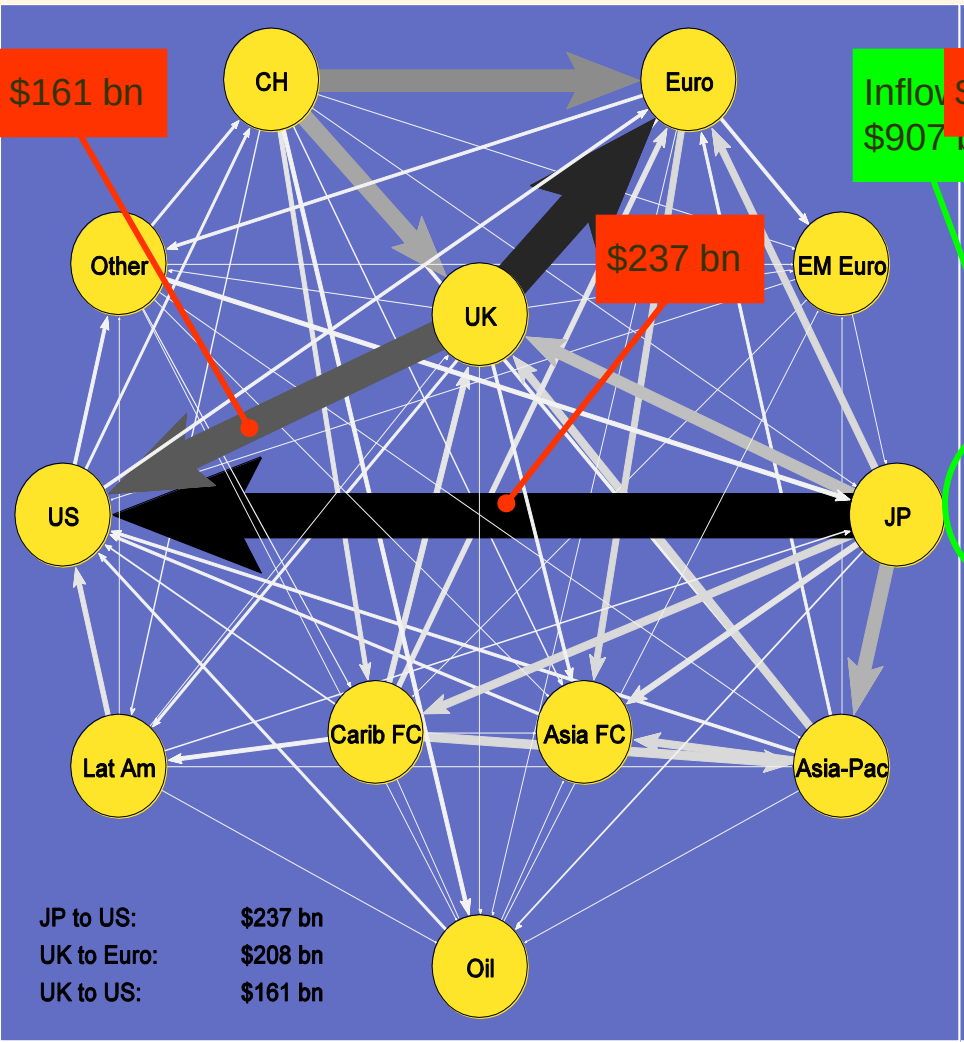
- Which *borrower countries* would be most at risk?
  - Answer requires ***joint consolidated and residency*** reporting

Question 3: The Residency view

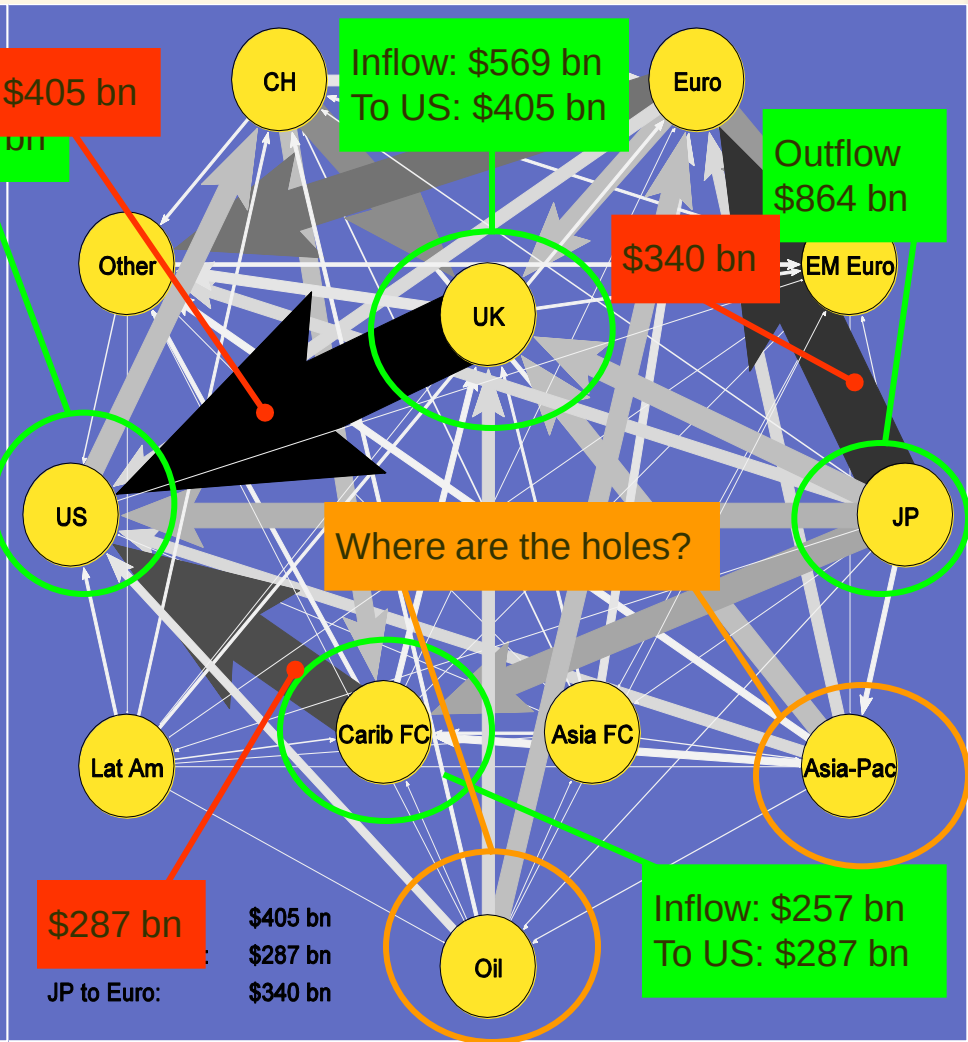


Question 3: Cross-country cumulative net banking flows

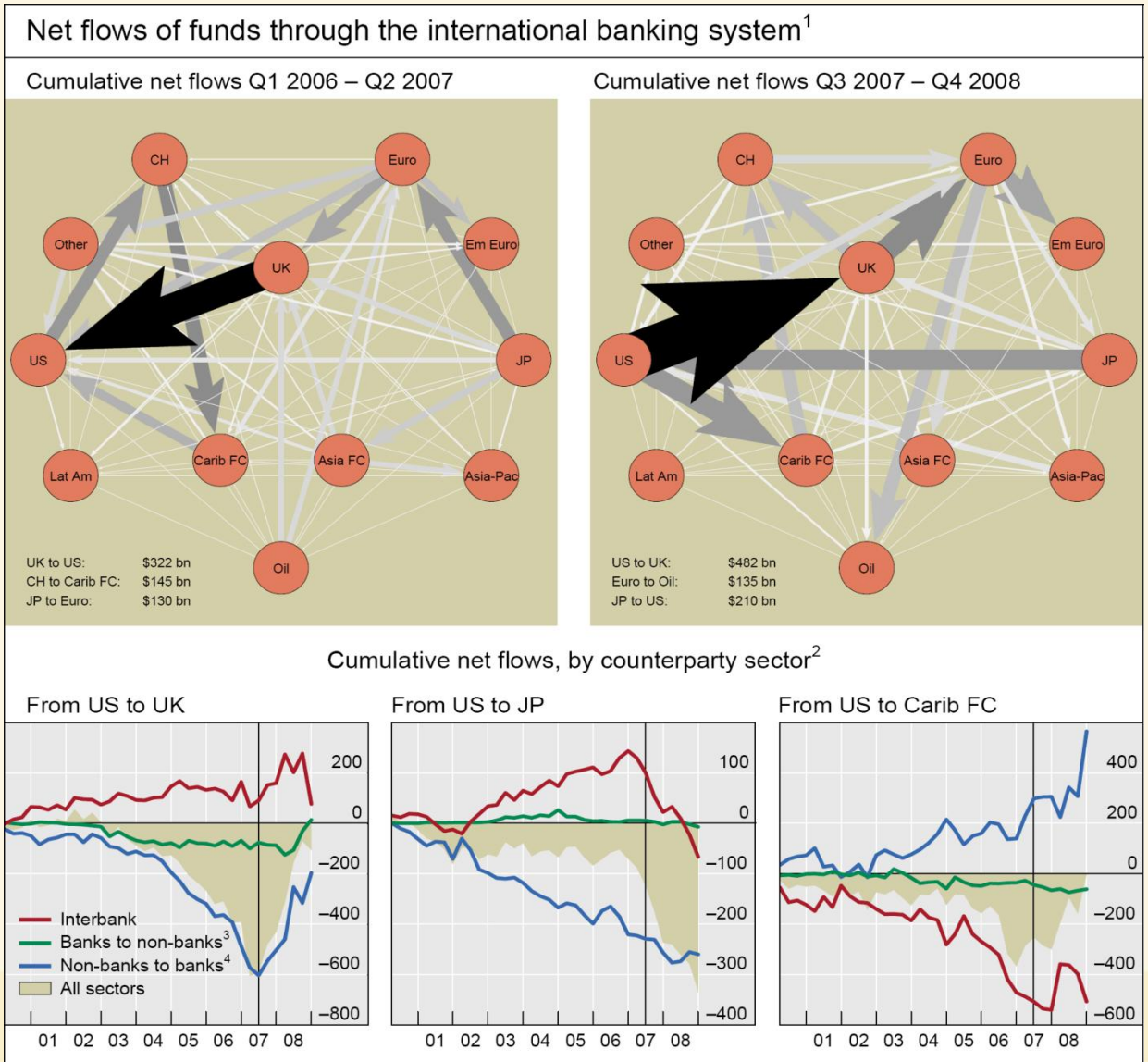
1990 Q3 - 1998-Q4



1999 Q1 - 2007 Q2

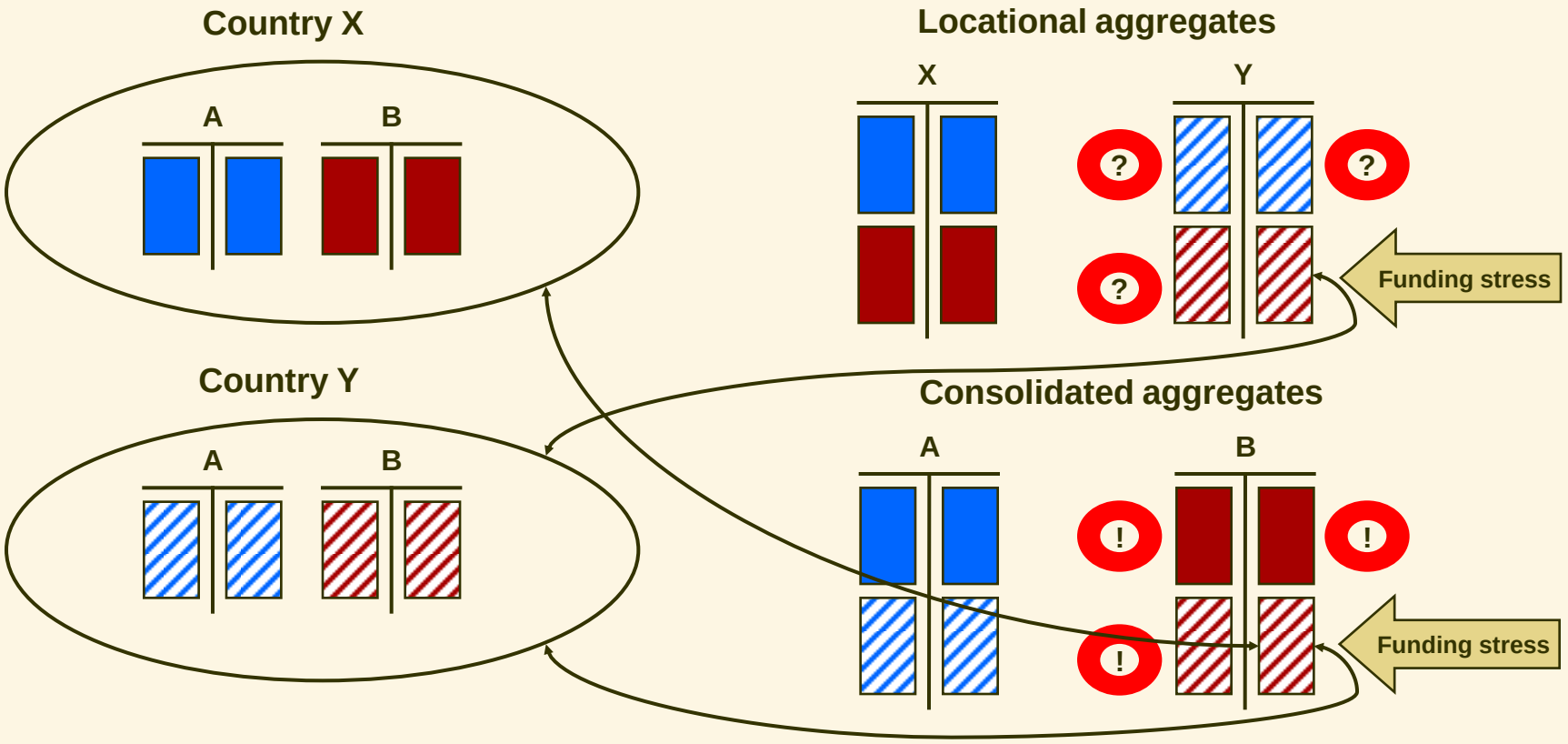


Question 3: Reversal of net flows during the crisis



- Capital flows reverse since 2007Q2
- Banks in London unwind positions in US non-banks
- Banks in Japan channel funds into UST

Question 3: Residency data is not enough



Home offices less than half of Frgn Claims

Question 3: The structure of banks' global operations

Table 1

Size and structure of banks' foreign operations

Positions at end-2007

Banking system	BE	CA	CH	DE	ES	FR	IT	JP	NL	UK	US
Number of banks[1]	18	17	23	1,801	96	135	724	106	49	17	33
Total assets ($bn)[2]	2,218	2,437	3,810	10,585	4,541	8,359	4,180	9,845	4,649	10,008	9,904
Asset concentration[3]	94.9	72.4	89.3	53.5	62.9	96.1	70.6	62.3	93.6	75.3	50.5
Foreign claims($bn)[4]	1,608	912	3,390	5,177	1,416	4,456	1,543	2,571	2,962	4,378	2,285
over total assets (%)	72	37	89	49	31	53	37	26	64	44	23
over annual GDP (%)	8	63	776	155	98	171	18	58	378	157	16
US dollar share (%)	23	70	60	33	36	31	10	48	31	42	52
Foreign claims, by office location (%)[5] Home cntry[6]	42	23	18	44	27	51	39	75	27	44	22
UK	6						6		20		25
US	6	41	23	6	9	12	3	9	12	16	
Euro Area	37	2	4	16	10	15	35	2	23	11	7
OFC[7]	3	9	21	7	2	6	2	6	6	14	24
Other	6	7	4	4	24	10	17	3	13	15	22
Assets booked by foreign offices (%)[8]	42	26	80	27	22	27	19	7	47	29	21

Foreign claims are big part of balance sheet

Question 3: The host country's per

Banks' assets ***large*** share of host country assets

Table 2

Bank assets in total external assets

Positions at end-2007

Country	BE	CA	CH	DE	ES	FR	IT	JP	NL	UK[2]	US
Gross external assets ($bn)[1]	2,407	1,199	3,231	7,367	2,091	7,758	2,827	5,355	3,795	12,777	17,640
Net external assets ($bn)	141	–127	635	949	–1,081	375	–119	2,195	14	–586	–2,442
Cross-border bank claims ($bn)[3]											
All banks	1,162	303	1,539	3,561	613	2,821	648	2,402	1,342	6,844	2,961
Domestic banks	881	282	1,235	2,953	471	2,497	478	2,169	1,133	1,966	1,113
Foreign banks	280	21	304	608	141	324	169	233	209	4,878	1,848
Cross-border bank claims / external assets (%)[4]											
All banks	48	25	48	48	29	36	23	45	25	54	17
Domestic banks	37	24	38	40	23	32	17	41	30	15	6
Foreign banks	12	2	9	8	7	4	6	4	5	38	10
Net external assets ($bn)											
All banks	191	40	146	1,568	–89	11	–294	1,690	149	–1,274	–754
Domestic banks	160	64	117	1,339	68	123	–130	1,623	207	–400	–814
Foreign banks	32	–24	30	229	–157	–111	–165	67	–59	–874	60

Table 1 & 2 combined ➔ What does "***national balance sheet***" really mean?

Question 3: Implications beyond BIS banking statistics

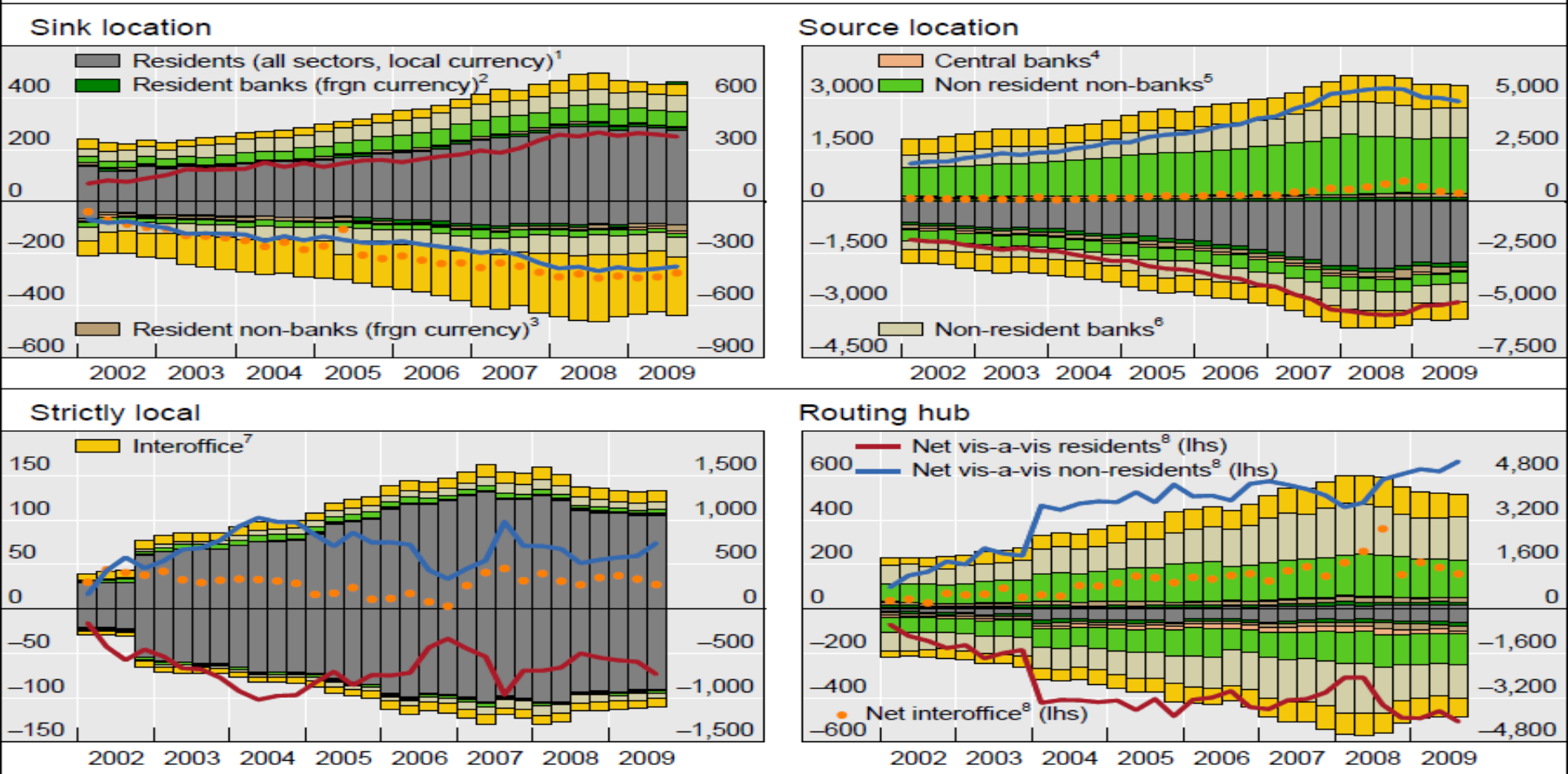
- BIS banking stats (hopefully) to be improved (CGFS working group)
  - Direct information on maturities
  - Finer counterparty and instrument breakdown
  - Holes in the data repaired

- But what about non-banks? They have big balance sheets too!

- Need to enhance existing aggregate statistics (BoP, FoF, CPIS)
  - Add nationality dimension on the reporting side
  - Add currency breakdown (required for maturity transformation)
  - Allows analysis along the lines of BIS banking statistics

Banking operations in different locations

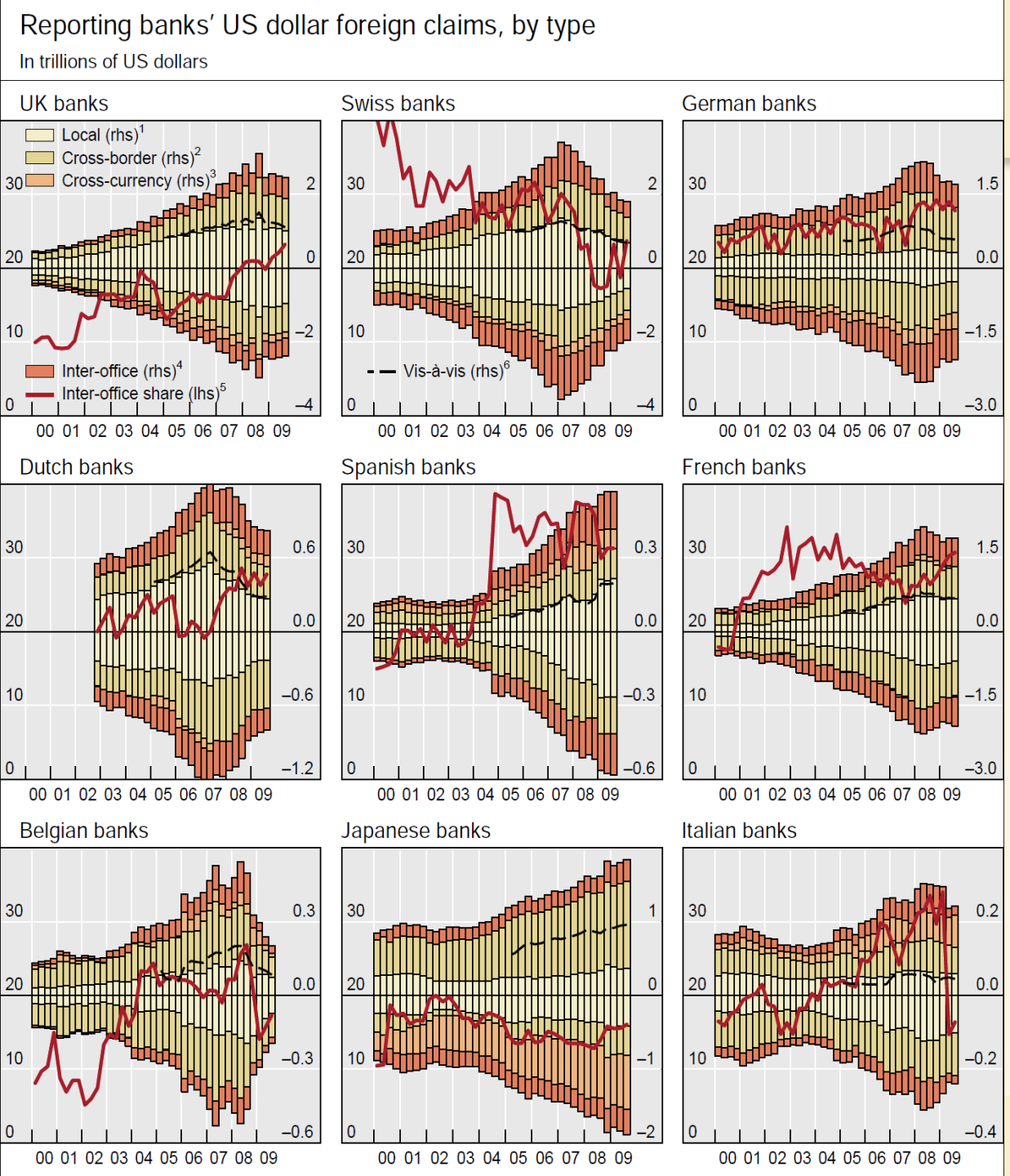
In billions of US dollars



Note: The graph shows four examples of what a banks' balance sheet in a particular office location can look like. The positive stacked bars indicate total assets and the negative stacked bars indicate total liabilities. The balance sheet examples are created by adding together similar looking balance sheets of offices of different banking systems in different locations, and thus the quantities are meaningless. The stacked bars indicate a double breakdown by counterparty location (resident counterparties and non-resident counterparties) and a breakdown by counterparty sector (bank, non-bank, central bank and interoffice). There is no counterparty sector breakdown available for local currency positions vis-à-vis residents (gray bars).

[1] Local currency positions vis-à-vis residents of the host country. [2] Local positions in foreign (ie non-local) currencies vis-à-vis (unaffiliated) banks in the host country. [3] Local positions in non-local currencies vis-à-vis non-banks in the host country. [4] Cross-border positions in all currencies vis-à-vis official monetary authorities. [5] Cross-border positions in all currencies vis-à-vis non-banks. [6] Cross-border positions in all currencies vis-à-vis (unaffiliated) banks. [7] Cross-border positions vis-à-vis affiliated own offices. [8] Net (assets minus liabilities).

Source: BIS consolidated statistics (immediate borrower basis); BIS locational statistics by nationality. Graph 1



USD funding sources

- US dollar positions broken down by type
  - Cross-border
  - Local
  - FX swaps
  - Interoffice (XB)
- We can not measure reliance:
  - On petrodollar funding
  - On Asian surplus funding

BANK FOR INTERNATIONAL SETTLEMENTS

Template for aggregate data

Instrument type	C-party type	C-party location	Remaining Maturity	Assets		Liabilities	Remaining Maturity	C-party location	C-party type	Instrument type
	Bank	Country A	Short Term	USD		USD	Short Term	Country A		
		Country B								
		Country C								
		Country D						Country B	Non-Bnk Fin	Debt Security
		Country E						Country C		
Loan	Corporate	Country A	Long Term				Long Term	Country A		
Debt Security								Country B	Household	
Equity							Short Term	Country A		
Other								Country B	Corporate	
	Household						Long Term	Country A		
	Non-Bnk Fin				FX Swaps			Country B	Corporate	
	Bank								Household	
	Public Sect								Non-Bnk Fin	Deposit
	Central Bnk									Debt Security
	Interoffice									Other
		Country B							Bank	
		Country C							Public Sec	
Loan	Corporate	Country A	Short Term	euro		euro			Central Bank	
	Non-Bnk Fin								Interoffice	
		Country B						Country A		
Debt Security	Corporate	Country A	Long Term			Equity		Country B	Non-Bnk Fin	Equity
	Interoffice								Pub Sect	
		Country B							Corporate	
		Country C						Country C		

Question 3: How much additional data are we talking about?

- Significant increase in data collection, but much already exists
  - Ideally: 4 x 7 x 3 x 190 x 5 x 2 = 159,600 cells
  - Current BIS data: 3 x 4 x _ x 190 x 5 x2 = 22,800 cells

- Off-balance sheet derivatives overlay also needed
  - BIS OTC derivatives database

- Closed system: no problem of missing liabilities if everyone reports! (debt securities get lost on secondary markets)

That’s it!

Thank you.

Questions?