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## The great liquidity freeze: What does it mean for international banking?

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## **ADB Working Paper Series**

### **The Great Liquidity Freeze: What Does It Mean for International Banking?**

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Dietrich Domanski and  
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**Abstract**

In mid-September 2008, following the bankruptcy of Lehman Brothers, international interbank markets froze and interbank lending beyond very short maturities virtually evaporated. Despite massive central bank support operations and purchases of key assets, many financial markets remained impaired for a long time. Why was this funding crisis so much worse than other past major bank failures and why has it proved so hard to cure? This paper suggests that much of that answer lies in the balance sheets of international banks and their customers. It outlines the basic building blocks of liquidity management for a bank that operates in many currencies and then discusses how the massive development of foreign exchange (forex) and interest rate derivatives markets transformed banks' strategies in this area. It explains how the pervasive interconnectedness between major banks and markets magnified contagion effects. Finally, the paper provides some recommendations for how strategic borrowing choices by international banks could make them more stable and how regulators could assist in this process.

**JEL Classification: E44, G01, G15, G18, G24 and G28**

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# 1. INTRODUCTION

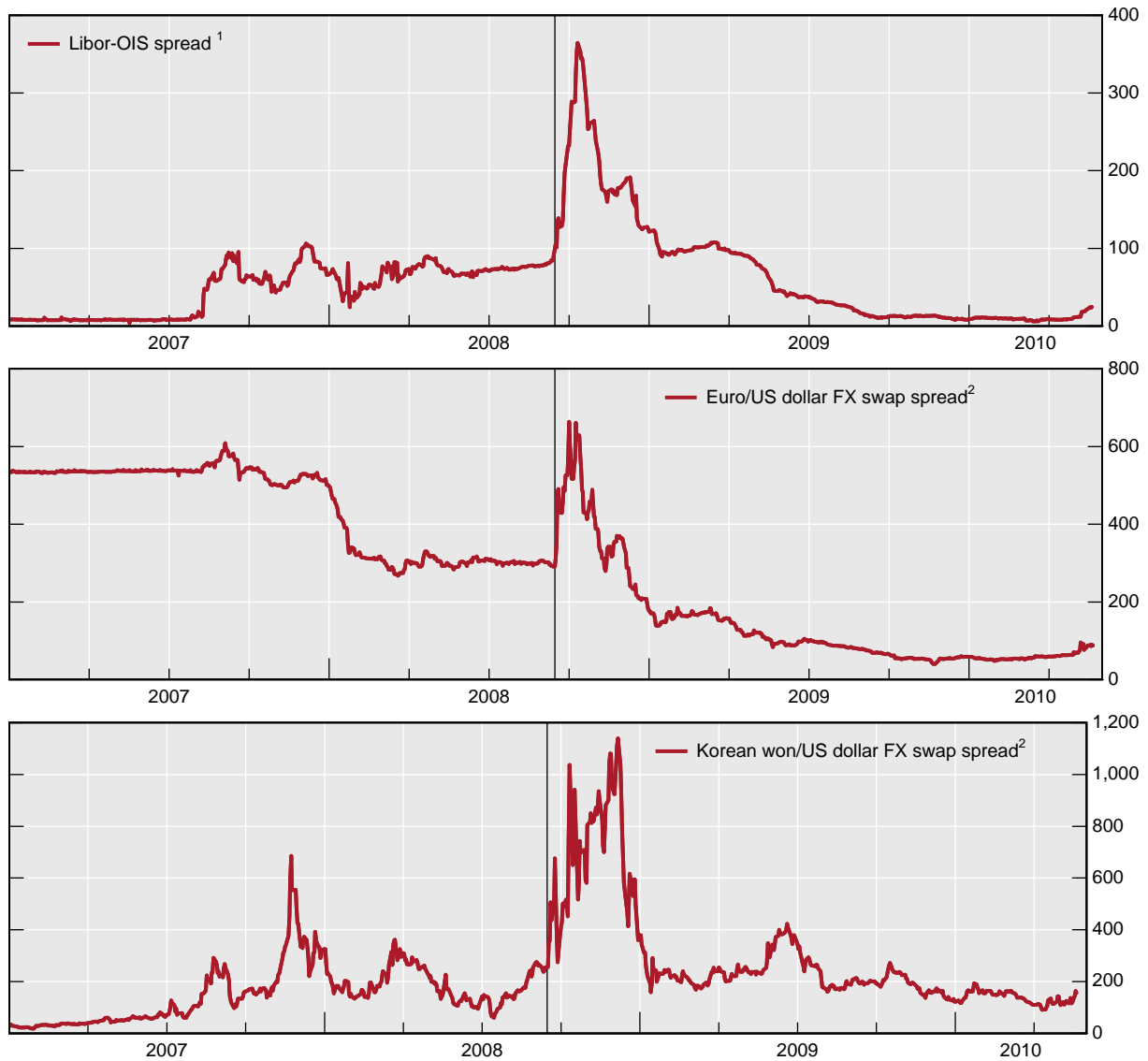
In mid-September 2008, following the bankruptcy of Lehman Brothers, the financial crisis became global. International interbank markets froze (Table 1 lays out the main events). Interbank lending beyond very short maturities virtually evaporated. Three-month Libor, the key benchmark for a wide range of financial contracts in money markets, rose sharply. Interest rate and forex swap markets became dysfunctional (Figure 1). The financial markets in emerging economies, which had risen for several months after the onset of the crisis in August 2007, fell sharply.

**Table 1: The liquidity freeze: a chronology**

<b>2008</b>	
7 September	Fannie Mae and Freddie Mac are taken into government conservatorship.
15 September	Lehman Brothers files for bankruptcy.
16 September	A large US money market fund, "breaks the buck," triggering large volumes of fund redemptions. AIG supported by US government.
18 September	Central banks address the squeeze in US dollar funding with USD160 billion in new or expanded swap lines.
19 September	The US Treasury announces a temporary guarantee of money market funds. US Treasury proposal to remove troubled assets from bank balance sheets (the Troubled Asset Relief Program, or TARP).
25 September	The authorities take control of Washington Mutual, the largest US thrift institution, with some USD300 billion in assets. This is followed in later days by the effective nationalization of several European financial institutions
29 September	TARP is rejected by the US House of Representatives.
30 September	The Irish government announces a guarantee safeguarding all deposits, covered bonds and senior and subordinated debt of six Irish banks; other governments take similar initiatives over the following weeks.
3 October	The US Congress approves the revised TARP plan.
8 October	Major central banks undertake a coordinated round of policy rate cuts.
13 October	Major central banks jointly announce the provision of unlimited amounts of US dollar funds to ease tensions in money markets.
29 October	To counter the protracted global squeeze in US dollar funding, the US Federal Reserve agrees swap lines with the monetary authorities in Brazil, Korea, Mexico, and Singapore.

Source: BIS 2009.

**Figure 1: Three-month Libor-Overnight Interest Swap (OIS) and forex swap spreads**  
(in basis points)\*



Sources: Bloomberg; Datastream; BIS calculations.

Notes: \*The vertical line marks 15 September 2008 (i.e., when the Lehman Brothers Bankruptcy occurred).

<sup>1</sup> Three-month US dollar Libor minus overnight index swap (OIS) rates, in basis points.

<sup>2</sup> Spread between three-month FX swap-implied dollar rate and the three-month USD Libor; the FX swap implied dollar rate is the implied cost of raising US dollars via FX swaps using the funding currency.

Tensions began to ease only after the announcement, in mid-October of that same year, that the United States (US) Federal Reserve would provide unlimited amounts of US dollar funds to other central banks in the major industrial countries. Central banks in emerging economies were also forced to act to support their currencies or their local interbank markets. Massive central bank support operations—unprecedented in scale, in form, in counterparty, and in duration—eventually contributed to a gradual normalization

of pricing conditions in the largest wholesale markets during 2009 (Allen and Moessner 2010; Turner 2010). Despite substantial central bank purchases of illiquid assets, however, many financial markets remained impaired. A further round of turbulence triggered by the Greek fiscal crisis led to the renewal of funding pressures on major banks in May 2010—once again leading to the reinstatement of central bank support operations (notably inter-central bank swap operations that had been phased out).

Tensions in interbank markets following the failure of a major bank are not new. For instance, the loss of confidence in, and subsequent failure of, Continental Illinois in 1984 led to similar tensions as the money center banks found it more costly to borrow in wholesale markets. But the US Federal Reserve was able to stabilize this run of deposits from a single bank essentially by reshuffling dollars from other US banks. Hence, it managed to do this without significantly increasing the total reserves supplied to the banking system.

This crisis went deeper and lasted longer because:

- (i) There was a simultaneous loss of confidence in large banks in the US and Europe;
- (ii) Corporations worldwide (and, in some countries, households) had denominated their bank loans (and derivative exposures) in US dollars on a substantial scale;<sup>1</sup>
- (iii) A large expansion by non-US banks in dollar lending and holdings of dollar-denominated securities either had been financed by short-term dollar (or foreign currency) deposits or had relied on the ready availability of wholesale hedging markets to roll over currency or maturity mismatches.
- (iv) The wholesale funding operations of banks remained vulnerable for some time—the difficulties were not settled as quickly.

Why was this funding crisis so much worse and why it has proved so hard to cure? Much of any answer to these questions lies in the balance sheets of banks and of their customers. Balance sheets tend to change slowly and the balance sheet structure of major banks at the outset of the crisis took many years to develop. These structures made banks much more vulnerable to currency, maturity and refinancing risks than they had been at the start of the 2000s. But the development of more and more complete hedging markets masked the threats posed by such vulnerabilities. Banks are now in the process of re-appraising their international business strategies and bank regulators are examining more closely liquidity issues.

Section II outlines the basic building blocks of liquidity management for a bank that operates in many currencies. How the massive development of forex and interest rate derivatives markets transformed banks' strategies in this area is discussed in Section III. Section IV explains how the ever more pervasive interconnectedness between major banks and markets magnified contagion effects. Section V looks at the strategic borrowing choices for international banks in the context of the new constraint; these choices are then examined in Section VI.

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<sup>1</sup> Or in another major international currency such as euros. For simplicity in this paper, the US dollar is used as a shorthand for all international currencies.



## 2. BUILDING BLOCKS OF LIQUIDITY MANAGEMENT IN MANY CURRENCIES

What does liquidity management in many currencies mean? This is not an easy question to answer because “liquidity” is a notion that covers many distinct elements. It is therefore useful to begin by breaking down complex strategies into two simple components: liquidity management in one currency and currency mismatches.

### 2.1 Liquidity Management: Local Operations in its Domestic Currency

Even for a bank that operates locally in its own currency, liquidity management is very complex. The ultimate aim (to be sure of being able to meet claims as they arise) is easy to state but not so easy to make operational. Banks must consider: maturity mismatches between assets and liabilities, refunding risk, what central banks will accept as collateral, and local liquidity rules. These elements are considered in turn.

#### 2.1.1 Maturity mismatches between assets and liabilities

Banks make money from maturity transformation—by borrowing short and lending long. By doing this, banks traditionally perform the valuable function of financing fixed and illiquid investment in real assets by creating liabilities that are liquid for the individuals that hold them.

Banks must therefore manage the resultant maturity mismatches that arise from this transformation. This has at least three elements:

*Asset liquidity.* This covers how readily an asset can be sold. The usual measures of market liquidity in normal times are microeconomic.<sup>2</sup> But such measures may be quite misleading guides to liquidity in times of stress. Tirole (2008) argues that a better measure is what he calls the macroeconomic dimension of liquidity: an asset is liquid when it keeps its value in those circumstances when its holder wants to liquidate it for cash. Government short-term bills are usually seen as the benchmark asset that is safe even in times of stress. There are additional risks to long-term government paper that depend on the nature of the shock (inflationary or deflationary) and on the country’s fiscal position. The European debt crisis has underlined such risks. What central banks accept as collateral will also influence asset quality—see (iii) below.

*Duration gap between assets and liabilities.* The greater this is, the more vulnerable the bank is to movements in the yield curve. The underlying duration of assets may be longer than apparent on the surface. For instance, a construction company engaged in long-term projects may finance itself by regularly renewing short-term loans (that is, with a notional duration that is short), but may be unable to repay at short notice. In such circumstances, the bank may be forced to roll over these loans in order to avoid losses, which means that the underlying duration is longer than in the contract.

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<sup>2</sup> These microeconomic elements are usually defined and measured as follows:

- Depth: the market’s ability to absorb large transaction volumes with small changes in price (measured by average turnover);
- Tightness: cost efficiency (measured by low bid-ask spreads);
- Resilience: ability to absorb random shocks (day-to-day price volatility).

*Duration of wholesale liabilities.* A severe economic or financial market shock may lead to the effective closure of some of the markets used by banks to refinance its liabilities. A bank therefore needs to have cash or near-cash to be able to meet liabilities falling due the following day (or week or month) without new borrowing in these markets.

In deciding on these elements, a bank will have to weigh the profits earned from its exposures against the risks created by its mismatch exposures. There is no simple one-size-fits-all optimum for any of these elements. Any element could in theory be traded off with another element. In addition, the credit risk of assets is important. The market's assessment of a bank's ability to meet its short-term obligations—and hence the bank's ability to borrow—will be influenced by the market's judgment about the quality or marketability of its assets. A bank with low credit risk exposures may therefore be able to run larger maturity mismatches.

### 2.1.2 Refunding risk for short-duration deposit liabilities

Retail deposits in local currency have traditionally been regarded as a more stable or reliable source of funding than borrowing in wholesale markets. But depositors are likely to flee weak banks in a crisis—unless the deposit protection schemes in force convince them that their money is safe. Hence it would be more accurate to say “retail deposits guaranteed by the government” could be regarded as stable in a crisis.

### 2.1.3 Central bank practices on collateral and asset purchases

In Bagehot's day, the Bank of England would accept only short-term exchange bills and thus avoided the capital value risks of long-term paper. Such bills were self-liquidating (usually financing trade) and had the guarantee of acceptance house endorsement. This also had the advantage of creating a large diversified pool of liquid assets—which meant less market contagion than would have arisen if all the banks had to liquidate identical assets in a crisis. This preference for **commercial** bills—and not **government-issued** Treasury bills—lasted well into the 1920s. Indeed, it was by monitoring the quality of commercial bills in money markets that the Bank of England kept some oversight of the stability of the banking system (Goodhart and Tsomocos 2007).<sup>3</sup>

Since that period, and given the massive rise in government debt, the Bank of England began to accept long-term government paper in their discount operations with commercial banks. Indeed, the near-universal convention nowadays is that central banks accept bonds issued by “their” government as their most preferred collateral. Such paper is not risk-free. When debt ratios are high, there is a risk of sovereign default, particularly monetary arrangements rule out an inflationary “solution.” There is also interest rate risk (which can be accentuated by inflation risks). The fact that the central bank will accept long-term bonds as collateral for a short-term loan to a commercial bank makes such bonds more liquid—even if they might not be very liquid in the absence of such acceptance.

Central bank lending practices could, in theory, seek to discriminate between banks. They could, for instance, seek to reduce moral hazard risks by “rewarding” banks that had maintained more liquid balance sheets in normal times by giving them greater or cheaper access to central bank liquidity in a crisis. In practice, few (if any) do so. But many observers have recently suggested rules to make access to central bank liquidity conditional on past behavior (Turner [2010] summarizes a number of proposals).

<sup>3</sup> As Sayers (1976: 277) notes, “The rule against ‘all but commercial bills’ ... implied a frown on Treasury bills as well as private finance bills.”

### **2.1.4 Local liquidity rules imposed by bank regulators**

Bank regulators may take account of elements (a), (b), and (c) to impose liquidity rules. Practices on the use of liquidity ratios vary widely across countries. In some countries (particularly developing countries), bank reserve ratios—a specific example of a liquidity ratio—are still important for the implementation of monetary policy. In most industrial countries, however, bank reserve ratios no longer play a central monetary policy role.

Before the 1980s, a central focus of bank regulators was on various liquidity ratios. Banks had to provide regular reports on the maturity profiles of their assets and liabilities. Regulators paid particular attention to assets liquidity, and banks were often required to invest a certain percentage of their total assets in government bills or bonds or in high quality paper issued by the private sector.

During the 1980s, however, this emphasis on liquidity ratios waned. There were two reasons for this. One was that monetary policy implementation became more centered on short-term interest rates and less on liquid asset ratios. In the United Kingdom (UK), for instance, the reserve asset ratio required of banks was a central instrument of monetary control in the 1970s—its aim was to contain credit growth, not to protect bank depositors. Nevertheless, the Bank of England at the time recognized that its abolition in 1981—as new arrangements for monetary control were introduced—left something of a prudential gap:

The reserve asset ratio is not a prudential ratio... but as its constituents are liquid assets, it has had some relevance to the maintenance by banks of adequate levels of liquidity... The Bank would expect any changes [in banks' management of their liquidity] on the abolition of the reserve asset ratio to be made only gradually and after full consultation... the Bank will seek to develop a single comprehensive measurement of the overall liquidity of banks (Bank of England 1981: 41).

This “single comprehensive measurement,” however, proved to be elusive. The desire for such an indicator remained in the background for decades, and has been reignited by the recent crisis.

Another reason that the emphasis on liquidity ratios waned was the developing consensus on the central importance of international banks having adequate capital. Because any well-capitalized bank would always be able to access deep wholesale money markets with only miniscule spreads, so the argument went, the liquidity of assets became unimportant. What mattered was access to markets to fund positions (funding liquidity).

Until the Basel III proposals, there were no international rules about how quantitative liquidity rules should be formulated. Differences in the depth and breadth of wholesale money markets and in central bank discount practices have always made it difficult to formulate rules to apply worldwide. And because rules on the assets that commercial banks must hold on their balance sheets will influence what they pledge to the central bank as collateral, central banks may resist any attempt by regulators to have the first claim on a bank's “best” collateral.

## **2.2 Currency mismatches and liquidity risks from operations in foreign currency**

Lending and borrowing by banks in foreign currency add further complications. In the late 1970s and the early 1980s, such foreign currency operations were dominated by the

lending in US dollars by European and Japanese banks. Their customers were (usually) large international companies, foreign governments, and banks in developing countries. Further globalization in succeeding decades brought the banks of many more countries into international interbank markets.

### **2.2.1 Direct currency mismatches**

Commercial banks do not generally take large open foreign currency positions. Regulators usually impose capital charges on such positions, including in some countries ceilings on aggregate exposures.

There are, however, several ways that unanticipated direct currency mismatches could arise as a result of market developments. Two were important in the 2007–2010 financial crisis. One is that foreign currency assets lose their value. The substantial decline in the value of US dollar assets related to the US housing market crisis, for instance, led to large losses for European banks. To return to their pre-crisis aggregate dollar exposure, therefore, banks would have to sell non-dollar assets to raise dollars or would have to repay (i.e., not rollover) dollar liabilities falling due. Paradoxically, then, the loss of value of dollar assets may strengthen the dollar on forex markets.<sup>4</sup> Another was that foreign currency liabilities cannot be rolled over: the dysfunctions in interbank dollar and forex swap markets did greatly limit refinancing choices.

### **2.2.2 Indirect currency mismatches**

In general, international lending banks typically did not have currency mismatches on their own balance sheets in the early 1980s debt crisis. Their dollar loans were usually matched by wholesale dollar deposits. But many of their borrowers—particularly governments in Latin America and parts of developing Asia—were exposed to massive currency mismatches. Because dollar borrowings were typically at floating rates, debtors also faced large interest rate risks too (Goldstein and Turner, 2004).

The string of defaults on these international bank loans in the 1980s shook the international financial system. As a result of these losses, the international banks (often “encouraged” by their regulators) gradually moved away from cross-border lending denominated in foreign currency towards lending in local currencies via local affiliates. Dollar-denominated cross-border lending to the developing world actually declined in the five years following the Asian crisis, while local lending more than doubled (Table 2).

It is of interest that the increased importance of local lending appears to have made global bank lending more stable in this crisis than it was in earlier crises. The boom-bust cycle was much more marked in international claims than in local claims (Figure 2). In addition, the Committee on the Global Financial System (CGFS 2010b, Section 5.1) report on funding patterns found that large international banks that had a more decentralized multinational model were less affected by funding problems than those with more centralized funding models.

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<sup>4</sup> McGuire and McCauley (2009) argue that European financial institutions were probably not rolling over their short-term dollar liabilities once they recognized their losses on their US dollar assets (mainly structured products) and that this helped to strengthen the dollar during 2008.

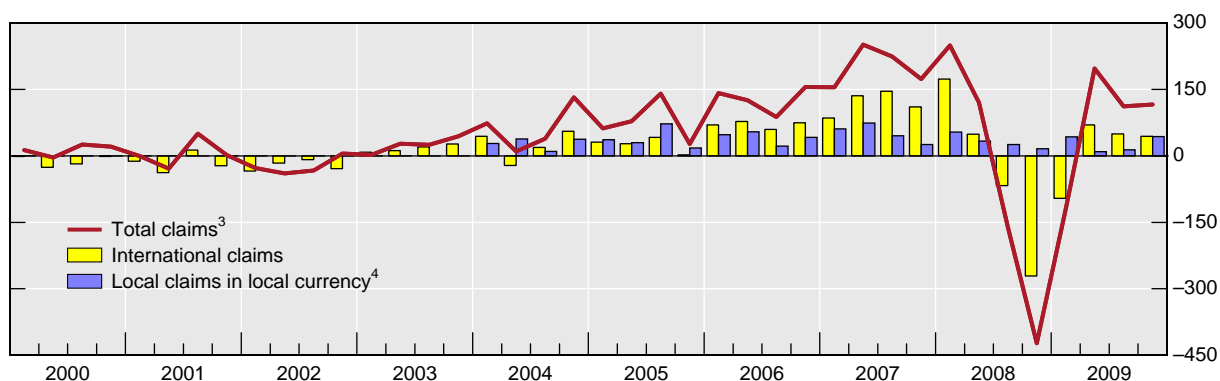
**Table 2: The consolidated claims of foreign banks vis-à-vis developing countries**  
(in billions of US dollars)

	1990	1995	1997	2002	2007	2008	2009
Local currency claims on residents	51	123	250	529	1833	1720	1926
International claims	528	744	980	772	2409	2326	2487

Note: End-year. Local claims comprise those of BIS reporting banks' foreign offices denominated in local currency. International claims are the sum of cross-border claims in all currencies and local claims of BIS reporting banks' foreign offices denominated in foreign currency only.

Source: BIS.

**Figure 2: BIS reporting banks' consolidated lending to EMEs (adjusted)<sup>1</sup>**  
(changes in stocks,<sup>2</sup> in billions of US dollars)



Source: BIS consolidated banking statistics on an immediate borrower basis.

<sup>1</sup> Consolidated positions of banks headquartered in 30 reporting countries vis-à-vis Argentina; Brazil; Chile; the People's Republic of China (PRC); Hong Kong, China; India; Indonesia; Korea; Malaysia; Mexico; the Philippines; Poland; Russia; Saudi Arabia; Singapore; South Africa; Thailand, and Turkey.

<sup>2</sup> Quarterly difference in outstanding stocks.

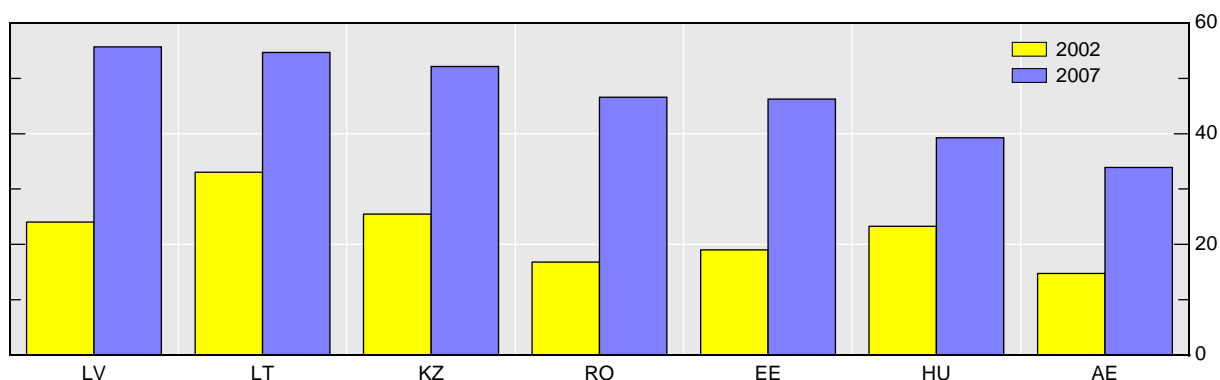
<sup>3</sup> Sum of international claims and local claims in local currency (unadjusted); international claims comprise cross-border claims in all currencies and local claims in foreign currencies; local claims relate to those booked by reporting banks' foreign offices on residents of the country in which the foreign office is located.

<sup>4</sup> Adjusted for exchange rate movements by converting all changes in local claims at the exchange rate prevailing in Q1 2009. Note that total claims (red line) are computed using unadjusted local claims.

Currency mismatches on the balance sheet of borrowers were the main common ingredient in all of the financial crises affecting emerging markets in the 1980s and the 1990s. In the recent crisis, however, direct currency mismatches on balance sheets in the emerging markets were a major problem only in Central and Eastern Europe. Figure

3 identifies a few countries where the rise in the ratio of the external liabilities of bank-to-bank lending suggests a massive dependence on foreign borrowing.

**Figure 3: External liabilities to gross loans<sup>1</sup>**



Sources: Federal Reserve Bank of New York, based on banking superintendency and central bank data.

LV = Latvia (from 2003); LT = Lithuania; KZ = Kazakhstan; RO = Romania; EE = Estonia; HU = Hungary; AE = United Arab Emirates.

<sup>1</sup> External liabilities are for the banking sector and gross loans include both public and private sector loans.

But contingent and off-balance sheet forex exposures—often not all visible—were much more widespread. Corporations in Brazil, the Republic of Korea (hereafter Korea), and Mexico had large exposures, often in the form of options or other derivative contracts. Some positions were non-linear so that exposures were magnified as the currency fell through successive trigger points.<sup>5</sup>

In the case of Korea, for instance, these forex derivatives of corporations were largely with the Korea-based banks (including foreign-owned banks). To avoid holding such exchange rate risks on their balance sheets, banks usually sold their derivative contracts to foreign banks and hedge funds. If the corporation defaulted on its contract, however, the Korea bank would still be responsible for its losses vis-à-vis the foreign bank. When the crisis broke, banks became much more cautious, pulling back from such markets as they hoarded liquidity.

### 2.2.3 Funding risks

In addition, the international banks were exposed to funding risks. Cooke (1981: 241) explained that, in the early 1980s, the Basel Committee

... shared the concern that the rapid increase in international lending in the 1970s has increased the mismatch between banks' assets and liabilities. This gives rise to an interest rate risk and a funding risk... the Committee considers that the degree of maturity transformation effected by banks in their international business is a matter of especial importance to supervisors because funding problems are not infrequently the origin of a problem bank situation. More importantly, there is the risk that the increased interdependence of banks for their liquidity management could lead to domino effects throughout the international banking system in the event of problems emerging in one corner of it.

<sup>5</sup> See pp 119-125 of CGFS (2009) for an analysis of these exposures. For an analysis of several aspects of the policy responses in EMEs, see BIS (2010).

The Basel Committee on Banking Supervision, however, failed in the 1980s in its attempts to reach an accord on liquidity as they had successfully done for capital.<sup>6</sup> In any case, since that time, the progressive development of money markets—in both depth and breadth—seemed to make regulatory rules about liquidity quite superfluous.

One consequence was that the exposure of international banks to funding risk grew steadily for more than 20 years. A report by the Bank for International Settlements' (BIS) Committee on the Global Financial System (CGFS 2010c) discusses in some detail two significant long-term trends. First, international banks' reliance on wholesale market funding rose—i.e., between 1985 and 2006, the share of liabilities vis-à-vis non-banks in advanced economies increased from 24% to 35%. Second, the share of intra-group funding grew from 22% to 30%, reflecting the active use of major financial centers and offshore markets as funding sources.

#### **2.2.4 No international lender of last resort**

A fundamental difference from a bank's management of liquidity risk in its own local currency is that there is no international lender of last resort in foreign currency. International banking business involves usually three central banks: the central bank where the bank conducts this business; the central bank where the bank is headquartered; and the central bank of the currency used. Which central bank should take responsibility for emergency liquidity and exactly how this would be provided has been long debated.<sup>7</sup> There was a worry when the Eurodollar markets began to expand in the early 1970s that central banks would not be able to react quickly because of unresolved disagreements among them. After much debate, however, the G10 central banks concluded that [with reference to the problem of the lender of last resort in the Euromarkets] it was not practical to lay down in advance detailed rules and procedures for the provision of temporary liquidity (BIS, 1974). This formal position has remained in place ever since. And the recent crisis has stimulated a renewed debate about this.<sup>8</sup>

### **3. MARKETS TO TRADE EXPOSURES ACROSS MATURITIES AND ACROSS CURRENCIES**

A bank with operations in several currencies in principle must both limit aggregate currency exposures and manage liquidity risks in each currency. In an earlier and simpler world, how a bank did this could largely be read from its balance sheet. The huge development of forex and interest rate derivative markets (including forwards, interest rate swaps, futures, and currency options) in recent decades made this much more difficult. These instruments not only gave banks powerful tools to develop lending more easily but could also help banks understate their true exposures. International

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<sup>6</sup> Goodhart (2007). In Davies and Green (2010: 98–100), the authors point out that in the 1960s, 30% of British clearing bank assets were held in the form of highly liquid paper—cash, Treasury bills, or short-dated government paper. This percentage was, however, seen as too high even at that time. The banks' enormous holdings of Treasury bills—a legacy of war and immediate post-war public finance—created a risk that banks could suddenly increase lending to the private sector. This made the authorities reluctant to abolish direct controls on lending.

<sup>7</sup> Shafer (1982) provides an excellent review of the theory of a lender of last resort in international banking markets.

<sup>8</sup> Park (2011) advocated what he calls a “global liquidity safety net.”

bank claims rose from under USD800 billion in 2002 to over USD2,400 billion by 2007—an extraordinary expansion in just five years (Table 2).

The use of ever more complete hedging markets allowed banks worldwide to borrow dollars in international markets on a massive scale. They could, in effect, sell their forex and maturity exposures arising from many different business strategies to someone else. Most of their transactions were with other banks. Often, at the end of a long interbank chain, there were institutional investors outside the banking system. The willingness of investors to take the positions that banks in aggregate wanted to shed could help to make these funding strategies resilient to shocks. Such investors include pension funds, other institutional investors, and official investors such as central banks. However, CGFS (2010b) found that many institutional investors outside the United States were also hedging their considerable US dollar portfolios through the swap market—reinforcing the transatlantic funding asymmetry of the banks. Also essential in sustaining these funding strategies was full confidence in the creditworthiness of the counterparties—usually banks—who wrote such contracts at very low spreads.

One business model was for banks to use foreign wholesale markets to finance a bigger increase in lending at home than domestic bank deposits would permit. The Australian banking system illustrates this well. Australian banks in effect borrowed fixed-rate (usually medium- to long-term) dollars but swapped their exposures into floating-rate Australian dollars. This matched the nature of their lending terms to Australian residents. This is clear because Australia is one of the few countries to collect and publish data from their financial institutions on off-balance sheet forex positions. Currency and maturity mismatches were thus generally avoided in the Australian case (Table 3). Between June 2001 and March 2009, the foreign currency denominated debts of Australian banks rose by A\$350 billion—financing a sizeable increase in lending. As their hedging operations rose by about the same magnitude, currency mismatches were avoided. Net foreign currency exposures rose by A\$14 billion. Equally, the large expansion in bank lending entailed a three-fold increase in foreign currency derivative contracts—so that this business strategy was very dependent on the availability and pricing of these hedging contracts.

In other countries, however, the foreign currency liabilities used to finance (comparatively illiquid) domestic lending in local currency were of very short duration. The foreign exchange risks were also hedged using short-term instruments, usually forex swaps. Both operations required refinancing at frequent intervals and therefore depended on continued access to deep wholesale markets.



**Table 3: Australian banks' foreign currency exposure**

(in billions of Australian dollars)

	<b>2001 June</b>	<b>2009 March</b>
<b>Net foreign currency balance sheet exposure</b>	<b>-86.0</b>	<b>-316.6</b>
Foreign equity assets	30.7	22.7
Foreign currency denominated debt assets	69.8	208.9
Foreign currency denominated debt liabilities	186.5	548.2
<b>Net foreign currency derivatives exposure (hedging)</b>	<b>109.5</b>	<b>354.5</b>
Principal value of foreign currency derivative contracts bought in exchange for Australian dollars	435.3	1,273.6
Principal value of foreign currency derivative contracts sold in exchange for Australian dollars	325.8	919.1
<b>Net foreign currency exposure after hedging (total of the above)</b>	<b>23.4</b>	<b>37.9</b>

Source: Australian Bureau of Statistics.

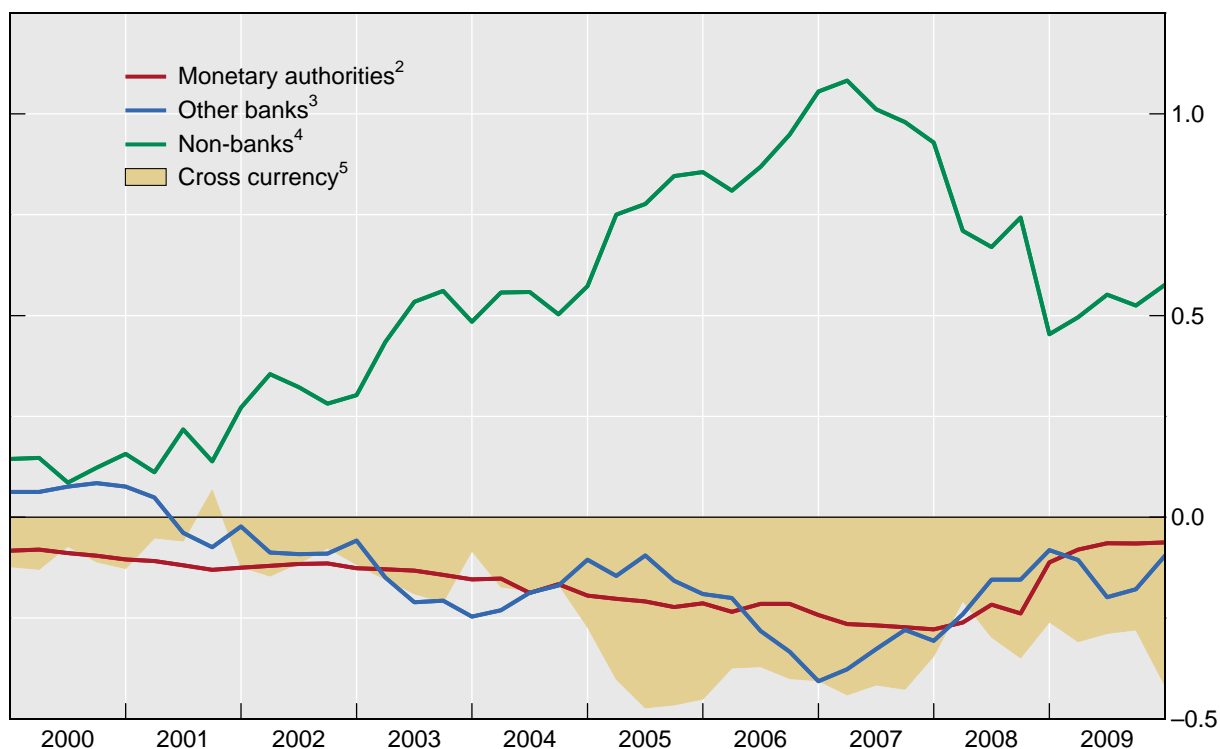
Another business model was to use wholesale markets to fund the acquisition of higher-yielding or illiquid foreign assets. Most of the activity in international interbank markets was indeed driven by this global business strategy of the large international banks. From the earliest days of what was then called the Eurocurrency markets, major non-US banks borrowed dollars short in order to lend long—the classic business of banking. Surplus short-term dollar funds (from other banks, central banks, money markets or asset managers, corporate treasurers, etc.) are passed through a long chain of banks. Any particular bank will not necessarily know either the initial source of funds or its ultimate (non-bank) destination. In normal times, this is a seamless market—and is internationally homogenous.<sup>9</sup>

In the years before the recent crisis, the European banks financed a sizeable expansion of long-dated or less liquid dollar denominated assets by short-term dollar borrowing (or by using forex swap proceeds). As CGFS (2010a) documents, it was this maturity mismatch that aggravated the vulnerability of the banks. Unfortunately, we do not nowadays have detailed data on the maturity of banks' dollar assets and liabilities. So we are forced to use what is available in the BIS's international banking statistics and do some educated guesswork. Patrick McGuire has shown much ingenuity in extracting the maximum information from these data (McGuire and von Peter 2009; Cecchetti, Fender, and McGuire 2010). Figure 4 shows the dollar-denominated positions of four European

<sup>9</sup> For an early analysis with detailed numbers see Ellis (1981). It is interesting to note that the comprehensive data he provides for European and Japanese banks operating in London on banks' maturity mismatches on foreign currency positions along the maturity spectrum—that is, at less than 8 days, 8 days–1 month, 1–3 months, 3–6 months, 6–12 months, 1–3 years and 3 years and over—are no longer available.

banking systems with large funding gaps in dollars (that is, longer-term US dollar holdings financed by short-term US dollar funds). This shows a significant maturity transformation across banks' balance sheets. Lower-bound estimates of the dollar funding gap of financial firms in these countries—that is, implicitly assuming US dollar liabilities to non-banks are longer-term—peaked at well over USD1 trillion in mid-2007. It fell to over USD0.5 trillion at end-2009. On top of this, we know there are large short-term US dollar liabilities to money market funds (which are counted as non-banks in BIS statistics): USD1 trillion in mid-2007 and this may have fallen to USD0.75 trillion by end-2010 Q1. Adding these two estimates implies a decline in the dollar funding gap from about USD2 trillion in mid-2007 to over USD1.25 trillion at the end of 2009. This is still very large—and there are certainly short-term dollar liabilities of other financial firms in these banking systems. The international community must do much more to plug these statistical gaps.

**Figure 4: The US dollar positions of banks in four European countries<sup>1</sup>**  
(in trillions of US dollars)



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

1 Estimates are constructed by aggregating the on-balance sheet cross-border and local positions reported by Dutch, German, Swiss, and UK banks' offices.

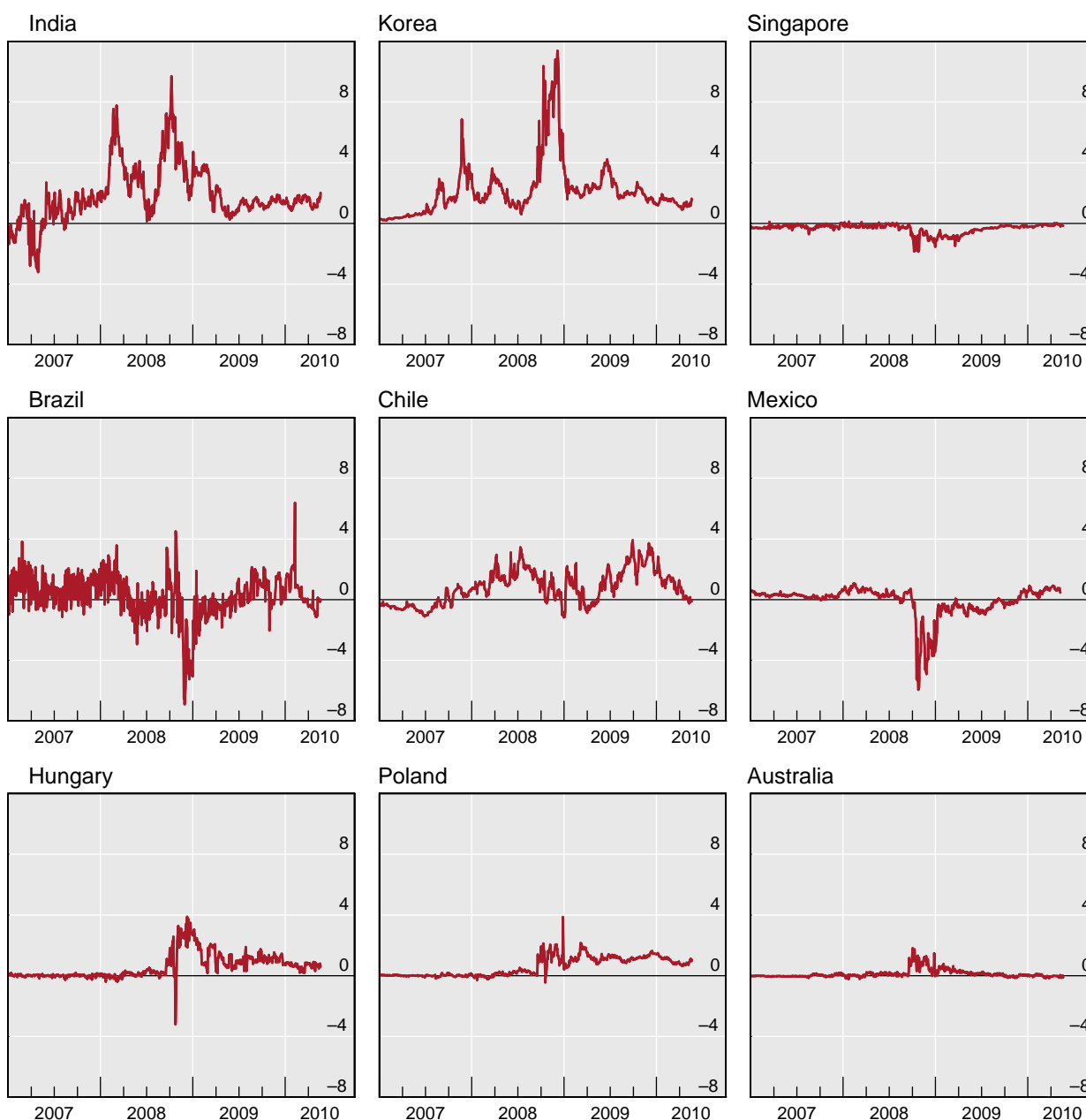
2 Cross-border positions in all currencies and local positions in foreign currencies vis-à-vis official monetary authorities. Excluding liabilities to Japanese monetary authorities placed in banks located in Japan.

3 Estimated net interbank lending to other (unaffiliated) banks.

4 The net position vis-à-vis non-banks is estimated as the sum of net international positions vis-à-vis non-banks and net local US positions (vis-à-vis all sectors). By construction, net claims on non-banks is the sum of net positions vis-à-vis other banks, vis-à-vis monetary authorities and cross-currency funding, which is the lower bound estimate of the US dollar funding gap.

5 Implied cross-currency funding (i.e., forex swaps), which equates gross US dollar assets and liabilities.

The dependence of non-US financial firms on such a scale on wholesale short-term dollar funding markets created a major systemic risk. Each individual bank may have felt that its own dependence was manageable—but the aggregate dependence of all banks globally became untenable in the crisis. The dislocations that took place in forex swap markets were dramatic (Figure 5), particularly in the currencies of the major emerging market economies. For many currencies, swap spreads still remain above pre-crisis levels, seem sensitive to adverse news, and transaction volumes have fallen.

**Figure 5: Implied FX swap spreads<sup>1</sup>**

Sources: Bloomberg; Datastream; BIS; authors' calculations.

<sup>1</sup> Calculated as the difference between three-month forex swap implied interest rate and three-month US dollar Libor, in percentage. The former is derived from covered interest parity condition based on the following domestic three-month interest rates: India, Mumbai interbank rate; Korea, 91-day certificate of deposit rate; Singapore, interbank rate; Brazil, certificate of deposit rate; Chile, 90-day discontinued Treasury Bill (DISCTB) promissory note rate; Mexico, Tasa de Interés Interbancaria de Equilibrio (TIIE) interbank rate; Hungary, interbank rate; Poland, Warsaw interbank rate; Australia, interbank rate.

## 4. SIX KEY ELEMENTS OF CONTAGION DURING THIS CRISIS

The most disturbing feature of this episode was that the disruption of virtually all wholesale bank funding markets was on a global scale. There was a systemic seizure of funding markets. The root cause was a loss in confidence in the major bank counterparties for such contracts. Related to this, a dramatic narrowing in the quality of collateral international lending banks would accept hit asset classes worldwide in a near-indiscriminate way. The sharp rise in the dollar, particularly against major emerging market currencies, brought to light large but hidden forex exposures in several major emerging market economies. Deleveraging (or even exiting) by investment banks and hedge funds accentuated the dislocations.

Disentangling the various mechanisms at work in this crisis is not easy. From the point of view of contagion mechanisms affecting liquidity, however, six elements seem to have been key:

(i) *Vulnerability of leveraged investors.* Wholesale markets that are dominated by leveraged investors (banks, hedge funds, etc.) might well offer, in good times, impressive market liquidity on all the usual microeconomic criteria—high turnover, low spreads, and limited day-to-day volatility. But they are not resilient in the face of large macroeconomic or financial system shocks: leverage magnifies the impact of such a shock on the firm's net worth and thus on its creditworthiness. Leveraged investors can be simply forced to sell.

(ii) *Counterparty risks.* Deepening uncertainties about counterparty risks in the interbank markets in the major centers (because the value of their exposures to subprime mortgage debt, collateralized debt obligations [CDOs], etc., was unknown) led to an evaporation in liquidity in the (large) interbank cash markets. This forced banks to attempt to raise liquidity (or curb lending) in forex swap markets, which, faced with these large demands, became dysfunctional. This forced the liquidation by leveraged investors of their portfolios of emerging market economy assets.<sup>10</sup> (In some emerging markets, surprisingly, pockets of surplus dollars developed amid the global shortage. It is not fully clear why local investors may have become reluctant to deposit their surplus dollars with major US banks, which may explain the negative swap spreads in Mexico and Singapore [Figure 3]). Other impediments to cross-border dollar arbitrage may have further constrained local banks.

(iii) *Narrowing in the quality of collateral.* As the crisis deepened, international lending banks became much more demanding in the quality of collateral they would accept. Fostel and Geanakoplos (2008) demonstrated just how important the impact of collateral practices on demand for non-core financial assets is. The “collateral capacity” of an asset depends on its volatility. If this increases (or is expected to increase), the value of an asset as collateral falls much more than its market price because lenders demand larger “haircuts” (i.e., the discount applied to the asset's current market value) of more volatile assets. Leveraged investors will therefore be more inclined to buy assets that they can then pledge as collateral with minimum haircuts to their bankers—and may have to forego buying some assets regarded as underpriced (because their price has become too volatile). This narrowing in the quality of collateral hit financial assets in the

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<sup>10</sup> See Baba, Packer, and Nagano (2008) for an explanation of this mechanism.

emerging markets much harder than the underlying fundamentals warranted. This made the financial crisis global.

(iv) *Foreign exchange exposures via derivatives.* Sharp currency depreciation brought to light significant forex exposures in several large emerging market countries, notably Brazil, Korea and Mexico. Increased exchange rate volatility contributed to the virtual disappearance of many forex hedging markets.

(v) *Liquidity hoarding by banks.* Most banks were well aware that they had, over many years, reduced their liquidity buffers and had become very dependent on their continued access to funding markets. Hence they had every motive to hoard liquidity once the crisis struck—thus aggravating the illiquidity in major funding markets. International banks also used their affiliates in emerging markets to improve their dollar position at home.

(vi) *Liquidity pressures in vehicle currencies.* Liquidity pressures in dollar markets mean that those international financial transactions with the dollar as one component were seriously affected. This was very important in this crisis because the US dollar is more dominant as a vehicle currency in swap transactions than it is in spot markets. Forex swap operations between two non-dollar currencies were seriously disrupted during this crisis.

The contractionary forces set in motion by these six elements reinforced each other. As banks found one market closed (or the pricing prohibitive), they sought to borrow in other markets. As a result, funding markets became very closely linked in this period of severe stress.<sup>11</sup> Furthermore, time zone differences made it harder for banks to manage their liquidity positions. CGFS (2010a: 5) describes this problem:

As US-based lenders became reluctant to lend early in the US day (Europe afternoon) when their own liquidity positions for the day were not yet known, dollar borrowing late in the European day became more difficult. As a result, European banks increasingly sought to secure funds earlier during Asian trading hours (Europe morning). At the same time, however, the supply of US dollar liquidity in the Asian and European time zones declined as many lenders, particularly official sector lenders, reduced unsecured lending. There are also reports that some foreign banks were effectively shut out of interbank markets in other jurisdictions, particularly in Asia, as counterparty concerns took hold.

## 5. STRATEGIC BORROWING CHOICES FOR INTERNATIONAL BANKS

International banks can reduce their exposure to funding market pressure in four, possibly complementary, ways. First, they can try to reduce dependence on cross-border wholesale funding by borrowing funds locally. Second, banks can reduce their overall reliance on wholesale funding. Third, borrowing at longer durations can reduce the risk that banks face near-term liquidity pressures. And finally, banks can step up efforts to reduce (or at least more effectively manage) cross-currency maturity mismatches.

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<sup>11</sup> CGFS (2010a) explains in more detail the different channels through which disruption in one funding market is quickly transmitted to other markets.

## 5.1 Increase in the local sourcing of liabilities

One natural response to the stress experienced in cross-border funding markets is to increase the local sourcing of wholesale liabilities. Borrowing in local markets to finance local assets would remove the cross-currency dimension of liquidity risk. Indeed, discussions with international banks suggest that greater emphasis on local funding is one important element of adjustments in bank funding approaches (CGFS 2010b).

However, there are limitations to the local sourcing of funds. First, local markets for many wholesale funding instruments may lack depth or simply not exist, especially in emerging market economies, but also in smaller advanced economies. For example, the ability of banks to issue bonds in local currency may be limited to short maturities if liquid instruments—usually government bonds—that can serve as basis for pricing of private debt are only short-term.<sup>12</sup> In addition, certain segments of interbank markets—e.g., repo markets, may be shallow, limiting the scope for managing funding liquidity efficiently in individual currencies.<sup>13</sup>

Second, a simultaneous shift of all banks towards local funding would face macroeconomic constraints. The domestic funding base in many countries that are net borrowers on international interbank markets may be too small. This limited funding base may reflect many factors. It could just reflect low saving propensities caused by demographic factors. Or poor macroeconomic policies (e.g., large fiscal deficits, weak monetary policies, etc.) may have depressed aggregate national savings. Conversely, savings-rich economies may lack investment opportunities at home. Indeed, a substantial share of the surplus savings of capital-exporting countries is intermediated through the global banking system, especially in countries where banks traditionally play a major role. For example, banks' cross-border claims accounted for 40–50% of the gross external claims of Japan, Germany, Switzerland, and Belgium by end-2007. Banks play an analogous role for capital-importing countries (e.g., Australia, Spain, and Italy). In less mature markets, banks often fund local credit with cross-border intra-group transfers from the parent bank: local borrowers are often saddled with sizeable currency mismatches. Persistent current account deficits may result in the build-up of large cross-border claims (as they did in central and eastern Europe).

Taken together, shallow local markets and inelastic supply of domestic savings imply that increased local funding may lead to a rise in funding costs. How banks would respond to tighter local funding conditions depends on their business model and risk appetite.

## 5.2 Shift from wholesale to retail funding

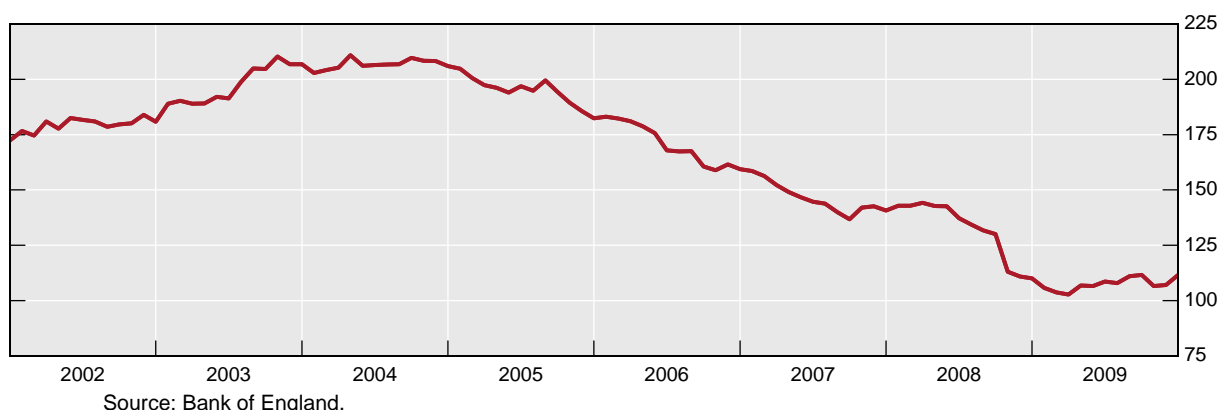
Another response to the crisis experience is to reduce reliance on wholesale market funding. The use of money market funding has been identified as major source of bank vulnerability (Brunnermeier and Pedersen 2009; European Central Bank 2009). Indeed, in discussions with the CGFS, banks said that they intend to increase reliance on retail

<sup>12</sup> CGFS (2007) shows that the development of a local currency yield curve helps banks hedge maturity risks and develop instruments.

<sup>13</sup> Immaturity and incompleteness of local funding markets might become less of a constraint over time. Banks themselves may well have greater interest in developing domestic markets and may devote more resources to domestic market activities, such as market making, or lead efforts to lengthen maturities, standardize instruments or develop market infrastructure. Such initiatives could foster more rapid development of domestic markets.

funding (CGFS 2010b). In many countries, the reliance on retail deposits fell sharply—for example, see the UK case in Figure 6. Ideally, banks need to ensure that some retail deposits are longer term maturities. A larger share of retail funding is seen as offering several benefits. First, retail funding is less exposed to changes in risk appetite in markets, and are therefore more stable than wholesale funding. Wholesale funding gives rise to concentration risks—especially in small markets. In addition, large-scale providers of wholesale funding, such as money market funds, may themselves be exposed to liquidity risk. Second, increased retail deposits will help a bank that is heavily reliant on wholesale markets to achieve a greater diversity of funding, especially when combined with the geographical diversification discussed before.

**Figure 6: UK banks' retail to wholesale deposits<sup>1</sup>**



<sup>1</sup> Wholesale deposits include certificates of deposit, sterling commercial paper and other short-term paper.

Like the shift towards domestic funding, attempts to raise retail deposits face limitations. In some developing countries, a lack of trust in the health of the banking system makes it difficult for banks—even foreign banks—to raise longer term deposits. More generally, retail funding is likely to become more costly with growing competition. For instance, in the United Kingdom since 2008 Q3, competition among UK banks for retail balances has intensified (Bank of England 2009). This represents a significant source of pressure on banks' and building societies' net interest margins and overall profitability. In addition, retail deposits might become less stable if fierce competition were to trigger more frequent shifts of deposits across institutions. Increasing competition from non-bank financial intermediaries, especially money market funds, has similar effects.

### 5.3 Lengthening of the duration of the liabilities of banks

A lengthening of the duration of liabilities reduces the exposure to rollover risk or an unexpected withdrawal of funding. But such an extension of funding maturities has costs. The incremental cost of expanding funding maturities in major currencies is high in the current environment of very low short-term interest rates and unusually steep yield curves. In this sense, monetary policies may be discouraging banks from lengthening their liabilities. Current fiscal policy does not help: high, and rising, public sector financing needs may add to upward pressure on long-term interest rates in the foreseeable future.

At the turn of the 21<sup>st</sup> century, government bonds outstanding amounted to less than USD15 trillion; by September 2010, this had risen to more than USD40 trillion. Table 4



shows BIS estimates of global net issuance of bonds by government and by financial institutions. Despite substantial government guarantees, long-term debt issuance by financial institutions in 2009 was USD1.4 trillion—about half of what it had been from 2003 to 2008. Net issuance was actually negative in the first three quarters of 2010.

**Table 4: Debt securities, changes in stocks<sup>1</sup>**  
(in billions of US dollars)

	2003– 2006 <sup>2</sup>	2007	2008	2009	Dec 2009– Sep 2010 <sup>3</sup>
Governments	1,771	1,195	2,651	4,172	3,732
remaining maturity <1 year	346	–52	1,500	314	–247
longer remaining maturity	1,425	1,247	1,150	3,858	3,980
Financial institutions	3,084	4,927	2,617	516	–938
remaining maturity <1 year	588	808	–56	–902	–696
longer remaining maturity	2,497	4,119	2,673	1,418	–242
World gross domestic product	43,479	55,392	61,221	57,937	60,933

Source: Dealogic; Euroclear; Thomson Reuters; Xtrakter Ltd; national authorities; International Monetary Fund; BIS.

<sup>1</sup> Domestic plus international issues. Exchange rate adjusted.

<sup>2</sup> Annualized.

<sup>3</sup> Cumulative.

Note: The BIS endeavors to eliminate any overlap between its international and domestic debt securities statistics as far as possible. However, as two different collection systems are used (security by security collection system for International Debt Statistics (IDS) and collection of aggregated data for Domestic Debt statistics (DDS) as well as two different approaches and definitions (market definitions for the IDS and statistical definitions in the DDS), some overlap and inconsistencies might remain by a margin which differs from country to country.

During the past decade, several large emerging market economies have made substantial progress in developing local currency debt markets. But corporate debt markets remain shallow compared with government debt markets, making it harder for banks to borrow longer term. In some smaller emerging market countries, longer-term funding may not be possible at all. As mentioned before, underdeveloped wholesale funding markets usually mean that only short-term instruments are available. In addition, the recent flat yield curve environment has accentuated the shortening in the maturity of bank deposits, particularly in emerging Asia.

## 5.4 Enhancing liquidity risk management

Addressing shortcomings in liquidity risk management complements changes in bank funding approaches. There are several areas in which banks seem to be engaged in reforming their practices (CGFS 2010b). On a general level, monitoring of liquidity risk and funding conditions may become more intense and frequent. This is likely to involve reinforcing the Head Office's central overview of liquidity management. For instance, a consolidated assessment of liquidity risk and coordinating access to central bank facilities at the group level requires that the Head Office has more information and better control over existing holdings of liquidity and collateral. Thus, while one may observe further decentralization in funding, the general trend seems to be one of increasing centralization in monitoring activity at the group headquarters.

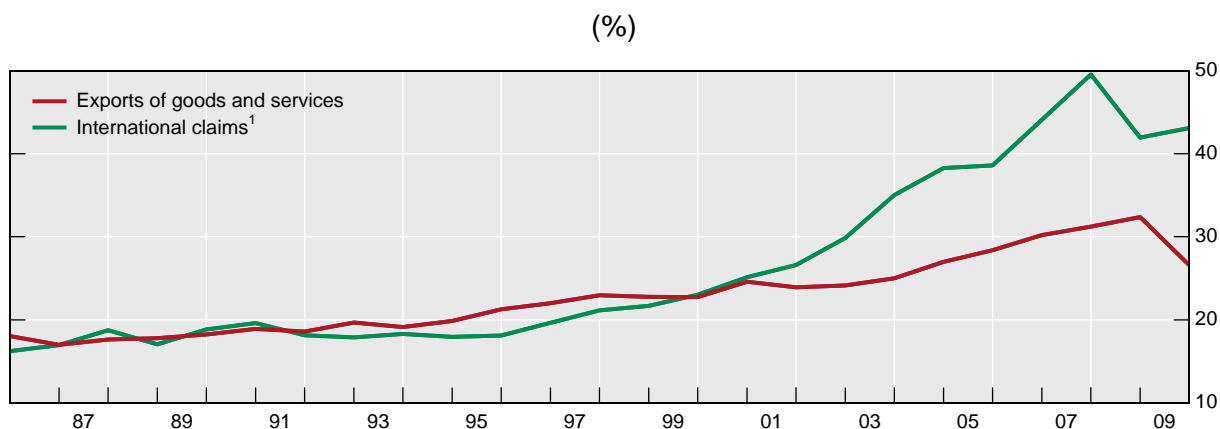
Another area for improvement is internal fund transfer pricing in order to better reflect liquidity costs and risk. This suggests that even for banks to continue to rely on centralized funding, internal transfers will probably be undertaken at conditions that are closer to those prevailing in the markets. A more realistic pricing of internal fund transfers could also create incentives for local offices to raise stable funding at home and to become less dependent on intra-group funding.

While these measures will reduce the vulnerability of banks to idiosyncratic liquidity shocks, they are unlikely to address the externalities that give rise to systemic liquidity risk. More stringent and frequent stress testing may go some way in strengthening the resilience to system-wide liquidity shocks (Senior Supervisors Group 2008). But the crisis may well have changed the endogenous dynamics of liquidity shocks in interbank markets. Any sign of interbank market strain may lead to widespread precautionary liquidity hoarding by virtually all banks. If so, the shock absorbing capacity of interbank markets may have been reduced permanently. As a consequence, liquidity shocks could become even larger and more abrupt.

## 6. NEW CONSTRAINTS SHAPING INTERNATIONAL BANKING

As discussed above, the past decade was characterized by an extraordinarily rapid expansion of international banking activity. After the early 2000s, global banking activity grew much faster than international trade—a significant change from the 15 years before, when both had expanded more or less in lockstep (Figure 7). However, there are questions as to whether strong growth in international banking will resume. Key factors that accommodated the growth of banks' international balance sheets include buoyant demand for securities products, the availability of hedging instruments at near-zero costs; and relatively light regulation of certain activities (such as low capital requirements on trading books or holdings of highly rated structured products).

**Figure 7: Ratio of international trade and banks' global claims to global gross domestic product**



Sources: IMF World Economic Outlook Database for World GDP; BIS international banking statistics.

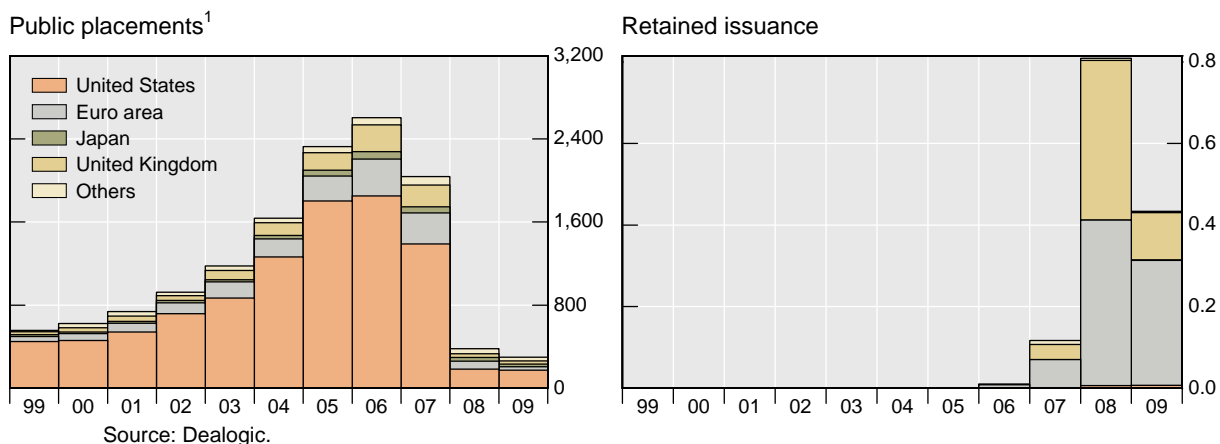
<sup>1</sup> The series are based on current exchange rates vis-à-vis the US dollar. Foreign claims comprise cross-border claims and local claims in all currencies. Interoffice accounts are excluded.

Reforms across the whole spectrum of financial intermediation (e.g., money market, mutual funds, pension funds, insurance companies, etc.) will affect wholesale funding markets for banks. The more realistic pricing of securitization and hedging risks is likely to constrain business expansion. The more effective regulation of bank liquidity risks will be a major force.

## 6.1 Limited availability of securitization markets

Issuance volumes of securitized products collapsed in 2007–2009, (Figure 8). As a consequence, banks had to keep assets on their balance sheet that could no longer sell in the market. The inability to securitize assets severely constrained credit supply. Such constraints in securitization markets became visible especially in trade finance and the syndicated loan market (Chui et al. 2010).

**Figure 8; Global securitization market**  
(in billions of US dollars)



<sup>1</sup> Securitizations issued by US agencies are not included.

The outlook for securitization markets remains uncertain. Much of the remaining market activity is still being underpinned by government and central bank support. Yet it must not be forgotten that securitization represents a technique that—properly handled—offers worthwhile benefits. Getting it restarted will probably require simpler, more standardized forms. Standardization has made headways in the past two years, but is still incomplete due to some remaining disagreements over its form; further progress is needed to improve transparency and disclosure. The experience with covered bond markets, which have held up relatively well, suggests that the double protection provided both through collateralization and through the guarantees of banks can reduce liquidity problems arising from information asymmetries—but because banks keep the risks on their balance sheets, they do not save capital.

There is an expectation of some “self-healing” of the market for securitization once the economic recovery gets underway and investment demands increase. But it remains uncertain how much of the previous market is likely to return through such a process. Some forms of credit—such as credit card debt (which draws on large pools of underlying debt and is short term) and trade credit—may be easier to securitize than others. Overall, however, the ability of banks to rapidly expand credit by securitization will probably be smaller than before.

One important open question is whether the greater acceptance of high-quality private sector debt products to meet regulatory requirements for liquidity could help securitization markets recover. Securitized products that are based on liabilities that are due to mature over approximately the next 12 months would have the attractive self-liquidating properties that exchange bills had in the 19th century. The accuracy of credit ratings assigned to such short-term paper could be regularly tested as maturing paper falls due within short intervals—quite unlike the ratings on very long-term debt!

## **6.2 Higher prices for hedging instruments such as cross-currency swaps**

Higher costs of managing cross-currency exposures may place additional constraints on the future expansion of international banking. Forex swaps spreads were near-zero for many currency pairs before the crisis, including relatively small and illiquid currencies (see above). The fact that forex swaps spreads have remained elevated may indicate a persistent change in hedging costs.

There is also greater differentiation in forex swap spreads across currencies. In part, this is probably attributable to perceived differences in swap market liquidity. Such differentiation should encourage a better pricing of cross-currency liquidity risk, especially if it is reflected in internal fund transfer pricing.

## **6.3 Changes in the regulation of institutional investors**

Institutional investors—money market funds (MMFs), insurance firms, and pension funds—are important sources of bank funding. At times, their behavior has had strong effects on market conditions. For example, MMFs held nearly 40% of outstanding commercial paper (CP) in the first half of 2008, half of which was issued by non-US banks. Overall, European banks appear to have relied on money market funds for about an eighth of their USD8 trillion in dollar funding (Baba, McCauley, and Ramaswamy 2009). It is not a surprise that the withdrawal of MMFs from short-term bank investments exacerbated bank funding strains during the crisis.

Many institutional investors face major changes in regulatory and accounting frameworks. This could make them less willing to fund banks. New SEC rules (effective from May 2010), require MMFs to hold a larger share of highly liquid assets, reduce their ability to invest in securities that bear significant credit risk, and impose stricter maturity limits.

Solvency II, the capital adequacy for European insurers scheduled to come into effect in 2012, makes the capital needs of insurance firms more sensitive to credit risk and market risk. As a result, insurance firms might review the attractiveness of investments in long-term bank bonds. Moreover investment decisions might become increasingly sensitive to changes in bank ratings. The upshot is that one major source of long-term bank funding might become more expensive.

Regulation that leads to a better pricing of counterparty and liquidity risk should help to prevent banks' over-reliance on short-term wholesale funding. And greater risk sensitivity could help to strengthen risk management and monitoring of investors in bank debt. At the same time, the confluence of regulatory changes could interact, and affect banks' funding conditions, in ways that are hard to predict.

## **6.4 More intrusive oversight by host country supervisors, especially on liquidity positions**

Before discussing why governments might force international banks operating in their jurisdiction to hold liquid assets locally, one issue deserves a mention. Governments with large budget deficits throughout history have been tempted to force central banks, commercial banks, or institutional investors such as pension funds to buy and hold the debt securities they issue. These pressures frequently extend to bonds issued by

government-sponsored corporate entities (including those related to mortgage finance). Such policies undermine fiscal discipline and distort the pricing of maturity risks. This issue, relevant today given large structural fiscal deficits in many countries, needs to be kept in mind.

But it is legitimate for governments to ensure that banks operating in their jurisdictions hold some form of liquid assets to cover outflows of funds under stress and to protect local depositors. Alan Bollard's remarks in 2004 suggesting that the areas of potential divergence between home and host supervisors are likely to become most apparent in a situation of stress when the stakes are highest look very prescient in the light of the recent crisis.<sup>14</sup>

Host country liquidity regulation is one traditional approach to ensure that banks hold sufficient liquid assets domestically and that these assets are not transferred to the parent in a crisis. Such regulation would be less necessary if there were an effective international agreement on bank resolution—and if it were credible that the legal and political authorities in both home and host countries would actually abide by its provisions in a crisis.

Various regulatory initiatives with the aim of strengthening liquidity requirements are under way. There is a strong demand for quantification: private sector counterparties dealing with opaque and complex firms argue for the publication of some benchmark measures. The Basel Committee on Banking Supervision (BCBS) proposed, for the first time, a global minimum standard (BCBS 2010). This is designed to expand and harmonize existing approaches used by national supervisors and the banking industry (i.e., liquidity coverage ratios, net liquid assets, and cash capital methodologies). Global liquidity requirements are new, and it will take time for banks to adapt their diverse liquidity risk management practices. And the Basel Committee has announced it will review the liquidity rules in the light of experience.

From the perspective of the geographical organization of international bank funding, the scope of application of liquidity regulation is of great importance. If liquidity requirements were (only) applied at the level of the worldwide consolidated entity, the geographical organization of a banking group (and thus the degree of centralization) would be inconsequential. Although intended as a global standard for regulating the consolidated entity, the BCBS consultative paper nonetheless gives host jurisdictions the option of applying the standards on a legal entity basis as well.

A few regulators have announced their intention to apply quantitative liquidity requirements to the subsidiaries and branches of foreign banks in their jurisdiction (CGFS 2010b). The main departure from current practice is that some host regulators will require quantitative liquidity ratios to be satisfied by all entities on a stand-alone basis. In some instances, such practices may be used to induce banks to buy the debt issued by host country governments. This may well confront many foreign subsidiaries and branches active in those jurisdictions with binding constraints.

The combination of consolidated (home) and host country regulation of banks' foreign operations can force several changes in international bank funding and liquidity management. The first is to decentralize important aspects of liquidity management. Compliance with local liquidity requirements may require setting up local treasury

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<sup>14</sup> Bollard said: "In times of stress, the allocation of capital and risk within the group can be crucial... the home and host countries may have very different views on the choice of techniques for responding to bank distress... and quite different perceptions of when a crisis is systemic" (Bollard 2004: 5).

functions for the measurement of regulatory ratios and the management of liquid asset holdings. One important drawback could be the fragmentation of liquidity holdings. While banking groups under consolidated regulation may hold liquid assets at the central treasury, local regulation could require each entity to hold liquid assets in the host country, possibly in local currency, to meet local liquidity requirements without reliance on other parts of the group.

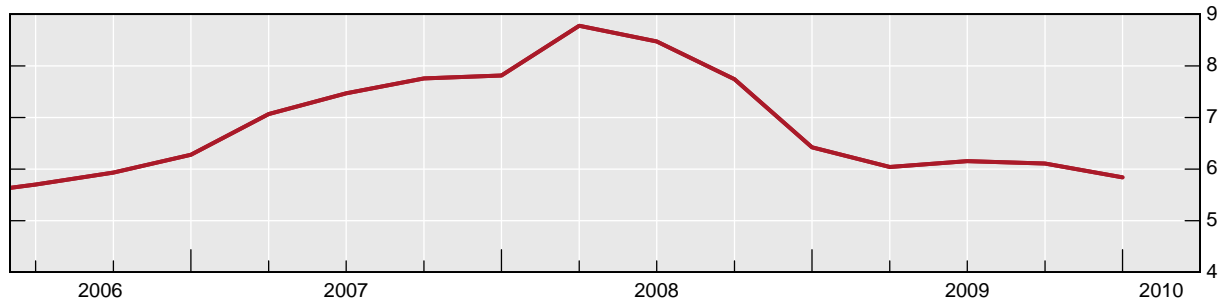
But there are also advantages. Local liquidity regulation is likely to limit maturity and currency mismatches across the banking group. If currency and maturity mismatches offset each other to some extent when consolidated across jurisdictions, this form of diversification would no longer be recognized by host supervisors focused on the legal entity alone. Pressure to reduce mismatches at local entities may work towards lowering overall mismatches of the consolidated group as a whole.

## **7. “GLOBAL LIQUIDITY” AND ITS MANAGEMENT**

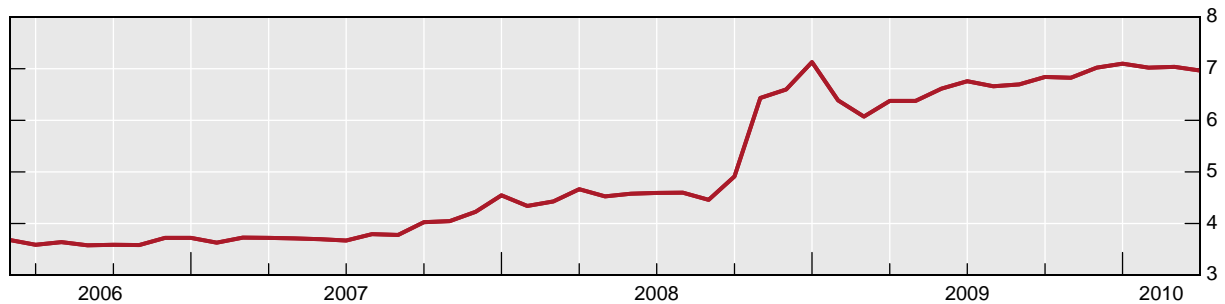
This paper has explained that the term “liquidity” has many connotations. One key dimension internationally is liquidity in global interbank markets, which remains strained. The price-based measures (Libor-OIS and implied forex spreads shown in Figures 1 and 5, respectively) were described in the introduction. One crude quantity-based measure, shown in panel A of Figure 9, is global interbank claims. This declined from a peak of almost USD9 trillion at the end of the first quarter of 2008 to less than USD6 trillion by the end of 2009.

**Figure 9: Liquidity in international markets**  
(in trillions of current US dollars)

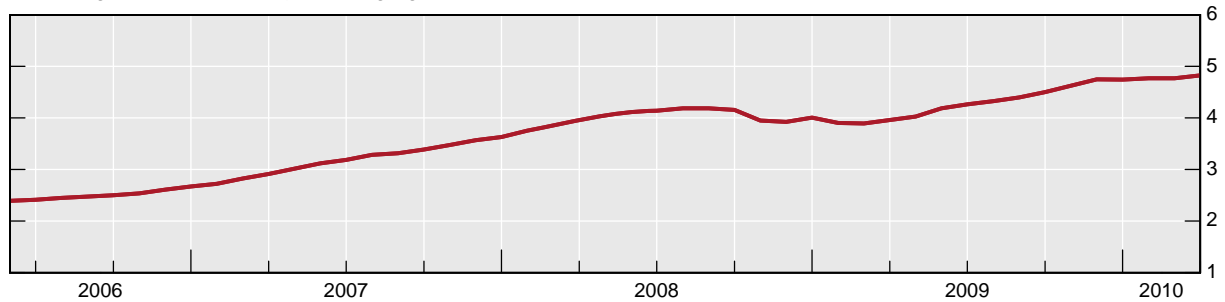
A. Global interbank claims<sup>1</sup>



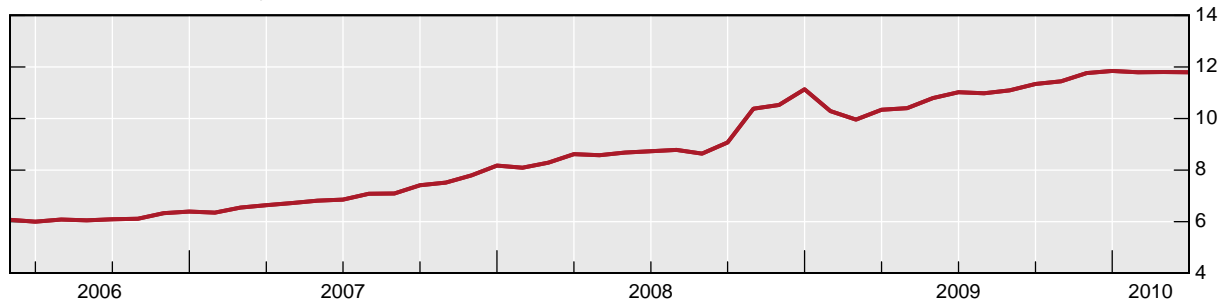
B. Central bank assets in advanced economies<sup>2</sup>



C. Foreign reserves of major emerging market economies



D. Global official liquidity (B+C)





Sources: BIS consolidated statistics (ultimate risk basis), Datastream; national data.

<sup>1</sup> BIS reporting banks consolidated foreign claims of on banks worldwide.

<sup>2</sup> Total for the United States, the euro area, Japan, Canada, Sweden, Switzerland, and the United Kingdom.

<sup>3</sup> Total of major emerging market economies (Brazil; PRC; Taipei, China; Hong Kong, China; India; Korea; Malaysia; Mexico; Russia; Singapore; Thailand; and Turkey).

The official sector has created a huge amount of liquidity globally to offset this massive private sector shift. That this has happened is beyond doubt; but defining it precisely is of course impossible. Hannoun (2009) suggests, as a rough-and-ready calculation, adding central bank assets in advanced economies (panel B) to foreign exchange reserves of the major emerging market economies (panel C). On this calculation, global official liquidity has risen from about USD7 trillion in mid-2007 to around USD12 trillion by the end of 2009.

Hannoun (2009) argues that such policies could create a “new permanent accommodative monetary policy regime” as central banks or governments seek to influence the entire length of yield curves. Therefore it will be up to international banks to reform the business strategies that, ultimately, led to the Great Liquidity Freeze. Regulators and central banks will have to play their part in preventing future excessive build-up of liquidity risks in the global financial system.

This paper has argued that the management and regulation of the liquidity of banks is very difficult. The discussions about liquidity ratios that took place in the early 1980s, and which failed to produce an international agreement on the regulation of bank liquidity, showed this clearly. The structure of bank balance sheets that gave rise to the severe funding vulnerabilities from 2007 took years to develop—it was not just a short-lived lapse in banks’ risk management. The banks who were interviewed in the CGFS exercise were well aware of the great challenges this involves. International banks seem set to gradually increase the local funding of local assets while monitoring more closely liquid reserves and liabilities at headquarters. The fact that emerging market economy banks emerged largely unscathed from this crisis should not lull regulators into complacency. The financing by banks of heavy infrastructure and housing investment by short-term liabilities could expose banks in emerging market economies to larger liquidity risks.

Policy action will have to be far-reaching and forceful. Particular attention must be paid to how new regulations for banks, for non-bank intermediaries such as money market mutual funds, for insurance companies, and for markets interact with each other. Regulation will have to be adaptable as lessons are learned about new international policies. Policymakers need to find ways both to prevent an autarkic approach to the liquidity of the affiliates of international banks and to ensure that the reliquification of the global banking system does not lead to a prolonged credit squeeze.

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