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European banks' US dollar funding pressures¹

With major central banks having re-established temporary foreign exchange swap facilities to alleviate growing strains in short-term funding markets, European banks' US dollar funding patterns are back in the news. This article documents the persistence of these banks' aggregate US dollar funding needs, pointing to an ongoing, large-scale reliance on sources of wholesale funds and, in particular, on the foreign exchange swap market.

JEL Classification: F34, F55, G01 G21.

Dollar funding problems are back in the news. On 9 May 2010, as part of a comprehensive policy package to address the risk of contagion among euro area sovereigns and financial institutions, the Federal Reserve and other major central banks re-established temporary foreign exchange (FX) swap facilities to alleviate growing strains in US dollar short-term funding markets in Europe.² An identical set of swap lines had been the major central banks' response to similar funding pressures in the wake of the Lehman failure in September 2008.³ Both the re-emergence of these pressures (as apparent from rising Libor-OIS and cross-currency basis spreads) and the subsequent re-establishment of FX swap lines to alleviate them indicate that maturity mismatches in European banks' cross-currency activities have remained significant. As a result, with concerns about exposures to fiscally challenged sovereigns on the rise, European banks have apparently found it difficult to roll over their short-term US dollar funding positions. This article documents European banks' aggregate US dollar funding needs in more detail and shows how some European banking systems have been more successful than others in reducing their reliance on short-term sources of US dollar funds relative to the levels seen before the recent financial crisis.

¹ The views expressed in this article are those of the authors and do not necessarily reflect those of the BIS.

² In addition to the Federal Reserve, these facilities involve the Bank of Canada, the Bank of England, the European Central Bank and the Swiss National Bank. The arrangement with the Bank of Canada supports drawings of up to \$30 billion, while those with the other central banks are designed to allow tenders of US dollars at fixed rates for full allotment. See Federal Reserve (2010).

³ See Fender and Gyntelberg (2008) and BIS (2009).

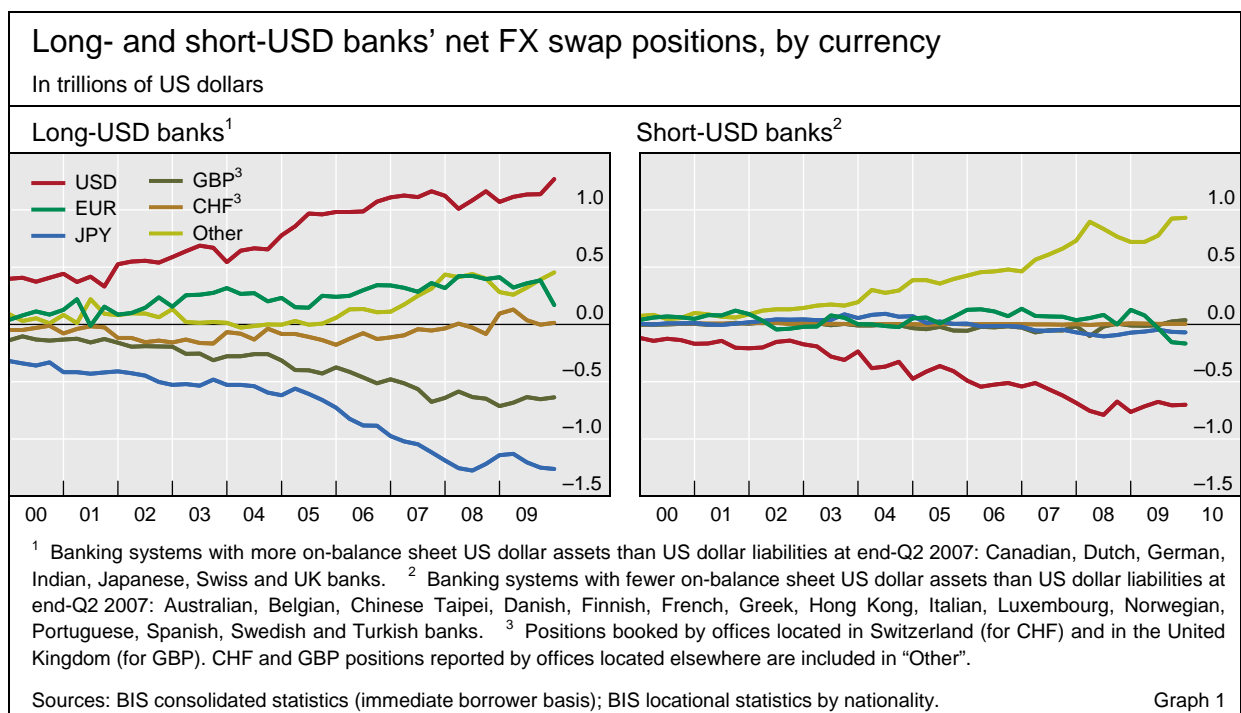
Cross-currency financing and the FX swap market

In principle, a non-US bank can finance its foreign currency assets in two ways. It can borrow foreign currency outright from the interbank market or from non-bank market participants or central banks, using retail (ie deposits) as well as wholesale (eg commercial paper or repurchase arrangements) instruments. Alternatively, the bank can use FX swaps to convert liabilities in its domestic or third currencies (which will themselves be from either retail or wholesale sources) into the desired funds for the purchase of foreign currency assets. Either way, it will seek to match the level of its foreign currency investments with on- or off-balance sheet liabilities in the same currency to avoid taking open FX exposures. Yet, to the extent that these assets and liabilities have different maturities, the bank will be exposed to *embedded maturity mismatch* and, hence, face *funding* (or rollover) *risks*.

For many national banking systems, foreign currency assets persistently exceed the amount of outright foreign currency funding. Consolidated banking data thus point to structural cross-currency funding needs arising from banks' international activities. The underlying FX swap positions, which are off-balance sheet and notoriously hard to track with available volume data, must be inferred from reported on-balance sheet activities at the level of national banking systems. Specifically, assuming that banks have very small open FX positions, any *on-balance sheet* net (ie assets minus liabilities) long or short position in a particular currency provides an estimate of banks' offsetting net FX swaps (and futures) off-balance sheet positions in that currency.

Using the BIS international banking statistics, Graph 1 aggregates these on-balance sheet positions by currency separately for two groups of banking systems: those that had either an excess or a shortfall of on-balance sheet US dollar assets relative to US dollar liabilities at the start of the crisis. We label these banking systems as *long-USD* and *short-USD*, respectively. If banks

Cross-currency financing ...



hedge their foreign exchange risk in the way described above, then these figures imply that, at end-2009, long-USD banks (shown in the left-hand panel) demanded an estimated aggregate of \$1.27 trillion (net) in US dollars from the FX swap market. In exchange, these banks provided an equal amount of yen, euros, sterling, Swiss francs and other currencies. On the other side (shown in the right-hand panel), short-USD banks were net providers of roughly \$700 billion to the FX swap market. The difference of some \$570 billion is accounted for by non-bank participants not captured by BIS banking data.

Measuring US dollar funding gaps⁴

Gauging the funding risk arising from these activities requires information on the amount of banks' net short-term US dollar liabilities at any point in time (ie those short-term liabilities that are not offset by assets of corresponding maturity). This, in turn, necessitates a breakdown by *residual maturity* of banks' US dollar-denominated assets and liabilities. Although maturity information is not available, the counterparty type (bank, non-bank or central bank) can serve as a proxy. Specifically, banks' US dollar-denominated claims on non-banks can be thought of as their desired dollar-denominated investment portfolio. This portfolio of non-bank assets includes banks' retail and corporate lending, lending to hedge funds, and holdings of securities ranging from US Treasury and agency bonds to structured products. These exposures are of varying maturities, but, on average, are likely to be longer-term than the funding that supports them. In contrast, interbank positions (both assets and liabilities) are typically short-term, as are any FX swap positions used to convert funds into US dollars.

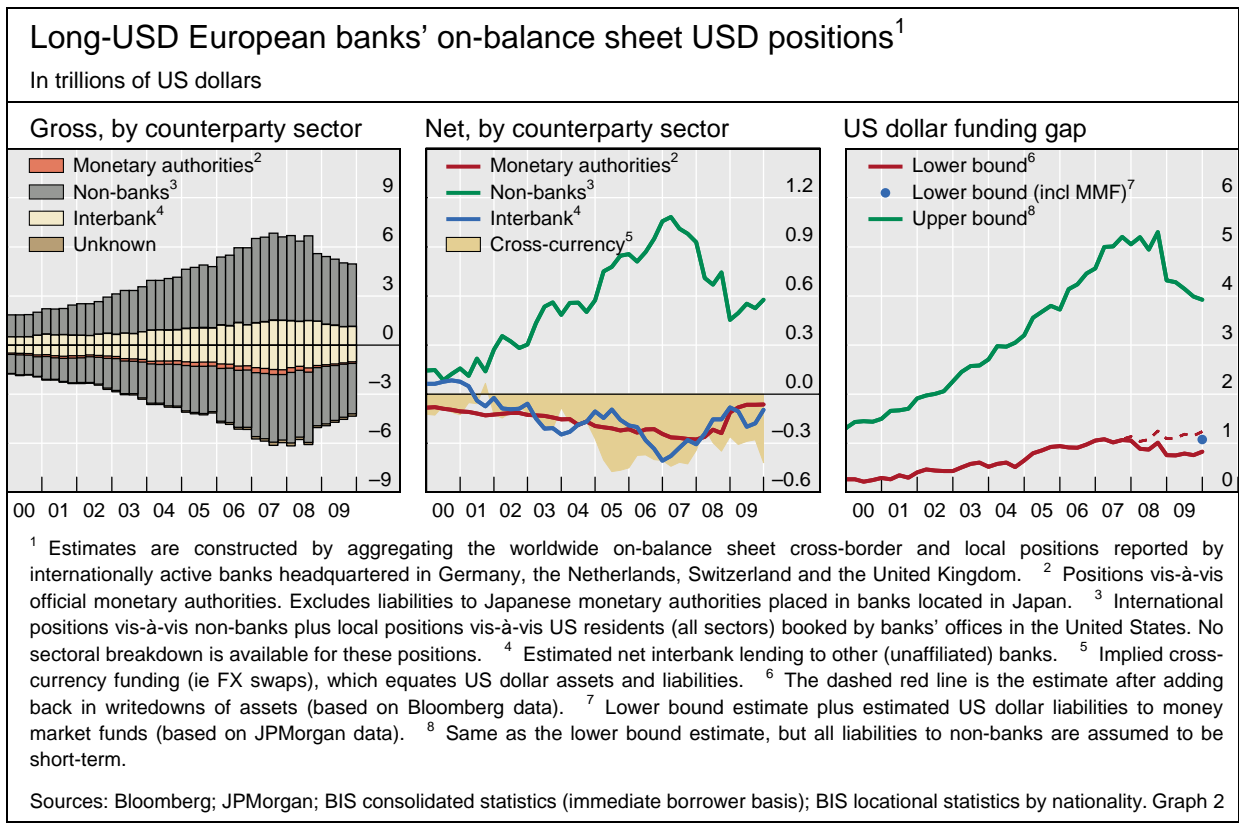
Graph 2 (left-hand and centre panels) illustrates the size of these positions (in both gross and net terms) for European banks that were long US dollars at the start of the crisis (Graph 3 presents corresponding data for short-USD banking systems). Additional assumptions about banks' liabilities to non-banks then allow the construction of various estimates of maturity mismatch – what might be called *funding gaps*.

Measures of these funding gaps are presented in the right-hand panels of Graphs 2 and 3, aggregated for long- and short-USD banks, respectively.⁵ If liabilities to non-banks are all assumed to be long-term, then the lower bound estimate of these banking systems' overall US dollar funding gap is net interbank borrowing (if positive) plus net borrowing from the FX swap market, which is backed out from the balance sheet identity (see Table 1 for an illustration). To this, any net US dollar borrowing from official monetary authorities (mainly via deposits of currency reserves) is added – positions with

... can embed sizeable maturity mismatches in bank balance sheets

⁴ See McGuire and von Peter (2009). This article updates and extends these earlier results.

⁵ Note that the overall estimate of the US dollar funding gap will critically depend on, among other things, the sample of national banking systems included in the calculation. Furthermore, for technical reasons related to the compilation of the BIS banking statistics, the quality of the funding position estimates differs across banking systems, with data for Swiss banks being particularly difficult to analyse. See McGuire and von Peter (2009) for details.



unclear maturity, but which proved to be volatile during the recent crisis. The upper bound estimate is then set simply by adding liabilities to non-banks to the lower bound measure, under the assumption that these are short-term (and, hence, might not be replaced).⁶

The range defined by both estimates implies that long-USD European banks' aggregate US dollar investments were subject to considerable funding risk at the start of the crisis. Even by the lower bound measure, the estimated US dollar funding gap for Dutch, German, Swiss and UK banks combined reached some \$1 trillion by mid-2007, having built up gradually over time.

Estimated funding gaps ...

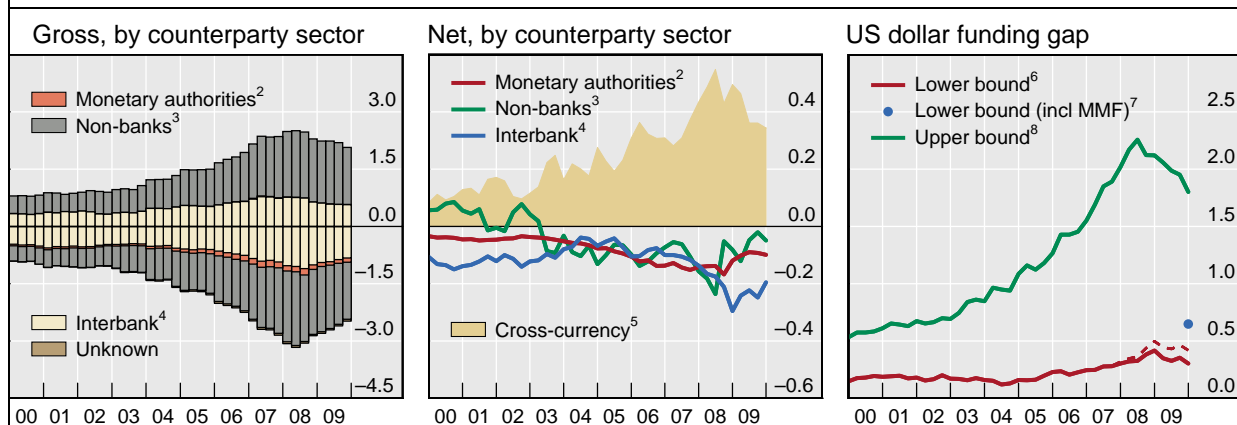
Stylised bank balance sheet	
US dollar book (assets and liabilities denominated in US dollars)	
Assets	Liabilities
Claims on non-banks (assumed long-term)	Liabilities vis-à-vis non-banks (short- or long-term)
	Net interbank borrowing (short-term)
	Net borrowing from monetary authorities (short-term)
	Net borrowing via the FX swap market (short-term)

Table 1

⁶ For long-USD banks with positive net interbank borrowing, the first (lower bound) measure is identically equal to banks' net US dollar claims (assets minus liabilities) on the non-bank sector. The second (upper bound) measure, in turn, is identically equal to banks' gross US dollar claims on non-banks.

Short-USD European banks' on-balance sheet USD positions¹

In trillions of US dollars



¹ Estimates are constructed by aggregating the worldwide on-balance sheet cross-border and local positions reported by internationally active banks headquartered in Belgium, Denmark, Finland, France, Greece, Italy, Luxembourg, Norway, Portugal, Spain and Sweden. ² Positions vis-à-vis official monetary authorities. Excludes liabilities to Japanese monetary authorities placed in banks located in Japan. ³ International positions vis-à-vis non-banks plus local positions vis-à-vis US residents (all sectors) booked by banks' offices in the United States. No sectoral breakdown is available for these positions. ⁴ Estimated net interbank lending to other (unaffiliated) banks. ⁵ Implied cross-currency funding (ie FX swaps), which equates US dollar assets and liabilities. ⁶ The dashed red line is the estimate after adding back in writedowns of assets (based on Bloomberg data). ⁷ Lower bound estimate plus estimated US dollar liabilities to money market funds (based on JPMorgan data). ⁸ Same as the lower bound estimate, but all liabilities to non-banks are assumed to be short-term.

Sources: Bloomberg; JPMorgan; BIS consolidated statistics (immediate borrower basis); BIS locational statistics by nationality. Graph 3

Banks obtained the funds to close this gap mainly from non-US dollar sources, and then swapped the proceeds into the US currency. If all liabilities to non-banks are treated as short-term funding, the upper bound estimate of these long-USD banks' combined US dollar funding gap would have been roughly \$5 trillion as of mid-2007.

Cross-currency funding patterns for long-USD banks contrast with those for the short-USD banking systems. In the latter, asset holdings (domestic or foreign) were largely built up in the domestic currency. Banks, therefore, were able to fund part of these activities from their domestic deposit base, with the balance obtained from domestic wholesale and foreign currency sources. As a result, short-USD banks accumulated net short on-balance sheet positions in US dollars, which were then channelled through the FX swap market to fund activities in their domestic as well as other currencies. The aggregate funding gap arising from this activity reached an estimated \$400 billion–\$2.1 trillion in late 2008.

Dollar funding during the crisis

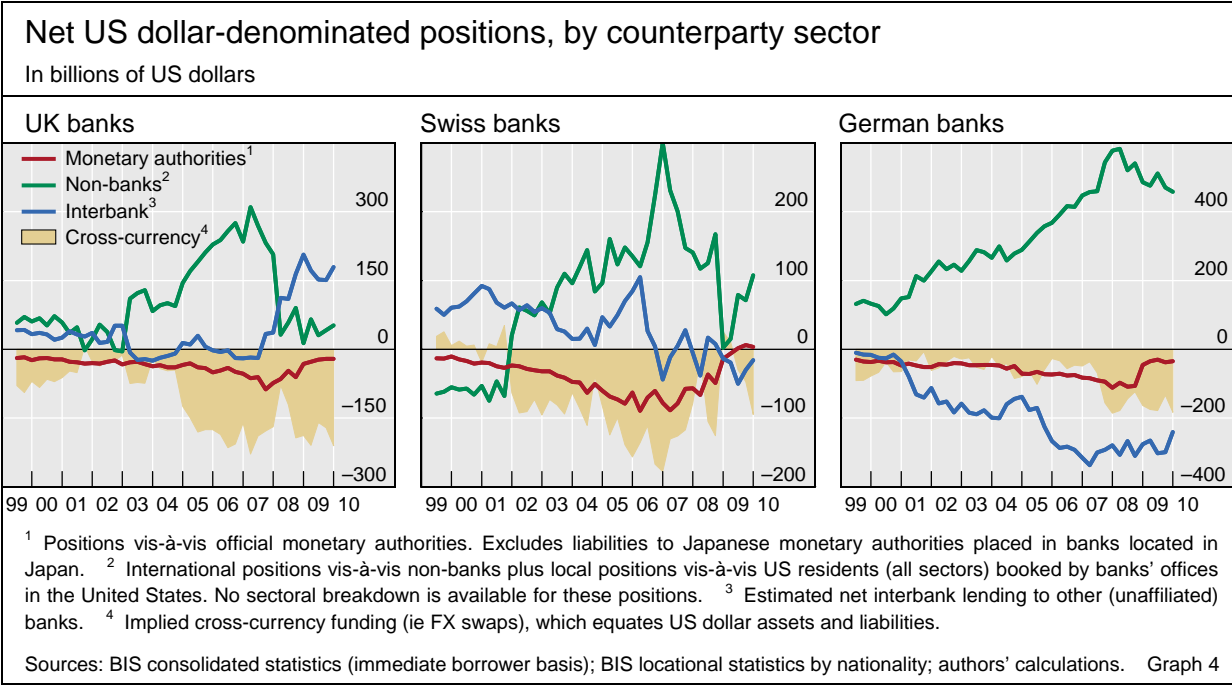
The estimates of the US dollar funding gaps for both groups of banks have come down over the past year. Data up to end-2009 show dollar funding gaps within a range of \$820 billion–\$3.9 trillion for the long-USD banks,⁷ and within \$300 billion–\$1.8 trillion for short-USD banks. If estimates (taken from

⁷ This range becomes \$800 billion–\$3.4 trillion if Dutch banks, which have moved since the start of the crisis and the break-up of ABN AMRO from a long on-balance sheet US dollar position to a short US dollar position, are excluded.

Roever (2010)) of banks' reliance on money market funds (which are treated as non-bank counterparties in the BIS banking data) are included in the analysis as short-term liabilities, then the lower bound estimates at end-2009 are considerably higher in each case (as indicated by the blue dots in the right-hand panels of Graphs 2 and 3). Overall, while lower than before the crisis, this persistence of funding gaps on European banks' balance sheets points to an ongoing, large-scale reliance on sources of wholesale funds and, for long-USD banks, on the FX swap market.

Moreover, there are also some aspects of bank behaviour that could make any observed declines in the measures misleading. One issue is whether banks close out funding positions as soon as assets are written down. Asset writedowns reduce the reported stock of US dollar claims and thus lead to a decline in net claims on non-banks. Since the net FX swap positions have to be backed out as a residual from the balance sheet identity, any writedown on the asset side is automatically reflected in a reduction in the implied net FX swap positions. As a result, the accuracy of the estimated US dollar funding gap depends on the extent to which banks *actually* unwound the funding positions supporting these written-down assets as they matured. If the long-USD banks closed out *all* these positions by, for example, buying US dollars in the spot market, then the original lower bound estimate of their US dollar funding gap is correct. If, on the other hand, banks have *not* closed out all their funding positions (perhaps because they do not expect writedowns to be permanent), then the observed measure would underestimate the true funding gap by the amount of the corresponding writedowns (ie the difference between the solid and dashed red lines in the right-hand panels of Graphs 2 and 3). In this latter case, assuming that banks' writedowns are related mainly to US dollar-denominated non-bank assets, the lower bound estimate of the US dollar funding gap at end-2009 could still be in the neighbourhood of its pre-crisis peak, and considerably higher than the estimated \$800 billion lower bound gap

... remained large up to end-2009 ...



... but differed by
banking system

that results when long-USD banks' funding positions are assumed to have been closed in lockstep with asset writedowns.

Importantly, however, banking systems differ in their reliance on short-term US dollar funds (Graph 4). Swiss banks' net non-bank US dollar positions have fallen from \$300 billion before the crisis to just over \$100 billion most recently, following a reduction in the size of their US dollar books (centre panel). Reflecting the same trend, UK banks' net non-bank positions have also come down significantly (left-hand panel). The change in Dutch banks' positions (not shown), in turn, appears to be largely the result of the break-up of ABN AMRO, a source of sizeable US dollar activities before the crisis. German banks, finally, stand out as maintaining the largest US dollar funding gaps among European banking systems, at least on the basis of BIS data (right-hand panel).

Possible implications

The funding patterns documented in this article point to an ongoing, large-scale reliance of European banks on sources of wholesale cross-currency funding. As a result, banks are required to roll over significant parts of their funding at relatively short maturities, which are bound to become even shorter if conditions deteriorate. Reduced access to outright funding in individual currencies could then force banks to rely even more strongly on FX swap markets for any additional foreign currency funds or require the transfer of collateral across jurisdictions (for use in repo or other transactions).

Such funding patterns put a premium on contingency funding arrangements for international banks and underline the need for further diversification in banks' funding profiles (ie a reduced reliance on short-term foreign currency funds). In particular, they point to potential benefits from improvements to FX swap market infrastructure, such as the use of central counterparties to allow multilateral netting and more efficient collateral management. In addition, broader measures to address systemic cross-border funding pressures could include mechanisms that facilitate the cross-border use of collateral in central bank refinancing operations or regional swap arrangements on the basis of reserve pooling.⁸

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⁸ See CGFS (2010) for a detailed discussion of these measures; CPSS (2006) examines the mechanics of cross-border collateral arrangements.

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