



Leverage in the small and in the large

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I am pleased to join Tobias Adrian and fellow panellists to discuss systemic risk and macroprudential stress tests. Systemic risk is about the system as a whole. One approach to gauging systemic risk is to drill down to detailed micro evidence of how financial institutions are intertwined. There is much to be learned through this approach, as we delve into the complex web of interconnections. The other way to go is to “drill up”, to the macro, and indeed global, aggregates.

I will argue that drilling up is often more informative, as it delivers the all-important time dimension of systemic risk – how it builds up over time and how it unwinds. In this vein, I draw a distinction between leverage in the small (leverage of individual institutions) from leverage in the large (leverage of the financial system as a whole), and will argue for two propositions.

First, mitigating complexity is mostly about taming leverage in the small. The motto is: *if you take care of leverage in the small, complexity will take care of itself.*

Second, lest we fall into complacency, taming complexity is not enough to ward off systemic risk. Systemic risk is mostly about leverage in the large. Addressing systemic risk entails taking a macro and global perspective. Here, the motto is: *take a global approach to macroprudential frameworks.*

Leverage in the small

Banks are intermediaries; they borrow from other lenders, combine the borrowed funds with their own funds, and then lend the combined total to ultimate borrowers. Equity is the bank’s own funds. The more equity a bank has, the more own funds it has to lend out. As well as lending out its own funds, a bank can borrow and lend out the proceeds. Imagine a bank’s total lending as the capacity of a building. Then the bank’s equity is like the size of the building’s foundations, and its leverage is the height of the building. Increasing leverage expands lending by building a taller building on the same foundations.

Graph 1 is a scatter chart for a large European bank. It shows the change in assets and how the change is financed – either from equity (in blue) or from debt (in red). The fitted line through the red scatter has a slope of 1, meaning that changes in assets over horizons of around one year are almost all explained by the change in debt. The blue scatter for equity is flat, meaning that the bank’s own funds do not vary much over the cycle. This scatter chart suggests that the foundations of the building are pretty much fixed, and what changes is the height of the building. During boom times, the bank increases lending by adding floors to the building. When the downturn arrives, the bank has to remove some floors, in a painful adjustment.

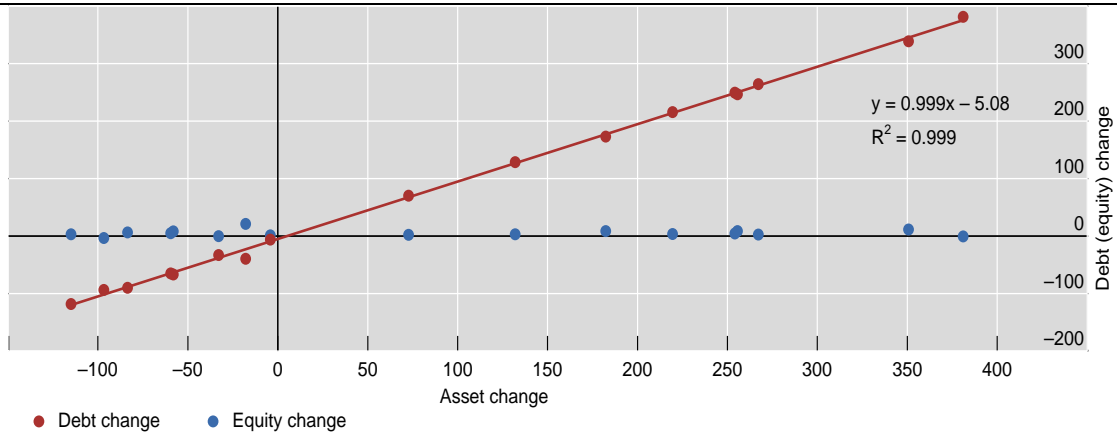
¹ I thank Iñaki Aldasoro, Stefan Avdjiev, Claudio Borio, Jaime Caruana, Dietrich Domanski, Mathias Drehmann, Krista Hughes and Robert McCauley for comments and Taejin Park for excellent research assistance. The views expressed here are my own, and not necessarily those of the Bank for International Settlements.



Annual changes in assets, equity and debt for a large European bank

1999–2015, in billions of euros

Graph 1



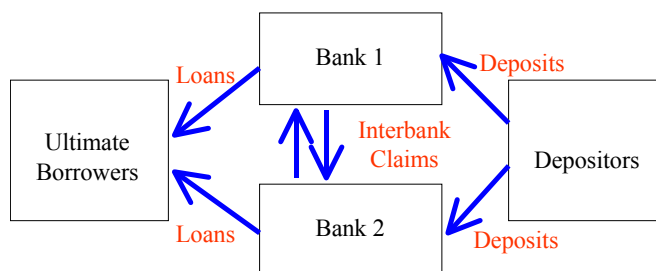
Sources: S&P Capital IQ; BIS calculations.

The bank draws on deposits to finance the lending, but it can also borrow from other banks. The leverage of the banking sector as a whole (leverage in the large) depends on how much lending is being done by the banking sector as a whole compared to its total equity base. Leverage in the small (leverage of individual banks) can vary a lot, even if leverage in the large does not.

Graph 2 is a deliberately stark (and unrealistic) example to make one point: that the leverage of the banking system can differ from the leverage of individual institutions. Two banks, Bank 1 and Bank 2, draw on deposits and borrow from each other. Suppose that the economy is closed to external funding. Then by construction, total lending is given by the sum of deposits and the combined equity of Banks 1 and 2, and leverage of the system is the ratio of total lending to bank equity. However, the leverage of the two banks can increase by any amount through higher interbank lending, without affecting at all the leverage of the system. Indeed, it is a theorem² that any level of leverage for the financial system is consistent with (almost) any profile of leverage of individual banks.

Stylised closed economy banking system

Graph 2



² See Proposition 1 in H S Shin, "Securitisation and financial stability", *The Economic Journal*, vol 119, 2009, pp 309–32. The relationship is: $L = 1 + (\sum_{i=1}^n e_i z_i (\lambda_i - 1)) / (\sum_{i=1}^n e_i)$, where L is the leverage of the banking system, e_i is the equity of bank i , λ_i is leverage of i and z_i is i 's funding that comes from outside the banking system.

Interconnectedness is the flip side of the divergence between leverage in the small and in the large. Keeping individual leverage in check keeps a lid on interconnectedness. In practice, however, aggregate leverage is closely tied to the leverage of individual institutions. Unlike Graph 2, the banking system in reality is open both to new domestic funding sources and to external funding sources. In Graph 2, we should insert another box representing these additional funding sources.

Comparing the experiences of Spain and Korea

The experience of Spain is a good illustration of the external dimension of lending booms. On the eve of the 1999 launch of the euro, total bank credit in Spain stood at €414 billion. Over the next 10 years, bank lending in Spain rose fivefold to €1.87 trillion. Loans unrelated to the property sector grew modestly, but property-related lending grew very rapidly.

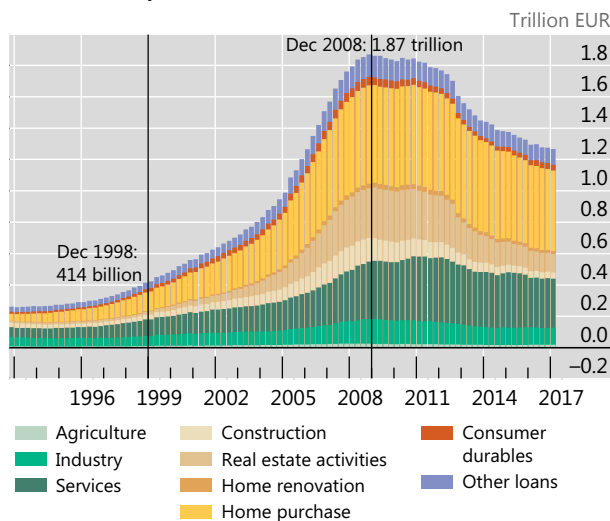
How was the lending financed? Before the euro, domestic bank lending in Spain could be financed entirely from deposits of Spanish residents (Graph 3). Indeed, deposits exceeded lending, as shown by negative non-core funding, defined as lending minus deposits, shown in the right-hand panel. However, as loans outpaced deposits, more funding came from investors outside Spain, for instance, through the issuance of long-term covered bonds.

Spain: Banking sector credit and funding

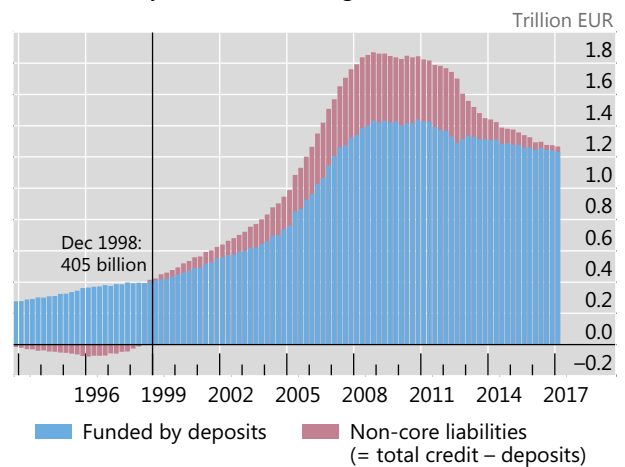
Total credit to domestic private non-financial resident sector

Graph 3

Breakdown by borrower sector



Breakdown by source of funding



Source: Bank of Spain.

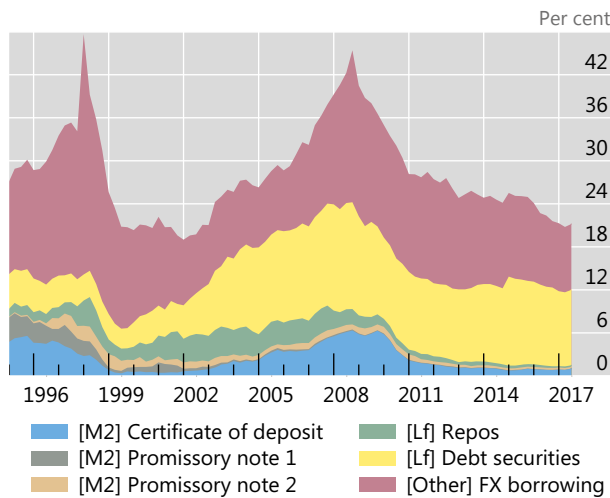
In the case of Korea, the rapid increase in non-core funding showed up as increased foreign currency liabilities of the banking system. Graph 4 charts the most volatile components of bank liabilities, expressed as a percentage of M2, a proxy for core deposit liabilities. The first peak in non-core liabilities coincides with the Asian financial crisis of 1997. The total is in local currency terms, which explains the sharp spike in 1997 due to currency depreciation. After a lull in the early 2000s, non-core liabilities again rose rapidly in the run-up to the 2008 crisis.



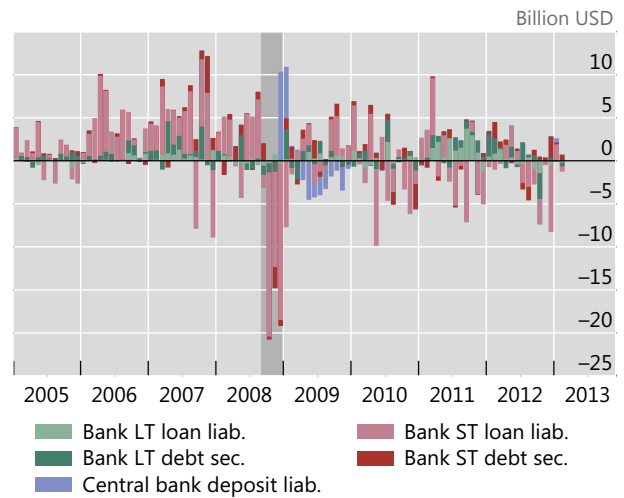
Korea: non-core liabilities and capital flows

Graph 4

Non-core bank liabilities as a proportion of M2



Capital flows by category



Sources: Bank of Korea; BIS calculations.

There are, however, two important and instructive differences between Spain and Korea. The first is the currency denomination of bank funding. Spanish banks borrowed in domestic currency (euros) while Korean banks had substantial US dollar liabilities. Second, while Spanish banks were subject to the “sudden stop” of short-term funding, they also borrowed long-term, by issuing covered bonds of several years’ maturity. Korean banks borrowed mostly short-term, exposing them to greater risk from the drying-up of short-term funding.

Korean banks had dollar claims on local corporate borrowers so that currency mismatch was limited, but there was an overall maturity mismatch when banks and corporates were taken together. Corporates had long-dated dollar claims, such as export receivables, but the currency hedging by Korean banks entailed rolling over short-term dollar liabilities. The overall maturity mismatch left the banking system vulnerable to a run on short-term dollar funding with the onset of the Great Financial Crisis. The right-hand panel of Graph 4 shows the sharp reversal of funding flows in 2008.

Global dimension

Run risk has an important global dimension. Before the Great Financial Crisis, commentators pointed to the large US current account deficit and raised concerns about a depreciation of the US dollar, drawing parallels with the experience of emerging market economies that suffer a sudden stop in capital flows.

In the event, far from crashing, the dollar soared with the onset of the financial turmoil. This was because European banks had used short-term dollar funding to invest in long-term dollar assets in the United States. As asset prices fell and dollar debts came due, borrowers sought dollars to repay their maturing debts. Dollar appreciation fed on itself, as the stronger dollar piled further pressure onto these banks’ balance sheets.



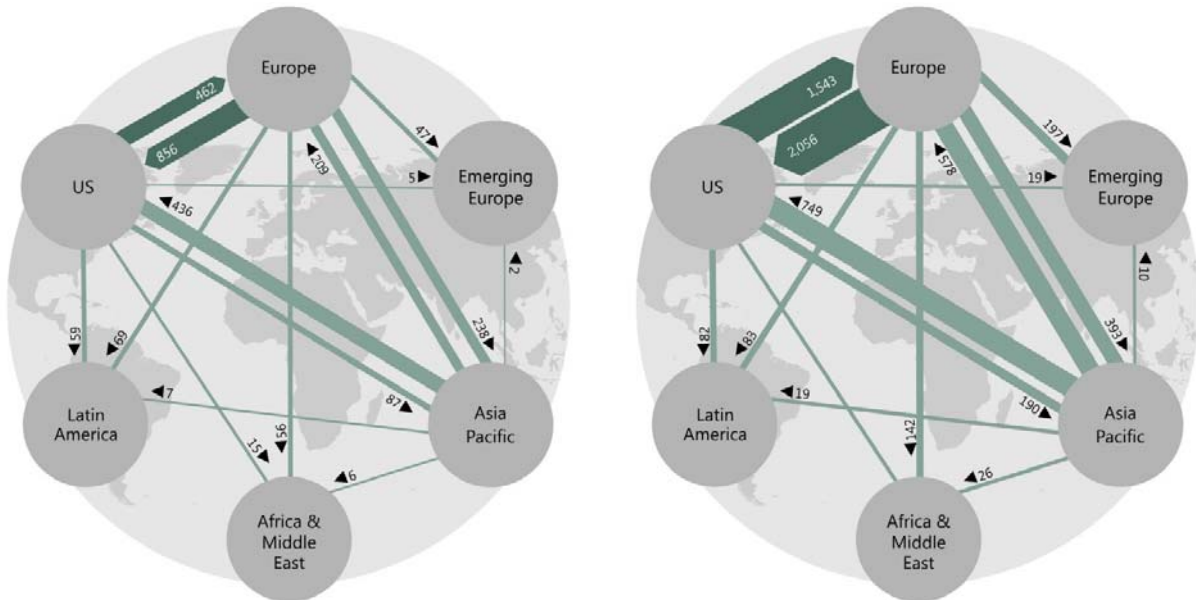
US dollar-denominated cross-border bank claims

In billions of US dollars

Graph 5

2002

2007



Source: BIS locational banking statistics.

Graph 5 presents two snapshots of cross-border bank claims in US dollars – first in 2002 and then in 2007. European banks had claims of \$856 billion on US borrowers in 2002, but this grew to over \$2 trillion by 2007. This increase was associated with the rapid growth of the asset-backed securities (ABS) issuer sector, which grew from modest beginnings in the early 2000s to well over \$2 trillion by 2007. Subprime mortgage securitisation depended heavily on the activity of European banks.³ Some of the short-term dollar funding came from US money market funds, but a substantial amount came from the currency swap market, where European banks borrowed dollars by pledging other currencies (euros, for instance) as collateral.

An FX swap is similar to other collateralised borrowing arrangements in that the borrower posts collateral. However, the accounting convention deems FX swaps not to be debt, as the collateral is cash. Recent work at the BIS⁴ has put a number on the size of this “missing debt”. Of the \$58 trillion of FX swaps and related exposures, 90% is denominated in dollars and an estimated \$13–14 trillion is owed by non-banks outside the US. For comparison, world GDP is about \$75 trillion, and global trade \$21 trillion. Most of the swaps are short-term. Around three quarters have maturities of less than one year, and that of the typical transaction is much shorter.

What are the risks? Since cash is the collateral, credit risk is minimal. However, there is liquidity risk resulting from maturity mismatch, as we saw during the dollar funding squeeze for European banks in 2008.

³ See C Bertaut, L DeMarco, S Kamin and R Tryon, “ABS inflows to the United States and the global financial crisis”, Federal Reserve Board *International Finance Discussion Papers*, 2011-1028, 2011.

⁴ See C Borio, R McCauley and P McGuire, “FX swaps and forwards: missing global debt?”, *BIS Quarterly Review*, September 2017, pp 37–54.



Concluding remarks

I have argued that “drilling up” to the macro and global aggregates should have pride of place in the analysis of systemic risk. Complexity is part of the story, but it is largely a consequence of higher leverage of individual institutions. Mitigating complexity is mostly about taming this leverage. The motto is: *if you take care of leverage in the small, complexity will take care of itself*. There is by now an active literature using network analysis, exploring detailed micro data on cross-exposures.

However, taming complexity by itself is unlikely to be enough to ward off systemic risk. We cannot take our eye off the aggregate macro and global picture. Financial crises are mostly about leverage in the large. Addressing leverage in the large entails taking a global perspective, where a country’s financial system is part of the global financial system.