BANK FOR INTERNATIONAL SETTLEMENTS

The bank/capital markets nexus goes global

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I am happy to be back at the LSE, especially to return to the corridors of the Old Building. As I was preparing this lecture and laying out the list of references, I realised how much of what I know now was shaped by interactions with colleagues and students at the LSE from the mid-2000s.

One debate at the time was on the relative merits of banks and capital markets, with one theme being how market finance was a stabilising influence on the financial system, acting as a "spare tire" when the banking sector is impaired. The contrary view was that it makes the financial system less stable by injecting greater procyclicality into the banking system. The answer depends, among other things, on whether market finance connects ultimate borrowers and investors directly or whether it works through the wholesale funding of the banking system. The recent paper by Stijn Claessens,[2] presented at this year's ECB Forum in Sintra, is a good introduction to these issues.

Among the many lessons from the Great Deleveraging of 2008, one was the futility of drawing a clear-cut distinction between banks and capital markets when wholesale funding is the margin of adjustment for bank leverage. My main message today is that this link between banks and capital markets has gone global. We can begin to understand some of the big puzzles of our day when we lift our gaze to take in this global picture.

Before going there, it is worth retracing how the bank/capital markets nexus played out in the domestic context. The story of the run on Northern Rock in 2007 is a famous example. The television images of retail depositors queuing outside their local branches to withdraw their money conjured up associations with traditional bank run narratives. These narratives are based on the coordination failure of small depositors, the staple of movies such as "It's a Wonderful Life" or "Mary Poppins". However, as I have explained elsewhere,[3] if we want to find the critical event for the run on Northern Rock, we have to look in the capital markets. It was the deleveraging forced on Northern Rock by its wholesale creditors that precipitated the run. The retail depositors queuing outside its branches was very much an event in the *aftermath* of the run on Northern Rock.

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[1] I am grateful to Stefan Avdjiev, Claudio Borio, Frederic Boissay, Dietrich Domanski, Wenxin Du, Ingo Fender, Leonardo Gambacorta, Krista Hughes, Catherine Koch and Nikola Tarashev for comments on earlier drafts and to Bat-el Berger, Bilyana Bogdanova and Agne Subelyte for excellent research support. The views expressed here are mine, and do not necessarily reflect those of the BIS.

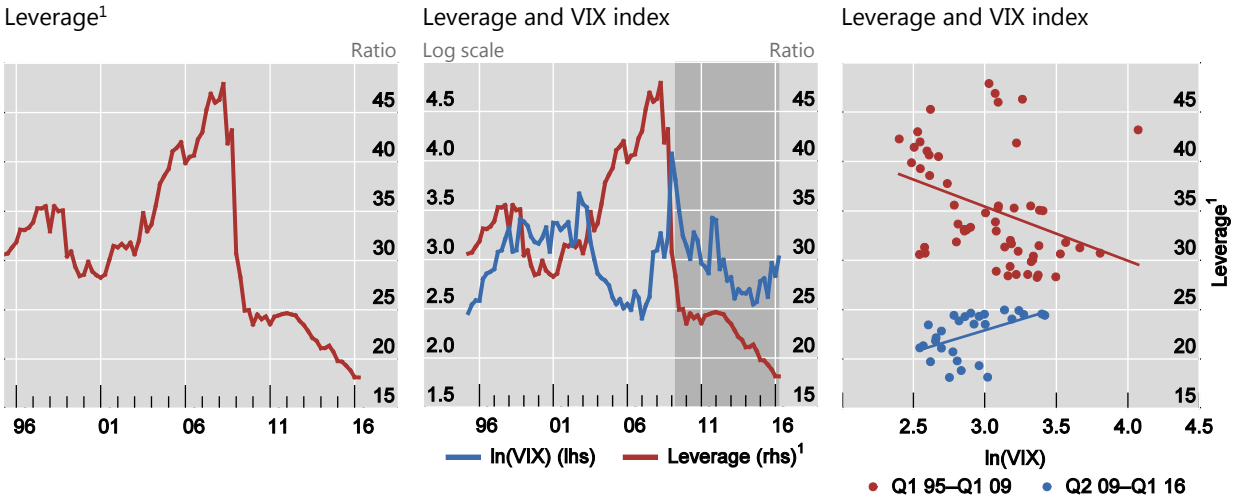
[2] S Claessens, "Regulation and structural change in financial systems", proceedings of the ECB Forum on Central Banking, 26–28 June 2016 (forthcoming). See also L Gambacorta, J Yang and K Tsatsaronis, "Financial structure and growth", *BIS Quarterly Review*, March 2014, pp 21–35.

[3] H S Shin, "Reflections on Northern Rock: the bank run that heralded the global financial crisis", *Journal of Economic Perspectives*, vol 23, no 1, 2009, pp 101–19.

VIX and leverage

The best way to think about forced deleveraging is in terms of the implicit maximum leverage achievable by a bank in a repurchase agreement, or "repo". The repo is a way to borrow by pledging securities as collateral. The borrower sells a security today, promising to buy it back in the future at a pre-agreed price. The difference between the value of the pledged collateral and the amount borrowed is called the "haircut". For instance, if the haircut is 2%, the bank can borrow 98 dollars by pledging 100 dollars' worth of securities. This means that, to hold 100 dollars' worth of securities, the borrower need only come up with two dollars of its own funds. So, at a haircut of 2%, the bank can have leverage as high as 50.

Leverage of US securities broker-dealer sector — Graph 1



[1] Calculated as total assets divided by equity.

Sources: Federal Reserve, *Flow of Funds*; Bloomberg; BIS calculations.

Graph 1 illustrates how the leverage of the banking sector fluctuates when wholesale funding is the margin of adjustment. The left-hand panel of Graph 1 plots the leverage of the US broker-dealer sector from the mid-1990s to today. Here, leverage is measured as the ratio of total assets to equity. Leverage starts out at around 30 in the mid-1990s, but then climbs to almost 50 on the eve of the crisis, before dropping sharply with the onset of the crisis. As the crisis erupted, the leverage of the broker-dealer sector dropped sharply to less than 25, and has recently fallen further to a level of around 18. Broker-dealers constitute a small portion of the overall banking sector, but they offer a window on the market forces that shape bank balance sheets in the short to medium term.

When banks and other financial intermediaries are stretched to high levels of leverage, supported by razor-thin haircuts, any slight knock to the haircut leaves them vulnerable to forced deleveraging. Forced deleveraging is key to understanding funding pressures on banks.[4] In terms of the haircuts charged by the wholesale creditors, the fall in leverage from 50 to 25 corresponds to a slight increase in the haircut from 2% to a still modest 4%. However, the impact on the financial system itself is immense. Even if banks'

[4] J Geanakopolos, "The leverage cycle", in D Acemoglu, K Rogoff and M Woodford (eds), *NBER Macroeconomic Annual* 2009, vol 24, no 1-65, University of Chicago Press, 2010; A Fostel and J Geanakopolos, "Endogenous collateral constraints and the leverage cycle", *Annual Review of Economics*, May 2014; G Gorton and A Metrick, "Securitized banking and the run on the repo", *Journal of Financial Economics*, vol 104, no 3, June 2012, pp 425–51.

equity stays roughly constant, this means cutting total assets by half. If banks suffer losses, the retrenchment is even sharper, setting in motion second- and third-round effects in the financial system and the wider economy.

One variable, the VIX index, stands out as the barometer of the appetite for leverage in the years before the 2008 crisis. The VIX is a measure of the implied volatility from option prices on the stock market. It has been dubbed the "fear gauge" by financial journalists for its famed ability to track market sentiment. The middle panel of Graph 1 shows that before the crisis, there was a very close relationship between leverage and the VIX index. When the VIX is low, leverage is high; when the VIX spikes, leverage crashes.[5]

Given this close association between the VIX index and leverage, a generation of researchers grew up with the VIX as a "wonder variable" in empirical research. The VIX was like the secret sauce that livened up an ordinary dish. The VIX was able to capture the way that risk appetite fluctuated in the financial system. Risk-taking depends on leverage, and if the financial system as a whole goes through a period of ample funding liquidity, even thinly capitalised banks can borrow on easy terms. Since banks borrow in order to lend, easier borrowing conditions translate into easier lending conditions, reinforcing the already easy financial conditions. By the nature of the interactions between liquidity conditions and leverage, the boom phase rides an apparent virtuous circle of greater leverage and easier liquidity. The VIX index was capable of capturing such shifts in sentiment.

However, something has changed in recent months, and the VIX no longer works as a barometer of the appetite for leverage. We can see this from the centre and right-hand panels of Graph 1. The middle panel of Graph 1 shows that in the years after the crisis, the VIX index has been subdued, easing to levels close to the lows seen in the years before the crisis. Despite this, leverage has continued to fall. Leverage of the broker-dealers is now around 18, lower than at any time in the last 25 years.

The right-hand panel highlights the structural break by means of two scatter groups of dots. The red dots indicate the relationship between leverage and the VIX for the period up to March 2009, and the blue dots indicate the relationship from June 2009. There was a tight negative relationship between leverage and the VIX index before the crisis, but this relationship has now broken down. The VIX index – the famed "fear gauge" – no longer has any explanatory power for leverage.

This breakdown of the familiar rule of thumb for the VIX has contributed to the sense of puzzlement and unease among observers of capital markets. There is something of a conundrum at the heart of today's financial markets. On the one hand, there are signs of unabated risk appetite in financial markets, as witnessed in high stock market valuations, compressed credit spreads and subdued volatility, the recent pickup notwithstanding.

Yet, the banking sector is going through a tough time. In contrast to the overall stock market, banking stocks are struggling, with depressed market-to-book ratios, especially for advanced economy banks outside the United States. Why is this?

One element in the explanation may be monetary easing. We know that monetary easing has a market-calming effect; it quells the VIX and compresses credit spreads.[6] However, most of this evidence comes from periods when policy rates were positive. We know much less about the impact of monetary easing on bank leverage when policy rates reach zero and dip into negative territory. We cannot rule out

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[5] For more on why this is the case, see T Adrian and H S Shin, "Procyclical leverage and value-at-risk", *Review of Financial Studies*, vol 27, no 2, 2014, pp 373–403 and T Adrian and H S Shin, "Liquidity and leverage", *Journal of Financial Intermediation*, vol 19, no 3, 2010, pp 418–37

[6] Monetary easing lowers the VIX, as shown by G Bekaert and M Hoereva, "The VIX, the variance premium and stock market volatility", *Journal of Econometrics*, vol 183, no 2, 2012, pp 181–92. The effect goes through leverage, as shown in V Bruno and H S Shin "Cross-border banking and global liquidity", *Review of Economic Studies*, vol 82, 2015, "Capital flows and the risk-taking channel of monetary policy", *Journal of Monetary Economics*, vol 71, 2015, pp 119–32.

perverse effects on bank valuations through the squeeze on bank net interest margins and the flattening of the yield curve.

Whatever the reason, the evidence from Graph 1 is that we can no longer count on the traditional relationship between the market-calming effect of monetary easing and a pickup in bank leverage. Nor should we rule out a sudden re-establishment of the link, once the VIX picks up again. In the current environment of low market-to-book ratios for banks, a sudden sharp spike in the VIX will almost certainly re-test the appetite for leverage.

Some of you may be wondering about the role of regulation. Regulation certainly has an impact on the behaviour of banks, and regulation interacts with market-induced constraints on leverage. However, the Great Deleveraging of 2008 was not due to the introduction of new regulation. Market conditions were key then, and they remain so today. Global capital markets provide the evidence, as I will show shortly.

My colleague Jaime Caruana is giving a speech this Thursday in London on the challenges facing the banking sector, addressing in particular how much tighter regulation is responsible for the current challenges facing the banking sector. I will not steal his thunder here by giving away the punch line, but both his speech and my lecture today emphasise the perspective of the bank as a *borrower*. A bank borrows in order to lend, and a stronger borrower can borrow on better terms. A weak borrower, on the other hand, may borrow on good terms when market conditions are favourable, but will soon find it tough going when conditions change for the worse. The fact that better capitalised banks have fared better along many dimensions suggests that what ails the banking system today is not just tighter regulation.

Failure of covered interest parity

The failure of covered interest parity (CIP) illustrates well the high price placed by banks on the use of their balance sheets. Covered interest parity, or "CIP" for short, is the proposition that interest rates implicit in foreign exchange markets should be consistent with money market interest rates.[7] In an FX swap, one party borrows US dollars by lending another currency in return. The *forward rate* is the agreed exchange rate at which repayment takes place. From the forward rate and the current "spot" rate, we can calculate the implied interest rate on the US dollar.

Covered interest parity is the principle that the interest rate on the dollar implicit in this transaction should coincide with the money market interest rate on the dollar. Otherwise, a market participant can borrow at the low interest rate, lend out at the higher interest rate while hedging currency risk completely, and do so at any quantity, potentially reaping unlimited profit. Before 2008, CIP held as an empirical regularity, but has broken down since then. What is remarkable now is that deviations from CIP have appeared during periods of relative calm. Recent deviations have been especially large for the yen. Graph 2 shows the evidence.

The top panels of Graph 2 plot the implied three-month interest rate on the dollar from forward rates embedded in FX swaps. Each series shows the particular currency lent out in return. In Graph 2, I have plotted for comparison the three-month US dollar Libor, the interbank market interest rate for dollars. When the implied dollar interest rate from FX swaps is above Libor, this means that the borrower of dollars in the FX swap is paying more than the rate available in the open market. This has been the case for the yen, Swiss franc and euro. The bottom two panels of Graph 1 show the size of the deviations from CIP,

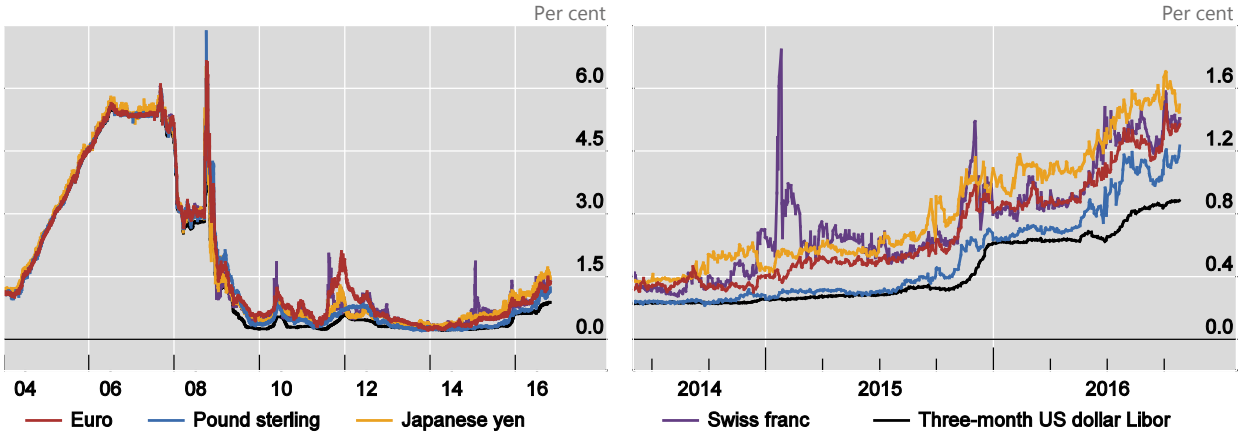
[7] Formally, covered interest parity is the statement that $1 + r_A = \frac{F}{S}(1 + r_B)$, where r_A and r_B are the market interest rates on two currencies A and B, and *S* and *F* are the spot and forward exchange rate of A in terms of B.

where deviations are measured as US dollar Libor minus the FX swap-implied dollar interest rate. The difference is called the "cross-currency basis", and for the currencies listed in Graph 2, the cross-currency basis is negative, meaning that dollar borrowers in FX swaps pay more than indicated by the Libor.[8]

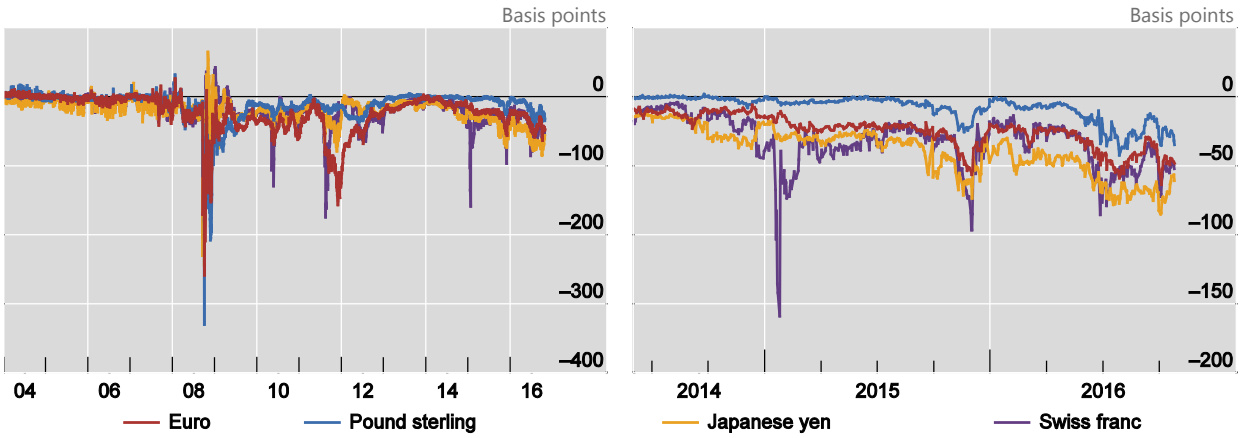
US dollar interest rate implied by FX swaps

Graph 2

Three-month US dollar interest rate implied by FX swaps[1]



FX swap spread, three-month[2]



[1] Implied US dollar interest rate in an FX swap involving the indicated currency. Three-month US dollar Libor rate is plotted for comparison. [2] Spread between three-month US dollar Libor and three-month dollar rate implied by FX swaps.

Sources: Bloomberg; Datastream; BIS calculations.

Why has the gap persisted? What prevents textbook arbitrage of borrowing at the low interest rate and lending out at the higher interest rate with currency risk fully hedged?

In textbooks, there are no banks, and someone can take on any size of exposures at prevailing market prices. In practice, arbitrage entails borrowing and lending through banks. Since hedge funds or other unregulated entities are also reliant on dealer banks to put on leveraged trades, the banking sector remains the focus of attention. If the gap persists, it suggests that banks do not have enough capital

[8] W Du, A Tepper and A Verdelhan, "Deviations from covered interest rate parity", *SSRN Working Paper*, September 2016, formally establish CIP arbitrage opportunities based on secured rates and present evidence that bank balance sheet costs and asymmetric monetary policy shocks act as drivers of CIP deviations. C Borio, R McCauley, P McGuire and V Sushko, "The failure of covered interest parity: FX hedging demand and costly balance sheets", *BIS Working Papers*, no 590, 2016, show that the cross-currency basis depends on the net swap position of the banking sector.

available to take on such transactions, or at least are putting such a high price on the use of their balance sheet that the trade becomes uneconomical at these spreads. Many banks have capital comfortably above any regulatory constraints, and so regulation cannot be the whole story for why the gap has persisted.

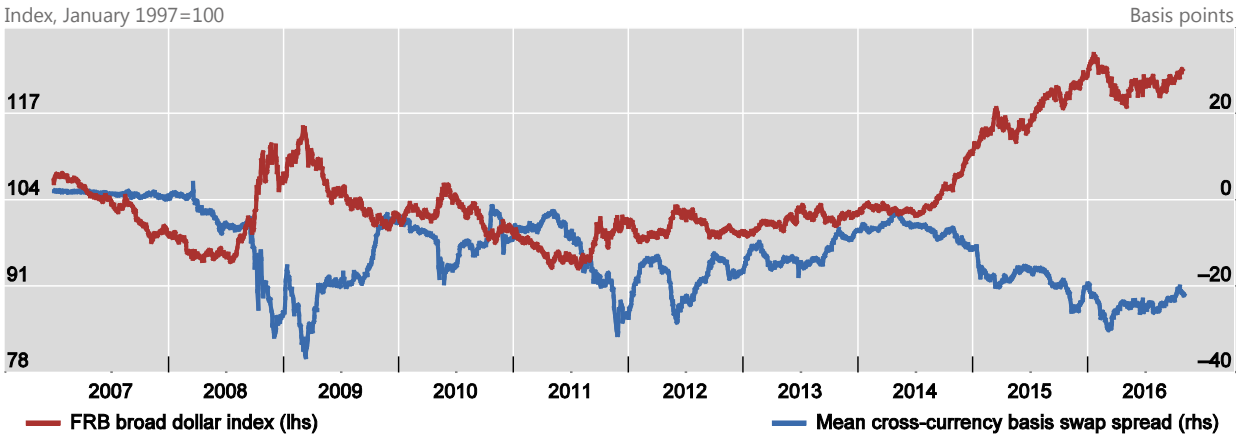
The slow deleveraging of the broker-dealer sector in the post-crisis period, even as the VIX has stayed low, suggests that there is something else holding back the banks. The VIX no longer works as a barometer of the appetite for leverage. If it is not the VIX, is there another variable that has taken over as the barometer of the appetite for leverage?

From the VIX to the dollar

Any simple answer will be misleading, but there is a surprising candidate for the barometer of the appetite for leverage. The answer is "the dollar". The dollar has supplanted the VIX index as the variable most associated with the appetite for leverage. When the dollar is strong, risk appetite is weak, and market anomalies such as the breakdown of covered interest parity (CIP) become more pronounced.

To understand why, one has to take a step back and take in the global picture. The deviation from covered interest parity is a mirror to the shadow price of balance sheet utilisation, as it gives an indication of how badly the textbook arbitrage argument fails – of how much money is being "left on the table". Judged by this metric, the pressures have been building in recent months.

US dollar broad index and the cross-currency basis — Graph 3



The red line shows the Federal Reserve Board's US trade-weighted broad dollar index, with higher values indicating a stronger US dollar. The blue line is the simple average of the five-year cross currency basis swap spreads for AUD, CAD, CHF, DKK, EUR, GBP, JPY, NOK, NZD and SEK vis-à-vis the US dollar.

Sources: Board of Governors of the Federal Reserve System; Bloomberg.

What is the evidence for the link between CIP violations and the dollar? Graph 3 is from a BIS *Working Paper* released today. The paper is co-authored with my BIS colleagues Stefan Avdjiev and Cathérine Koch, together with Wenxin Du of the Federal Reserve.[9]

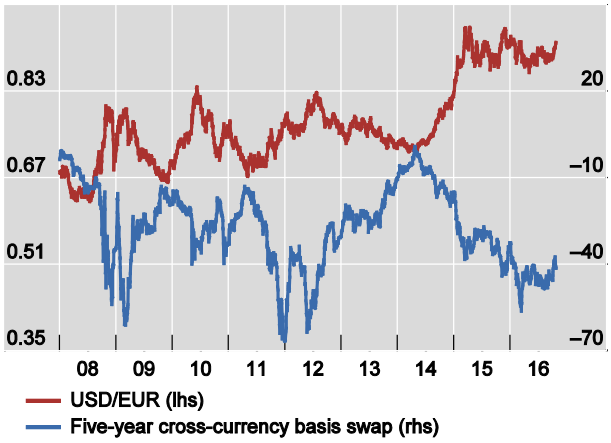
[9] S Avdjiev, W Du, C Koch and H S Shin, "The dollar, bank leverage and the deviation from covered interest parity", *BIS Working Papers*, no 592, November 2016.

Graph 3 plots daily data for the value of the US dollar (in red) as represented by the broad dollar index of the Federal Reserve. When the red line goes up, the dollar strengthens. On the same chart, I have plotted (in blue) the average cross-currency basis of 10 advanced economy currencies against the US dollar. Notice how the cross-currency basis is the mirror image of the dollar's strength. When the dollar strengthens, the cross-currency basis widens. This is especially so since mid-2014, reflecting the stronger dollar since then.

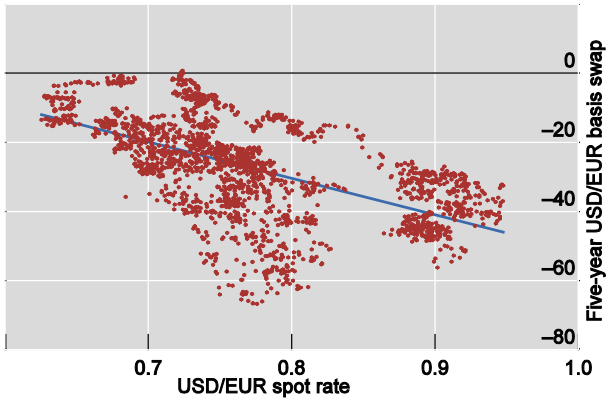
Graph 4 is another illustration of the same relationship using daily data for the bilateral exchange rate between the euro and the US dollar. The left-hand panel shows the relationship between the strength of the dollar against the euro (in red), plotted against the cross-currency basis of the euro against the dollar.

Cross-currency basis of euro against the dollar — Graph 4

Time plot of USDEUR cross-currency basis



Scatter chart of USDEUR cross-currency basis



Source: Bloomberg.

We see again, the reflected symmetry whereby a stronger dollar is associated with a larger deviation from covered interest parity. The blue line indicates the extra cost of borrowing dollars – it is an indicator of the "dollar shortage" for borrowers who pledge euros as collateral. Notice how the deviation fluctuates from one day to the next with the strength of the dollar. The right-hand panel is the scatter chart of the same relationship. We see the negative slope, where a stronger dollar is associated with a larger deviation from CIP.

The deviation from CIP is quite a clean measure of the price placed by banks on the use of their balance sheet. This is because the gap represents the additional profit that would follow from textbook arbitrage where a bank borrows at the low interest rate and lends at the high interest rate with currency risk fully hedged. The fluctuation of the cross-currency basis therefore represents the fluctuations in the daily "going rate" for the use of banks' balance sheet capacity. In effect, it represents the "money left on the table" by the banks, and could be seen as one indicator of deleveraging pressures. What is quite clear from Graphs 3 and 4 is that the price of bank balance sheet fluctuates from one day to the next, and that this fluctuation tracks the strength of the dollar.

Just as the VIX index was a good summary measure of the price of balance sheet before the crisis, so the dollar has become a good measure of the price of balance sheet after the crisis. The mantle of the barometer of risk appetite and leverage has slipped from the VIX, and has passed to the dollar.

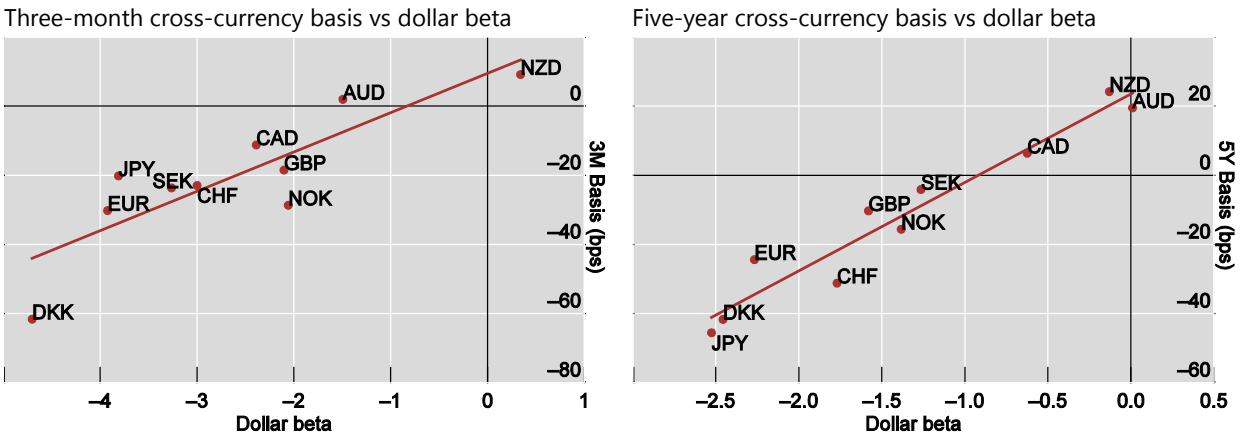
There is an important lesson here about regulation. If new regulation were the sole reason for the deleveraging pressures on banks, then (given the evidence in Graphs 3 and 4) we have to believe that the impact of regulation fluctuates from one day to the next. But regulation does not change from one

day to the next – it is a longer-term phenomenon with long transition periods. Whatever is the impact of regulation, it cannot be the sole reason for the balance sheet pressures faced by banks today.

To drive home the point, we can see the dollar as a risk factor in an asset pricing context. Define the "dollar beta" for a currency as the sensitivity of its CIP deviation with respect to the strength of the dollar itself. Then, the dollar beta is a classical risk factor in the sense that the size of the CIP deviation increases with a currency's exposure to the dollar.

Graph 5 from Avdjiev et al (2016) shows the evidence. The left-hand panel plots the CIP deviation for a currency at the three-month horizon against the dollar beta for that currency using daily price changes. The right-hand panel shows the five-year CIP deviation using quarterly price changes. In both cases, there is a striking positive, linear relationship. In effect, the dollar is a risk factor which "prices" the CIP deviation. The correlation is 85% for the three-month basis and 97% for the five-year basis.

Cross-currency basis vs dollar beta (2007–16) Graph 5



The vertical axis of the LHP shows the average three-month cross-currency basis expressed in basis points, while the horizontal axis indicates the regression beta of running daily regression for changes in the three-month cross-currency basis on changes in the broad US dollar index. The vertical axis of the RHP shows the average five-year cross-currency basis expressed in basis points, while the horizontal axis indicates the regression beta of running quarterly regression for changes in the five-year cross-currency basis on changes in the broad US dollar index.

Sources: Board of Governors of the Federal Reserve System; Bloomberg; BIS calculations.

What explains the dollar's role as the summary measure of the appetite for leverage? In a nutshell, the paper shows that there is a tight "triangular" relationship between (1) the dollar, (2) cross-border bank capital flows in dollars and (3) the deviation from CIP. The key to understanding this relationship is that dollar cross-border capital flows closely track the leverage decisions of global banks. The triangular relationship says volumes about the role of the US dollar in the global banking system, and ultimately how the monetary policy backdrop determines global financial conditions.

The dollar as a barometer of appetite for leverage

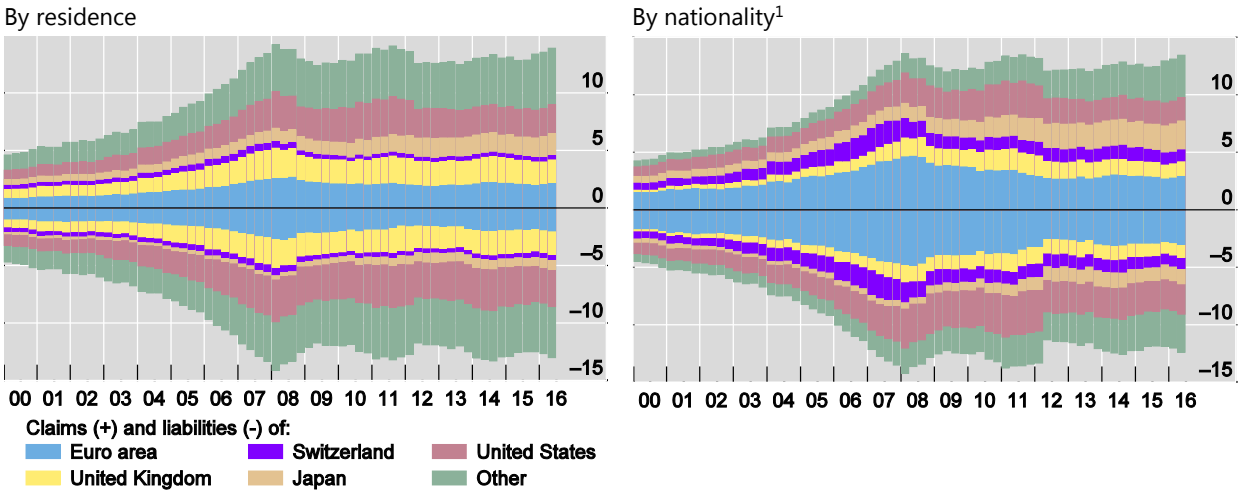
As interest rates have fallen to historically low and even to negative levels in some regions, investors searching for yield have sought higher-yielding assets. In practice, given the global role of the dollar as the borrowing currency of choice, such higher-yielding assets have been denominated in US dollars, even if the borrowers are non-US residents. Long-term yields for US dollar-denominated securities have been higher than for assets of similar maturities in Japan, the euro area or Switzerland. For institutional investors

who hold a global portfolio of assets, the currency mismatch between the assets they hold and the commitments they have to their domestic stakeholders in yen, euros or Swiss francs looms large.

For instance, pension funds and life insurance companies have obligations to their beneficiaries and policyholders. These obligations are denominated in domestic currency – in euros, yen or Swiss francs. To the extent that investors face currency risk, they will hedge that risk. We know that investors from emerging economies with large funded pension systems hedge actively.[10] However, institutional investors from rich economies will face the problem most acutely, as they have the largest portfolios of global assets. The hedging counterparty is typically a domestic bank, and the bank lays off its own currency risk by borrowing dollars. That way, dollar claims are counterbalanced by dollar debts. The upshot is that banks take on liabilities denominated in dollars in the process of providing hedging services, and dollar intermediation by the global banking system mirrors the underlying currency hedging demands.[11]

Cross-border US dollar-denominated credit, all sectors

In trillions of US dollars — Graph 6



[1] The break in series between Q1 2012 and Q2 2012 is due to the Q2 2012 introduction of a more comprehensive reporting of cross-border positions. For more details, see www.bis.org/publ/qtrpdf/r_qt1212v.htm.

Source: BIS locational banking statistics, Tables A5 (by residence) and A7 (by nationality).

Graph 6 provides a window on the total dollar-denominated cross-border bank intermediation arranged by jurisdiction. In both panels, upward-pointing bars indicate cross-border assets and downward-pointing bars indicate cross-border liabilities. The left-hand panel breaks out the total by residence, while the right-hand panel breaks out the total by *nationality*, meaning the location of the headquarters. So, for instance, the cross-border claims of a German bank office in London is classified as "UK" in the left-hand panel, but as "euro area" in the right-hand panel.

[10] See F Avalos and R Moreno, "Hedging in derivatives markets: the experience of Chile", *BIS Quarterly Review*, March 2013, pp 53–62.

[11] C Borio, R McCauley, P McGuire and V Sushko, "The failure of covered interest parity: FX hedging demand and costly balance sheets", *BIS Working Papers*, no 590, 2016.

Notice how the undulations in cross-border dollar liabilities have tracked global financial conditions. The totals in Graph 6 grew strongly up to 2008 but contracted with the onset of the Great Financial Crisis, and then with the euro area crisis of 2011–12.

Impact of a stronger dollar

The macro impact of exchange rates on net exports is well known, but perhaps less appreciated is the financial channel, which kicks in when borrowing in dollars takes place in large amounts. The key is the so-called risk-taking channel described in Bruno and Shin (2015a, b).[12] The risk-taking channel of exchange rates turns on the impact of dollar appreciation in a world where many balance sheets have dollar liabilities. When so many borrowers have borrowed so much in dollars, whether for hedging or speculative purposes, dollar appreciation exposes borrowers and lenders to valuation changes and in turn impacts their balance sheets.

The simplest example is when there is a naked currency mismatch on borrower balance sheets – say, when emerging market non-financial corporates have borrowed in dollars but hold domestic currency assets. In this case, a weaker dollar flatters the balance sheet of dollar borrowers, whose liabilities fall relative to assets. From the standpoint of creditors, the stronger credit position of the borrowers reduces tail risk in the credit portfolio and creates spare capacity for additional credit extension even with a fixed exposure limit through a value-at-risk (VaR) or economic capital constraint, which in turn leads to more lending. In many cases, the dollar liabilities create exposure not only through naked currency mismatch, but also through endogenous valuation changes, such as when oil firms finance their investment through dollar borrowing. As the price of oil is negatively related to the dollar, a stronger dollar tends to go hand in hand with weaker balance sheets of borrowers.

The currency hedging activities of global banks may be less susceptible to the valuation mismatches associated with naked currency mismatches. However, if the banks have a portfolio of dollar assets, some of which may be vulnerable to dollar appreciation, then a bank's overall risk-taking capacity will be subject to shocks. In particular, if a global bank lends to EME corporates as well as engaging in hedging operations that accommodate local life insurance companies and pension funds, then any pickup in measured risks in the corporate lending book will erode its risk-taking capacity to provide hedging services to these pension funds and life insurance companies. A prime example of such a setting would be Japanese banks that both lend to Asian corporates in dollars and provide hedging services to domestic insurance companies. Avdjiev, Du, Koch and Shin (2016) explore a formal model where the erosion of bank risk capital leads to a higher price on bank balance sheet capacity through an increase in the Lagrange multiplier of the value-at-risk (VaR) constraint.

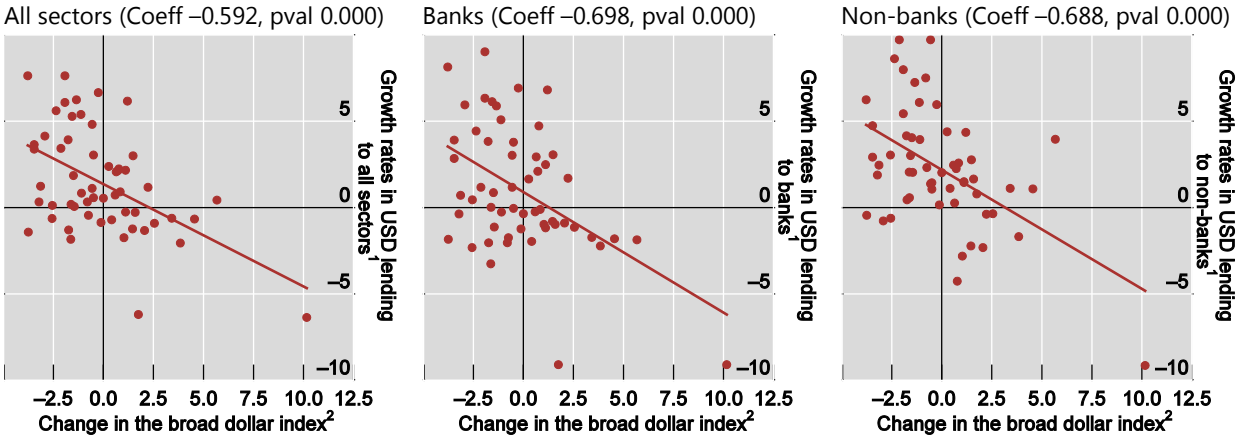
Crucially, the financial channel of exchange rate fluctuations often operates in the opposite direction relative to the net exports channel. For net exports, it is when the domestic currency *depreciates* that real economic activity picks up. By contrast, the financial channel operates through the liabilities side of the balance sheet of borrowers, so that it is when the domestic currency *appreciates* that balance sheets strengthen and economic activity picks up. The impact of exchange rates is back-to-front compared with the textbook stories.

Graph 7 documents the evidence; it is a simple scatter, showing the relationship between the growth rate of dollar cross-border lending and the nominal effective exchange rate of the dollar. The three panels are arranged to show the impact on total dollar lending, dollar lending to banks and to non-banks.

[12] Op cit.

We see that the relationship is strongly negative, so that dollar appreciation is associated with a slowing of cross-border dollar lending.

Cross-border bank lending to non-residents vs the broad dollar index Graph 7



[1] Quarterly growth rates, in per cent. [2] Quarterly changes, in per cent.

Sources: Board of Governors of the Federal Reserve System (US); BIS locational banking statistics; BIS calculations.

Cross-border bank lending in dollars is a reflection of the fluctuations in the size of the balance sheet, and hence can be regarded as being a proxy for risk-taking and leverage. The "triangle" is completed by showing that the dollar, leverage and the deviations from CIP go hand in hand.

The results reported in the accompanying working paper (Avdjiev et al (2016)) provide much-needed context to the sensitivity of the cross-currency basis to the dollar exchange rate. Banks evidently adjust their balance sheets actively in response to changes in the dollar exchange rate. As the dollar appreciates, banks reduce their dollar lending, playing a less accommodating role in response to hedging demands by non-bank institutions. Demand-supply imbalances and a higher price for hedging services will result in wider deviations from covered interest parity. These fluctuations point to the dollar as an important indicator for the risk appetite and leverage of the banking sector.

Banks based in Europe have traditionally played a sizeable role in intermediating dollars to Asian borrowers. The additional European dimension takes on importance when considering dollar funding strains in Asia. Graph 8, constructed from the BIS locational banking statistics, shows dollar intermediation by global banks broken down into bilateral cross-border claims across continents, providing two snapshots – the first in 2009 and the second in 2014.

Graph 8 reveals that banks based in Europe have traditionally lent more in US dollars to borrowers in Asia than did banks based in the United States. For example, in 2014, banks based in Europe had claims of $647 billion against borrowers in Asia, while banks in the United States had $571 billion. In this respect, European banks are more important than US-based banks for dollar intermediation in Asia. This is another example of how the global role of the US dollar makes its presence felt.

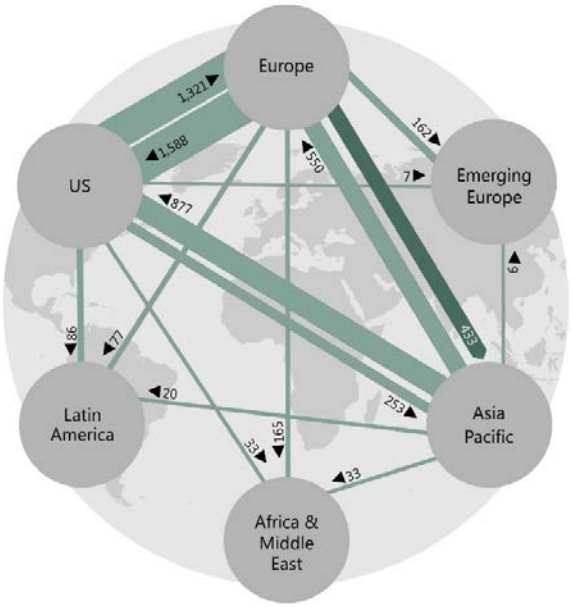
Given the importance of European banks for dollar intermediation, any calculation of dollar credit to Asian borrowers will need to take account of both direct and indirect dollar lending. It would not be enough, for instance, to calculate the total amount of dollars borrowed by Asian banks from money market funds in New York in order to calculate the dollar exposures of borrowers or hedgers in Asia. To the direct exposures, one would need to add the indirect exposures through third-party banks, such as those from Europe.

US dollar-denominated cross-border claims

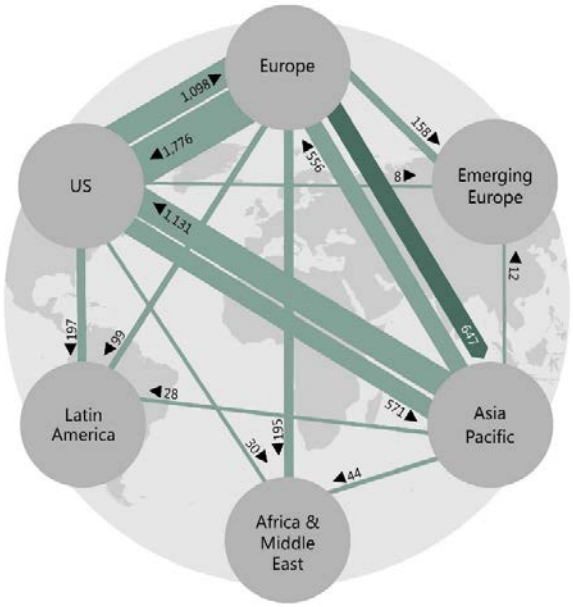
In billions of US dollars

Graph 8

2009



2014



Source: BIS locational banking statistics.

Why does it matter?

The dollar as the barometer of leverage and risk-taking capacity has implications both for financial stability and the real economy. If banks put such a high price on balance sheet capacity when the financial environment is largely tranquil, what will happen when volatility picks up? If banks react to resurgent volatility by reducing their intermediation activity, as happened during the 2007–09 crisis, the banking sector may become an amplifier of shocks rather than an absorber of shocks. The deviation from covered interest parity provides a window on the shadow price of bank balance sheet capacity. For this reason, it would be important for policymakers to keep a close eye on this formerly rather esoteric corner of the foreign exchange market.

As well as the financial stability implications, dollar strength matters for the real economy, too. Here, it is not just the impact of a stronger dollar on the United States. The global economy will be affected, as the dollar is now a variable that reflects global risk appetite. Let me conclude this lecture with one example of the impact of tighter financing constraints on global value chains (GVCs) and the growth of trade.

One of the greatest puzzles in economics today is the sharply slower growth in trade and productivity. The recent issue of the IMF's *World Economic Outlook* devoted a whole chapter to the slowdown in global trade.[13] However, in spite of a comprehensive empirical investigation, the conclusion is that there is still a large gap between the data and plausible explanations using existing models.

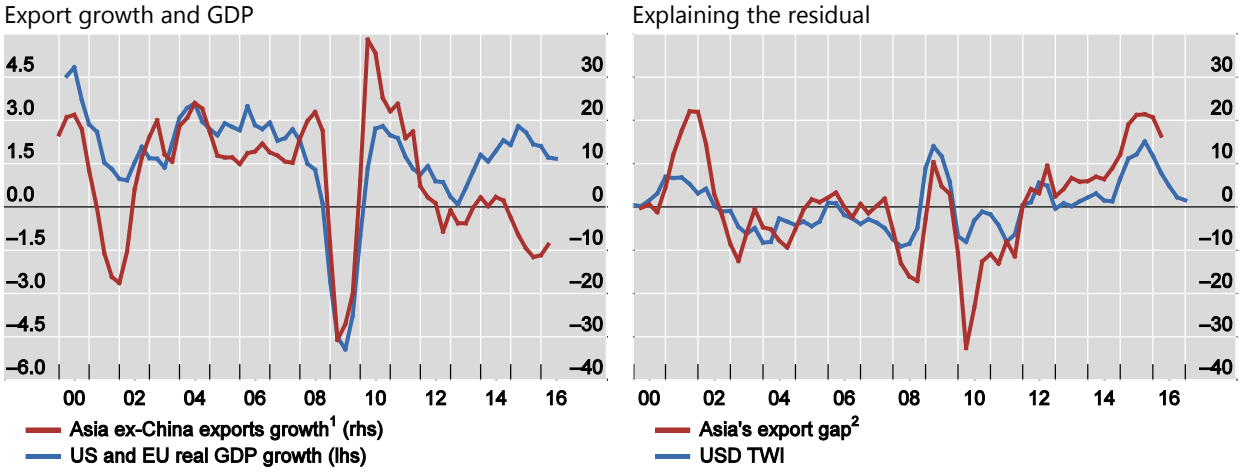
[13] See IMF, "Subdued demand: symptoms and remedies", *World Economic Outlook*, October 2016.

One avenue to solving this puzzle may be to follow the implications of the stronger dollar for the viability of lengthy global value chains (GVCs). Long production chains make heavy demands on working capital, typically financed by dollar borrowing from banks. By the nature of production chains, the longer the chain, the more value added is inherent in each unit, and hence the larger is the financing demand to sustain them. The financing demand typically grows at the rate of the *square* of the length of the chain.[14]

Graph 9 draws on a presentation by Michael Spencer.[15] It shows how growth in the G2 economies (the euro area and the United States) has been the prime driver of the export growth of Asian economies outside China – until recently. The explanatory power of G2 growth for Asian exports broke down around the middle of 2014 (Graph 10, left-hand panel). This is exactly the period when the dollar began to strengthen. The right-hand panel shows that the strength of the dollar tracks closely the latest slowdown in export growth. Could it be that the tighter financial conditions resulting from the stronger dollar have been a drag on export growth? More work is needed here but this is an issue of first-order importance.

Export growth in Asia and the dollar

Annual percentage changes — Graph 9



[1] Sum of Hong Kong SAR, India, Indonesia, Korea, Japan, Malaysia, the Philippines, Thailand and Singapore. [2] Difference between the fitted exports (explained by US and EU real GDP growth alone) and the actual Asia ex-China exports growth.

Sources: Michael Spencer (2016); Datastream; IMF; national data.

Concluding remarks

The nexus between bank and capital markets is more important than ever. The lesson from the 2008 crisis was that it is not possible to draw a clear distinction between banks on the one hand and capital markets on the other. This is an old lesson. What is new is that the bank/capital markets nexus has gone global. The VIX index was the barometer of deleveraging pressures in 2008, but now it is the dollar.

[14] S-J Kim and H S Shin, "Productivity and trade: a working capital perspective", unpublished paper.

[15] M Spencer, "Solving Asia's export puzzle", research note, Deutsche Bank, 2016.

In all this, the cross-currency basis emerges as an important variable to track, as it gives us a relatively clean measure of the price of balance sheet capacity of banks. Above all, we need to keep a global perspective. This is true both for discussions of financial stability, but especially for the real economy. European banks are more important for dollar intermediation in Asia than are US banks. The ripple effects of bank stresses in one region will be felt globally through the channels of global banking. In terms of the real economy, the slow growth of trade (and hence of productivity) may be the mirror image of the failure of covered interest parity. In this respect, the three great economic puzzles of our time – slow productivity growth, the slowdown in trade and the failure of covered interest parity – may all be related. Given the dollar's role as barometer of global appetite for leverage, there may be no winners from a stronger dollar.