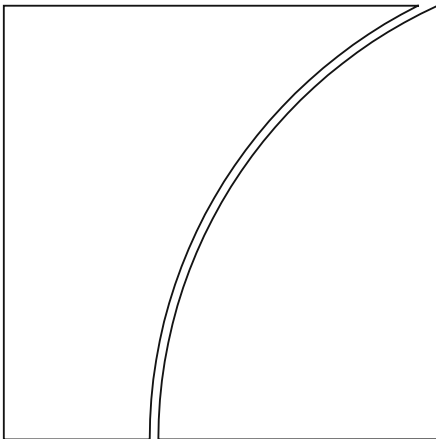




BANK FOR INTERNATIONAL SETTLEMENTS



# BIS Working Papers

## No 524

# Breaking free of the triple coincidence in international finance

by Stefan Avdjiev, Robert N McCauley and  
Hyun Song Shin

Monetary and Economic Department

October 2015

JEL classification: Breaking free of the triple coincidence  
in international finance

Keywords: capital flows, global liquidity, international  
currencies.

BIS Working Papers are written by members of the Monetary and Economic Department of the Bank for International Settlements, and from time to time by other economists, and are published by the Bank. The papers are on subjects of topical interest and are technical in character. The views expressed in them are those of their authors and not necessarily the views of the BIS.

This publication is available on the BIS website ([www.bis.org](http://www.bis.org)).

© *Bank for International Settlements <2015>. All rights reserved. Brief excerpts may be reproduced or translated provided the source is stated.*

ISSN 1020-0959 (print)  
ISSN 1682-7678 (online)

# Breaking free of the triple coincidence in international finance

Stefan Avdjiev, Robert N McCauley and Hyun Song Shin<sup>1</sup>

## Abstract

The traditional approach to international finance is to view capital flows as the financial counterpart to savings and investment decisions, assuming further that the GDP boundary defines both the decision-making unit and the currency area. This “triple coincidence” of GDP area, decision-making unit and currency area is an elegant simplification but misleads when financial flows are important in their own right. First, the neglect of gross flows, when only net flows are considered, can lead to misdiagnoses of financial vulnerability. Second, inattention to the effects of international currencies may lead to erroneous conclusions on exchange rate adjustment. Third, sectoral differences between corporate and official sector positions can distort welfare conclusions on the consequences of currency depreciation, as macroeconomic risks may be underestimated. This paper illustrates the pitfalls of the triple coincidence through a series of examples from the global financial system in recent years and examines alternative analytical frameworks based on balance sheets as the unit of analysis.

Keywords: capital flows, global liquidity, international currencies.

JEL classification: F30, F31, F32, F33, F34.

<sup>1</sup> This paper was prepared for the 62<sup>nd</sup> meeting of the *Economic Policy* panel in October 2015. The authors thank Mario Barrantes, Stephan Binder, Pablo Garcia-Luna, Koon Goh and José Maria Vidal Pastor for research assistance and Claudio Borio, Ingo Fender, Catherine Koch, Ilhyock Shim, Pat McGuire and Goetz von Peter for discussion. The views expressed are those of the authors and not necessarily those of the Bank for International Settlements.

## Contents

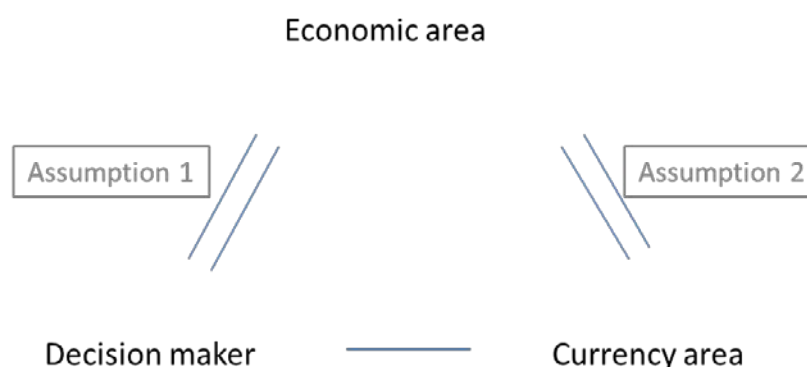
Breaking free of the triple coincidence in international finance .....	1
1. Introduction .....	3
2. Gross flows matter .....	7
2.1 A typology of global dollar banking flows .....	7
2.2 European banks as enablers of US shadow banking .....	11
2.3 A regional view of cross-border bank claims .....	13
3. Role of international currencies .....	14
3.1 The second phase of global liquidity: bond flows .....	15
3.2 Firms as carry traders .....	15
3.3 The strong dollar and the “risk-taking channel” .....	17
3.4 The role of the US dollar in global banking .....	19
4. Consolidation and sectoral disparities .....	21
4.1 Non-financial firms .....	22
4.2 Banks .....	23
4.3 A consolidated external balance sheet for the US economy .....	26
4.4 Sectoral exposures to foreign exchange risk .....	27
5. Next steps and new analytical frameworks .....	28
References .....	34

## 1. Introduction

Capital flows are traditionally viewed as the financial counterpart to savings and investment decisions. The unit of analysis is the GDP area, and what is “external” or “internal” is defined with reference to its boundaries. From this perspective, the focus is typically on net capital flows. The current account takes on significance as the borrowing requirement of the country as a whole.

The textbook analysis then incorporates two further features which, although apparently innocuous, turn out to be hugely consequential for the conclusions. The first is an aggregation property – namely, that all sectors in the economy (firms, households, government) can be summed into one representative decision-maker.

The second is that each economic area has its own currency and the use of that currency is largely confined to that economic area. The upshot of these two additional assumptions is a “triple coincidence” between: (1) the economic area defined by the GDP boundary; (2) the decision-making unit; and (3) the currency area. The triple coincidence can be represented by the following triangle of equivalence relationships.



In this schematic, Assumption 1 is the proposition that all sectors of the economy can be summed into one representative decision-maker and Assumption 2 is the proposition that each economic area has its own currency and that the use of the currency is largely confined to that currency area.

No doubt the triple coincidence is an elegant and useful simplification for analytical purposes. However, it can mislead whenever financial flows are important in their own right.

Consider three examples of how the triple coincidence can mislead. The first example is cross-border banking and the subprime mortgage crisis in the United States. Bernanke (2005) famously coined the term “global saving glut” to explain how the large US current account deficit could co-exist with easy financial conditions in the United States during the run-up to the global financial crisis. In line with the triple coincidence, Bernanke attributed these circumstances to excessive saving in some emerging economies, notably China, combined with a preference for US financial assets by these countries’ residents.

In the event, however, investors from China or other emerging market economies did not bear the losses from subprime mortgage securities. Instead, European investors, notably banks, took the hit. The large subprime portfolio positions of European banks had been obscured in the current account by the “round-tripping” of capital flows. In particular, dollars raised by borrowing from US money market funds flowed back to the United States through purchases of securities built on subprime mortgages. Since the outflows to Europe were matched by the inflows from Europe, the *net* flows were small. The current account between Europe and the United States remained broadly in balance, even though the *gross* capital flows from Europe into the United States grew enormously, fuelling the rapid increase in credit to subprime borrowers (McGuire and von Peter (2012)). We return to this point in Section 2, but we summarise it here in the motto that *gross flows matter, not just net flows*. The assumption of the triple coincidence misleads, because it obscures the role of gross flows.

The second example of how the triple coincidence can mislead is in discussions of exchange rate adjustments implied by current account imbalances for countries with international currencies.

In the mid-2000s, the US dollar depreciated against major currencies even as the US current account deficit widened to an historically large share of output. In an influential paper delivered at the 2006 *Economic Policy* panel, Krugman (2007) warned of an impending collapse in the value of the dollar, fretting that the dollar would fall abruptly when the currency market met its Wile E Coyote moment.<sup>2</sup> This would be the moment when investors collectively came to realise the inevitability of the fall in the dollar’s value, triggering a sudden rush to sell the currency. Krugman’s views echoed earlier warnings (Summers (2004), Edwards (2005), Obstfeld and Rogoff (2005), Setser and Roubini (2005)) and remained influential in financial commentary even as the global financial crisis began.<sup>3</sup>

In the event, the US dollar rose sharply with the onset of the global financial crisis in 2008. Its strong appreciation was associated with the deleveraging of financial market participants outside the United States, such as the European banks mentioned above, who had used short-term dollar funding to invest in risky long-term dollar assets. As the crisis erupted and risky US mortgage bonds fell in value, these financial market participants found themselves overleveraged and with dollar liabilities in excess of depreciating dollar assets. This forced them to bid aggressively for dollars to repay their dollar debts, pushing up the dollar’s value in the process.

An analytical framework with the triple coincidence misleads in that it gives insufficient weight to international funding currencies that are extensively borrowed outside the borders of their home countries. Indeed, the neglect of international currencies in Krugman (2007) stands in contrast to Krugman (1999), who placed the

<sup>2</sup> Wile E Coyote is a hapless cartoon character who is apt to run off cliffs and then hover in mid-air until he looks down and realises that there is nothing to support him below. He then crashes to the ground after a plaintive look to the viewer. See [https://en.wikipedia.org/wiki/Wile\\_E\\_Coyote\\_and\\_The\\_Road\\_Runner](https://en.wikipedia.org/wiki/Wile_E_Coyote_and_The_Road_Runner).

<sup>3</sup> “Is this the Wile E Coyote moment?”, <http://krugman.blogs.nytimes.com/2007/09/20/is-this-the-wile-e-coyote-moment/>. See also the related blog post “Robert Rubin is wrong about the dollar”, <http://krugman.blogs.nytimes.com/2007/11/10/robert-rubin-is-wrong-about-the-dollar/>.

dollar debt of Asian corporates at the centre of the narrative for the Asian financial crisis. Section 3 addresses the implications for exchange rate adjustment and financial conditions of international currencies, which have a broader domain than the home jurisdiction (Kenen (1969, 2002)). The lesson from our second example is that *international currencies matter for the transmission of financial conditions*. Models with international currencies often flout the predictions of textbook models based on the triple coincidence.

The third example of how the triple coincidence can mislead is when the aggregation assumption is violated. Take the case of Korea in 2008. Korea was running current account surpluses in the run-up to the 2008 crisis, and had a positive net external asset position vis-à-vis the rest of the world. That is to say, the value of its claims on foreigners in debt instruments exceeded the value of its debt liabilities to foreigners. Furthermore, as pointed out by Tille (2003) and many others subsequently, an appreciating dollar tends to boost US net international liabilities because US residents have dollar-denominated liabilities to the rest of the world that exceed their corresponding assets. Conversely, an appreciating dollar is a positive wealth shock for a country such as Korea. Nevertheless, Korea was one of the countries worst hit by the 2008 crisis, with GDP growth slowing sharply in 2009.

A closer look at the sectoral decomposition of the international investment position sheds light on why Korea was hit so hard in 2009. Although Korea had a positive net external asset position vis-à-vis the rest of the world, when balance sheets were summed across all sectors (and hence foreign exchange reserves are included), there was considerable disparity across sectors. In particular, the corporate sector was a large net debtor vis-à-vis the rest of the world, as depicted in Krugman (1999). Korean firms' negative net position mattered more for economic growth than the net positive investment position of the official sector. Unless there is some automatic mechanism to transfer the exchange-rate gains on official reserves to distressed non-financial firms, they will need to adjust their spending and hiring, hitting domestic economic activity directly. The capital gains seen on the central bank balance sheet will not help the corporate borrowers who face a surge in the dollar's value and a resulting bank credit crunch.

Section 4 delves into the sectoral decomposition issue in greater detail. The lesson here is that *the triple coincidence can mislead if it misconstrues the relevant decision-making unit*. Sometimes, as in the Korean example above, the triple coincidence aggregates too much when such aggregation is not justified. However, sometimes, the relevant decision-making unit *straddles* the GDP boundary, so that the triple coincidence is not only too coarse, but also draws the boundary in the wrong place altogether (Fender and McGuire (2010)). This last point is especially important at the time of writing, given the large stock of dollar-denominated debt of emerging market firms owed by their offshore affiliates.

Thus, the failure of the triple coincidence is important not only in retrospect, given these missed steps in analysis, but it is likely to prove important in prospect as well. Indeed, the reasons for the concept's failure – the importance of gross flows, global currencies and sectoral disparities – may well be more important than ever. McCauley, McGuire and Sushko (2015) estimate that the US dollar-denominated debt of non-banks outside the United States stood at \$9.6 trillion as of March 2015. Of this total, more than 70% involved no counterpart creditor in the United States. These facts highlight the important role of international currencies and the role of

the US dollar, in particular, as the funding currency of choice among borrowers outside the United States.

Underscoring the sectoral disparities, the fastest-growing component of the US dollar debts outside the United States has been the debt taken on by non-financial corporate borrowers in emerging market economies. Just as Korea experienced in 2008, the impact on corporate spending and hiring could well be felt in the form of slowing growth, even if the corporate borrowers are headquartered in countries with large foreign exchange reserves.<sup>4</sup>

Post-crisis, there has been a growing recognition that it may no longer be enough to build the analytical framework of international finance purely around savings and investment decisions. In his Ely lecture at the 2012 American Economic Association meeting, Obstfeld (2012, p 3) concludes that “large gross financial flows entail potential stability risks that may be only distantly related, if related at all, to the global configuration of saving-investment discrepancies”.

Borio and Disyatat (2011, 2015) emphasise the distinction between *saving* and *financing*, with the former involving an intertemporal allocation of spending while the latter is about incurring liabilities and acquiring claims – and this distinction takes an important first step in building an alternative analytical framework. Nevertheless, enormous challenges lie ahead when we seek to move from a recognition of the inadequacy of our current analytical frameworks towards a workable general equilibrium framework that transcends the triple coincidence. Twenty years have elapsed since Obstfeld and Rogoff (1996) published their textbook on international macroeconomics. In the meantime, their intertemporal framework has been refined in many directions by introducing more sophisticated dynamic techniques and various “financial frictions”, but the triple coincidence has endured in most of these extensions.

By its nature, the task of building a general equilibrium approach that departs from the triple coincidence faces modelling difficulties. General equilibrium models deal with GDP components and hence start with the GDP area as the unit of analysis. However, financial flows and balance sheets often do not map neatly on to the traditional macro variables that are measured within the GDP boundary. While general equilibrium models exist that allow firms or currencies to transcend national borders, they have tended to limit themselves to asset or even cash holdings, rather than taking in credit relationships.<sup>5</sup>

Take the concrete instance of a US branch of a global European bank that borrows dollars from a US money market fund, and then lends dollars to an Asian firm through its Hong Kong branch. The bank may be headquartered in London, Paris or Frankfurt, but the liabilities on its balance sheet are in New York and the

<sup>4</sup> Mendoza (2002) models debt denominated in traded goods prices in a non-monetary economy, but the debt is held in the household sector. Caballero and Krishnamurthy (2001) model firms with debt to foreigners collateralised by international assets and domestic debt collateralised by domestic assets in a non-monetary economy with no exchange rate; see also Céspedes et al (2002).

<sup>5</sup> Examples include Canzoneri et al (2013), who model a two-country world in which dollar bonds are held in the foreign country as currency reserves to finance dollar-denominated trade. While there is much empirical work on dollarisation and euroisation (eg Levy Yeyati (2006), Brown and Stix (2015)), the most developed theoretical treatment considers only dollar bills held as cash (Végh (2013)).



assets on its balance sheet are in Hong Kong SAR. No obvious mapping relates this bank's balance sheet to a GDP area or to GDP components within the GDP area.

In spite of the conceptual difficulties, some progress can be made in developing an analytical framework that transcends the triple coincidence if the task is limited to delineating the decision-makers through their consolidated balance sheets, irrespective of where the balance sheets lie in GDP space. The focus on consolidated balance sheets is a long-standing theme in the BIS international banking and financial statistics. Once behavioural features are projected on to the consolidated balance sheets, and provided that such frameworks are limited to addressing global conditions rather than individual country GDP components, useful lessons can be gleaned on key macroeconomic questions. We report on some recent advances in analysis at the BIS, both in theoretical frameworks and in measurement, which point to some promising avenues for progress.

This paper is structured as follows. Section 2 makes the case for gross flows as a more relevant metric than net flows in international finance. Section 3 discusses the importance of global currencies, especially the role of the US dollar in denominating global debt contracts. Section 4 points out the pitfalls in aggregating across sectors and in drawing the boundary around the decision-making unit. Section 5 draws methodological lessons and outlines an analytical framework, based on firms' and banks' consolidated balance sheets, that transcends the triple coincidence.

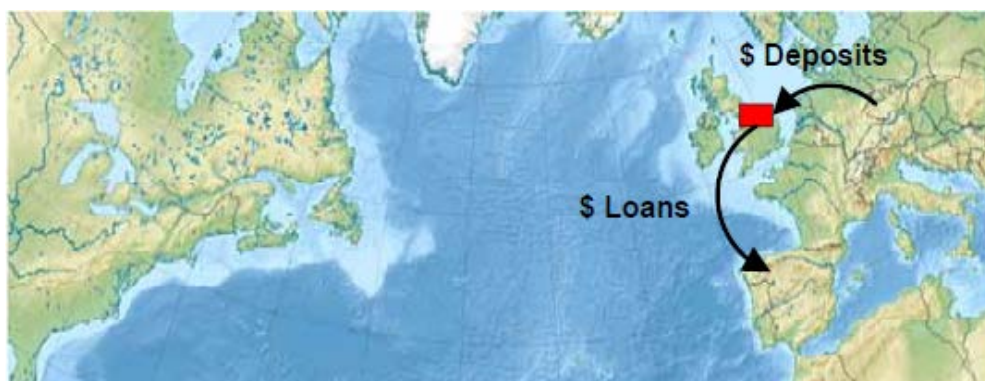
## 2. Gross flows matter

Bernanke (2005) attributed the combination of US current account deficits and easy US financial conditions to the "global saving glut" arising from excessive saving in emerging economies together with a preference for US financial assets by these countries' residents. Blanchard et al (2005) similarly place the role of foreign investors' preference for US financial assets at the core of their argument, although they build on the portfolio balance approach that gives weight to gross flows (McKinnon (1969); Dornbusch (1980); Gabaix and Maggiori (2015)). Under the triple coincidence, financial flows are *net* capital flows that mirror the current account balance. However, as argued in Borio and Disyatat (2011, 2015), the financial boom in the United States that preceded the 2008 crisis and which gave rise to the subprime mortgage crisis can only be understood by reference to *gross* capital flows, especially through banks headquartered in Europe, and gross flows gained prominence in the post-crisis debates (see Obstfeld (2010)).

To introduce the argument, it is helpful first to organise the discussion around the typology of capital flows. To make the discussion more concrete, we focus on banking sector flows in US dollars. Graph 1, taken from He and McCauley (2012), illustrates four types of cross-border bank flows in US dollars.

### 2.1 A typology of global dollar banking flows

Under the triple coincidence, if an economy spends more than it earns, it must borrow the remainder. The financial flow reflects such borrowing. In Graph 1, mode 3 (outflows) and mode 4 (inflows) reflect such flows contemplated under the triple coincidence.

**Mode 1: Pure offshore transactions****Mode 2: Round-trip transactions****Mode 3: Outflow****Mode 4: Inflow**

Source: He and McCauley (2012) and authors' adaptation of Dufey and Giddy (1978, p 165; 1994, p 292).

However, capital flows can be associated with a round-trip transaction, as in mode 2. Here, the deposits of US residents flow offshore from where they are lent back to the United States to provide credit to US residents. To the extent that outflows exactly match the inflows into the United States, there is no impact on net flows. Such “round-tripping” has no impact on the current account balance, but round-tripping turns out to be crucial in understanding the US subprime crisis.

Historically, round-tripping was associated with regulatory arbitrage (Aliber (1980)). If domestic deposits attract reserve requirements or incur deposit insurance premiums or pay yields that are capped by regulation, then depositors willing to hold a deposit in a Caribbean or London branch of a familiar bank can avoid such costs or regulations and receive a higher yield. However, as we will show below, the round-tripping that grew most rapidly in the run-up to the 2008 financial crisis was between the United States and Europe, which owed little to reserve requirements, deposit insurance or interest rate caps.

Graph 1 also illustrates the case of “pure offshoring” (mode 1). The archetypal transaction in the offshore market of an international currency is one denominated in that currency, that takes place between non-residents, outside the country of issue of the currency and subject to the law of another jurisdiction. Such a transaction, pictured in the top panel of Graph 1, need not register in the capital account or the current account of the currency’s home country, although it typically clears and settles through banks in the country of issue.

Consider an example from the 1970s: a Middle East central bank deposits \$10 million in a bank in London, which in turn lends the funds to a Brazilian oil importer. The dollars might go through one or more offshore interbank transactions that could take place in London or another banking centre, and the interbank counterparties could be arm’s length or could be affiliated.<sup>6</sup>

Another example of pure offshore intermediation is what Obstfeld and Taylor (2004) call an “asset swap”. This is a symmetrical exchange of claims that amounts to a pair of offsetting gross flows but no net flow. A German resident and a French resident exchange dollar claims on each other. Here, they diversify their portfolios in the dimensions of credit (a claim on a foreign rather than domestic resident) and currency (a claim in dollars instead of French francs or Deutsche marks (or, more recently, euros)).

Pure offshore intermediation in dollars does not require the funds to be either sourced or deployed in the United States. In the example of London’s intermediation of dollars between the Middle East oil producer and Brazilian oil importer, the Brazilian firm could borrow dollars in London to buy oil and the Middle East central bank might end up holding the deposit created by the loan’s drawdown. Or the story can be told in the other direction. While the funds may flow through the US banking system, the residence of the placer of funds, the borrower’s residence, the booking locations of the deposit or the loan, and the jurisdiction governing the transaction all lie outside the United States.

<sup>6</sup> In the 1970s, Middle East oil exporters ran current account surpluses while Brazil ran current account deficits, so this transaction through the eurodollar market exemplifies what Obstfeld and Taylor (2004) dub development finance, involving *net* flows. From the standpoint of the US economy, however, there is no net borrowing or lending.

Which of the four types of dollar banking flows have prevailed in the recent past? BIS data on the offshore dollar market (the “eurodollar” market), a significant share of global dollar banking, including domestic US banking (Graph 2, left-hand panel), show that it has played all four roles in Graph 1 at various historical points.

Generally, the most common transaction involved a non-US borrower sourcing funds from a non-US lender, as in the pure offshore type. Indeed, the eurodollar market has served only to a limited extent as a conduit of funds in the textbook triple coincidence sense of channelling funds from the United States to abroad into the 1980s or since from abroad to the United States (He and McCauley (2012)).

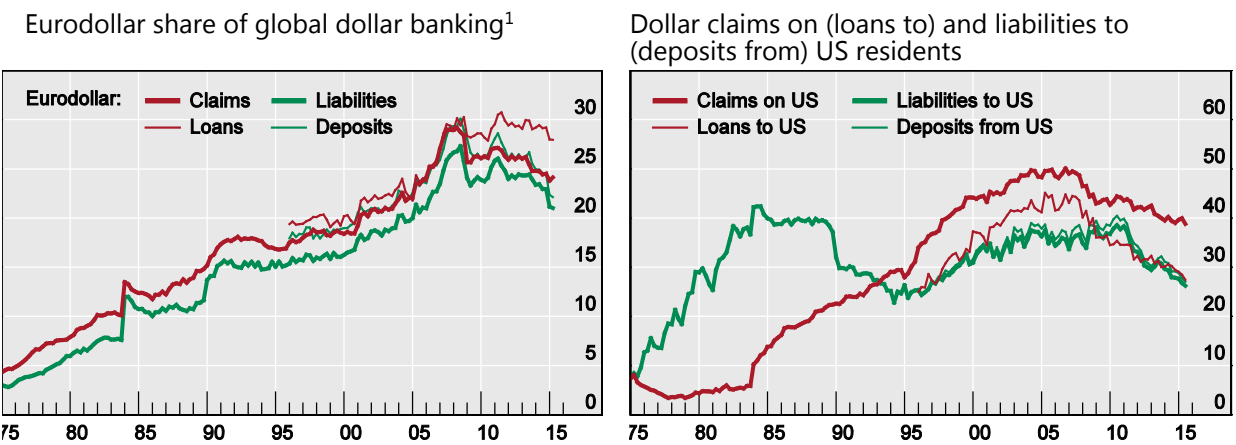
However, the key theme in the eurodollar market from the late 1990s was the rise in round-tripping as the offshore market became a circuit for deposit-like claims of US residents to become unsafe investments in securities backed by US mortgages. To see the rise and fall of round-tripping, we plot four US shares of the offshore dollar balance sheet: pure offshore banking registers at zero and pure round-tripping at 100% (Graph 2, right-hand panel). Claims on US residents in thick red originally accounted for less than 15% of overall dollar claims booked offshore; liabilities to US residents in thick green were a larger share. This share of claims then rose to almost half before the outbreak of the crisis. US residents accounted for an even larger share of loans and deposits (the thin red and green lines), once these were separately reported in the mid-1990s. These shares have all fallen since 2008.

In sum, in the period leading up to the Great Financial Crisis, the eurodollar market had changed its modal pattern of intermediation. It shifted from standing between lenders and borrowers *outside* the United States to an unprecedented intermediation between lenders and borrowers *inside* the United States.<sup>7</sup>

Eurodollar banking: relative size and importance of US residents

In per cent

Graph 2



<sup>1</sup> Break in series in Q4 1983, when Caribbean centres joined the reporting area.

Sources: Federal Reserve Statistical Release Z.1 (flow of funds); BIS.

<sup>7</sup> Some of the 1983-95 decline in the share of dollar liabilities from US residents is an artefact of banks’ relying more on bond funding, since a bondholder’s residence is unknown. Maggiori (2013) accepts the triple coincidence: US banks take foreign deposits and there is no round-tripping.

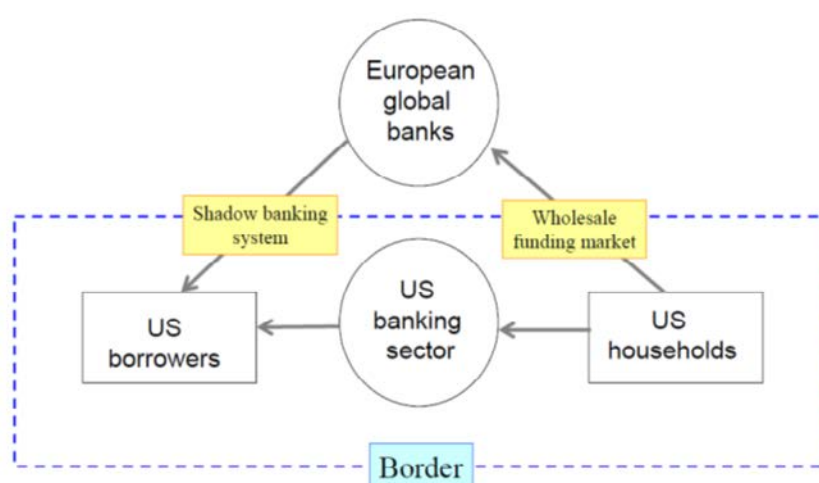
## 2.2 European banks as enablers of US shadow banking

European banks played a pivotal role as the major players in global financial flows in the period leading up to the 2008 crisis. A reasonable case can be made that the European global banks enabled the shadow banking system in the United States by drawing on dollar funding from non-banks in the wholesale market to lend back to US residents through the purchase of securitised claims on US borrowers (Graph 3). Shin (2012) has called this round-tripping by European banks the “banking glut”, to distinguish the gross flows via Europe from Bernanke’s (2005) “saving glut”, which manifests itself as net flows and registers in the current account. European banks inserted themselves in a chain of intermediation reaching from households and firms and back to households by providing highly rated paper to US money market funds and then investing in private label asset-backed securities that proved very risky.<sup>8</sup> Low volatility meant that risk-weighted assets could be piled onto shareholder equity. Financial firms unconstrained by a simple leverage ratio, such as US securities firms and European banks, ran up their leverage to 50:1 or even higher. If there was regulatory arbitrage as a driver of the round-tripping through European banks, it arose from the absence of a constraint in Europe on overall (ie not risk-adjusted) bank leverage.

Baba et al (2009) estimate that European banks sourced \$1 trillion from US dollar money market funds in mid-2008, amounting to about an eighth of their overall dollar funding. From the standpoint of the money market funds, the relationship was even closer: as much as half of the assets of US dollar money market funds were invested in European banks (Graph 4, left-hand panel). Money market funds had little exposure to banks in the periphery of Europe, and they

European banks and US shadow banks

Graph 3

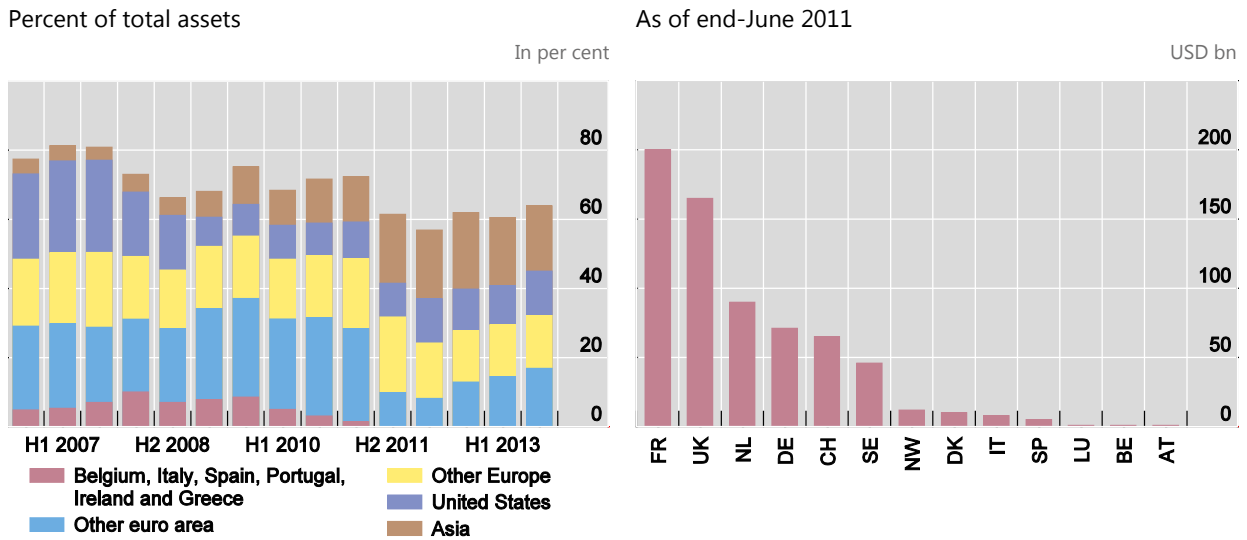


<sup>8</sup> In addition to the round-tripping were portfolios of risky private label asset-backed securities that were held by foreign bank affiliates in the United States. UBS (2008) describes how the bank's global liquidity was invested in highly rated private label asset-backed securities in the United States. Only when these assets were put into a special purpose vehicle funded by the Swiss National Bank did the assets become foreign claims from a balance of payments perspective.



Amount owed by banks to US prime MMFs by nationality of bank

Graph 4



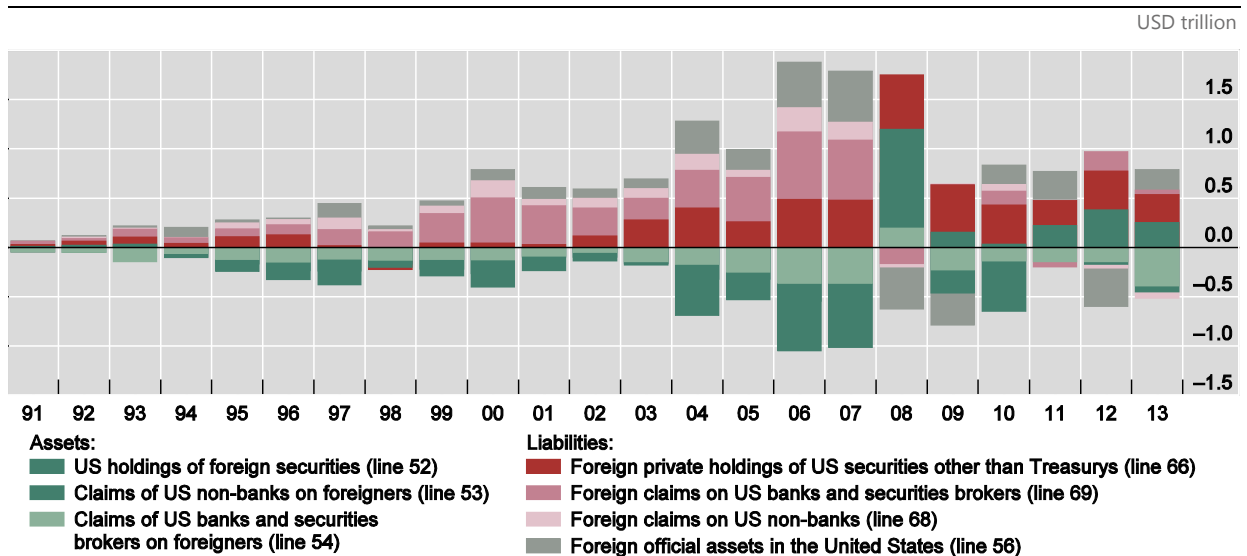
Sources: IMF, *Global Financial Stability Report*, October 2011; Fitch.

moved quickly to disinvest at the first sign of trouble. In the cross section (Graph 4, right-hand panel), the funds favoured French, Dutch and German banks in the euro area, and UK, Swiss and Swedish banks outside that area.

An alternative vantage point for the round-tripping is the balance of payments accounts for the United States. In Graph 5, positive bars indicate gross capital inflows into the United States – an increase in claims of foreigners on US residents – while negative bars indicate gross capital outflows. The grey shaded bars indicate the increase in claims of official creditors on the United States. This includes the

US annual capital flows by category

Graph 5



Note: Positive bars represent an increase in liabilities, or a capital inflow into the United States.

Sources: Shin (2012) updated; US Bureau of Economic Analysis.

increase in claims of China and other current account surplus countries that accumulated official reserves. While official flows are large, private sector gross flows are larger still. The negative bars before 2008 indicate large outflows of capital from the United States (principally through the banking sector), which then re-enter the country through the purchases of non-Treasury securities. In interpreting the numbers, bear in mind that the branches and subsidiaries of European-headquartered banks in the United States are treated as US residents in the balance of payments, as the balance of payments accounts are based on residence, not nationality. The gross capital flows into the United States in the form of European banks' purchases of products of the shadow banking system played a pivotal role in influencing US credit conditions in the run-up to the subprime crisis, but their role was obscured in the current account by round-tripping.

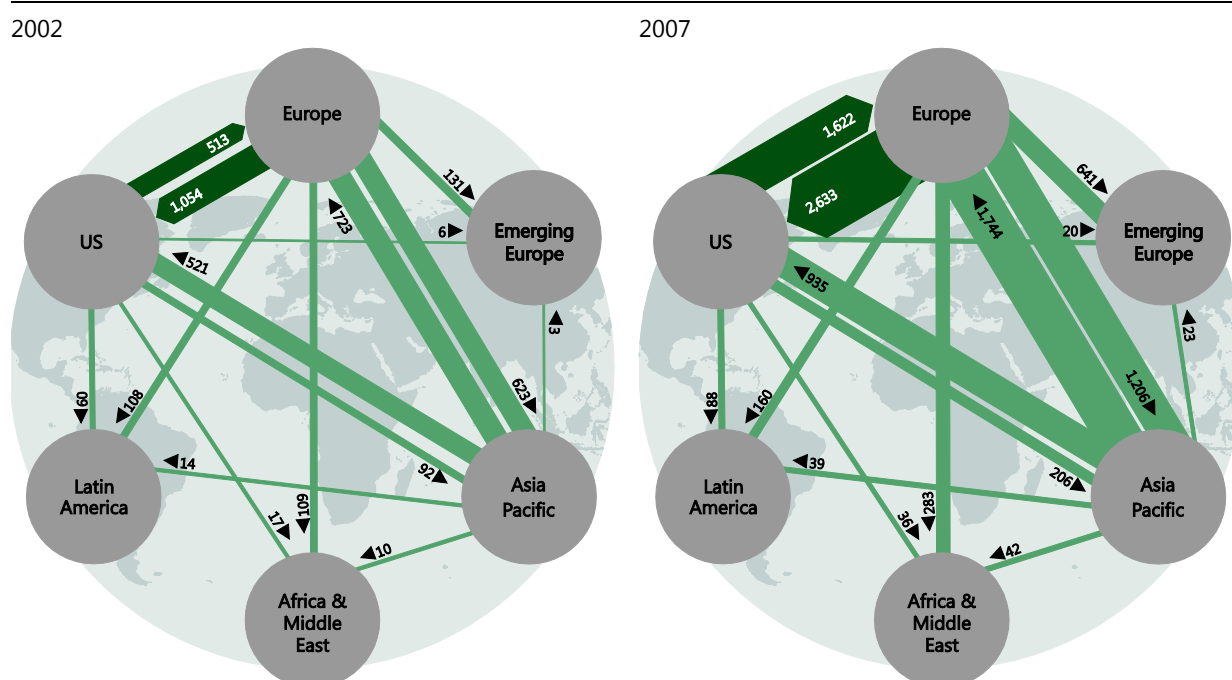
## 2.3 A regional view of cross-border bank claims

The BIS locational banking statistics by residence give useful insights into the shifting regional patterns in cross-border bank credit since they contain information on the residence of the lending bank and the borrower. In the build-up to the 2008 crisis, bank funding surged in the triangle of Europe, Asia and the United States (Graph 6). In particular, gross cross-border bank claims among the three regions more than doubled from \$3.5 trillion at end-2002 to \$8.3 trillion at end-2007.

Cross-border bank claims (denominated in all currencies)<sup>1</sup>

In billions of USD

Graph 6



<sup>1</sup> The thickness of the arrows indicates the size of the outstanding stock of claims. The direction of the arrows indicates the direction of the claims: arrows directed from region A to region B indicate lending from banks located in region A to borrowers located in region B.

Source: BIS locational banking statistics.

Two-way flows marked not only the transatlantic flows (see above and below), but also those between Europe and Asia and the United States and Asia. A macro-economic impulse might be to cancel out the two-way flows in Graph 6, but it is worth considering gross flows as a determinant of financial conditions. Lending standards depend on total balance sheet size, and this is inherently a gross rather than a net concept. By inserting themselves into the middle of a chain of intermediation that started with saving households and firms in the United States and ended with borrowing households in the same country, banks in Europe contributed to the easing of US financial conditions. These developments could only have been detected by examining gross flows between Europe and the United States. Focusing on net flows or on the respective current account balances as suggested by the triple coincidence missed the big picture.

### 3. Role of international currencies

The recognition of the dollar and euro as global currencies often does not extend beyond their roles as official reserve currencies, or perhaps their role as invoicing currencies in denominating international trade in goods and services (Ito and Chinn (2015)). However, they play a third role, often neglected, as a *funding currency*, meaning the currency that denominates debt contracts. The amount to be repaid is denominated in dollars or euros, but predominantly in dollars. Often, the dollar serves as the funding currency even when neither the borrower nor the lender is located in the United States. As we will show in the next section, the US dollar also plays the pre-eminent role in the international banking system, whereby banks outside the United States borrow and lend in dollars.

The round-tripping by European banks and the concomitant role of the US dollar shed light on the reasons for the rapid appreciation of the US dollar with the onset of the 2008 crisis, contrary to the predictions of the textbook model based on the triple coincidence. The US dollar appreciated sharply in late 2008 and this coincided with a cyclical shrinking of the US current account deficit. The dollar appreciated as European banks suffered losses on the risky dollar mortgage bonds and bid for dollars to square their books (McCauley and McGuire (2009)). Thus, the deleveraging amid write-downs of assets of European banks that had used short-term US dollar funding to invest in risky long-term US dollar assets boosted the dollar.<sup>9</sup> In the deleveraging process, these institutions sought dollars aggressively, not only bidding up the dollar's value but also causing episodes of "dollar shortage" (McGuire and von Peter (2012)).

<sup>9</sup> Even though European banks did not originally have large currency mismatches, they did have very large maturity mismatches within the US dollar-denominated segment of their balance sheets. More concretely, many of them had entered into short-term FX swaps in which they lent euros and borrowed US dollars, which they used to invest in risky long-term US dollar assets (eg residential mortgage-backed securities).



### 3.1 The second phase of global liquidity: bond flows

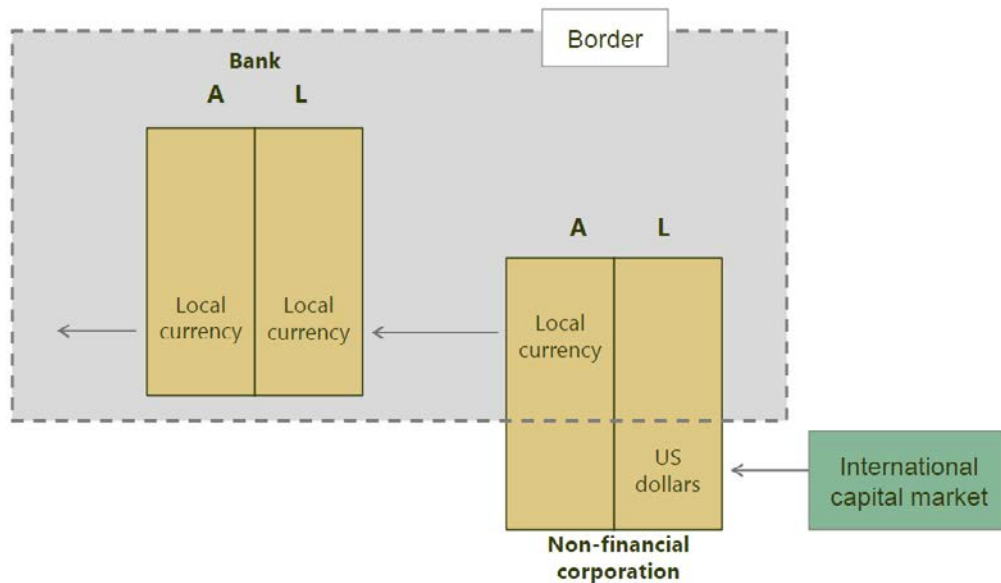
Emerging market firms have actively issued dollar bonds since the Great Financial Crisis, showing that the US dollar's international role extends well beyond the banking system. Here, the US dollar has continued to play the role of the global unit of account in debt contracts in the sense that firms have tended to issue dollar-denominated corporate bonds. In turn, the corporate bonds have attracted investors from all over the world, meaning that borrowers have borrowed in dollars and lenders have lent in dollars even when neither party is a US resident. Shin (2013) dubs this development the "second phase" of global liquidity, as distinguished from the first phase that centred on dollar intermediation by global banks. McCauley, McGuire and Sushko (2015) estimate that, of the \$9.6 trillion outstanding US dollar-denominated debt of non-banks located outside the United States at the end of March 2015, about half took the form of bonds. Thus, while the Federal Reserve eased monetary conditions for the US economy, by promising low policy rates and by purchasing US bonds, its policy had the unintended consequence of boosting the bond issuance of borrowers outside the United States.

A new element that potentially obscures the scale of EM corporate borrowing has been the practice of issuing debt securities through offshore affiliates. Official external debt statistics that are compiled on a residence basis may not fully reflect the true underlying vulnerabilities, or the consolidated exposures that are relevant for explaining corporate behaviour. McCauley et al (2013) note that most of the offshore issuance of international debt securities has been in US dollars, so that emerging market firms have become much more sensitive to exchange rate fluctuations vis-à-vis the US dollar.

The question that presents itself in this second phase of global liquidity is what assets and cash flows back the stock of dollar-denominated debt. Some corporate borrowers, such as exporters and particularly commodity producers, have dollar cash flows. Others, such as utilities and real estate firms, do not. Yet, even when the borrower has dollar receivables, a strong dollar can lead to strains. For one thing, even though commodities are priced in dollars, there is an empirical regularity whereby commodity prices weaken in dollar terms when the dollar strengthens. Thus, in those states of the world when the dollar is strong, the balance sheets and cash flows of borrowers tend to be weak. From the lenders' perspective, dollar strength represents a deterioration of the credit quality of outstanding debt. If lenders respond by cutting back lending, then dollar strength leads to credit tightening through the "risk-taking channel". We now turn to an examination of this channel.

### 3.2 Firms as carry traders

If the overseas subsidiary of an emerging market company has taken on US dollar debt, but the company is holding domestic currency financial assets at its headquarters, then the company as a whole has taken on a currency mismatch (Graph 7). Appreciation of the funding currency against the domestic currency may



hurt the company's creditworthiness, even if no currency mismatch is captured in the official net external debt statistics.<sup>10</sup>

Nevertheless, the firm's fortunes (and hence its actions) will be sensitive to currency movements and thus foreign exchange risk. In effect, the firm has taken on a carry trade position, holding cash in local currency but with dollar liabilities in its overseas subsidiary. One motive for taking on such a carry trade may be to hedge export receivables. Alternatively, the carry trade position may be motivated by the prospect of financial gain if the domestic currency is expected to strengthen against the dollar. In practice, the distinction between hedging and speculation may be difficult to draw.

Chung, Lee, Loukoianova, Park and Shin (2015) highlight the relevance of the stock of corporate deposits as an indicator of the channel through which the offshore issuance of emerging market firms may ease domestic financial conditions. The financial activity of firms that straddle the border can leave a big footprint on the domestic financial system. A financing subsidiary that issues debt offshore in foreign currency may make an intercompany loan to headquarters.<sup>11</sup> It in turn can accumulate liquid financial assets in domestic currency in the form of claims on domestic banks or on the shadow banking system. Then, keeping track of the corporate deposits and short-term financial assets of the firm may indicate its overseas financial activities, which may convey the broad financial conditions that prevail in international capital markets. These authors show that external financial

<sup>10</sup> If the funds raised by the offshore affiliate have been lent back to head office, the latter will show a smaller direct investment claim on the rest of the world. Bénétrix et al (2015) would score this as a smaller net foreign currency asset position for the economy. The question we pose in what follows is what the head office does with the funds.

<sup>11</sup> See Avdjiev et al (2014).

conditions are reflected in the monetary aggregates of capital-recipient economies through the increased size of corporate deposits, as measured by the IMF's *International Financial Statistics*. The advantage of a liability measure derives from the difficulty of monitoring the activity of non-financial firms whose activity straddles the border. Such activity is not easily monitored through the usual external debt measures that use the locational definitions that underpin balance of payments and national income statistics.

There is evidence that emerging market firms have recently sold dollar bonds to accumulate cash, and the timing points to its deployment in domestic currency. Bruno and Shin (2015c) compile a micro data set of corporate bond issuance by firms from 47 countries that matches the issuance data with balance sheet information of the firms. They find that emerging market firms that issue US dollar-denominated bonds tend to hold more cash to begin with, and that the proceeds of bond issuances are more likely to be held as cash. As for the timing of bond issuances, they are more prevalent when the dollar carry trade is favourable in terms of a higher interest rate differential vis-à-vis the US dollar, higher recent appreciation of the local currency and lower exchange rate volatility. On this evidence, they conclude that dollar bond issuance by emerging market firms is motivated, at least in part, by the financial motive of the dollar carry trade, as well as any financing of real activity.

### 3.3 The strong dollar and the “risk-taking channel”

In retrospect, the Latin American debt crisis broke out after several years of the dollar strengthening from its local trough in 1978–79. And the Asian financial crisis broke out after several years of the dollar strengthening from its local trough in 1995. It appears that the dollar quietly troughed in 2011, and its appreciation accelerated in 2014 and into 2015, with some retracement in 2015. Could something systematic be at work here?

The “risk-taking channel” of exchange rates suggests that dollar movements can affect domestic financial conditions. Consider dollar weakening, as happened between 2002 and 2011, with an interruption in 2008. Such weakening flattens the balance sheets of dollar borrowers and their creditworthiness. From the standpoint of creditors, the stronger credit position of the borrowers creates extra headroom for credit extension even with an unchanged exposure limit. Thus credit supply becomes more plentiful.

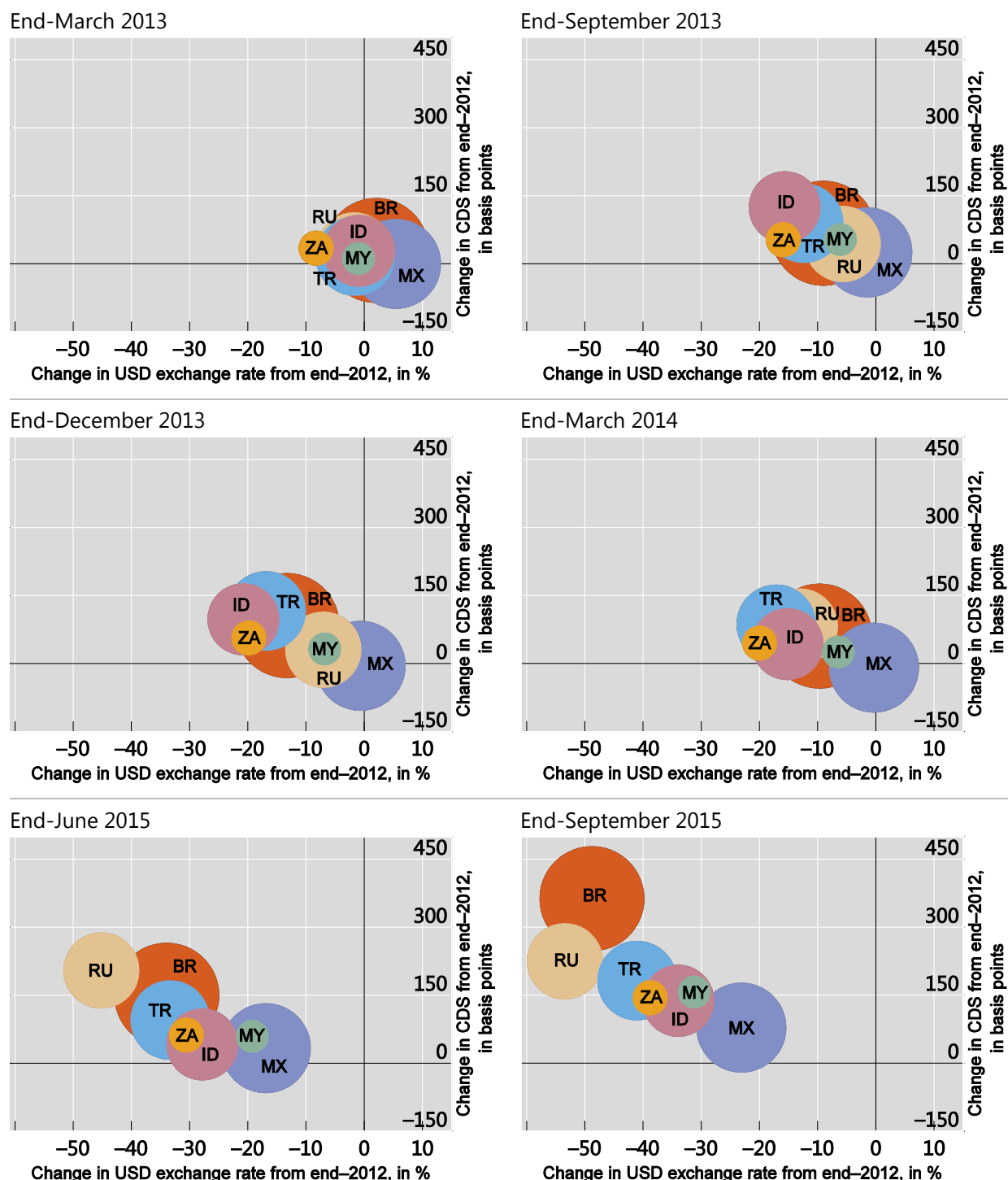
But when the dollar strengthens, these relationships conspire to tighten financial conditions. Borrowers' balance sheets look weaker. Their creditworthiness declines. Creditors' capacity to extend credit declines for any given exposure limit. And thus credit supply tightens. For the banking sector, exposure limits associated with value-at-risk (VaR) or similar constraints would serve to open the risk-taking channel (Bruno and Shin (2015a)). Even in the case of non-bank creditors, such as asset managers who extend credit by purchasing corporate bonds, if fund investments tend to fluctuate with recent market conditions, then a similar risk-taking channel can be seen to open (Hofmann, Shim and Shin (forthcoming)). These results echo the findings in Rey (2015) that US monetary shocks affect credit conditions globally, and sharpen the dilemma versus trilemma debate in Rey (2014).

Empirical support for the risk-taking channel comes from a range of findings whereby a strong dollar is associated with tighter credit-supply conditions.

## Illustrating the risk-taking channel

Bilateral USD exchange rate and five-year sovereign CDS, change from end-2012

Graph 8



BR = Brazil; ID = Indonesia; MX = Mexico; MY = Malaysia; RU = Russia; TR = Turkey; ZA = South Africa. The size of the bubbles indicates the size of dollar debt in Q2 2015.

Sources: Markit; national data; BIS.

For instance, consider how the sovereign CDS spread moves with shifts in the bilateral exchange rate against the US dollar (Graph 8). The horizontal axis is the percentage change in the bilateral exchange rate against the US dollar for a group of emerging market countries from the end of 2012. The vertical axis is the change in the five-year sovereign CDS spread since the end of 2012. The size of the bubbles in Graph 8 denotes the total dollar debt owed by non-banks in the country.

Notice how the bubbles move in the north-west direction in times of financial turbulence. Thus, when the currency weakens against the dollar, the sovereign CDS spread widens. Some of this will be due to greater credit risk, but the large shifts in CDS spreads suggest that some is due to credit supply fluctuations.

The period beginning in mid-2014, when the price of crude oil began to fall sharply, showed the linkage with particular force. By end-March 2014, fixed-income and foreign exchange markets had settled down after the turmoil of May 2013. By June 2015 the bubble for Russia had moved in the north-westerly direction. More recently, the bubble for Brazil has floated up towards the northwest, indicating the combination of a sharp *real* depreciation against the US dollar as well as tighter financing conditions. The September 2015 bubbles show that emerging market borrowers are facing challenges due to the stronger dollar.

### 3.4 The role of the US dollar in global banking

In addition to providing information about the evolution of cross-border bank credit across countries and regions, the BIS locational banking statistics by residence allow us to decompose those flows by currency of denomination. These data are especially well suited for such an analysis since they simultaneously report not only the residence of the lending bank and the borrower, but also the currency denomination of the loans.

Historically, banks have extended credit across borders primarily in US dollars. In the early 1980s, more than three quarters of all global cross-border bank claims were denominated in US dollars. Even though that share has since gradually declined, the US dollar continues to be the leading currency in international banking. As of end-2014, cross-border bank claims denominated in US dollars totalled \$13.4 trillion, accounting for nearly half of such claims.

Banks located outside the United States extend most of the cross-border credit in US dollars (Graph 9). From 2002 to 2014, banks in the United States accounted for less than a third of the global stocks of USD-denominated cross-border bank claims: the share ranged between 25% and 31%. Moreover, banks in the United States accounted for only about a third (35%) of the surge in global cross-border bank lending in US dollars between 2002 and 2007 and for only 8% of the respective increase between 2007 and 2014.<sup>12</sup>

Transatlantic activity dominated the pre-crisis period of 2002–07. Bank claims between the United States and Europe almost tripled (Graph 9, top two panels). This

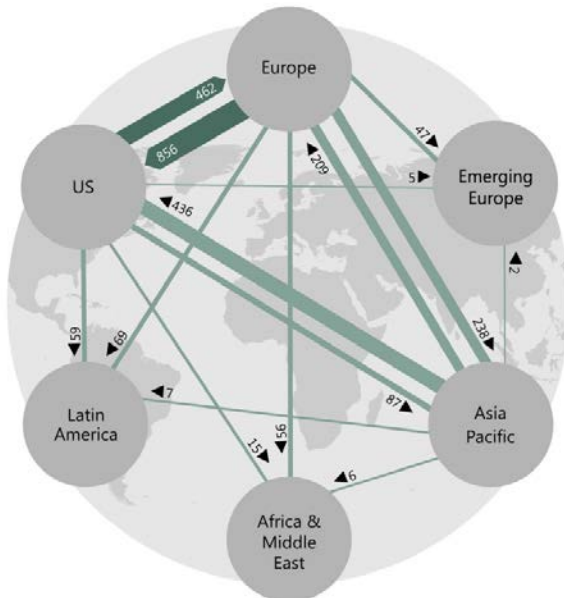
<sup>12</sup> See Kreicher et al (2014) and McCauley and McGuire (2014) on the impact of the widening of the FDIC assessment base on the claims of foreign banks in the United States on the rest of the world.

## US dollar-denominated cross-border claims<sup>1</sup>

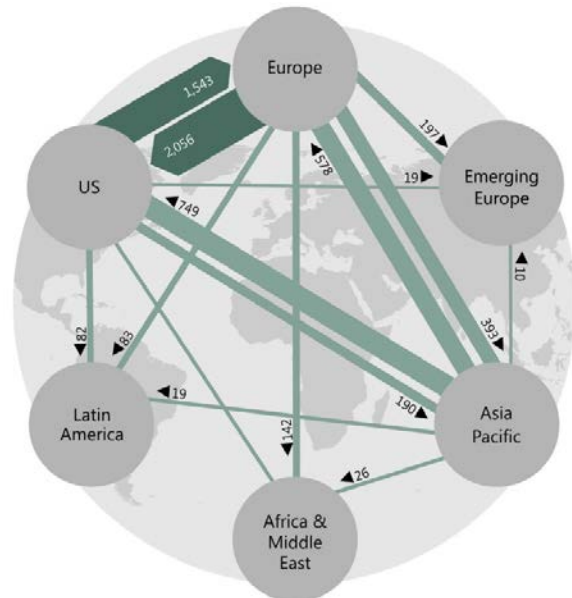
In billions of US dollars

Graph 9

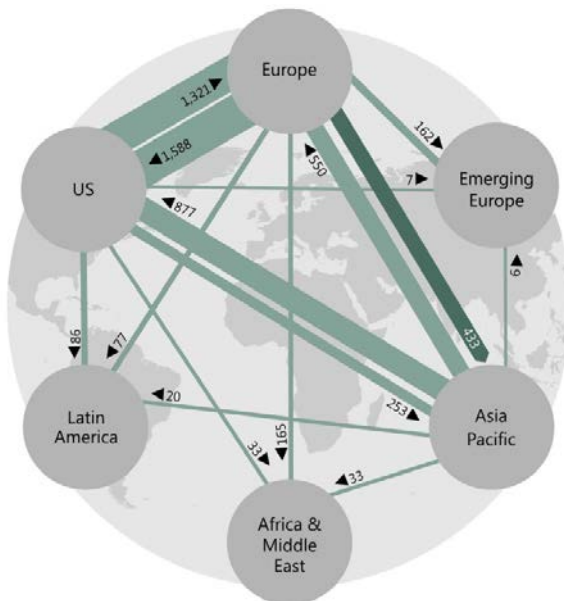
2002



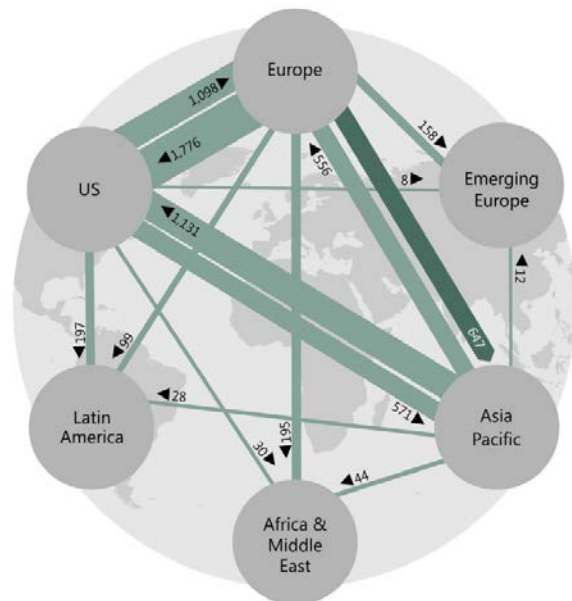
2007



2009



2014



<sup>1</sup> The thickness of the arrows indicates the size of the outstanding stock of claims. The direction of the arrows indicates the direction of the claims: arrows directed from region A to region B indicate lending from banks located in region A to borrowers located in region B.

Source: BIS locational banking statistics.

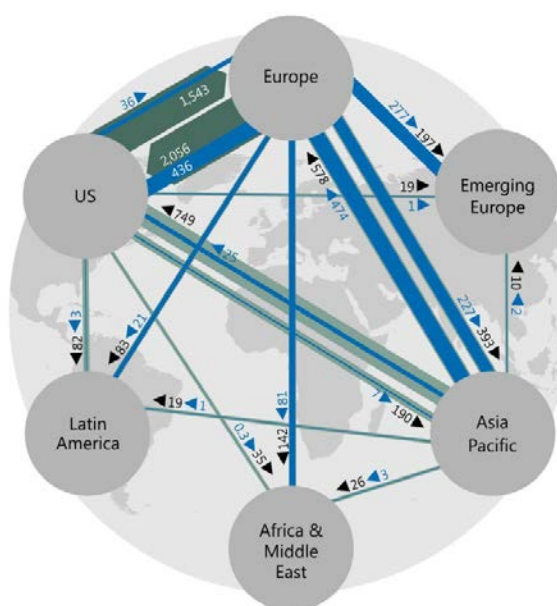
growth in dollar bank claims between these two mature economies greatly exceeded the growth of US or European cross-border claims vis-à-vis rapidly growing Asia. In fact, while dollar-denominated cross-border bank claims grew for every single lender-borrower pair shown, nearly two thirds (\$2.3 trillion out of \$3.6 trillion) of the global increase was due to the US-Europe axis).



In the post-crisis period, the dollar vector pivoted toward Asia (Graph 9, bottom two panels). US dollar-denominated cross-border bank claims between the United States and Europe contracted by \$724 billion. By contrast, cross-border bank lending to Asia surged by \$636 billion both from banks located in the United States (\$382 billion) and in Europe (\$254 billion). Much of the latter increases favoured banks located in advanced Asia-Pacific countries, which in turn lent to non-bank borrowers in emerging Asia. As a consequence of this growth in intraregional banking, banks located in Asia and the Pacific now account for more than 50% of international claims on emerging Asia-Pacific (Remolona and Shim (2015)).

US dollar- and euro-denominated cross-border claims, 2007<sup>1</sup>

Graph 10



<sup>1</sup> The thickness of the arrows indicates the size of the outstanding stock of claims. The direction of the arrows indicates the direction of the claims: arrows directed from region A to region B indicate lending from banks located in region A to borrowers located in region B.

#### 4. Consolidation and sectoral disparities

analysis would be the GDP boundary. However, for some important questions, such as the one examined above on the financing choices of non-financial corporations using offshore subsidiaries, it is important to define the boundary of the decision-making unit more broadly. Only then can one hope to assess vulnerabilities and to forecast choices made in response to financial developments.

Concern over the US current account deficit 30 years ago led to important findings that depended on a consolidated view of US-based multinationals. Kravis and Lipsey (1985, 1987) demonstrated that, while the United States had lost market share in global manufacturing, US firms had not. They concluded that the difference points to factors specific to the US economy (the dollar, wages or other prices) rather than to characteristics of consolidated firms such as management or technology (or cost of equity).

In 1992, a National Academy of Sciences panel suggested that supplementary international transactions accounts be compiled that would “draw borders around groups of firms classified by nationality of ownership rather than around geographical entities” (Baldwin et al (1998, p 4, citing National Research Council (1992)). Lipsey et al (1998) found that the difference between production as measured by geography and production as measured by ownership – what they termed “internationalised production” – was a growing share of the world economy.

The global treatment of banking exposures that underpin the BIS consolidated banking statistics is an example of a consolidated approach that has managed to achieve greater traction and use. Historically, the BIS consolidated banking statistics were designed with the credit risk of banking organisations in mind. The rationale was to gauge enterprise-wide credit exposures that can lead to credit losses. The failure of Herstatt Bank in 1974 gave rise to the Basel Committee on Banking Supervision (BCBS), which sought to harmonise the supervision of increasingly multinational and multicurrency banking. The BCBS began its discussion of home and host responsibilities in October 1977, and in June 1979 the G10 Governors accepted the Basel Concordat that lodged the supervision of solvency issues with the home authority, which implied the need for consolidated reporting (Goodhart (2011, pp 100–2)). Meanwhile, the UK and US banking authorities started to publish regular consolidated country exposure lending surveys in 1977.

Fully consolidated international banking data began to be produced at the BIS only after the outbreak of the Latin American debt crisis in 1983. These supplemented the previously collected data collected on a balance of payments basis. After the Asian financial crisis, these data were extended to cover exposures to the advanced economies as well. Now there are 31 reporting countries, including emerging economies (Brazil, Chile, Hong Kong SAR, India, Korea, Mexico, Panama, Singapore, Chinese Taipei and Turkey).

In the following two subsections, we demonstrate how different things look when one takes a consolidated view. We start with non-financial firms and then move to banks.

#### 4.1 Non-financial firms

Baldwin and Kimura (1998) demonstrated the power of the distinction between geography and ownership by measuring the net sales of Americans to foreigners. By Americans, they meant both US-owned firms in the United States and US-owned



firms abroad. With regard to the conventional trade statistics, on the export side, they exclude sales by US-owned multinationals to their foreign affiliates as well as sales to foreigners by affiliates of foreign-owned firms in the United States. In 1991, these represented 23% and 18% respectively of US exports of goods and services. Proceeding in this manner on the import side and taking account of domestic sales of US affiliates abroad and of foreign affiliates in the United States, they arrive at a conclusion that is strikingly different from the 1991 trade deficit figure of \$28 billion: by their estimate, US firms ran a surplus of \$60 billion.

The authors recognised that their estimates were only approximate, but US-owned firms seemed to be doing better than firms in the United States at selling to foreigners. For our purposes, the take-away is that, on a flow of activity measure, redrawing the lines along consolidated, national lines could give a distinctly different impression of the competitiveness of US firms.

## 4.2 Banks

The need to break free of the triple coincidence in banking can be demonstrated from two different perspectives. First, looking at the external assets of the home country, it is evident that banks headquartered elsewhere can account for a large share of cross-border claims. Thus, taking external assets as a measure of the vulnerability of the home country's banks, one can easily measure too much. For instance, in the European sovereign crisis, a vulnerability assessment by the UK authorities vis-à-vis Spain would have to distinguish between a claim on Spain booked in the United Kingdom by a UK bank from one booked by a German bank.

Second, looking at consolidated bank balance sheets by nationality, it is evident how many foreign assets are booked outside the country in which the bank is headquartered. As a result, one misses a lot by looking only at the balance sheet of the country in which the bank is headquartered. In the context of the triple coincidence framework, the main decision-making unit (ie the bank head office) exercises control over agents (ie affiliated banking units abroad) that are located well beyond the border of the economic area associated with the decision-maker (ie the country in which its head office is located).

From both perspectives, McGuire and von Peter (2012) presented compelling evidence of the deviation from the triple coincidence in their study of the US dollar shortages during the Great Financial Crisis. They demonstrated that, at the end of 2007, foreign-owned units accounted for the bulk of banks' external positions in many countries. Switching perspectives, they also showed that most major national banking systems booked the majority of their foreign assets outside their respective home countries.

In the remainder of this subsection, we build on the analysis of McGuire and von Peter (2012) in two ways. First, we use the latest data on the size and the composition of banks' cross-border claims to update and to confirm, seven years later, their findings about the pre-crisis composition of banks' international balance sheets. Second, we use the new counterparty country dimension in the recently enhanced BIS *locational banking statistics by nationality* to show that focusing on the location in which claims are booked, rather than on the nationality of the lending bank, could lead to misleading conclusions about national banking systems' credit risk exposures.

## Banks' cross-border assets, by bank location and nationality

Positions at end-2014, in trillions of USD

Table 1

Country	Belgium	Canada	Switzer- land	Germany	Spain	Italy	Nether- lands	United Kingdom	United States
In all currencies									
Home banks in home country	0.2	0.5	0.7	1.9	0.4	0.4	1.1	1.6	1.5
All banks in home country	0.7	0.5	0.9	2.4	0.4	0.5	1.2	4.8	3.2
Home banks in all BIS IBS reporting countries	0.4	1.0	2.2	3.2	0.6	0.8	1.6	2.9	3.5
In the home currency									
Home banks in home country	0.1	0.1	0.2	1.2	0.2	0.3	0.6	0.2	1.2
All banks in home country	0.4	0.1	0.2	1.7	0.3	0.4	0.6	0.4	2.7
Home banks in all BIS IBS reporting countries	0.3	na	0.3	1.8	0.3	0.6	0.9	0.3	2.3

Source: BIS locational banking statistics by nationality.

As demonstrated in McGuire and von Peter (2012), one cannot infer an economy's vulnerabilities from its external assets and liabilities (the first perspective). Banks headquartered elsewhere can use a given location to book cross-border claims. Here the point applies most strongly to the United Kingdom, owing to the banking version of Wimbledon – competitors on these English courts come from all over the world. Similarly, banking competitors in the City of London come from all over the world. Thus, banks headquartered in the United Kingdom (the first line of Table 1) were responsible for only about a third of all cross-border claims booked by banks in the United Kingdom (the second line of Table 1). Foreign-owned banks booked the remaining two thirds. It would be wrong to deny that losses incurred by foreign banks might lead them to reduce their activity in the United Kingdom. But it would be far more wrong to treat such losses as hits to the capital of UK-owned banks.

Meanwhile, one cannot draw conclusions about a banking system's size and vulnerability by focusing on the home balance sheet (the second perspective). Neither an investor in bank shares nor a bank supervisor would stop at the national border in analysing a bank's global footprint. Indeed, Table 1 reveals that the residence and the nationality perspectives result in starkly different conclusions about the overall size of a banking system's external assets. For most large advanced countries, banks' external assets by nationality (the third line of Table 1) substantially exceed those by residence (the second line of Table 1). In many cases, the two measures differ very substantially. For example, the cross-border assets of German banks exceed those of banks resident in Germany by over \$800 billion (or 35%). In the case of Switzerland, the former measure exceeds the latter one by

roughly \$1.3 trillion (or 140%).<sup>13</sup> In sum, residence-based external bank claims differ from those based on nationality.

Furthermore, BIS data also testify against the second assumption of the triple coincidence framework (that the currency area overlaps perfectly with the economic area). In particular, a substantial share of banks' cross-border claims is denominated in currencies other than that of the country hosting them. In fact, foreign currency-denominated claims (the difference between the second lines in the top and bottom panels of Table 1) account for the majority of cross-border bank claims in a number of advanced economies (eg Canada, Switzerland and the United Kingdom). The United Kingdom represents the most extreme case – the foreign currency share for banks located there is 91%.

What is more, the new BIS *locational banking statistics by nationality* data reveal starkly different measures of the geographical composition of credit risk exposures. In particular, these newly enhanced data distinguish a nationality-based rather than a residence-based geographical distribution of banks' cross-border exposures because they simultaneously report (i) the residence of the lending bank; (ii) its nationality; and (iii) the residence of the borrower (see Avdjiev et al (2015)).

To take an extreme example, as of end-2014, the geographical distribution of external claims on non-bank borrowers for UK-headquartered banks (Graph 11, red bars) differed considerably from the respective distribution for banks resident in the United Kingdom (Graph 11, blue bars). For instance, banks in the United Kingdom had a share of claims on the Netherlands (8.2%) that was nearly 70% higher than the respective share for UK banks (4.8%). By contrast, the share of claims on China for banks in the United Kingdom (1.0%) was roughly only a quarter of that for UK-headquartered banks (3.7%). Thus, the locational data would understate (overstate) the potential impact of negative shocks to the creditworthiness of Chinese (Dutch) non-bank borrowers on UK-headquartered banks.

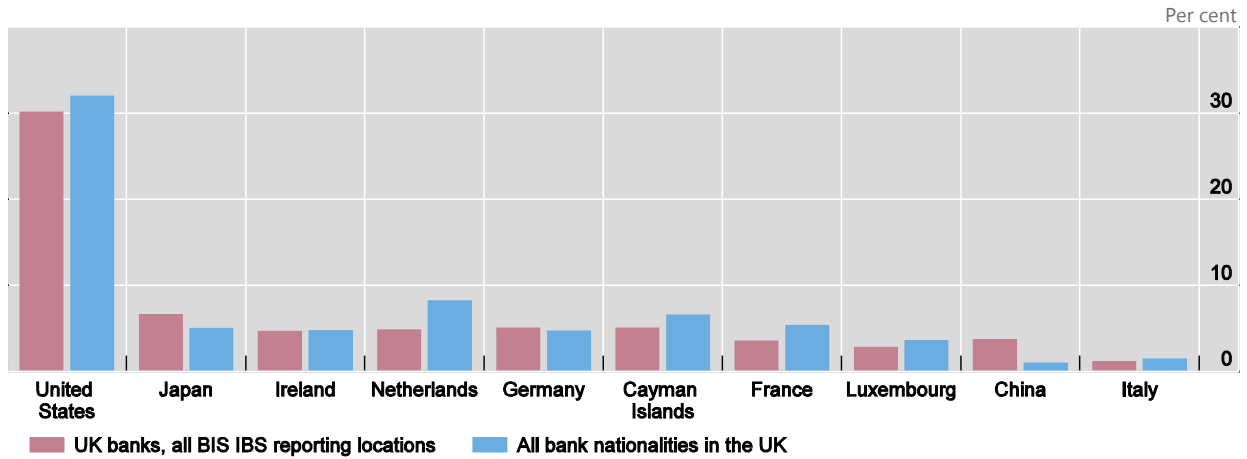
These contrasts demonstrate that any credit risk analysis that takes the locational perspective starts on the wrong foot. In other words, any attempt to work out channels of contagious losses or international risk-sharing that works with the matrix of locational (ie balance of payments) can only mislead. The UK financial regulators (and ultimately the UK government and its taxpayers) should be more concerned about the exposures of UK-owned banks around the world (regardless of their location) than about the exposures of banks located in the United Kingdom (many of which are foreign-owned). The approach of Fratzscher and Imbs (2009) of excluding financial centres does not address the problem in a satisfactory way. True, it does succeed in preventing linkages between the United Kingdom and other economies from being overstated. But it leaves untouched the understatement of Germany's exposure that arises from the exclusion of German bank loans booked in London. Researchers need to think hard about the appropriateness of the locational data, and resist their siren call of a larger number of observations. A larger matrix is not necessarily a more telling matrix.

<sup>13</sup> There are also large differences that go in the opposite direction. For instance, in the case of the United Kingdom, which is a large international financial centre, the residence-based measure of banks' external assets is \$2.5 trillion (or 71%) larger than its nationality-based counterpart.

## Cross-border claims on non-bank borrowers in selected countries, end-Q4 2014

As a share of global cross-border claims on non-bank borrowers for the respective group of banks

Graph 11



Source: BIS locational banking statistics by nationality (Stage 1 enhanced data).

### 4.3 A consolidated external balance sheet for the US economy

So far we have discussed separately the inadequacies of the assumption in international macroeconomics that national borders delimit decision-making units or balance sheets for banks and non-financial firms. Multinational firms operate across borders; management focuses on group-wide profits, and risks and balance sheets span national boundaries. A consolidated perspective better reflects the reach of multinational firms and the extent of global integration.

The US example illustrates how such a consolidated view of foreign assets and liabilities differs from the official international investment position recorded on a residence basis – the defining criterion of the national accounts and balance of payment statistics.<sup>14</sup> The process of consolidation aligns balance sheets with the nationality of ownership rather than with the location where the assets and liabilities are booked. This amounts to redrawing the US border to include the foreign balance sheets of US-owned firms, and to exclude the US balance sheets of foreign firms, as suggested by Baldwin et al (1998). Here we summarise the results of the consolidation performed in BIS (2015) for the banking sector and the non-bank business sector (multinational companies).

Together, the act of consolidating banks and multinational companies more than doubles the gross foreign position of the United States. US external assets and liabilities combined jump from \$40 trillion on a residence basis to an estimated \$89 trillion when measured on a consolidated basis. The upshot is that the US economy

<sup>14</sup> See Baldwin and Kimura (1998) for a flow consolidation. For an analysis of the differences between the residence-based and nationality-based measures of the foreign-financed debt of non-financial corporations in EMEs, see Avdjiev et al (2014), Gruić et al (2014a) and Gruić et al (2014b).

is more open, and its foreign balance sheet larger, than is apparent from the external position derived from the balance of payments.

This example serves to show that even the most basic stylised fact, namely the de facto openness of the US economy, can be significantly altered by shifting from a perspective that stops at the border to one that follows decision-making units which span borders. While historians may debate whether geography is destiny, economists should recognise that ownership is consequential.

#### 4.4 Sectoral exposures to foreign exchange risk

Many studies use national external balance sheets to characterise international risk-sharing (Lane and Shambaugh (2010a,b), Gourinchas et al (2010, 2012), Gourinchas and Rey (2014), Bénétrix et al (2015)). By using the national balance sheet as the unit of analysis, these studies neglect sectoral differences that may have important consequences for aggregate behaviour.

The example of Korea illustrates how dollar appreciation can deliver wealth gains to non-US residents as a whole, while still representing a tightening of financial conditions for non-US firms that have funded themselves in dollars. The Korean government can gain from dollar appreciation without adjusting its spending, while Korean firms can lose, face tighter credit and need to cut spending.

It is by now well known that dollar appreciation boosts US net international liabilities (Tille (2003)). This is because US residents have dollar-denominated liabilities to the rest of the world that exceed their corresponding assets to the tune of 39% of GDP. With the dollar's appreciation in 2014, the US net international investment position declined from  $-\$5.4$  trillion to  $-\$6.9$  trillion, as US assets stopped growing in dollar terms despite rising local currency valuations. This  $\$1.5$  trillion difference was more than three times the current account of  $\$410$  billion. Accordingly, the rest of the world's wealth increased.

Typical of the rest of the world, Korea's net international investment position as a whole gained from dollar appreciation. Still, Korean firms with dollar debt can still see their net worth fall. Overall, the country's modestly positive ( $\$82$  billion in Table 2) external position shows net foreign currency assets of  $\$719$  billion, with over half in the official sector (official reserves of  $\$364$  billion) and substantial portfolio holdings by institutional investors of  $\$204$  billion). Much of the portfolio and other foreign currency liabilities ( $\$348$  billion), and  $\$65$  billion of foreign currency loans booked by banks in Korea, are owed by corporations. Moreover, BIS data show an additional  $\$25$  billion of dollar bonds issued by offshore arms of Korean non-banks, and there is offshore bank credit as well. The benefits of dollar appreciation to the official sector are not conveyed to firms that lose net worth.

Much analysis of international balance sheets, in general, and the insurance afforded by foreign exchange reserve holdings, in particular, implicitly suffers from a fallacy of division, according to which what is true of the whole is true of the parts. In the absence of transfers paid when the domestic currency depreciates – which

## Korea's external balance sheet, end-2014

in billions of US dollars

Table 2

	Assets	Liabilities	Net assets
Domestic currency	13	650	-637
Direct investment		182	-182
Portfolio	2	441	-439
Other	10	27	-17
Foreign currency	1,068	348	719
Direct investment	259		259
Portfolio	204	149	55
Other	242	199	42
Official reserve assets	364		364
Total	1,080	998	82

Source: Bank of Korea.

would themselves be fraught with moral hazard – the gains to the public sector do not offset corporate losses. Firms need to adjust their spending and hiring. And if the authorities eventually deploy international reserves to provide dollar liquidity to banks and firms, the intervention may follow disruptions that have already exacted a price.

## 5. Next steps and new analytical frameworks

To recap, we have contended that the triple coincidence of the GDP area, decision-making unit and the currency area does not serve analysts well for three reasons. First, the triple coincidence neglects gross flows, even when gross flows are key to balance sheet size and hence to questions of credit standards. Second, it neglects the pervasive role of international currencies, especially the US dollar. Third, it often draws the boundary in the wrong place when delineating the relevant decision-making unit.

Breaking free of the triple coincidence entails providing an alternative analytical framework, and the challenge is to provide one that addresses all three of the concerns above. Admittedly, there are enormous challenges in moving from a recognition that our current analytical frameworks are inadequate towards a workable analytical framework in international finance that transcends the triple coincidence. By its nature, the task of building a traditional general equilibrium model that departs from the triple coincidence faces modelling difficulties. General equilibrium models solve for GDP components such as consumption and investment decisions but, if balance sheets do not map well onto the traditional macro variables that are measured within the GDP boundary, the mapping between the decision-making unit and the accounting unit is not well defined.

An important first step would be to define the consolidated decision-making unit and the balance sheet that corresponds to that decision-maker. Having

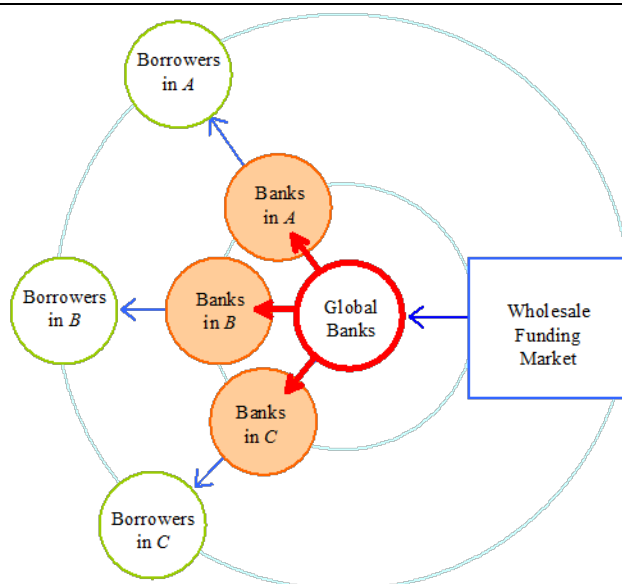
gathered the balance sheets of the relevant decision-making units, the task would then be to examine the interrelationships between them and to map out the system of balance sheets including any interconnections between them.

A substantial body of BIS research in international finance has focused on the consolidated perspective, exemplified by the important place occupied by the BIS consolidated banking statistics. For example, McGuire and Tarashev (2008) use consolidated banking data in order to study the impact of bank health on lending to emerging markets. Similarly, McGuire and von Peter (2012) organise their analysis of the US dollar shortage in global banking during the Great Financial Crisis around the consolidated balance sheet of national banking systems. In addition, Avdjiev, Kuti and Takáts (2012) use the BIS consolidated banking statistics to measure the impact of the euro area crisis on lending to emerging markets. From the borrower's perspective, Gruić and Wooldridge (2015) have demonstrated that, for many large emerging market economies, the outstanding stocks of international debt securities on a nationality basis well exceed those on a residence basis.

The BIS consolidated statistics provide a promising starting point but an analytical framework that can address macroeconomic questions requires additional elements. Foremost among them would be a framework for explaining how decisions are made and behaviour is modelled in the analytical framework. The balance sheets are the units of analysis, but the analysis needs to follow.

We outline one example of an analytical framework for the analysis of the global banking system and how macroeconomic conclusions can be drawn based on the analysis. Graph 12 depicts the operation of the global banking system developed in Bruno and Shin (2015a), which is designed to examine the spillover effects of financial conditions through the interconnected nature of bank balance sheets. Banks draw on US dollar funding in wholesale markets and channel it to banks without such access located in other parts of the world (denoted as regions A, B and C in Graph 12). Global banks with US headquarters participate but, as discussed above, global banks with European headquarters still predominate in channelling US dollar funding around the world.

In contrast to traditional macro models which seek to explain components of GDP, Bruno and Shin (2015a) seek to explain the leverage of the global banking system and the associated risk premium embedded in the lending rates. The shortcoming of such a framework is that traditional macro variables – consumption, investment, output etc – cannot be addressed directly in the model. Note also that the mapping between the circles in Graph 12 and geographical locations can be tenuous. Recall the example of the global European bank providing US dollar funding to Asian borrowers mentioned at the outset. One way for the bank to do this would be to borrow US dollars from money market funds in New York, and then book the loans to the Asian borrower in a Hong Kong branch. So, the European global bank would have the liabilities side of its balance sheet in New York, the asset side of its balance sheet in Hong Kong SAR, and its headquarters in Paris, Frankfurt or London. Thus, the simple chart in Graph 12 would not correspond in a neat way to the GDP boundaries that would underpin a general equilibrium analysis of consumption and investment in any particular location. However, for some set of questions involving the global financial system, the financial relationships may be illuminating. The test will ultimately be one of usefulness in practice.



The interconnected nature of the global banking system allows financial conditions to spill across borders (Rey (2014, 2015); Obstfeld (2015)). Greater ease in raising wholesale funds at the centre through cheaper US dollar bank funding rates implies a greater availability of funding to regional banks, which in turn translates into more lenient lending conditions to ultimate borrowers. Moreover, given the interlocking nature of global banking, the global factors that guide the decisions of global banks will determine credit conditions throughout the global banking system. The spillover effects thus generated mean that more accommodative credit conditions associated with global liquidity<sup>15</sup> at the centre lead to lower risk-adjusted lending rates, inducing firms to apply lower discount rates in their investment decisions. For any given fundamental cash flows, lower discount rates and higher net present values induce firms to take on more investment projects and greater risk.

Empirically, Bruno and Shin (2015b) show that the leverage of the global banks at the centre of the system can serve as a summary statistic for the activity of global banks in channelling funding from the centre to the periphery. In this sense, the leverage of the global banks turns out to be a useful proxy for the single global factor that determines credit availability to borrowers across peripheral economies.

In this connection, the risk-taking channel of currency appreciation turns out to be key. The link works through shifts in the effective credit risk faced by banks that lend to local borrowers that may have a currency mismatch. When the local currency appreciates, local borrowers' balance sheets become stronger, resulting in lower credit risk and hence expanded bank lending capacity. In this way, currency appreciation leads to greater risk-taking by banks, as shown in Bruno and Shin

<sup>15</sup> See CGFS (2011) for a comprehensive discussion on the measurement, drivers and policy implications of global liquidity. See also Borio et al (2011).



(2015a,b). This “risk-taking channel” of currency appreciation entails a link between exchange rates and financial stability.

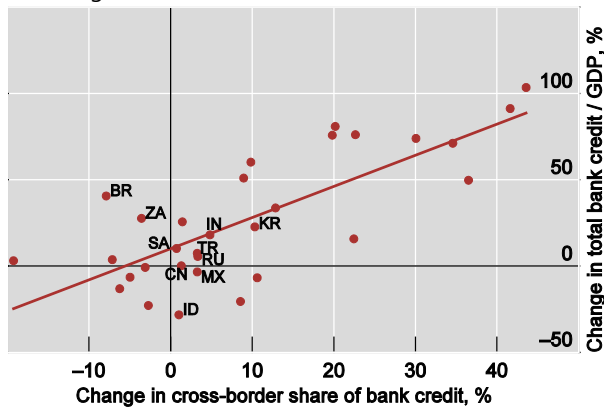
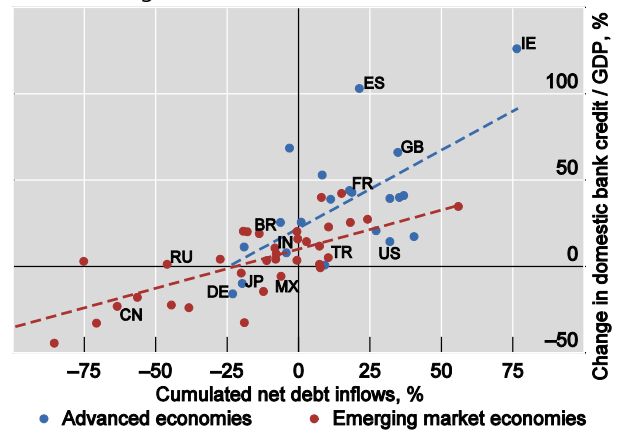
Consider the example of a foreign bank branch lending in dollars to local borrowers who convert the proceeds of the dollar loan into local currency. The borrowers may be hedging the currency risk from long-term export receivables, or be engaging in outright speculation that the local currency will appreciate further against the dollar. In such a situation, an initial appreciation of the home country’s currency will strengthen the balance sheets of domestic borrowers who have borrowed in dollars. Since borrowers become more creditworthy, bank loan books will become less risky, creating additional capacity to lend. In this way the initial impulse from the appreciation of the domestic currency can be amplified through a reinforcing mechanism in which greater risk-taking by banks reduces credit risk, which elicits even greater risk-taking by the banks and further appreciation of the domestic currency, thereby completing the circle.

In such a setting, an appreciation of the domestic currency may not have the presumed effect of curtailing capital inflows. The upward phase of the cycle will give the appearance of a virtuous circle, in which the mutually reinforcing effect of real appreciation and improved balance sheets operate in tandem. Once the cycle turns, however, the amplification mechanism operates in reverse, reinforcing the financial distress of borrowers and the banking sector.

The rapid growth of the banking sector fuelled by capital inflows and an appreciating currency has been a classic early warning indicator for emerging economy crises. Gourinchas and Obstfeld (2012) conduct an empirical study using data from 1973 to 2010 and find that two factors emerge consistently as the most robust and significant predictors of financial crises, namely a rapid increase in leverage and a sharp real appreciation of the currency. Their finding holds both for emerging and advanced economies, and holds throughout the sample period. Schularick and Taylor (2012) similarly highlight the role of leverage in financial vulnerability, especially the leverage associated with the banking sector.

Rapid credit growth attracts cross-border bank flows. These flows enable domestic credit booms, easing the constraint of the domestic funding base. In a sample of 31 EMEs between early 2002 and 2008, a rise in the share of cross-border bank funding, extended both directly to domestic non-banks and indirectly through banks, helped boost the ratio of bank credit to GDP, a measure of credit booms (Graph 13, left-hand panel). Banks found non-core liabilities abroad to fund credit at home (Avdjiev, McCauley and McGuire (2012); Hahm et al (2013)).

Analysis of a broader sample of 62 countries and a more inclusive measure of international capital flows point to a similar dynamic (Lane and McQuade (2014)). Here, the larger the net debt inflows, both portfolio and bank flows, the larger the increase in a given economy’s ratio of bank credit to GDP (Graph 13, right-hand panel). The inclusion of Ireland, Spain and the United Kingdom shows that a domestic credit boom’s reliance on external financing is not a symptom of financial underdevelopment. In fact, in the subsample of 23 advanced economies the reliance on capital inflows is greater than among EMEs, as the steeper trend line suggests.

... through cross-border bank credit<sup>1</sup> ...... and through broader net debt inflows<sup>2</sup>

BR = Brazil; CN = China; DE = Germany; ES = Spain; FR = France; GB = United Kingdom; ID = Indonesia; IE = Ireland; IN = India; JP = Japan; KR = Korea; MX = Mexico; RU = Russia; SA = Saudi Arabia; TR = Turkey; US = United States; ZA = South Africa.

<sup>1</sup> Q1 2002–Q2 2008. “Total bank credit” adds to domestic credit (IFS line 32) the stock of cross-border bank credit to non-banks in the country (using the BIS locational banking statistics). “Cross-border share of bank credit” is the share of total bank credit to non-banks received cross-border through direct lending to non-banks and through net lending to banks in the country (if positive). Based on Avdjiev, McCauley and McGuire (2012). <sup>2</sup> Domestic credit from IFS line 32, end-2002 to end-2008. The x-axis shows balance of payments net debt inflows as a share of GDP, cumulated over 2003–08. Net debt flows are calculated by aggregating changes in net portfolio debt assets, net other investment and reserve assets, all expressed as inflows. Extends Lane and McQuade (2014).

Sources: IMF, *International Financial Statistics* and *World Economic Outlook*; BIS international banking statistics; BIS calculations.

Economists have traditionally seen exchange rate appreciation driven by capital inflows as self-correcting. Once the currency has appreciated sufficiently, the investors responsible for the capital inflows will recognise the change in the risk-return configuration and will therefore slow their investment. Indeed, the standard prescription of the official sector continues to follow a lexicographic ordering in which the real exchange rate should be allowed to appreciate sufficiently, and all the domestic macroeconomic policy responses (including fiscal tightening) should be exhausted before (and as a last resort) deploying measures to stem the capital inflows directly.

Of course, standard caveats accompany the standard prescription. Domestic distortions could be responsible for both the capital inflows and the exchange rate appreciation. For example, very high domestic interest rates may be why foreign investors are willing to take long positions in the domestic economy, in particular in the short run. In this case there may be a positive correlation between short-term inflows and exchange rate appreciation, but the ultimate cause will be a third factor: the distortion in domestic yields. Problems will then be exacerbated if the country authorities then attempt to limit appreciation. Anticipated appreciation plus the high domestic interest rate will attract additional inflows, dooming the attempt to limit appreciation. The implication is that policymakers should not attempt to use capital controls to defend policy inconsistencies, which often are not possible to resolve in the short run. (The experiences of Chile in the 1990s and of Brazil since 2009 are especially informative in this connection.)

When bank credit constitutes the bulk of inflows, there is an additional caveat to the standard prescription of letting the currency appreciate. The behaviour of

banks and other leveraged institutions is influenced by their capital position and the perceived risks. Currency appreciation and strong profitability coupled with tranquil economic conditions can be seen by banks as a cue to further expand lending, leading to further capital inflows.

The basic philosophical divide is therefore between those who do and do not believe that real appreciation eventually chokes off capital inflows as investors reassess the attractiveness of the target currency. Members of the first camp (the traditional view) believe that capital flows are driven by textbook portfolio investors who act on fundamental assessments of currency values. Members of the second camp believe that capital flows are driven not only by assessments of fundamental value but also by the short-term imperatives of bank balance sheet capacity and what Borio and Disyatat (2011) refer to as the “excess elasticity” of credit.

On the second view, macroprudential policy and monetary policy are likely to be strong complements to one another when global liquidity is operating strongly. Prudential rules can create sufficient space for domestic monetary policy to operate without the distortionary effects of capital flows.

The triple coincidence is an elegant simplification for analytical purposes, but we have argued here that it can mislead when financial flows take on importance in their own right. Consolidation of balance sheets and the identification of the relevant decision-making unit are the first steps towards a more illuminating analytical framework that can also incorporate the impact of global currencies by explicitly modelling the currency denomination of debt contracts.

Ultimately, a decisive break from the triple coincidence can only happen when an alternative analytical framework is available. Some progress has been made, but much remains to be done.

## References

- Aliber, R (1980): "The integration of the offshore and domestic banking system", *Journal of Monetary Economics*, vol 6, no 4, October, pp 509–26.
- Avdjiev, S, R McCauley and P McGuire (2012): "Rapid credit growth and international credit: challenges for Asia", in V Pontines and R Siregar (eds), *Exchange rate appreciation, capital flows and excess liquidity: adjustment and effectiveness of policy responses*, The SEACEN Center, pp 215–44 [www.seacen.org/GUI/pdf/publications/research\\_proj/2012/rp87/capital-chap6.pdf](http://www.seacen.org/GUI/pdf/publications/research_proj/2012/rp87/capital-chap6.pdf).
- Avdjiev, S, M Chui and H S Shin (2014): "Non-financial corporations from emerging market economies and capital flows", *BIS Quarterly Review*, December, pp 67–77.
- Avdjiev, S, Z Kuti and E Takáts (2012): "The euro area crisis and cross-border bank lending to emerging markets", *BIS Quarterly Review*, December, pp 37–47.
- Avdjiev, S, P McGuire and P Wooldridge (2015): "Enhancements to the BIS international banking statistics", *IFC Bulletin* no 39, April.
- Baba, N, R McCauley and S Ramaswamy (2009): "US dollar money market funds and non-US banks", *BIS Quarterly Review*, March, pp 65–81.
- Baldwin, R and F Kimura (1998): "Measuring U.S. international goods and services transactions", in R Baldwin, R Lipsey and D Richardson (eds), *Geography and ownership as bases for economic accounting*, University of Chicago Press for the National Bureau of Economic Research, pp 9–48.
- Baldwin, R, R Lipsey and D Richardson (1998): "Introduction", in R Baldwin, R Lipsey and D Richardson (eds), *Geography and ownership as bases for economic accounting*, University of Chicago Press for the National Bureau of Economic Research, pp 1–8.
- Bank for International Settlements (2015): "The international monetary and financial system", *85th Annual Report*, June, Chapter V.
- Bénétrix, A, P Lane and J Shambaugh (2015): "International currency exposures, valuation effects and the global financial crisis", *Journal of International Economics*, vol 96, Supplement 1, July, pp S98-S109.
- Bernanke, B (2005): "The global saving glut and the U.S. current account deficit", Remarks at the Sandridge Lecture, Virginia Association of Economists, Richmond, Virginia, March.
- Blanchard, O, F Giavazzi and F Sa (2005): "International investors, the U.S. current account, and the dollar", *Brookings Papers on Economic Activity*, no 1, pp 1–65.
- Borio, C and P Disyatat (2011): "Global imbalances and the financial crisis: Link or no link?", *BIS Working Papers*, no 346, May.
- (2015): "Capital flows and the current account: taking financing (more) seriously", *BIS Working Paper*, no 525, October.
- Borio, C, H James and H S Shin (2014): "The international monetary and financial system: a capital account historical perspective", *BIS Working Paper*, no 457, August.
- Borio, C, R McCauley and P McGuire (2011): "Global credit and domestic credit booms", *BIS Quarterly Review*, September, pp 43–57.

- Brown, M and H Stix (2015): "The euroization of bank deposits in Eastern Europe", *Economic Policy*, vol 30, no 81, January, pp 95–139.
- Bruno, V and H S Shin (2015a): "Capital flows and the risk-taking channel of monetary policy" *Journal of Monetary Economics*, vol 71, pp 119–32.
- (2015b): "Cross-border banking and global liquidity", *Review of Economic Studies*, vol 82, no 2, April, pp 535–64.
- (2015c) "Global dollar credit and carry trades: a firm level analysis", *BIS Working Paper*, no 510, August.
- Caballero, R and A Krishnamurthy (2001): "International and domestic collateral constraints in a model of emerging market crises", *Journal of Monetary Economics* vol 48, no 3, December, pp 513–548
- Canzoneri, M, R Cumby, B Diba and D López-Salido (2013): "Key currency status: an exorbitant privilege and an extraordinary risk", *Journal of International Money and Finance*, vol 37, pp 371–93.
- Céspedes, L, R Chang and A Velasco (2002): "Dollarization of liabilities, net worth effects and optimal monetary policy", in S Edwards and J Frankel (eds), *Preventing currency crises in emerging markets*, University of Chicago, pp 559–600.
- Chung, K, J-E Lee, E Loukoianova, H Park and H S Shin (2015): "Global liquidity through the lens of monetary aggregates", *Economic Policy*, vol 30, no 82, April, pp 231–90.
- Committee on the Global Financial System and Markets Committee (2011): *Global liquidity – concept, measurement and policy implications, Report submitted by an Ad-hoc Group established by the Committee on the Global Financial System, CGFS Papers*, no 45, November.
- Dornbusch, R (1980): *Open economy macroeconomics*, Part 5, Basic Books.
- Dufey, G and I Giddy (1978, 1994): *The international money market*, first and second editions, Prentice-Hall.
- Edwards, S (2005): "Is the U.S. current account deficit sustainable? If not, how costly is adjustment likely to be?", *Brookings Papers on Economic Activity*, no 1:2005, pp 211–288.
- Fender, I and P McGuire (2010): "Bank structure, funding risk and the transmission of shocks across countries: concepts and measurement", *BIS Quarterly Review*, September, pp 63–79.
- Fratzscher, M and J Imbs (2009): "Finance, institutions and risk sharing in international portfolios", *Journal of Financial Economics*, December, vol. 94 no 3, pp 428–47.
- Gabaix, X and M Maggiori (2015): "International liquidity and exchange rate dynamics", *Quarterly Journal of Economics*, vol 130, 3, March, pp 1369-1420.
- Goodhart, C (2011): *The Basel Committee on Banking Supervision: a history of the early years 1974–1997*, Cambridge University Press.
- Gourinchas, P-O, and M Obstfeld (2012): "Stories of the twentieth century for the twenty-first century", *American Economic Journal: Macroeconomics 2012*, vol 4, no 1, pp 226–65.

- Gourinchas, P-O and H Rey (2014): "External adjustment, global imbalances, valuation effects", in G Gopinath, E Helpman, and K Rogoff (eds), *Handbook of International Economics*, vol 4, North Holland, pp 585–646.
- Gourinchas, P-O, H Rey and N Govillot (2010): "Exorbitant privilege and exorbitant duty", Bank of Japan, *IMES Discussion Paper*, no 2010-E-20.
- Gourinchas, P-O, H Rey and K Truemptler (2012): "The financial crisis and the geography of wealth transfers", *Journal of International Economics*, vol 88, no 2, pp 266–85.
- Gruić, B, M Hattori and H S Shin (2014a): "Recent changes in global credit intermediation and potential risks", *BIS Quarterly Review*, September, pp 17–8.
- Gruić, B, C Upper and A Villar (2014b): "What does the sectoral classification of offshore affiliates tell us about risks?", *BIS Quarterly Review*, December, pp 20–1.
- Gruić, B and P Wooldridge (2015): "BIS debt securities statistics: a comparison of nationality data with external debt statistics", *IFC Bulletin*, no 39, April.
- Hahm, J-H, H S Shin and K Shin (2013): "Noncore bank liabilities and financial vulnerability", *Journal of Money, Credit and Banking*, vol 45, issue S1, pp 3–36.
- He, D and R McCauley (2012): "Eurodollar banking and currency internationalisation", *BIS Quarterly Review*, June 2012, pp 33–46.
- Hofmann, B, I Shim and H S Shin (2015): "Risk-taking channel of currency appreciation", *BIS Working Paper*, forthcoming.
- Ito, H and M Chinn (2015): "The rise of the redback: evaluating the prospects for renminbi use in invoicing", in B Eichengreen and M Kawai (eds), *Renminbi internationalization: achievements, prospects, and challenges*, Brookings Institution Press and the Asian Development Bank Institute, pp 111–158.
- Kenen, P (1969): "The theory of optimum currency areas; an eclectic view", in R Mundell and A Swoboda (eds), *Monetary problems of the international economy*, University of Chicago Press, pp 41–60.
- (2002): "Currency unions and policy domains", in D Andrews, C Henning and L Pauly (eds), *Governing the world's money*, Cornell, pp 78–104.
- Kravis, I, and R Lipsey (1985). "The competitive position of U.S. manufacturing firms", Banca Nazionale del Lavoro, *Quarterly Review*, no 153, June, pp 127–54.
- (1987): "The competitiveness and comparative advantage of U.S. multinationals, 1957–1984", Banca Nazionale del Lavoro *Quarterly Review*, no 161, June, pp 147–65.
- Kreicher, I, R McCauley and P McGuire (2014): "The 2011 FDIC assessment on bank managed liabilities: interest-rate and balance-sheet responses", in R de Mooij and G Nicodeme (eds), *Taxation of the financial sector*, MIT Press.
- Krugman, P (1999): "Balance sheets, the transfer problem, and financial crises", in P Isard, A Razin, and A Rose (eds), *International finance and financial crises*, Kluwer, pp 31–55.
- (2007): "Will there be a dollar crisis", *Economic Policy*, vol 22, no 51, pp. 436–67.

Lane, P and P McQuade (2014): "Domestic credit growth and international capital flows", *Scandinavian Journal of Economics*, vol 116, no 1, January, pp 218–52.

Lane, P and J Shambaugh (2010a): "Financial exchange rates and international currency exposures", *American Economic Review*, vol 100, no 1.

——— (2010b): "The long or short of it: determinants of foreign currency exposure in external balance sheets", *Journal of International Economics*, vol 80, issue 1, January, pp 33–44.

Levy Yeyati, E (2006): "Financial dollarization: evaluating the consequences", *Economic Policy*, vol 21, pp 61–118.

Lipsey, R, M Blomstrom, and E Ramstetter (1998): "Internationalized production", in R Baldwin, R Lipsey and D Richardson (eds), *Geography and ownership as bases for economic accounting*, University of Chicago Press for the National Bureau of Economic Research, pp 83–135.

Maggiore, M (2013): "Financial intermediation, international risk sharing, and reserve currencies", mimeo.

McCauley, R and P McGuire (2009). "Dollar appreciation in 2008: safe haven, carry trades, dollar shortage and overhedging", *BIS Quarterly Review*, December, pp 85–93.

——— (2014): "Non-US banks' claims on the Federal Reserve", *BIS Quarterly Review*, March, pp 89–97.

McCauley, R, P McGuire and V Sushko (2015): "Global dollar credit: links to US monetary policy and leverage", *Economic Policy*, vol 30, no 82, April, pp 187–229.

McCauley, R, C Upper and A Villar (2013): "Emerging market debt securities issuance in offshore centres", *BIS Quarterly Review*, September, pp 22–3.

McGuire, P and G von Peter (2012): "The US dollar shortage in global banking and the international policy response", *International Finance*, vol 15, no 2, pp 155–78.

McGuire, P and N Tarashev (2008): "Global monitoring with the BIS international banking statistics", *BIS Working Papers*, no 244, February.

McKinnon, R (1969): "Portfolio balance and international payments adjustment", in R Mundell and A Swoboda (eds), *Monetary problems of the international economy*, University of Chicago, pp 199–234.

Mendoza, E (2002): "Credit, prices and crashes: business cycles with a sudden stop", in J Frankel and S Edwards (eds), *Preventing currency crises in emerging markets*, Chicago University Press, pp 335–89.

National Research Council, Panel on Foreign Trade Statistics (1992): *Behind the numbers: US trade in the world economy*, A Kester (ed), National Academy Press.

Obstfeld, M (2010): "Expanding gross asset positions and the international monetary system" panel remarks at the 2010 Federal Reserve Bank of Kansas City symposium at Jackson Hole

——— (2012): "Does the current account still matter?", *American Economic Review Papers & Proceedings*, vol 102, no 3, May, pp 1–23.

——— (2015): "Trilemmas and trade-offs: living with financial globalisation", *BIS Working Paper*, no 480, January.

Obstfeld, M and K Rogoff (1996): *Foundations of international macroeconomics*, MIT Press.

——— (2005): "Global current account imbalances and exchange rate adjustments", *Brookings Papers on Economic Activity*, no 1:2005, pp 67–123.

Obstfeld, M and A Taylor (2004): *Global capital markets: integration, crisis, and growth*, Cambridge University Press.

Remolona, E and I Shim (2015): "The rise of regional banking in Asia and the Pacific", *BIS Quarterly Review*, September, pp 119–34.

Rey, H (2014): "Dilemma not trilemma: the global financial cycle and monetary policy independence", in Federal Reserve Bank of Kansas City Jackson Hole Economic Symposium, *Proceedings*, pp 285–333.

——— (2015): "International credit channel and monetary policy autonomy", *IMF Economic Policy Review*, forthcoming.

Schularick, M, and A Taylor (2012): "Credit booms gone bust: monetary policy, leverage cycles, and financial crises, 1870–2008", *American Economic Review*, vol 102, no 2, pp 1029–61.

Shin, H S (2012): "Global banking glut and loan risk premium", *IMF Economic Review*, vol 60, issue 2, pp. 155–92.

——— (2013): "The second phase of global liquidity and its impact on emerging economies", keynote address at Federal Reserve Bank of San Francisco Asia Economic Policy Conference, 3–5 November.

Setser, B; and N Roubini (2005): "Our money, our debt, our problem", *Foreign Affairs*, vol 84, no 4, Jul/Aug, pp 194–198.

Summers, L (2004): "The US current account deficit and the global economy", Per Jacobsson Lecture, International Monetary Fund, October.

Tille, C (2003): "The impact of exchange rate movements on US foreign debt", Federal Reserve Bank of New York, *Current Issues in Economics and Finance*, vol 9, no 1, January.

UBS (2008): *Shareholder report on UBS's write-downs*, UBS, 18 April.

Vegh, C (2013): *Open economy macroeconomics in developing countries*, MIT Press.



## Previous volumes in this series

No	Title	Author
523 October 2015	The evolution of inflation expectations in Canada and the US	James Yetman
522 October 2015	Do banks extract informational rents through collateral?	Bing Xu, Honglin Wang and Adrian van Rixtel
521 October 2015	Does variance risk have two prices? Evidence from the equity and option markets	Laurent Barras and Aytek Malkhozov
520 October 2015	Optimal Inflation with Corporate Taxation and Financial Constraints	Daria Finocchiaro, Giovanni Lombardo, Caterina Mendicino and Philippe Weil
519 October 2015	The hunt for duration: not waving but drowning?	Dietrich Domanski, Hyun Song Shin and Vladyslav Sushko
518 October 2015	Monetary Policy and Financial Spillovers: Losing Traction?	Piti Disyatat and Phurichai Rungcharoenkitkul
517 October 2015	Leverage on the buy side	Fernando Avalos, Ramon Moreno and Tania Romero
516 October 2015	Optimal Time-Consistent Macroprudential Policy	Javier Bianchi and Enrique G. Mendoza
515 October 2015	The impact of CCPs' margin policies on repo markets	Arianna Miglietta, Cristina Picillo and Mario Pietrunti
514 September 2015	The influence of monetary policy on bank profitability	Claudio Borio, Leonardo Gambacorta and Boris Hofmann
513 September 2015	The determinants of long-term debt issuance by European banks: evidence of two crises	Adrian van Rixtel, Luna Romo González and Jing Yang
512 September 2015	International reserves and gross capital flow dynamics	Enrique Alberola, Aitor Erce and José María Serena
511 September 2015	Higher Bank Capital Requirements and Mortgage Pricing: Evidence from the Countercyclical Capital Buffer (CCB)	Christoph Basten and Cathérine Koch
510 August 2015	Global dollar credit and carry trades: a firm-level analysis	Valentina Bruno and Hyun Song Shin
509 August 2015	Investor redemptions and fund manager sales of emerging market bonds: how are they related?	Jimmy Shek, Ilhyock Shim and Hyun Song Shin
508 August 2015	Bond markets and monetary policy dilemmas for the emerging markets	Jhuvesh Sobrun and Philip Turner

All volumes are available on our website [www.bis.org](http://www.bis.org).