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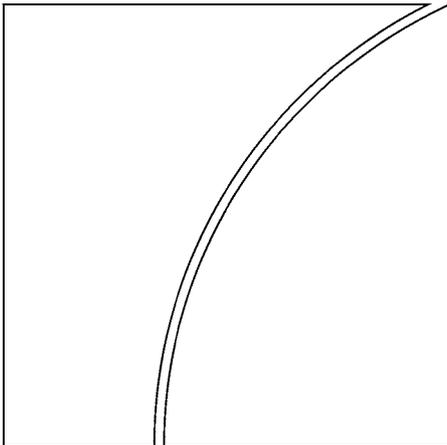
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Rapid credit growth and international credit: Challenges for Asia

by Stefan Avdjiev, Robert McCauley and Patrick McGuire

Monetary and Economic Department

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Keywords: international credit, credit booms, cross-border lending,
emerging markets

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Rapid credit growth and international credit: Challenges for Asia^{1,2}

Stefan Avdjiev, Robert McCauley and Patrick McGuire

Abstract

Very low interest rates in major currencies have raised concerns over international credit flows to robustly growing economies in Asia. This paper examines three components of international credit and highlights several of the policy challenges that arise in constraining such credit. Our empirical findings suggest that international credit enables domestic credit booms in emerging markets. Furthermore, we demonstrate that higher levels of international credit on the eve of a crisis are associated with larger subsequent contractions in overall credit and real output. In Asia today, international credit generally is small in relation to overall credit – as was not the case before the Asian crisis. So even though dollar credit is growing very rapidly in some Asian economies, its contribution to overall credit growth has been modest outside the more dollarised economies of Asia.

Keywords: international credit, credit booms, cross-border lending, emerging markets

JEL classification: E32, F34, F43

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² Authors are members of the Monetary and Economic Department, Bank for International Settlements, Basel, Switzerland. The views expressed here are those of the authors and not necessarily those of the BIS.

Contents

I.	Introduction.....	1
II.	Rising international credit in domestic credit booms: cases	2
III.	Rising international credit in credit booms: regression analysis.....	5
IV.	Dollar credit in Asia in 2009–11	11
V.	Carry trades and international credit	15
VI.	Conclusions	17
	References	18
	Annex 1: Sample of economies	20
	Annex 2: International credit and financial openness	21
	Annex 3: Bank credit to non-banks: private vs public sector borrowers.....	22

I. Introduction

Monetary policy in advanced economies, implemented through very low interest rates and large-scale asset purchases, has led to concerns in emerging markets about a surge in global liquidity. The main worry is that monetary ease in the major currencies could amplify capital flows into emerging market economies when risk is “on” and capital outflows when risk is “off”. Concerns arise about the risk that capital inflows might ease monetary conditions or that outflows might destabilise the financial system. International credit thus raises both monetary and financial stability issues.

International credit, defined here as foreign currency and cross-border credit, can pose particular risks to an economy that is experiencing rapid domestic credit growth. Financial crises in the past two decades have often followed periods of rapid credit expansion accompanied by buoyant asset prices in equity and real estate. In Asia, these risks became evident in the Asian financial crisis of 1997–98. More recently, the countries most affected by the global financial crisis have demonstrated these risks anew. When credit grows rapidly, international credit tends to gain share in overall credit. This association spans fixed and floating exchange-rate regimes, and even economies within currency areas (eg Ireland and Spain, as well as the United States, where international credit is almost entirely dollar-denominated).³

The international dimensions of credit growth pose specific policy challenges (Borio et al (2011)). First, in economies experiencing booms, international credit often complicates the job of domestic authorities who seek to monitor and to constrain credit. For example, domestic authorities have several tools to slow the growth of credit extended by banks *within* their jurisdiction. But short of capital controls, the tools to measure, much less to control, credit extended by institutions outside the country are limited.

Second, local firms and households may shift out of domestic currency liabilities (“liability dollarisation”) in an attempt to avoid tightening in monetary conditions imposed by the home authorities.⁴ This not only reduces the efficacy of domestic monetary policy, it also ties the economy to interest rate conditions set elsewhere. Moreover, heavy reliance on foreign currency borrowing exposes domestic firms and households to currency risk.

Finally, international (foreign currency) credit can also put upward pressure on the real exchange rate, as borrowers exchange foreign for domestic currency for the purchase of domestic goods or assets. With a fixed exchange rate (or within a currency area), real exchange rate appreciation can take the form of relatively rapid inflation. For a country with an independent currency, real exchange rate appreciation can result from either nominal appreciation or relatively rapid inflation.

In this paper, the next section shows how international credit grew in selected European countries that were hard hit in the recent crisis, and then draws a parallel to the lead-up to the Asian financial crisis in the 1990s. The third section demonstrates that, for a broad sample of emerging market economies, a growing share of international credit in 2002–08 was associated with booming overall credit. The fourth section examines the recent data for Asia and finds that, in contrast to the mid-1990s, international credit is generally small in relation to overall credit, and thus its rapid growth has made a limited contribution to overall

³ In a related study, Magud et al (2011) show that the degree of flexibility of the exchange rate regime in emerging market economies is negatively correlated with both the pace of credit growth and the share of credit that is denominated in foreign currencies.

⁴ One aptly titled study of central Europe found that monetary tightening systematically increased private sector borrowing in the euro and the Swiss franc. See Brzoza-Brzezina et al, “Substitution between domestic and foreign currency loans in central Europe: do central banks matter?”, 2010.

credit growth outside the region's more dollarised economies. The fifth section examines the extent to which carry trades could be a driver of international credit and the sixth section concludes.

II. Rising international credit in domestic credit booms: cases

Rapid expansion in international credit bears watching because, in many boom-bust credit cycles in the past, such credit tended to grow faster than overall credit during the boom.⁵ We illustrate this broad finding with data from several European countries that have suffered credit booms and busts since 2000. Then, we draw a parallel with countries that were caught up in the Asian financial crisis of the late 1990s.

By international credit, we refer to three components of total bank credit, the first two of which are types of cross-border credit. First, non-banks in a country can borrow directly from non-resident banks (or issue bonds targeted at non-resident investors, not measured here). Such (1) *direct cross-border credit* is a large share of total credit to non-banks in some countries, and it tended to fall sharply during the recent crisis (Cetorelli and Goldberg (2010), McCauley et al (2010)). Second, banks located in a particular country may finance a large share of their locally extended credit to non-banks (ie domestic credit) with net borrowing from non-residents (either from other banks or non-banks). This (2) *indirect cross-border credit* allows credit growth to outrun domestic deposit growth. This component of international credit is often ignored in empirical analysis of credit booms but, as discussed below, it tends to be large during such periods. Finally, we also examine (3) *foreign currency-denominated credit* to non-banks, regardless of whether this credit is extended by banks inside or outside the country. As mentioned above, when non-bank borrowers shift their liabilities out of the domestic currency, they create challenges for the domestic authorities.

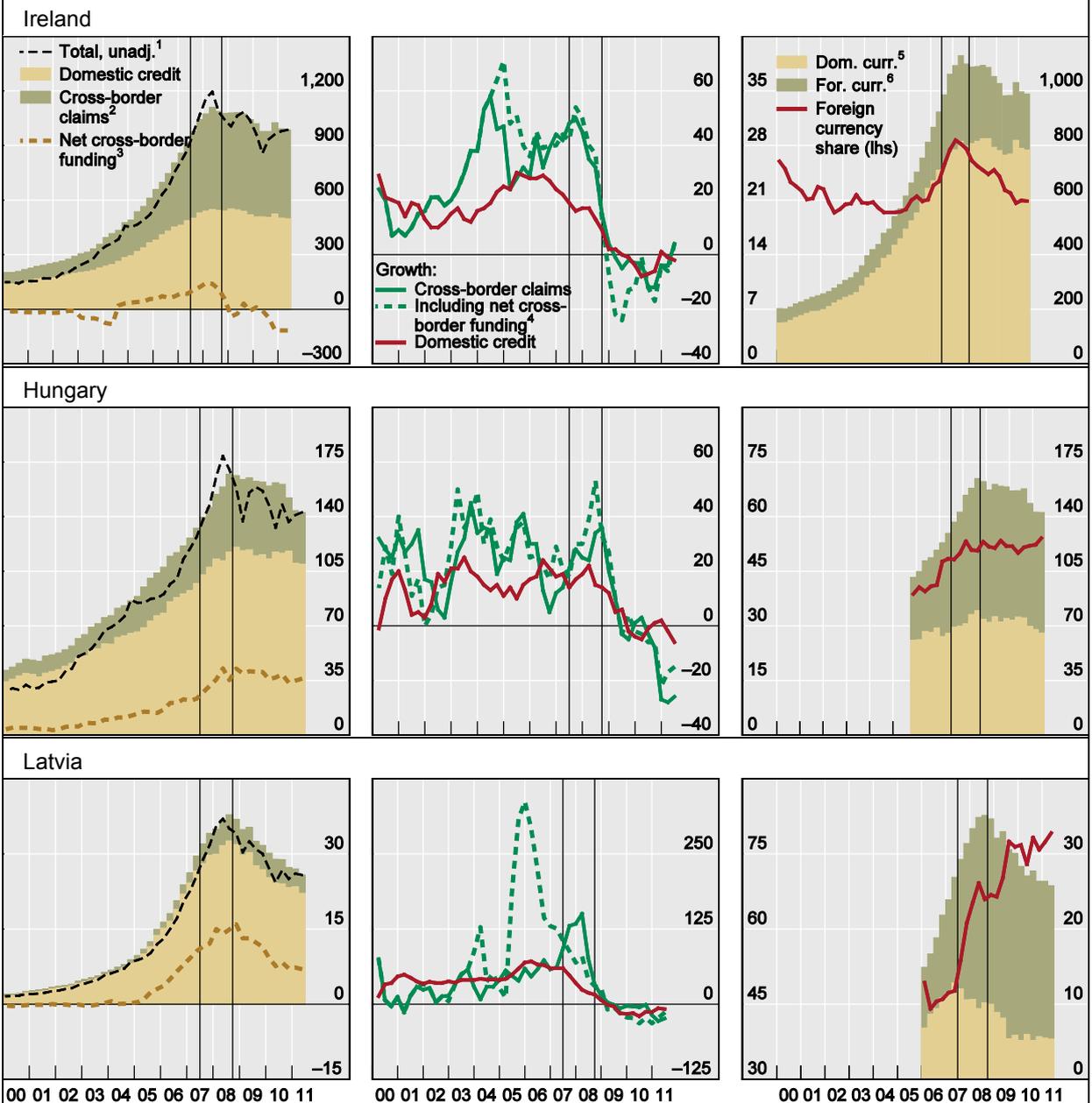
Several European cases highlight to varying degrees the roles of direct and indirect cross-border credit in the course of the global credit boom of the 2000s (Graph 1). *Direct cross-border credit* to non-banks in Ireland (dark shaded area), for example, grew at roughly 40% year on year in the three years prior to the crisis (centre panel), 10 percentage points above the rate for domestic bank credit. Moreover, banks *in* Ireland drew on *indirect cross-border credit* (left-hand panel, dashed brown line) to support their domestic lending. Combined, these two cross-border components accounted for more than half of the stock of total bank credit to non-banks in the country by 2008.

In other European countries such as Hungary and Latvia, this *indirect cross-border credit* was even more important in the run-up to the crisis. Much of this reflected the (interoffice) channelling of funds by foreign banks outside these countries to their *subsidiaries* in these countries (left-hand panels, dashed brown line), which in turn extended *foreign currency* loans to residents (right-hand panels). In the Baltic states combined, for example, credit extended by subsidiaries of foreign banks located in these countries accounted for 80% of total bank credit to non-banks, mostly euro-denominated.

⁵ Borio et al (2011). Note that a comparison of cross-border with overall credit growth differs from a comparison of external claims with GDP, as in Lane and Milesi-Ferretti (2007). In particular, our comparison recognises that domestic credit stocks tend to be large in relation to GDP in Asia, but smaller in Latin America. Thus, our cross-border bank credit as a share of overall bank credit provides a measure of openness that takes into account differences in financial depth across regions and countries. Our approach also differs from that of Magud et al (2011), who identify capital flow booms by reference to their own trend (with no reference to domestic credit developments) and rely on domestic credit without integrating cross-border bank credit.

Bank credit to non-banks in selected European countries

At constant end-Q2 2011 exchange rates¹



¹ The stacked bars indicate total bank credit expressed in US dollars at constant end-Q2 2011 exchange rates, and thus exclude valuation effects. The dotted black line shows unadjusted total bank credit converted into US dollars at contemporaneous exchange rates. ² BIS reporting banks' cross-border claims on non-banks. Claims include loans and securities, most of which is debt. ³ Net cross-border borrowing (liabilities minus claims) from all sectors by banks located in the country. For non-BIS reporting countries (Hungary and Latvia), BIS reporting banks' net cross-border claims on banks in the country. ⁴ Growth after first including net cross-border borrowing (if positive) by banks in the country (dashed brown line), under the assumption that this cross-border credit is ultimately passed on to non-banks in the country. ⁵ Estimated cross-border and locally extended claims on non-banks in domestic currency. ⁶ Estimated cross-border and locally extended claims on non-banks in foreign currencies.

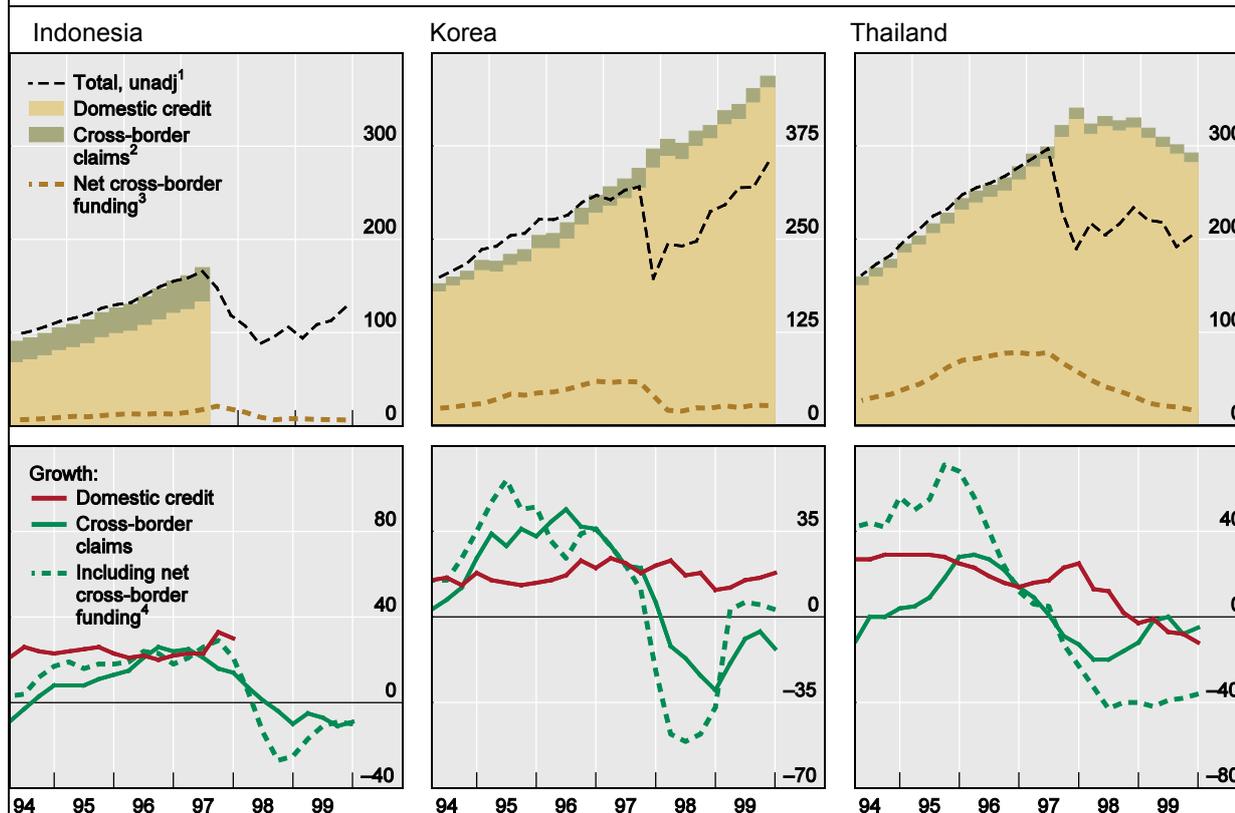
Sources: IMF, *International Financial Statistics*; BIS locational banking statistics; BIS consolidated banking statistics.

Graph 1

In sum, these admittedly extreme European cases show an increased share of cross-border funding in economies experiencing a boom of credit in the run-up to the recent global financial crisis. These cases must strike those who lived through the Asian financial crisis in 1997–98 as oddly familiar.

Bank credit to non-banks in selected emerging Asian countries in the mid-1990s

At constant end-Q4 1996 exchange rates¹



¹ The stacked bars indicate total bank credit to non-banks expressed in US dollars at constant end-Q4 1996 exchange rates, and thus exclude valuation effects. The dotted black line shows total bank credit converted into US dollars at contemporaneous exchange rates. ² BIS reporting banks' cross-border claims on non-banks. Claims include loans and securities, most of which is debt. ³ Net cross-border borrowing (liabilities minus claims) by banks located in the country estimated as BIS reporting banks' net cross-border claims on banks in the country. ⁴ Growth after first including net cross-border borrowing (if positive) by banks in the country (dashed brown line), under the assumption that this cross-border credit is ultimately passed on to non-banks in the country.

Sources: IMF, *International Financial Statistics*; BIS locational banking statistics by residence.

Graph 2

Indeed, turning back the clock to that period, we see that the credit booms in Asian economies displayed much the same regularity.⁶ In the run-up to the Asian crisis, direct and indirect cross-border credit grew to account for a combined share of roughly one third of the total credit to non-banks in Indonesia and Thailand, and more than a quarter in Korea (Graph 2). Indonesian firms relied heavily on direct cross-border credit, especially in 1996–97 (albeit not to the same extent as borrowers in Ireland more recently). Since regulation in Indonesia had restricted resident banks' ability to lend foreign currency to local firms, foreign banks lent directly to them from outside the country (dark shaded area, top left-hand panel).⁷ By contrast, Korea and Thailand (like the Baltic countries 10 years later) saw dollar credit funnelled through banks in the country (including Bangkok International Banking Facilities

⁶ Our presentation in Graph 2 for the 1990s differs from that of the more recent cases in Graph 1 because the detail in BIS international banking data was improved in response to the Asian financial crisis, yielding better estimates of the foreign currency share of bank credit.

⁷ On Thailand, see Kawai and Takayasu (1999). On Indonesia, Radelet and Woo (2000, p 172) citing BIS data, note that Indonesian firms owed \$40 billion of the \$57 billion in debt to international banks owed by Indonesians in mid-2007; Grenville (2004, p 14) notes how small a proportion was Indonesian bank debt.

included in the dashed brown line in Graph 2, top right-hand panel). While differences in the composition of cross-border credit thus reflected regulatory differences, rises in the share of international credit accompanied the domestic credit booms in each of these cases.

The six cases point to an association of rapid overall credit growth and a rise in the share of direct or indirect cross-border credit. Is such an association evident in a broader cross-section of experience? The next section suggests that it is.

III. Rising international credit in credit booms: regression analysis

In this section, we focus on the relationship between total bank credit to non-bank borrowers and the international components of bank credit in emerging economies (see Annex 1 for sample of 31). We find that, in the years before the recent global financial crisis, a rising share of international credit was positively related to a rising ratio of bank credit to GDP.⁸ In other words, the evidence systematically implicates international credit in credit booms. We also show that the economies most dependent on international credit suffered the largest reductions in bank credit in the period from mid-2008 to mid-2011.

Our analysis required us to construct bank credit aggregates for a large sample of countries. Domestic credit as usually measured captures only loans or securities booked at banks in a given jurisdiction vis-à-vis residents of that jurisdiction. To this we added the cross-border credit reported in the BIS international banking statistics, yielding a measure of the total credit provided by banks to non-banks in a particular country.⁹ To use this total to distinguish the underlying change in credit outstanding from valuation changes arising from currency movements requires an estimate of the breakdown between domestic and foreign currency credit. By exploiting detail in both the BIS locational and consolidated statistics, we generated estimates of the currency composition of our total bank credit measure for each country. Making allowances for the effect of exchange rate movements shows that very few countries experienced outright declines in bank credit in the wake of the financial crisis (see Box).

As discussed above in the context of the Asian financial crisis, capital controls and bank regulation in a particular country can dampen international credit flows or, depending on the type of regulation, they can favour one form of international credit over another. That is, international credit can flow both directly and indirectly, with the particular mix affected by policy and the organisation of globally active banks. Thus, focusing on only one type of international credit (eg direct cross-border) runs the risk of missing important developments in other forms (eg indirect cross-border).

⁸ Borio and Lowe (2002) and Borio and Drehman (2009) examine credit-to-GDP ratios for a large sample of countries and show that the credit-to-GDP “gap” can anticipate financial stress.

⁹ We generally include bank credit to governments in each country, although the results for the pre-crisis 2002–08 period discussed below are robust to exclusion of this credit. In the wake of the crisis (2008–11), banks shifted their portfolios towards holdings of government securities. Thus, for some analyses (eg Graph 4 below), it is necessary to exclude credit to governments to ascertain whether credit to the non-bank *private* sector is growing. The graph in Annex 3 decomposes bank credit into credit to non-bank private sector borrowers and credit to governments.

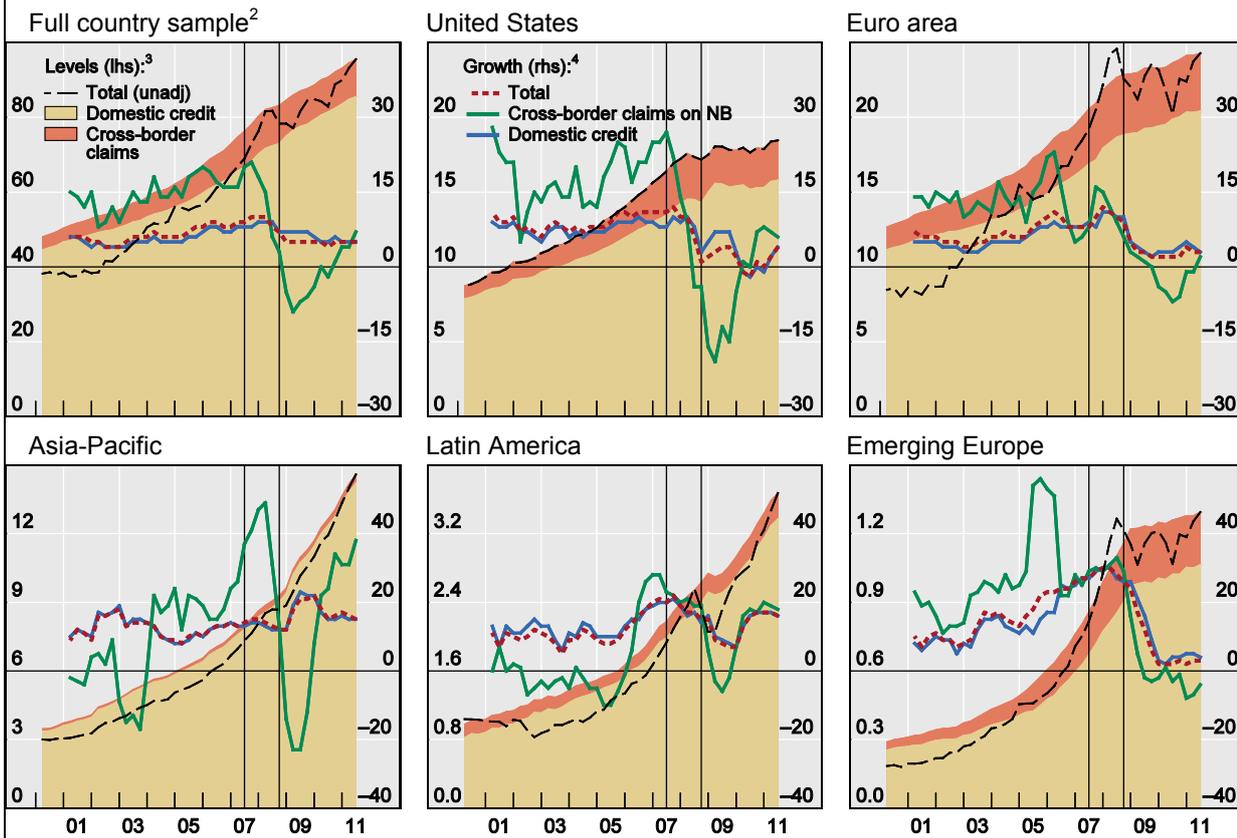
Box: Did bank credit drop in the recent crisis?

The US dollar appreciated by roughly 25% with respect to the euro and Swiss franc in the five months following the collapse of Lehman Brothers, and by even more against many other currencies during this period.¹ Unless accounted for, exchange rate movements of this size severely distort credit growth rates for those economies where credit stocks have large foreign currency components. Moreover, they complicate the construction of regional and global credit aggregates (and growth rates), which requires that credit to borrowers in different countries be expressed in a common currency.

Both cross-border and domestic bank credit are (generally) denominated in multiple currencies. The BIS international banking statistics in combination with domestic bank credit data from the IMF's *International Financial Statistics*, along with some assumptions, yield an estimate of the currency breakdown of total credit to non-banks (either including or excluding bank credit to governments) in a particular country.² This breakdown allows us to express credit stocks at constant exchange rates (in this particular case, end-Q2 2011 rates). This, in turn, yields credit growth rates that are (largely) undistorted by exchange rate movements and thus provides a better measure of credit growth.

Global bank credit aggregates, by borrower region

At constant end-Q2 2011 exchange rates¹



The vertical lines represent end-Q2 2007 and end-Q3 2008.

¹ The shaded areas indicate total bank credit to non-bank borrowers (including governments), expressed in US dollars at constant end-Q2 2011 exchange rates. The dashed black line shows unadjusted total credit converted into US dollars at contemporaneous exchange rates. The shaded areas are adjusted using various components of the BIS banking statistics to produce a breakdown by currency for both cross-border credit and domestic credit. ² Aggregate for a sample of 56 countries (see the statistical appendix for full list). ³ In trillions of US dollars. ⁴ In per cent.

Sources: IMF, *International Financial Statistics*; BIS international banking statistics; BIS calculations.

Graph A

The estimates for a sample of 56 large and emerging economies are summarised in Graph A.[Ⓢ] The stacked shaded areas show the stock of bank credit to non-banks (including governments and adjusted for exchange rate movements), broken down into domestic credit (tan area) and cross-border credit (salmon area). By contrast, the dashed black lines show the same credit total expressed in US dollars on an unadjusted basis.

What first strikes the eye is the difference in the importance of cross-border credit across regions. It represented a substantial share of bank credit even in the US and euro area economies. Among emerging markets, it accounted for a high share – roughly a quarter – of total bank credit in emerging Europe, but much less in Asia and the Pacific and Latin America. Comparing these measures, the data that have been adjusted for exchange rate fluctuations tell very different stories from the ones implied by the unadjusted data. While the latter show large contractions outside the United States, the former indicate that, worldwide, total bank credit *did not actually contract* during the crisis. What did contract was direct cross-border credit. While growth in domestic credit remained positive in all six regions (blue lines), growth in direct cross-border credit (green lines) turned negative in each, at least for a time.

Data by country reveal that, despite the severity of the recent global financial crisis, bank credit contracted in only a handful of individual economies. When bank credit includes credit to governments in each country, as in Graph A, our estimates indicate that Estonia, Hungary, Ireland, Iceland, Latvia, Lithuania and Luxembourg experienced outright contractions in bank credit to non-bank borrowers between Q2 2008 and Q2 2011. In the wake of the crisis, government deficits in many countries have ballooned just as banks sought refuge from a volatile investing environment, a combination that tilted banks' portfolios towards government securities. If we focus on the growth in credit to non-bank *private* sector borrowers and strip out banks' domestic and cross-border claims on governments (see Graph A.3 in Annex 3), Croatia, the Netherlands, Romania, Spain, Ukraine and the United States experienced contractions of credit as well.

[Ⓢ] See Fratzscher (2009) and McCauley and McGuire (2009) for a discussion of the global factors driving exchange rate movements during this period. [Ⓢ] The quality of the estimates is higher for those countries that report in the BIS statistics. See footnotes in graphs for more details.

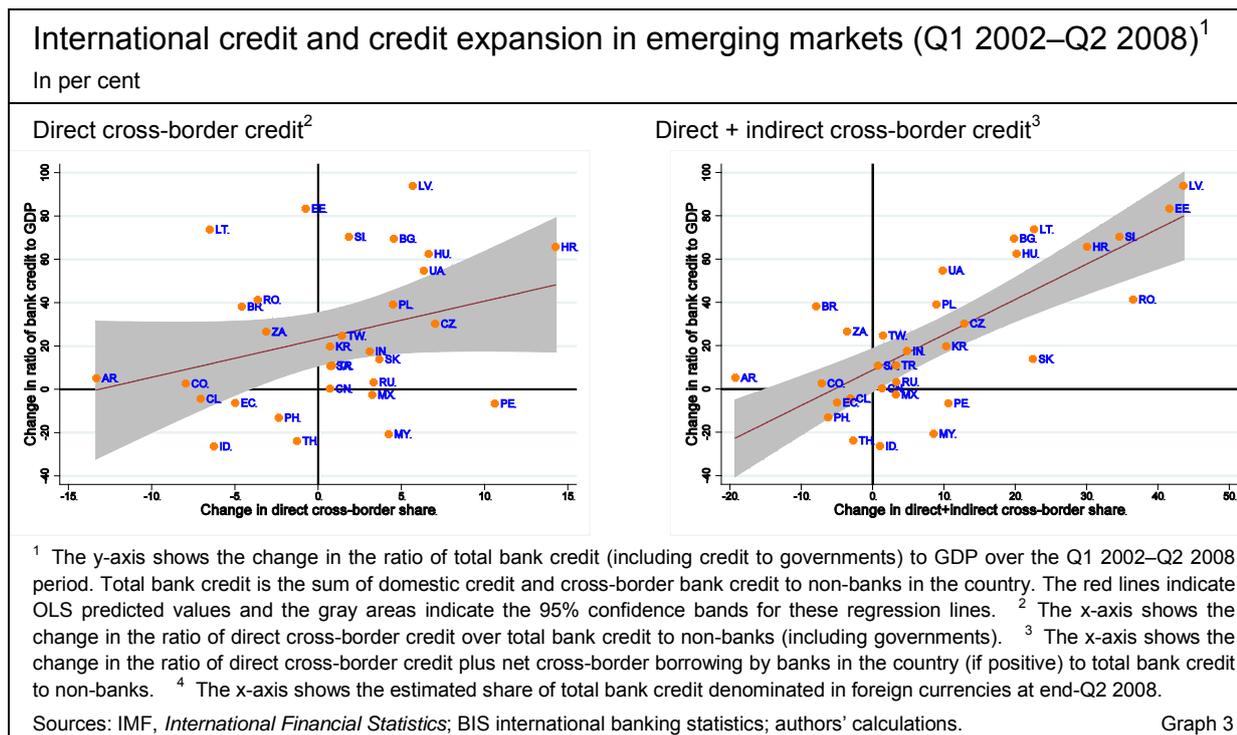
In support of this assertion, and as a prelude to our analysis below, note that for the 2002–08 period, it is the *combined* share of direct and indirect cross-border credit that is most strongly correlated with readily available measures of financial openness.¹⁰ As shown in Annex 2, cross-sectional regressions of the share of direct *plus* indirect cross-border credit (in total bank credit) on a country's financial openness, as captured by the Chinn-Ito index¹¹ (Chinn and Ito (2008)), reveal a strong positive relationship which is robust to the inclusion of various controls. Corresponding regressions taking as the dependent variable *only* the share of direct cross-border credit show no such relationship. This is not to say that direct cross-border credit cannot play an important role, as in the case of Ireland (Graph 1). Rather, the

¹⁰ The international credit share considered here, and in the centre panel of Graph 4, is a combination of both the direct cross-border share and the indirect cross-border financing components. It is the ratio of direct cross-border credit to non-banks plus net cross-border borrowing by banks in the country (if positive), all divided by total bank credit to non-banks (ie domestic credit plus direct cross-border credit).

¹¹ The Chinn-Ito index measures a country's degree of capital account openness. It is based on the binary dummy variables that codify the tabulation of restriction on cross-border financial transactions reported in the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*.

set of results suggests that, in practice, both forms of international credit are potentially important contributors to domestic credit booms.

To investigate this, we examine the relationship between international credit and credit growth in the lead-up (2002–08) to the financial crisis. Overall, credit tended to boom in emerging markets where international sources of credit rose in importance. Graph 3 plots overall credit developments as measured by the *change* in the ratio of total bank credit to GDP on the y axis against the *change* in borrower countries' reliance on the international components of bank credit (as a share of total credit) on the x axis. Broadly speaking, the scatter plots show a positive relationship: bank credit rose in relation to GDP most (y axis) in emerging economies that experienced the largest increase in the international dimensions of credit between 2002 and 2008 (x-axis).



The relationship is most pronounced when the more comprehensive measure of international credit is used. That is, the change in the bank-credit-to-GDP ratio is only loosely related to the change in the share of *direct cross-border credit* in the left-hand panel. It is much more tightly related to the change in combined share of *direct cross-border credit* and *indirect cross-border credit* (centre panel). This is evidenced by the steeper slope of the regression line and the much narrower grey shaded area (confidence band for the estimated regression line) in the right-hand panel. In short, *indirect cross-border credit*, often denominated in foreign currency, appears to be a frequent enabler of domestic credit expansion.

Such indirect cross-border credit can be either plain or fancy. In Poland (and in other eastern European countries), it was plain: foreign banks advanced euros or Swiss francs to their affiliates in the country, which in turn extended mortgages to households at lower interest rates than those available on domestic-currency mortgages. Indeed, central and eastern European countries stand out, having experienced big credit booms and also showing a high share of credit denominated in foreign currency in mid-2008 (Graph 1, right-hand panels). In Korea, much of the *indirect cross-border credit* was fancy. Foreign banks advanced dollars to banks in the country, who bought won investments hedged into dollars with forward purchase of dollars against won. The forward counterparties, mostly Korean exporters such as shipbuilders, in effect borrowed dollars by contracting to sell future dollar revenues.

Further regression analysis confirms the impression conveyed by Graph 3 that direct cross-border credit is weakly related to overall credit growth. Models 1 through 4 in Table 1 relate the rise in bank credit as a share of GDP from mid-2002 to mid-2008 to the change in *direct cross-border credit* and various controls, including size (GDP or total credit), financial openness (Chinn-Ito index), the short-term interest rate differential and the volatility of the domestic currency. All the controls are potential incentives for domestic borrowers to draw on international credit. Again, direct cross-border credit is only weakly related to overall credit developments. While its coefficient is positive in all four model specifications, it is not statistically significant in any of them. Furthermore, the R-squared suggests that no more than a fifth of the variance in overall credit growth is associated with international credit.

Bank credit booms and international credit (Q1 2002–Q2 2008)								
Cross-sectional change in credit-to-GDP ratio regressed on change in international credit and controls ¹								
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Δ (direct cross-border share)²	1.757 (1.73)	1.644 (1.65)	1.717 (1.69)	1.128 (1.03)				
Δ (direct + indirect cross-border share)³					1.631 (6.24)	1.615 (5.66)	1.615 (5.92)	1.576 (5.26)
Size (nominal GDP 2002)		-0.0331 (-1.57)				-0.0026 (-0.16)		
Size (total credit 2002)			-0.0146 (-1.10)	-0.004 (-0.32)			-0.026 (-0.27)	0.002 (0.21)
Financial openness⁴				8.74 (1.74)				-1.231 (-0.30)
Short-term interest rate differential⁵				-1.034 (-0.76)				-0.671 (-0.69)
FX volatility⁶				69.79 (3.03)				49.19 (2.84)
Constant	23.086 (3.92)	29.981 (4.16)	25.981 (4.04)	-13.93 (-1.09)	8.694 (1.84)	9.36 (1.47)	9.37 (1.73)	-12.436 (-1.34)
Adjusted R²	0.093	0.167	0.131	0.45	0.573	0.574	0.575	0.71
No. observations	31	31	31	30	31	31	31	30

Note: Values in parentheses are *t* statistics.

¹ The change in the ratio of total bank credit (including credit to governments) to GDP over the Q1 2002–Q2 2008 period. Total bank credit is the sum of domestic credit and cross-border bank credit to non-banks in the country. ² The change in the ratio of direct cross-border credit over total bank credit to non-banks. ³ The change in the ratio of direct cross-border credit plus net cross-border borrowing by banks in the country (if positive) to total bank credit to non-banks. ⁴ Capital account openness as measured by Chinn and Ito (2008). It is based on binary dummy variables that codify restrictions on cross-border financial transactions reported in IMF, *Annual Report on Exchange Arrangements and Exchange Restrictions*. ⁵ The difference between short-term interest rates in each country and euro (for emerging European countries) and US dollar (for all other countries) short-term interest rates, average over the sample period. ⁶ Quarterly measure of exchange rate volatility generated from daily price data, average over the sample period. Eastern European yields are measured against the euro; others against the US dollar.

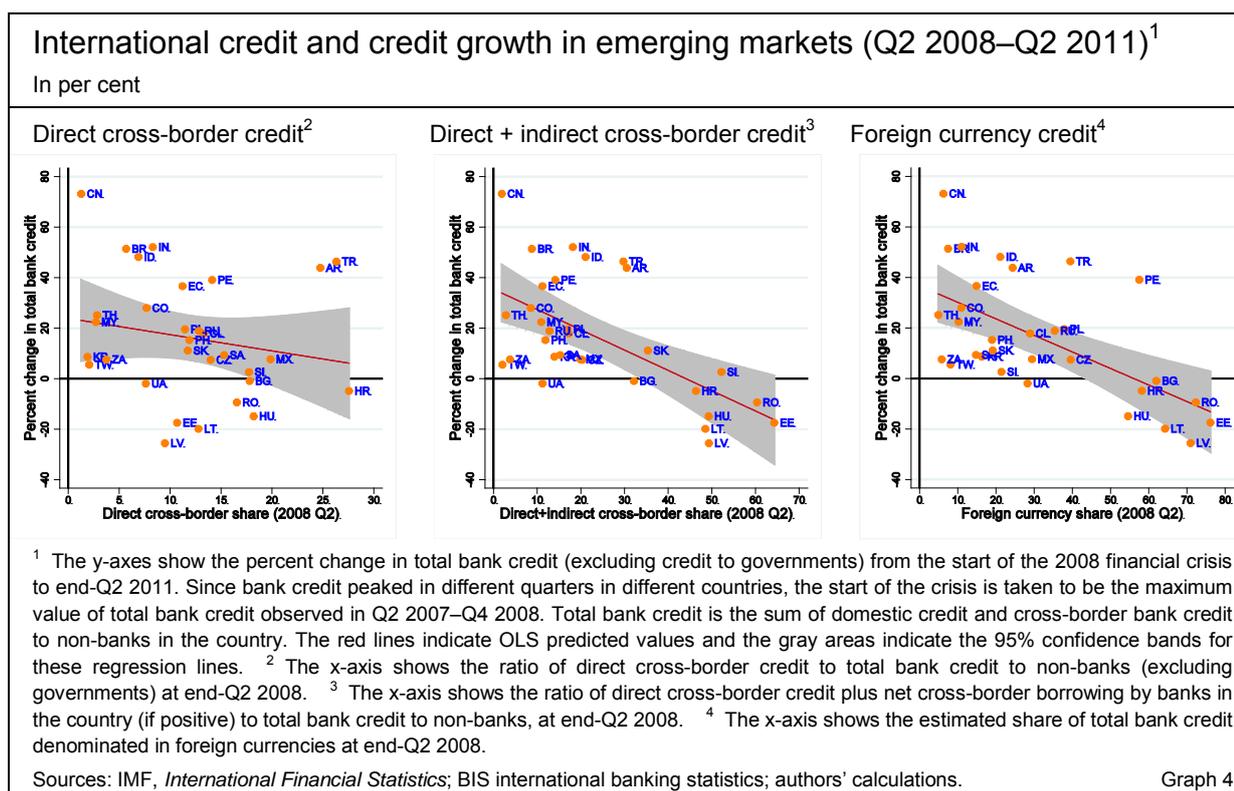
Table 1

However, there is a strong relationship between the combined share of direct and indirect cross-border credit and overall credit developments, as indicated in Models 5–8 (Table 1). The change in this combined share accounted for well over half of the cross-country variation in the change in credit-to-GDP ratios over this period. The inclusion of various controls does not change this relationship. The estimated coefficients suggest that a 1 percentage point

increase in (either direct or indirect) international credit as a share of total credit raises total credit by more than 1.6% of GDP.

To sum up, the evidence for emerging markets in 2002–08 suggests that international credit is an enabler of domestic credit booms, as captured by a rise in the ratio of overall credit to GDP. Now we plot the data to see whether a parallel proposition holds concerning credit developments *after* the outbreak of the financial crisis in mid-2008. In particular, whether overall bank credit fell fastest where international credit had come to play the largest role.

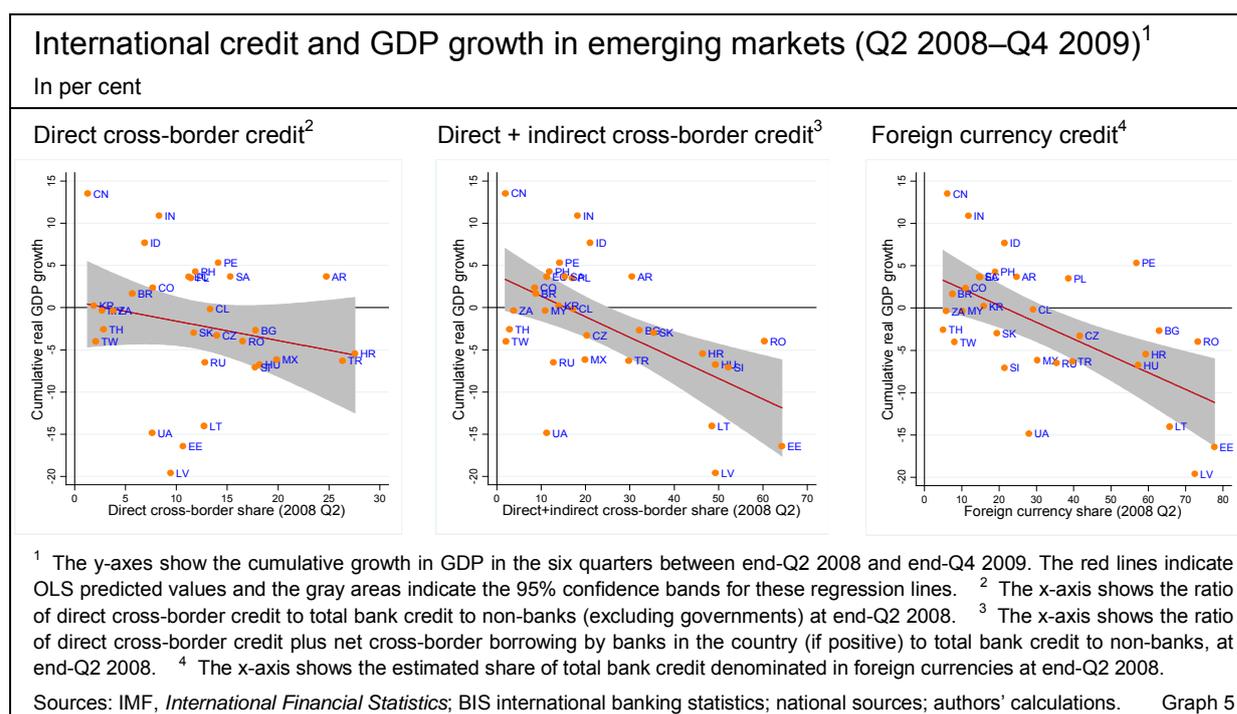
Note that the proposition is a parallel one, not a converse one, in that we examine not the change in the ratio of bank credit to GDP but rather the percent change in outstanding bank credit. This is because recessions can drive down nominal GDP, leaving the ratio of credit to GDP to rise during a recession. So it is more telling to examine how the change in bank credit accorded with the overall dependence of emerging market economies on international credit, as in Graph 4. The x-axis in this graph measures the share of international credit in total credit at end-Q2 2008, and the y-axis measures the percent change in the stock of outstanding bank credit to non-banks in each country from its peak level going into the crisis (taken as the maximum value in Q2 2007–Q4 2008) to Q2 2011. As shown in the Box, only a handful of economies experienced outright contractions in total bank credit, and thus lie below the zero horizontal line. The results indicate that after the onset of the crisis, overall credit tended to contract more where the dependence on international credit had reached a higher level.¹²



¹² Cetorelli and Goldberg (2011) and McCauley et al (2010) analyse how the shock to internationally active banks' global portfolio was transmitted to emerging economies. Bruno and Shin (2011) provide a more theoretical treatment.

Again the relationship is most pronounced for the more comprehensive measure of international credit. When only direct cross-border credit is considered (left-hand panel) the data do not reveal a strong relationship across the sample; the slope coefficient on the regression line is negative, but not statistically significant. As in the earlier discussion, however, when the indirect cross-border credit is also taken into account (centre panel), a tighter (and statistically significant) pattern emerges. By these estimates, a 2 percentage point higher share of (direct and indirect) cross-border credit on the eve of the crisis is associated with a 1 percentage point lower growth rate in total bank credit in the following two years. Similarly, the right-hand panel shows that those economies where more credit was denominated in foreign currency at the onset of the crisis also suffered larger reductions in credit in the following two years.

Consistent with the evidence in Graph 4, those emerging economies heavily dependent on international credit also tended to suffer larger contractions in output during the crisis. Of course, as global trade contracted, few economies escaped recession. But those that had depended most on international credit before the Lehman collapse tended to suffer sharper downturns. Graph 5, plots cumulative GDP growth between Q2 2008 and Q4 2009 on the y-axis against the same three international credit shares at Q2 2008 on the x-axis. As above, the share of direct cross-border credit is only loosely related to GDP growth (left-hand panel). But once again, the combined (direct plus indirect) share of cross-border credit (centre panel), and foreign currency credit (right-hand panel), are more tightly associated with the severity of the downturn.



IV. Dollar credit in Asia in 2009–11

With the perspective afforded by these results for the broad cross-section of emerging markets, this section reviews recent credit developments in major Asian economies. We first show that Asia's bank credit generally involves international credit only to a limited extent. Then we narrow the focus to a measure of credit to the non-financial *private* sector which comprises both bank and securities credit, in order to measure as precisely as possible the

contribution of dollar-denominated credit to overall private credit growth in Asia. We find that, even though dollar credit grew very rapidly in 2010–11, its low share in overall credit kept its contribution to overall credit growth modest. Thus, as central banks in Asia tightened monetary policy in 2010–11, they may have overstated the challenge of borrowers obtaining credit from abroad in lower-yielding US dollars.¹³ That said, we consider how Korea's experience in 2008 and Chinese borrowers' offshore borrowing in 2010–11 serve as a caution against complacency.

The most salient finding is that, in contrast to the mid-1990s, international sources of credit generally represent a small share of total bank credit in Asia in this century (Graph 6). In particular, local lending to non-banks dwarfs direct cross-border lending to non-banks in the major Asian economies (also see Graph A in the Box). For its part, indirect cross-border funding also tends to be small relative to the total. Even in Korea, where it is largest in relation to overall credit, it has not reached the proportions seen in that country before the Asian financial crisis of 1997–98 (Graph 2) – much less that that reached in Thailand at that time. As a result, even though cross-border credit grew faster than overall credit before and since the recent financial crisis (Graph 6, centre column, green lines above red lines), international credit generally contributed modestly to overall increases in credit.

The contrast is stark not only between Asia in the mid-1990s and Asia in the 2000s, but also between eastern Europe and Latin America, on the one hand, and Asia now. Compared to emerging Europe and Latin America, in Asia the foreign currency component of total bank credit (including that booked by domestic banks) forms a small portion of the total. As a result, the rapid growth of such credit before the global financial crisis did not make a substantial contribution to overall bank credit growth (Graph 6). The small share of cross-border credit also led to a different experience of the crisis in Asia. Even though direct cross-border credit to the region contracted sharply during 2009, falling by more than 20% over four quarters, growth in bank credit to Asian borrowers hardly slowed after mid-2008 (see Box).

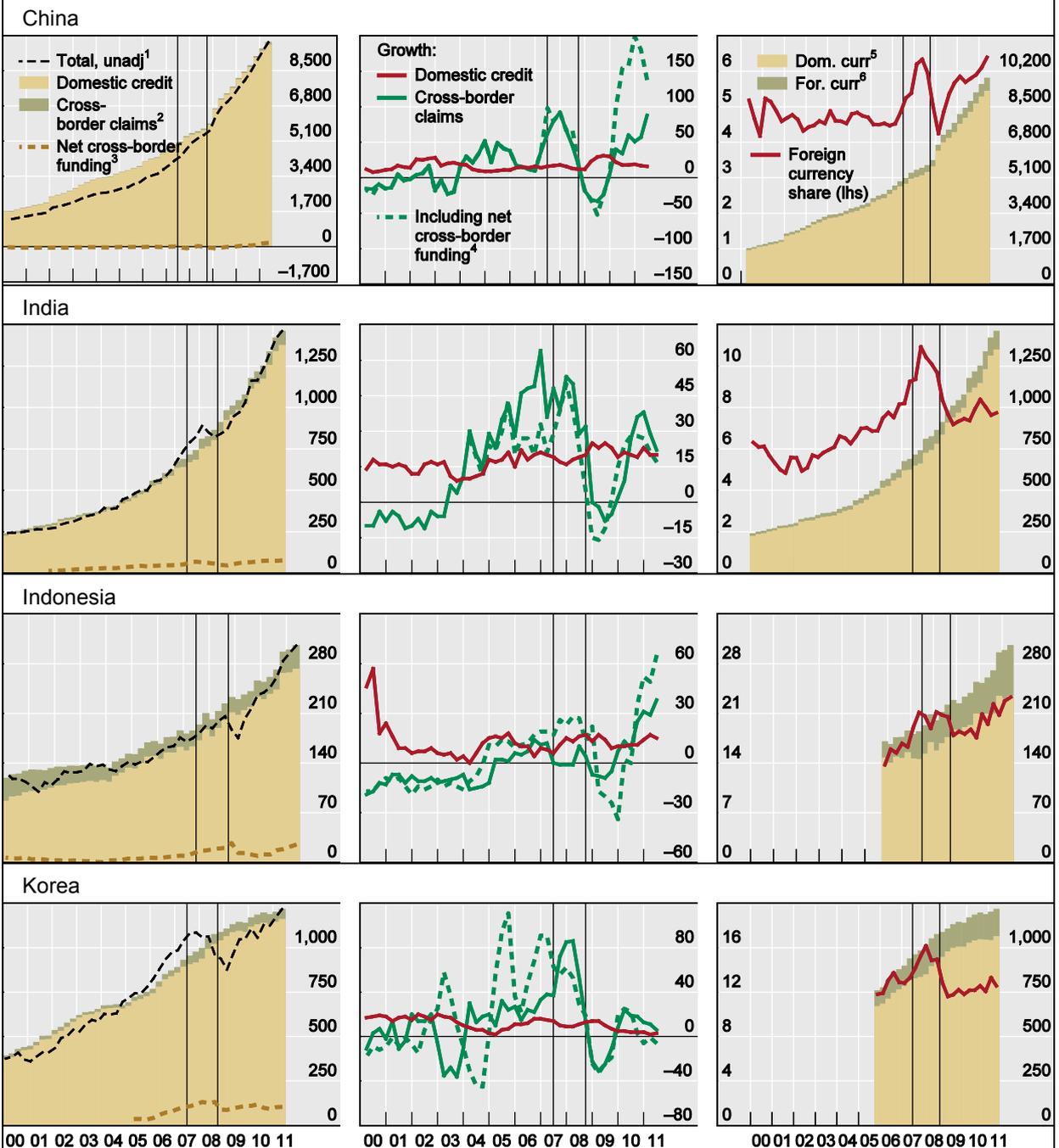
In view of the concerns over dollar credit in particular, Table 2 goes beyond the bank credit that we have analysed thus far and brings together data from the BIS international banking statistics, BIS international debt securities statistics and national sources to construct estimates of credit to non-financial private sector borrowers with a currency breakdown. Where available (United Kingdom, euro area), we start with a broad measure of total credit based on the total liabilities (bank borrowing and debt securities) of non-financial private sector borrowers as reported in flow-of-funds statistics. In combination with BIS data, these permit us to estimate the US dollar share of these liabilities. For all other countries, we construct total credit aggregates, as in Borio et al (2011), by summing domestic credit (excluding credit to governments and non-bank financials), cross-border bank *loans* and issues of international debt securities by non-financial private sector residents.

Again, owing to its small share of overall credit in Asia, dollar credit growth's contribution in relation to overall credit growth was generally modest (last row of Table 2). Only in the more dollarised economies in the region, that is, in Hong Kong, the Philippines, Thailand and Indonesia, did the contribution rise to double-digit percentage points.

¹³ Since the global financial crisis, US dollar credit to non-US residents resumed robust growth through the first quarter of 2011. Borio et al (2011) report that from the first quarter of 2009 to the first quarter of 2011, dollar credit to non-financial private borrowers outside the United States actually grew by \$1.1 trillion. Indeed, the resumption of double-digit growth in US dollar credit to borrowers outside the United States stands in sharp contrast to stagnant private credit growth in the United States.

Bank credit to non-banks, selected emerging Asian countries

At constant end-Q2 2011 exchange rates¹



¹ The stacked bars indicate total bank credit to non-banks expressed in US dollars at constant end-Q2 2012 exchange rates, and thus exclude valuation effects. The dotted black line shows unadjusted total bank credit converted into US dollars at contemporaneous exchange rates. ² BIS reporting banks' cross-border claims on non-banks. Claims include loans and securities, most of which is debt. ³ Net cross-border borrowing (liabilities minus claims) from all sectors by banks located in the country. For non-BIS reporting countries (China and Indonesia), BIS reporting banks' net cross-border claims on banks in the country. ⁴ Growth after first including net cross-border borrowing (if positive) by banks in the country (dashed brown line), under the assumption that this cross-border credit is ultimately passed on to non-banks in the country. ⁵ Estimated cross-border and locally extended claims on non-banks in domestic currency. ⁶ Estimated cross-border and locally extended claims on non-banks in foreign currencies.

Sources: IMF, *International Financial Statistics*; BIS locational banking statistics; BIS consolidated banking statistics.

Graph 6

Total credit to the non-financial private sector in selected countries, mid-2011												
	UK	XM	HK	CN	IN	ID	KR	TH	MY	PH	BR	MX
Total credit ¹	4,883	22,534	590	8,800	1,006	228	1,143	354	317	77	1,447	281
US dollar credit ²	881	887	146	468	89	31	109	16	23	14	120	101
As % of GDP ³	37.3	7.0	61.8	7.3	5.1	4.0	10.0	4.9	9.4	6.7	5.2	9.1
As % of total credit ⁴	18.0	3.9	24.7	5.3	8.9	13.7	9.5	4.5	7.2	18.1	8.3	36.0
Total credit growth 2009 ⁵	12.4	13.7	69.8	60.9	64.2	85.9	36.5	44.9	46.9	32.5	102.2	25.6
Dollar credit growth 2009 ⁵	26.9	12.1	76.8	121.4	45.0	117	33.3	1,389	32.3	171	48.6	17.2
Contribution ⁶	4.3	0.5	18.2	4.7	4.5	13.7	3.3	6.1	2.6	15.2	5.5	6.6
Contribution/total growth ⁷	34.7	3.6	26.1	7.7	7.0	15.9	9.0	13.6	5.5	46.8	5.4	25.8

BR = Brazil; CN = China; HK = Hong Kong SAR; ID = Indonesia; IN = India; KR = Korea; MX = Mexico; MY = Malaysia; PH = Philippines; TH = Thailand; UK = United Kingdom; XM = euro area.

¹ Total credit to non-financial private sector borrowers. For the euro area (XM) and the United Kingdom (UK), total liabilities of non-financial private sector borrowers from the flow of funds. For other countries, estimates constructed as the sum of domestic credit, cross-border loans to non-bank borrowers and issues of international debt securities by resident non-bank corporates. ² For those countries which are reporters in the BIS banking statistics, estimates are constructed as the sum of (i) BIS reporting banks' cross-border loans to non-bank residents, (ii) resident banks' loans to resident non-banks and (iii) outstanding international debt securities issued by non-bank private sector residents. For non-BIS reporting countries (China, Indonesia, the Philippines and Thailand), the third component is not available in the BIS banking statistics. For China, locally extended US dollar credit is estimated from national data; for other non-reporters, it is proxied by BIS reporting banks' net cross-border claims on resident banks on the assumption that credit is onlent to non-financial private sector residents. In billions of US dollars. ³ Stock over nominal GDP of the country, in per cent. ⁴ Contribution of US dollar credit growth to total growth since end-Q1 2009 in credit to non-bank private sector borrowers, in per cent. ⁵ Percentage change in outstanding stocks between end-Q1 2009 and end-Q2 2011. ⁶ Contribution in percentage points of US dollar credit growth to growth of total credit to non-financial private sector borrowers. ⁷ Row 7 divided by row 5, multiplied by 100.

Sources: People's Bank of China; Hong Kong Monetary Authority; IMF, *International Financial Statistics*; national flow of funds statistics; BIS locational banking statistics by nationality; BIS international debt securities statistics. Table 2

Still, dollar credit did grow rapidly. It outpaced total credit growth (in the row above) across much of Asia between March 2009 and June 2011. In China, for example, dollar credit grew by 121% while overall credit grew at just half that pace. Hong Kong SAR, Indonesia, Thailand and the Philippines also saw faster growth of dollar credit. But Thailand's 1,000%-plus growth was from a tiny base, underscoring how these data need to be interpreted with care.¹⁴

While the contribution of dollar credit growth to overall credit growth needs to be kept in perspective, general considerations and particular developments in Korea and China suggest, in different ways, that there are no grounds for complacency. As a general matter, policy to varying extents seems to hold down the growth of dollar credit in the region. In the cross-section of countries, international credit as a share of total credit in 2002–08 was to some extent related to capital account restrictions as captured by Chinn and Ito (2008) (see Annex 2). So while it seems at face value that international credit has played a limited role in credit developments in Brazil – Table 2 shows substantially more rapid growth of real credit than dollar credit in the recent past – this outcome may reflect to some extent policies such as the tax on private short-term foreign borrowing (IMF (2011, p 66–7)).

In Korea, Graph 6 above suggests that the reliance on indirect international credit before the global financial crisis was modest in relation to that in contemporary Hungary (Graph 1) or in Thailand or Korea before the Asian financial crisis (Graph 2). That did not prevent financial trauma, which hit not only the relatively thin foreign exchange market but even the domestic

¹⁴ Elsewhere, the rate of expansion of foreign currency credit relative to overall credit has not been as high. In Korea, dollar credit grew in tandem with overall credit, and in India and Malaysia, dollar credit grew more slowly than overall credit.

government bond market, when international banks' withdrew \$56 billion in the fourth quarter of 2008. Policies to prevent the build-up of short-term cross-border interbank debt have been tightened since the global financial crisis (Baba and Shim (2010)) and have been associated with more moderate overall and international credit growth.

In China's case, the extension of dollar credit to Chinese firms outside the mainland implies that the economy's overall dependence on dollar credit is understated. In particular, Chinese firms' affiliates in Hong Kong are using renminbi deposits in mainland banks or guarantees from mainland banks to secure US dollar credits extended in Hong Kong. If such dollar credit is funnelled back to the mainland, or otherwise replaces debt that might have been raised on the mainland, the measure in Table 2 of dollar credit to residents of China understates the effective flow of dollar credit. After the head of the Hong Kong Monetary Authority (2011) warned banks about the "unsustainable" rise in lending to Chinese-related non-banks, Yuen (2012) reports that the 60% growth in Hong Kong loans to Chinese non-banks in 2010 had slowed to 35% in 2011. As Chinese firms become more multinational it becomes more challenging to assess their dependence on foreign currency credit.

To sum up, the previous section has established an association between a rise in the share of international credit in overall credit and the rise in the ratio of overall bank credit to GDP across emerging markets in the 2000s. In this section, we have shown that Asian emerging market economies generally show low shares of international credit and small contributions from US dollar credit. But the record in Asia and elsewhere suggests that policymakers should keep an eye on international credit, including that part of it which is not readily captured in national reporting systems.

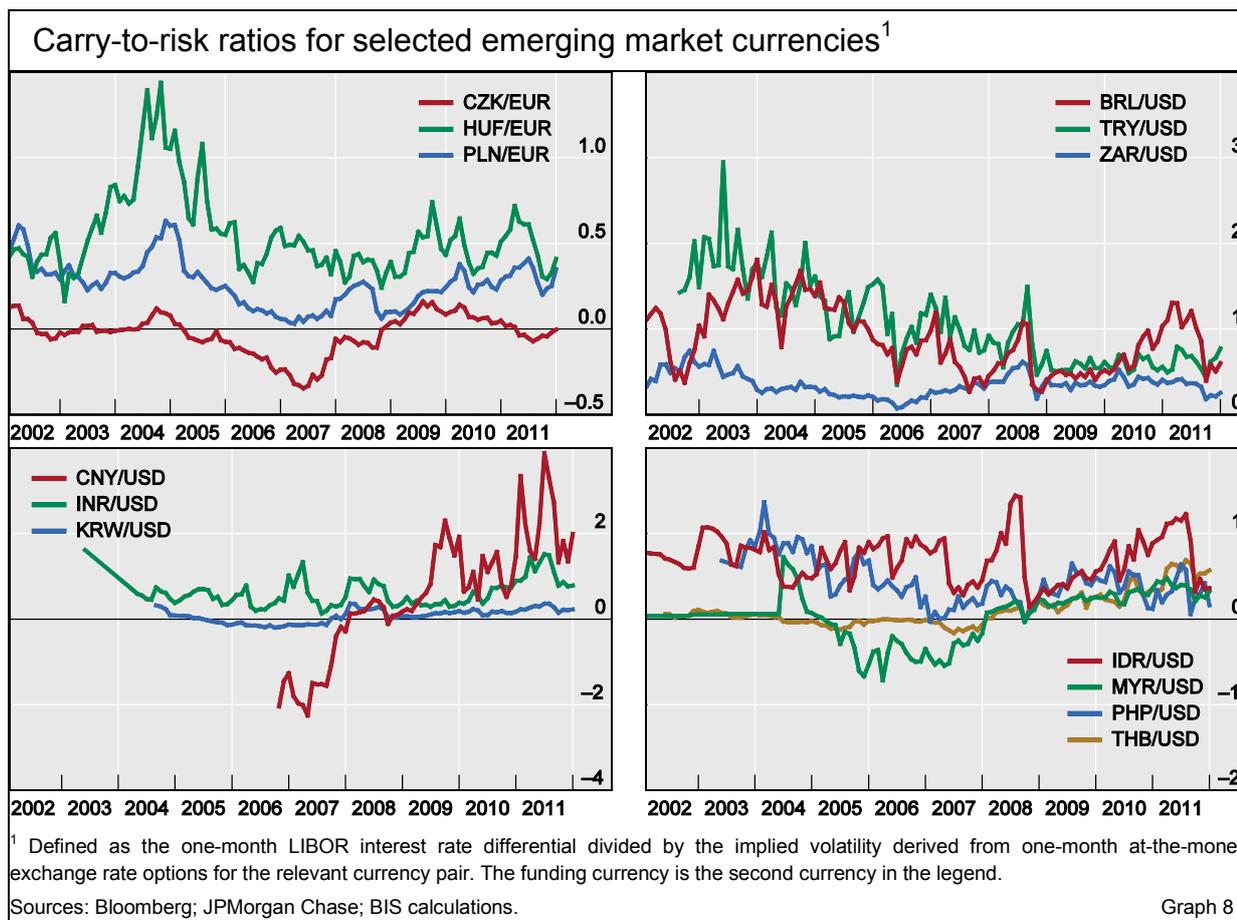
V. Carry trades and international credit

As we have seen, rapid credit growth in the 2000s in many emerging markets involved a greater reliance on international credit, much of it denominated in foreign currencies. No doubt open capital accounts and a large presence of foreign banks in some countries enabled the build-up of the stock of international credit. Also contributing to foreign currency credit growth were carry trade opportunities, where borrowers take advantage of interest rate differentials across currencies amidst low exchange rate volatility. Such opportunities can be gauged by a carry-to-risk ratio, which is essentially a Sharpe ratio for a currency. In the numerator is the interest rate differential and in the denominator is a measure of the volatility of the currency. The higher the interest rate differential is for a given volatility level, the more attractive a long position becomes.

When exchange rate volatility is low, even small interest rate differentials can generate strong carry trade incentives. For example, Graph 8 plots carry-to-risk ratios for selected currency pairs based on one-month interest rate differentials and implied volatilities extracted from currency options.¹⁵ In mid-2011, the CNY-USD currency pair had the highest carry-to-risk ratio (2.21) in our sample of currency pairs. While the CNY-USD interest rate differential (4.4 percentage points) is far from the highest in the sample, the implied volatility of the CNY-USD exchange rate (1.9%) is by far the lowest. It is, of course, capital controls that prevent domestic borrowers in China and international investors outside from taking advantage of this opportunity (McCauley (2011)). Nevertheless, the CNY-USD case illustrates how an

¹⁵ Using implied rather than realised exchange rate volatility in the denominator yields a forward-looking Sharpe ratio.

exchange rate regime that censors volatility can create strong carry trade incentives even without huge yield differentials.¹⁶

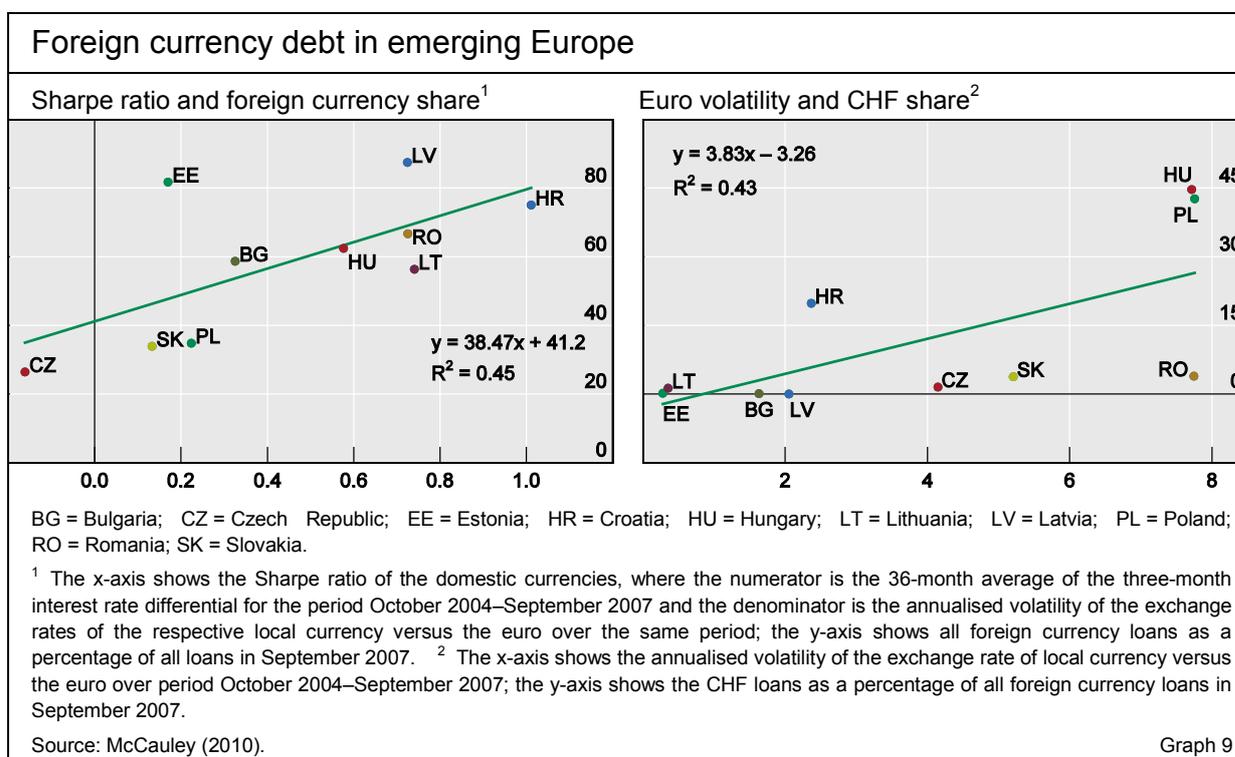


In emerging Europe, where countries are, in general, more financially open than in emerging Asia, sustained carry trade opportunities seemed to contribute to the massive shift to foreign currency borrowing by the real side of the economy over the past decade (Graph 1, right-hand panels). For example, McCauley (2010) documents a positive relationship between the carry-to-risk ratio and the share of foreign currency credit during 2004–07 (Graph 9, left-hand panel). This finding suggests that, when deciding in which currency to take out a mortgage loan, households acted like so-called carry traders. Heavy reliance on foreign currency credit during the boom saddled these economies with much larger debt loads in real terms once the crisis hit and local currencies depreciated.

Furthermore, carry-to-risk ratios help explain why, in some central and eastern European countries, households and firms borrowed in euros while, in other economies in the same region, most of the borrowing was in Swiss francs (McCauley (2010) and Brown et al (2009)). In countries where the domestic currency was quite stable against the euro, as in the Baltic states, the borrowing was largely in euros (Graph 9, right-hand panel). Where there was considerable volatility in the domestic currency against the euro, borrowers reached for the larger interest rate differential by borrowing in Swiss francs. For example, the volatility of the

¹⁶ By contrast, the carry-to-risk ratio for the free-floating BRL-USD pair is roughly half as large (1.10), even though the interest rate differential here (11.9 percentage points) is nearly three times greater. In other words, the volatility of the BRL/USD rate (the denominator of the carry-to-risk ratio) reduces the incentive to engage in this carry trade.

Hungarian forint or Polish zloty against the Swiss franc was only a bit higher than that against the euro, while the Swiss franc offered yields about a percentage point lower than the euro. As a result, the shares of foreign currency loans denominated in Swiss francs were substantial in both of those countries.



In sum, interest differentials combine with currency volatility to shape the incentives to borrow in foreign currency. And borrowing in foreign currency (“liability dollarisation”) in turn puts upward pressure on the domestic currency. To the extent that an appreciation leads to expectations of further appreciation, then the incentive to borrow in foreign currency increases at any given level of the interest differential. Given the current and prospective low yields on the dollar and other major currencies, policies that squelch currency volatility should be expected to invite carry trades, at least during “risk-on” periods in global financial markets (Ogus (2011)). Moreover, limiting the depreciation of the domestic currency during “risk off” periods will encourage positions in domestic currency assets funded with foreign currency liabilities.¹⁷

VI. Conclusions

Recent cases in Europe and older cases from before the Asian financial crisis of 1997–98 suggest that an increased role for international bank credit in overall credit is associated with larger credit booms. Regression analysis shows that this regularity holds in a sample of 31 emerging market economies in the years 2002–08. In addition, we present evidence that, after the onset of the crisis, overall credit and real output tended to contract more where the dependence on international credit had reached a higher level. Most importantly, our

¹⁷ Grenville (2011, p 28) advocates “buying cheap and selling dear over the exchange rate cycle, where the width of the band gives some measure of the profit margin” – to the authorities, and the risk to private investors and borrowers.

empirical analysis highlights how both *direct cross-border* credit and *indirect cross-border* financing (of domestic credit) enable domestic credit booms.

In Asia, the growth of international credit has not contributed much to the recent period of rapid credit growth. However, if countries in the region become more financially open, residents will be able to capitalise on carry trade opportunities, and thus shift their liabilities out of the domestic currency. As the experience of emerging Europe suggests, greater dependence on international credit, particularly foreign currency credit, limits the ability of local policymakers' to constrain credit growth. The implication for Asia is that international credit growth merits attention. Authorities can use BIS statistics as a cross-check for estimates of the international indebtedness of their residents, especially taking into account the direct cross-border lending to non-banks.

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Annex 1: Sample of economies

The analysis in this paper is based on a sample of 56 economies.

Advanced economies (25):

AT=Austria, AU=Australia, BE=Belgium, CA=Canada, CH=Switzerland, DE=Germany, DK=Denmark, ES=Spain, FI=Finland, FR=France, GB=United Kingdom, GR=Greece, HK=Hong Kong SAR, IE=Ireland, IS=Iceland, IT=Italy, JP=Japan, LU=Luxembourg, NL=Netherlands, NO=Norway, NZ=New Zealand, PT=Portugal, SE=Sweden, SG=Singapore, US=United States

Emerging economies (31):

Asia-Pacific: CN=China, ID=Indonesia, IN=India, KR=Korea, MY=Malaysia, PH=Philippines, TH=Thailand, TW=Chinese Taipei

Latin America: AR=Argentina, BR=Brazil, CL=Chile, CO=Colombia, EC=Ecuador, MX=Mexico, PE=Peru

Emerging Europe: BG=Bulgaria, CZ=Czech Republic, EE=Estonia, HU=Hungary, HR=Croatia, LT=Lithuania, LV=Latvia, PL=Poland, RO=Romania, SI=Slovenia, SK=Slovakia, UA=Ukraine

Other: RU=Russia, SA=Saudi Arabia, TR=Turkey, ZA=South Africa

Annex 2: International credit and financial openness

Table A reports a regression of the change in the share of international credit (in total bank credit) on financial openness, yield differentials and currency volatility. The narrower measure of international credit, the share of direct cross-border claims on non-banks, is not significantly correlated with any of the regressors. By contrast, the broader measure, which takes into account both direct and indirect cross-border credit, is strongly correlated with the Chinn-Ito measure of capital account openness. About a third of the cross-sectional variation in the penetration of direct and indirect international credit in this period is associated with capital account openness.

International share of bank credit and financial openness								
Change in the international share of total bank credit over the period mid-2002 to mid-2008								
	Δ (direct cross-border share) ¹				Δ (direct + indirect cross-border share) ²			
	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Financial openness ³	0.639 (0.72)	0.608 (0.60)	0.66 (0.68)	-0.122 (-0.11)	7.06 (3.60)	6.35 (2.84)	7.026 (3.27)	6.19 (2.52)
Size (nom GDP 2002)		-0.0002 (-0.07)				-0.007 (-0.68)		
Size (total credit 2002)			0.0002 (0.06)	-0.001 (-0.35)			-0.006 (-0.05)	0.0003 (0.04)
ST interest rate diff ⁴				-0.378 (-1.33)				-0.65 (-1.02)
FX volatility ⁵				-0.414 (-0.08)				13.53 (1.20)
Constant	0.248 (0.20)	0.327 (0.19)	0.205 (0.14)	2.31 (0.84)	5.12 (1.85)	6.93 (1.80)	5.19 (1.59)	1.62 (0.26)
Adjusted R²	0.018	0.018	0.018	0.10	0.317	0.328	0.316	0.36
No. observations	30	30	30	30	30	30	30	30

Note: Table shows a cross-sectional regression of the change in the international share of total bank credit (Q2 2002–Q2 2008) on various right-hand side controls. Values in parentheses are *t* statistics.

¹ The change (Q2 2002–Q2 2008) in the ratio of direct cross-border credit over total bank credit to non-banks. ² The change (Q2 2002–Q2 2008) in the ratio of direct cross-border credit plus net cross-border borrowing by banks in the country (if positive) to total bank credit to non-banks. ³ Financial openness as measured by the Chinn and Ito (2008). It is based on binary dummy variables that codify restrictions on cross-border financial transactions reported in IMF, *Annual Report on Exchange Arrangements and Exchange Restrictions*. ⁴ The difference between short-term interest rates in each country and euro (for emerging European countries) and US dollar (for all other countries) short-term interest rates, average over the sample period. ⁵ Quarterly measure of exchange rate volatility generated from daily price data; average over Q2 2002–Q2 2008.

Table A

Annex 3: Bank credit to non-banks: private vs public sector borrowers

This Annex Graph is an alternative version of the graph discussed in the Box in the main text. Here, the stacked shaded areas depict total bank credit to non-bank borrowers, broken down into bank credit to governments and non-bank private sector borrowers.

