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## Conference Paper

# The determinants of cross-border bank flows to emerging markets - new empirical evidence on the spread of financial crises

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*PRELIMINARY DRAFT VERSION*

The determinants of cross-border bank flows to emerging markets – new empirical evidence on the spread of financial crises

Sabine Herrmann  
Dubravko Mihaljek

## **Abstract**

The paper studies the nature of spillover effects in bank lending flows from advanced to the emerging markets and identifies specific channels through which such effects occur. Based on a gravity approach, we examine a panel data set on cross-border bank flows from 17 BIS reporting advanced economies to 28 emerging market countries in Asia, central and eastern Europe and Latin America from 1993 to 2008. The empirical analysis suggests that global as well as country specific factors are significant determinants of cross border bank flows. In particular, stronger global risk aversion and higher expected market volatility seem to have been the most important channels through which spillover effects occurred during the crisis of 2007/08. The reduction in cross-border loans to emerging Europe was more limited compared to emerging Asia and Latin America in large measure because of the higher degree of financial and monetary integration in Europe and relatively sound banking systems in the region. These results are robust to various specification, sub-samples and econometric methodologies.

JEL-Classification: F34, F36, G01, O57, C23

Keywords: gravity model, cross border bank flows, financial crisis, emerging market economies, spillover effects, panel data

## **Non Technical Summary**

This paper uses a gravity model of international trade to examine whether and how far *global* financial stress indicators and *country specific* risk factors in lender and borrower countries determine the transmission of financial crises. The empirical investigation is based on a panel data set on cross border bank flows from 17 advanced economies to 28 emerging markets in Asia, central and eastern Europe and Latin America. The period under review from 1993 to 2008 covers the Mexican crisis, the Asian crisis as well as the latest economic and financial crisis in 2007-08.

The analysis reveals that both standard variables of the gravity model and various financial stress indicators were significant determinants of cross-border bank flows. In particular, there is evidence that banks in advanced economies readjusted their cross-border bank loans to emerging markets due to a reassessment of global risk factors (the so-called “*wake-up call*”), but also in response to the exposure of their banks to a primary crisis country (the “*common lender effect*”). The advanced economy lenders also reduced cross-border loans in response to unstable macroeconomic and financial developments in borrower countries. By contrast, close financial and monetary linkages between lender and borrower countries stabilized the cross-border bank flows to the emerging markets.

During the latest financial crisis, the most important channels through which spillover effects spread seem to have been the global factors, ie the reassessment of global risk and higher expected market volatility in the wake of the financial crisis. To a lesser extent this was also true during the Asian crisis; however, during the Mexican crisis, the deterioration of the global environment had no major impact on cross-border bank flows.

During the latest financial crisis, there is also empirical evidence that more healthy banking sectors, more rigid exchange rate regimes and deeper financial integration helped limit the withdraw of cross-border loans from Emerging Europe compared to the two other emerging market regions.

## **Nicht technische Zusammenfassung**

Das Papier untersucht auf Grundlage eines Gravitationsansatzes ob und in welchem Ausmaß *globale* Stressindikatoren sowie *länderspezifische* Risikofaktoren in den Geber- und Empfängerländern zur Übertragung von Finanzkrisen beitragen. Die empirischen Untersuchungen beziehen sich auf ein Panel, das bilaterale grenzüberschreitende Bankkredite aus 17 Industrieländern in 28 Aufholländer Asiens, Mittel- und Osteuropas sowie Lateinamerikas zwischen 1993 und 2008 berücksichtigt. Der Untersuchungszeitraum umfasst die Mexiko-Krise, die Asienkrise sowie die jüngsten finanziellen und wirtschaftlichen Verwerfungen 2007/2008.

Neben den Standardvariablen des Gravitationsmodells stellten im Untersuchungszeitraum die finanziellen Stress- und Risikoindikatoren signifikante Determinanten der internationalen Bankflüsse dar. Es gibt Hinweise darauf, dass die Industrieländer ihre Bankkredite an Aufholländer auf Grund einer Verschlechterung der globalen Stimmung reduzierten (*wake-up call*), aber auch in Folge der Tatsache, dass ihre Banksektoren selbst dem primären Krisenherd ausgesetzt waren (*common lender effect*). Zudem hat auch eine instabile makroökonomische und finanzielle Situation im Empfängerland den De-Leveraging Prozess der Industrieländer verstärkt. Dagegen trugen die finanzielle sowie die geldpolitische Integration zwischen Geber- und Empfängerländern zur Stabilisierung der Bankkredite in die Aufholländer bei.

In der gegenwärtigen Krisensituation sind globale Einflussgrößen - d.h. eine höhere Risikoaversion oder gestiegene Marktvolatilität - der wichtigste Übertragungskanal von finanziellen Verwerfungen. In schwächerer Form ist dies auch in der Asien-Krise der Fall, während sich das globale Umfeld in der Mexiko-Krise kaum verschlechterte.

Das Papier liefert Hinweise darauf, dass ein stabilerer Banksenktor, fixere Wechselkursregime sowie ein höherer Grad an bilateraler finanzieller Integration zwischen Kreditgeber und -nehmer im Rahmen der aktuellen Verwerfungen dazu beitragen, dass die Aufholländer in Europa einen geringeren Abfluss an internationalen Bankflüssen zu verzeichnen hatten als dies in den beiden anderen Aufhol-Regionen zu beobachten war.

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# **The determinants of cross-border bank flows to emerging markets – new empirical evidence on the spread of financial crises\***

## **1. Introduction**

The economic and financial crisis of 2007–09 marks the first major economic downturn in emerging market economies since the Asian and Russian crises of 1997–98. For quite some time, what started as a financial turbulence in August 2007 seemed to threaten financial stability primarily in the advanced economies, especially the United States and the United Kingdom. While emerging markets were exposed to some spillover effects – they were affected by de-leveraging of financial institutions in the advanced economies and the resulting rise of risk premia – until September 2008 their real economies continued to function quite well. Notwithstanding structural imbalances in some countries, a soft landing had been widely expected. After the collapse of Lehman Brothers in September 2008, however, liquidity tensions in money markets spread worldwide and financial stress in the emerging markets intensified. The crisis culminated in early 2009, when in addition to the financial sector the outlook for the real sector deteriorated sharply. While all emerging market countries have been affected to some degree, the impact varied significantly across and within emerging market regions.

International banks have been one of the major sources of finance for the catching-up process of the emerging market economies in recent years. As a result, it is not surprisingly that financial links and, in particular, the bank lending ties have been identified as one of the main channels of transmission of the latest crisis from advanced economies to the emerging markets (see eg IMF, 2009a). The determinants of cross-border bank flows should therefore be an important issue to look at when investigating how the crisis was transmitted, and why different emerging market countries were affected differently. Understanding the main factors driving cross-border bank flows in financial stress periods is also important for financial stability in advanced economies, because of negative feedbacks of financial crises in emerging markets on banks in advanced economies. This is especially the case with banks from the euro area, many of

which have built up significant exposures to emerging markets in Asia, Latin America and, in particular, central and eastern Europe.

This paper tries to clarify the nature of spillover effects in cross-border lending, and identify specific channels through which crises spread from advanced to emerging market economies. The paper is thus part of a small and fairly recent literature linking cross-border banking flows and financial stress indicators (see eg Buch et al, 2009; McGuire and Tarashev, 2008; World Bank, 2008). In addition to the push and pull factors traditionally used in the literature to explain cross-border bank flows, we look at indicators of global financial strain and financial stress in home and host countries as important determinants of cross-border lending.

Our empirical investigation addresses two main questions: *First*, how far do banks from advanced economies readjust their cross-border loans to emerging markets in response to changes in country specific fundamentals of the emerging market borrowers, and how far in response to a reassessment of global risk and broad-based de-leveraging by financial intermediaries? And within the latter, which set of factors seems to be more important: the exposure of international banks to a primary crisis country (*the common lender effect*), or the more general revision of banks' credit policy based on greater risk aversion in the wake of financial crisis (*the wake-up call*)?

*Second*, how far is transmission of financial stress driven by country specific risk factors, and how far by the degree of international linkages between lender and borrower countries? More specifically, we examine whether the emerging market economies that exhibited more pronounced macroeconomic vulnerabilities before the crisis experienced larger reductions of cross-border bank inflows. In addition, we examine whether a high degree of financial integration between lender and borrower countries, and more rigid exchange rate regimes in borrower countries helped stabilize financial flows, or made borrower countries more vulnerable to the withdrawal of cross-border bank flows following the onset of the crisis.<sup>1</sup>

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\* The views expressed in this paper are those of the authors and do not necessarily reflect the views of the Deutsche Bundesbank or the Bank for International Settlements (BIS). The authors thank Jimmy Shek for outstanding research assistance. The paper has benefited from valuable comments by J. Breitung and

The empirical investigation in our paper is based on a gravity model. The basic idea of classical gravity models is relatively simple: these models explain bilateral import or export flows from country  $i$  to country  $j$  for the most part by bilateral distance and country size (Anderson, 1979). Recent gravity models are more sophisticated and include many additional variables (see eg Frankel and Rose, 2002). Martin and Rey (2004) and Portes and Rey (2005) use gravity models not only to explain trade in goods but also trade in assets. Based on this literature, we focus on bilateral data and country pair panel estimates to explain how and why the financial crises spread from advanced economies to the emerging markets. We compiled quarterly data on bilateral flows between 17 BIS reporting advanced economies and 28 emerging market countries from 1993 through 2008. The resulting data set contains some 30,500 observations.

Besides the unique data set, the paper makes some methodological contributions. In addition to the standard random effects panel model, we estimate a two-step Heckman selection model for panel data following Woolridge (1995, 2002), Mundlak (1978) and Chamberlain (1980, 1982). In order to exploit full information contained in the data on zero bilateral flows, we estimate separately the decision *whether* banks *in* advanced economies lend to emerging markets, and the decision *how much* they lend.

Our analysis suggests that global as well as country specific factors are significant determinants of cross border bank flows. In the latest financial crisis, stronger risk aversion and higher expected market volatility seem to have been the most important channels through which spillover effects occurred. In emerging Europe, sounder banking sectors, fixed exchange rate regimes, and stronger financial integration with advanced economies have dampened the reduction of cross-border flows compared to emerging Asia and Latin America.

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<sup>1</sup> According to the IMF (2009b), financial interconnectedness within Europe increases the risk of adverse feedback loops. Hernandez et al (2001) provide empirical evidence that contagion was more important during the 1990s' than the earlier crises, and argue that one reason for increased contagion was stronger financial integration.

The rest of the paper is organised as follows. *Chapter 2* reviews recent developments in cross-border flows to emerging markets. *Chapter 3* links our approach to the existing literature. *Chapter 4* describes the model specification, provides information on the data and summarises the main results. *Chapter 5* provides some robustness checks. *Chapter 6* concludes.

## **2. Cross-border lending to emerging markets – some stylized facts**

By “cross-border lending” we understand two data series taken from the BIS international banking statistics – the *external positions* and the *external loans* of BIS reporting banks vis-à-vis individual countries. Both data series are taken from the BIS locational banking statistics, which comprises data on gross international financial claims and liabilities of banks resident in a given country, on banks and the non-bank sector in other countries (hence the term “cross-border”). We use the locational statistics because the focus in this paper is on the emerging market countries receiving the loans.<sup>2</sup> The data include both quarterly stocks (“amounts outstanding”) and flows (“changes”). The flow data are adjusted for exchange-rate changes.

As shown in *Figure 1*, emerging markets in Asia, Latin America and central and eastern Europe experienced quite different dynamics of cross-border bank flows over the past 16 years. During the 1990s there were two distinct crisis episodes: 1994–95 (the Mexican crisis) and 1997–99 (the Asian and Russian crises). The Mexican crisis was short-lived and affected only Latin America and Emerging Europe, which was at the time also going through the first phase of deep financial sector reforms. The effects of the Asian and Russian financial crises on cross-border bank flows lasted longer and affected in particular emerging Asia and Latin America, but, surprisingly, less so

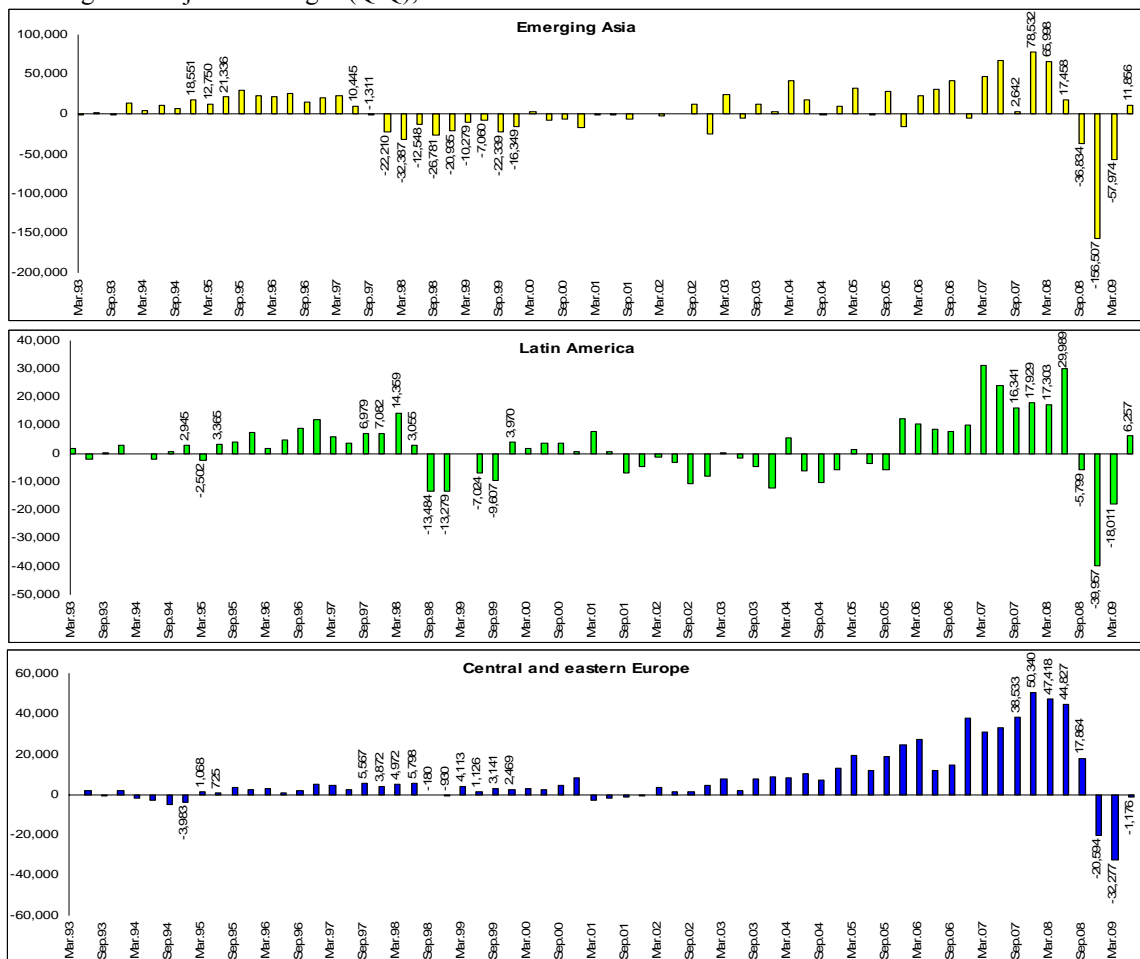
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<sup>2</sup> The alternative set of international banking data compiled by the BIS is the consolidated banking statistics, in which creditor data are reported on the nationality (i.e. home country) rather than residence (i.e. host country) basis. For instance, in the consolidated statistics, the Swiss banks’ loans to the emerging markets are consolidated on a worldwide basis and reported as loans from Swiss banks. In the locational statistics, all cross-border loans made by banks based in Switzerland (including, e.g., the French banks) are reported as “Swiss”, while the loans from the Swiss banks’ subsidiaries in London are reported as the UK loans. The main purpose of both data sets is to provide information on the role of internationally active banks in intermediating cross-border capital flows. The locational data are more relevant for countries receiving external loans, because they measure lending flows in a given period, consistent with the balance of payments data (“external positions” correspond to the “other investment” category of capital flows). The consolidated data are more relevant for creditor countries, because they help assess the size of their banks’ country and liquidity risk exposures. For further details see the Annex.

emerging Europe. Thailand, Indonesia, Korea, Malaysia and the Philippines were hit the hardest and experienced strong and long-lasting reductions in cross-border bank flows between the third quarter of 1997 and the last quarter of 1999. Latin America was strongly affected by contagion from the Russian domestic debt default.

The early 2000s were a period of muted inflows in all three regions, interrupted by occasional sharp outflows. Since 2003, however, cross-border bank inflows began to pick up strongly in emerging Europe and Asia, followed by Latin America in 2006. Financial liberalisation, sophisticated new financial products, and the search for yield in times of low global interest rates have led internationally active banks to expand significantly their operations in emerging market economies, particularly in central and eastern Europe (see Mihaljek, 2008).

**Figure 1: External positions of reporting banks vis-à-vis emerging markets**  
Exchange rate adjusted changes (Q/Q), in millions of US dollars

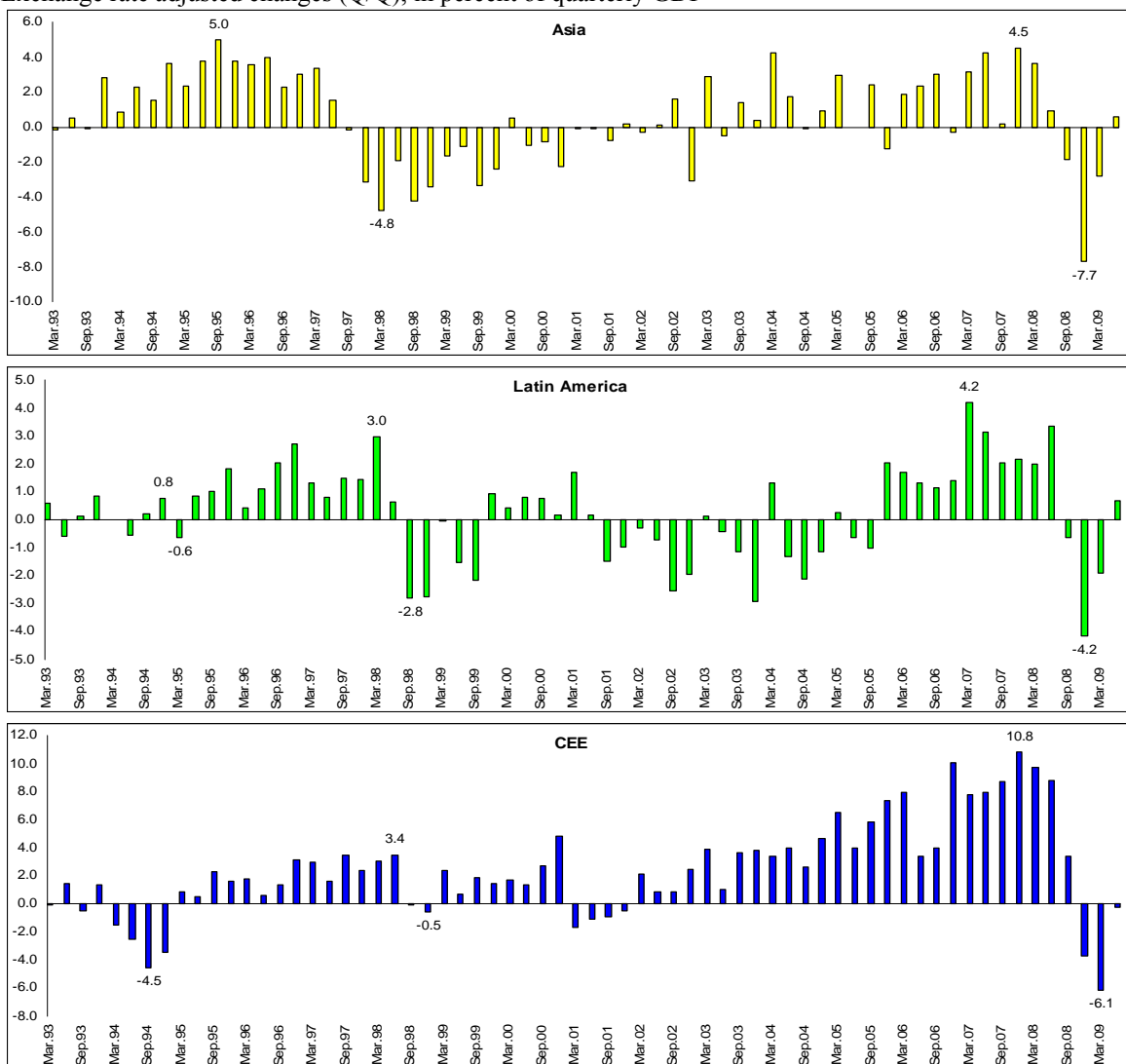


Source: BIS, locational banking statistics.

The cross-border lending boom peaked in absolute terms between mid-2007 and mid-2008. Emerging Asia and Europe, for instance, received, respectively, \$79 billion and \$50 billion of cross-border bank inflows during the last quarter of 2007; and Latin America received \$30 billion during the second quarter of 2008 (*Figure 1*). Relative to GDP, the inflows were the largest in emerging Europe (10.8% of the region’s GDP at the peak in Q4:2007), and exceeded 4% of GDP in both emerging Asia and Latin America (*Figure 2*).

**Figure 2: External positions of reporting banks vis-à-vis emerging markets**

Exchange rate adjusted changes (Q/Q), in percent of quarterly GDP



Source: BIS, locational banking statistics; IMF, World Economic Outlook.

During the third quarter of 2008, disruptions in international credit markets mutated into a full-scale global financial crisis. Major international banks started to reduce their financing of banks in emerging markets. Countries initially affected were those with more liquid banking systems (as measured, for instance, by the ratio of deposits to loans). In the fourth quarter of 2008 and the first quarter of 2009, international banks further withdrew funds from all three emerging market regions (*Figure 1*). This period also saw a widespread reduction in cross-border financing of the non-bank sector. But banks and the non-bank sector in many smaller countries with a large share of foreign bank ownership, especially in central and eastern Europe received additional cross-border loans during this time, indicating that foreign bank presence provided some stability to cross-border loans (see Mihaljek, 2009). In the second quarter of 2009 international banks for the most part resumed lending to the emerging markets.

Data in *Table 1* provide further details on the development of cross-border bank financing across different regions and time periods.<sup>3</sup> Banks from advanced economies held on average \$684 billion in total assets and \$426 billion in cross-border loans vis-à-vis emerging markets on average each quarter during the full sample period. Their cross-border loans to the emerging markets increased on average \$8.4 billion each quarter in exchange-rate adjusted terms. Central and eastern Europe accounted for the bulk of these loans: \$6.5 billion on average per quarter during the entire sample period, and as much as \$16.3 billion per quarter during 2005–08. The Emerging Asia was experiencing reductions in cross-border bank flows during the second half of the 1990s, and Latin America during the first half of the 2000s.

Bilateral cross-border loans between the BIS reporting countries and emerging market economies were very volatile: they ranged from a maximum of \$14.6 billion per quarter and country to a minimum of -\$15.6 billion per quarter and country. The average size of a bilateral loan for the entire sample of more than 30,000 pairs of quarterly observations was \$21 million, and the standard deviation was as much as \$546 million. The most frequent observation was that of zero flows. European banks accounted for

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<sup>3</sup> The coverage of data in Table 1 is slightly narrower than in Figures 1 and 2 because they refer to a subset of 17 reporting banks from advanced economies rather than all BIS reporting banks.



65% of the outstanding stock of cross-border loans to the emerging markets in our sample, US banks for 24% and Japanese banks for 10%.

**Table 1** **Cross-border loans to emerging market economies**  
**In billions of US dollars**

	External positions <sup>1</sup>		Cross-border loans <sup>2</sup>	
	Amounts outstanding <sup>3</sup>	Quarterly changes <sup>4</sup>	Amounts outstanding <sup>3</sup>	Quarterly changes <sup>4</sup>
Vis-à-vis all emerging markets <sup>5</sup>	684	12.9	426	8.4
Vis-à-vis CEE <sup>5</sup>	201	8.4	130	6.5
1990-94	42	-0.5	...	...
1995-99	74	2.8	54	1.7
2000-04	112	3.9	82	2.4
2005-08	386	20.2	266	16.3
Vis-à-vis emerging Asia <sup>5</sup>	255	3.7	168	0.7
1990-94	90	2.1	...	...
1995-99	212	2.4	161	-1.0
2000-04	169	2.6	141	1.7
2005-08	306	3.8	219	1.0
Vis-à-vis Latin America <sup>5</sup>	228	0.8	128	1.2
1990-94	131	-2.2	...	...
1995-99	188	2.3	130	1.6
2000-04	101	-1.2	78	-1.2
2005-08	191	5.1	134	4.3

<sup>1</sup> External positions of BIS reporting banks from 17 advanced economies vis-à-vis all sectors (banks and the non-bank sector) in 28 emerging markets. <sup>2</sup> External loans of BIS reporting banks from 17 advanced economies vis-à-vis all sectors (banks and the non-bank sector) in 28 emerging markets. <sup>3</sup> Amounts outstanding at the end of quarter, quarterly averages. <sup>4</sup> Estimated exchange rate adjusted changes; quarterly averages. <sup>5</sup> Quarterly averages for the full sample, 1990–2008 (1996–2008 for cross-border loans).

Source: BIS, locational banking statistics; authors' calculations.

### 3. Cross-border bank lending and financial crises – a literature review

The early literature on emerging market crises focused on the role of trade linkages in the propagation of crises (see eg Glick and Rose, 1998; Eichengreen et al, 1996). Later on, as financial globalisation spread to emerging markets, the literature started to investigate the role of financial linkages in the propagation of a crises. Calvo (1998) for instance argued that contagion spread through the balance sheet effects of financial intermediaries. Kaminski and Reinhart (2000) found that the bank lending channel

outperformed the trade channel in explaining the vulnerability of emerging markets to contagion.<sup>4</sup> Van Rijckeghem and Weder (2003) found that common bank lenders were a fairly robust predictor of contagion. Likewise, Kaminski, Reinhart and Vegh (2003) identified a *leveraged common creditor* involved in all episodes of international spillover effects. Caramazza et al (2004) and Calvo et al (2008) confirmed that strong financial linkages substantially raised the probability of contagion. For the latest crisis, the IMF (2009a) also singled out bank linkages as the primary transmission channel. In summary, the main conclusion of the literature is that “even if banks are not the immediate trigger of financial contagion, their actions certainly make or contribute to the spillover” (Kaminski and Reinhart, 2000, p. 79).

The literature on the determinants of bank lending traditionally focused on classical push and pull factors.<sup>5</sup> Generally, it came to the conclusion that both sets of factors determined these flows (see eg Jeanneau and Micu, 2002). For instance, macroeconomic conditions of host countries (Garcia-Herrero and Martinez-Peria, 2005; Hernandez et al, 2001) as well as home countries (Goldberg, 2001) were identified as major factors influencing bank lending to the emerging markets. In addition, Papaioannou (2008) referred to geographical, historical and institutional factors. His results suggested that institutional underdevelopment could explain a significant part of the Lucas (1990) paradox, according to which capital did not flow from rich to poor countries but rather the other way around.

So far, there has been little empirical work on bank lending to the emerging markets in periods of crises. To our knowledge, Van Rijckeghem and Weder (2003) were the first who combined the traditional push and pull factors with financial stress indicators. They found that the emerging markets that depended on a lender exposed to a primary crisis country were more vulnerable to spillovers through bank flows. Heid et al (2004) confirmed such common-lender effects on the micro level. They also came to the conclusion that a sudden increase in risk aversion played a fundamental role in

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<sup>4</sup> Note, however, that Forbes and Chinn (2009) came to the conclusion that bilateral trade flows were a large and significant determinant of how shocks were transmitted to the emerging markets.

<sup>5</sup> A different strand of the literature focuses on driving forces of portfolio equity investment (see eg Lane and Milesi-Ferretti (2004)).

explaining cross-border lending by German banks.<sup>6</sup> The World Bank (2008) showed that tensions in the global interbank market were associated with lower growth of bank lending during the current crisis. McGuire and Tarashev (2008) established a link between measures of bank health in host countries and growth of cross-border bank flows to the emerging markets. Buch et al (2009) examined the relationship between macroeconomic shocks and banks' foreign assets. They found that bank responses were characterised by temporary overshooting and subsequent adjustment which extended over several quarters.

## **4. The empirical investigation**

### **4.1. The empirical model**

Building on the existing empirical literature discussed above, this paper analyses the nature of spillover effects in bank lending flows between advanced economies and emerging markets. We examine in particular whether global financial strains and financial stress in home and host countries were major driving forces of international bank lending. The linkage between cross border bank flows and financial crises periods has not yet been studied in sufficient detail in the literature. We also extend the literature in several other dimensions, including the data sample and the empirical model.

Our sample covers 17 advanced BIS reporting countries and 28 emerging market economies in three regions: emerging Asia, central and eastern Europe and Latin America.<sup>7</sup> The analysis is based on bilateral data and country pair panel estimates, on a quarterly basis, from 1993 to 2008. Data on cross-border banking flows come from the

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<sup>6</sup> There is a large literature analysing the determinants of bank lending based on the micro level data, ie various indicators of the financial condition of banks. One strand of this literature focuses on the impact of bank capital, especially in times of stress (see eg Gambacorta and Mistrulli, 2004). A second strand deals with the impact of financial innovation (eg Scheicher and Marques-Ibanez, 2008). For an overview, see Bernanke (2008).

<sup>7</sup> The advanced economies in our sample are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Japan, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom and the United States. The emerging market countries are, in Asia: China, India, Indonesia, Korea, Malaysia, the Philippines, Taiwan, Thailand and Vietnam; in Europe: Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia and Turkey; and in Latin America: Argentina, Brazil, Chile, Columbia, Mexico, Peru and Venezuela.

BIS locational banking statistics, which is based on the location (ie residence) of the counterparty. As already explained in *Chapter 2*, these data allow a better matching of the macroeconomic characteristics of lender and borrower countries with bilateral credit flows than would be the case with consolidated data.<sup>8</sup>

The dependent variable in our estimations is the external position of reporting banks in an advanced economy  $i$  ( $i = 1, \dots, 17$ ) vis-à-vis an emerging market  $j$  ( $j = 1, \dots, 28$ ) at time  $t$  ( $t = \text{Q1:1993} - \text{Q4 2008}$ ).<sup>9</sup> The external position includes standard cross-border loans from banks in country  $i$  to banks and the non-bank sector in country  $j$  (such loans account for about 80% of external positions), as well as some other types of capital flows, for instance, holdings by banks in country  $i$  of bonds, money market instruments and equities issued by banks and the non-bank sector in country  $j$ .<sup>10</sup> These observations enter our regressions as *changes* in external positions, adjusted for exchange rate effects.<sup>11</sup> Further details on the data are provided in the Annex.

The empirical framework used in this paper is the standard gravity model. The pioneering work in this field was done by Tinbergen (1962), who linked the volume of trade between two countries in a very simple manner to the economic size and the economic distance between the countries. In recent years, gravity models have been also applied to financial flows. The model in this paper is related to the gravity model for

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<sup>8</sup> However, by using the *locational banking statistics* we cannot control for third-party effects, that is bank lending by country A ultimately flowing to an institution residing in country C via a financial center in country B. Rather, we consider the flow from A to B and the flow from B to C. For variables representing the characteristics of lender countries, the consolidated banking statistic would be more appropriate. However, as most of the variables included in the estimation focus on borrower countries, we stick to the locational banking statistic.

<sup>9</sup> The dependent variable is "gross" only in the sense that we do not consider changes in the liabilities of banks in country  $i$  vis-à-vis banks and the non-bank sector in country  $j$ . However, it is "net" in the sense that they include repayments of loans. If no new loans are granted and debtors make scheduled repayments of old loans, the stock of old loans will decrease during a quarter.

<sup>10</sup> We use the data on external positions as these data are available since 1977, whereas the data on external loans are available only since 1995.

<sup>11</sup> The exchange rate adjustment takes into account exchange rate changes during a given quarter. For instance, stocks of outstanding loans from Switzerland to China at end-Q1 and end-Q2 2009 are reported in USD; they are converted into CHF using the end-Q1 and end-Q2 USD/CHF exchange rates. Then one subtracts end-Q1 from end-Q2 amounts in CHF to get the change in loans during the quarter, and one converts this CHF amount back into USD using the period average exchange rate. As this exchange rate

asset flows used in Martin and Rey (2004). In particular, our *basic model* comprises the following variables:

$$LOANS_{it} = \rho_0 + \rho_1 DISTANCE_{it} + \rho_2 GDP_j + \rho_3 GDP_i + \rho_4 INTEREST_{it} + \rho_5 GROWTH_{it} + \rho_6 EXCHANGE_{it} + \rho_7 X_{it} + \varepsilon_{it} \quad (1)$$

where the dependent variable LOANS is the (exchange-rate adjusted) change in the external position of the BIS reporting banks in country *i* vis-à-vis all sectors in an emerging market economy *j* at time *t*<sup>12</sup>; DISTANCE is the distance between the capitals of countries *i* and *j* (it is time-invariant); GDP\_i and GDP\_j are the respective GDPs of lender and borrower countries; INTEREST is the interest rate differential between the borrower and lender country; GROWTH is the growth differential between the borrower and lender country; EXCHANGE is the bilateral exchange rate change (units of country *j* currency per unit of country *i* currency)<sup>13</sup>; *X* is a vector of control variables; and  $\varepsilon$  is the vector of error terms. All variables are expressed as logarithms, except interest and growth differentials and the exchange rate, which are expressed in percentage points. Thus, the estimated coefficients  $\rho_i$  can be interpreted as elasticities or semi-elasticities. The null hypothesis of this basic model is that one should obtain the following signs of estimated coefficients  $\rho_i$ :

$\rho_1 > 0$  Smaller distance between country *i* and country *j* should, ceteris paribus, increase the volume of cross-border loans flowing from country *i* to country *j*;

$\rho_2, \rho_3 \gg 0$  Generally, gravity models stipulate a positive coefficient for the size of both lender and borrower economy. However, one can argue that banks in a lender country with a larger home market are less dependent on

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adjustment does not control for the whole valuation effect, we keep the exchange rate as an additional variable in the standard gravity model.

<sup>12</sup> The exchange-rate adjusted changes in cross-border flows also take negative values implying that, in a given quarter, country *j* repaid more in old loans to country *i* than it received in new loans from country *j*. Negative values can be observed, for instance, when advanced economies stop providing new loans, or provide some positive but small amount relative to the repayment of old loans by emerging markets. In order to use the logarithms for such observations we follow a method proposed by Papaioannou (2009): for negative values of the dependent variable we take the logarithm of the absolute value and assign it the negative sign.

<sup>13</sup> The index is normalised to the base year.

business in foreign markets, so that  $\rho_2$  could be negative. Similarly, smaller emerging markets could attract more cross-border loans than larger ones, so  $\rho_3$  could be negative. The sign of GDP coefficients has to be determined empirically;

- $\rho_4 > 0$  A higher relative interest rate differential should, ceteris paribus, increase the volume of cross-border loans flowing from country i to country j;
- $\rho_5 > 0$  A higher relative growth differential should, ceteris paribus, increase the volume of cross-border loans flowing from country i to country j;
- $\rho_6 < 0$  A depreciation of the emerging market currency vis-à-vis the advanced economy currency is expected to dampen the inflows of cross border loans as, ceteris paribus, it reduces the expected yield of an investment.

In order to investigate how the financial crises were transmitted from advanced to the emerging markets, and through which specific channels spillover effects occur, four different model specifications are chosen.

1. The *Global model* corresponds to the idea that variables determined on a global scale are major determinants of cross-border bank flows. Thus, in addition to standard gravity model variables, we introduce two measures of the state of the global financial market: the Chicago Board Options Exchange S&P 100 Volatility Index (*VIX*) and the average difference in yields between US corporate bonds and ten-year US treasuries (*RISK\_AVERSION*). The former is used as an indicator of expected short-term volatility of the global financial market, and the latter as an indicator of risk aversion of market participants.<sup>14</sup> We expect higher market volatility and more pronounced risk aversion to increase the risk premia on a worldwide scale and, consequently, reduce the volume of cross-border bank loans from advanced to the emerging market economies.
2. In the *Lender model*, characteristics of lender countries are assumed to have a major bearing on cross-border bank flows. In line with Krugman (2008) who

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<sup>14</sup> A high value of VIX corresponds to a more volatile market and hence higher cost of options to defray the volatility risk. It represents a widely used measure of the market's expectation of volatility over a 30-day period.

argued that the balance sheets of international financial intermediaries were a major source of spillover effects, we focus on the *common lender effect*, ie the proposition that financial stress in a creditor country (eg Spain) is determined by that country's exposure to the primary crisis country (eg the United States). We measure the common lender effect of a lender country  $i$  vis-à-vis the primary crisis country  $k$ ,  $CLE_{i,k}$  as:

$$CLE_{i,k} = \frac{\text{External assets of BIS reporting banks in country } i \text{ vs. primary crisis country } k}{\text{External assets of BIS reporting banks in country } i \text{ vs. all countries}}$$

Three different crisis periods are distinguished: the Mexican crisis (1994–95), with Mexico as the primary crisis country; the Asian crisis (1997–98), with Hong Kong, Indonesia, Korea, Malaysia, and Thailand as the primary crisis countries; and the current financial and economic crisis (2007–09), for which the United States are identified as the primary crisis country. We expect that the advanced economies with greater exposure to the primary crisis country to be subject to more pronounced de-leveraging and, hence, reduced capacity to lend to the emerging markets (see eg Rijckeghem and Weder, 2003).

In addition, a bank health indicator *BANK\_HEALTH\_LENDER* is used to account for the soundness of the banking sector in the lender country  $i$  (measured by the deviation of the banking industry subindex from the main equity price index). A positive coefficient is expected, implying that a banking sector under stress would be forced to reduce cross-border lending. For instance, if banks in a lender country are saddled with large non-performing loans in their home market, it is quite natural for them to reduce their cross-border loans.

3. The *Risk model* presumes that factors which make an individual borrower country most vulnerable to the transmission of financial stress are country-specific risk indicators. We use in particular the general government balance (*GOV\_BALANCE*) as a summary indicator of such country specific vulnerabilities. A higher fiscal deficit is expected to go hand in hand with a higher probability of future default on government debt and, hence, a lower volume of cross-border loans. One would therefore expect this variable also to capture differences in

country risk. By analogy to the lender model, we use an indicator of bank soundness in borrower country  $j$ , *BANK\_HEALTH\_BORROWER*, measured by the deviation of the banking industry subindex from the main equity price index, as an additional country specific risk indicator. A stronger banking sector in the borrowing country should be positively correlated with the volume of cross-border loans the country receives.

4. The *Linkages model* reflects the idea that the factor contributing most prominently to the transmission of financial stress is the degree of international financial integration of the borrower economy. More specifically, we assume that bilateral financial stocks are a large and significant determinant of how shocks are transmitted from advanced economies to the emerging markets. In this respect, we introduce a *bilateral* financial openness indicator *FINANCEOPEN*, measured as the ratio of external assets and liabilities of all sectors in country  $j$  vis-à-vis banks in BIS reporting country  $i$  relative to the country  $j$ 's GDP. In addition, we use the exchange rate regime indicator (*ER\_REGIME*) based on the Reinhart-Rogoff (2004) classification to capture the degree of monetary interlinkages between a borrower and a lender country. The null hypothesis is that greater financial openness and a more rigid exchange rate regime would induce larger bank flows from advanced to the emerging markets in good times; however, the tendency to disintegrate in a financial crisis period and the risk of fixed exchange rate regimes to come under pressure could make these countries more vulnerable to the withdrawal of cross-border banking flows and, as a result, accelerate the transmission of financial stress.

There are several potentially relevant empirical issues that could not be studied because of the lack of data. One issue is the maturity structure of cross-border loans – with data available on a quarterly basis, short-term flows (eg, motivated by short-term interest rate differentials) cannot be distinguished from loans with longer maturities. Similarly, the relative shares of new loans versus repayments of maturing loans are not known. The demand for cross-border loans also depends on the schedule of external debt repayment for emerging market countries, which is often not available on a quarterly basis for aggregate debt, let alone bilateral debt. Finally, possible effects of capital controls on



inflows of bank loans cannot be assessed because of the lack of consistent data series and the multitude of forms of capital controls.

## 4.2. Estimation results

The five different models are estimated using a random effects estimator with panel-corrected standard errors (PCSE), taking into account a heteroskedastic structure of errors and correlation between countries. In addition, country specific fixed effects (for 17 advanced and 28 emerging markets) are introduced.<sup>15</sup> One should note that this approach is not equivalent to a de facto fixed effects model, which would include the bilateral country fixed effects (for 17 advanced times 28 emerging markets). The disadvantage of the de facto fixed effects model is that the distance variable drops out of the equation due to a near-singular matrix. The Hausman specification test revealed that there was no systematic difference between fixed and random effects models, and, thus, confirmed that the random effects estimator was efficient in our empirical framework. The main results of the estimates of the five models are summarized in *Table 2*.<sup>16</sup>

Altogether, most estimated parameters have the expected signs, are statistically highly significant, and are robust with respect to different models and different specifications. The low  $R^2$  is not unusual in such large panels and is also due to the fact that we are trying to explain the (quarterly) flow data, which are by their very nature extremely volatile and often switch the sign or take on the zero value. The main conclusions one can draw from the estimates are the following:

- The *Basic model* shows, *first*, that greater distance between the lender and borrower countries reduces the amount of cross-border loans by about 6% for a 10% increase in the distance between the capitals of the two countries. The coefficient of  $-0.6$  is in line with other empirical investigations, which found a similar impact of the distance on international capital flows (see Buch, 2005).

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<sup>15</sup> In order to avoid a near-singular matrix some fixed effects have to be dropped (Basic model: US/MX; Global model: US/MX; Lender model: FI/GR/NO/US/CH; Risk model: US/LT; Linkage model: GR/NO/CN).

<sup>16</sup> The panel unit root tests of Levin, Lin and Chu (2002), Breitung (2000), Im, Peasaran and Shin (2003), and an ADF test based on Maddala and Wu (1999) were applied. The dependent variable and most explanatory variables revealed to be stationary. For some variables the tests showed signs of non-stationarity. However, as for large N and small T the cross-section dimension dominates, the possibility of non-stationarity can be ignored. The regressions were estimated using Eviews 6 and Stata 10.

Thus, notwithstanding considerable improvements in transportation, communication and information technology over the past two decades, distance still matters for international capital flows. This result holds in the other four models as well, with estimated parameters varying from  $-0.3$  to  $-0.7$ .<sup>17</sup> Furthermore, the impact of the distance on international capital flows seems to be comparable to the impact of the distance on international trade.

The *second* result that is also consistent across all specifications is that the size of the borrower country is positively correlated with the size of cross-border bank loans. The estimated elasticity implies that a 10% higher GDP in the borrower country will increase cross-border bank loans by slightly more than 10%.

The *third* main result is that the larger the economy of the lender country, the less its banks will engage in cross-border lending to emerging markets. More specifically, a 10% increase in the GDP of a lender country reduces its cross-border loans on average by 7%. Cross-border bank flows thus follow a pattern similar to international trade – smaller countries usually trade more with the rest of the world than bigger countries and are consequently more open.<sup>18</sup> Furthermore, the results might support the assumption that financial centres are usually located in small countries while in large countries the sector structure is more diversified.

*Fourth*, cross-border flows respond positively to interest rate and growth differentials, and negatively to the weakening of the borrower country currency relative to the lender country currency. None of these three semi-elasticities are large, however. A percentage point interest rate differential between the borrower and lender country will induce 0.01% larger inflows; a percentage point growth differential will induce 0.04% larger inflows; and a depreciation of the borrower country currency vis-à-vis the lender country currency by 1 percentage point will reduce the flows by about 0.02%. Nonetheless, all the estimates are statistically

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<sup>17</sup> Buch (2002) argues that one should be cautious in interpreting distance in terms of information costs only. There is evidence that trade declines in distance and that the negative coefficient of distance might partly be capturing this effect. In fact, Aviat and Coeurdacier (2007) showed that controlling for trade flows reduces the impact of the distance variable drastically.

<sup>18</sup> See, however, the section on robustness checks, where we compare alternative estimators and find that in some cases larger lender countries provide more cross-border bank flows. Other studies also report a reversal of the sign for this variable when alternative estimators are used (see e.g. Blank and Buch, 2009).

significant, confirming that capital flows respond to relative return differentials and income growth expectations (see Obstfeld and Rogoff, 1996).

**Table 2: Determinants of cross border bank flows from advanced to emerging markets - Random effects estimator with country specific fixed effects and PCSE**

Dependent variable: log of quarterly, exchange-rate adjusted change in external position (in millions of USD) of country <i>i</i> vis-à-vis country <i>j</i>					
	(1)	(2)	(3)	(4)	(5)
	BASIC	GLOBAL	LENDER	RISK	LINKAGES
	Model	Model	Model	Model	Model
DISTANCE	-0.594 (-8.51)***	-0.660 (-3.20)***	-0.693 (-8.77)***	-0.690 (-4.64)***	-0.315 (-1.93)***
GDP_BORROWER	1.038 (10.67)***	1.198 (12.24)***	1.098 (8.77)***	0.789 (6.75)***	1.14 (9.26)***
GDP_LENDER	-0.715 (-5.14)***	-0.972 (-6.40)***	-0.733 (-3.55)***	-0.656 (-3.95)***	-0.667 (-2.96)***
INTEREST	0.011 (4.50)***	0.005 (1.93)**	0.012 (4.30)***	0.016 (3.82)***	0.015 (5.19)***
GROWTH	0.044 (7.84)***	0.030 (5.03)***	0.046 (7.00)***	0.040 (6.10)***	0.049 (7.12)***
EXCHANGE	-0.015 (-6.76)***	-0.011 (-4.99)***	-0.016 (-6.27)***	-0.028 (-8.31)***	-0.011 (-4.49)***
VIX		-0.027 (-5.80)***			
RISK_AVERSION		-0.002 (-4.02)***			
COMMON LENDER US			-0.023 (-2.20)**		
COMMON LENDER AS			-0.010 (-0.95)		
COMMON LENDER MX			-0.286 (-3.88)***		
BANK_HEALTH_ LENDER			0.001 (2.52)**		
GOVBALANCE				0.080 (6.59)***	
BANK_HEALTH_ BORROWER				0.006 (11.01)***	
FINANCE_OPEN					0.165 (10.50)***
ER_REGIME					-0.380 (-9.66)***
R <sup>2</sup>	0.03	0.03	0.04	0.03	0.04
N	30,464	30,464	30,464	30,464	30,464

DurbinWatson	2.02	2.08	2.01	2.08	2.09
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Notes: Standard errors in parentheses.\*\*\* Significant at the 1% level,\*\* Significant at the 5% level,\* Significant at the 10% level. PCSE= panel-corrected standard errors.

- In the *Global model*, the two additional variables, VIX and RISKAVERSION, are both significant at the 1% level and have the expected negative sign. This result confirms that global financial market factors – a higher degree of financial market volatility and more pronounced risk aversion on the part of global investors – have a dampening impact on cross border lending from advanced to emerging markets. The estimated size of coefficients is low, but as both the volatility index and the corporate bond spread display considerable variation over time, these global factors are a significant channel through which spillover effects in international bank lending occur (see the section on contribution analysis).
- The results of the *Lender model* support the view that the characteristics of lending countries such as their exposure to the primary crisis country and the health of their banking sectors have a major bearing on cross-border bank flows to the emerging market countries. The model confirms in particular the *common lender effect*, according to which financial stress in the creditor country is determined by its exposure to the primary crisis country; this exposure in turn has a negative impact on the creditor country's loans to the emerging markets (see Rijkeghem and Weder, 2003). The impact of the common lender effect is confirmed for all three crisis episodes studied in this paper, but the coefficient is significant only for the Mexican and the current financial crises.

The second variable in this model, the indicator of a lender country's bank health confirms that stress in the banking sector of the lender country reduces cross-border loans to emerging markets.

- The results of the *Risk model* indicate that individual borrower country risk factors significantly affect cross-border bank flows. A percentage point higher general government budget deficit is on average associated with a 0.1% reduction in cross-border loans from advanced to the emerging market countries. This result is

in line with the empirical literature that identified high public deficits as an early warning indicator of financial crises.<sup>19</sup>

Likewise, the health of the banking sector in the borrower country helps attract cross-border inflows. For instance, if bank share prices increased by 10% relative to the overall share price index in a given quarter, the country received on average 0.06% more cross-border bank loans.

- The *Linkages Model* confirms that the degree of international linkages is a further factor that matters prominently for the transmission of financial stress via bank lending flows. A borrower country that has 10% higher degree of financial openness vis-à-vis a lender country will attract on average as much as 1.7% more cross-border bank loans. Conversely, to the extent that financial openness decreases during a crisis (a quite common phenomenon as the borrower country withdraws its deposits from the lender country, thereby reducing its external assets, and meanwhile the lender country reduces its loans to the borrower country, thereby reducing the latter's liabilities), one can expect cross-border loans to decrease by an equivalent amount. Hernandez et al. (2001), for instance, provide empirical evidence that contagion was more important during the 1990s' crises than in prior crisis episodes, and argue that this was most likely because of increasing financial integration over time. In addition, the IMF (2009c) argue as well, that financial interconnectedness within Europe significantly increases the risk of such adverse feedback loops during a crisis.

Finally, a more rigid exchange rate regime induces larger bank flows by way of stronger monetary integration with advanced economies. Thus, for instance, countries with fixed exchange rate regimes received on average 1.9% higher inflows compared to the countries with freely floating exchange rate regimes.<sup>20</sup>

The same mechanism might work in a financial crisis situation as well and contribute to the stabilisation of financial flows. However, this link may be a

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<sup>19</sup> See e.g. Goldstein, Kaminski and Reinhart (2000).

<sup>20</sup> In the Reinhart and Rogoff (2004) classification, fixed exchange rate regimes are assigned the rank 1 and the floaters rank 6; relative to the floaters the fixers would thus receive on average  $(1 - 6) \times (-0.38) = 1.9\%$  more cross-border bank loans.

stylized fact applicable to developments in recent years: fixed exchange rate regime are not a macroeconomic stabiliser per se. For example, in emerging Europe, a high degree of financial integration within the EU and fixed exchange rate regimes may have contributed to major imbalances, for instance an excessive credit growth and large current account deficits, and as such, made these countries more vulnerable to the withdrawal of cross-border banking flows during a crisis.

### 4.3. Contribution Analysis

The contribution analysis goes beyond the identification of statistically significant determinants of cross-border bank flows and provides additional information on the *economic* significance of the estimated parameters. In particular, the analysis quantifies the impact of global and country specific factors of home and host countries contributed on the observed bank flows between the countries. The contribution analysis also enables us to assess the impact of different model specifications on the size of cross-border bank flows, and, thus, to verify how financial stress is effectively transmitted from advanced to the emerging markets.<sup>21</sup> The contribution of each variable is calculated by multiplying the parameter estimated in the above regressions with the average value of the corresponding explanatory variable over a given period.<sup>22</sup> The contribution of each model is then the sum of the contributions of all variables included in the model.<sup>23</sup>

We focus in our analysis first on the three crisis periods taken together. In these periods, the variables of the basic gravity model made the largest contribution to the observed outflow of cross-border bank loans (*Figure 3*). The distance and the GDP of lender and

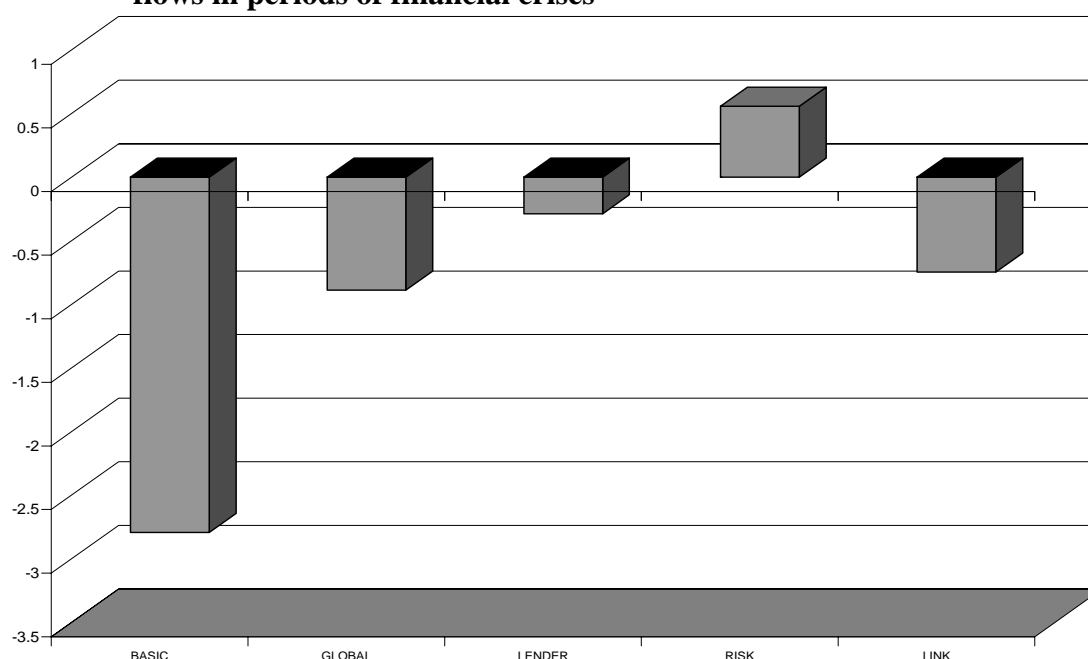
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<sup>21</sup> Deviations of actual values from estimated values can be attributed to factors not considered in the estimated models, or to exogenous shocks. Thus, the residuals indicate to what extent the model captures true developments. *Figure A1* in the Annex shows the residuals for all countries under consideration during the observation period. The residuals are white noise, ie they do not follow an autoregressive process. However, in line with the low  $R^2$ , they highlight the fact that the variables included in the model – although highly significant – only explain a small fraction of the actual cross-border bank flows from advanced to the emerging markets. As noted above, this is not unusual in such large panels and, more generally, in regressions with very volatile flow data.

<sup>22</sup> The analysis is based on the results of the random effects model with fixed country effects and panel-corrected standard errors presented in *Table 2*.

borrower countries made the largest contributions, while interest rate differentials, growth rate differentials and the bilateral exchange rate explain a much smaller fraction of cross-border bank flows in crisis periods. On average, variables of the basic model together contributed to an outflow of bank flows of \$16 million per country pair and quarter in the three crisis periods.

**Figure 3: Contribution of variables in five estimated models to cross-border bank flows in periods of financial crises**



Note: Vertical axis is the log of bilateral, quarterly, exchange-rate adjusted cross-border bank flows, in millions of US dollars, during the three crisis periods.

Source: Authors' calculations.

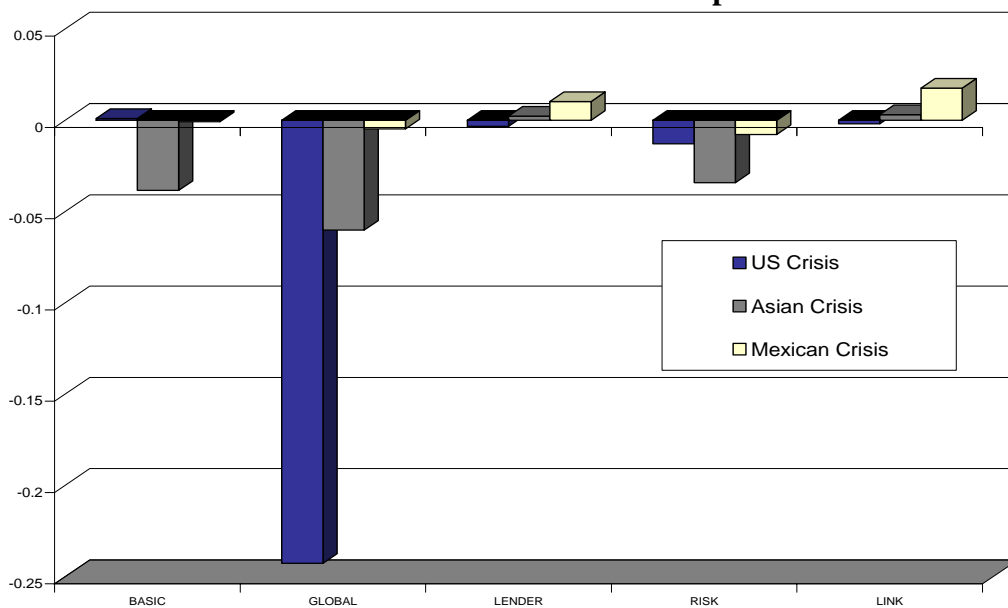
The variables in the remaining four models made comparatively smaller contributions to the observed cross-border flows in crisis periods. The global environment variables – global market volatility and global risk aversion – together contributed to an outflow of cross-border bank loans of \$2.4 million on average per country pair and quarter. The exposure of lender countries to a primary crisis country and banking sector problems in lender countries together contributed to an outflows of bank loans of \$1.3 million. Variables of the linkage model – the exchange rate regime and bilateral financial

<sup>23</sup> The contribution analysis of models (2) to (5) does not sum up the contributions of all variables in these models, but only those of *additional* variables in each model compared to the basic model. These contributions do not sum up to 100% because different models are estimated by separate regressions.

integration – on balance worked in favour of an outflow of funds of about \$2 million during financial stress periods. The only set of variables that promoted the inflow of cross-border loans in crisis situations under review were stable macroeconomic situation and healthy banking sectors in borrower countries, together they contributed to an inflow of about \$1.7 million.

Next we look at the contribution of different models to *changes* in cross-border flows. *Figure 4* shows the percentage change in cross-border flows explained by the five estimated models in the three different crises periods under review.<sup>24</sup> In the current financial crisis, global indicators seem to be the main driving force of the reduction in cross-border bank flows to emerging markets. The increase in global financial market volatility and higher risk aversion of global market participants accounted for 25% of the withdrawal of bank loans from emerging markets in 2007-08. The only other more noticeable contribution came from the worsening of borrower-specific risk factors.

**Figure 4: Contribution of variables in five estimated models to changes in cross border bank flows in three different crises periods**



Note: Vertical axis is the percentage change in bilateral, quarterly, exchange-rate adjusted cross-border bank flows, in millions of US dollars, explained by the respective model during each crisis period.

Source: Authors' calculations.

<sup>24</sup> Here the contributions are in percent as we calculate them by multiplying the estimated parameters with the average *change* of the corresponding explanatory variable observed over a given period.



During the *Asian* crisis, global risk factors also made the largest contribution (amounting to about 7%) to the reduction in cross-border bank flows. However, two other sets of factors accounted for a significant proportion of the reversal in bank flows as well; *first*, the reduction in emerging market growth rates from the basic gravity model; and second, the deterioration of financial indicators in borrower countries, ie, higher public deficits and worsening health of the banking sector. These two sets of factors accounted each for about 3% of the reduction of cross-border flows to the emerging markets during the Asian crisis.

In the *Mexican crisis*, the worsening of global financial conditions did not play a major role. This is quite obvious as the crisis was caused to a major extent by financial turbulences in *one* emerging market economy only. Rather, a withdraw of cross-border flows was predominantly affected by borrower-specific risk factors. By contrast, the good shape of the lender countries which were not seriously affected by the developments as well as an increasingly tight monetary linkage between borrower and lender countries added to a stabilisation of the bank flows to emerging markets.

Finally, we look at the contribution of individual explanatory variables from models 2-5 (ie, other than the standard gravity model) to changes in cross-border bank flows in different emerging market regions during the latest financial crisis. On balance, countries in emerging Europe experienced a less severe reduction in cross-border bank flows than the other two regions (*Figure 5*). The contribution analysis points to three set of factors that accounted for this difference.

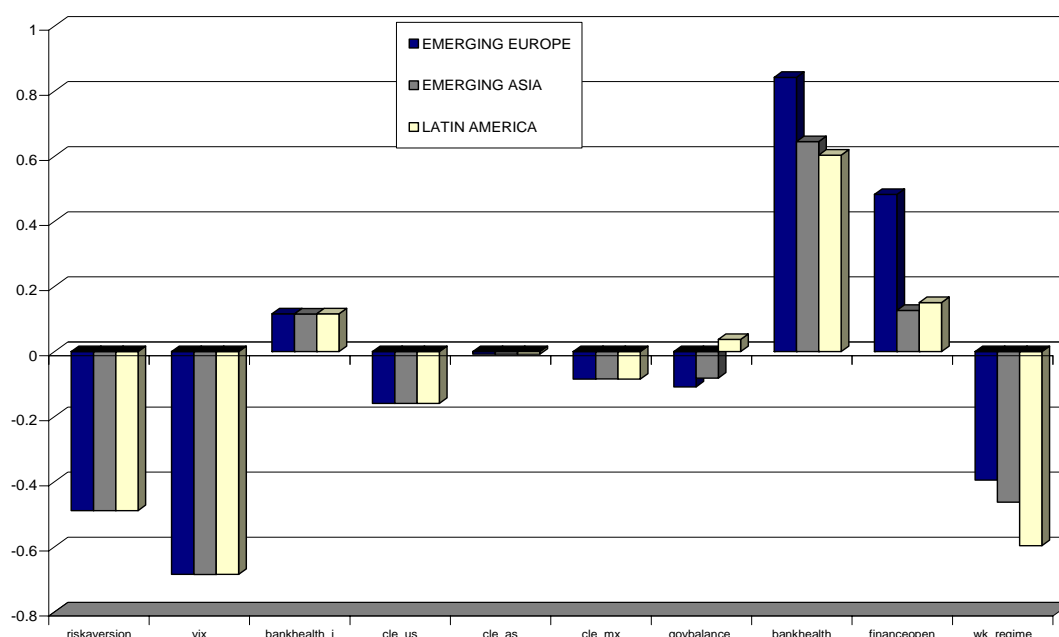
*First*, healthier banking sectors in emerging Europe, which might be the consequence of institutional preconditions for EU accession and the high share of foreign-owned banks in this region – seem to have worked in favour of additional cross-border bank flows.<sup>25</sup> *Second*, tighter monetary integration with lender countries may have also played a stabilising role in contrast to emerging Asia and especially Latin America, where more flexible exchange rate regimes have been associated with larger reductions in cross-

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<sup>25</sup> There is a strong positive correlation of 0.7 between the degree of foreign ownership in the banking sector and the bank health indicator in emerging Europe.

border bank flows during the current turmoil. *Third*, and most striking is the remarkable impact of greater bilateral financial integration of emerging Europe which has been associated with average inflows of cross-border bank loans of \$1.6 million per country pair and quarter significantly higher than either in emerging Asia or Latin America (Figure 5).

**Figure 5: Contribution of financial stress factors to cross-border bank flows in different emerging market regions during the current financial crisis**



Note: Vertical axis is the log of bilateral, quarterly, exchange-rate adjusted cross-border bank flows, in millions of US dollars, during the financial crisis of 2007-08.

Source: Authors' calculations.

## 5. Robustness checks

### 5.1. Econometric options

#### a) Time effects

As the first step in our robustness checks, we added period fixed effects and re-estimated the five different models using a random effects estimator with country specific fixed effects and panel-corrected standard errors. This correction might be relevant because some explanatory variables show signs of trend-stationarity. The results are presented in *Table A.1* in the Annex. The inclusion of time dummies did not significantly alter the original results. The main differences are that the interest rate

variable becomes statistically less significant (it is now insignificant in the *Global model*); while the common lender effect becomes highly significant for all three crisis periods.

#### **b) Dynamic instrumental variables approach**

In the second step of robustness checks we used the instrumental variables approach proposed by Anderson and Hsiao (1981). In particular, we added a lagged dependent variable to regression equations in order to control for potential endogeneity of explanatory variables. The constant, the second lag of the endogenous variable, the exogenous variables and their first lags, as well as the two lags of the predetermined variables, were used as instruments. *Table A.2* in the Annex shows the results.

The instrumental variables estimates are on the whole quite similar to the original ones from *Table 2*. The lagged dependent variable is significant at the 1% level in all estimated models. This points to a certain degree of persistence in bank lending flows, without, however, offering a clear explanation for it. One important difference compared to the original model is that the lender country GDP changes the sign, implying a positive link between the size of the economy of lender countries and their bank loans to the emerging markets. This positive link is normally found in standard gravity models. Another difference is that the significance of the distance and GDP parameters (for both lender and borrower countries) diminishes significantly.

#### **c) The Woolridge approach**

Helpman, Melitz and Rubinstein (2008) pointed out that gravity models should not rely only on country samples with positive trade flows – samples with zero trade flows between countries also contained useful information. They argued that the selection bias embedded in the commonly used data sets may be substantial and proposed an alternative, two-step estimation method in order to exploit full information contained in the data on zero flows between countries. Likewise, Silva and Tenreyo (2006) suggested a Poisson pseudo-maximum likelihood estimator, which is robust to different patterns of heteroskedasticity, to deal with this kind of problem.

Compared to other studies, where about half of the observations are zeros (up to 95% in some data sets), zeros account for approximately 20% of observations in our sample. Nevertheless, in order to exploit the full extent of information, we used the estimator proposed by Woolridge (1995 and 2002), who postulated a two-step Heckman selection model for panels. This approach is based on the idea that a country will first decide whether it will lend to an emerging market. In the second step, it decides *how much* it will lend. In the first step of this procedure we thus introduce an additional variable (“Mundlak-Chamberlain correction”) in a panel probit model in order to control for the fixed effects.<sup>26</sup> In the second step, we estimated a simple fixed effects model for all countries that engage in cross-border lending, using the inverse Mills ratio<sup>27</sup> calculated from the first-step estimation.

*Table A.3* in the Annex shows the results of the second-step fixed effects estimation using the Woolridge approach. The inverse Mills ratio is significant in all models, suggesting that it was appropriate to take account of the selection bias. Nevertheless, the results after this correction are quite comparable to the original ones in *Table 2*. One difference is that we cannot calculate the distance variable in the fixed effects estimator; it has to be omitted as a result of a near-singular matrix. Another difference is that the coefficients on lender and borrower country GDP are higher than in the original random effects model. The coefficients on the remaining variables keep their signs and statistical significance. Thus, even after controlling explicitly for the zero flow problem, the results do not differ substantially from the original random effects estimation.

## **5.2. Country-specific risk factors: an extended analysis**

Our empirical analysis has so far come to the conclusion that country specific factors were significant determinants of cross-border bank flows. In the following, we introduce additional country specific risk factors for borrower countries following

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<sup>26</sup> This procedure is based on an approach for panel probit models developed by Mundlak (1978) and Chamberlain (1980, 1982): for each exogenous variable, an additional variable (deviation from its mean) is included in the Heckman first step-estimator.

<sup>27</sup> Mundlak (1978) proposed to calculate the inverse Mills ratio for the whole sample while Chamberlain (1980, 1982) used a more general approach allowing for a dynamic specification, and proposed to calculate time-specific inverse Mills ratios. Note that standard errors calculated by Stata under this

Goldstein, Kaminski and Reinhart (2000) and test how far they contribute to the transmission of financial stress.

*First*, we introduce the spread between the lending and deposit interest rates charged by commercial banks (*SPREADLD*). This spread acts as a proxy for financial sector quality, as inefficient or loss-making banks need larger spreads to ensure profitability. The spread is expected to be negatively correlated with the dependent variable – a worsening financial sector quality in the borrower country should go hand in hand with a reduction in cross-border bank flows to the country.

*Second*, we replace the fiscal indicator (general government balance) with short-term debt as a percentage of GDP (*SHORT DEBT*). This indicator points more directly to the short-term foreign liabilities of the economy as a whole, rather than a mixture of domestic and foreign liabilities of the government (assuming that emerging market governments finance their deficits partly from domestic and partly from foreign sources). A higher ratio of short-term debt could indicate future liquidity problems and induce foreign lenders to reduce their cross-border commitments.

*Third*, we add a foreign reserves indicator – the official foreign exchange reserves as a percentage of M2 (*FOREIGN RESERVES*). The build-up of large precautionary holdings of foreign exchange reserves in emerging markets countries provides an important self-insurance against external payment shocks, and should be therefore positively correlated with cross-border loans (Aizenman, 2009; Obstfeld, Shambaugh and Taylor, 2009).

*Fourth*, we add the external current account balance in percent of GDP (*CURRENT ACCCOUNT*). We expect that a higher current account deficit will reduce foreign bank inflows, as it signals that domestic absorption is higher than domestic saving, and, therefore, that the borrowing country may face external sustainability problems in the longer run.

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approach are not entirely correct: in the first step, the selected estimator does not take into account model uncertainty; in the second step, it does not consider heteroscedasticity of errors.

*Fifth*, we add the real growth rate of private domestic private sector credit (*CREDIT GROWTH*). Rapid credit growth sustained over several years can often signal a credit boom, which is typically followed by an increase in non-performing loans. One can therefore expect foreign lenders to be more cautious in extending cross-border loans to a country experiencing a credit boom. In order to avoid endogeneity stemming from the fact that higher inflows of capital lead to more pronounced current account deficits and domestic credit growth, we lag the current account and credit growth variables by one period.

Again, the analysis is done with the random effects estimator. *Table A.4* in the Annex summarizes the results. All additional country specific risk variables are statistically highly significant. All coefficients have the expected signs, except for the current account and credit growth variables. The signs of coefficients on these variables indicate that higher current account deficit and stronger credit growth in fact induced lender countries to provide more credit to the emerging markets. In other words, these variables did not operate as early warning indicators of external and domestic vulnerability but were rather interpreted as signs of buoyant demand for external financing. Such interpretation of risk factors may have contributed to excessive lending to some emerging markets especially the catching-up countries in emerging Europe, where current account deficits kept on widening and credit kept on expanding very rapidly for several years in the expectation of smooth convergence. Consumption smoothing is legitimate for emerging markets up to a certain degree. However, as the experience of countries such as Greece, Ireland, Portugal and Spain shows, it is not risk-free, as the catching-up economies eventually need to generate sufficient productivity gains to increase domestic saving and reduce external deficits.

### **5.3. Regional samples**

To assess the regional differences in the determinants of cross-border bank flows, we ran separate regressions of the five original models from *Table 2* for emerging Europe, Asia and Latin America. The analysis is done using the random effects estimator from

the original set of regressions. The results are presented in *Tables A.5, A.6 and A.7* in the Annex.

On the whole, the regional estimates are very much in line with the original estimates for the full sample of countries. For some variables we obtain less significant estimates, which is not surprising taking into account the smaller number of observations.<sup>28</sup> In the *Basic Model*, all variables have the expected signs, but several variables of the standard gravity model are no longer statistically significant. This suggests that the gravity model might be more relevant in studying credit flows *across* the regions than *within* each individual region. One interesting result is that, unlike the Asian and Latin American samples, the interest rate differential is not significant in emerging Europe. This suggests that interest rate differentials did not play a key role for bank lending flows to emerging Europe. As the bulk of cross-border lending to the emerging Europe is done by western European banks, this result points to the “soft” aspects such as strong linkages between parent banks and their subsidiaries, rather than the “hard” aspects such as interest rate differentials, as the more important determinants of cross-border bank flows.

The financial stress variables keep their signs as well as significance in the regional regressions. This suggests that spillover effects take place through similar channels in all three emerging market regions. Emerging Europe stands out with respect to the size and significance of the common lender effect across the three crisis episodes. This results probably reflects the fact that major western European banks are typically heavily involved in several emerging European markets at the same time, and may therefore have to reduce their exposures more or less simultaneously when liquidity crisis forces them to de-leverage.

#### **5.4. Different crisis periods**

To assess differences in the determinants of cross-border bank flows during three different crisis episodes we ran separate regressions for the Mexican crisis of 1994–95,

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<sup>28</sup>The estimations include 153 cross sections for the Asian sample, 204 for the European sample, and 119 for the Latin American sample compared to the 476 cross sections in the original full sample.

the Asian crisis of 1997–98, and the current economic and financial crisis of 2007–08. As with regional regressions, the estimates are done using the random effects estimator. The results are presented in *Tables A.8, A.9 and A.10* in the Annex.

For the Mexican and Asian crises (*Tables A.8 and A.9*), the determinants of cross-border flows were largely the same as in the full sample, although some coefficients were less significant, especially for the Mexican crisis. This is not surprising taking into account the smaller number of observations.<sup>29</sup>

For the current crisis, none of the variables representing financial stress in borrower and lender countries switched the sign (*Table A.10*). However, there are two major deviations from the original results. *First*, the interest rate differential is now significantly negative in all specifications, implying that higher interest rates in emerging markets relative to advanced economies *reduced* the inflows of bank credit. This probably reflects a combination of increased risk premia being inherent in emerging market interest rates, and of greater risk aversion on the part of advanced economy lenders.

*Second*, the coefficient of lender country GDP is reversed, i.e. it becomes positive. Again, this positive link is usually found in standard gravity models. Our hypothesis is that in the current crisis, larger advanced economies have tended to have greater fiscal and monetary policy freedom to handle the negative effects of the financial crisis, and their international banks were therefore not forced to reduce cross-border loans to the emerging markets to such an extent as banks from smaller advanced economies.

## **6. Conclusions**

This paper studied the nature of spillover effects in bank lending flows from advanced to the emerging market economies and tried to identify the main determinants of such flows. Based on a gravity model, we constructed a panel data set of bilateral cross-border bank flows from 17 advanced economies to 28 emerging market economies in

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<sup>29</sup> The estimations include 3808 observations in each sub-sample compared to 30,464 observations in the original full sample estimation.



three regions: Asia, Europe and Latin America. The observation period covers quarterly data from 1993 to 2008 and contains some 30,500 observations.

Based on the econometric panel analysis, we found that variables of the standard gravity model were significant determinants of international bank lending. Greater distance between lender and borrower countries and larger home markets in lender countries significantly reduced cross-border loans to the emerging markets. By contrast, larger markets in borrower countries increased the size of cross-border bank flows. Cross-border flows also responded positively to interest rate and growth differentials, and negatively to the weakening of the borrower country currency. However, none of these three semi-elasticities was as large as the ones associated with the variables of the standard gravity model.

With respect to the transmission of financial stress, the analysis revealed that both global and country specific risk factors, in lender as well as in borrower countries, were significant determinants of cross-border bank flows. This result applies to all three emerging market regions, suggesting that spillover effects occur through similar channels. In particular, there is evidence that advanced economies readjusted cross-border bank loans to emerging markets in response to reassessment of global risk (the “*wake-up call*”), but also in response to their own exposure to a primary crisis country (the “*common lender effect*”). Unstable financial environment in advanced economies encouraged a reduction in cross-border bank loans to the emerging markets. Lender countries also reduced cross-border loans in response to the worsening of country-specific risk factors in emerging markets, in particular higher fiscal deficits and deteriorating banking sector performance in borrower countries. By contrast, stronger financial and monetary linkages between lender and borrower countries helped stabilise cross-border bank flows even in times of financial stress.

Our analysis also produced some surprising results. A differentiation across emerging market samples revealed that the interest rate differential was not a significant determinant of cross border bank flows to emerging Europe. Our hypothesis is that lending to emerging Europe might be primarily driven by “soft” determinants such as

strong linkages between parent banks and their subsidiaries, rather than “hard” determinants such as interest rate differentials.

Another unexpected result was that high current account deficits and rapid credit growth in borrowing countries were not interpreted as risk factors, leading to a reduction in cross-border bank flows to emerging markets, but rather as a sign of buoyant demand, thus contributing to the build-up of large external and internal imbalances, especially in emerging Europe in recent years.

A comparison of crisis periods revealed that in the latest financial crisis, the most important channel for spillovers in cross-border lending between advanced and emerging markets occurred were greater expected volatility of global financial markets and reassessment of global risk. Healthier banking sectors, more rigid exchange rate regimes and stronger financial integration contributed to the stability of cross-border bank flows to emerging Europe. During the Asian crisis, worsening global environment and increased risk of borrower countries were the main channels of transmission of financial stress. During the Mexican crisis, a deterioration of macroeconomic conditions in the emerging markets was the major influence leading to the outflow of funds during the crisis.

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## APPENDIX

Table A.1 Determinants of cross-border bank flows from advanced to emerging markets  
- Random effects estimator with country fixed effects/time effects and PCSE

Dependent variable: log of quarterly, exchange-rate adjusted change in external position (in millions of USD) of country <i>i</i> vis-à-vis country <i>j</i>					
	(1)	(2)	(3)	(4)	(5)
	BASIC	GLOBAL	LENDER	RISK	LINKAGE
	Model	Model	Model	Model	Model
DISTANCE	-0.658 (-2.83)***	-0.659 (-3.29)***	-0.790 (-2.88)***	-0.694 (-4.18)***	-0.286 (-1.23)
GDP_BORROWER	1.196 (9.82)***	1.210 (9.95)***	1.3622 (9.23)***	0.791 (6.08)***	0.826 (5.42)***
GDP_LENDER	-0.795 (-3.72)***	-0.888 (-4.28)***	-0.594 (-1.78)*	-0.904 (-4.37)***	-1.783 (-6.78)***
INTEREST	0.005 (1.87)*	0.004 (1.32)	0.006 (1.87)*	0.010 (2.16)**	0.007 (2.35)**
GROWTH	0.029 (4.85)***	0.024 (3.92)***	0.027 (3.93)***	0.029 (4.14)***	0.035 (4.95)***
EXCHANGE	-0.013 (-6.09)***	-0.012 (-5.31)***	-0.014 (-5.43)***	-0.028 (-8.19)***	-0.011 (-4.29)***
VIX		-0.034 (-3.56)***			
RISK_AVERSION		-0.003 (-1.66)*			
COMMON LENDER US			-0.020 (-1.90)**		
COMMON LENDER AS			-0.032 (-2.62)***		
COMMON LENDER MX			-0.220 (-2.78)***		
BANK_HEALTH_ LENDER			0.001 (2.14)**		
GOVBALANCE				0.054 (4.09)***	
BANK_HEALTH_ BORROWER				0.005 (8.26)***	
FINANCE_OPEN					0.178 (11.14)***
ER_REGIME					-0.416 (-10.57)***
R2	0.05	0.06	0.06	0.06	0.07
N	30464	30464	30464	30464	30464
DurbinWatson	2.01	2.02	2.01	2.03	2.05

Notes: Standard errors in parentheses.\*\*\* Significant at the 1% level,\*\* Significant at the 5% level,\* Significant at the 10% level. PCSE= panel-corrected standard errors.

Table A.2 Determinants of cross border bank flows from advanced to emerging markets – IV estimator

Dependent variable: log of quarterly, exchange-rate adjusted change in external position (in millions of USD) of country <i>i</i> vis-à-vis country <i>j</i>					
	(1)	(2)	(3)	(4)	(5)
	BASIC	GLOBAL	LENDER	RISK	LINKAGE
	Model	Model	Model	Model	Model
DISTANCE	-0.248 (-5.08)***	-0.290 (-6.18)***	-0.229 (-6.18)***	-0.315 (-7.85)***	-0.466 (-14.87)***
GDP_BORROWER	0.070 (2.49)**	0.091 (3.30)***	0.054 (2.67)***	0.093 (4.11)***	0.253 (10.79)***
GDP_LENDER	0.056 (2.14)**	0.064 (2.54)**	0.082 (3.24)***	-0.063 (-3.48)***	0.111 (4.72)***
INTEREST	0.006 (3.18)***	0.005 (2.26)**	0.008 (5.78)***	0.012 (6.20)***	0.009 (4.29)**
GROWTH	0.029 (4.53)***	0.021 (3.29)***	0.029 (5.37)***	0.033 (6.09)***	0.052 (8.01)***
EXCHANGE	-0.015 (-6.76)***	-0.014 (-6.16)***	-0.016 (-6.23)***	-0.029 (-8.34)***	-0.014 (-5.86)***
VIX		-0.030 (-6.44)***			
RISK_AVERSION		-0.0003 (-0.58)			
COMMON LENDER_US			-0.0002 (-0.09)		
COMMON LENDER_AS			-0.007 (-1.72)*		
COMMON LENDER_MX			-0.003 (-0.13)		
BANK_HEALTH_ LENDER			0.001 (2.01)**		
GOVBALANCE				0.031 (4.10)***	
BANK_HEALTH_ BORROWER				0.002 (5.12)***	
FINANCE_OPEN					0.050 (4.69)***
ER_REGIME					-0.161 (-5.22)***

Notes: Standard errors in parentheses.\*\*\* Significant at the 1% level,\*\* Significant at the 5% level,\* Significant at the 10% level.



Table A.3 Determinants of cross-border bank flows from advanced to emerging markets  
– Woolridge approach

Dependent variable: log of quarterly, exchange-rate adjusted change in external position (in millions of USD) of country <i>i</i> vis-à-vis country <i>j</i>					
	(1)	(2)	(3)	(4)	(5)
	BASIC	GLOBAL	LENDER	RISK	LINKAGE
	Model	Model	Model	Model	Model
GDP_BORROWER	1.893 (7.94)***	1.855 (7.94)***	1.759 (7.69)***	1.389 (6.53)***	1.455 (8.03)***
GDP_LENDER	-1.031 (-4.31)***	-1.275 (-5.22)***	-1.139 (-4.42)***	-0.732 (-2.89)***	-0.749 (-2.98)***
INTEREST	0.029 (5.20)***	0.016 (5.20)***	0.021 (4.73)***	0.051 (5.53)***	0.018 (4.31)***
GROWTH	0.077 (8.48)***	0.077 (8.48)***	0.060 (6.72)***	0.064 (6.83)***	0.064 (7.09)***
EXCHANGE	-0.022 (-6.75)***	-0.022 (-6.75)***	-0.020 (-5.95)***	-0.035 (-7.65)***	-0.012 (-3.67)***
VIX		-0.034 (-3.56)***			
RISK_AVERSION		-0.003 (-1.66)*			
COMMON LENDER_US			-0.035 (-2.46)**		
COMMON LENDER_AS			-0.013 (-1.01)		
COMMON LENDER_MX			-0.373 (-3.07)***		
BANK_HEALTH_ LENDER			0.004 (3.73)***		
GOVBALANCE				0.133 (7.45)***	
BANK_HEALTH_ BORROWER				0.008 (10.91)***	
FINANCE_OPEN					0.152 (7.97)***
ER_REGIME					-0.466 (-9.20)***
R2	0.02	0.04	0.02	0.03	0.04
N	30464	30464	30464	30464	30464

Notes: Standard errors in parentheses.\*\*\* Significant at the 1% level,\*\* Significant at the 5% level,\* Significant at the 10% level.

Table A.4 Determinants of cross-border bank flows from advanced to emerging markets  
 – Random effect estimator with country fixed effects/time effects and PCSE

Dependent variable: log of quarterly, exchange-rate adjusted change in external position (in millions of USD) of country <i>i</i> vis-à-vis country <i>j</i>	
	Extended RISK Model
DISTANCE	-0.688 (-9.46)***
GDP_BORROWER	1.247 (9.12)***
GDP_LENDER	-0.806 (-4.28)***
INTEREST	0.017 (3.25)***
GROWTH	0.020 (2.61)***
EXCHANGE	-0.015 (-4.02)***
SPREADLD	-0.0003 (-2.67)***
SHORT DEBT	-0.010 (-1.98)**
FOREIGN RESERVES	0.008 (2.74)***
L_CURRENT ACCOUNT	-0.037 (-1.88)*
L_CREDIT GROWTH	0.006 (3.10)***
BANK HEALTH	0.005 (8.41)***
R2	0.06
N	30464

Notes: Standard errors in parentheses.\*\*\* Significant at the 1% level,\*\* Significant at the 5% level,\* Significant at the 10% level.

In order to avoid a near-singular matrix some of the country fixed effects have to be eliminated: US/IN/TR/TW/VN.

Table A.5 Determinants of cross border bank flows from advanced to emerging markets  
 – Random effects estimator for *emerging Asia* with country fixed effects and PCSE

Dependent variable: log of quarterly, exchange-rate adjusted change in external position (in millions of USD) of country <i>i</i> vis-à-vis country <i>j</i>					
	(1)	(2)	(3)	(4)	(5)
	BASIC	GLOBAL	LENDER	RISK	LINKAGE
	Model	Model	Model	Model	Model
DISTANCE	-0.136 (-0.29)	-0.147 (-0.33)***	0.082 (0.17)	0.018 (0.04)	-0.010 (-0.02)
GDP_BORROWER	0.339 (1.45)	0.605 (2.58)**	0.530 (1.89)**	-0.172 (-0.69)	1.067 (3.60)***
GDP_LENDER	-0.188 (0.73)	-0.550 (-1.99)	-0.394 (-1.07)	-0.206 (-0.73)	-0.160 (-0.43)
INTEREST	0.051 (4.97)***	0.045 (4.31)***	0.060 (5.02)***	0.024 (2.28)**	0.082 (6.53)***
GROWTH	0.114 (8.17)***	0.087 (6.15)***	0.117 (7.19)***	0.078 (5.32)***	0.093 (5.35)***
EXCHANGE	-0.022 (-4.42)***	-0.019 (-3.85)***	-0.026 (-4.56)***	-0.028 (-5.79)***	-0.008 (-1.31)
VIX		-0.046 (-5.06)***			
RISK_AVERSION		-0.001 (-1.24)			
COMMON LENDER US			-0.034 (-1.66)*		
COMMON LENDER AS			-0.003 (-0.12)		
COMMON LENDER MX			-0.294 (-2.56)***		
BANK_HEALTH_ LENDER			0.004 (4.42)***		
GOVBALANCE				0.257 (6.99)***	
BANK_HEALTH_ BORROWER				0.664 (11.57)***	
FINANCE_OPEN					0.158 (2.22)**
ER_REGIME					-0.605 (-6.14)***
R2	0.02	0.04	0.03	0.04	0.04
N	9792	9792	9792	9792	9792

Notes: Standard errors in parentheses.\*\*\* Significant at the 1% level,\*\* Significant at the 5% level,\* Significant at the 10% level. PCSE= panel-corrected standard errors. Due to near-singular matrix the following dummies have to be eliminated from the regression: Basic model: US/VN; Global model: US/VN; Lender model: GR/NO/SE/US/VN; Risk model: US/VN; Link model: GR/NO/US/VN.

Table A.6. Determinants of cross border bank flows from advanced to emerging markets – Random effects estimator for *emerging Europe* with country fixed effects and PCSE

Dependent variable: log of quarterly, exchange-rate adjusted change in external position (in millions of USD) of country <i>i</i> vis-à-vis country <i>j</i>					
	(1)	(2)	(3)	(4)	(5)
	BASIC	GLOBAL	LENDER	RISK	LINKAGE
	Model	Model	Model	Model	Model
DISTANCE	-0.880 (-7.83)***	-0.880 (-7.85)***	-0.963 (-7.77)***	-0.967 (-7.86)***	-0.395 (-3.83)***
GDP_BORROWER	0.919 (7.56)***	1.095 (8.75)***	0.774 (4.43)***	0.965 (5.97)***	0.793 (5.00)***
GDP_LENDER	-0.306 (-1.40)	-0.660 (-2.93)**	-0.027 (-0.08)	-0.563 (-2.02)**	-0.262 (-0.95)
INTEREST	0.002 (0.51)	-0.001 (-0.49)	-0.000 (-0.01)	-0.013 (-1.57)	0.005 (1.35)
GROWTH	0.048 (5.86)***	0.040 (4.85)***	0.053 (5.60)***	0.061 (5.89)***	0.040 (3.91)***
EXCHANGE	-0.005 (-1.89)**	-0.003 (-1.32)	-0.003 (-1.08)	-0.031 (-3.62)***	-0.007 (-2.23)**
VIX		-0.016 (-2.39)**			
RISK_AVERSION		-0.002 (-2.39)**			
COMMON LENDER US			-0.024 (-1.67)*		
COMMON LENDER AS			-0.035 (-2.87)***		
COMMON LENDER MX			-0.183 (-2.04)**		
BANK_HEALTH_ LENDER			0.001 (1.37)		
GOVBALANCE				-0.015 (-0.78)	
BANK_HEALTH_ BORROWER				0.002 (1.82)**	
FINANCE_OPEN					0.185 (14.40)***
ER_REGIME					-0.302 (-4.40)***
R2	0.06	0.06	0.06	0.04	0.10
N	13056	13056	13056	13056	13056

Notes: Standard errors in parentheses.\*\*\* Significant at the 1% level,\*\* Significant at the 5% level,\* Significant at the 10% level. PCSE= panel-corrected standard errors. Due to near-singular matrix the following dummies have to be eliminated from the regression: Basic model: US/TR; Global model: US/TR; Lender model: GR/NO/SE/US/TR; Risk model: US/TR; Link model: NO/US/TR.

Table A.7. Determinants of cross border bank flows from advanced to emerging markets – Random effects estimator for *Latin America* with country fixed effects and PCSE

Dependent variable: log of quarterly, exchange-rate adjusted change in external position (in millions of USD) of country <i>i</i> vis-à-vis country <i>j</i>					
	(1)	(2)	(3)	(4)	(5)
	BASIC	GLOBAL	LENDER	RISK	LINKAGE
	Model	Model	Model	Model	Model
DISTANCE	0.299 (0.23)	-0.407 (-0.09)	2.382 (1.65)*	-4.26 (-1.38)	-1.023 (-0.70)
GDP_BORROWER	1.709 (6.91)***	1.802 (6.89)***	0.158 (5.50)***	1.065 (4.07)***	1.721 (6.97)***
GDP_LENDER	-1.42 (-4.85)***	-1.531 (-4.80)**	-0.367 (3.50)***	-0.932 (-3.13)***	-0.283 (1.34)
INTEREST	0.017 (2.98)***	0.007 (1.03)	0.022 (3.07)***	0.013 (1.94)**	0.024 (3.65)***
GROWTH	0.009 (0.92)	-0.010 (-1.07)	0.007 (0.65)	0.003 (0.28)	0.020 (1.80)*
EXCHANGE	-0.028 (-4.11)***	-0.015 (-2.27)**	-0.029 (-3.81)***	-0.029 (-4.24)***	-0.008 (-0.99)
VIX		-0.029 (-2.78)***			
RISK_AVERSION		-0.002 (-1.63)*			
COMMON LENDER US			-0.004 (-0.21)		
COMMON LENDER AS			-0.024 (-1.20)		
COMMON LENDER MX			-0.477 (-2.23)**		
BANK_HEALTH_ LENDER			0.002 (1.93)**		
GOVBALANCE				0.086 (4.05)***	
BANK_HEALTH_ BORROWER				0.0056 (2.72)***	
FINANCE_OPEN					0.001 (0.01)
ER_REGIME					-0.255 (-4.10)***
R2	0.03	0.03	0.04	0.02	0.03
N	7616	7616	7616	7616	7616

Notes: Standard errors in parentheses.\*\*\* Significant at the 1% level,\*\* Significant at the 5% level,\* Significant at the 10% level. PCSE= panel-corrected standard errors. Due to near-singular matrix the following dummies have to be eliminated from the regression: Basic model: US/VE; Global model: US/VE; Lender model: GR/NO/SE/US/VE; Risk model: US/VE; Link model: GR/NO/US/VE.

Table A.8 Determinants of cross border bank flows from advanced to emerging markets – Random effects model for the *Mexican crisis (1994/1995)* with country fixed effects and PCSE

Dependent variable: log of quarterly, exchange-rate adjusted change in external position (in millions of USD) of country <i>i</i> vis-à-vis country <i>j</i>					
	(1)	(2)	(3)	(4)	(5)
	BASIC	GLOBAL	LENDER	RISK	LINKAGE
	Model	Model	Model	Model	Model
DISTANCE	-0.459 (-2.63)***	-0.461 (-2.65)***	-0.546 (-2.68)***	-0.694 (-1.70)*	-0.321 (-1.52)
GDP_BORROWER	-0.028 (-0.04)	0.304 (-0.44)	-0.844 (-0.84)***	0.298 (0.26)	-0.070 (-0.09)
GDP_LENDER	2.461 (2.26)**	1.547 (1.33)	3.660 (2.11)**	2.807 (1.52)	2.429 (1.98)**
INTEREST	-0.014 (-0.87)	-0.010 (-0.64)	-0.011 (-0.47)	-0.115 (-2.09)**	-0.015 (-0.85)
GROWTH	0.031 (1.91)*	0.025 (1.50)	0.035 (1.72)*	0.059 (1.95)**	0.040 (2.21)**
EXCHANGE	-0.013 (-1.36)	-0.016 (-1.70)*	-0.002 (-0.09)	0.009 (0.38)	-0.015 (-1.43)
VIX		-0.019 (-0.27)			
RISK_AVERSION		0.039 (2.53)			
COMMON			-2.542 (-2.12)**		
LENDER MX					
BANK_HEALTH_ LENDER			-0.004 (-0.79)**		
GOVBALANCE				0.161 (0.81)	
BANK_HEALTH_ BORROWER				0.0003 (0.03)	
FINANCE_OPEN					0.070 (0.76)
ER_REGIME					-0.311 (-1.74)*
R2	0.1	0.1	0.1	0.1	0.1
N	3808	3808	3808	3808	3808

Notes: Standard errors in parentheses.\*\*\* Significant at the 1% level,\*\* Significant at the 5% level,\* Significant at the 10% level. PCSE= panel-corrected standard errors. Due to near-singular matrix the following country dummies have to be eliminated from the regression: Basic model: FR/GR/NL/PT/US/AR/BR/HR/HU/IN/LT/MX/MY/RO/VE/VN; Global model: FR/GR/NL/PT/US/AR/BR/HR/HU/IN/LT/MX/MY/RO/VE/VN; Lender model: FR/GR/ NL/NO/PT/SE/US/AR/BR/HR /HU/IN /LT/MX/MY/RO/VE/VN; Risk model: FR/GR/NL/PT/US/AR/BG/BR/EE/HR/HU/IN/LT/LV/MX/ MY/RO/SI/SK/VE/VN; Link model: FR/GR/NL/NO/PT/US/AR/BR/HR/HU/IN/LT /MX/MY/RO/VE/VN.

Table A.9 Determinants of cross border bank flows from advanced to emerging markets – Random effects model for the *Asian crisis (1997/1998)* with country fixed effects and PCSE

Dependent variable: log of quarterly, exchange-rate adjusted change in external position (in millions of USD) of country <i>i</i> vis-à-vis country <i>j</i>					
	(1)	(2)	(3)	(4)	(5)
	BASIC	GLOBAL	LENDER	RISK	LINKAGE
	Model	Model	Model	Model	Model
DISTANCE	-0.254 (-1.69)*	-0.253 (-1.70)*	-0.245 (-1.43)	-0.371 (-2.22)**	0.864 (0.89)
GDP_BORROWER	1.478 (3.02)***	2.022 (4.04)***	1.786 (3.18)***	0.300 (0.46)	1.476 (2.63)***
GDP_LENDER	-5.352 (-4.24)***	-0.887 (-0.586)	-5.319 (3.86)***	-3.975 (-2.68)***	-6.192 (-4.81)***
INTEREST	0.027 (3.39)***	0.024 (3.00)***	0.029 (3.27)***	0.009 (0.64)	0.027 (3.19)***
GROWTH	0.066 (3.58)***	0.029 (1.55)	0.056 (2.71)***	0.044 (1.95)**	0.084 (4.24)***
EXCHANGE	-0.012 (-3.24)***	-0.012 (-3.20)***	-0.014 (-3.12)***	-0.022 (-3.78)***	-0.012 (-2.98)***
VIX		-0.080 (-3.07)***			
RISK_AVERSION		-0.009 (-2.40)***			
COMMON			-0.012 (-0.15)		
LENDER AS					
BANK_HEALTH_ LENDER			0.001 (0.461)		
GOVBALANCE				0.129 (1.91)**	
BANK_HEALTH_ BORROWER				0.006 (2.20)**	
FINANCE_OPEN					0.608 (3.91)***
ER_REGIME					-0.256 (-2.03)**
R2	0.1	0.1	0.1	0.1	0.1
N	3808	3808	3808	3808	3808

Notes: Standard errors in parentheses.\*\*\* Significant at the 1% level,\*\* Significant at the 5% level,\* Significant at the 10% level. PCSE= panel-corrected standard errors. Due to near-singular matrix the following country dummies have to be eliminated from the regression: Basic model: FR/NL/US/AR/LT/MX/MY/RO/VE/VN; Global model: FR/NL/US/AR/LT/MX/MY /RO/VE/VN; Lender model: FR/GR/NL/NO/SE/US/AR/LT/MX/MY/RO/VE/VN; Risk model: FR/NL /US/AR/BG/LT/MX/MY/RO/SI/SK/VE/VN; Link model: FR/GR/NL/US/AR/LT/MX/MY/NO/RO/VE/VN.

Table A.10 Determinants of cross border bank flows from advanced to emerging markets – Random effects model for the *economic and financial Crisis of 2007/2008* with country fixed effects and PCSE

Dependent variable: log of quarterly, exchange-rate adjusted change in external position (in millions of USD) of country <i>i</i> vis-à-vis country <i>j</i>					
	(1)	(2)	(3)	(4)	(5)
	BASIC	GLOBAL	LENDER	RISK	LINKAGE
	Model	Model	Model	Model	Model
DISTANCE	-1.306 (-8.69)***	-1.301 (-8.71)***	-1.374 (-8.17)***	-0.332 (-8.87)***	-01.144 (-5.60)***
GDP_BORROWER	0.942 (1.26)	0.010 (-0.01)	-0.635 (-0.76)	-0.294 (-0.58)***	1.826 (1.51)
GDP_LENDER	2.482 (2.31)**	2.558 (1.90)**	3.414 (2.48)***	0.236 (2.09)**	-2.354 (-1.07)
INTEREST	-0.258 (-4.85)***	-0.016 (-0.26)	-0.146 (-2.44)***	-0.242 (-5.12)***	0.607 (2.20)*
GROWTH	0.169 (6.61)***	0.085 (3.18)***	0.150 (4.88)***	0.162 (5.81)***	0.082 (0.92)
EXCHANGE	-0.105 (-7.26)***	-0.084 (-5.87)***	-0.099 (-6.19)***	-0.105 (-7.45)***	-0.086 (-1.64)*
VIX		-0.038 (-2.08)**			
RISK_AVERSION		-0.002 (-0.82)			
COMMON LENDER US			0.089 (0.79)		
BANK_HEALTH_ LENDER			0.015 (4.87)***		
GOVBALANCE				0.053 (0.60)	
BANK_HEALTH_ BORROWER				-0.010 (-1.91)*	
FINANCE_OPEN					0.156 (6.89)***
ER_REGIME					-4.20 (-2.64)***
R2	0.1	0.1	0.1	0.1	0.2
N	3808	3808	3808	3808	3808

Notes: Standard errors in parentheses.\*\*\* Significant at the 1% level,\*\* Significant at the 5% level,\* Significant at the 10% level. PCSE= panel-corrected standard errors. Due to near-singular matrix the following country dummies have to be eliminated from the regression: Basic model: US/VN; Global model: US/VN; Lender model: GR/NO/SE/US/VN; Risk model: US/VN; Link model: NO/US/VE/VN.



The list below contains mnemonics, sources and descriptions for all the variables included in the empirical investigation. In addition, we provide a list of the BIS reporting countries and emerging market countries used in our sample. Unless otherwise noted, data were available from 1993 through 2008 on a quarterly basis.

<b>Mnemonic</b>	<b>Source*</b>	<b>Variable description</b>
LOANS	BIS-LBS	External positions (assets) of BIS reporting banks in country <i>i</i> vis-à-vis all sectors in emerging market country <i>j</i> , in millions of US dollars. Changes in external positions are exchange-rate adjusted by converting the relevant stocks into their original currencies using end-of-period exchange rates and subsequently converting the changes in stocks into dollar amounts using period-average exchange rates.
DISTANCE	DIST	Distance between the capital of country <i>i</i> and country <i>j</i> , in kilometers.
INTEREST	IFS	Money market interest rate differential between country <i>j</i> and country <i>i</i> , in percentage points (for HU and CN three-month interbank rates, for TW three-month money market rates).
GROWTHDIFF	Datastream, IFS	Real GDP growth differential between country <i>j</i> and country <i>i</i> , in percentage points.
EXCHANGE	Datastream, IFS	Bilateral nominal exchange rate index.
FINANCEOPEN	BIS-LBS, WEO	Bilateral financial openness: sum of the external assets and liabilities of all sectors in country <i>j</i> vis-à-vis banks in BIS reporting country <i>i</i> , as a percentage of country <i>j</i> GDP.
GDP	CEIC, Datastream Eurostat, IFS, CEIC National Data	Nominal GDP, in millions of US dollars.
SPREADLD	IFS	Spread between the main lending and deposit rates of interest, in basis points.
WK_REGIME	RRI	Exchange rate regime, coarse classification codes from Reinhart and Rogoff (2004).
CURRENTACCOUNT	BOP, National Data	Current account balance as a percentage of annual GDP. For China, annual BOP data before 2001; semi-annual data after 2001 used to interpolate quarterly figures.
GOVBALANCE	WEO	General government balance, linearly interpolated, as a percentage of country <i>j</i> GDP.

SHORTDEBT	BIS-CBS, IDS, WEO	External short-term debt: short-term liabilities (with a maturity up to and including one year) plus international debt securities outstanding with a maturity of up to one year, of all BIS reporting countries vis-à-vis country j; as a percentage of country j GDP.
FOREIGNRESERVES	IFS, National Data	Foreign exchange reserves, outstanding positions as a percentage of M2.
CREDITGROWTH	IFS, National data	Real credit to the domestic private sector, annual growth rate in percent
BANKHEALTH	Datastream, IFS,	Sub-index of banking industry relative to the overall equity market index, rebased to 2000=100.
RISKAVERSION	Moody's	Spread of corporate bonds(AAA, AA, A and BAA) over 10-year US Treasury bonds, quarterly average.
VIX	Bloomberg	VIX Chicago Board Options Exchange S&P 100 Volatility Index, quarterly average.
CL_EFFECT	BIS-LBS	Common lender effect: Amounts outstanding of external assets of country i vis-à-vis the primary crisis country, as a percentage of the total amount outstanding of external assets of country i.

BIS-LBS: BIS locational banking statistics

BIS-CBS: BIS consolidated banking statistics

DIST: <http://www.timeanddate.com/worldclock/distance.html?p1=48>

IFS: International Monetary Fund, International Financial Statistics

DOT: International Monetary Fund, Direction of Trade Statistics

WEO: International Monetary Fund, World Economic Outlook

BOP: International Monetary Fund, Balance of Payments Statistics

IDS: International Debt Statistics

CEIC: Economic databases for emerging and developed markets,

[http://www.ceicdata.com/about\\_ceic.html](http://www.ceicdata.com/about_ceic.html)

RRI: Reinhart-Rogoff exchange rate regime classification,

<http://terpconnect.umd.edu/~creinhar/Data/ERA-Monthly%20coarse%20class.xls>,

[http://intl.econ.cuhk.edu.hk/exchange\\_rate\\_regime/index.php?cid=11](http://intl.econ.cuhk.edu.hk/exchange_rate_regime/index.php?cid=11)

**Advanced BIS reporting countries:** Austria (AT), Belgium (BE), Switzerland (CH), Germany (DE), Denmark (DK), Spain (ES), Finland (FI), France (FR), United Kingdom (GB), Greece (GR), Italy (IT), Japan (JP), Netherlands (NL), Norway (NO), Portugal (PT), Sweden (SE), United States (US).

**Emerging Asian countries:** China (CN), Indonesia (ID), India (IN), Korea (KR), Malaysia (MY), Philippines (PH), Taiwan (TW), Thailand (TH), Vietnam (VN).

**Emerging European countries:** Bulgaria (BG), Croatia (HR), Czech Republic (CZ), Estonia (EE), Hungary (HU), Latvia (LV), Lithuania (LT), Poland (PL), Romania (RO), Slovak Republic (SK), Slovenia (SI), Turkey (TR).

**Latin American countries:** Argentina (AR), Brazil (BR), Chile (CL), Colombia (CO), Mexico (MX), Peru (PE), Venezuela (VE).

The two endogenous variables – external positions and external loans of BIS reporting countries vis-à-vis emerging market economies - are taken from the BIS locational banking statistics. The locational statistics comprise data on gross international financial claims and liabilities of banks resident in a given country. The main goal of the locational statistics is to provide information on the role of banks and financial centres in the intermediation of international capital flows. The statistics includes stocks ("amounts outstanding") and flows ("changes"): the flows are exchange-rate adjusted (unadjusted flows are simply calculated as the difference between amounts outstanding). We use the locational statistics, because it is more relevant for countries receiving external loans, while the consolidated statistics is more relevant for countries giving such loans. The locational statistics also has longer data series (exchange-rate adjusted flows are available for 41 reporting countries since 1977 on a quarterly basis).