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

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Sabine Herrmann and Dubravko Mihaljek

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



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All opinions expressed are those of the authors and do not necessarily reflect the views of the Bank of Finland.

Sabine Herrmann and Dubravko Mihaljek<sup>1</sup>

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

### Abstract

This paper studies the nature of spillover effects in bank lending flows from advanced to the emerging market economies and identifies specific channels through which such effects occur. We examine a panel data set of cross-border bank flows from 17 advanced to 28 emerging market economies in Asia, Latin America and central and eastern Europe from 1993 to 2008. Our empirical framework is based on a gravity model of financial flows. We augment this model with global, lender and borrower country risk factors, as well as financial and monetary integration variables. The empirical analysis suggests that global as well as country specific factors are significant determinants of cross-border bank flows. Greater global risk aversion and expected financial market volatility have been the most important factors behind the decrease in cross-border bank flows during the crisis of 2007–08. The decrease in cross-border loans to central and eastern Europe was more limited compared to 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 crises, emerging market economies, spillover effects, panel data.

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Sabine Herrmann and Dubravko Mihaljek

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

### Tiivistelmä

Tässä tutkimuksessa analysoidaan kehittyneistä kehittyviin talouksiin kulkevia pankkien lainavirtoja ja identifioidaan ne kanavat, joita pitkin lainavirrat vaikuttavat. Tutkimuksessa käytetään paneeliaineistoa, joka kuvaa pankkien kansainvälisiä lainavirtoja 17 kehittyneestä taloudesta 28 kehittyvään talouteen Aasiassa, Latinalaisessa Amerikassa ja keskisessä Itä-Euroopassa vuosina 1993–2008. Empiirinen analyysi perustuu pääomavirtojen gravitaatiomalliin, jota on laajennettu globaaleilla, lainanantaja- ja lainanottajamaiden riskitekijöillä sekä finanssi- ja monetaarisen integraation muuttujilla. Tulosten mukaan globaalit ja maaspesifit muuttujat ovat tärkeitä kansainvälisten pankkien lainavirtojen selittäjiä. Riskiaversion kasvu ja odotukset finanssimarkkinoiden volatilitteetistä ovat olleet tärkeimpiä syitä lainavirtojen pienenemiseen vuosien 2007–2008 kriisin aikana. Keskisen Itä-Euroopan talouksiin kohdistuvien lainojen määrä on pienentynyt vähemmän kuin Aasiaan ja Latinalaiseen Amerikkaan suuntautuvien. Tämä johtuu etenkin Euroopan suuremmasta finanssi- ja monetaarisesta integraatiosta ja pankkijärjestelmien kohtalaisen hyvistä kunnosta alueella. Tulokset ovat robusteja valitusta spesifikaatiosta, otoksesta ja ekonometrisesta metodologiasta riippumatta.

Avainsanat: gravitaatiomalli, kansainväliset pankkien lainavirrat, finanssikriisit, kehittyvät markkinat, vuotovaikutukset, paneelidata.

# 1 Introduction

International banks have been a major source of external finance for emerging market economies (EMEs) over the past decade. It is therefore not surprising that financial linkages, and in particular bank lending ties, have been identified as one of the main channels of transmission of the 2007–09 crisis from advanced to the emerging markets (IMF, 2009a). Understanding the determinants of cross-border bank flows should therefore be a key to understanding how the crisis was transmitted, and why different EMEs were affected differently. It is also important for financial stability in advanced economies, considering the negative feedbacks of financial crises in EMEs on advanced economy banks.

This paper tries to clarify the nature of spillover effects in cross-border lending and to identify specific channels through which crises spread from advanced to the emerging markets. The empirical investigation is based on a gravity model of financial flows. The basic idea of gravity models, which have become the workhorse in the empirical trade literature, is to explain bilateral trade with distance between the countries and their economic size (Anderson, 1979). Recently, gravity models have also been used to explain financial flows. Martin and Rey (2004) developed a two-country model that allowed to link home bias, financial market size and asset returns to the size of an economy. Portes and Rey (2005) applied gravity equations to cross-border equity transactions, and Aviat and Coeurdacier (2007) to bilateral asset holdings.

Our paper extends this literature to the study of cross-border bank flows. Our basic model includes distance, GDP of lender and borrower countries, growth differentials, interest rate differentials, and bilateral exchange rate changes as the determinants of cross-border bank flows. We extend this model with four additional sets of factors affecting the cross-border flows: (i) global risk and global financial market volatility; (ii) the state of financial health of banks in advanced economies and their exposure to a primary crisis country; (iii) macroeconomic vulnerabilities in borrowing countries; and (iv) the degree of monetary and financial integration with borrower countries. The paper thus forms part of a small and fairly recent literature linking the determinants of cross-border bank flows and financial stress indicators (see eg Buch et al, 2009; McGuire and Tarashev, 2008; World Bank, 2008).

Our data set contains some 30,500 observations on bilateral credit flows from banks in 17 advanced economies to 28 emerging market countries between 1993 and 2008. Besides this



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

Our analysis suggests that global as well as country specific factors are significant determinants of cross-border bank flows. In the latest financial crisis, greater global risk aversion and expected financial market volatility seem to have been the most important channels through which spillover effects occurred. In central and eastern Europe (CEE), sound banking systems, stronger financial integration with advanced economies, and fixed exchange rate regimes have limited the decrease in cross-border bank flows despite pronounced vulnerabilities of these economies on the eve of the crisis.

The rest of the paper is organised as follows. Chapter 2 reviews stylised facts on cross-border bank flows to emerging markets. Chapter 3 links our approach to the existing literature. Chapter 4 specifies the model and the data and summarises the main results. Chapter 5 provides a comprehensive set of robustness checks. Chapter 6 concludes.

## 2 Stylized facts on cross-border bank flows to emerging markets

Data in Table 1 provide some key stylised facts on the development of cross-border bank flows to emerging markets. The external positions of BIS reporting banks vis-à-vis emerging markets increased more than four times between 1990 and 2008.<sup>2</sup> The expansion in cross-border financing was most pronounced in CEE, where external positions and cross-border loans outstanding at the end of 2008 were 13 times higher than at the end of 1990. The exposures of BIS reporting banks in CEE at the end of 2008 were roughly the same as those in emerging Asia, which is five times larger in terms of GDP compared to CEE.

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<sup>2</sup> This data series is taken from the BIS locational banking statistics, which comprise data on gross international financial claims and liabilities of banks resident in a given country ("BIS reporting banks"), on banks and the non-bank sector in other countries. About 80% of external positions consist of standard cross-border loans; the remainder includes holdings by BIS reporting banks of bonds, money market instruments and equities issued by banks and the non-bank sector in other countries. The external positions include quarterly stocks ("amounts outstanding") and flows ("changes"); the latter are adjusted for exchange rate changes. For details, see the list of variables in the Appendix.

Table 1 Cross-border loans to emerging market economies<sup>1</sup>

	All EMEs	Asia	Latin America	CEE
<b>Amounts outstanding</b> In billions of USD, end of period				
1990	406	165	191	50
1999	646	303	249	94
2008	1,695	679	351	666
<b>Growth rates</b> In percent, y/y, period average <sup>2</sup>				
1990–2008	9.3	11.3	3.5	17.4
1990–1999	5.9	10.6	1.7	9.3
2000–2008	13.2	12.0	5.5	26.5

<sup>1</sup> External positions of 17 BIS reporting banks from advanced economies vis-à-vis all sectors (banks and the non-bank sector) in 28 emerging market countries. <sup>2</sup> Calculated from quarterly data; four-quarter percentage changes, period averages.

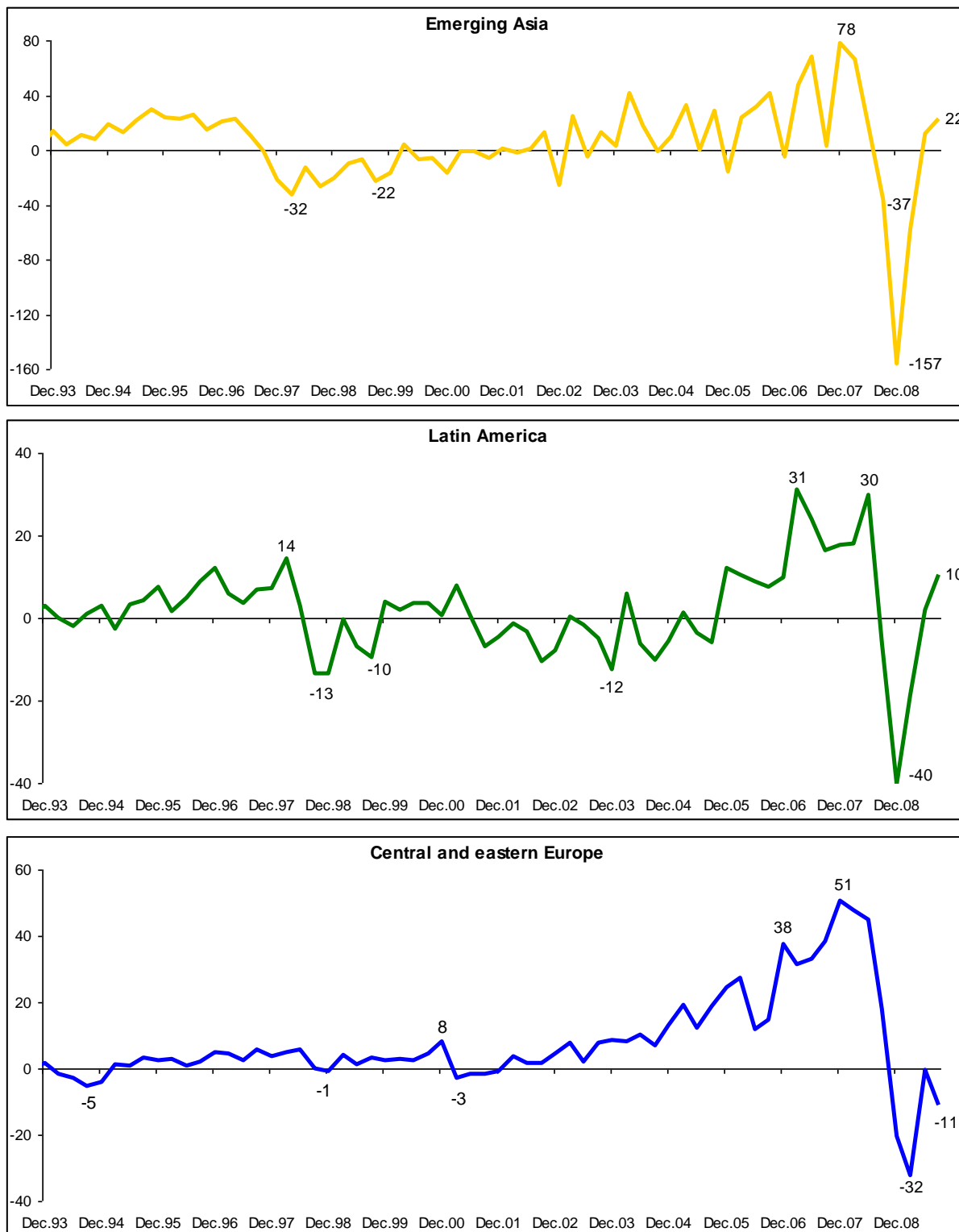
Source: BIS, locational banking statistics; authors' calculations.

Graph 1 shows that the dynamics of cross-border bank flows differed across time and emerging market regions. During the 1990s there were two distinct crisis episodes: the Mexican crisis of 1994–95, and the Asian crisis of 1997–99. The Mexican crisis was short-lived and affected only Latin America.<sup>3</sup> The effects of the Asian financial crises on cross-border bank flows were much bigger and lasted longer. Indonesia, Korea, Malaysia, the Philippines and Thailand were hit the hardest and experienced strong and long-lasting reductions in cross-border bank flows between mid-1997 and end-1999. Latin America was strongly affected by contagion from the Russian domestic debt default in 1998. Despite the proximity of the Russian market, CEE was less affected at the time.

The early 2000s were a period of muted inflows in all three regions, interrupted by occasional sharp reductions of inflows. Bank flows to Asia and CEE resumed strongly in 2003, and to Latin America in 2006. Financial liberalisation, sophisticated new financial products, and the search for yield in an environment of low global interest rates led the international banks to expand their operations in emerging markets, particularly CEE (see Mihaljek, 2008). During 2005–08, the CEE region received on average over \$40 billion in cross-border loans per year, emerging Asia over \$20 billion and Latin America about \$16 billion.

<sup>3</sup> The decrease in cross-border loans to CEE in 1994 reflected the implementation of deep financial sector reforms at the time, rather than developments in the external or domestic financial cycle.

Graph 1  
External positions of reporting banks vis-à-vis emerging markets  
Exchange rate adjusted changes (Q/Q), in billions of USD



Source: BIS, locational banking statistics.

The external lending boom peaked in absolute terms between mid-2007 and mid-2008. Emerging Asia and Europe received a combined total of, respectively, \$78 billion and \$51 billion (in exchange rate adjusted terms) in cross-border bank flows in Q4:2007; Latin America received a total of \$30 billion in Q2:2008 (Graph 1). Relative to GDP, the inflows were the largest in CEE (10.8% in Q4:2007). In emerging Asia and Latin America, peak inflows exceeded 4% of GDP.

Following the collapse of Lehman Brothers in Q3:2008, major international banks started to reduce their financing of banks and the non-bank sector in emerging markets. The largest reductions took place in Q4:2008 and Q1:2009 vis-à-vis emerging Asia (Graph 1).<sup>4</sup> Interestingly, banks and the non-bank sector in many smaller CEE countries with a large share of foreign-owned banks received further cross-border loans during this period. This suggests that foreign bank presence provided some stability to cross-border bank flows (see Mihaljek, 2010). In the second and third quarter of 2009, international banks for the most part resumed their lending to emerging markets.

### 3 Cross-border bank flows and financial crises: A literature review

The early literature on the determinants of capital flows focused on the role of trade linkages in the propagation of emerging market crises (see eg Glick and Rose, 1998; Eichengreen et al, 1996). With the spread of the financial globalisation to emerging markets, the literature started to investigate how financial linkages contributed to the spread of crises. Calvo (1998) argued that contagion typically spread through the balance sheet effects of international 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>5</sup> Van Rijckeghem and Weder (2003) found that common bank lenders were a fairly robust predictor of contagion. Similarly, Kaminski et al (2003) identified a leveraged common creditor in all episodes of international spillovers they studied. 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)

<sup>4</sup> At the time of writing, Q3:2009 was the latest observation available. In our regressions we used observations through Q4:2008 because other data for 2009 were not yet complete.

<sup>5</sup> Forbes and Chinn (2009) found that bilateral trade flows were nonetheless a large and significant determinant of the transmission of shocks to emerging markets.

highlighted financial interconnectedness within Europe as a factor increasing the risk of crises.<sup>6</sup> In summary, the main conclusion of the literature is that “even if banks are not the immediate trigger of financial contagion, their actions certainly contribute to the spillover” (Kaminski and Reinhart, 2000, p. 79).

Against this background, the literature on the determinants of cross-border bank flows focused in the past on various “push” and “pull” factors.<sup>7</sup> One general conclusion (see eg Jeanneau and Micu, 2002) is that both sets of factors help explain cross-border bank flows. For instance, macroeconomic conditions in host countries (Garcia-Herrero and Martinez-Peria, 2005; Hernandez et al, 2001) as well as home countries (Goldberg, 2001) were found to have a major influence on bank lending to emerging markets. Papaioannou (2009) in addition referred to geographical, historical and institutional factors. In his model, institutional underdevelopment explained a large part of the observed flow of capital from less developed countries to some advanced economies.

So far, there has been little empirical work on the determinants of cross-border bank flows to 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 and highlighted the importance of common lender effects. Heid et al (2004) confirmed such effects at the micro level. They also noted that a sudden increase in risk aversion played a fundamental role in explaining cross-border lending by German banks.<sup>8</sup> The World Bank (2008) showed that tensions in the global interbank market were associated with lower growth of bank loans during the current crisis. McGuire and Tarashev (2008) established a link between cross-border loans and measures of bank health in host countries. Buch et al (2009) examined the relationship between macroeconomic shocks and international banks’ foreign assets. They found that bank responses were characterised by temporary overshooting and subsequent adjustment over several quarters.

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<sup>6</sup> Hernandez et al (2001) provided empirical evidence that contagion was more important during the 1990s’ than the earlier crises, and argued that one reason was stronger financial integration in the 1990s.

<sup>7</sup> One strand of the literature focused on the determinants of portfolio equity investment; see eg Lane and Milesi-Ferretti (2004).

<sup>8</sup> There is a large literature analysing the determinants of bank lending at the micro level. One strand of this literature focuses on the impact of bank capital, especially in times of stress (see eg Gambacorta and Mistrulli, 2004). Another strand studies the impact of financial innovation (eg Scheicher and Marques-Ibanez, 2008).

## 4 Econometric estimates

### 4.1 Empirical model

Building on the existing empirical literature we first examine how far the standard gravity model helps explain changes in cross-border bank flows to EMEs. In the second step we study how far financial stress at the global, lender and borrower country levels affect these flows, especially in periods of financial crises. These issues have not yet been studied in the literature in sufficient detail. We also extend the literature in several other dimensions, including the data sample and the empirical model.

Our sample covers cross-border bank flows from 17 advanced to 28 emerging market economies between 1993 and 2008.<sup>9</sup> The analysis is based on bilateral, country pair data from the BIS locational banking statistics (eg loans from banks located in Austria to banks and the non-bank sector in Hungary). The dependent variable in our estimations (*LOANS*) is the change in the external position of BIS reporting banks in an advanced economy  $i$  ( $i = 1, \dots, 17$ ) vis-à-vis banks and the non-bank sector in an emerging market  $j$  ( $j = 1, \dots, 28$ ) at time  $t$  ( $t = Q1:1993 - Q4:2008$ ). Changes in external positions are adjusted for exchange rate valuation effects in a given quarter (discussed below).

The empirical framework used in this paper is the **standard gravity model**. A pioneering work in this field was done by Tinbergen (1962), who set out to explain the volume of bilateral trade with distance between two countries and their GDPs. The model in this paper is related to the gravity model for asset flows used in Martin and Rey (2004) and includes interest rate and growth differentials as additional explanatory variables. In particular, our *basic model* is described by the following equation:

$$LOANS_{ijt} = \rho_0 + \rho_1 DIST_{ij} + \rho_2 GDP_{it} + \rho_3 GDP_{jt} + \rho_4 INT\_diff_{ijt} + \rho_5 GR\_diff_{ijt} + \rho_6 ER_{ijt} + \rho_7 X_{ijt} + \varepsilon_{ijt} \quad (1)$$

where *DIST* is the distance between the capitals of countries  $i$  and  $j$ ;  $GDP_i$  and  $GDP_j$  are the respective GDPs of lender and borrower countries; *INT\_diff* is the nominal interest rate differential and

<sup>9</sup> The advanced economies (BIS reporting countries) 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 in Asia are: 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.

$GR\_diff$  is the growth differential between borrower and lender countries;  $ER$  is change in the bilateral exchange rate;  $X$  is a vector of control variables; and  $\varepsilon$  is a vector of error terms. The exact definitions of variables are provided in the Appendix.

The exchange rate adjustment of our dependent variable is necessary because stocks of outstanding loans from BIS reporting banks to emerging markets are reported in US dollars. The adjustment (done by the BIS) involves first converting US dollar stocks into home currency of reporting banks.<sup>10</sup> This conversion is done at end-quarter exchange rates. The resulting (quarterly) flow of cross-border loans in home currency (eg, euros) is then converted back into US dollars at quarterly average exchange rates. In other words, our dependent variable is measured in constant US dollars.

The rationale for including the exchange rate among explanatory variables is then a separate issue: lenders need to consider exchange rate movements of emerging market (“host”) currencies vis-à-vis their home currency as an indicator of the borrower’s ability to repay the loan. Weaker currency in the host country makes it more difficult for borrowers to repay the cross-border loan; an appreciating currency makes it easier to repay the loan.

Interest rate differentials, growth differentials and exchange rate changes are expressed in percentage points, and all other variables in logarithms. Our dependent variable can take on negative values: these can be observed when repayments of old loans are greater than new loans provided to 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. This transformation preserves the sign in the original variable and retains the symmetry between increases and decreases in cross-border bank flows.

The null hypotheses on the signs of estimated coefficients  $\rho_i$  are as follows:

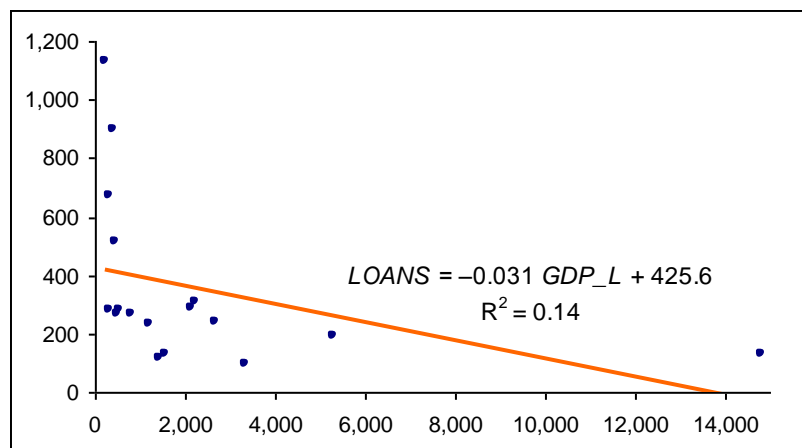
- $\rho_1 < 0$  Greater distance should decrease the flow of cross-border loans from country  $i$  to country  $j$ . As argued by Martin and Rey (2004), information and monitoring costs increase with distance: the cost of travelling is higher, cultural differences are likely to be stronger, and business links weaker. The distance is the simplest proxy that captures this informational dimension of cross-border banking.
- $\rho_2, \rho_3 > 0$  Gravity models of trade stipulate positive coefficients for the size of both lender and borrower economies. However, for cross-border loans from advanced to the emerging markets one can observe a negative relationship between the GDP of lender countries and cumulative change in loans over the past two decades. Banks from smaller countries (eg Austria and Belgium) generally increased their lending to emerging markets more than banks from large countries (Graph 2). One reason is that banks in countries with a small home market have become more depend-

<sup>10</sup> Given that reporting banks in our sample are all from advanced economies, this means converting US dollar stocks into other major international currencies.

ent on business in foreign markets. The sign of GDP coefficients therefore has to be determined empirically.

- $\rho_4 > 0$  Higher interest rate in the borrower country should, ceteris paribus, increase the flow of cross-border loans from the lender country;<sup>11</sup>
- $\rho_5 > 0$  Stronger growth in the borrower country should, ceteris paribus, increase the inflow of cross-border loans;

**Graph 2**  
**Change in cross-border loans and size of lender's economy<sup>1</sup>**



Note: Horizontal axis measures lender countries' GDP in 2008, in millions of USD. Vertical axis measures percentage change in external positions of banks from lender countries vis-à-vis EMEs, cumulative from 1993 to 2008.

Source: BIS, locational banking statistics; IMF, WEO database.

- $\rho_6 < 0$  Weaker currency in the borrower country, ceteris paribus, reduces the flow of cross-border loans by reducing the expected rate of return measured in lender's currency – a depreciating currency makes it more difficult for borrowers to repay their external loans. Conversely, an appreciating currency increases the expected rate of return measured in lender's currency and makes it easier for borrowers to repay their external loans; hence, it induces additional inflows.

This basic model can be expected to explain a fair proportion of cross-border bank flows in normal times. However, to study bank flows in periods of financial crises this model needs to be expanded, building on theoretical and empirical considerations discussed in Sections 2 and 3. For this purpose we add four additional sets of variables representing potential crisis transmission channels.

In the *global financial factors model*, the hypothesis is that variables determined in global financial markets exert strong influence on cross-border bank flows. To assess the state of the

<sup>11</sup> The rationale for using nominal rather than real interest rate differentials is that banks make all expected profit and loss calculations when granting loans in terms of nominal rates. In addition, the choice of inflation rate to deflate the nominal interest rate – home vs. host country inflation – would be arbitrary, as international banks can decide to reinvest profits in the host country or repatriate them to the home country.



global financial market we use the S&P 100 Volatility Index (*VIX*) of the Chicago Board Options Exchange; and the average difference in yields between US corporate bonds and ten-year treasuries (*RISK\_AVERS*). The former is widely used as an indicator of expected short-term (up to 30 days) volatility of the global financial market: a high value of the *VIX* corresponds to more volatile market expectations and hence higher cost of options to defray the volatility risk. The latter is widely used as an indicator of global risk aversion: a high yield differential between US corporate and sovereign bonds signals heightened risk aversion on the part of global investors.

The null hypothesis is that both indicators are negatively correlated with cross-border bank flows: higher expected global market volatility and growing risk aversion will reduce the flow of cross-border loans from advanced to emerging markets.

In the *lender exposure model*, the hypothesis is that certain characteristics of banks in lender countries strongly affect the flow of cross-border loans to emerging markets (see Van Rijckeghem and Weder, 2003). In line with Krugman (2008), who argued that banks' balance sheets were a major source of spillovers in international bank lending, we focus on the *common lender effect*, ie the proposition that financial stress in creditor country banks (eg in Spain) is determined by their exposure to the primary crisis country (eg the United States). We measure the common lender effect as:

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

We distinguish three sets of primary crisis countries: Mexico during 1994–95; Indonesia, Korea, Malaysia, Thailand and the Philippines during the Asian crisis of 1997–98; and the United States during the crisis of 2007–08. The greater the exposure of banks to a primary crisis country (or countries), the more they are expected to reduce their cross-border loans to emerging markets. Outside of crisis periods the common lender effect is by definition set to zero.

The second characteristic of lender banks that affects their loans to emerging markets is the state of their own health (*BK\_HLTH\_L*). To assess this variable we look at the deviation of the banking industry subindex from the main equity price index. We expect a positive relationship, as the banking sector under stress – eg with large non-performing loans in the home market – is normally forced to reduce cross-border loans.

In the *borrower country risk model*, the hypothesis is that cross-border bank flows respond to indicators of external and domestic vulnerability in emerging markets. As a summary indicator of borrower country risks we use initially general government balance (*GVT\_BAL*). A higher fiscal deficit is positively correlated with the probability of default on government debt, and should there-

fore reduce cross-border bank inflows. In an extended analysis we use other vulnerability indicators as well.

By analogy to the lender exposure model, we use a measure of bank soundness (*BK\_HLTH\_B*) as an additional borrower country risk factor. A stronger banking sector in the borrowing country should normally attract higher cross-border bank inflows. As in the lender exposure model, we measure bank health by looking at the deviation of the banking industry from the overall equity price index.

In the *financial and monetary linkages model* one hypothesis is that a higher degree of financial integration between the borrower and lender countries (*FIN\_OPEN*) increases cross-border bank flows. We measure bilateral financial openness with the ratio of external assets and liabilities of country *j* (the borrower) vis-à-vis banks in country *i* (the lender) relative to the borrower country's GDP. We expect borrower countries that are financially more integrated with lender countries (eg the Baltic states and Sweden) to attract larger inflows than those that are not (eg Vietnam and Sweden).

The second hypothesis of this model is that borrower countries with more rigid exchange rate regimes will attract larger cross-border bank inflows. By fixing the exchange rate of its currency vis-à-vis that of a major lender country, the borrower country becomes more tightly integrated with the lender country. We measure the degree of monetary integration with the Reinhart-Rogoff (2004) exchange rate regime index (*ER\_REGIME*), which varies from 1 (fixed exchange rate) to 6 (free float).

We expect the positive linkage between financial openness and cross-border inflows to hold in both normal and crisis periods. However, the positive linkage between monetary integration and cross-border bank flows need not hold in a crisis. The tendency for fixed exchange rates to come under pressure in a crisis makes countries with fixed exchange rate regimes more vulnerable, and hence more likely to experience a reduction of cross-border bank inflows (see eg Berkmen et al, 2009; Gosh et al 2010; and Gerdesmeier et al, 2009).

Potential issues in econometric analysis of these models include multicollinearity and endogeneity of variables. Multicollinearity is a lesser concern because it is partly unavoidable and because the correlation matrix does not show perfect collinearity between any of the regressors. Endogeneity is potentially a bigger problem. However, in this particular setup the dependent variable is the change in *bilateral* external positions, while independent variables are mostly based on aggregate data for home and host countries or the global financial market. Moreover, for most host

and the home countries bilateral cross-border flows are relatively small. Changes in these flows are therefore unlikely to condition the evolution of explanatory variables.

One case in point is exchange rates: *aggregate* capital flows do affect exchange rates (and vice versa); however, *bilateral* cross-border bank loans are only one small part of overall capital flows, and only one of many factors affecting bilateral exchange rates. Therefore, endogeneity between cross-border bank flows and nominal exchange rates is unlikely to arise. One should also note that the countries in our sample for which cross-border bank flows are large relative to GDP and hence endogeneity issues are potentially pronounced – such as the Baltic states and Bulgaria – have fixed exchange rate regimes.

There are several potentially relevant empirical issues that could not be studied because of the lack of data. One is the maturity structure of cross-border loans. With data available on a quarterly basis, short-term flows (eg those motivated by short-term interest rate differentials) cannot be distinguished from loans with longer maturities. Similarly, there is no information on the relative shares of new loans and repayments of maturing loans. Possible effects of capital controls on inflows of bank loans cannot be assessed, either, given the lack of consistent data and a large variety of capital controls. The demand for cross-border loans also depends on the schedule of external debt repayments, which is rarely available on a quarterly basis even for aggregate debt, let alone for bilateral debt.

## 4.2 Estimation results

We estimated all five models 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) were introduced.<sup>12</sup> One should note that this approach is not equivalent to a *de facto* fixed effects model, which would include bilateral country fixed effects for 17 advanced times 28 emerging market economies. 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 indicated that there was no systematic difference between the fixed and random effects models we used, thus confirming that the random effects estimator was efficient in our empirical framework.

We estimated the four financial stress models outlined above separately rather than jointly (ie nested in one large model) and compared different models in terms of their explanatory power

<sup>12</sup> In order to avoid a near-singular matrix, some fixed effects had to be dropped (basic model: US/MX; global model: US/MX; lender model: FI/GR/NO/US/CH; risk model: US/LT; linkages model: GR/NO/CN).

by looking at the coefficients of determination  $R^2$  and the  $F$ -tests. We opted for this approach because the determinants of cross-border flows examined in these models are not completely independent of each other. For instance, indicators of bank health in lender and borrower economies are not entirely independent from global financial market variables; and indicators of financial openness are not entirely independent from common lender effects.

The estimates of five models are summarised in *Table 2*.<sup>13</sup> Most estimated parameters have the expected signs, are statistically highly significant, and are robust with respect to different model specifications. The low  $R^2$  is not unusual in such large panels and is primarily 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. More precisely, bilateral flows in our sample 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 observations was \$21 million, and the standard deviation was as much as \$546 million. Zero flows accounted for about 20% of observations in the sample.

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  $i$  vis-à-vis country  $j$

	(1) BASIC Model	(2) GLOBAL Model	(3) LENDER Model	(4) RISK Model	(5) LINKAGES Model
DIST	−0.594 (−8.51)***	−0.660 (−3.20)***	−0.693 (−8.77)***	−0.690 (−4.64)***	−0.315 (−1.93)***
GDP_B	1.038 (10.67)***	1.198 (12.24)***	1.098 (8.77)***	0.789 (6.75)***	1.14 (9.26)***
GDP_L	−0.715 (−5.14)***	−0.972 (−6.40)***	−0.733 (−3.55)***	−0.656 (−3.95)***	−0.667 (−2.96)***
INT_diff	0.011 (4.50)***	0.005 (1.93)**	0.012 (4.30)***	0.016 (3.82)***	0.015 (5.19)***
GR_diff	0.044 (7.84)***	0.030 (5.03)***	0.046 (7.00)***	0.040 (6.10)***	0.049 (7.12)***
ER	−0.015 (−6.76)***	−0.011 (−4.99)***	−0.016 (−6.27)***	−0.028 (−8.31)***	−0.011 (−4.49)***

<sup>13</sup> To verify that variables used in regressions are stationary we used the panel unit root tests of Levin, Lin and Chu (2002); Breitung (2000); Im, Peasaran and Shin (2003); and the ADF test of Maddala and Wu (1999). The dependent variable and most explanatory variables were 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.

VIX		−0.027 (−5.80)***			
RISK_AVERS		−0.002 (−4.02)***			
CLE_US			−0.023 (−2.20)**		
CLE_AS			−0.010 (−0.95)		
CLE_MX			−0.286 (−3.88)***		
BK_HLTH_L			0.001 (2.52)**		
GVT_BAL				0.080 (6.59)***	
BK_HLTH_B				0.006 (11.01)***	
FIN_OPEN					0.165 (10.50)***
ER_REGIME					−0.380 (−9.66)***
R <sup>2</sup>	0.04	0.05	0.05	0.05	0.06
F-Test	14.75 (0.000)	12.45 (0.000)	13.87 (0.000)	11.12 (0.000)	13.23 (0.000)
N	30,464	30,464	30,464	30,464	30,464
Durbin-Watson	2.02	2.03	2.05	2.08	2.09

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

The main conclusions one can draw from these estimates are as follows.

The **basic gravity model** shows, first, that cross-border bank flows decrease by about 6% for a 10% increase in the distance between the capitals of lender and borrower countries. In other words, despite considerable improvements in transportation, communication and information technology, distance still matters for cross-border bank flows. This result holds in all five models, with estimated parameters varying from −0.3 to −0.7. Other empirical studies found a similar impact of the distance on capital flows (see Buch, 2005). Furthermore, the impact of the distance on bank flows is comparable to its impact on trade flows.

The second result that is consistent across specifications is the positive correlation of the borrower country GDP and cross-border bank flows. The estimated elasticity implies that a 10% higher GDP in the borrower country will increase cross-border bank flows between 8.0 and 10.2%.

The third main result of the basic gravity model is that the larger the economy of the lender country, the less its banks will engage in cross-border lending to the emerging markets. More spe-

cifically, a 10% increase in the GDP of a lender country reduces its banks' cross-border loans to EMEs by 7% on average. Graph 2 and the observation that financial centres are often located in small countries also support the negative relationship with lender country GDP in our sample.

One should note that by using the locational rather than consolidated banking statistics of the BIS we cannot control for third-party effects, ie bank lending by country A (eg Germany) ultimately flowing to an institution residing in country C (eg Thailand) via a financial centre in country B (eg the United Kingdom). Rather, we consider bank flows from Germany to the UK and from the UK to Thailand as separate. The consolidated banking statistics would be more appropriate if we analysed cross-border bank flows from the lender country perspective. However, we focus on the determinants of bank flows from the borrower country perspective. Moreover, in our sample there are only two major financial centres in terms of cross-border bank flows to EMEs – Switzerland and the United Kingdom.<sup>14</sup> By using the locational statistics we also have a longer sample (the consolidated data are available on a quarterly basis only since 2000), and we can use data on exchange rate adjusted flows. Most importantly, by using the locational data we do not lose information on flows between parent banks and their emerging market subsidiaries, which are netted out in the consolidated statistics. Nevertheless, in one of our robustness checks we drop Switzerland and the UK from the sample and show that the coefficient  $\rho_3$  does not differ significantly from the above estimates.

The fourth main result of the basic gravity model is that cross-border flows respond positively to interest rate and growth differentials between borrower and lender countries, and negatively to depreciation of the borrower country currency. All three estimates are statistically significant, confirming the theoretical result of Obstfeld and Rogoff (1996) that capital flows respond to relative return differentials and income growth expectations. At first sight, none of these three semi-elasticities is large: a percentage point interest rate differential will induce 0.01% larger inflows; a percentage point growth differential will induce 0.04% larger inflows; and a percentage point depreciation of the borrower country currency (vis-à-vis the lender country currency) will reduce the flows by 0.02%. However, one has to keep in mind that they refer to bilateral and not total cross-

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<sup>14</sup> Banks in Germany, Japan and the United States provide on their own large amounts of cross-border bank loans to emerging markets, but they do not book these loans on behalf of banks from other advanced economies to the extent that banks in Switzerland and the United Kingdom do (German banks, for instance, book significant amounts of loans to emerging markets via their London subsidiaries). Recall also that Hong Kong SAR and Singapore are not included in our sample.

border bank flows – an interest rate differential of 1 percentage point thus needs to be added up across many different advanced/emerging economy pairs for which it holds.

In the *global financial factors model*, the two additional variables, *VIX* and *RISK\_AVERS*, 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 – dampen cross-border bank flows from advanced to the emerging markets. The estimated size of coefficients is low; however, as the volatility index and the corporate bond spread both display considerable variation, these global factors are a significant channel through which spillover effects in international bank lending occur (see the contribution analysis below).

The results of the *lender exposure model* indicate that exposure of banks in lender countries to a primary crisis country, and the health of these banks strongly affect cross-border lending to emerging markets. 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 (see Van Rijckeghem and Weder, 2003) – the more the lender country is exposed to the primary crisis country (or countries), the more it will reduce lending to the emerging markets. The impact of the common lender effect is confirmed for all three crisis episodes studied in this paper, with the coefficient being statistically significant for the Mexican and current financial crises. Similarly, the positive coefficient on the second lender model variable, *BK\_HEALTH\_L*, confirms that better health of the banking sector in lender countries increases cross-border loans to emerging markets.

The results of the *borrower country risk model* indicate that risk factors specific to the borrower country strongly affect cross-border bank flows. A percentage point higher budget deficit is on average associated with a 0.08% reduction in bilateral cross-border loans to the country. This result is in line with the empirical literature that identified high budget deficits as an early warning indicator of EME crises.<sup>15</sup>

By contrast, good 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 bilateral cross-border bank loans. One should recognise, however, that a strong standing of bank share prices relative to the overall equity price index might reflect not only the intrinsic health of the banking sector, but also the build-up of an equity price bubble in the banking sector.

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<sup>15</sup> See eg Goldstein, Kaminski and Reinhart (2000).

According to the *financial and monetary linkages model*, a borrower country that was 10% financially more open attracted as much as 1.7% more bilateral cross-border bank loans.<sup>16</sup> Similarly, countries with fixed exchange rate regimes received on average 1.9% more inflows compared to those with floating regimes.<sup>17</sup>

How the financial and monetary linkages work in a crisis is an empirical question. To the extent that lenders reduce cross-border loans and borrowers withdraw deposits from banks in advanced economies, financial openness would amplify the effects of the crisis. Likewise, to the extent that fixed exchange rate regimes come under pressure, foreign creditors would stop lending to emerging market borrowers. In Section 5 we show, however, that financial openness and fixed exchange rate regimes both acted as stabilising factors during the latest crisis, especially in central and eastern Europe.

As noted above, in order to test whether it is worth adding or dropping a particular group of variables from a model we used the *F*-tests and the coefficients of determination  $R^2$ . The results of *F*-tests for all models show that we can reject the null-hypothesis that all slope coefficients are simultaneously zero – the specifications we estimated are statistically highly significant. Moreover, the four models that examine additional determinants of bank flows increase the explanatory power of the basic gravity model, as indicated by slightly higher coefficients of determination relative to the basic model.

### 4.3 Contribution analysis

The analysis in this section goes beyond the identification of statistically significant determinants of cross-border bank flows and provides additional information on the economic significance of estimated parameters. In particular, the contribution analysis quantifies the impact of global and country specific factors on cross-border bank flows, and thus enables us to assess how financial stress gets transmitted from advanced to the emerging market economies. The contribution of each variable is calculated by multiplying the estimated parameter from the above regressions with the average value of the corresponding variable over a given period. The contribution of each model is then the sum of the contributions of all explanatory variables included in the model.

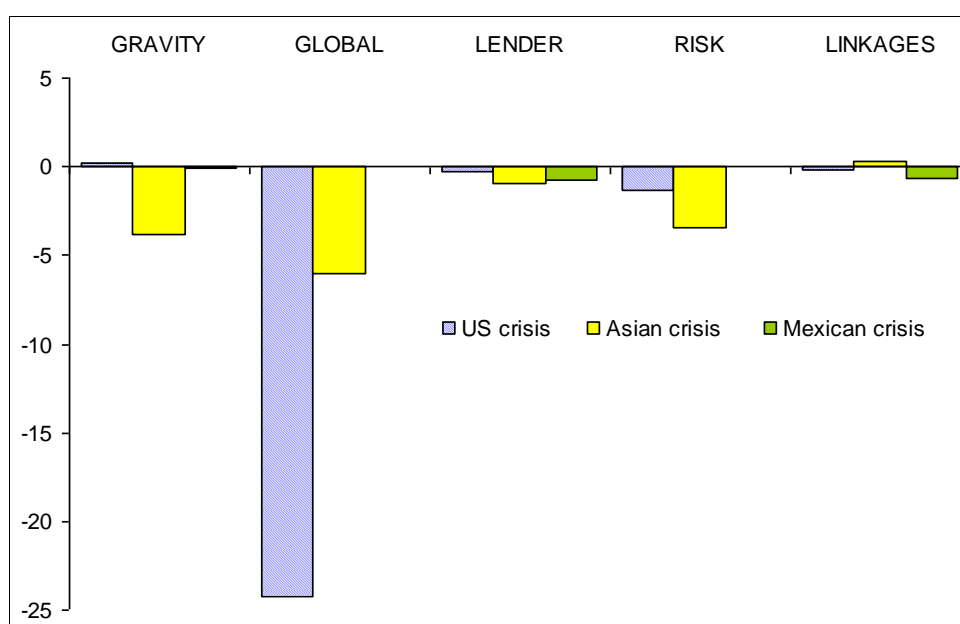
<sup>16</sup> Recall that financial openness is the sum of external assets and liabilities of all sectors in the borrower country vis-à-vis banks in the lender country, as a percentage of the borrower country's GDP.

<sup>17</sup> In the Reinhart and Rogoff (2004) classification, fixed exchange rate regimes are assigned the rank 1 and floaters the 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.



Graph 3 shows the percentage change in cross-border bank flows that different models explain during the three financial crises under review. In the *current crisis*, global factors have been the main driver of cross-border bank flows – higher expected global financial market volatility explains almost a quarter of the reduction in bank flows to emerging markets between Q3:2007 and Q4:2008.<sup>18</sup> The only other larger contribution came from borrower-specific risk factors, in particular the weakening performance of emerging market banks.

Graph 3  
Contributions of five models to changes in cross-border bank flows  
in three crisis periods



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

Source: Authors' calculations.

During the *Asian crisis*, global risk factors also made the largest contribution to the reduction in cross-border lending – at the time, higher global market volatility and greater risk aversion among global investors both had a significant negative impact on cross-border bank flows (see Section 5.5). Two other sets of variables also made a large contribution to the decline in cross-border bank flows: first, weaker growth and depreciating exchange rates in emerging markets (from the basic gravity model); and second, deteriorating fiscal positions and banking sector performance in emerging markets (from the borrower risk model).

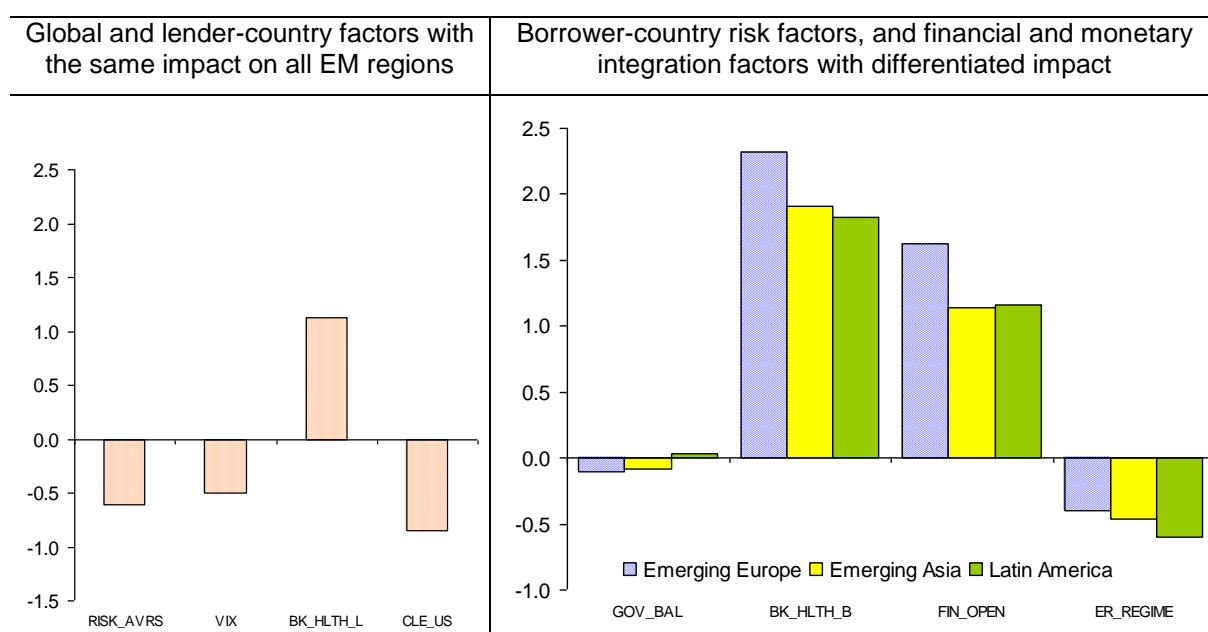
<sup>18</sup> These contributions do not sum up to 100% because the models are estimated separately. For detailed regression estimates for different crises episodes, see Section 5.5 below.

During the *Mexican crisis*, the reduction in cross-border flows in our empirical framework was mainly the result of risk factors specific to lender countries, especially the exposure of lender banks to Mexico and their weakening performance. The second contributing factor was lower degree of monetary integration (see Section 5.5).

Next we look at the contribution of four financial stress models to bank flows during the latest financial crisis. Global and lender country factors had by definition the same impact across all three emerging market regions (*Graph 4*, left-hand panel). Greater risk aversion, expected global financial market volatility, and exposure of lenders to the US economy (the common lender effect) contributed to a reduction in cross-border bank flows to EMEs. The only factor in this group that contributed to higher inflows during 2007–08 was the health of banking sectors in lender countries.

Graph 4

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



Note: Vertical axis measures the change in bilateral, quarterly cross-border bank flows, in millions of US dollars (exchange-rate adjusted), explained by the respective factors during the 2007–08 financial crisis.

Source: Authors' calculations.

Turning to the contribution of borrower-country and financial and monetary integration factors, the broad picture that emerges is that central and eastern Europe experienced a less severe reduction in cross-border flows in 2007–08 than emerging Asia and Latin America (*Graph 4*, right-hand panel). This is surprising, given that countries in CEE had more pronounced external and domestic finan-

cial vulnerabilities on the eve of the crisis. The contribution analysis points to two sets of factors that accounted for this difference.

First, banking sectors in central and eastern Europe were healthier: they induced higher inflows per country pair and quarter compared with banks in emerging Asia and Latin America (*Graph 4*, right-hand panel). This is most likely the consequence of the high share of foreign-owned banks in CEE – there is a strong positive correlation of 0.7 between the foreign bank share in total assets and the bank health indicator in CEE – and the fact that these banks were not heavily exposed to US toxic assets.<sup>19</sup>

Second, greater financial openness contributed to significantly higher inflows of cross-border bank loans per country pair and quarter in central and eastern Europe compared with either emerging Asia or Latin America.

Regarding other factors in this group, fiscal positions had a small negative impact on cross-border bank inflows in CEE and Asia, and a small positive impact in Latin America. A more interesting result is the effect of exchange rate regimes: central and eastern Europe's often less flexible regimes apparently moderated the reduction of inflows compared to the more flexible exchange rate regimes in emerging Asia and Latin America.

## 5 Robustness checks

To check whether estimates of our five models are robust with regard to different econometric methodologies and sample specifications we conducted five sets of checks: (i) estimates using different econometric options (time effects, dynamic instrumental variables, and the Wooldridge approach); (ii) estimates accounting for the financial centres effect; (iii) an extended analysis of country specific risk factors; (iv) analysis of regional sub-samples; and (v) analysis of different crisis periods. The overall conclusion that emerges from these checks is that the results shown in Table 2 are fairly robust to alternative econometric methodologies and sample specifications.

### 5.1 Econometric options<sup>20</sup>

**Time effects.** We added period fixed effects and re-estimated the five models using a random effects estimator with country specific fixed effects and panel-corrected standard errors. This correc-

<sup>19</sup> For the same conclusion using different approaches see EBRD (2009) and Mihaljek (2010).

<sup>20</sup> For details of estimates, see the Appendix in Herrmann and Mihaljek (2010).

tion might be relevant because some explanatory variables show signs of trend-stationarity. 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 (eg in the global financial factors model); and the common lender effect becomes highly significant for all three crisis periods.

***Dynamic instrumental variables approach.*** As an alternative estimation technique we used the instrumental variables approach proposed by Anderson and Hsiao (1981). In particular, we added a lagged dependent variable to regression equations. The instrumental variables estimates were on the whole quite similar to the original ones from Table 2. In particular, the lagged dependent variable was significant at the 1% level in all estimated models, pointing to a certain degree of persistence in bank lending flows – without, however, offering a clear explanation for it.

***Wooldridge 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 could be substantial, and proposed an alternative, two-step estimation method in order to exploit full information contained in the data on zero flows.

Compared to other studies, where about half of 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 Wooldridge (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 to lend to an emerging market, and then how much it will lend. In the first step we thus introduced an additional variable (“Mundlak-Chamberlain correction”) in a panel probit model in order to control for fixed effects. In the second step, we estimated a simple fixed effects model for all the countries that engaged in cross-border lending, using the inverse Mills ratio calculated from the first-step estimation. The results showed that the inverse Mills ratio was significant in all models, suggesting that it was appropriate to take account of the selection bias. But even after this correction the estimated parameters were quite comparable to the original ones in Table 2. One difference was that the coefficients on lender and borrower country GDP were higher than in the original model.

## 5.2 Financial centres effect

As noted above, the use of the locational banking statistics in a gravity model poses problems if some exposures are booked in financial centres. These problems could be addressed by shifting to the consolidated statistics, but at the expense of a shorter sample period and exchange rate adjusted data. We therefore decided to stick with the locational data and perform a robustness test by dropping two major financial centres in our data sample – Switzerland and the United Kingdom – to see whether the presence of these centres affects the results. The results of estimates without financial centres indicated that, with the exception of lender country GDP, which becomes statistically insignificant in the first three models, estimates of other parameters were quite comparable to the original results presented in Table 2 (for details, see Herrmann and Mihaljek, 2010). This confirmed that the inclusion of financial centres did not bias the results of our estimates.

## 5.3 Country-specific risk factors: An extended analysis

Our empirical analysis has so far come to the conclusion that country specific factors – fiscal balance and borrower country bank health – were significant determinants of cross-border bank flows. To test how far some other risk factors contributed to the transmission of financial stress, we introduced five country specific vulnerability indicators suggested among others by Goldstein et al (2000).

First, we introduced the spread between lending and deposit interest rates charged by commercial banks (*SPREAD\_L\_D*) as a proxy for financial sector efficiency – inefficient or loss-making banks need larger spreads to ensure profitability. The spread is expected to be negatively correlated with the dependent variable, as deteriorating bank efficiency in the borrower country should reduce cross-border bank flows to the country.

Second, we replaced general government balance with short-term debt as a percentage of GDP (*SHT\_DBT*). This indicator reveals more directly short-term foreign liabilities of the economy as a whole, rather than a mixture of domestic and foreign liabilities of the government that is implicit in the budget deficit figures. A higher ratio of short-term debt could indicate future liquidity problems and induce foreign lenders to reduce their cross-border loans.

Third, we added a foreign reserves indicator – the official foreign exchange reserves as a percentage of M2 (*FOR\_RES*). Large precautionary holdings of foreign exchange reserves provide self-insurance against external payment shocks, so one would expect them to be positively correlated with cross-border loans (Aizenman, 2009; Obstfeld et al, 2009).

Fourth, we added the external current account balance in percent of GDP (*CUR\_ACT*). We expect a higher external deficit to 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.

Fifth, we added real growth rate of domestic private sector credit (*CREDIT\_GR*). Rapid credit growth sustained over several years typically signals a credit boom, which is usually followed by an increase in non-performing loans. One can therefore expect foreign lenders to be more cautious in extending additional cross-border loans to a country experiencing a credit boom.

Again, the analysis is done with the random effects estimator. 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. *Table A1* in the Appendix summarises the results.

All additional country specific risk variables are statistically highly significant. Except for credit growth, all coefficients have the expected signs. The positive sign of the coefficient on credit growth indicates that external lenders provided more rather than less loans to the emerging markets with faster domestic credit growth. In other words, this variable did not operate as an early warning indicator of domestic vulnerabilities, but rather as a sign of buoyant demand for external financing. This interpretation of domestic credit growth may have contributed to excessive lending to some emerging markets, especially the catching-up economies in CEE, where credit kept expanding for several years in expectation of smooth convergence to the EU. Consumption smoothing is legitimate for emerging markets up to a point. However, as the recent experience of countries such as Greece, Ireland, Portugal and Spain shows, consumption smoothing is not risk-free, as the catching-up economies eventually need to generate sufficient productivity gains to increase domestic saving.

## 5.4 Regional samples

To assess regional differences in the determinants of cross-border bank flows we estimated regressions of five models from *Table 2* separately for emerging Asia, Latin America and central and eastern Europe. The analysis was done using the random effects estimator from the original set of regressions and covered the full time span of the data set from 1993 to 2008. The results are presented in *Tables A2–A4* in the Appendix.<sup>21</sup>

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<sup>21</sup> Note that the analysis of regional differences done in Graph 4 refers only to the latest crisis in 2007–08.

On the whole, regional estimates are in line with the original estimates for the full sample. For some variables we obtain less significant estimates, and for a few of those the sign changes, which is not surprising taking into account the smaller number of observations and regional differences.<sup>22</sup> In particular, distance retains statistical significance at the regional level only for the CEE sample and the global factors model in the Asian sample. This suggests that the gravity model might be more relevant for studying credit flows across several regions than to individual regions.

Another interesting result is that, unlike the Asian and Latin American samples, several macroeconomic variables are not significant in the CEE sample. These include interest rate differentials (insignificant in all five CEE regressions); the exchange rate differential (insignificant in two out of five CEE regressions); and the fiscal balance (insignificant and the “wrong” sign in the risk model) (*Table A4*). This suggests that higher interest rates and appreciating exchange rates in the CEE region did not by themselves attract foreign bank inflows – nor did fiscal imbalances deter them. As the bulk of cross-border lending to CEE comes from western European banks, this result suggests that “soft” aspects of lending, such as strong linkages between parent banks and their subsidiaries, have been more important determinants of cross-border bank flows than the “hard” aspects such as interest rate and exchange rate differentials or fiscal imbalances.

The financial stress variables keep their signs but not always significance in regional regressions. For instance, in the Asian sample estimates of parameters for global risk aversion and, surprisingly, exposure of lender banks to the Asian crisis countries are insignificant. In the Latin American sample, estimates of the US and Asian common lender effects are insignificant. And in the CEE sample, the parameter estimate for the health of lender banks is statistically insignificant (though positive). This suggests that spillovers to different emerging market regions do not always take place through the same channels.

Central and eastern Europe stands out with respect to the significance of the common lender effect across all three crisis episodes. This result might simply reflect the fact that banks lending to CEE – ie, major western European banks – are more international in the scope of their operations, and hence more likely to be affected by the crises occurring in different parts of the world, than banks lending to other emerging market regions. Thus, when exposure to a crisis country (or countries) forces European banks to de-leverage, lending to CEE might fall more than lending to Asia or Latin America.

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<sup>22</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 only statistically significant estimate (though at just the 10% level) with the “wrong” sign is the distance parameter in Latin America’s lender model (*Table A3*).

## 5.5 Different crisis periods

To assess how determinants of cross-border bank flows differ across crisis episodes, we estimated separate regressions for all emerging market countries during the Mexican crisis of 1994–95, the Asian crisis of 1997–98, and the global financial crisis of 2007–08. The estimates were done using the random effects estimator. The results are presented in *Tables A5–A7* in the Appendix.

For the Mexican crisis, the only model that performed somewhat better was the lender exposure model, in which the common lender effect and the coefficient on bank health in lender countries both are significant (*Table A5*). One difference with the full sample (as well as the Asian and current crisis samples) is that the coefficient on lender country GDP switched sign to positive, implying that banks from larger lender countries increased loans to emerging markets during the Mexican crisis.

For the Asian crisis, several models provide useful estimates. In addition to the basic gravity model, estimates of global financial factors, borrower country risk and financial/monetary linkages were all statistically significant (*Table A6*). However, some estimates of the basic gravity parameters from these models are insignificant (although in almost all cases correctly signed). One set of factors that did not help explain the reduction of cross-border lending to emerging markets during the Asian crisis is lender exposure: coefficients on the common lender effect and lender banks' health are both insignificant.

For the current crisis, the global, lender exposure and linkages models yielded statistically significant estimates of some of the key variables, including global financial market volatility, health of lender banks, the degree of financial openness and exchange rate regime (*Table A7*). Tighter financial and monetary integration seemed to have a particularly strong stabilising effect on cross-border bank flows during the latest crisis. However, other key variables, including global investors' risk aversion and exposure of lender banks to the US, did not have statistically significant parameter estimates.

In addition, the interest rate differential became negative and statistically significant in all specifications, suggesting that (higher) emerging market interest rates may have properly reflected increased risk premia during the crisis. Moreover, the sign of the coefficient on lender country GDP was reversed. Our hypothesis on this change in sign is that larger advanced economies had greater fiscal and monetary policy freedom to handle the negative effects of the crisis, and their interna-



tional banks were therefore not forced to reduce cross-border loans 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 markets and tried to identify the main determinants of such flows. We constructed a panel data set of bilateral cross-border bank flows from 17 advanced economies to 28 emerging market countries in Asia, Latin America and central and eastern Europe. The observation period covered quarterly data from 1993 to 2008. 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 reduced cross-border loans to the emerging markets. Larger markets in borrower countries were associated with larger cross-border bank lending. Cross-border bank flows also responded positively to interest rate and growth differentials, and negatively to appreciation of the borrower country currency.

Regarding transmission of financial stress, the analysis revealed that both global and country specific risk factors, in lender as well as borrower countries, were significant determinants of cross-border bank flows. This result applied to all three emerging market regions, suggesting that spillover effects were transmitted through similar channels.

In particular, banks from advanced economies tend to adjust cross-border loans in response to a reassessment of global risk and global financial market volatility, and in response to their own exposure to a primary crisis country. In addition, weak performance of banks in advanced economies was associated with lower cross-border loans to emerging markets. Lenders 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 emerging market economies. Stronger financial and monetary linkages between lender and borrower countries helped stabilise cross-border flows even in times of financial stress.

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 were reassessment of global risk and greater expected volatility of global financial markets. Healthier banking sectors, more rigid exchange rate regimes and stronger financial integration contributed to the stability of cross-border bank flows to central and eastern Europe compared to other emerging market regions.

## Appendix

Table A1

Determinants of cross-border bank flows from advanced to emerging markets  
Random effect estimator with country fixed effects/time effects and PCSE  
Extended analysis of borrower country risk factors

Dependent variable: log of quarterly, exchange-rate adjusted change in external position (in millions USD) of banks in country *i* vis-à-vis all sectors in country *j*

	Extended RISK Model
DIST	−0.688 (−9.46)***
GDP_B	1.247 (9.12)***
GDP_L	−0.806 (−4.28)***
INT_diff	0.017 (3.25)***
GR_diff	0.020 (2.61)***
ER	−0.015 (−4.02)***
SPREAD_L_D	−0.0003 (−2.67)***
SHT_DBT	−0.010 (−1.98)**
FOR_RES	0.008 (2.74)***
CUR_ACT_(t-1)	−0.037 (−1.88)*
CREDIT_GR_(t-1)	0.006 (3.10)***
BK_HLTH_B	0.005 (8.41)***
R <sup>2</sup>	0.06
N	30,464

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

To avoid a near-singular matrix, US/IN/TR/TW/VN country fixed effects had to be eliminated.

Table A2

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 banks in country <i>i</i> vis-à-vis all sectors in country <i>j</i> (in millions USD) of					
	BASIC Model	GLOBAL Model	LENDER Model	RISK Model	LINKAGE Model
DIST	−0.136 (−0.29)	−0.147 (−0.33)***	0.082 (0.17)	0.018 (0.04)	−0.010 (−0.02)
GDP_B	0.339 (1.45)	0.605 (2.58)**	0.530 (1.89)**	−0.172 (−0.69)	1.067 (3.60)***
GDP_L	−0.188 (0.73)	−0.550 (−1.99)	−0.394 (−1.07)	−0.206 (−0.73)	−0.160 (−0.43)
INT_diff	0.051 (4.97)***	0.045 (4.31)***	0.060 (5.02)***	0.024 (2.28)**	0.082 (6.53)***
GR_diff	0.114 (8.17)***	0.087 (6.15)***	0.117 (7.19)***	0.078 (5.32)***	0.093 (5.35)***
ER	−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_AVERS		−0.001 (−1.24)			
CLE_US			−0.034 (−1.66)*		
CLE_AS			−0.003 (−0.12)		
CLE_MX			−0.294 (−2.56)***		
BK_HLTH_L			0.004 (4.42)***		
GVT_BAL				0.257 (6.99)***	
BK_HLTH_B				0.664 (11.57)***	
FIN_OPEN					0.158 (2.22)**
ER_REGIME					−0.605 (−6.14)***
R <sup>2</sup>	0.02	0.04	0.03	0.04	0.04
N	9,792	9,792	9,792	9,792	9,792

Note: 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 fixed effects had 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; Linkages model: GR/NO/US/VN.

Table A3

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 USD) of banks in country <i>i</i> vis-à-vis all sectors in country <i>j</i>					
	BASIC Model	GLOBAL Model	LENDER Model	RISK Model	LINKAGE Model
DIST	0.299 (0.23)	-0.407 (-0.09)	2.382 (1.65)*	-4.26 (-1.38)	-1.023 (-0.70)
GDP_B	1.709 (6.91)***	1.802 (6.89)***	0.158 (5.50)***	1.065 (4.07)***	1.721 (6.97)***
GDP_L	-1.42 (-4.85)***	-1.531 (-4.80)**	-0.367 (3.50)***	-0.932 (-3.13)***	-0.283 (1.34)
INT_diff	0.017 (2.98)***	0.007 (1.03)	0.022 (3.07)***	0.013 (1.94)**	0.024 (3.65)***
GR_diff	0.009 (0.92)	-0.010 (-1.07)	0.007 (0.65)	0.003 (0.28)	0.020 (1.80)*
ER	-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_AVERS		-0.002 (-1.63)*			
CLE_US			-0.004 (-0.21)		
CLE_AS			-0.024 (-1.20)		
CLE_MX			-0.477 (-2.23)**		
BK_HLTH_L			0.002 (1.93)**		
GVT_BAL				0.086 (4.05)***	
BK_HLTH_B				0.0056 (2.72)***	
FIN_OPEN					0.001 (0.01)
ER_REGIME					-0.255 (-4.10)***
R <sup>2</sup>	0.03	0.03	0.04	0.02	0.03
N	7,616	7,616	7,616	7,616	7,616

Note: 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 fixed effects had 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; Linkages model: GR/NO/US/VE.

Table A4

Determinants of cross-border bank flows from advanced to emerging markets  
Random effects estimator for central and eastern Europe with country fixed effects and PCSE

Dependent variable: log of quarterly, exchange-rate adjusted change in external position (in millions USD) of banks in country *i* vis-à-vis all sectors in country *j*

	BASIC Model	GLOBAL Model	LENDER Model	RISK Model	LINKAGE Model
DIST	-0.880 (-7.83)***	-0.880 (-7.85)***	-0.963 (-7.77)***	-0.967 (-7.86)***	-0.395 (-3.83)***
GDP_B	0.919 (7.56)***	1.095 (8.75)***	0.774 (4.43)***	0.965 (5.97)***	0.793 (5.00)***
GDP_L	-0.306 (-1.40)	-0.660 (-2.93)**	-0.027 (-0.08)	-0.563 (-2.02)**	-0.262 (-0.95)
INT_diff	0.002 (0.51)	-0.001 (-0.49)	-0.000 (-0.01)	-0.013 (1.57)	(- 0.005 (1.35)
GR_diff	0.048 (5.86)***	0.040 (4.85)***	0.053 (5.60)***	0.061 (5.89)***	0.040 (3.91)***
ER	-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_AVERS		-0.002 (-2.39)**			
CLE_US			-0.024 (-1.67)*		
CLE_AS			-0.035 (-2.87)***		
CLE_MX			-0.183 (-2.04)**		
BK_HLTH_L			0.001 (1.37)		
GVT_BAL				-0.015 (-0.78)	
BK_HLTH_B				0.002 (1.82)**	
FIN_OPEN					0.185 (14.40)***
ER_REGIME					-0.302 (-4.40)***
R <sup>2</sup>	0.06	0.06	0.06	0.04	0.10
N	13,056	13,056	13,056	13,056	13,056

Note: 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 fixed effects had 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; Linkages model: NO/US/TR.

Table A5

Determinants of cross-border bank flows from advanced to emerging markets

Random effects model for the Mexican crisis (1994–95) with country fixed effects and PCSE

Dependent variable: log of quarterly, exchange-rate adjusted change in external position banks in country <i>i</i> vis-à-vis all sectors in country <i>j</i>		(in millions USD) of			
	BASIC Model	GLOBAL Model	LENDER Model	RISK Model	LINKAGE Model
DIST	−0.459 (−2.63)***	−0.461 (−2.65)***	−0.546 (−2.68)***	−0.694 (−1.70)*	−0.321 (−1.52)
GDP_B	−0.028 (−0.04)	0.304 (−0.44)	−0.844 (−0.84)***	0.298 (0.26)	−0.070 (−0.09)
GDP_L	2.461 (2.26)**	1.547 (1.33)	3.660 (2.11)**	2.807 (1.52)	2.429 (1.98)**
INT_diff	−0.014 (−0.87)	−0.010 (−0.64)	−0.011 (−0.47)	−0.115 (−2.09)**	−0.015 (−0.85)
GR_diff	0.031 (1.91)*	0.025 (1.50)	0.035 (1.72)*	0.059 (1.95)**	0.040 (2.21)**
ER	−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_AVERS		0.039 (2.53)			
CLE_MX			−2.542 (−2.12)**		
BK_HLTH_L			−0.004 (−0.79)**		
GVT_BAL				0.161 (0.81)	
BK_HLTH_B				0.0003 (0.03)	
FIN_OPEN					0.070 (0.76)
ER_REGIME					−0.311 (−1.74)*
R <sup>2</sup>	0.1	0.1	0.1	0.1	0.1
N	3,808	3,808	3,808	3,808	3,808

Note: 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 fixed effects had 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;

Linkages model: FR/GR/NL/NO/PT/US/AR/BR/HR/HU/IN/LT/MX/MY/RO/VE/VN.

Table A6

Determinants of cross-border bank flows from advanced to emerging markets  
Random effects model for the Asian crisis (1997–98) with country fixed effects and PCSE

Dependent variable: log of quarterly, exchange-rate adjusted change in external position banks in country <i>i</i> vis-à-vis all sectors in country <i>j</i> (in millions USD) of					
	BASIC Model	GLOBAL Model	LENDER Model	RISK Model	LINKAGE Model
DIST	−0.254 (−1.69)*	−0.253 (−1.70)*	−0.245 (−1.43)	−0.371 (−2.22)**	0.864 (0.89)
GDP_B	1.478 (3.02)***	2.022 (4.04)***	1.786 (3.18)***	0.300 (0.46)	1.476 (2.63)***
GDP_L	−5.352 (−4.24)***	−0.887 (−0.586)	−5.319 (3.86)***	−3.975 (−2.68)***	−6.192 (−4.81)***
INT_diff	0.027 (3.39)***	0.024 (3.00)***	0.029 (3.27)***	0.009 (0.64)	0.027 (3.19)***
GR_diff	0.066 (3.58)***	0.029 (1.55)	0.056 (2.71)***	0.044 (1.95)**	0.084 (4.24)***
ER	−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_AVERS		−0.009 (−2.40)***			
CLE_AS			−0.012 (−0.15)		
BK_HLTH_L			0.001 (0.461)		
GVT_BAL				0.129 (1.91)**	
BK_HLTH_B				0.006 (2.20)**	
FIN_OPEN					0.608 (3.91)***
ER_REGIME					−0.256 (−2.03)**
R <sup>2</sup>	0.1	0.1	0.1	0.1	0.1
N	3,808	3,808	3,808	3,808	3,808

Note: 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 fixed effects had 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;

Linkages model: FR/GR/NL/US/AR/LT/MX/MY/NO/RO/VE/VN.



Table A7

Determinants of cross-border bank flows from advanced to emerging markets

Random effects model for the global financial crisis of 2007–08 with country fixed effects and PCSE

Dependent variable: log of quarterly, exchange-rate adjusted change in external position banks in country <i>i</i> vis-à-vis all sectors in country <i>j</i> (in millions USD) of					
	BASIC Model	GLOBAL Model	LENDER Model	RISK Model	LINKAGE Model
DIST	−1.306 (−8.69)***	−1.301 (−8.71)***	−1.374 (−8.17)***	−0.332 (−8.87)***	−0.144 (−5.60)***
GDP_B	0.942 (1.26)	0.010 (−0.01)	−0.635 (−0.76)	−0.294 (−0.58)***	1.826 (1.51)
GDP_L	2.482 (2.31)**	2.558 (1.90)**	3.414 (2.48)***	0.236 (2.09)**	−2.354 (−1.07)
IR_diff	−0.258 (−4.85)***	−0.016 (−0.26)	−0.146 (−2.44)***	−0.242 (−5.12)***	0.607 (2.20)*
GR_diff	0.169 (6.61)***	0.085 (3.18)***	0.150 (4.88)***	0.162 (5.81)***	0.082 (0.92)
ER	−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_AVERS		−0.002 (−0.82)			
CLE_US			0.089 (0.79)		
BK_HLTH_L			0.015 (4.87)***		
GOV_BAL				0.053 (0.60)	
BK_HLTH_B				−0.010 (−1.91)*	
FIN_OPEN					0.156 (6.89)***
ER_REGIME					−0.420 (−2.64)***
R <sup>2</sup>	0.1	0.1	0.1	0.1	0.2
N	3,808	3,808	3,808	3,808	3,808

Note: 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 fixed effects had 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; Linkages model: NO/US/VE/VN.

## List of variables

Mnemonic	Data sources*	Variable description
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.
DIST	www.timeanddate.com	Distance between the capital of country <i>i</i> and country <i>j</i> , in kilometres.
GDP (_L, _B)	CEIC, Datastream, Eurostat, IFS, CEIC, National data	Nominal GDP (of lender and borrower countries), in millions of US dollars.
INT_diff	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).
GR_diff	Datastream, IFS	Real GDP growth differential between country <i>j</i> and country <i>i</i> , in percentage points.
ER	Datastream, IFS	Bilateral nominal exchange rate index.
VIX	Bloomberg	VIX Chicago Board Options Exchange S&P 100 Volatility Index, quarterly average.
RISK_AVERS	Moody's	Spread of corporate bonds (AAA, AA, A and BAA) over 10-year US Treasury bonds, quarterly average.
CLE (_MX, _AS, _US)	BIS, LBS	Common lender effect, measuring exposure of banks in a lender country to the primary crisis country (MX, five Asian crisis countries, or the US); external assets of country <i>i</i> vis-à-vis the primary crisis country, as a percentage of the total amount outstanding of external assets of country <i>i</i> .
BK_HLTH (_L, _B)	Datastream, IFS	Bank health indicator (of lender and borrower countries); deviation of the banking industry subindex from the main equity price index; in percent.
GVT_BAL	WEO	General government balance, linearly interpolated, as a percentage of country <i>j</i> 's GDP.
FIN_OPEN	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> 's GDP.
ER_REGIME	RRI	Exchange rate regime, coarse classification codes from Reinhart and Rogoff (2004).
SPREAD_L_D	IFS	Spread between the main lending and deposit rates of interest, in basis points.
SHT_DBT	BIS, CBS, IDS, WEO	Debt 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 <i>j</i> ; as a percentage of country <i>j</i> 's GDP.
FOR_RES	IFS, National Data	Foreign exchange reserves, outstanding positions as a percentage of M2.
CUR_ACT	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.
CRED_GR	IFS, National data	Real credit to the domestic private sector, annual growth rate in percent.

**\* Sources of data**

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

**Central and eastern European economies:** 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 economies:** 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).

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