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Global Banks and International Shock Transmission: Evidence from the Crisis

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Abstract

Global banks played a significant role in transmitting the 2007-09 financial crisis to emerging-market economies. We examine adverse liquidity shocks on main developed-country banking systems and their relationships to emerging markets across Europe, Asia, and Latin America, isolating loan supply from loan demand effects. Loan supply in emerging markets across Europe, Asia, and Latin America was affected significantly through three separate channels: 1) a contraction in direct, cross-border lending by foreign banks; 2) a contraction in local lending by foreign banks' affiliates in emerging markets; and 3) a contraction in loan supply by domestic banks, resulting from the funding shock to their balance sheets induced by the decline in interbank, cross-border lending. Policy interventions, such as the Vienna Initiative introduced in Europe, influenced the lending-channel effects on emerging markets of shocks to head-office balance sheets.

Key words: bank, global, liquidity, transmission, capital markets, cross-border lending, emerging market

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I. Introduction

Global banks expanded their international activities over their past decade, with this expansion interrupted by the Great Recession. The consequences of this increased internationalization of banking have been debated. One dimension of the debate focuses on the advantages and disadvantages of banks from more developed financial systems having expanded and sometimes dominant positions in emerging market economies. Banking globalization can lead to institutional and regulatory or supervisory improvements, which promote "strong property rights and a financial system that directs capital to its most productive uses [which] are crucial to achieving high economic growth and the eradication of poverty" (Mishkin 2009). [1] When shocks originate within the emerging markets, foreign bank entry into local banking systems is a stabilizing force. It also results in more efficient allocation of productive resources in globalized economies [see survey by Goldberg (2009)].

Yet, international banking linkages are viewed as having spread the profound difficulties from the financial crisis that began in industrialized countries in 2007. The dramatic changes in capital flows to emerging markets are cited as evidence for such concerns (Chart 1). After a period of strong growth through 2007, capital inflows contracted across Emerging Asia, Latin America, and Emerging Europe. The initial boom was across multiple forms of private international capital flows (Chart 2), covering foreign direct investment, bank loans, portfolio equity, and net debt securities. While the subsequent reversal was in all broad categories of inflows, by far the sharpest decline in activity was in international bank loans. After rising to over $500 billion in 2007, international bank loans dropped to slightly above $100 billion in 2008. Such observations prompted the International Monetary Fund's April 2009 *World Economic Outlook* (WEO) to argue that global bank linkages "fuel the fire" of the current crisis to emerging markets (page 149).

In this paper we provide a conceptual and econometric examination of the international transmission of the balance sheet shocks that pummeled industrialized-country banks. We conjecture the existence of multiple channels of transmission of the original shock through the

[1] See also the discussion by Crystal, Dages, and Goldberg (2001) and by Calomiris and Powell (2001). Additionally, globalization of banking weakens the lending channel for monetary policy within the United States, while extending the transmission of U.S. policy and liquidity shocks to foreign markets (Cetorelli and Goldberg, 2008). The home market shocks are transmitted into the lending of foreign affiliates. At the same time, such internal capital markets mean that foreign bank subsidiaries do not need to rein in their credit supply during a (local) financial crisis at the same time that domestically-owned banks need to (De Haas and van Lelyveld, 2009). .

operations of global banks. Using bilateral lending data covering cross-border lending and local claims between countries, as well as data from destination emerging markets, we identify the magnitude and consequences of respective channels of transmission through international banks. To achieve this goal, we isolate loan demand from loan supply shocks, both of which contributed to the patterns shown in Chart 2, adapting an econometric methodology recently utilized by Khwaja and Mian (2008). Controlling for loan demand shocks is important, since the crisis also induced declines in home investment, home consumption, and international trade.[2]

In Section II we use the heuristic of T-accounts for bank balance sheets to show that the loan supply effects through global banks and international capital markets take three different forms. The intuition begins with the observation that changes in the sources of funds available to banks initiate a lending supply response (Kashyap and Stein 2000). The sources differ for global banks and domestically-owned banks in emerging markets. The *external capital market* of all banks in emerging markets includes local deposits, other host market sources, and cross-border interbank borrowing. Banks that are part of a broader organization, for example a global bank holding company, may also receive funding from related affiliates, with such resources falling under the heading of *internal capital market* funding.[3] Both external and internal capital markets play roles in the international transmission of shocks.

In a crisis, a foreign-owned bank hit by an adverse liquidity shock may reduce its cross-border lending. If this bank has overseas affiliates, it may also activate an internal capital market channel, reducing funding to affiliates abroad or actively transferring foreign funds in support to the head office balance sheet. The foreign-owned banks are not the only entities that may reduce lending in emerging markets. *Domestically*-owned banks may rely on external capital markets

[2] The dramatic collapse of global trade in goods and services during the crisis has spawned a debate about the reasons for this collapse. Comparative facts on the downturn are provided by Imbs (2010). Some studies posit that banking and trade credit disruptions played a key role (Amiti and Weinstein, 2009; Chor and Manova 2009). Other studies dispute the central role of trade credit, instead arguing that global demand and the expanded role of vertically integrated production account for most of the observed collapse of trade (Eaton, Kortum et al. 2009, Yi, Bems, and Johnson 2010, Levchenko, Lewis, and Tesar 2009), or that the collapse was a manifestation of an inventory adjustment (Alessandria, Kaboski, and Midrigan 2010).

[3] Internal capital markets have received earlier attention in domestic banking contexts. For example, Houston, Marcus, and James (1997) emphasize active internal capital markets in banking organizations, with banks relying on related entities in a bank holding company to get insulation from localized shocks within the United States. Likewise, Ashcraft (2008) shows that bank holding companies are a source of strength to their affiliates, while Campello (2002) shows that parent bank insulation from access to external capital markets extends to small affiliated banks, leaving them less vulnerable to shocks than other small banks that are unaffiliated. See also Ashcraft and Campello (2007). The application to global banks by Cetorelli and Goldberg (2008, 2009) argues that there is often internal borrowing and lending between parent organizations and their overseas affiliates. Correa and Murry (2009) consider the cross-border lending dynamics.

for funding local activities, with cross-border interbank borrowing being one of these external sources. Hence, domestically-owned banks also could end up with a balance sheet shock that reduces their own lending capacity. Indeed, the external capital markets of small host country banks can be quite volatile, leading to lending activity that is hostage to the boom and bust features of cross-border lending. Ex ante, however, it cannot be concluded that domestically-owned banks operating in emerging markets will necessarily be more stable or effective lenders in those markets than the foreign banks that have entered over the past decades. Which of these respective channels are larger in emerging markets is an empirical question.

In Section III we provide the econometric analysis of the bank lending channel in emerging markets, focusing on mechanics at work during the financial crisis of 2007 to 2009. Our methodology, an adaptation of Khwaja and Mian (2008), uses a difference-in-difference approach to isolate loan demand from loan supply in a matrix of lending between 17 developed source and 94 emerging market destination countries across Asia, Latin America, and Europe. Three types of lending are considered: cross-border loans, local loans extended by foreign-owned banks, and local loans extended by domestically-owned banks.

We find evidence of substantial lending supply shocks to emerging markets through all three balance sheet channels conjectured ex ante. Foreign banks that were particularly affected by the original liquidity shock to their balance sheet, cut both cross-border lending and local lending growth to emerging markets. Transmission through external capital markets was strong for both foreign-owned and domestically-owned banks. The loan supply contraction by domestically-owned banks was not attributable to their reliance on cross-border funding sources per se. Instead, the contraction was greater for those countries that had more cross-border funding from banking systems that were ex ante more imbalanced.[4]

Section IV concludes with a discussion of related policy themes. We argue that cross-border lending and internal capital markets are both conduits for international shock transmission, both positive and negative. However, these features do not imply that closed or reduced access to international capital markets is welfare-improving for emerging markets.

[4] Our approach focuses on transmission channels as a result of existing bilateral ties between source and destination countries. A complementary take is to look at potential "contagion" effects, so that transmission occurs also through "third" country channels. van Rijckeghem and Weder (2003) find evidence of significant transmission of shocks through such channels.

II. A Brief Primer on Internal and External Capital Markets and Bank Balance Sheets

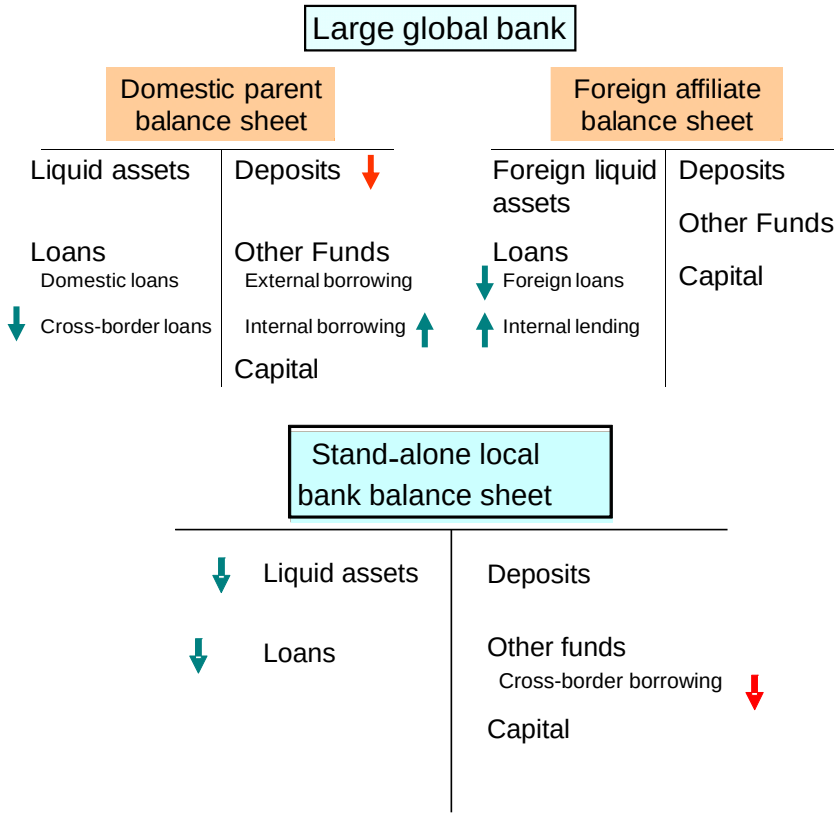
What can a bank do when confronted with a shock to its balance sheet? Alternative responses to a liquidity shock can be illustrated using a simplified version of bank balance sheets. The generic bank T-account has bank assets on the left side of the T and bank liabilities on the right side. In broad terms, bank liabilities are divided into deposits, other funds, and bank capital; bank assets are divided into liquid assets and less liquid assets such as loans extended to bank customers.

Prior research describes how a contraction in available liquidity, for example through a decline in a bank's reservable deposits, has distinct consequences across types of banks, such as small stand-alone banks, small banks affiliated with larger bank holding companies, and larger banks (Kashyap and Stein 2000; Campello 2002). A contractionary monetary policy that reduces the amount of reservable deposits (or other shock to bank funds) can translate into a reduction in bank lending activity when banks are unable to replace each dollar of lost deposits with other liabilities. The reduced liabilities will lead to a combination of reduced liquid assets and reduced lending. Larger banks or bank holding companies can either be domestically oriented or have operations spread across global markets. In the international context, balance sheet effects incorporate international transmission through internal capital markets and are statistically and economically important (Cetorelli and Goldberg 2008). International transmission also occurs through cross-border flows by global banks, even those without overseas branches and affiliates. The transmission of policy and liquidity shocks through U.S. bank cross-border flows has been statistically and economically significant: a significant reduction in the level of cross-border claims occurs during periods of U.S. monetary tightening, pointing to the existence of a cross-border lending channel (Correa and Murry 2009).

These themes are illustrated in Box 1 using the T-account framework applied to banks lending to emerging markets. Consider two types of banks: a global bank with an affiliate operating within an emerging market and a domestically-owned bank. The top panel presents the global bank balance sheets, distinguishing between those of the parent bank balance sheet and the affiliate. The parent bank has assets divided into liquid assets, loans in the home market, and cross-border loans. Given an initial adverse shock to liabilities through deposits or other sources of funds, the global bank can respond by trying to replace this liquidity in external capital markets. If this is not sufficient (or desirable), the bank can engage in some form of lending

contraction, reducing loan issuance at home or cross-border flows to foreign markets. Some balance sheet pressures can be alleviated if the parent organization borrows liquidity from overseas affiliates, i.e., through internal capital markets. Such borrowing may mitigate the liquidity shock consequences in the home market of the parent bank (Cetorelli and Goldberg 2008) or even cross-border loans. However, the internal capital market transfer changes the balance sheet of the affiliate firm, leading to adjustments that might lead to a reduction of local lending by that affiliate if other adjustments to affiliate bank assets or liabilities are not forthcoming. The cross-border loan supply contraction and the contraction in affiliate lending are two possible forms of parent bank transmission to emerging markets.

Box 1: Global Balance Transmission through Different Channels



By contrast, the initial transmission channel to the domestically-owned, stand-alone banks may come from a drop in cross-border interbank borrowing, used by these banks as a

source of funds. It is possible that deposits move between the domestically-owned banks and the foreign affiliates, but the direction of these flows is not straight-forward to predict. Without access to offsetting alternative funding sources, the loans extended by the domestically-owned bank might contract in line with the reduced availability of cross-border funds. This illustrates a third channel through which there can be international transmission of shocks into the loan supply to emerging markets.

III. Bank Funding and Lending Volatility in the Financial Crisis

The econometric analysis explores the scale and existence of these three channels of transmission of global bank shocks to emerging market economies in the crisis beginning in 2007. A priority in this analysis is isolating contractions in loan supply from those in loan demand. Below, we present the econometric methodology, discuss the main data sources, and conclude with the empirical findings.

III. 1 The econometric methodology

Our goal is to assess to what extent the balance sheet shocks suffered by banks in many developed countries during the financial crisis determined a corresponding shock to their supply of 1) cross-border loans to emerging economies and 2) local loans from their offices located in emerging market countries. Additionally, we want to assess the potential impact on the supply of loans by *domestic* banks in emerging markets, and the extent that the retreat in cross-border lending corresponded to a shock to domestic bank funding sources.

The empirical implementation presents important and well known identification challenges. In particular, it requires showing that if banks are affected by a shock to their funding sources, their ultimate response is to accommodate such shock with an equivalent adjustment in their lending activity. However, as our section II exposition of bank balance sheets shows, this accommodation of lending does not need to occur: banks may be able to substitute away from adversely shocked funding sources into other, more readily available ones. Moreover, even in the presence of imperfect substitution on the liability side of the balance sheet, banks may still be able to insulate lending activity by absorbing the liability shock with a corresponding change in available liquid asset buffers.

Moreover, establishing the existence of a bank lending channel also requires the identification of an effective lending *supply* shock, separate from potential contamination by concomitant changes in credit *demand* conditions. Recall from Chart 2 the substantial drop in international bank lending to emerging markets in the aftermath of the crisis. This decline in lending is not evidence *per se* of a loan supply shock. The same decline could have also been observed if banks had been able to insulate their lending books from the original liquidity shock – either through funding substitution and/or utilization of existing liquid asset buffers – and yet firms, simultaneously hit on current product demand or on their future investment opportunities, may have simply reduced overall loan demand. Given the extent of the crisis and the after-the-fact impact on global GDP growth, we cannot exclude a priori this alternative explanation.

In a recent paper, Khwaja and Mian (2008) propose a simple but elegant identification strategy that very effectively isolates a lending supply shock around a well-defined funding shock on banks' balance sheets.[5] The authors focused their attention on bank lending activity in Pakistan around the time of an exogenous macroeconomic shock that occurred in 1998 as a result of nuclear testing by India and Pakistan. In this episode, capital controls were imposed in response, generating a shock on dollar-denominated deposits and a resulting *quasi* natural experiment that Khwaja and Mian (2008) exploited to assess the extent of both the bank lending channel and the ultimate impact on firm borrowings.[6] The authors relied heavily on the fact that the liquidity shock was *not* felt homogeneously across banks, since ex ante not all Pakistani banks had built similar levels of dollar-denominated liabilities. Moreover, the authors took advantage of the fact that many firms had been borrowing simultaneously from more than one bank; hence, firm funding sources were heterogeneously affected. In light of this set of

[5] Schnabl (2009) provides another recent example of loan supply shock identification. He uses the 1998 Russian default as a negative credit supply shock to international banks and analyzes its impact on bank lending in Peru. With data on individual firms, he controls for credit demand by examining firms that borrow from several banks.

[6] In retaliation to unanticipated nuclear tests in India in May 2008, Pakistan followed through in a matter of days with their own nuclear tests. As a result of such tests, both countries were promptly sanctioned by the international community, with the suspension of exchange rate support to the Pakistani rupee as part of the sanction package. This chain of events, unrelated to the functioning of the Pakistani banking industry, ultimately resulted in a severe bank liquidity crunch, since many Pakistani banks had a substantial deposit base in dollar-denominated accounts. The dollars collected through these bank deposits, however, had to be transferred to the government, which upon withdrawal requests from bank clients would eventually release such dollars at the exchange rate at the time of the original deposit. In essence, the government bore all the currency risk on bank deposits. In response to the financial sanctions cited above, the Pakistani government announced the suspension of this convertibility agreement, releasing instead dollars at the current, much devalued exchange rate, effectively imposing a partial default on this liability. Despite the much less favorable conditions, a substantial amount of dollars were withdrawn by depositors, thus determining a severe funding crisis for the Pakistani banking system.

conditions, Khwaja and Mian (2008) modeled the change in the growth of lending supply by an array of individual banks vis-à-vis an array of firms to which they make loans. This informative difference-in-difference approach facilitates isolation of loan supply versus loan demand effects.

At least from the perspective of a natural experiment design, the characteristics of our empirical study have strong similarities to those in Khawja and Mian (2008). The recent financial crisis mainly originated as a sudden and exceptional shortage of dollar funding on the balance sheet of banks in many developed economies, the result of previous large build ups of dollar denominated assets from structured products that in the summer of 2007 became virtually unmarketable (see, e.g., Coffey, Hrung, Nguyen, and Sarkar 2009). Bank funding problems eventually mounted in the following months, and with the Lehman Brothers bankruptcy event in September 2008, dollar funding sources for banks effectively froze across the board. Ex ante vulnerability to dollar funding was significantly heterogeneous across banks, and, when aggregated to the country level, also significantly heterogeneous across banking systems. Similar to Khwaja and Mian (2008), the original balance sheet shock was felt differently across banking systems. These differences created associated balance sheet shocks and the potential lending supply shocks to differ across countries that previously had been a common source of funding to emerging market economies.

Going back to Khwaja and Mian (2008), the derived lending supply schedule in terms of (log) changes from before to after the shock is[7]

$$(1) \qquad \Delta L_{ij} = \beta_0 + \beta_1 \cdot \Delta D_i + \eta_j + \varepsilon_{ij}$$

In their article, the dimension *i* represented individual banks, and *j* individual borrowing firms. β_0 is a constant term, ΔD_i the indicator of the liquidity shock sustained by bank *i*, and η_j an unobservable term capturing simultaneous shocks to firm *j* credit demand. The term ΔL_{ij} captures the change in lending from before to after the event, and banks that were hit more by the liquidity shock should be those that reduce more (or grow less) their lending. As shown by Khawja and Mian, specification (1) as estimated with basic OLS would likely generate biased estimates of $\hat{\beta}_1$ because of a correlation with simultaneous demand shocks embedded in the unobservable term η_j. In normal circumstances, for instance, one would expect a simultaneous reduction in credit demand when there is a liquidity shock, so that not taking this effect into

[7] We defer to the original Khwaja and Mian (2008) article for the details of the model.

account would lead to an over-estimate of the true supply shock.[8] However, introducing borrowers' fixed effects on model specification (1) would absorb any demand driven contamination thus resolving the bias problem affecting the OLS estimation. Consequently, the alternative model specification for estimation is

$$(2) \qquad \Delta L_{ij} = \gamma_1 \cdot \Delta D_i + \gamma_j + \varepsilon_{ij}$$

with γ_1 now unbiased and γ_j being a vector of fixed effect coefficients. In essence, this alternative model specification achieves identification comparing the impact on lending of separate banks *i* to the *same* firm *j*. Under the less stringent assumption that the same firm uses multiple banks to obtain similar type of loans, any common shock on demand factors would not affect the identification of the supply effect.

In our study, we use data on the aggregate international lending activity (cross border claims and local claims) of developed countries *i* to emerging market economies *j*. We rely on the fact that the banking systems of the lending countries had built up significantly different degrees of reliance on dollar-denominated liabilities, and, therefore, from an ex ante perspective exhibited substantially different degrees of vulnerability to what happened next, a sudden shortage in dollar funding. In terms of the identification strategy above, this translates in different ΔD_i . Through model specification (2), where destination country fixed effect indicators are included, we test if the lending to a certain emerging market economy by banking systems that were ex ante highly vulnerable to dollar funding shocks changed more from the crisis than the lending to the same emerging market by banking systems that were ex ante less dollar vulnerable. We perform these tests separately for cross-border lending and for local lending by foreign-owned banks. We also explore whether government interventions to affect the bank lending channel and maintain loan supply were effective. In particular, we focus on the so-called Vienna Initiative, discussed further below.

While our empirical exercise lends itself very nicely to the same identification strategy, we are obviously limited by the scope of our sample size: Khawja and Mian (2008) had extensive micro-level data where each observation was a bank-firm loan, with a total sample size

[8] Khawja and Mian (2008) actually argue for a possible negative correlation and in their case found evidence consistent with their prior.

above 20,000 observations.[9] In our case, as discussed in section III.2, we use data for 17 source countries lending to 94 emerging economies, with a total theoretical sample size of 1598 observations, but that is smaller in practice since not all source countries may be lending to all destinations.

Another part of our empirics considers whether domestically-owned banks in emerging markets had balance sheet vulnerabilities to supply shocks via their reliance on cross-border sources of funding, leading to a loan supply response. The testing of the existence of this third channel of transmission, however, can only be based on simple cross sectional regressions using lending data by domestic banks in the emerging markets. The inability to "correct" for contemporaneous changes in loan demand is a problem. However, we can assess the potential severity of the demand bias from the estimation results obtained analyzing the local lending of foreign banks, under the assumption that local foreign banks and local domestic banks face similar loan demand schedules. In the empirical exercise we analyze post-pre crisis domestic lending growth in relation to two variables related to cross-border funding. One variable is total cross-border bank lending to the emerging market (summed across all source markets) relative to total domestic bank lending in the same emerging market. The second variable embeds a more nuanced view of which source countries accounted for this cross-border bank lending. Specifically, we consider the extent of funding sourced from low ex ante dollar-vulnerable countries or from high ex ante dollar-vulnerable countries. This exercise allows us to address the issue of whether loan supply contracted the most in the crisis for the domestically-owned banks that relied the most on *any* cross-border financing (emerging market banking system most open to international funding markets), or whether instead the contraction was mainly the result of relative high exposure to a set of foreign countries that ex ante had become especially dollar vulnerable.

[9] The constraint imposed by the fixed effect specification is that, by relying on a *within* firm comparison of lending by two separate banks, it can only be implemented on the subset of firms borrowing ex ante from more than one bank. This limitations lead to a drastic reduction in sample size in the Khawja and Mian (2008) exercise (but still leaving them with more than 5,000 unique bank/firm observations). In our case, this is less of an issue, since at an aggregate level only a handful of destination countries in the dataset borrow from just one source country. In our regression analysis those destination countries are excluded.

III.2 Data

Bank lending data. The bilateral data on international bank lending are from the Bank for International Settlements' (BIS) Consolidated International Banking Statistics. This database contains information on positions of banks from BIS reporting countries with respect to counterparties around the world, with data aggregated across all reporting banks from the source countries. The two main lending variables are: 1) international claims, which capture the sum of cross border lending and local claims extended in foreign currency, and 2) local claims in local currency. These variables are our proxies for cross-border lending and local lending, respectively, by foreign-owned banks in destination markets.[10] Our analysis includes data for 17 source countries and 94 destination countries from three emerging market regions: Latin America (30 countries), Emerging Asia (21 countries), and Emerging Europe (43 countries). The source countries are: the United States, Japan, Australia, Belgium, Canada, Switzerland, Denmark, Germany, Spain, France, Great Britain, Ireland, Sweden, Portugal, the Netherlands, Luxembourg, and Italy. The list of destination countries is provided in Appendix Table 1.[11]

The pattern of partnering between developed countries and the emerging markets validates our application of the Khwaja and Mian (2008) approach. Table 1 presents the destination countries as rows, focusing only on the 8 largest emerging markets in each region, and shows how many of the seventeen source countries were partners in cross-border lending or local lending for each destination in the pre-crisis and crisis period. The cross-border flows come from a wider array of source countries compared with local claims, where financial sector foreign direct investment is a precondition. The similarity of pre- and post- columns for both international claims and local claims shows that the capital flow adjustments were on the intensive margin (quantity adjustments vis-a-vis existing partners) and not the extensive margin (countries added or dropped as partners), at least as measured at the level of bank-country observations. Table 1A presents information on the number of destination countries, out of the

[10] The treatment of local claims in foreign currency in the database makes these proxy variables instead of true representations.

[11] Some gaps appear in the data available in DBSonline, and are due to confidentiality concerns of the reporting central banks. For example, Both Denmark and Finland no longer have a numerous national banking system, as most of their domestic banks have over time been bought up by larger banks from other Scandinavian countries. When reported data is the aggregate from a small number of commercial banks, the reporting central banks may report the observations to the BIS marked with Observation Level Confidentiality C Confidential, and this data is suppressed from export to DBSonline. The bank type B Domestic Banks amounts vis-à-vis developing countries are not in DBSonline, but the bank type A All Banks amounts are available there.

full sample of 94, that are served by very few of the (17) source countries. All destination EMs receive cross-border funds. Only two EMs are served by a single source, and need to be dropped from the fixed effects estimation sample. Almost all destination EMs receive cross-country funds from more than three sources. The patterns, as expected, are much different for local claims. Twenty-six EMs do not have local claims extended by any of the 17 source countries, while another 19 EMs have only 1 source presented. The EM country sample for the fixed effects specifications is the remaining group of 49 countries.

Table 2 provides a complementary set of observations from the vantage point of the respective source countries. In cross border flows (international claims), a majority of the emerging markets were served by France and Great Britain, followed by another broader group of active European lenders and the United States. In local claims, source countries have more limited international footprints as measured in terms of numbers of EM destinations. Some source countries have had very little entry into EM banking systems (Australia, Ireland, Luxembourg) while banks from other source countries have a broader global presence (United States, France, Great Britain, Netherlands).

The upper panel of Table 3 provides detailed summary information covering bilateral and domestic lending growth pre-crisis versus in the post-crisis period. These summary data directly pertain to the dependent variables to be used in the formal econometric exercises. Cross-border lending will include 1032 observations, while the number of local claims observations is smaller, at 267. Positive mean pre-post values pick up a general upward trend in lending patterns. Nonetheless, there is a wide range of experiences across pairs of countries, as illustrated by the minimum, maximum, and standard deviation columns.

The final piece of lending information pertains to lending by domestically-owned banks. Since such information is not readily available for the broad group of 94 EMs we construct a proxy by combining the BIS local claims data and information from the International Monetary Fund's International Financial Statistics (IFS). From the IFS data we extract series on Bank Claims on Private Sector and Bank Claims on the Central Government.[12] Then, we construct domestic bank lending as the sum of Bank Claims on Private Sector plus Claims on Central

[12] IFS 22d for bank lending means something slightly different for different countries (most often claims on private sector from banking institutions, but sometimes claims on other sectors from deposit money banks or another combination). 22a through c are claims on central government, state and local governments, and nonfinancial public enterprises.

Government from (both IFS), net of the total of Local Claims in Local Currency from all BIS reporting countries. The last row of Table 3 shows that our analysis will work with a smaller sample of data, on 62 country observations on the change in domestic bank lending growth, with there being a wide range of positive and negative values across countries.

Banking Sector Dollar Vulnerability. A third type of data used in the econometrics is a constructed indicator of banking system vulnerability at the onset of the crisis. Recall that the strategy for identifying lending supply shocks relies on the observation that, from an ex ante perspective, banks from different developed countries had differing degrees of vulnerability to U.S. dollar funding shocks. This vulnerability was the result of the buildup of dollar-denominated assets on their balance sheets and degrees of maturity mismatching between dollar assets and corresponding funding sources. As shown by McGuire and von Peter (2009a, b), there were substantial differences across countries in the tendency of internationally active banks to accumulate mismatches.

Using confidential components of the BIS International and Consolidated Banking Statistics, McGuire and von Peter have constructed three alternative measures capturing the degree of dollar vulnerability for a number of developed-economy banking systems (see box). The basic idea is that the measures reflect gross short term U.S. dollar funding risks. All measures include the summed external liabilities of banking systems, with differences in whether some exposures are treated as gross or as net of corresponding asset positions. For example, measures V1 and V2 differ only with respect to treatment of liabilities to banks, taken either as net or gross positions. V3 also contains net positions of country banks vis-à-vis non-banks, but only if these positions are liabilities of the banks.

We use the values of these three alternative measures of country-specific dollar vulnerability calculated at the time right before the onset of the crisis. Basic summary statistics are provided in Table 3, Panel B, together with the computation of the pair wise correlations across the three ex-ante measures of banking system dollar vulnerability. The summary statistics show a substantial degree of cross-sectional variability for each measure. The pairwise correlations of measures are high, especially across V1 and V2. By construction, V3 is most different from the other two (reflected also in the lower correlations) and also based on the strongest assumptions.

Definitions of the three gross short term dollar funding need measures.

All three measures are normalized by each country's total international claims for the econometric work.

V1: Liabilities to official monetary authorities + International liabilities to non-banks + Local liabilities to US residents booked by US offices + Liabilities to banks + cross-currency FX swap (if negative);

V2: Liabilities to official monetary authorities + International liabilities to non-banks + Local liabilities to US residents booked by US offices + Net Liabilities to banks + cross-currency FX swap (if negative);

V3 either : Liabilities to official monetary authorities + Net Liabilities to banks + cross-currency FX swap (if negative) + Net positions vis-à-vis non-banks (if negative), or Liabilities to official monetary authorities + Net Liabilities to banks + cross-currency FX swap (if negative) (if Net positions vis-à-vis non-banks is positive).

Panel B also provides information of the magnitude of banking system imbalances in 2007, at the outset of the crisis, for a subset of the group of seventeen source countries.[13] Using V2 as the reference measure, the data show that German banks had $865 billion of dollar funding needs, while Spanish and U.K. banks had needs of $247 billion and $1.5 trillion, respectively. When these constructions are normalized by the total international claims of banks from these same countries, Germany had relatively low ex ante dollar vulnerability, at 25.4 percent of external loans, while the U.K. banks had relatively high funding needs, at 90 percents of international loans. Based on the distribution of observations across source banking countries, Germany had low (percentage) banking sector dollar vulnerability, while Spain was moderate, and U.K. banking system vulnerability was high.

Policy Initiative. Finally, our econometric exercise allows for the possibility of global bank transmission consequences of the so-called Vienna Initiative that was contracted between banks and internally active banks in Europe in February 2009 with the goal of preventing a destabilization of Emerging Europe. This joint international financial institution action plan

[13] Due to the confidential nature of the data, we are only authorized to display actual vulnerability figures for a limited subset of the source countries.

resulted in a total of $10.8 billion of support committed to a range of European banks to support their lending to ten European Union countries, the Western Balkans, and Turkey. Beyond the private banks participating in this program, the public policy partners included the European Bank for Reconstruction and Development, the European Investment Bank Group, and the World Bank. Appendix Table 2 provides details on reported disbursements through this program through September 2009, by bank and by destination country.

III.3 Bank transmission from industrialized to emerging markets

A non-parametric illustration. The identification strategy can be appreciated first with a simple, non-parametric exercise comparing average international lending to emerging markets before and after the crisis event, between banking systems that were ex ante highly vulnerable to dollar funding shocks and those that were instead less vulnerable. We defined the pre-crisis period from 2006q2 to 2007q2 and the post-crisis period from 2008q3 to 2009q2. As previously noted, we purposefully leave out the intermediate period between 2007q3 and 2008q2. Arguably the Lehman's events in September 2008 mark the cleanest and most important crisis event, but at the same time the last quarter of "normal" market functioning goes back to the time prior to August 2007. Alternative datings of the period before the dollar funding shock and following this shock certainly can be argued and were considered in robustness tests.[14]

For this first exercise, we divide source banking countries into two groups – those with high or low ex ante dollar vulnerability. We compute the (log of) lending growth by source country vis-à-vis each destination country and then take averages across pre- or post- periods, averages across destinations, and averages across groups of source countries. We defined high (low) dollar vulnerable countries as those with values of the vulnerability measure V2 above (below) the median. In the subsequent regression analysis, we make use of the whole information embedded in the continuous variables V's, and not just use of the coarse high-low vulnerability groupings.

Time averages across each of the intervals and broad vulnerability divisions are provided in Table 4. For cross-border lending, shown in the top panel, countries with high ex ante dollar vulnerability exhibited higher average lending growth than low vulnerability countries before the

[14] In order to address the robustness of the empirics under alternative timing assumptions, we have experimented with a number of alternative definitions for both the pre and post periods. The choice of alternative dates does not really have any material impact on the results. Results based on alternative time windows are available upon request.

crisis (first row comparison). While these level differences can be attributed to basic country-specific factors, such differences are not what drive the identification. In the period after the dollar crisis hit, the data indicates higher average numbers for both sub group of countries and the same rank order (second row comparison).[15] However, even the difference in post crisis lending levels is not driving the identification. What matters is the comparison of the lending growth pre to post period between the high and the low vulnerability countries. This comparison, obtained taking the difference-in-difference value from Table 4 (figure in bold) shows that ex ante high vulnerability countries displayed ex post about 15 percent lower cross-border lending growth to emerging markets than low vulnerability countries. Another way to interpret this result, based on comparing the level difference pre crisis with the level difference post crisis (figures in the row marginals), is that due to the crisis and the consequent balance sheet liquidity shocks hitting banks, the countries that ex ante were less exposed to the dollar funding shock were more able to partially close the cross-border lending gap to emerging markets compared to the more exposed source countries.

The same exercise performed for the local lending in local currencies by the foreign banks is shown in the right-most cells of the same rows of Table 4. As with cross border lending, local lending exhibits similar pre- and post- crisis patterns for both high and low vulnerability funding source countries. The only difference is in the scale. As the difference-in-difference comparison shows, low vulnerability countries exhibited a 49 percent higher local lending growth rate in the crisis aftermath, compared with the high vulnerability countries.

These results for cross-border lending growth and local lending growth are suggestive of a potentially important lending supply shock from developed country banks to emerging market economies, with the shock magnified for banks that ex ante exhibited greater balance sheet vulnerabilities. While suggestive, this non-parametric exercise, however, is limited as it cannot take into account differences in the lending *destinations*. It could be that high vulnerability countries were disproportionately focusing their lending in a particular group of emerging markets that perhaps experienced stronger credit demand shocks.

[15] Higher numbers post crisis are likely driven by a steep increase in the pre-crisis quarters, so that time averaging yields relatively lower numbers pre than post. We could have chosen the observation right at the quarter before the crisis and the last quarter in the data set to do the comparison, but the time averages have the advantage of smoothing out quarter-specific idiosyncratic factors. In any case, as argued in the main text, the identification does not rely on the simple pre-post comparison on levels but on the comparison in the pre-post growth *between* the two sub-group of countries.

As another exploratory exercise prior to starting the formal empirical analysis, we performed a basic check on the reliance of the vulnerability measures. We ran basic regressions using the post-pre growth measures for both cross-border and local lending as dependent variables and the whole set of fixed effects for source and destination countries on the right hand side. If the presumption is correct, that source countries with ex-ante higher dollar imbalances should be the ones to suffer the largest balance sheet shock and therefore those that reduce lending the most, it should be the case that the vulnerability measures should be correlated with the series of estimated coefficients of the source country indicator variables. In other words, those countries exhibiting larger changes in lending growth around the crisis should also be the ones with the higher values of the vulnerability measures. This pattern is verified in the data.[16]

Formal econometric study of transmission. To separate loan demand from loan supply effects we next turn to the more formal approach involving the estimation of equations (1) with OLS and equation (2), where destination country differences are taken into account by the destination fixed effect (FE) indicator variables. Both OLS and FE specifications are informative. While the OLS estimates are by construction biased, their comparison with the FE estimates provides insights on the degree of bias associated with the simultaneous shocks to lending demand experienced by destination markets. Specifications are performed over cross-border lending growth, with baselines presented in Table 5, and local claims growth, presented in Table 6. Columns 1-3 of each table focus on the basic OLS specifications, columns 4-6 prove the results of fixed effects specifications, and columns 7-8 includes consideration of the Vienna Initiative implemented within Europe. Since we have three alternative measures of ex ante vulnerability, we run similar regressions using the three measures separately. Moreover, in order to fully exploit the information contained in the vulnerability measures, in the regression analysis we use

[16] The results from these regression checks are reassuring. The V measures exhibit high correlations with the fixed effect estimated coefficients from both cross-border and local lending regressions. The correlations vis-à-vis the coefficients from the cross-border lending regression are higher, around 0.6, and highly significant. The correlations vis-à-vis the coefficients from the local lending regression are smaller, ranging between 0.35 and 0.55 across the three V measures, and significant for one of the three measures. This pattern of relative strength in the results will be found in the formal regression analysis as well, in large part probably due to the fact that, as already mentioned above, the sample size for cross-border lending is much greater than that for local lending. We thank Romain Ranciere for suggesting running this test.

the actual indexes rather than the simpler dummy grouping countries that indicated ex ante vulnerability above or below the median of the source countries.

First, consider the pre-post shock consequences for cross-border lending growth (Table 5). The coefficients on the vulnerability proxies in the first three columns show the relationship between ex ante source country vulnerability and the extent of slowed lending growth ex post. Countries that ex ante had more severe potential exposure to a dollar funding crisis had significantly lower ex post rates of cross-border lending growth to emerging markets. The results are consistent across the three different vulnerability measures. A low vulnerability banking source would have continued lending growth post shock, while high vulnerability was associated with reversals.

In columns 4 to 6 we report the results from the corresponding fixed effect estimations.[17] The estimates of γ_1 still are largely negative and significant. As expected, the comparison of 4-6 with the OLS estimates of 1-3 indicates some role played by concomitant changes in demand. The fixed effect estimates are systematically lower (in absolute value) than the corresponding OLS ones. At least part of the reduction in cross-border lending activity is attributable to a simultaneous decline in demand for cross-border loans. The magnitude of this loan demand shock, however, seems to be relatively small.

Next, consider the impact of the crisis on growth of local claims, with results reported in Table 6. As before, the OLS estimates using the three distinct measures of vulnerability are reported in the first three columns. The estimated effects of the shock event are again quite strong and in the expected direction with loan supply contractions particularly strong when affiliate banks overseas were ex ante more vulnerable. The model with fixed effects, columns 4-6, indicates relatively smaller estimated coefficients (in absolute value). By and large, however, the results confirm that the lower growth in local claims on emerging markets is largely due to the supply shock from ex ante vulnerable banking systems.

Next, consider the magnitude of effects for local claims growth when controls are introduced for the Vienna Initiative (columns 7 and 8). These specifications lead to reduced

[17] Note that the FE specification is based on the comparison of lending growth by at least two different source countries with different degrees of dollar vulnerability to the same destination country. Hence, in what follows we need to restrict the regression analysis by excluding those destination countries that do not maintain flows from at least two source countries. Of course this set if different in the analysis for cross border lending from that for local lending, but the differences in sample size with the corresponding OLS regressions is explained by the imposition of this constraint.

significance of ex ante vulnerability in general. Instead, the Vienna countries appear to be associated with mitigated local lending declines. Such reduced effects of the crisis on local claims growth, in particular in emerging Europe, were a key goal of the Vienna Initiative.

Also notice that the magnitude of reported coefficients in Table 6 is significantly smaller (in absolute terms) than in Table 5. The implication is that the role of differences in banking system vulnerability plays out strongest in the arena of cross border flows. We calculated the economic significance of the identified supply shocks. Table 7 presents examples of such impacts, focusing on three source countries for funding that are in the low, median, and high end of the ex ante vulnerability spectrum across the countries of our sample. Using the specifications of column (5) of Tables 5 and 6, we observe cross border lending supply growth after the crisis that was 8.02 percent lower than in the pre-crisis period for Germany, and comparable changes of 28.44 percent lower for the United Kingdom. Local claims supply adjustments also were quite large and quantitatively important across the lower and higher ex ante vulnerability countries.

III.4. Robustness

There are various potential critiques of the methodology we have applied to isolate loan demand from international loan supply effects of the shock. Such critiques include questioning the assumption of exogeneity of the shock event, our treatment of ex ante dollar vulnerability as a defining feature of source country banking systems while instead potentially proxying for other source country bank characteristics, time trends in lending across destinations, and the inclusion of United States as a source country. Below, we consider the robustness of our results to each of these critiques.

Shock endogeneity. The significance of the econometric results is heavily based on the presumption that the shock event, materializing in a severe shortage of U.S. dollar funding, is exogenous to the lending dynamics to emerging market countries. We think there is a legitimate case for the assumed exogeneity of the shock event. First, this particular crisis did not originate in emerging markets. Second, the accumulation of dollar exposure by developed countries' banks was very much driven by investment strategies of the developed economy's banks and did not derive in any quantitatively significant way from economic dynamics in emerging markets

countries, nor from specific lending policies toward these economies. As McGuire and von Peter (2009b) clearly state: "…banks' (particularly European banks') foreign positions have surged since 2000 … As banks' balance sheets grew, so did their appetite for foreign currency assets, notably US dollar-denominated claims on non-bank entities. These assets include retail and corporate lending, loans to hedge funds, and holdings of structured finance products based on US mortgages and other underlying assets. During the build-up, the low perceived risk (high ratings) of these instruments appeared to offer attractive return opportunities; during the crisis they became the main source of mark to market losses. …" (p. 1). Consequently, the dollar vulnerability of different developed countries banking systems in the months prior to the crisis can be reasonably assumed to be independently determined by the concomitant level of lending activity to emerging market countries.

Dollar vulnerability as a proxy for other bank balance sheet characteristics. A related concern is that, in fact, different levels of dollar vulnerability are just the reflection of specific ex-ante differences across source country banks in other balance sheet characteristics and do not reflect the relative severity of balance sheet shocks. We can test this alternative hypothesis by conducting a series of "horse races", by sequentially controlling for pre-crisis bank balance sheet characteristics by country in the main fixed effect specification of equation (2). The set of country-level bank balance sheet variables identified for this purpose are: the ratio of private credit by deposit money banks to GDP as a measure of the importance of banking activity in source markets (*pcrdbgdp*); the ratio of bank's overhead costs to total assets as a measure of banking efficiency (*overhead*); the return on equity (*roe*) and return on assets (*roa*) as measures of performance; the equity to asset ratio as a measure of banking capitalization (*cap*); the z-score as a measure of risk (*zscore*); [18] a measure of the share of deposits that are offshore (*offdep*); and the log of total international claims as a broad measure of global size (*linclaims*). Table 8, Panel A, reports the pairwise correlations among these variables and the measure V2 of dollar vulnerability. While there are strong correlations across some of these financial variables, for example between *cap* with *roa* or *overhead*, the correlations are weaker for the V2 variable (adjusted by international claims).

[18] The data is from the World Bank update to Beck, Demirgüç-Kunt and Levine (2000).

In Table 8, Panel B, we report the estimation results from a range of alternative specifications, which are the baseline specifications (columns 5 of Tables 5 and 6) where the V2 measure "competes" against each of these additional variables that are introduced within the regression. We report only the resulting coefficients and the significance of the variable V2 from these alternative FE regression specifications, with each cell of Panel B drawn from a distinct regression specification. The coefficients estimated for V2 remain fairly stable, both for cross border lending growth and for local claims growth. This finding indicates that the degree of dollar vulnerability is capturing a specific type of funding fragility exhibited by developed countries' banks prior to the crisis and had a direct impact on lending dynamics in emerging market countries.

Time trends. Another potential critique of our findings is that the accumulation of dollar liabilities and the subsequent crisis had no effect on changes in lending to EM economies, and that the difference detected between high- and low-vulnerability source countries is just the result of pre-existing differences in time trends. Analyses of the time series dynamics in both cross-border and local lending for high- and low-vulnerability countries do not support this claim. In Table 9 we report quarterly averages in (log) lending for the two separate groups of countries. For ease of comparison, both series are depicted as differences between value in each quarter and value at time zero (set at 2007q2), so that the vertical axis indicates the growth rate between each respective quarter and time zero. Panel A reports cross-border lending. While there was a detectable difference in time trends in the pre-crisis quarters, or at least through 2006, the chart shows that there was a visibly significant change in trend for both series in the quarters after 2007q2, and certainly an important difference in growth rate trends from 2008q3 and onward. A similar pattern can be detected for local lending in Panel B. Pre-crisis time series had a similar trend, but trends changed, even more dramatically in the post-crisis period.

Results driven by the inclusion of U.S. banks. We recognize that the dollar vulnerability measure may have a distinct interpretation for U.S. banks which can readily access dollar-based liquidity facilities such as the discount window and special facilities that emerged during the crisis.[19] In

[19] Goldberg, Kennedy, and Miu (2010) provide details on the availability of dollars to financial institutions outside the United States via central bank dollar swap facilities that were established.

addition, the conversion of investment banks into commercial banks, with data for the latter included in the post sample of BIS data, may influence the outcomes of the regression analysis.[20] We perform regression specifications excluding observations on U.S. lending to the respective emerging markets and generate qualitatively similar results.

III.5 Domestic lending

The final channel of international transmission through banks was posited to work through the funding of local, domestic banks. In this section we test whether such banks in emerging markets experienced a loan supply shock of their own as a result of the changes in cross-border lending of foreign banks. One component of cross-border lending is lending to local banks, in which case the original supply shock transmitted into cross-border financing could also determine a second round lending supply effect through the impact on the balance sheet of the local banks.[21] For this part of the empirical exercise, data at the level of aggregate lending by domestic banks leaves just the cross-sectional variability of destination countries for analysis. Moreover, while our full sample of emerging markets covers 94 countries, a significant share of these countries do not have adequate domestic lending data in the IFS or have totals for domestic lending that show some inconsistencies with the BIS local claims data. 58 countries are used in the final regression analysis. For this reason, we can produce qualitative results that can, at best, provide indications of the existence of this effect.

If local domestic banks experience a lending supply shock as a result of changes in cross-border funding by foreign banks, then one could expect that – all else equal – this shock would be larger exactly in those emerging markets where cross-border bank borrowing came predominantly from those banking systems that were ex ante more vulnerable to the original credit market disruptions. The BIS international banking statistics provide a breakdown of total cross border claims in cross border lending to banks and cross border lending to non banks (private and public sectors). Hence, from the cross border lending *to banks* data by source and destination country we compute total cross-border lending to banks for each destination country from all BIS reporting countries during the pre-crisis period. We then compute the fraction of this total that came from ex ante vulnerable countries, using the same high versus low ex ante

[20] We thank Patrick McGuire for pointing this out.

[21] At least for Latin American countries we know of significant tightening in domestic funding sources as a result of the crisis (Jara, Moreno and Tovar, 2009)

vulnerability classification used in the non-parametric exercise of Table 4. Subsequently, we compute for each destination country the fraction of total cross-border bank borrowing from high vulnerable countries. We also compute the ratio of cross-border bank-to-bank lending into a destination, relative to the total amount of lending done by domestic banks (*share x-border*). This second variable captures the degree of overall "openness" to international funding markets by banks in EM countries. The dependent variable in our regressions is the pre-post comparison of lending growth for domestic banks in each emerging market.

If lending of domestic banks in emerging markets was exposed to the financial crisis through cross-border linkages, is it the case that countries with banks having the highest reliance on cross-border borrowing overall were the one to suffer the largest declines in domestic lending? Or is the exposure only through reliance on banking systems with high ex ante vulnerability? Table 10, column (1), shows that lending contractions by domestic banks in emerging markets were stronger if they had been especially dependent on cross border borrowing from ex ante more vulnerable banking systems. Column (2) shows that differences across countries in the overall openness to cross-border borrowing were instead *not* significant in explaining ex post lending growth contractions. If anything, overall openness generated an opposite, positive effect. Columns (3) and (4) combine these terms in regression specifications, but continue to support the same suggestive relationships between ex ante exposures to international capital and ex post adjustments. Hence, openness of emerging market banking systems to international funding does not seem to have been a source of propagation of the original shock. Exposure to international funding from source countries that were ex ante more likely to suffer from the shock instead provided for multiple and independent channels of shock transmission.

The economic effect of such changes cannot be accurately gauged from these econometric specifications as we cannot correct for concomitant changes in demand. However, the results from the regressions on local claims of foreign banks offer information on this issue: assuming that both local domestic banks and local foreign banks face a similar demand schedule, we know that the FE regressions on local lending by foreign banks indicated the existence of a simultaneous demand change, which amounted to a reduction of about 25 percent in the size of the estimated coefficient of the vulnerability measure (comparing column (2) and (5) of Table 6).

Applying a similar correction to the estimated coefficient in column (1) of Table 10 suggest that the effective supply shock on domestic lending was still substantial.

IV. Concluding Remarks

The opening of capital markets to allow foreign bank participation, either through expanded cross-border lending activity or via direct entry into local banking markets, produces significant benefits to emerging markets in terms of enhanced efficiency, liquidity provision, risk-sharing, and overall superior growth opportunities. Global banks also have been demonstrably more resilient and better prepared to handle shocks originating in emerging markets. However, the transmission of a large shock from source countries to emerging markets has raised concerns about the mechanisms for such transmission and appropriate policy responses. Our analysis has demonstrated that both foreign-owned banks and local stand-alone banks are expected to be impacted by foreign liquidity conditions but to differing degrees. These magnitudes are based on their exposure to cross-border funding and to the internal capital markets of the broader banking organizations in which they participate.

Direct transmission of the shock is through the cross-border lending of source countries. Indirect transmission occurs through the internal capital markets of globalized banks,[22] where reduced support of emerging market affiliates or increased outflows from emerging markets trigger reduced lending at home by these affiliates. Domestically-owned banks in emerging markets are not immune to transmission and associated lending growth contraction. Reliance on cross-border funding does not necessarily lead to international transmission of shocks. The ex ante balance sheets of source countries appear to matter for the ex post consequences.

While cross-border lending and internal capital markets are both conduits for international shock transmission, both positive and negative, these features are not an argument for concluding that closed or reduced access to international capital markets is welfare-improving for emerging markets. Instead, the results suggest the importance of addressing the vulnerabilities in source funding markets so that these funding sources remain a net positive for the economies in which they operate. The results also highlight a potentially new reality across markets on the relative importance of respective channels of international transmission. As stated

[22] Cetorelli and Goldberg (2008) show that such internal capital markets are activated in U.S. banks in response to monetary policy conditions.

by Donald Kohn, the vice chairman of the Federal Reserve, "… when liquidity conditions tighten in one country, globally active banks may attempt to pull liquidity from overseas affiliates, reducing the liquidity consequences at home but simultaneously transmitting the shock abroad. What is particularly interesting is that in some cases, financial linkages might now be more important for transmission than the traditional trade linkages." [23]

[23] Kohn (2008).

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Table 1A Number of BIS Countries (of 17) Engaged in Lending to 24 Emerging Markets

		International Claims		Local Claims in Local Currency	
	EM Borrower	Pre Crisis 2006Q3-2007q2	Post Crisis 2008q3-2009q2	Pre Crisis 2006Q3-2007q2	Post Crisis 2008q3-2009q2
Latin America	Argentina	17	17	9	10
	Brazil	17	17	10	12
	Chile	17	16	8	9
	Colombia	16	16	6	6
	Costa Rica	15	16	4	4
	Mexico	17	17	7	8
	Peru	15	16	7	5
	Venezuela	17	16	4	4
Emerging Asia	China	17	17	10	12
	India	17	17	8	9
	Indonesia	17	17	8	8
	Malaysia	16	16	9	9
	Philippines	17	16	6	7
	Korea	17	17	10	8
	Taiwan	17	17	10	11
	Thailand	16	16	9	8
Emerging Europe	Turkey	17	17	10	8
	Slovakia	16	16	9	8
	Russia	17	17	8	9
	Romania	16	17	6	6
	Poland	16	17	13	13
	Hungary	17	16	11	10
	Czech Republic	17	17	10	10
	Croatia	16	16	2	3

Table 1B Number of Emerging Market Destinations with Counts of Source Countries

Lending Type	Time Frame	# of Destinations with Source Countries			
	# of Source Countries:	0	1	2	3+
International Claims	Pre Crisis (2006Q3- 2007 Q2)	0	2	3	89
	Post Crisis (2008Q3-2009Q2)	0	2	5	87
Local Claims in Local Currency	Pre Crisis (2006Q3- 2007 Q2)	26	19	12	37
	Post Crisis (2008Q3-2009Q2)	24	19	15	36

Table 2 Number of Emerging Market Countries (of 94) in BIS Reporting Country Lending

	International Claims (Cross-Border)		Local Claims in Local Currency	
Source Country	Pre Crisis 2006Q3-2007q2	Post Crisis 2008q3-2009q2	Pre Crisis 2006Q3-2007q2	Post Crisis 2008q3-2009q2
United States	72	76	41	42
Japan	50	47	15	15
Australia	33	32	1	3
Belgium	72	71	11	14
Canada	63	65	21	22
Switzerland	80	79	23	23
Germany	82	81	19	23
Denmark	59	58	13	1
Spain	70	67	16	17
France	86	82	34	43
Great Britain	86	86	37	35
Ireland	46	43	2	1
Sweden	64	63	6	7
Portugal	52	49	5	5
Netherlands	79	78	29	29
Luxembourg	37	38	0	0
Italy	66	72	20	19

Table 3A Summary statistics on Lending Growth

Variable	Obs	Mean	Std. Dev.	Min	Max
Pre-post cross-border lending growth	1032	0.263	0.968	-6.031	4.727
To EM Europe	303	0.459	0.919	-5.524	4.054
To EM Latin America	346	0.207	0.892	-3.105	4.727
To EM Asia	383	0.159	1.049	-6.031	4.094
Pre-post local lending growth	267	0.394	0.889	-6.788	5.215
To EM Europe	88	0.688	0.921	-0.766	5.215
To EM Latin America	85	0.243	0.760	-2.100	3.379
To EM Asia	94	0.254	0.907	-6.788	2.197
Pre-post domestic lending growth	62	0.409	0.306	-0.755	1.023

Table 3B Summary statistics on ex ante dollar vulnerability

	correlations		Obs	Mean	Std. Dev.	Min	Max
V1			17	0.780	0.506	0.064	1.674
V2	0.992		17	0.611	0.447	0.051	1.455
V3	0.702	0.710	17	0.208	0.207	0.009	0.831

Examples of ex ante dollar vulnerability values and scale

	Germany		Spain		United Kingdom	
	$billion	share	$billion	share	$billion	share
V1	1,165	0.342	294	0.693	1,797	1.060
V2	865	0.254	247	0.578	1,524	0.900
V3	311	0.091	72	0.169	265	0.156

Lending in the "pre" crisis period is defined as the time average between 2006q2 and 2007q2. Lending in the "post" crisis period is defined as the time average between 2008q3 and 2009q2. Cross-border lending is lending of foreign banks to an EM destination country originated in the source country. Local lending is the lending of local offices of foreign banks in local currency in each EM country. Domestic lending is the aggregate lending by domestic banks in each EM country. Pre-post lending growth is calculated as the log change between the post- and the pre-crisis periods. Twenty-six of the 94 countries had missing or incomplete domestic claims data (IFS), and six other emerging markets had domestic claims data (IFS) exceeded by total local claims data.

The measures of ex-ante dollar vulnerability are calculated using country-specific gross and net US Dollar aggregates. The definitions of the three measures are as follows. V1: Liabilities to official monetary authorities + International liabilities to non-banks + Local liabilities to US residents booked by US offices + Liabilities to banks + cross-currency FX swap (if negative); V2: Liabilities to official monetary authorities + International liabilities to non-banks + Local liabilities to US residents booked by US offices + Net Liabilities to banks + cross-currency FX swap (if negative); V3 either : Liabilities to official monetary authorities + Net Liabilities to banks + cross-currency FX swap (if negative) + Net positions vis-à-vis non-banks (if negative), or Liabilities to official monetary authorities + Net Liabilities to banks + cross-currency FX swap (if negative) (if Net positions vis-à-vis non-banks is positive). Shares are presented in the correlations and summary statistics cells. These shares are the raw values of the vulnerability measures divided by country international claims.

Table 4 Non-Parametric Comparisons of Lending Growth

	Cross-Border Lending			Local Lending		
	Low Vulnerability	High Vulnerability	Low-High	Low Vulnerability	High Vulnerability	Low-High
Pre-Crisis	4.16	4.41	-0.25	5.39	6.34	-0.95
Post-Crisis	4.53	4.63	-0.10	6.13	6.59	-0.46
Post-Pre	0.37	0.22	**0.15**	0.74	0.25	**0.49**

Low vulnerability countries are those source countries with a measure of vulnerability V2 below the median. High vulnerability countries have a measure V2 above the median. The "pre" crisis period is defined as the time average between 2006q2 and 2007q2. The "post" crisis period is defined as the time average between 2008q3 and 2009q2. The figures reported in the table are time averages of quarterly log lending data.

Table 5 Cross-border lending growth to emerging markets

VARIABLES		(1) OLS	(2) OLS	(3) OLS	(4) FE	(5) FE	(6) FE	(7) OLS	(8) FE
ΔD_i proxy	V1	-0.307***			-0.271***				
		(0.063)			(0.0606)				
	V2		-0.354***			-0.316***		-0.417***	-0.380***
			(0.0711)			(0.0689)		(0.081)	(0.078)
	V3			-0.778***			-0.605***		
				(0.176)			(0.172)		
Vienna								-0.113	-0.037
								(0.227)	(0.218)
V2·Vienna								-0.049	-0.309
								(0.650)	(0.625)
Constant		0.508***	0.486***	0.410***				0.561***	
		(0.058)	(0.054)	(0.045)				(0.070)	
Observations		1,032	1,032	1,032	1,029	1,029	1,029	1,032	1,029
R-squared		0.023	0.024	0.019	0.249	0.250	0.243	0.026	0.253

The measures of ex-ante dollar vulnerability are calculated using country-specific gross and net US Dollar aggregates. The definitions of the three measures are as follows. V1: Liabilities to official monetary authorities + International liabilities to non-banks + Local liabilities to US residents booked by US offices + Liabilities to banks + cross-currency FX swap (if negative); V2: Liabilities to official monetary authorities + International liabilities to non-banks + Local liabilities to US residents booked by US offices + Net Liabilities to banks + cross-currency FX swap (if negative); V3 either : Liabilities to official monetary authorities + Net Liabilities to banks + cross-currency FX swap (if negative) + Net positions vis-à-vis non-banks (if negative), or Liabilities to official monetary authorities + Net Liabilities to banks + cross-currency FX swap (if negative) (if Net positions vis-à-vis non-banks is positive). The first three columns report results from OLS regressions. The next three columns are from fixed effect regressions. Fixed effect coefficients not reported. The final two columns introduce a dummy variable, Vienna, indicating source countries involved in the Vienna initiative. Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 6. Local claims lending growth in emerging markets

VARIABLES		(1) OLS	(2) OLS	(3) OLS	(4) FE	(5) FE	(6) FE	(7) OLS	(8) FE
ΔD_i proxy	V1	-0.291***			-0.206				
		(0.111)			(0.126)				
	V2		-0.364***			-0.271*		-0.256	-0.269
			(0.126)			(0.147)		(0.166)	(0.189)
	V3			-1.184***			-1.050***		
				(0.347)			(0.384)		
Vienna								-0.865**	-0.927**
								(0.404)	(0.420)
V2.Vienna								3.304***	3.070***
								(1.090)	(1.131)
Constant		0.674***	0.675***	0.636***				0.529***	
		(0.120)	(0.111)	(0.0889)				(0.170)	
Observations		267	267	267	245	245	245	267	245
R-squared		0.025	0.030	0.042	0.395	0.397	0.409	0.073	0.421

The measures of ex-ante dollar vulnerability are calculated using country-specific gross and net US Dollar aggregates. The definitions of the three measures are as follows. V1: Liabilities to official monetary authorities + International liabilities to non-banks + Local liabilities to US residents booked by US offices + Liabilities to banks + cross-currency FX swap (if negative); V2: Liabilities to official monetary authorities + International liabilities to non-banks + Local liabilities to US residents booked by US offices + Net Liabilities to banks + cross-currency FX swap (if negative); V3 either : Liabilities to official monetary authorities + Net Liabilities to banks + cross-currency FX swap (if negative) + Net positions vis-à-vis non-banks (if negative), or Liabilities to official monetary authorities + Net Liabilities to banks + cross-currency FX swap (if negative) (if Net positions vis-à-vis non-banks is positive). The first three columns report results from OLS regressions. The next three columns are from fixed effect regressions. The final two columns introduce a dummy variable, Vienna, indicating source countries involved in the Vienna initiative. Fixed effect coefficients not reported. Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 7 Quantitative significance of ex ante vulnerability on lending

	Cross-Border Lending		**Local Lending**	
	Pre-Crisis Bilateral Quarterly Average ($ millions)	Post-Pre % Change	Pre-Crisis Bilateral Quarterly Average ($ millions)	Post-Pre % Change
Germany	9,233	-8.02%	5,136	-6.88%
Spain	1,454	-18.26 %	14,417	-15.66%
United Kingdom	3,644	-28.44%	8,547	-24.39%

The Post-Pre % change figures are obtained using the values of V2 for the three countries, as reported in the bottom panel of Table 3B, and the estimated coefficients of the V2 variable from column (5) regressions in table 5 (for Cross-Border Lending) and 6 (for Local Lending).

Table 8 Robustness Test Details

Panel A. Correlations among Country Control Variables

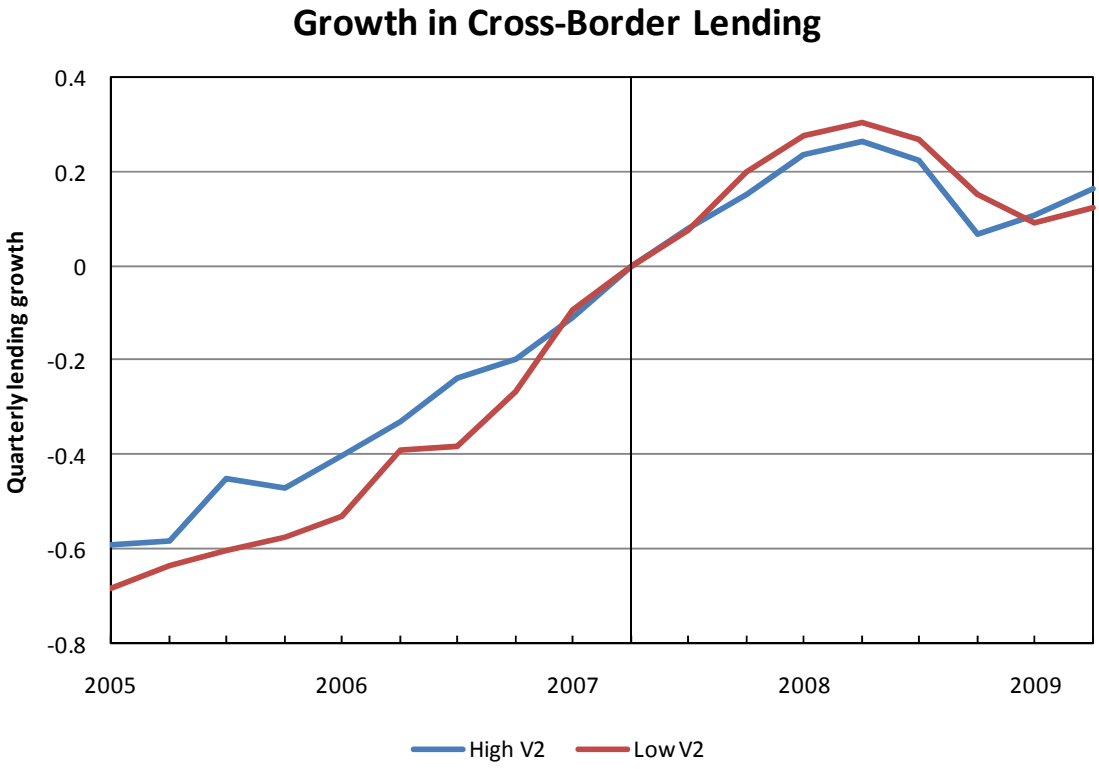
	pcrdbgdp	overhead	roa	roe	zscore	offdep	cap	lintclaims	v2_adj
pcrdbgdp	1.000								
overhead	0.040	1.000							
roa	0.304	0.417	1.000						
roe	0.107	-0.168	0.608	1.0000					
zscore	0.212	-0.555	-0.340	-0.202	1.000				
offdep	0.347	-0.174	-0.079	0.149	0.090	1.000			
cap	0.271	0.695	0.812	0.068	-0.231	-0.155	1.000		
lintclaims	-0.262	0.605	-0.112	-0.501	-0.318	-0.097	0.195	1.000	
V2	-0.138	0.183	0.185	0.189	-0.464	-0.324	0.078	0.027	1.000

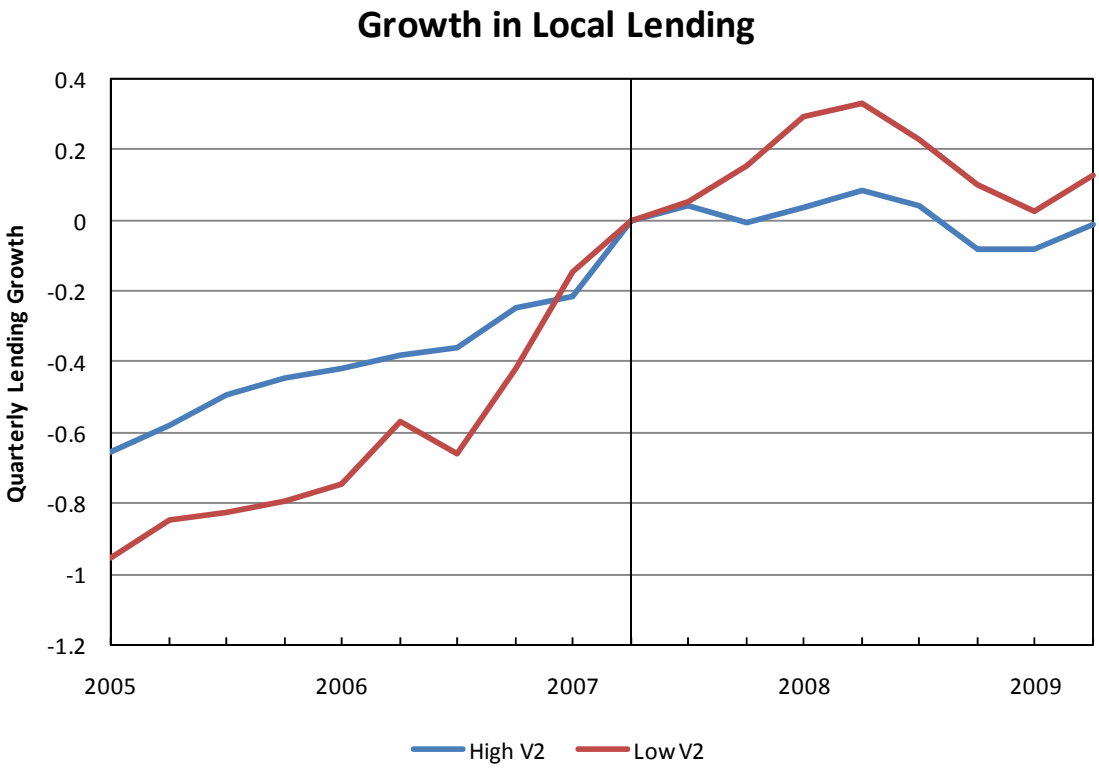
Panel B. Regression Coefficients on V2 in specifications that control for banking variables

	pcrdbgdp	overhead	roa	roe	zscore	offdep	cap	lintclaims	All bank variables
X-border	-0.315***	-0.303***	-0.313***	-0.320***	-0.362***	-0.290***	-0.312***	-0.314***	-0.336***
	(0.069)	(0.067)	(0.069)	(0.069)	(0.077)	(0.070)	(0.070)	(0.069)	(0.091)
Local	-0.269*	-0.271*	-0.267*	-0.272*	-0.208	-0.280*	-0.264*	-0.246	-0.367
	(0.148)	(0.147)	(0.147)	(0.147)	(0.161)	(0.154)	(0.146)	(0.149)	(0.259)

The source-country controls are defined as follows: pcrdbgdp is private credit by deposit money banks and other financial institutions to GDP; overhead is accounting value of a bank's overhead costs as a share of its total assets; roa is net bank income over total bank assets; roe is net bank income over total equity; zscore is (roa+equity/assets)/standard deviation(ROA; offdep is offshore bank deposits relative to domestic deposits; cap is equity to asset ratio; lintclaims is the log of total international claims. The estimated coefficients in Panel B are those of the V2 measure in fixed effects regressions including the country control(s) listed in each column. Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 9 Time Trends by Ex-Ante Dollar Vulnerability





The charts depict quarterly averages of log cross-border and local lending for source countries with low or high V2. Figures on the vertical axis are rescaled so that they are both equal to zero at time zero. Time zero is 2007q2.

Table 10 Domestic Lending Supply Growth Shock

VARIABLES	(1)	(2)	(3)	(4)
High V2 share in cross border (H)	-0.370***		-0.348**	-0.453***
	(0.135)		(0.135)	(0.160)
Cross border share in funding (X)		0.431*	0.311	-0.174
		(0.243)	(0.238)	(0.467)
(H)·(X)				0.818
				(0.678)
Constant	0.654***	0.370***	0.610***	0.677***
	(0.093)	(0.044)	(0.098)	(0.112)
Observations	58	58	58	58
R-squared	0.118	0.050	0.145	0.167

The dependent variable is domestic bank lending growth pre-post crisis for each emerging market country. Lending in the "pre" crisis period is defined as the time average between 2006q2 and 2007q2. Lending in the "post" crisis period is defined as the time average between 2008q3 and 2009q2. High V2 share in cross border is the share of cross border interbank funding obtained from source countries with V2 values above the median value across source countries. Cross-border share in funding is the ratio of total cross-border interbank funding to total domestic lending. Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1 .

Chart 1

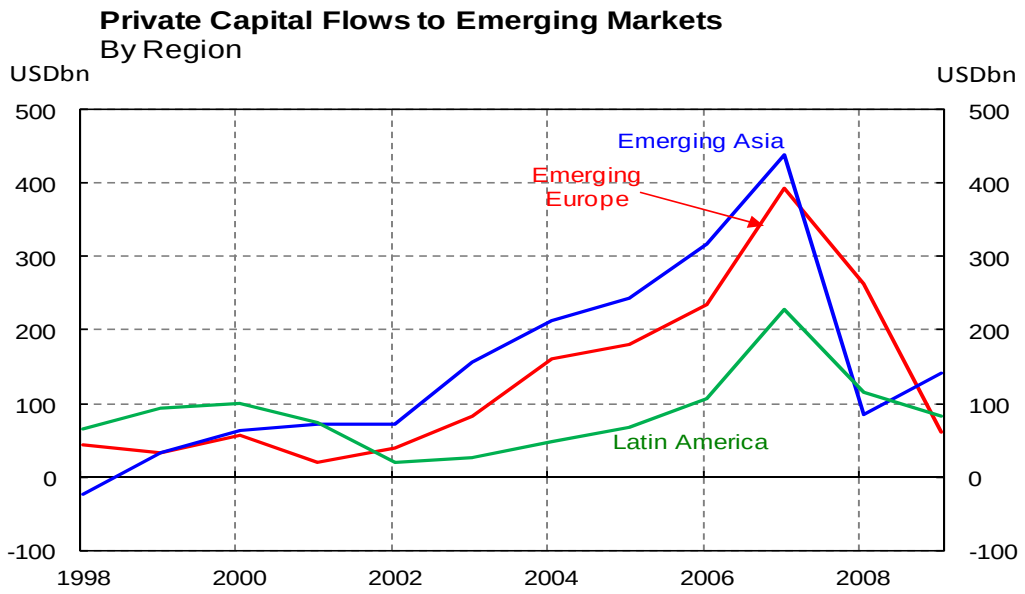
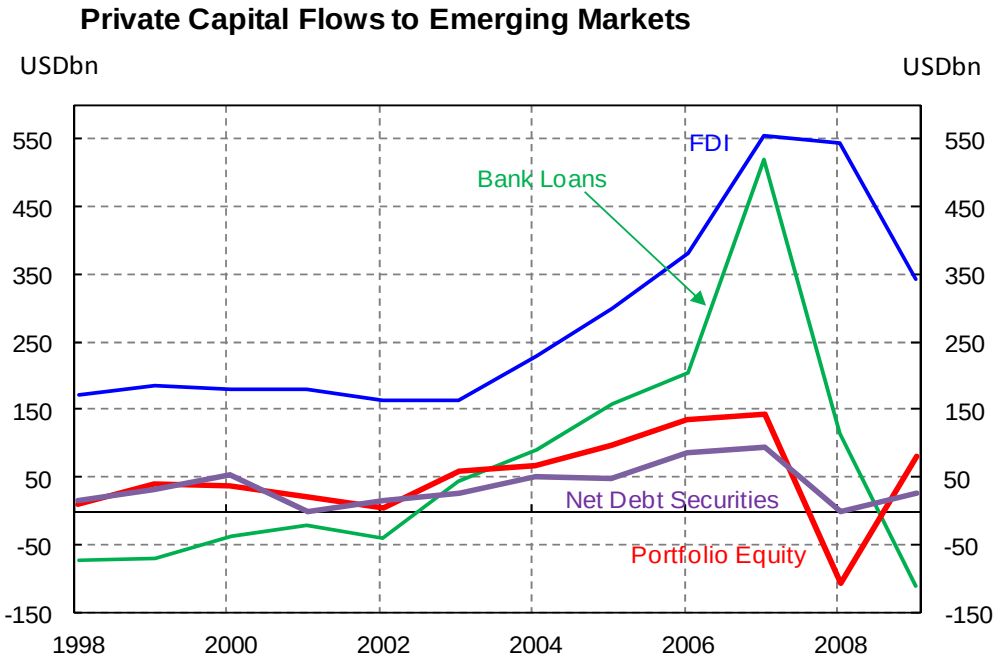


Chart 2



Source for Charts 1 and 2: BIS Locational Banking Statistics, Bank Loans (Table 7c), Net Bond Issues (Table 11); Foreign Direct Investment from the Global Development Fund; Portfolio equity data from CEIC; also Federal Reserve Bank of NY staff estimates. Annual data.

Appendix Table 1. Sample of Developing Countries

Latin America (30)	Emerging Europe (21)	Emerging Asia (43)	
Argentina	Albania	Afghanistan	Solomon Islands
Belize	Belarus	Armenia	South Korea
Bolivia	Bosnia and Herzegovina	Azerbaijan	Sri Lanka
Brazil	Bulgaria	Bangladesh	Taiwan
Chile	Crotia	Bhutan	Tajikistan
Colombia	Cyprus	Brunei	Thailand
Costa Rica	Czech Republic	Cambodia	Timor Leste
Cuba	Estonia	China	Tonga
Dominica	Hungary	Fiji	Turkmenistan
Dominican Republic	Latvia	French Polynesia	Uzbekistan
Ecuador	Lithuania	Georgia	Vietnam
El Salvador	Macedonia	India	Wallis and Futuna
Falkland Islands	Malta	Indonesia	Western Samoa
Grenada	Moldova	Kazakhstan	
Guatemala	Poland	Kiribati	
Guyana	Romania	Kyrgyz Republic	
Haiti	Russia	Laos	
Honduras	Slovakia	Malaysia	
Jamaica	Slovenia	Maldives	
Mexico	Turkey	Marshall Islands	
Nicaragua	Ukraine	Micronesia	
Paraguay		Mongolia	
Peru		Myanmar	
St. Lucia		Nauru	
St. Vincent		Nepal	
Suriname		New Caledonia	
Trinidad and Tobago		North Korea	
Turks and Caicos		Pakistan	
Uruguay		Papau New Guinea	
Venezuela		Philippines	

Appendix Table 2 Delivery on EIB's Commitments under the *Joint IFI Action Plan*

By Institution up to end-September 2009 (Euro millions)

Bank	Available	Disbursed	2009 pipeline	Total
UniCredit Group (Italy)	951	204	75	1,230
Erste Bank Group (Austria)	446	280	0	726
Société Générale (France)	393	59	40	492
Intesa Sanpaolo (Italy)	265	139	50	454
Dexia Group (Belgium)	226	117	100	443
Bayern LB (Germany	242	100	100	442
EFG Eurobank (Greece)	315	35	0	350
BNP Paribas / Fortis (France)	300	30	0	330
RZB (Austria)	230	8	40	278
KBC Group (Belgium)	110	63	100	273
Total	**3,478**	**1,035**	**505**	**5,018**
Other Banks	4,051	682	1,005	5,738
Grand Total	**7,529**	**1,717**	**1,510**	**10,756**

By Country up to end-September 2009 (Euro millions)

Country	Available	Disbursed	2009 pipeline	Total
Bulgaria	169	25	60	254
Czech Republic	591	269	0	860
Estonia	25	50	0	75
Hungary	679	409	0	1,088
Latvia	115	30	145	290
Lithuania	25	23	0	48
Poland	1,023	211	275	1,509
Romania	424	65	50	539
Slovakia	260	22	100	382
Slovenia	709	40	100	849
Total EU – 10	**4,019**	**1,144**	**730**	**5,893**
Albania	0	0	20	20
Bosnia Herzegovina	291	37	120	449
Croatia	540	34	40	613
FYROM	110	0	0	110
Montenegro	132	0	0	132
Serbia	583	44	100	727
Total Western Balkans	**1,655**	**115**	**280**	**2,050**
Total Turkey	**1,855**	**459**	**500**	**2,813**
Total	**7,529**	**1,717**	**1,510**	**10,756**

"Progress Report on the Joint IFI Action Plan," European Bank for Reconstruction and Development, European Investment Bank Group, and World Bank Group, October 2009, pp. 14-15.