A CONTAGION THROUGH EXPOSURE TO FOREIGN BANKS DURING THE GLOBAL FINANCIAL CRISIS

Cyn-Young Park and Kwanho Shin

ADB ECONOMICS WORKING PAPER SERIES

ASIAN DEVELOPMENT BANK

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No. 516 | July 2017

Cyn-Young Park (cypark@adb.org) is a director at the Economic Research and Regional Cooperation Department, Asian Development Bank.
Kwanho Shin (khshin@korea.ac.kr) is a professor at the Department of Economics, Korea University.

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ABSTRACT

Although the global financial crisis of 2008 took root in the advanced countries, its shocks spread through the emerging economies, reflecting the increasingly interconnected global financial system. This paper develops an empirical methodology to test the contagion effect at the country level using bilateral data on bank claims between countries. It measures the direct and indirect exposures of emerging economies to crisis countries and tests whether these matter for capital outflows from emerging economies. The paper measures these exposures to the crisis-affected countries by using bilateral foreign claims sourced from Bank for International Settlements (i) consolidated banking statistics foreign claims on immediate counterparty and ultimate risk bases and (ii) locational banking statistics cross-border total claims. Findings show that emerging market economies more exposed directly or indirectly to banks in the crisis-affected countries suffered more capital outflows during the global financial crisis.

I.   INTRODUCTION

Although the global financial crisis of 2008 took root in the advanced countries, its shocks spread through the emerging economies, reflecting the increasingly interconnected global financial system. The deterioration of subprime loans that seeded the crisis hit banks in advanced countries directly, forcing them to retreat and curtail their international exposures in search for liquidity. The market for short-term loans dried up and some of these troubled banks had to withdraw their funds from emerging economies. This in turn, led to a liquidity crunch among banks in emerging economies that had borrowed short-term funds from banks in advanced countries to provide long-term loans to domestic borrowers. These spillovers tended to be disproportionately high when the troubled banks in advanced countries were larger and more interconnected, that is, they are systemically more important banks.

Clearly, the growing global financial network and interconnectedness can amplify and transmit a shock from one bank to another, leading to systemic crisis. Providing microlevel evidence of such transmission is very difficult, however, due to a lack of data representing the comprehensive banking network and individual banks' international exposures.

Morrison et al. (2016) were able to identify bank credit default swap (CDS) returns attributable to counterparty losses through the network of CDS transactions between banks. Their findings show that information about counterparty losses is transmitted to a bank's own CDS spread. That is, whenever the counterparties from which a bank has purchased default protection experience losses, the likelihood of endorsing the default protection decreases and the CDS spread of the bank increases. Hale, Kapan, and Minoiu (2016) also find that profitability and loan supply decline in banks with direct or indirect exposures to countries experiencing systemic banking crises.

This paper develops an empirical methodology to test the contagion effect at the country level using bilateral data on bank claims between countries. Our goal is to empirically measure direct and indirect exposures of emerging economies to crisis countries and test whether these exposures matter for capital outflows from emerging economies. The country-level bilateral bank claims data are collected from Bank for International Settlement (BIS) consolidated banking statistics and locational banking statistics.[1]

While financial interconnectedness can arise from both the asset and the liability sides of banks' balance sheets, earlier studies on banking crises focused more on the asset side of interconnectedness for financial contagion and spillovers. For example, the first-generation models of banking crises considered how an economic downturn or recession would undermine corporate borrowers' ability to service their debts and impair bank assets, setting off bank runs (Mishkin 1978). Another set of studies paid attention to a lending boom and increased financial leverage, often followed by a subsequent burst and collapse in asset prices, leading banks to scale back their lending (Demirgüç-Kunt and Detragiache 1998). Allen and Babus (2009) also reviewed a group of papers that used network theory to explain financial contagion. Not only do bank failures spread directly through mutual claims they have on one another, but they can also spread indirectly through forced sale of assets by some banks that depress the market price, inducing further distress in other institutions.

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[1]   BIS compiles and publishes two sets of statistics on banks' international positions. Consolidated banking statistics measure banks' country risk exposures by capturing the worldwide consolidated claims of internationally active banks headquartered in BIS reporting countries. Locational banking statistics provide information about the currency composition of banks' balance sheets and the geographical breakdown of their counterparties by capturing outstanding claims and liabilities of banks located in BIS reporting countries, including intragroup positions between offices within the same banking group.

However, recent studies have noted the risk of contagion through bank exposures on the liabilities side. Shin (2009) reflects on the Northern Rock bank run in the United Kingdom, and notes that when risk constraints took effect, lenders cut back their exposures in response to the crisis. He points to potential disruption in financial systems caused by a sharp pullback in leverage as creditors adjust their risk exposure. He notes that creditors' deleveraging actions, while prudent from their risk management perspective, would look like a "run" from Northern Rock's viewpoint.

Čihák, Muñoz, and Scuzzarella (2011) further note that it is important to determine whether the cross-border interlinkages are stemming primarily from banks' asset or liability sides. Using measures that differentiate the types of interconnectedness, they find that the impact of changes in interconnectedness on banking system fragility are more significant for liability-side (upstream) interconnectedness than for asset-side (downstream) interconnectedness. That is, financial turmoil originated in creditor countries and moving upstream through borrowing countries' funding channels is found to have more detrimental economic impact on the borrowing countries than financial turmoil originated in borrowing countries and moving downstream to the creditors.

Our paper empirically investigates how shocks are transmitted through banks' exposures on the liability side. We find that the more emerging economies' liability sides were exposed directly or indirectly to crisis countries during the global financial crisis, the higher the rate of capital outflows they suffered. During the global financial crisis, as banks in advanced countries experienced liquidity and risk constraints, they reversed their lending positions against banks in emerging economies. Our findings suggest that deleveraging of the banks in advanced economies then triggered a run on banks and other entities in emerging economies.[2]

The remainder of the paper is organized as follows. In the next section, we explain the data used in our empirical analyses. In section III, we lay out our empirical framework of calculating direct and indirect exposures of emerging economies to crisis countries. In section IV, we report and discuss the main empirical findings of the paper. Section V concludes.

II. DATA

Bilateral data on cross-border liability positions are collected from BIS consolidated banking statistics and locational banking statistics. The consolidated banking statistics provide consolidated claims of internationally active banks headquartered in 30 BIS reporting countries against 223 counterparty countries.[3] In these statistics, the claims of banks' foreign affiliates are included but intragroup positions are excluded, similar to the consolidation approach followed by financial regulatory supervisors.[4] The statistics also report the transfer of credit risk from the immediate counterparty to the country of ultimate risk (where the guarantor of a claim resides). Locational banking statistics report the outstanding claims of banks located in 43 BIS reporting countries.[5] The important difference between consolidated and locational banking statistics is that the latter include intragroup positions between offices of the same banking group if they are in different countries.

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[2] See, among others, Shin (2009), which emphasizes the liability side of the balance sheet and its implications for a bank run.

[3] In the consolidated banking statistics, claims refer to outstanding loans and holdings of securities by reporting banks. Appendix Table A1 (a) lists the reporting countries.

[4] Detailed explanations of the BIS consolidated banking statistics can be found in BIS (2016).

[5] In 2016, there were 43 reporting countries. However, when we measure the direct and indirect exposures in 2007, the actual number with bilateral data available declines to 29. Appendix Table A1 (b) lists reporting countries of locational banking statistics in 2007.

Since the number of the BIS reporting countries is limited, that is, there are other claims of banks with controlling parents located outside the BIS reporting countries, the sum of all claims of these reporting countries against a counterparty country would not be equal to the sum of all liabilities held by the counterparty country. However, since the BIS reporting countries include most countries active in international bank loans, actual total foreign claims on a counterpart country are not expected to deviate too much from the sum of the claims of the banks of these reporting countries only.[6]

The locational banking statistics report the claims of all banks resident in 43 BIS reporting countries. The claims are broken down by instrument, currency, sector, country of residence of counterparty, and nationality of reporting banks.[7] Since the organization principle underlying the reporting requirement of the local banking statistics is the location of the banking office, the statistics include international transactions of a bank with any of its own affiliates outside the reporting country, consistent with balance of payments and external debt methodology. The claims cover deposits and balances placed with banks, loans, and advances to banks and nonbanks, and holdings of securities and participations.

In the locational banking statistics, banks' total international claims are decomposed into three categories: (i) loans, (ii) debt securities, and (iii) other assets. The last category (iii) includes equity shares, participations, derivative instruments, and working capital supplied by head offices to their branches abroad. The sectoral breakdown of banks' total international claims on (i) banks and (ii) nonbanks is also available. In fact, the locational banking statistics report total claims and claims on nonbanks, and claims on banks are calculated by subtracting the latter from the former. In addition, loans are again disaggregated into those to the banking and to the nonbanking sectors.

Consolidated banking statistics report the claims at an aggregate level compiled in two ways: by immediate counterparty and by ultimate risk.[8] The immediate counterparty is the entity in the counterparty country with which the bank in the reporting country counteracts directly. Ultimate risk is the counterparty country to which credit exposure transfers through credit risk mitigants such as collateral, guarantees, and credit protection. For example, suppose a bank of the United States extends a loan to a company in a counterparty, country A, and the loan is guaranteed by a bank of another country, country B. Then, based on an immediate counterparty basis, country A is reported as the counterparty country of the US because the US bank reports the loan as a claim on the company in country A. On an ultimate risk basis, however, country B is reported as the counterparty country of the US because, if the company in country A defaults, then ultimately the claims will be made to the bank in country B that guarantees the loan.

On an immediate counterparty basis, foreign claims by the nationality of reporting banks are decomposed into (i) international claims and (ii) local positions in local currency. The international claims of a reporting country include both cross-border claims of a bank headquartered in the reporting country and local claims in foreign currencies provided by its foreign affiliates. International claims are again disaggregated using two different approaches: (i) by remaining maturities in which it is divided into (a) up to and including 1 year, (b) over 1 year and up to 2 years, and (c) over 2 years; and (ii) by sectors of the counterparty country, which are (a) banks, (b) nonbank financial sector, (c) other private sector,

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[6] For example, as of the second quarter of 2016, the sum of foreign claims of BIS reporting countries on counterparties in Argentina is $44,902 (in millions) while total foreign claims including those of nonreporting countries is $45,494 (in millions).

[7] See BIS (2012) for a detailed description of the nature of the locational banking statistics, which this paper mostly follows.

[8] See the explanation in BIS (2016) for the difference between immediate country and ultimate risk bases.

and (d) official sector. Local positions in local currency refer to credits in local currency provided by foreign affiliates of the banks headquartered in the reporting country.

On an ultimate risk basis, foreign claims by nationality of reporting banks are disaggregated in two different ways: (i) by the type of position, which are (a) cross-border claims and (b) local claims; and (ii) by the four sectors the international claims by immediate counterparty are divided into (as indicated in the previous paragraph). The main difference in how the two reporting bases are disaggregated is that, for the ultimate risk basis, local claims denominated in local currencies and international claims are not reported separately, no maturity breakdown is available, and foreign claims, not international claims, are disaggregated into four different sectors.[9]

III.   METHODOLOGY

In this section, we develop two measures—direct and indirect—of emerging economies' exposures to crisis countries' banks through a network of bank claims.[10] Direct exposure of foreign claims on an emerging economy i at time t to banks in crisis countries, denoted by DE_i^f, is measured by the sum of shares of foreign claims held by all countries that experience crises:

$$DE_{i,t}^f = \sum_{j \in C_t} share_{ij,t}^f \, , \, share_{ij,t}^f = \frac{fc_{ijt}}{\sum_{k=1}^N fc_{ikt}},$$ (1)

where N is the number of reporting countries, fc_{ikt} stands for the foreign claims held by reporting country k on counterparty country i at time t and hence $share_{ij,t}^f$ is the share of foreign claims held by reporting country j on country i at time t. Since C_t is a set of reporting countries that experience crises at time t, the direct exposure is defined as the sum of shares of foreign claims across all reporting countries that experience crisis. While it would be more desirable to measure foreign claims and the degree of liquidity shocks at a bank level, this kind of data is not available. Instead we assume that all banks in a reporting country that experience a crisis are faced with the same degree of liquidity problems.

The direct measure captures the idea that a country is exposed to the crisis-affected countries through its borrowing from them as the crisis-affected countries facing liquidity and risk constraints would withdraw funds or reverse their lending. The more a country borrowed from the crisis-affected countries, the more vulnerable is the country in concern to a reversal in capital flows. In Figure 1, which shows how the direct exposure is measured, each emerging economy is affected directly from crisis countries only (circles), and the measure is calculated by summing up the arrows that denote shares of foreign claims by reporting countries for each emerging economy.

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[9] This difference is because the breakdown by booking office location for claims on an immediate-borrower basis differs from the breakdown on an ultimate-risk basis. See BIS (2015) and McGuire, Patrick, and Philip Wooldridge (2015) for more details.

[10] Similar measures of direct and indirect exposures through the global bank network were developed by Hale, Kapan, and Minoiu (2016). Morrison et al. (2016) also identified bank CDS returns attributable to counterparty losses using the network of CDS transactions between banks.

Figure 1: Direct Exposures

Reporting countries

Emerging economies

Systematically important country

Direct exposure

● Crisis country ▲ Noncrisis country ■ Emerging economy

Note: The width of the arrows represents the share of foreign claims by reporting countries for each emerging economy.
Source: Authors' illustration.
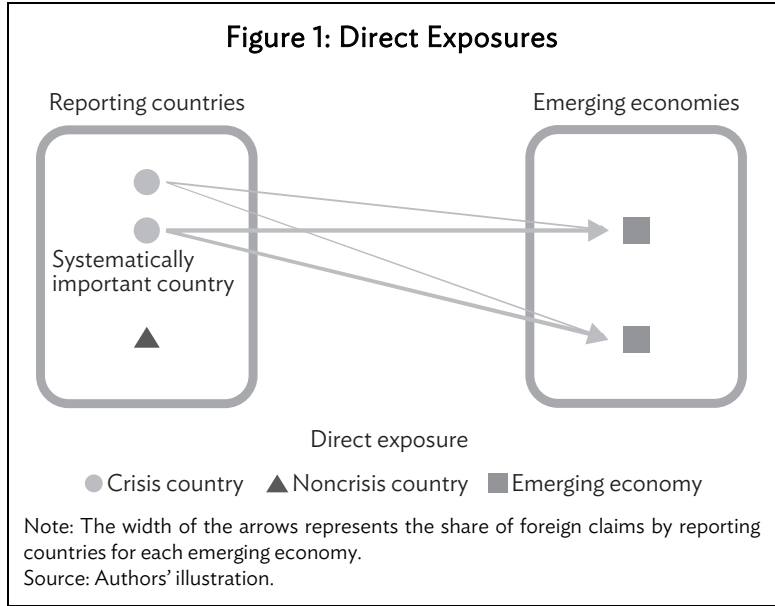
However, the direct measure alone cannot fully capture a country's exposure to the crisis-affected countries, because it does not consider the country's exposure to all other countries that are not directly hit by the crisis but exposed to the crisis-affected countries and therefore face liquidity problems indirectly. For example, suppose country A itself does not experience a crisis, but it is exposed directly to countries that do, i.e., it is affected through the contagion effect measured by the direct exposure to crisis countries. Then an emerging country B that borrows funds from banks in country A can be indirectly affected from crisis countries through country A.

The above arguments imply that we can also define an indirect exposure of foreign claims of an emerging economy i at time t, $IDE_{i,t}^{f}$, as follows:

$$IDE_{i,t}^{f} = \sum_j share_{ij,t}^{f} \cdot DE_{j,t}^{f}. \tag{2}$$

Note that the indirect exposure of foreign claims is the weighted average of direct exposures faced by all reporting countries, with their shares of claims used as the weights. In Figure 2, showing how indirect exposure is measured, indirect exposure is indicated by the dashed arrows. Note that the dashed arrow comes even from a noncrisis country (triangle) that is affected from other crisis countries (solid arrows).

As explained, in the consolidated/locational banking statistics, claims are disaggregated either into different sectors and/or maturities. But unfortunately, in the consolidated banking statistics on an immediate counterparty basis, these disaggregate data for each reporting country are available only against all counterparty countries combined and not at the individual counterparty country level. These disaggregated data are available in the consolidated banking statistics only on an ultimate risk basis. In the locational banking statistics, bilateral claims on the banking sector are available for total cross-border claims and cross-border loans.

Figure 2: Indirect Exposures

Note: The width of the solid arrows represents shares of foreign claims by reporting countries for other reporting countries, while the width of the dashed arrows represents those for emerging economies.
Source: Authors' illustration.
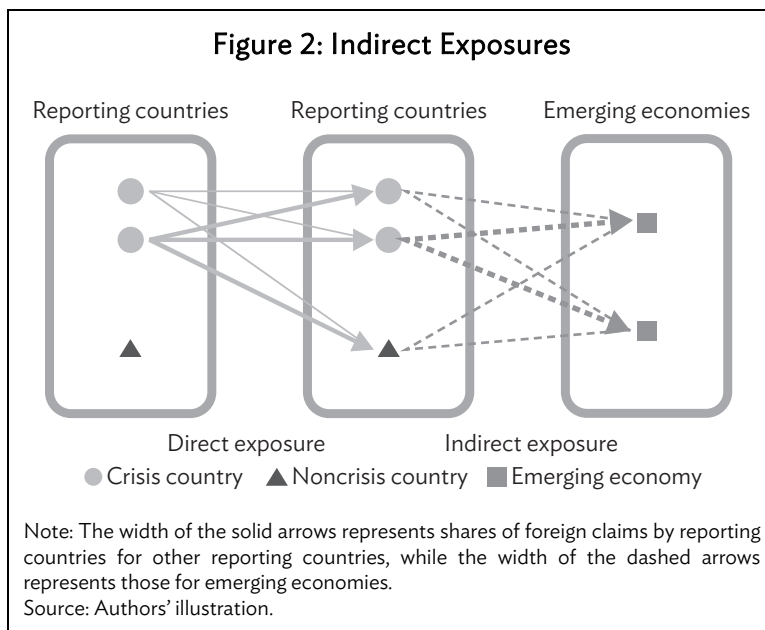
Utilizing these disaggregate data, we define direct and indirect exposures of the banking sector, $DE_{i,t}^b$ and $IDE_{i,t}^b$, based on claims on the banking sector in the counterparty country:

$$DE_{i,t}^b = \sum_{j \in C_t} share_{ij,t}^b, \, share_{ij,t}^b = \frac{bc_{ijt}}{\sum_{k=1}^N bc_{ikt}}, \tag{3}$$

$$IDE_{i,t}^b = \sum_j share_{ij,t}^b \cdot DE_{j,t}^b, \tag{4}$$

where $share_{ij,t}^b$ is the share of foreign claims held by country j on the banking sector in country i at time t. These exposure measures based on the banking sector are particularly interesting since the liabilities of the banking sector play a crucial role in transmitting shocks. For example, Hahm, Shin, and Shin (2013), defining noncore liabilities of the banking sector as consisting mostly of banks' borrowings from foreign countries, showed that a large stock of noncore liabilities indicates the erosion of risk premiums and hence of vulnerability to a crisis.

We also define direct and indirect exposures of short-term maturities, $DE_{i,t}^s$ and $IDE_{i,t}^s$, using data on claims of maturities with less than 1 year on the counterparty country as follows:

$$DE_{i,t}^s = \sum_{j \in C_t} share_{ij,t}^s, \, share_{ij,t}^s = \frac{sc_{ijt}}{\sum_{k=1}^N sc_{ikt}}, \tag{5}$$

$$IDE_{i,t}^s = \sum_j share_{ij,t}^s \cdot DE_{j,t}^s, \tag{6}$$

where $share_{ij,t}^s$ is the share of short-term claims held by country j on country i at time t. As explained, short-term claims are available only for consolidated banking statistics international borrowings on immediate counterparty basis. Since long-term claims are not easily withdrawn even by troubled banks, we expect that a bank-run type of sudden withdrawals of claims from emerging economies is more likely to take place in short-term borrowings by stopping rollovers.

We hypothesize that countries more exposed, both directly and indirectly, to banks in crisis countries suffered from more capital outflows during the global financial crisis. To test this hypothesis, we measure the rate of capital outflows from country i during the global financial crisis, $Koutflow_i$, as follows:

$$Koutflow_i = \frac{TFC_i^{max} - TFC_i^{min}}{TFC_i^{max}}, \tag{7}$$

where TFC_i^{max} and TFC_i^{min} are the maximum and the minimum levels of total foreign claims on country i during the period from the first quarter (Q1) of 2007 to Q4 2009. That is, we are assuming that the difference between the maximum and the minimum levels of foreign claims on country i during the period represent the volume of capital outflows from country i. Total foreign claims are measured by summing up foreign claims on country i across all reporting countries.

IV. EMPIRICAL FINDINGS

For country i, we choose 65 emerging economies from the set of counterparty countries.[11] The list of emerging economies is identical to that in Park, Ramayandi, and Shin (2016) that also follows Eichengreen and Gupta (2015) and Lim, Mohapatra, and Stocker (2014).

Table 1 shows summary statistics of the variables used in the regressions below. Measures of direct and indirect exposures are calculated for 57–62 emerging economies depending on the choice of consolidated and locational banking statistics and sectors. Generally, the measure of direct exposures is higher than that of indirect exposure, except for short-term debts, for which they are almost the same. We also report statistics for various bilateral claims. Note that, according to the consolidated banking statistics foreign claims on an ultimate basis and locational banking statistics cross-border total claims, the volume in the banking sector is about half the size of that in the entire sector. If you restrict to cross-border loans in the locational banking statistics, the volume of claims in the banking sector is about 80% of that in the entire sector.

Table 2 reports regression results for the following equation:

$$Koutflow_i = \beta_0 + \beta_1 DE_{i,2007}^f + \beta_2 IDE_{i,2007}^f + \beta_3 X_{i2007} + \varepsilon_i , \tag{8}$$

where $DE_{i,2007}^f$ and $IDE_{i,2007}^f$ are direct and indirect exposures of the entire sector in Q4 2007, just before the global financial crisis, and X_{i2007} is other control variables of country i at time t, that include aggravation of current account balances, real exchange rate appreciation before the global financial crisis, increase in domestic credit–gross domestic product (GDP) ratio, inflation rate, and real GDP growth rate, capital account openness, and sovereign credit rating (see Appendix Table A2 for the definition and data sources of the control variables used in the regression).[12]

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[11] Appendix Table A1 (c) lists the emerging economies.
[12] We also measured direct and indirect exposures in Q1 2008, and the main results did not change. See Eichengreen and Gupta (2015) and Park, Ramayandi, and Shin (2016) for the motivation for including these as explanatory variables.

Table 1: Summary Statistics

	Count	Mean	Min	Max
Direct exposure of the entire sector on counterparty basis (CBS)	62	0.95	0.53	1.00
Direct exposure of the entire sector on ultimate risk basis (CBS)	62	0.93	0.33	1.00
Direct exposure of the entire sector (LBS)	62	0.86	0.35	1.00
Direct exposure of the banking sector (CBS)	57	0.94	0.65	1.00
Direct exposure of the banking sector (LBS)	60	0.84	0.00	1.00
Direct exposure of the cross-border loans on the banking sector (LBS)	60	0.89	0.00	1.00
Direct exposure of short-term debts (CBS)	62	0.92	0.46	1.00
Indirect exposure of the entire sector on counterparty basis (CBS)	62	0.91	0.85	0.98
Indirect exposure of the entire sector on ultimate basis (CBS)	62	0.90	0.84	0.98
Indirect exposure of the entire sector (LBS)	62	0.85	0.75	0.94
Indirect exposure of the banking sector (CBS)	58	0.89	0.87	0.96
Indirect exposure of the banking sector (LBS)	60	0.82	0.64	0.96
Indirect exposure of the cross-border loans on the banking sector (LBS)	60	0.87	0.74	0.99
Indirect exposure of short-term debts (CBS)	62	0.92	0.88	0.96
Aggravation of current account balance	59	−2.76	−19.14	15.20
Real appreciation	60	0.36	0.05	0.61
Increase in domestic credit	62	9.21	−10.36	34.02
GDP growth	62	6.96	0.43	15.17
Total immediate foreign claims (CBS)	1,914	43,602.62	0.00	4,427,835
Total ultimate foreign claims (CBS)	1,836	43,568.83	0.00	4,256,984
Ultimate foreign claims on the banking sector (CBS)	811	21,500.67	0.00	1,361,044
Short-term international borrowings (CBS)	1,032	20,787.52	0.00	1,587,179
Total cross-border foreign claims (LBS)	2,480	10,658.72	1.00	1,481,374
Cross-border foreign claims of the banking sector (LBS)	2,075	6,854.03	0.00	674,054
Total cross-border loans (LBS)	2,125	7,444.38	1.00	1,089,827
Cross-border loans to the banking sector (LBS)	1,869	5,859.10	0.00	670,016

CBS = consolidated banking statistics, GDP = gross domestic product, LBS = locational banking statistics.
Notes: Bilateral claims are measured in million United States dollars. Originally some values of claims are reported to be negative because the Bank for International Settlements overwrites the unallocated member with a calculated residual to ensure consistency. In the above summary statistics, however, we excluded the negative values.
Source: Authors' calculations.

Measures of direct and indirect exposures are calculated by using bilateral foreign claims in three data sources: consolidated banking statistics foreign claims on immediate counterparty (Table 2a) and ultimate risk bases (Table 2b), and locational banking statistics cross-border total claims (Table 2c). Tables 2a, b, and c show that the coefficients of indirect exposure of foreign claims are positive and statistically significant, whether country-specific control variables (X_{i2007}) are added as explanatory variables (columns 2 and 4). Among the control variables, change in real exchange rates, credit growth, GDP growth, inflation, financial openness, and sovereign credit ratings significantly influence the size of capital flows during the crisis. After controlling these variables, indirect exposure seems to play a more important role in signaling the possibility of capital outflows for the claims in the entire sector. While the coefficients of direct exposure of foreign claims are positive and statistically significant in columns (1)–(2) of Table 2c using locational banking statistics, they are generally not statistically significant in Tables 2a and 2b using consolidated banking statistics.

Table 2: Impact of Direct and Indirect Exposures of Foreign Claims on Capital Outflows during the Global Financial Crisis

(a) Foreign claims of consolidated banking statistics on immediate counterparty basis

Variables	(1) Outflow	(2) Outflow	(3) Outflow	(4) Outflow
Direct exposure of foreign claims	0.247	0.284	0.315	0.284
	[0.421]	[0.277]	[0.377]	[0.277]
Indirect exposure of foreign claims			1.775**	0.804
			[0.856]	[0.749]
Increase in current account deficit (2004–2007)		−0.002		−0.003
		[0.005]		[0.005]
Average change in real exchange rate (% annual, 2004–2007)		−0.896***		−0.865***
		[0.275]		[0.275]
Increase in credit-to-GDP ratio (2004–2007)		0.000		−0.000
		[0.002]		[0.002]
GDP growth (% annual, 2007)		0.027***		0.025**
		[0.009]		[0.009]
Inflation rate (2007)		−0.013**		−0.011
		[0.006]		[0.007]
Chinn–Ito index (2007)		0.064		0.069
		[0.060]		[0.061]
S&P sovereign LCY credit rating (2007)		−0.023***		−0.023***
		[0.007]		[0.007]
Observations	62	49	62	49
R^2	0.011	0.507	0.062	0.515

Notes: The dependent variable is the rate of capital outflows from each emerging economy during the global financial crisis. The rate of capital outflows is measured using the difference between the maximum and the minimum levels of foreign claims on an emerging economy during the period from the first quarter (Q1) of 2007 to Q4 2009. Measures of direct and indirect exposures are calculated using consolidated banking statistics on immediate counterparty basis. For others, see data description in Appendix Table A2. Numbers in brackets are robust standard errors and ***, **, and * denote the significance levels of 1%, 5%, and 10%, respectively.

(b) Foreign claims of consolidated banking statistics on ultimate risk basis

Variables	(1) Outflow	(2) Outflow	(3) Outflow	(4) Outflow
Direct exposure of foreign claims	−0.143	0.143	−0.113	0.149
	[0.351]	[0.265]	[0.345]	[0.273]
Indirect exposure of foreign claims			1.296*	1.095
			[0.761]	[0.751]
Increase in current account deficit (2004–2007)		−0.003		−0.004
		[0.005]		[0.005]
Average change in real exchange rate (% annual, 2004–2007)		−0.892***		−0.834***
		[0.267]		[0.271]
Increase in credit-to-GDP ratio (2004–2007)		0.000		−0.000
		[0.002]		[0.002]
GDP growth (% annual, 2007)		0.027***		0.026***
		[0.009]		[0.009]
Inflation rate (2007)		−0.012*		−0.009
		[0.007]		[0.008]
Chinn–Ito index (2007)		0.069		0.087
		[0.060]		[0.062]
S&P sovereign LCY credit rating (2007)		−0.024***		−0.022***
		[0.007]		[0.007]
Observations	62	49	62	49
R^2	0.007	0.497	0.042	0.521

Notes: The dependent variable is the rate of capital outflows from each emerging economy during the global financial crisis. Measures of direct/indirect exposures are calculated using consolidated banking statistics on ultimate risk basis. For others, see data description in Appendix Table A2. Numbers in brackets are robust standard errors and ***, **, and * denote the significance levels of 1%, 5%, and 10%, respectively.

(c) Cross-border foreign claims of locational banking statistics

Variables	(1) Outflow	(2) Outflow	(3) Outflow1	(4) Outflow1
Direct exposure of foreign claims	0.283*	0.298**	0.114	0.225
	[0.151]	[0.136]	[0.155]	[0.139]
Indirect exposure of foreign claims			1.537***	1.078**
			[0.518]	[0.449]
Increase in current account deficit (2004–2007)		–0.005		–0.005
		[0.005]		[0.004]
Average change in real exchange rate		–0.706*		–0.614*
(% annual, 2004–2007)		[0.365]		[0.345]
Increase in credit-to-GDP ratio		0.005**		0.005**
(2004–2007)		[0.002]		[0.002]
GDP growth (% annual, 2007)		–0.015		–0.016
		[0.009]		[0.010]
Inflation rate (2007)		–0.026***		–0.025***
		[0.009]		[0.008]
Chinn–Ito index (2007)		0.104*		0.111*
		[0.059]		[0.059]
S&P sovereign LCY credit rating		–0.020*		–0.021**
(2007)		[0.010]		[0.009]
Observations	62	49	62	49
R²	0.063	0.437	0.174	0.497

GDP = gross domestic product, LCY = local currency, S&P = Standard & Poor's, US = United States.
Notes: The dependent variable is the rate of capital outflows from each emerging economy during the global financial crisis. Measures of direct/indirect exposures are calculated using locational banking statistics on cross-border claims. For others, see data description in Appendix Table A2. Numbers in brackets are robust standard errors and ***, **, and * denote the significance levels of 1%, 5%, and 10%, respectively.
Source: Authors' calculations.

Table 3 reports regression results for the following equation:

$$Koutflow_i = \beta_0^b + \beta_1^b DE_{i,2007}^b + \beta_2^b IDE_{i,2007}^b + \beta_3^b X_{i2007} + \varepsilon_i \, , \tag{9}$$

where $DE_{i,2007}^b$ and $IDE_{i,2007}^b$ are direct and indirect exposures of the banking sector in Q4 2007. Measures of direct and indirect exposure of the banking sector are calculated by using bilateral foreign claims in three data sources: consolidated banking statistics foreign claims on ultimate risk basis (Table 3a), and locational banking statistics cross-border total claims (Table 3b) and cross-border loans (Table 3c). In all three, columns (1)–(4) unanimously indicate that the coefficients of direct exposure of the banking sector are positive and statistically significant irrespective of whether indirect exposure is added or not and whether country-specific control variables (X_{i2007}) are added as explanatory variables or not. Interestingly, however, while the coefficient of indirect exposure of the banking sector is positive except for just one case, it is much less statistically significant. Again, the coefficients of indirect exposure are positive and significant only when locational banking statistics are used (Tables 3b and 3c). Especially when sovereign credit rating is added to the regression equations, the country's indirect exposure based on both immediate counterparty and ultimate risk bases of consolidated banking statistics loses its significance. Table 3 therefore indicates that direct exposure, rather than indirect exposure, of the banking sector is much more important in explaining the vulnerability of emerging economies.

Table 3: Impact of Direct and Indirect Exposures of the Banking Sector on Capital Outflows during the Global Financial Crisis

(a) Total foreign claims on the banking sector based on consolidated banking statistics on ultimate risk basis

Variables	(1) Outflow	(2) Outflow	(3) Outflow	(4) Outflow
Direct exposure of banking sector	0.795***	0.660***	0.913***	0.662***
	[0.188]	[0.206]	[0.247]	[0.219]
Indirect exposure of banking sector			1.900	0.057
			[1.940]	[1.350]
Increase in current account deficit (2004–2007)		–0.002		–0.002
		[0.005]		[0.005]
Average change in real exchange rate (% annual, 2003–2007)		–0.953***		–0.951***
		[0.234]		[0.243]
Increase in credit-to-GDP ratio (2004–2007)		0.001		0.001
		[0.002]		[0.002]
GDP growth (% annual, 2007)		0.024***		0.024***
		[0.009]		[0.008]
Inflation rate (2007)		–0.010		–0.010
		[0.006]		[0.006]
Chinn–Ito index (2007)		0.016		0.016
		[0.057]		[0.058]
S&P sovereign LCY credit rating (2007)		–0.014**		–0.014**
		[0.007]		[0.006]
Observations	57	48	57	48
R^2	0.156	0.503	0.183	0.503

Notes: The dependent variable is the rate of capital outflows from each emerging economy during the global financial crisis. Measures of direct and indirect exposures are calculated using total foreign claims on the banking sector based on consolidated banking statistics on ultimate risk basis. For others, see data description in Appendix Table A2. Numbers in brackets are robust standard errors and ***, **, and * denote the significance levels of 1%, 5%, and 10%, respectively.

(b) Cross-border claims on the banking sector based on locational banking statistics

Variables	(1) Outflow	(2) Outflow	(3) Outflow	(4) Outflow
Direct exposure of banking sector	0.257***	0.228**	0.282***	0.253***
	[0.075]	[0.085]	[0.078]	[0.086]
Indirect exposure of banking sector			0.722**	0.359
			[0.285]	[0.269]
Increase in current account deficit (2004–2007)		–0.006		–0.005
		[0.004]		[0.004]
Average change in real exchange rate (% annual, 2003–2007)		–0.676*		–0.667*
		[0.366]		[0.355]
Increase in credit-to-GDP ratio (2004–2007)		0.005**		0.004**
		[0.002]		[0.002]
GDP growth (% annual, 2007)		–0.017*		–0.016
		[0.009]		[0.010]
Inflation rate (2007)		–0.023***		–0.022***
		[0.008]		[0.008]
Chinn–Ito index (2007)		0.124**		0.126**
		[0.060]		[0.061]
S&P sovereign LCY credit rating (2007)		–0.021**		–0.020**
		[0.010]		[0.010]
Observations	60	49	60	49
R^2	0.111	0.459	0.212	0.483

Notes: The dependent variable is the rate of capital outflows from each emerging economy during the global financial crisis. Measures of direct and indirect exposures are calculated using cross-border claims on the banking sector based on locational banking statistics. For others, see data description in Appendix Table A2. Numbers in brackets are robust standard errors and ***, **, and * denote the significance levels of 1%, 5%, and 10%, respectively.

(c) Cross-border loans on the banking sector based on locational banking statistics

Variables	(1) Outflow	(2) Outflow	(3) Outflow	(4) Outflow
Direct exposure of banking sector	0.222***	0.237**	0.304***	0.273***
	[0.069]	[0.090]	[0.093]	[0.096]
Indirect exposure of banking sector			0.862*	0.394
			[0.433]	[0.371]
Increase in current account deficit (2004–2007)		–0.006		–0.005
		[0.004]		[0.004]
Average change in real exchange rate (% annual, 2003–2007)		–0.619*		–0.644*
		[0.362]		[0.350]
Increase in credit-to-GDP ratio (2004–2007)		0.006**		0.005**
		[0.002]		[0.002]
GDP growth (% annual, 2007)		–0.016*		–0.016
		[0.009]		[0.010]
Inflation rate (2007)		–0.023***		–0.022**
		[0.008]		[0.008]
Chinn–Ito index (2007)		0.131**		0.126*
		[0.062]		[0.063]
S&P sovereign LCY credit rating (2007)		–0.022**		–0.021**
		[0.010]		[0.010]
Observations	60	49	60	49
R²	0.075	0.456	0.168	0.473

GDP = gross domestic product, LCY = local currency, S&P = Standard & Poor's, US = United States.
Notes: The dependent variable is the rate of capital outflows from each emerging economy during the global financial crisis. Measures of direct and indirect exposures are calculated using cross-border loans on the banking sector based on locational banking statistics. For others, see data description in Appendix Table A2. Numbers in brackets are robust standard errors and ***, **, and * denote the significance levels of 1%, 5%, and 10%, respectively.
Source: Authors' calculations.

Table 4 reports regression results for the following equation:

$$Koutflow_i = \beta_0^s + \beta_1^s DE_{i,2007}^s + \beta_2^s IDE_{i,2007}^s + \beta_3^s X_{i2007} + \varepsilon_i \,, \tag{10}$$

where $DE_{i,2007}^s$ and $IDE_{i,2007}^s$ are direct and indirect exposures of the short-term borrowings in Q4 2007. Measures of direct and indirect exposures of the short-term borrowings are calculated by the consolidated banking statistics on immediate counterparty basis. In columns (1)–(4), again, the coefficients of direct exposure of the short-term maturity are positive and statistically significant whether or not indirect exposure is added and whether country-specific control variables (X_{i2007}) are added or not as regressors. We also find that the coefficient of indirect exposure of the short-term maturity is not statistically significant in column (4). As for the banking sector, therefore, the direct exposure of the short-term borrowings seems to play a more crucial role in explaining the degree of vulnerability of emerging economies.

Table 4: Impact of Direct and Indirect Exposures of Short-Term International Borrowings on Capital Outflows during the Global Financial Crisis: Consolidated Banking Statistics on Immediate Counterparty Basis

Variables	(1) Outflow	(2) Outflow	(3) Outflow	(4) Outflow
Direct exposure of short-term maturities	0.612***	0.279	0.553***	0.262
	[0.199]	[0.204]	[0.206]	[0.184]
Indirect exposure of short-term maturities			1.977	1.264
			[1.430]	[1.247]
Increase in current account deficit, 2004–2007		–0.002		–0.003
		[0.005]		[0.005]
Average change in real exchange rate		–0.878***		–0.943***
(% annual, 2004–2007)		[0.291]		[0.300]
Increase in credit-to-GDP ratio		0.001		0.001
(2004–2007)		[0.002]		[0.002]
GDP growth (% annual, 2007)		0.028***		0.026***
		[0.009]		[0.008]
Inflation rate (2007)		–0.011*		–0.013**
		[0.007]		[0.006]
Chinn–Ito index (2007)		0.064		0.065
		[0.058]		[0.059]
S&P sovereign LCY credit rating		–0.021***		–0.020**
(2007)		[0.007]		[0.007]
Observations	62	49	62	49
R^2	0.116	0.520	0.142	0.530

Notes: The dependent variable is the rate of capital outflows from each emerging economy during the global financial crisis. Measures of direct and indirect exposures are calculated using short-term international borrowings based on consolidated banking statistics on immediate counterparty basis. For others, see data description in Appendix Table A2. Numbers in brackets are robust standard errors and ***, **, and * denote the significance levels of 1%, 5%, and 10%, respectively.
Source: Authors' calculations.

V.   CONCLUSION

In this paper, we investigated and tested financial contagion from advanced to emerging market economies through the global banking network. We computed measures of a country's direct and indirect exposures to the crisis-affected countries by using bilateral foreign claims sourced from (i) consolidated banking statistics foreign claims on immediate counterparty and ultimate risk bases and (ii) locational banking statistics cross-border total claims. Our findings show that emerging market economies that were more exposed, both directly and/or indirectly, to banks in the crisis-affected countries suffered from more capital outflows during the global financial crisis.

Empirical evidence suggests that a country's direct and indirect exposures to the crisis-affected countries can affect the size of capital outflows from the country during the crisis. Overall, the degree of the country's direct exposure through the banking sector to the crisis-affected countries is the most important for capital outflows during the crisis. However, using locational banking statistics, indirect exposure becomes significant. This may reflect the added information value of the geographical breakdown of banks' counterparty exposures, including intragroup positions between offices within the same banking group, which would unlikely be captured by sovereign credit rating assessment.

Our findings also suggest that the global banking network of aggregate cross-border lending can be an avenue for global liquidity crunch to spread financial shock around the world. This liquidity issue

of creditor banks can be particularly problematic for emerging market economies that rely heavily on foreign borrowing. The findings also support the argument in recent financial contagion studies, such as Shin (2009), that countries that are not directly affected by a crisis can also experience financial disruption due to deleveraging actions by creditors in crisis-affected countries. That is, increased global financial network leaves no safe havens from a financial crisis. Also, as in Čihák, Muñoz, and Scuzzarella (2011), our findings show that financial turmoil originated in creditor countries can spread to borrowing countries through their funding channels.

Our findings are potentially quite important for macroprudential policies and financial sector regulations in emerging market economies. Our findings suggest that cross-border bank lending can transmit the risk of global liquidity problems from creditor to borrowing economies. Growth in the global banking network can make countries that are not directly hit by a crisis vulnerable to the effect of financial crisis and threaten their financial stability. A complete picture of financial interlinkages and their impact on any country's financial stability is an important topic for further research. While we have tried to compile the aggregate cross-border lending positions as accurately and comprehensively as possible, our empirical analysis cannot overcome data constraints imposed by incomplete reporting in BIS banking statistics (for example, the People's Republic of China was not part of the BIS locational banking statistics reporting countries until Q4 2016). Further research is warranted as a more granular approach based on individual bank balance sheet data and further enhancement of BIS international banking statistics would allow a more accurate and comprehensive analysis of the global banking network.

APPENDIXES

Table A1: Reporting Countries Consolidated and Locational Banking Statistics, 2007

(a) Consolidated banking statistics

Austria	Finland	Mexico
Australia	France	The Netherlands
Belgium	United Kingdom	Panama
Brazil	Greece	Portugal
Canada	Ireland	Sweden
Switzerland	India	Singapore
Chile	Italy	Turkey
Germany	Japan	Taipei,China
Denmark	Korea, Republic of	United States

(b) Locational banking statistics

Austria	Finland	Korea, Republic of
Australia	France	Luxembourg
Belgium	United Kingdom	Macau, China
Brazil	Guernsey	Mexico
Canada	Greece	The Netherlands
Switzerland	Hong Kong, China	Sweden
Chile	Ireland	Taipei,China
Germany	Isle of Man	United States
Denmark	Jersey	South Africa
Spain	Japan	

(c) Emerging countries

Albania	Indonesia	Nigeria
Argentina	Israel	Pakistan
Armenia	Jamaica	Paraguay
Bangladesh	Jordan	Peru
Bosnia & Herzegovina	Kazakhstan	Philippines
Brazil	Kenya	Poland
Bulgaria	Korea, Republic of	Romania
Cape Verde	Kyrgyz Republic	Russian Federation
Chile	Latvia	Seychelles
Colombia	Lebanon	South Africa
Costa Rica	Lesotho	Sri Lanka
Croatia	Lithuania	Suriname
Czech Republic	Macedonia, FYR	Tanzania
Dominican Republic	Malaysia	Thailand
Egypt	Mauritius	Tunisia
Georgia	Mexico	Turkey
Ghana	Moldova	Uganda
Guatemala	Mongolia	Ukraine
Honduras	Morocco	Uruguay
Hungary	Mozambique	Venezuela
India	Nicaragua	

FYR = former Yugoslav Republic.
Source: Bank for International Settlements and authors' compilation.

Table A2: Definitions of Variables and Data Sources

Variables	Description and Construction	Data Source
Bilateral foreign claims	Consolidated banking statistics and locational banking statistics	Bank for International Settlements. https://www.bis.org (accessed July 2016)
Gross domestic product (GDP)	GDP in nominal United States (US) dollars. For countries with missing quarterly GDP, we use interpolated annual data.	International Monetary Fund (IMF). International Financial Statistics. www.imf.org/en/Data (accessed September 2016); World Bank. World Development Indicators. http://databank.worldbank.org (accessed October 2016)
GDP growth rate for emerging countries	Aggregate, year-on-year growth rate	
Percent change in real exchange rate	Log difference in real exchange rate (National currency per US dollar) between the first month (M1) 2003 to M12 2007	IMF. International Financial Statistics. www.imf.org/en/Data (accessed September 2016)
Increase in current account deficit from 2010 to 2012	Difference in current account deficit from 2004 to 2007	World Bank. World Development Indicators. http://databank.worldbank.org (accessed October 2016)
Increase in credit to GDP from 2004 to 2007	Increase in domestic credit to private sector (% of GDP) from 2004 to 2007	
Inflation (Consumer price index) 2007	Inflation, consumer prices (% annual)	
Chinn–Ito index, 2007	An index measuring a country's degree of capital account openness. It is based on the binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions	Chinn and Ito (2006)
S&P sovereign local currency credit rating, 2007	End of period credit rating on government-issued local currency-denominated debt securities	Standard & Poor's. Ratings Direct. https://www.globalcreditportal.com/ratingsdirect (accessed February 2017)

Source: Authors' compilation.

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A Contagion through Exposure to Foreign Banks during the Global Financial Crisis

The paper develops an empirical methodology to test cross-border financial contagion using bilateral data on bank claims between countries. Results indicate that emerging market economies that were more exposed to banks from crisis-affected countries recorded more capital outflows than other countries during the global financial crisis.

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