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The International Transmission of Bank Liquidity Shocks: Evidence from an Emerging Market

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ABSTRACT

I exploit the 1998 Russian default as a negative liquidity shock to international banks and analyze its transmission to Peru. I find that after the shock international banks reduce bank-to-bank lending to Peruvian banks and Peruvian banks reduce lending to Peruvian firms. The effect is strongest for domestically owned banks that borrow internationally, intermediate for foreign-owned banks, and weakest for locally funded banks. I control for credit demand by examining firms that borrow from several banks. These results suggest that international banks transmit liquidity shocks across countries and that negative liquidity shocks reduce bank lending in affected countries.

AN IMPORTANT QUESTION IN FINANCE is whether financial institutions transmit liquidity shocks across markets, and if so, whether such shocks impact real economic activity. On the one hand, efficient market theory suggests that, as long as investment opportunities are constant, shocks to financial institutions in one market should not affect lending in other markets. On the other hand, if financing frictions prevent financial institutions from accessing alternative financing sources to cover shortfalls, then liquidity shocks in one market may affect lending in other markets.

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To provide compelling evidence that financial institutions transmit liquidity shocks across markets and that liquidity shocks have real effects, one has to address several challenges. First, liquidity shocks are typically systemic (or aggregate) shocks that affect many financial institutions at the same time. Hence, one needs to identify a setting in which similar financial institutions differ in their exposure to a systemic shock. Second, the same economic forces that trigger liquidity shocks may also directly affect firms' investment opportunities. One therefore needs to control for changes in investment opportunities, ideally at the firm level. Third, firms can offset bank liquidity shocks by borrowing elsewhere. Hence, one needs to observe real firm outcomes to evaluate the impact of liquidity shocks on real economic activity.

In this paper, I address these challenges by interpreting the 1998 Russian debt default as a negative liquidity shock to international banks and by analyzing its impact on bank lending in Peru. This setting is ideal for three reasons. First, the impact of the liquidity shock varies across Peruvian banks because Peruvian banks vary in their exposure to international bank-to-bank lending. I use this variation to construct bank-specific exposure to the liquidity shock. Second, I collect a novel data set that covers all bank loans in Peru. This data set allows me to control for changes in firm-level investment opportunities by analyzing firms that borrow from several banks. Third, I observe total borrowing, loan default, and survival of Peruvian firms. I can therefore estimate the impact on real economic activity for the universe of Peruvian firms.

The following example illustrates the transmission channel under investigation. Suppose Citibank-US and UBS are both international banks that provide loans to Peruvian banks. Assume Citibank-US has a subsidiary in Peru (e.g., Citibank-Peru), but UBS does not. I refer to banks such as Citibank-US as owners and to banks such as UBS as arm's-length lenders. I show that owners are less likely to transmit liquidity shocks to their subsidiaries than arm's-length lenders to their borrowers. The intuition is straightforward: An owner can directly monitor its subsidiary's lending and can therefore prevent risk shifting in response to higher interest rates but an arm's-length lender cannot. Hence, among banks that borrow internationally, the transmission of liquidity shocks by arm's-length lenders is stronger than the transmission by owners.

To analyze the transmission of the Russian default empirically, I proceed in several steps. First, I document the impact of the Russian default on international banks. I find that, after the Russian default, both owners (e.g., Citibank-US) and arm's-length lenders (e.g., UBS) experience a sharp drop in their share prices. The drop is similar in magnitude for both groups of banks. This finding suggests that the Russian default represents a systemic liquidity shock that negatively affects all international banks.

Second, I examine the impact of the liquidity shock on bank-to-bank lending to Peruvian banks. Among Peruvian banks that borrow internationally, I distinguish between foreign-owned banks (e.g., Citibank-Peru) and domestically owned banks (e.g., Banco Wiese). I find that owners lend more to their Peruvian subsidiaries and less to other Peruvian banks (e.g., Citibank-US lending more to Citibank-Peru and less to Banco Wiese), but arm's-length lenders reduce

loans to all Peruvian banks (e.g., UBS lending less to Citibank-Peru and less to Banco Wiese). As a result, after the Russian default, bank-to-bank loans to domestically owned banks decrease by 61% but bank-to-bank loans to foreign-owned banks decrease by only 26%.

I next analyze the impact of the liquidity shock on lending by Peruvian banks. The liquidity shock affects lending under two conditions. The first condition is that banks cannot offset the shock by accessing other sources of financing. The second condition is that firms cannot offset the shock by switching across banks or borrowing elsewhere.

To evaluate whether banks can offset the shock, I use loan-level data and analyze lending by Peruvian banks before and after the liquidity shock. I control for changes in investment opportunities at the firm level by focusing on firms that borrow from more than one bank and compare changes in borrowing from different banks *within* firms (e.g., for the same firm, I compare the change in borrowing from Citibank-Peru and Banco Wiese). The analysis shows that domestically owned banks with international bank-to-bank loans (e.g., Banco Wiese) reduce lending by 8.2% relative to foreign-owned banks (e.g., Citibank-Peru). As an additional control group, I analyze locally funded banks that did not borrow from international banks prior to the Russian default. I find that domestically owned banks with international borrowing reduce lending by 13.1% relative to locally funded banks. These results suggest that Peruvian banks transmit the liquidity shock to Peruvian firms and that the transmission is larger for banks that are more exposed to the liquidity shock.

I conduct several robustness tests to ensure that my results reflect the impact of the liquidity shock. First, I control for a large number of loan, firm, and bank characteristics. The results are robust to including these variables. Second, I analyze changes in lending by firm age, firm size, and export status. I find that the results are similar across groups, which suggests that the results are not driven by a single group that changes its bank preferences after the Russian default. Third, I estimate the transmission of the liquidity shock without controlling for firm-level investment opportunities. The analysis yields qualitatively similar results, which suggests that the change in lending can be explained solely by the liquidity shock. Fourth, I estimate the impact of the liquidity shock using the change in international bank-to-bank borrowing as the main explanatory variable. I find qualitatively similar results, which provides direct evidence on the transmission channel under investigation. Fifth, I estimate a placebo regression 1 year before the liquidity shock and find no statistically significant effect of bank exposure on bank lending.

To evaluate whether firms can offset the shock, I analyze the impact of the liquidity shock on real economic activity. I measure a firm's exposure to the liquidity shock by computing borrowing from each type of bank as a share of total borrowing before the liquidity shock. I expect that firms with established relationships to less affected banks have a smaller reduction in total borrowing. Indeed, I find that a one-standard-deviation increase in the share of borrowing from foreign-owned banks increases total borrowing after the liquidity shock by 3.0%, reduces loan default by 1.1 percentage points, and increases firm survival

by 1.4 percentage points relative to domestically owned banks that borrow internationally. I find qualitatively similar results for locally funded banks but the quantitative impact is smaller and some results are not statistically significant. These findings suggest that Peruvian firms cannot offset the negative liquidity shock and that the liquidity shock affects real firm outcomes.

Overall, my results establish the transmission of a bank liquidity shock originating in one country, Russia, to another country, Peru. The transmission channel is through international lending between banks. The transmission is strongest for domestically owned banks that borrow internationally, intermediate for foreign-owned banks, and weakest for locally funded banks. These results suggest that lending between international banks establishes a transmission channel for bank liquidity shocks across countries and that negative liquidity shocks reduce bank lending in affected countries.

The analysis of bank liquidity shocks connects to a large literature on the impact of financial shocks on the real economy.[1] Theoretical work by Bernanke and Blinder (1988), Bernanke and Gertler (1989), Holmstrom and Tirole (1997), and Stein (1998) shows that financial shocks affect real firm outcomes only if there are credit market imperfections at both the bank and the firm level. The early empirical literature by Bernanke (1983) and Bernanke and Blinder (1992) uses correlations between aggregate changes in liquidity and aggregate changes in output to show that financial shocks affect real outcomes.

However, aggregate correlations may be driven by omitted variables that affect both bank credit supply and firm investment. More recent empirical work uses variation across banks and firms (e.g., Kashyap, Lamont, and Stein (1994), Kashyap and Stein (2000), Campello (2002), Ashcraft (2006), and Ashcraft and Campello (2007)) or natural experiments (e.g., Peek and Rosengren (1997), Peek and Rosengren (2000a), Ashcraft (2005), Gan (2007), Khwaja and Mian (2008), Paravisini (2008), Chava and Purnanandam (2011), Iyer and Peydro (2011)) to control for omitted variables. This paper is closest to that of Khwaja and Mian (2008), who also use a within-firm estimator to identify the bank lending channel. However, their paper studies a domestic shock to bank deposits rather than the transmission of liquidity shock across countries.

This paper relates to studies on the differences between foreign- and domestically owned banks in emerging markets. Empirical work using cross-sectional data on lending, such as Berger, Klapper, and Udell (2001), Mian (2006), and Detragiache, Tressel, and Gupta (2008), or using panel data on foreign bank entry, such as Gormley (2010), finds that foreign-owned banks tend to finance larger firms and domestically owned banks tend to finance smaller firms. Using bank-level data for Latin American and Asian countries, Diamond and Rajan (2001), Peek and Rosengren (2000b), and Detragiache and Gupta (2004), among others, find that, after financial crises, foreign-owned banks increase

[1] I define a bank liquidity shock as a shock to a bank's funding liquidity. Alternatively, some papers in the bank lending literature refer to such shocks as credit supply shocks. In the context of this paper, there is no substantive difference between bank liquidity shocks and credit supply shocks.

lending relative to domestically owned banks. Other authors, such as Arena, Reinhart, and Vazquez (2007), find only weak evidence that foreign- and domestically owned banks behave differently during financial crises. My paper is different from previous studies because I distinguish between domestically owned banks that borrow internationally and domestically owned banks that do not. Moreover, I estimate the transmission of liquidity shocks using loan-level data, which allows me to control for firm-level changes in investment opportunities.

This paper also relates to studies on international financial contagion. Several papers document international comovements of equity returns around financial crises. Some of these comovements reflect underlying changes in economic fundamentals as shown by Eichengreen, Rose, and Wyplosz (1996), Glick and Rose (1999), and Forbes (2004). However, economic fundamentals cannot fully explain comovements across markets and hence some authors have analyzed whether international financial linkages amplify these relationships (e.g., Forbes and Rigobon (2002), Goldberg (2002), Bekaert, Harvey, and Ng (2005), and Joikashthira, Lundblad, and Ramadorai (2010)).[2] Ceterolli and Goldberg (2010) analyze financial contagion using data on capital flows within global banks. This paper complements research on international financial contagion by examining the transmission of liquidity shocks using both bank-to-bank lending and loan-level data.

This paper is organized as follows. Section I discusses the institutional setting. Section II describes the nonparametric results. Section III summarizes the data. Section IV develops the theoretical framework and presents the empirical analysis. Section V concludes.

I. The Setting

In 1992, Russia implemented far-reaching economic reforms. The reforms replaced an order based on state ownership and central planning with an order based on private property rights and voluntary exchange. The reforms led to a large increase in private sector employment and the formation of capital markets, but also created macroeconomic instabilities.

To address these instabilities, in 1995 the Russian government implemented an economic stabilization program. The program successfully reduced inflation, but generated a large decline in federal tax revenues that sharply increased Russia's debt burden. Starting in July 1997, the Asian Financial Crisis prompted concerns about emerging markets and investors started to withdraw funds from Russia and other emerging markets. In August 1998, the Russian government decided to abandon its support for a fixed exchange-rate regime, which triggered a surge in withdrawals by international investors and led to a massive default on government debt. As a result, many Russian banks went

[2] See Claessens and Forbes (2001) and Karolyi (2003) for surveys of international financial contagion.

bankrupt, the domestic payment system collapsed, and inflation reached more than 80%.[3]

Because Russia's reforms were supported by the International Monetary Fund, many international investors failed to anticipate Russia's default and were surprised by the sudden crisis in Russia. The resulting losses reverberated internationally, triggering the default of several financial institutions in the United States and Europe, including the hedge fund Long-Term Capital Management. These defaults generated uncertainty in interbank lending markets, which prompted banks to hoard liquidity and reduce interbank lending.

Many investors interpreted the sudden changes in Russia as a negative signal about emerging market risks and lowered their expectations of returns in these markets. Moreover, some emerging market investors faced liquidity shortages due to losses on investments in Russia. As a result, many investors reduced their exposure to emerging markets, which further increased the price pressure on emerging market investments and prompted more sell-offs.

The main impact of the Russian default on Peru was via the reduction in bank-to-bank lending to Peruvian banks.[4] The Peruvian banking system was highly dependent on bank-to-bank loans provided by international banks. One month prior to the Russian default, international banks had provided bank-to-bank loans accounting for about one-fifth of total bank liabilities in Peru.

Apart from the reduction in bank-to-bank loans, the Russian default also affected export opportunities of Peruvian firms. Even though Peruvian firms had almost no direct trade relationships with Russian firms, the Russian default affected global trade, which in turn affected Peruvian firms. In particular, two of Peru's largest trading partners, Brazil and the United States, were negatively affected by the Russian default and reduced their demand for export goods.

The combined effect of the reduction in bank-to-bank loans and the reduction in export opportunities had a large negative effect on the Peruvian economy. During the 3 years prior to the Russian default, the Peruvian economy was growing at an annual real rate of 6.0%. In the year of the Russian default, economic growth declined to −0.7%. In the 2 years after the Russian default, economic growth slowly recovered to 0.9% and 3.0%, respectively. Economic growth only returned to rates of more than 5% after a newly elected government took office in 2001.

II. Nonparametric Results

To trace the impact of the Russian default on Peru, I start by analyzing lending relationships between international banks and Peruvian banks.

[3] For a more detailed account of the Russian default, see Shleifer and Treisman (2000).

[4] For a discussion of the transmission of the Russian default to Peru, see Superintendence of Banking, Insurance, and Pension Funds (2006) and Castillo and Barco (2008).

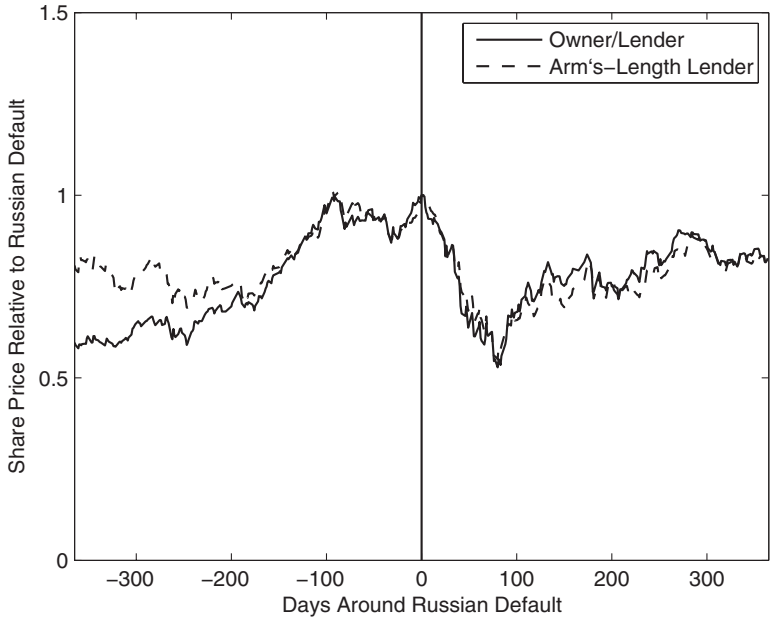

Figure 1. Share prices of owners and arm's-length lenders. This figure plots the average share prices of owners (e.g., Citibank-US) and arm's-length lenders (e.g., UBS) 1 year before and 1 year after the Russian default. Owners are international banks with equity holdings in Peruvian banks. Arm's-length lenders are international banks that do not have equity holdings in Peruvian banks. The figure is based on data for all owners and the 30 largest arm's-length lenders for which share price data are available. I normalize all share prices to one relative to the date of the Russian default. The figure shows that both owners and arm's-length lenders suffer a significant decrease in share price immediately after the Russian default and recover gradually thereafter. I note that there is no discernible difference in the impact of the Russian default on the share price of owners relative to arm's-length lenders.

Table I provides information on bank-to-bank loans provided by international banks to the 20 largest Peruvian banks. Column (1) lists bank names and Column (2) reports their market shares. Column (3) indicates whether a Peruvian bank was owned by an international bank. Column (4) shows the share of liabilities financed with international bank-to-bank loans. Columns (5) and (6) show that Peruvian banks borrow both from owners (e.g., Citibank-US) and arm's-length lenders (e.g., UBS).

Figure 1 plots the share prices of owners and arm's-length lenders 1 year before and 1 year after the Russian default. I interpret the share price as a measure of the impact of the Russian default on international banks. I use the share price because it incorporates both the direct impact (e.g., losses on investments in Russia) and the indirect impact (e.g., negative effect of the collapse of Long-Term Capital Management) of the Russian default. I normalize the share price to one at the time of the Russian default such that the y axis represents the relative change compared to the date of the Russian default. Owners and

Table I

Peruvian Banks and International Lenders

This table provides an overview of Peruvian banks and their international lenders. Column (1) lists the 20 largest banks in Peru ranked by market share. Column (2) reports the market share. Column (3) shows whether the bank has an international bank as an owner. If a bank does have an international owner, I list the owner's name and country of origin. Column (4) lists the share of liabilities financed by international lenders. Columns (5) and (6) list the names of the two largest international lenders. I randomly reassign international lenders across banks to preserve bank anonymity. All variables are defined in the Appendix. * distinguishes international lenders that own a Peruvian bank and also provide bank-to-bank loans to the same bank.

Peruvian Bank (1)	Market Share (2)	International Owner (3)	International Debt (4)	International Lenders	
				1st (5)	2nd (6)
Banco de Credito	21.3%	No	12.4%	Barclays	UBS
Banco Wiese	17.2%	No	23.9%	Citibank	Rabobank
Banco Continental	11.4%	BBVA (Spain)	11.2%	BBVA*	Standard Chartered
Interbank	7.3%	No	27.2%	Bank of America	Dresdner Bank
Banco Santander	6.0%	Santander (Spain)	27.1%	Banco Santander*	ING Bank
Banco Lima	5.7%	Sudameris (Italy)	18.5%	Sudameris*	Rabobank
Banco Nuevo Mundo	4.7%	No	22.6%	Dresdner Bank	Hamilton Bank
Banco Latino	4.6%	No	8.9%	West Merchant Bank	Anglo Irish
Banco Bancosur	4.0%	Central Hispano (Spain)	21.9%	West Merchant Bank	Rabobank
Banco Sudamericano	3.2%	Scotiabank (Canada)	19.5%	Prime Bank	Scotiabank*
Banco Progreso	2.2%	No	33.0%	EFG Bank	UBS
Citibank Peru	2.2%	Citibank (U.S.)	46.3%	Citibank*	Standard Chartered
Banco Financiero	1.8%	Pichincha (Ecuador)	23.5%	Hamilton Bank	Pichincha*
Banco Banex	1.5%	No	4.4%	Popular Bank	UBS
Banco NBK	1.4%	No	14.4%	Tribank	Dresdner Bank
Extebandes	1.3%	No	26.0%	Standard Chartered	BBVA
Banco Interamericano	1.3%	Banco Fierro (Spain)	31.6%	Banca Della Svizzera	Lloyds Bank
Banco Republica	1.3%	No	5.6%	Commerzbank	Standard Chartered
Banco de Comercio	0.9%	No	5.5%	Bank Austria	Hamilton Bank
Banco Orion	0.5%	No	9.9%	Tribank	Socimer International
Bank Boston Peru	0.4%	Bank Boston (U.S.)	61.1%	Bank Boston*	

arm's-length lenders are defined in relation to Peruvian banks. Hence, some banks that are owners with respect to Peruvian banks (e.g., Citibank-US) may be arm's-length lenders in other emerging markets and vice versa.

The figure shows that stock prices of both owners (e.g., Citibank-US) and arm's-length lenders (e.g., UBS) evolve similarly before and after the Russian default. Both groups of lenders suffer about a 50% decline in stock prices immediately after the Russian default and recover gradually thereafter. I find no discernible difference in the impact of the Russian default across owners and arm's-length lenders. This finding suggests that the Russian default was a systemic liquidity shock that negatively affected international banks independent of whether they owned subsidiaries in Peru.

To determine the impact on Peruvian banks, I use data on bank-to-bank loans provided by international banks to Peruvian banks. In the month before the Russian default, international banks provided bank-to-bank loans of $3.2bn to Peruvian banks. Most of the bank-to-bank loans were short term with maturities of less than 1 year. There were practically no bank-to-bank loans provided by Peruvian banks to international banks. The Peruvian banking system was thus a net borrower with total borrowing of $3.2bn from international banks. By comparison, the domestic interbank lending market was much smaller and accounted for only $0.2bn in the month before the Russian default.

I analyze the response of arm's-length lenders and owners separately. Figure 2 plots bank-to-bank loans provided by arm's-length lenders (e.g., UBS) to foreign-owned banks (e.g., Citibank-Peru) and to domestically owned banks (e.g., Banco Wiese) 4 months before and 12 months after the Russian default.[5] To facilitate comparison across the two groups, I use the natural logarithm of total loans and normalize the series to zero at the time of the Russian default. The figure shows that within 1 year after the Russian default, arm's-length lenders reduce bank-to-bank loans to both foreign- and domestically owned banks by 58% and 47%, respectively. Hence, there is practically no difference in the reduction of bank-to-bank lending across the two groups of banks. The reduction is economically significant and accounts for $1.4bn or 14% of total bank lending at the time of the Russian default.

For comparison, Figure 3 plots bank-to-bank loans provided by owners (e.g., Citibank-US) to foreign-owned banks (e.g., Citibank-Peru) and to domestically owned banks (e.g., Banco Wiese). The figure shows that, in the first 3 months after the Russian default, owners increase financing to foreign-owned banks by $122m or 27%, but reduce bank-to-bank loans to domestically owned banks by 25% or $54m. One year after the crisis, owners continue to provide financing at pre-crisis levels to foreign-owned banks, but reduce bank-to-bank loans to domestically owned banks by 68% or $148m.

Figures 2 and 3 suggest an important difference in the response of owners and arm's-length lenders to the liquidity shock. Even though Figure 1 shows no difference in the impact of the Russian default on owners and arm's-length

[5] I plot only 4 months in the pre-default period because the Peruvian bank regulator only started collecting these data at that time.

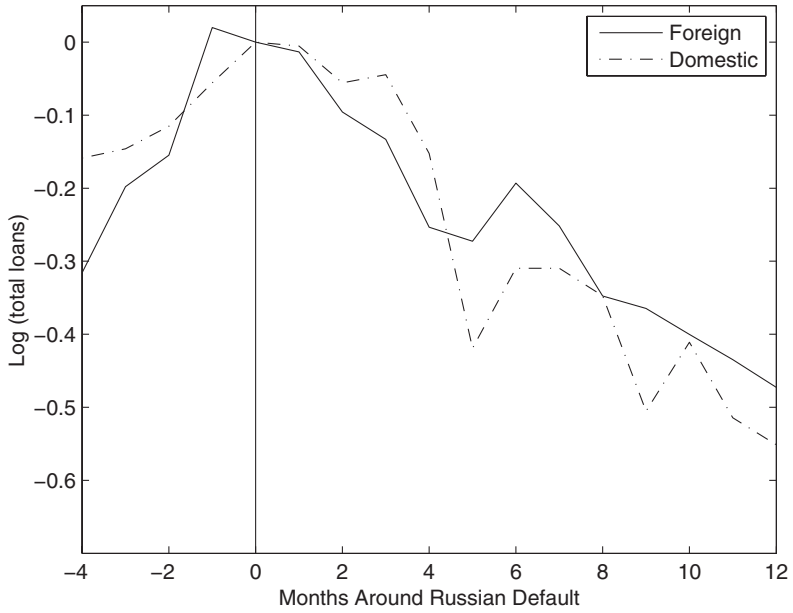

Figure 2. Bank-to-bank loans provided by arm's-length lenders. This figure plots the natural logarithm of bank-to-bank loans provided by arm's-length lenders (e.g., UBS) to foreign- and domestically owned Peruvian banks (owners are plotted in Figure 3). I compute bank-to-bank loans as total bank-to-bank loans outstanding per month and per type of bank. I define arm's-length lenders as international banks that do not have equity holdings in Peruvian banks. I define Peruvian banks as foreign-owned if at least 50% of bank equity is owned by shareholders based outside Peru and as domestically owned otherwise. I normalize the series to zero relative to the date of the Russian default, such that the y axis represents the relative change in bank-to-bank loans compared to the date of the Russian default. The figure shows that, after the Russian default, arm's-length lenders reduce bank-to-bank loans to both foreign- and domestically owned banks in equal proportions.

lenders, the two groups of lenders respond differently regarding their bank-to-bank loans provided to Peruvian banks. After the shock, owners *divert* bank-to-bank loans from domestically owned banks to foreign-owned banks, while arm's-length lenders *reduce* bank-to-bank loans to both foreign- and domestically owned banks.

Figure 4 summarizes the aggregate effect of the liquidity shock on bank-to-bank lending to foreign-owned banks (e.g., Citibank-Peru) and to domestically owned banks (e.g., Banco Wiese). I construct this figure by adding bank-to-bank loans from Figures 2 and 3. The figure shows a decrease of 26%, or $264m, in loans provided to foreign-owned banks after the Russian default and a decrease of 61%, or $928m, in loans provided to domestically owned banks. Hence, the reduction in bank-to-bank loans after the Russian default is significantly larger for domestically owned banks relative to foreign-owned banks. This result suggests that domestically owned Peruvian banks with international bank-to-bank

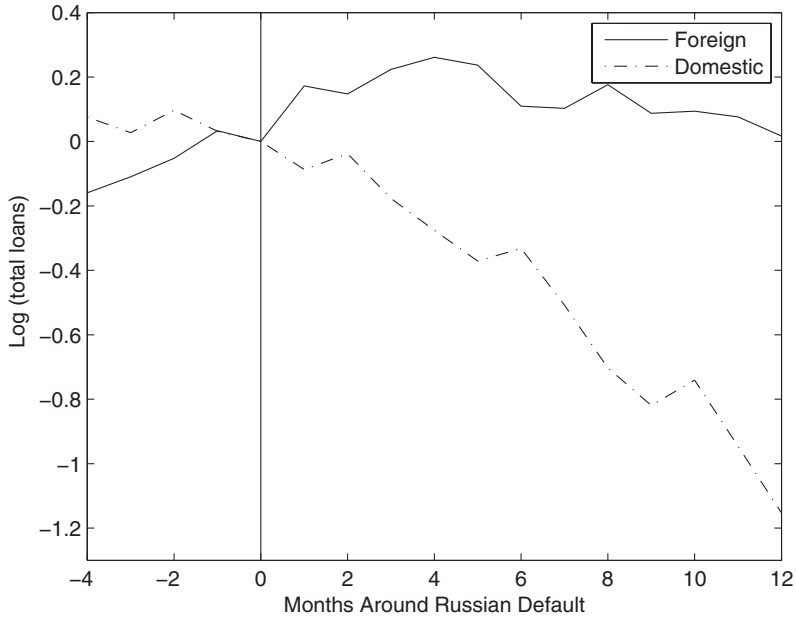

Figure 3. Bank-to-bank loans provided by owners. This figure plots the natural logarithm of bank-to-banks loans provided by owners (e.g., Citibank-US) to foreign- and domestically owned Peruvian banks (arm's-length lenders are plotted in Figure 2). I compute bank-to-bank loans as total bank-to-bank loans outstanding per month and per type of bank. I define owners as international banks with equity holdings in Peruvian banks. I define Peruvian banks as foreign-owned if at least 50% of bank equity is owned by shareholders based outside Peru and as domestically owned otherwise. I normalize the series to zero relative to the date of the Russian default. The figure shows that, after the Russian default, owners increase lending to foreign-owned banks relative to domestically owned banks.

loans are more negatively affected by the liquidity shock than foreign-owned Peruvian banks. This is the international transmission channel under investigation in this paper.

III. Data and Summary Statistics

I use four novel data sets for my empirical analysis: bank-level data on Peruvian banks, loan-level data on lending from international banks to Peruvian banks, loan-level data on loans provided by Peruvian banks to Peruvian firms, and firm-level data on Peruvian firms. I obtain the first three data sets from the Peruvian bank regulator Superintendence of Banking, Insurance, and Pension Funds (SBS). I collect the firm-level data from the Peruvian tax administrator Superintendence of Tax Administration (SUNAT). All data are public information except the bank-to-bank loan data.

The bank data consist of financial statements for all of Peru's commercial and municipal banks from January 1996 to December 2000. The data also

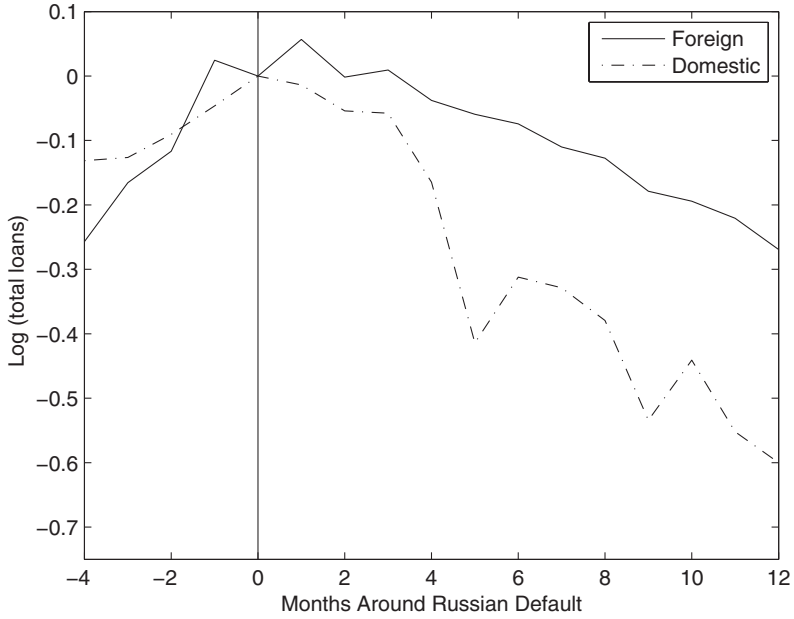

Figure 4. Bank-to-bank loans to foreign- and domestically owned banks. This figure plots the natural logarithm of outstanding bank-to-bank loans to foreign- and domestically owned Peruvian banks. I compute bank-to-bank loans as total bank-to-bank loans outstanding per month and per type of bank. I define Peruvian banks as foreign-owned if at least 50% of bank equity is owned by shareholders based outside Peru and as domestically owned otherwise. I construct the figure by adding bank-to-bank loans from Figures 2 and 3. I normalize the series to zero relative to the date of the Russian default. The figure shows that, after the Russian default, international lenders reduce bank-to-bank loans to domestically owned banks relative to bank-to-bank loans to foreign-owned banks.

contain financial statements for five leasing companies, three finance companies, and two microfinance organizations. The leasing companies are wholly owned subsidiaries of commercial banks and are consolidated with the respective parent company. I drop finance companies and microfinance organizations from the analysis because they do not provide significant lending to firms.

I classify Peruvian banks along two dimensions: foreign bank ownership and the share of liabilities funded internationally. Regarding foreign bank ownership, I define a bank as foreign-owned if shareholders based outside Peru own at least 50% of bank equity.[6] All foreign shareholders in Peruvian banks are international banks based in the United States, Canada, Europe, and Latin

[6] Three out of 43 banks are joint ventures in which foreign and domestic shareholders each own 50% of bank equity. In the regression analysis, I code them as foreign-owned. The results are robust to coding these banks as domestically owned.

America. Similar to other emerging markets, all foreign-owned banks have a significant share of liabilities that are funded internationally.[7]

Among domestically owned banks, I split the sample into banks with total borrowing from international banks as a share of liabilities above and below the median of 6.2%. This strategy yields 15 banks in each group. Banks with an above-median share of internationally funded liabilities are mostly larger banks that operate similarly to foreign-owned banks and lend to large firms. Banks with a below-median share of liabilities funded internationally are mostly smaller banks that lend to small and medium-sized firms.

There is a natural ranking of banks in terms of banks' exposure to the liquidity shock. Domestically owned banks with international funding have *high exposure* to the liquidity shock because they experience a sudden decrease in international bank-to-bank loans after the Russian default. Foreign-owned banks have *intermediate exposure* to the liquidity shock because they also experience a sudden decrease in international bank-to-bank loans but the decrease is partially offset by increased funding from their owner. Domestically owned banks without international funding have *low exposure* because they are not directly affected by the liquidity shock. For simplicity, I refer to banks in terms of their exposure rather than by bank ownership and the share of liabilities funded internationally.

Panel A of Table II provides bank summary statistics by exposure. The data set comprises 43 banks that are almost equally divided among the three groups. High and intermediate exposure banks are of similar size and have average total assets of \$868m and \$599m, respectively. Both groups of banks have loans worth about 64% of assets, hold about 18% of assets in liquid instruments, and finance more than 40% of liabilities with local deposits. Both groups of banks rely heavily on international funding and respectively finance 15.0% and 22.3% of liabilities internationally. Intermediate exposure banks have lower equity ratios than high exposure banks, 10.9% relative to 14.8%, and lower return on assets, 2.1% relative to 3.0%. Using standard tests of mean differences, I find that none of the differences in observable characteristics are statistically significant.

Low exposure banks have average total assets of \$21m and are significantly smaller than high and intermediate exposure banks. They have practically no international funding with only 0.7% of liabilities funded internationally. They have loans worth about 63% of assets, hold about 18% of assets in liquid assets, and finance slightly less than 40% of liabilities with local deposits. They have an equity ratio of 19.7% and a return on assets of 0.1%. Using standard tests of mean differences, I find that the differences in terms of size and international borrowing between low exposure banks and the two other groups of banks are statistically significant.

[7] An Internet Appendix provides information on foreign ownership for all Peruvian banks. The Internet Appendix is available on *The Journal of Finance* website at http://www.afajof.org/supplements.asp.

In short, the summary statistics suggest that intermediate and high exposure banks are similar in terms of observable characteristics. In contrast, low exposure banks differ in terms of size and international funding. To ensure that differences in observable characteristics do not confound the empirical analysis, I control for bank characteristics in my regression analysis.

Panel B of Table II provides information on international lending between banks. I restrict the sample to banks with internationally funded liabilities. About 87% of internationally funded liabilities are bank-to-bank loans provided by international banks. The remaining 13% of internationally funded liabilities are loans provided by multinational financial institutions such as the World Bank. I distinguish between lending by owners (e.g., Citibank-US) and arm's-length lenders (e.g., UBS).

Columns (1) and (2) show loan size and loan characteristics for loans provided by owners to Peruvian banks. On average, owners provide loans of $34.4m to their Peruvian subsidiaries relative to loans of $5.5m to nonsubsidiaries. About 66% and 94% of loans are less than 1 year, respectively. Columns (3) and (4) show loan size and loan characteristics for loans provided by arm's-length lenders to Peruvian banks. On average, arm's-length lenders provide loans of $9.8m to Peruvian banks with international owners and loans of $7.1m to banks without international owners. About 98% and 95% of loans have a maturity of less than 1 year, respectively.

Table III provides summary statistics on loans provided by Peruvian banks to Peruvian firms. The loan-level data are based on the universe of corporate loans from January 1996 to December 2000. I define a loan as a single loan relationship between a bank and a firm. If a firm has several loan products with the same bank (e.g., overdraft and term loan), then I aggregate all loan products into a single loan. There are almost no missing data, because financial institutions are required by law to report monthly data on all loans above a threshold of $5,000. The data comprise variables on tax identification number, lending bank, loan amount, collateral, borrowing currency, loan type, and default status. One small commercial bank (Banco Solventa) is missing from the data set. This is not a concern because the bank only operated for 2 years and had a market share of less than 2% at the time of the Russian default.

The loan data are generally of high quality. The Peruvian bank regulator invests considerable resources to ensure complete coverage and conducts regular bank audits to verify the accuracy of the data set. Personal interviews with managers from several banks confirm that all banks refer to these data for approving and monitoring credit. The data are also used for credit reports sold by private credit bureaus. An interview with the general manager of the largest private credit bureau, Equifax, confirms that the data quality is comparable to consumer lending data in the United States. To ensure data quality, I conduct several data consistency checks. I check that, once a financial institution enters the data set, the institution consistently reports its data. Moreover, I aggregate loans per bank-month and find a correlation coefficient of 0.99 with total loans from bank balance sheets.

Table II
Bank Summary Statistics

Panel A of this table provides summary statistics for Peruvian banks by exposure to the liquidity shock. Domestically owned banks with significant international funding are classified as "High" exposure banks. Foreign-owned banks are classified as "Intermediate" exposure banks. Domestically owned banks without significant international funding are classified as "Low" exposure banks. Panel B of this table provides summary statistics on interbank lending data. I show summary statistics for owners and arm's-length lenders separately. Owners are international lenders with equity holdings in Peruvian banks. Arm's-length lenders are international banks that do not have equity holdings in Peruvian banks. All variables are defined in the Appendix. Standard errors are in parentheses.

Panel A: Banks

	All		High		Intermediate		Low	
Exposure	Mean (1)	*SD* (2)	Mean (3)	*SD* (4)	Mean (5)	*SD* (6)	Mean (7)	*SD* (8)
Total assets	491,533	(1,059,735)	868,276	(1,559,704)	598,924	(790,223)	21,716	(43,767)
Assets (%)								
Liquid assets/Assets	18.1	(6.0)	18.0	(5.6)	17.9	(5.8)	18.4	(6.8)
Credit/Assets	63.7	(6.3)	64.1	(6.2)	63.8	(6.4)	63.1	(6.8)
Liabilities (%)								
International debt/Assets	12.3	(14.1)	15.0	(8.4)	22.3	(18.0)	0.7	(1.5)
Deposits/Assets	42.9	(17.7)	42.5	(18.8)	48.9	(16.1)	38.0	(17.6)
Equity/Assets	15.3	(8.7)	14.8	(8.9)	10.9	(3.2)	19.7	(10.1)
Profit (%)								
Return on assets	1.8	(2.5)	3.0	(3.1)	2.1	(1.5)	0.1	(3.0)
Sample Size	43		15		13		15	

Panel B: Bank-to-Bank Loans

	All		Intermediate		High	
Exposure Ownership	Owner (1)	Arm's-Length (2)	Owner (3)	Arm's-Length (4)	Owner (5)	Arm's-length (6)
Loan size						
Mean (millions)	17.9 (36.8)	6.5 (13.7)	34.4 (31.2)	5.5 (9.4)	9.8 (16.1)	7.1 (15.4)
Median (millions)	4.3	0.3	4.3	0.3	0.2	0.2
Maturity (%)						
0–6 months	70.1	66.7	41.8	65.2	78.3	67.6
6–12 months	20.8	28.0	23.7	28.8	20.1	27.6
>12 months	8.6	5.3	34.4	6.1	1.5	4.8
Sample size	35	395	13	134	22	261

Table III
Loan and Firm Summary Statistics

Panel A of this table provides summary statistics on Peruvian bank lending by exposure to the liquidity shock. Domestically owned banks with significant international funding are classified as "High" exposure banks. Foreign-owned banks are classified as "Intermediate" exposure banks. Domestically owned banks without significant international funding are classified as "Low" exposure banks. All variables are defined in the Appendix. Standard errors are in parentheses.

	All		High		Intermediate		Low	
Exposure	Mean (1)	*St.dev.* (2)	Mean (3)	*St.dev.* (4)	Mean (5)	*St.dev.* (6)	Mean (7)	*St.dev.* (8)
Panel A: Loan-Level Variables								
Loan size								
Mean	212,098	(1,128,615)	252,135	(1,205,910)	174,976	(1,058,243)	113,342	(594,978)
Median	35,906		34,793		32,777		20,395	
Loan type (%)								
Overdraft	13.2	(24.9)	15.1	(26.1)	11.3	(23.3)	13.7	(26.9)
Factoring	27.2	(38.1)	28.6	(37.9)	26.0	(38.2)	25.8	(38.2)
Term loan	55.2	(43.6)	51.9	(42.0)	58.4	(44.7)	59.2	(46.1)
Leasing	2.4	(13.5)	1.8	(11.3)	2.9	(15.1)	1.3	(9.5)
Export loan	2.0	(10.2)	2.6	(10.6)	1.4	(9.9)	0.0	(0.4)
Loan characteristics (%)								
Foreign currency	95.5	(19.6)	95.0	(20.5)	96.0	(18.2)	91.7	(26.5)
Collateral	45.7	(45.5)	41.1	(44.5)	50.3	(46.0)	45.1	(45.8)
Oldest lender	27.8	(44.8)	33.2	(47.1)	22.5	(41.8)	21.6	(41.2)
Share of total borrowing	43.5	(27.0)	44.9	(27.0)	42.3	(26.9)	40.9	(28.7)
Sample size	31,342		15,520		15,281		541	
Panel B: Firm-Level Variables								
Mean borrowing	465,680	(2,849,686)	567,360	(2,726,990)	362,599	(3,009,135)	156,306	(356,757)
Median borrowing	69,157		74,643		65,460		42,968	
Loan relationships	2.64	(1.38)	2.72	(1.48)	2.56	(1.27)	2.42	(1.06)
Firm age	9.5	(11.72)	9.9	(11.8)	8.8	(11.4)	10.5	(14.1)
Located in Lima	0.62	(0.48)	0.62	(0.48)	0.63	(0.48)	0.77	(0.46)
Sample size	14,657		7,561		6,915		181	

In most of my analysis, I restrict the data set to firms that borrow from more than one bank before the liquidity shock. I choose this restriction because my empirical analysis uses variation within firms, which requires loan relationships with more than one bank. The restricted sample contains 31,342 loan relationships and 14,657 firms, and covers 73% of total loan value. The full sample contains 86,346 loan relationships and 69,661 firms.

Panel A of Table III presents summary statistics at the loan level by exposure. The median loan size of high and intermediate exposure banks is similar at $34,793 and $32,777, respectively. Low exposure banks provide smaller loans with a median loan size of $20,395. All three groups of banks provide similar types of loans to Peruvian firms. About 55% of loans are term loans, 25% are factoring, 13% are overdraft, and the remaining loans are leasing and export loans. The main difference across the three groups of banks is that low

exposure banks provide almost no export loans. All three groups of banks lend more than 90% of loans in U.S. dollars and require about 40% of loan size as collateral (although collateral requirements vary significantly across loan types). About a third of the loans are provided by the bank with the longest loan relationship with a given firm and loans on average represent about 43% of total firm borrowing. Using standard pair-wise tests of mean differences, I find that the majority of differences across the three groups of banks are statistically significant. This result suggests that it is important to control for loan characteristics in the regression analysis.

Panel B of Table III provides summary statistics at the firm level for all three groups of banks. For each firm, I compute the borrowing from each type of bank as a share of total borrowing. I assign the type of bank with the largest share as the main bank. On average, firms have 2.64 loan relationships, their median borrowing is $69,157, their average firm age is 9.5 years, and most firms are headquartered in Peru's capital, Lima. The firm characteristics do not vary greatly across groups of banks but I note that low exposure banks provide loans to fewer firms than the other groups of banks.

IV. The International Transmission of Bank Liquidity Shocks

A. Theoretical Framework and Empirical Implementation

This section analyzes the international transmission of bank liquidity shocks. A key aspect of modeling the transmission is the presence of information asymmetries between lenders and borrowers. If borrowers are better informed about their investment opportunities than lenders and if lenders cannot observe investment choices of borrowers, then a negative liquidity shock can lead to credit rationing due to adverse selection. If the credit rationing is severe and borrowers cannot substitute to other sources of credit, then the banking system can amplify the initial liquidity shock leading to a severe decline in the availability of credit.

The key assumption of this paper is that bank ownership can alleviate information asymmetries between lenders and borrowers. In the context of bank-to-bank lending, this means that a lending bank has better information about a borrowing bank if the lending bank has an equity stake in the borrowing bank. One reason why an equity stake may provide a lending bank with better information is because the lending bank can better monitor the borrowing bank, either because the lending bank directly manages the borrowing bank or because the lending bank can nominate the borrowing bank's board of directors.

Better information is especially important after a negative liquidity shock because a negative liquidity shock raises interest rates, which increases a borrowing bank's incentive to take on risky projects. Lending banks without equity stakes anticipate such risk taking by borrowing banks and therefore reduce lending after negative liquidity shocks. In contrast, lending banks with an equity stake in the borrowing bank can monitor the borrowing bank's risk taking and are therefore more likely to continue lending after a liquidity shock.

As a result, lending banks are less likely to transmit liquidity shocks to borrowing banks in which they have equity stakes relative to other borrowing banks. In other words, bank owners provide implicit guarantees against liquidity shocks to banks in which they have an equity stake.[8]

There are also other ways in which bank ownership may affect bank-to-bank lending after a liquidity shock. For example, suppose that, for a given level of investment, lending banks generate higher returns from loans to banks in which they have an equity stake relative to loans to banks in which they do not. One possible motivation for this assumption is that the equity stake alleviates costly informational frictions between banks. In equilibrium, lending banks equalize returns across all borrowing banks such that lending banks lend more to banks in which they have equity stakes relative to banks in which they do not. Moreover, if returns to lending are concave, then lending banks are also less likely to transmit liquidity shocks to banks in which they have equity stakes because such lending is less sensitive to interest rate changes. Again, this model suggests that equity stakes mitigate financial frictions and therefore reduce the transmission of liquidity shocks.

Finally, lending banks with an equity stake also internalize the effect of their lending decisions on the value of the equity stake. Hence, if a reduction in lending has a negative effect on the equity stake, lending banks with an equity stake are less likely to transmit the liquidity shock than lending banks without an equity stake. This mechanism also provides an incentive for lending banks to divert lending from banks in which they have no equity stake to banks in which they have an equity stake after a liquidity shock. As a result, lending banks may even increase lending to borrowing banks in which they have an equity stake after a negative liquidity shock.

To test empirically whether bank ownership affects the transmission of liquidity shocks, I proceed in three steps. First, I examine the impact of the liquidity shock on bank-to-bank loans. I differentiate between loans in which the lending bank has an equity stake in the borrowing bank and other lending relationships. I expect that banks without equity stakes are more likely to transmit liquidity shocks. Second, I analyze whether a reduction in bank-to-bank loans affects lending to firms. I expect that banks with a higher exposure to the liquidity shock reduce lending more. Third, I estimate the impact of changes in lending on real firm outcomes. I expect that firms that borrow from banks that face a larger liquidity shock have a larger reduction in borrowing and are less likely to survive after the liquidity shock.

B. First Stage: Transmission from International Banks to Peruvian Banks

This section estimates the impact of equity stakes on the transmission of liquidity shocks from international banks to Peruvian banks. The estimation poses an identification problem because it requires distinguishing between

[8] The Internet Appendix contains a formal model of this theoretical framework.

changes in credit supply and credit demand. For example, a reduction in lending by a large international bank to a Peruvian bank may reflect a liquidity shortage at the international bank or lower credit demand at the Peruvian bank or a combination of both. Similarly, a reduction in borrowing by a Peruvian bank may reflect a reduction in credit supply by its lenders or a reduction in credit demand by the Peruvian bank or a combination of both.

To address the identification problem, I control for both lender and borrower fixed effects in the regressions. The borrower fixed effects control for the average change in credit demand by Peruvian banks. The lender fixed effects control for the average change in credit supply by international lenders. The regression thus estimates the impact of equity stakes on bank-to-bank loans after controlling for average changes in bank-specific credit demand and lender-specific credit supply.

Specifically, I use bank-to-bank loan data and estimate

$$\Delta D_{ik} = \beta_E E_{ik} + \beta_i + \beta_k + \varepsilon_{ij}, \tag{1}$$

where ΔD_{ik} is the change in bank-to-bank loans provided by international bank k to Peruvian bank i, E_{ik} is an indicator variable equal to one if lender k owns an equity stake of 50% or larger in bank i and zero otherwise, β_i are bank fixed effects, and β_k are lender fixed effects. The coefficient of interest is β_E, which measures the impact of equity holdings on the provision of bank-to-bank loans after the liquidity shock.

I estimate the regression in first differences, which I construct by collapsing and time-averaging the data 4 months before and 1 year after the Russian default. Collapsing the data smooths out variation and generates conservative standard errors (Bertrand, Duflo, and Mullainathan (2004)). Moreover, the first-differenced specification facilitates computation and ensures consistency with my loan-level estimation. For the coefficient β_E, the first-differenced specification yields the same result as a specification in levels that include a full set of interactions between the fixed effects and an indicator variable for the period after the liquidity shock.

Table IV presents the results. Column (1) shows that bank-to-bank loans provided by international banks to Peruvian banks in which they own equity increase by 11%, but other bank-to-bank loans decrease by 80%.[9] Columns (2) and (3) add control variables for borrower and lender fixed effects. After adding borrower controls, Column (2) shows that the coefficient on equity stakes slightly decreases but remains economically and statistically significant. After adding lender controls, Column (3) shows that the coefficient remains stable and statistically significant. Column (4) adds both lender and borrower fixed effects and the coefficient remains stable and statistically significant. These results indicate that, after the liquidity shock, international banks increase bank-to-bank loans to banks in which they own equity relative to banks in which they do not.

[9] I compute exact percentage changes from log changes because the estimated coefficients are large and the approximation of setting percentage changes equal to log changes is therefore invalid.

Table IV
Transmission of Liquidity Shock to Peruvian Banks

The regressions in this table examine the effect of equity holdings on bank-to-bank loans provided by international lenders to Peruvian banks. I define a loan as a single lender-bank pair. The dependent variable is the change in the natural logarithm of total amount outstanding. All monthly data are collapsed and time-averaged before and after the Russian default. The variable "Equity stake" is equal to one if the lending bank has an equity stake in the borrowing bank and equal to zero otherwise. Columns (2) and (4) include borrowing bank fixed effects. Columns (3) and (4) include lending bank fixed effects. Standard errors in parentheses are clustered at the bank level. *** Significant at 1%; ** significant at 5%; and * significant at 10%.

Dependent Variable	Change in Bank-to-Bank Lending			
	OLS	FE	FE	FE
	(1)	(2)	(3)	(4)
Equity stake	1.72***	1.59***	1.22***	1.16**
	(0.23)	(0.26)	(0.21)	(0.47)
Constant	−1.61***	−1.60***	−1.54***	−1.37***
	(0.17)	(0.29)	(0.10)	(0.46)
Borrower fixed effects	N	Y	N	Y
Lender fixed effects	N	N	Y	Y
N	430	430	430	430
R^2	0.04	0.10	0.71	0.74

C. Second Stage: Transmission from Peruvian Banks to Peruvian Firms

This section uses loan-level data to estimate the transmission of the liquidity shock from Peruvian banks to Peruvian firms. This estimation poses an identification problem because it requires distinguishing between changes in credit supply by Peruvian banks and changes in credit demand by Peruvian firms.

The identification problem is best illustrated with an example. Suppose that exporters borrow primarily from foreign-owned banks, such as Citibank-Peru, and non-exporters borrow primarily from domestically owned banks, such as Banco Wiese. If the Russian default improves export opportunities, then borrowers of foreign-owned banks may demand more credit than borrowers from domestically owned banks. As a result, the differences I observe in borrowing across banks may reflect the composite effect of changes in both credit demand and credit supply. More generally, any variation in the distribution of firms across banks that directly affects credit demand after the Russian default may bias the estimation of the transmission of the liquidity shock.

To address this identification problem, I exploit the fact that many firms borrow from several banks. My analysis controls for changes in credit demand at the firm level by comparing the change in borrowing across loan relationships within firms rather than across firms. To illustrate the identification strategy, suppose a firm borrows from both Citibank-Peru and Banco Wiese. In my empirical analysis, I estimate the change in borrowing from Citibank-Peru relative to the change in borrowing from Banco Wiese for the same firm. By

using within-firm variation, I control for firm-level credit demand shocks and thus identify the impact of the credit supply by banks.[10]

I implement the identification strategy using OLS to estimate

$$\Delta L_{ijb} = \beta_j + \beta_l L_b + \varepsilon_{ijb}, \tag{2}$$

where ΔL_{ijb} is the change in loan i of firm j from bank b, L_b denotes the exposure of bank b to the liquidity shock, and β_j are firm fixed effects. The coefficient of interest is β_l, which measures the transmission of the liquidity shock to Peruvian firms after controlling for firm-specific credit demand shocks. Regarding a bank's exposure to the liquidity shock, I continue to classify Peruvian banks into high, intermediate, and low exposure banks.

The key assumption for identification is that, in expectation, firms reduce borrowing from all banks in equal proportion after the liquidity shock. This assumption is plausible for high and intermediate exposure banks, which are similar based on observable characteristics. Low exposure banks differ significantly in their observable characteristics and I therefore control for bank characteristics in my analysis.

I restrict the sample to firms that have loans from more than one bank before the liquidity shock. I choose this sample because the preferred specification includes firm fixed effects, which means that the coefficient of interest is only identified off firms that borrow from more than one bank. To facilitate computation, I collapse and average the data 1 year before and 1 year after the Russian default. I winsorize the extreme 2% of loan size to ensure that the results are not driven by outliers. The results are robust to estimating all regressions without winsorizing. I cluster all standard errors at the bank level to allow for correlation of error terms across loans within banks. I choose this level of clustering because the coefficient of interest varies at the bank level.

A loan is defined as a single firm–bank relationship. If a firm takes out several loans from the same bank, I aggregate all loans for this firm–bank pair. I add controls for loan, firm, and bank characteristics in some of the regressions. I include these control variables to ensure that the results are not driven by differences in loan or firm characteristics before the liquidity shock.

The controls for loan type are the percentages of loans that are classified as overdraft, factoring, leasing, and export loans. The omitted category is regular term loans. Additional loan controls are collateral as a share of loan size, loan size as a share of total firm borrowing, and an indicator variable for whether a loan is denominated in U.S. dollars. The controls for firm characteristics are 25 indicator variables for Peruvian states, 40 indicator variables for firm age, 253 indicator variables for three-digit industry, and firm size measured as the natural logarithm of total firm borrowing before the liquidity shock. The controls for bank characteristics are balance sheet variables such as total credit as a share of assets, liquid instruments as a share of assets,

[10] A formal derivation of the main estimating equation is available in the Internet Appendix.

deposits as a share of assets, the equity ratio, the natural logarithm of assets, and return on assets. I measure all variables using data before the liquidity shock to avoid bias coming from changes in variables because of the liquidity shock.

C.1. Main Results

Table V presents the main results. Column (1) shows the specification with firm fixed effects only. I find that intermediate and low exposure banks increase loan size by 8.1% and 12.1%, respectively, relative to high exposure banks. Column (2) adds controls for loan characteristics. The coefficients on intermediate and low exposure banks decrease slightly to 7.1% and 10.7%, respectively, but remain statistically significant.

Regarding loan types, I find that overdraft loans increase by 39.8% relative to regular loans. One explanation for this result is that overdrafts are used for transaction purposes and provide banks proprietary information on a firm's cash flow position. We would expect this information to be particularly valuable after a liquidity shock. I further find that changes in factoring and leasing are similar to regular loans with increases of 0.8% and 7.2% relative to regular loans. I find that export loans decrease by 18.6% relative to other forms of lending. This result is not statistically significant but the large point estimate indicates that there was a decrease in demand for export financing after the liquidity shock. This finding suggests that it is unlikely that the difference across banks can be explained by higher demand for export financing after the liquidity shock. Regarding collateral, the coefficient on the share of lending covered by collateral suggests a large positive effect on lending after the liquidity shock: moving from no collateral to full collateral increases loan size by 7.7% after the liquidity shock. Other loan controls generally have little effect on the coefficients of interest.

Column (3) adds controls for bank characteristics. The coefficients on intermediate and low exposure banks increase to 8.9% and 13.7%, respectively. One possible explanation for the increase in the coefficients is that I control for return on assets. As shown in the summary statistics, high exposure banks have a higher return on assets than intermediate and low exposure banks. If high return on assets mitigates the transmission of liquidity shocks, possibly because high return on assets provides banks access to internally generated cash flows, the coefficients of interest should increase once I add return on assets as a control variable. Regarding other bank characteristics, I find that a 10% increase in asset size reduces lending by 0.1%. This coefficient is not statistically significant but the point estimate is somewhat surprising because larger banks are typically considered more stable after liquidity shocks. However, bank size is positively correlated with exposure to the liquidity shock, which may explain this result. Other bank controls generally have no significant impact on the coefficients of interest.

Column (4) reports the results of a specification without firm fixed effects. I estimate this regression to evaluate the importance of changes in credit demand

Table V

Transmission of Liquidity Shock to Peruvian Bank Lending

The regressions in this table examine the impact of exposure to the liquidity shock on bank lending. I restrict the data to firms that borrow from more than one bank (73% of lending). I define a loan as a single bank-borrower pair. The dependent variable is the change in the natural logarithm of total amount outstanding. All monthly data are collapsed and time-averaged 1 year before and 1 year after the Russian default. Columns (1)–(3) include controls for firm fixed effects. Columns (2)–(4) include controls for loan characteristics. Columns (3) and (4) include controls for bank characteristics. Loan controls comprise currency, loan type, collateral, length of lending relationship, and share of borrowing. Bank controls comprise bank size, return on assets, credit share, liquid assets share, deposit share, and equity share. Firm controls comprise 253 industry dummies, 25 state dummies, 40 firm-age dummies, and the natural logarithm of total firm borrowing before the liquidity shock. All variables are defined in the Appendix. Standard errors in parentheses are clustered at the bank level. *** Significant at 1%; ** significant at 5%; and * significant at 10%.

Dependent Variable	Change in Bank Lending			
	FE (1)	FE (2)	FE (3)	OLS (4)
Intermediate exposure	0.081**	0.071**	0.089***	0.082***
	(0.032)	(0.030)	(0.026)	(0.021)
Low exposure	0.121**	0.107**	0.137	0.131
	(0.051)	(0.045)	(0.124)	(0.102)
Overdraft		0.398***	0.405***	0.273***
		(0.070)	(0.070)	(0.072)
Factoring		0.008	0.005	−0.102**
		(0.055)	(0.049)	(0.033)
Leasing		0.072	0.050	0.041
		(0.057)	(0.050)	(0.043)
Export loan		−0.186	−0.174	−0.017
		(0.145)	(0.132)	(0.132)
Collateral		0.077***	0.064**	0.028*
		(0.027)	(0.030)	(0.015)
Bank size			−0.011	0.016
			(0.037)	(0.028)
Return on assets			0.339	0.481
			(0.404)	(0.294)
Firm fixed effects	Y	Y	Y	N
Firm controls	N	N	N	Y
Loan controls	N	Y	Y	Y
Bank controls	N	N	Y	Y
Observations	31,342	31,342	31,342	31,342
R^2	0.55	0.56	0.56	0.07

in explaining my results. I include all controls for loan and bank characteristics. I also add controls for firm characteristics, which I do not include in Columns (1)–(3) because they are collinear with firm fixed effects. I find that intermediate and low exposure banks increase lending by 8.2% and 13.1%, respectively, relative to high exposure banks. I note that the coefficients on most control variables are similar to those in Column (3). This finding shows that the variation in lending across firms is almost identical to the variation in lending within firms,

which suggests that the changes in lending can be explained solely by the liquidity shock.[11]

Moreover, these results address concerns about changes in bank preferences. For example, firms may change bank preferences after the liquidity shock because foreign-owned banks are better at export financing and Peruvian firms have improved export opportunities after the Russian default. In this case, we should see a positive effect on intermediate exposure banks but no effect on low exposure banks. Instead, we observe a positive effect on both intermediate and low exposure banks and the effect is larger for low exposure banks that are less affected by the liquidity shock.[12] Indeed, it is unlikely that changes in bank preferences can explain the results, because the preference shift would need to apply to both intermediate and low exposure banks, which are very different types of banks.

C.2. Results by Firm Size, Firm Age, and Export Status

I next examine the impact of the liquidity shock by firm type. I first estimate the main specification separately for exporters and non-exporters. I define a firm as an exporter if the firm took out an export loan before the Russian default and as a non-exporter otherwise. I include firm fixed effects and the full set of loan and bank controls in the regressions. If my results reflect changes in export opportunities, I expect a larger effect for exporters relative to non-exporters.

Table VI presents the results. Columns (1) and (2) show that exporters increase borrowing from intermediate and low exposure banks by 6.0% and 4.7%, respectively. The impact on non-exporters is larger at 9.1% and 15.9%, respectively. Hence, there is no evidence that the results in Table V can be explained solely by exporters. The results instead suggest that the effects are smaller for exporters, which is consistent with lower credit demand among exporters after the liquidity shock.

Next, I estimate the regressions separately by firm size and firm age because some studies find that young and small firms are more affected by bank liquidity shocks. In general, we expect stronger effects for young and small firms because they have fewer loan relationships, which makes it more difficult for them to switch to other banks. I define a firm as large if total firm borrowing

[11] I note that the coefficient on low exposure banks increases from 10.7% (firm fixed effects in Column (1)) to 13.1% (firm controls in Column (4)). This is somewhat surprising because we usually expect that firm fixed effects are better controls for underlying differences in firm quality and we therefore expect a decrease in the coefficient. A partial explanation for this result is that the fixed effects results are only identified from the sample of firms that borrow from two banks with different exposure to the liquidity shock. If I restrict the sample to these firms, the difference between the coefficients decreases by two-thirds.

[12] As an alternative way to test for this explanation, I examine the exchange rate between the U.S. dollar and the Peruvian currency. I find that, both in nominal and real terms, the rate of depreciation is the same in the year before and in the year after the Russian default. This finding indicates that there is no evidence of an improvement in export opportunities due to changes in the U.S. exchange rate.

Table VI
Transmission of Liquidity Shock to Peruvian Bank Lending by Firm Type

The regressions in this table examine the impact of exposure to the liquidity shock on bank lending by export status, firm size, and firm age. I define firms as exporters if they take out export loans before the liquidity shock and as non-exporters otherwise. I define firms as large if firm size is above the median firm size and as small otherwise. I define firms as old if firm age is above median firm age and as young otherwise. I restrict the data to firms that borrow from more than one bank (73% of lending). I define a loan as a single bank-borrower pair. The dependent variable is the change in the natural logarithm of total amount outstanding. All monthly data are collapsed and time-averaged 1 year before and 1 year after the Russian default. All columns include controls for firm fixed effects, loan characteristics, and bank characteristics. The control variables are the same as in Table V. All variables are defined in the Appendix. Standard errors in parentheses are clustered at the bank level. *** Significant at 1%; ** significant at 5%; and * significant at 10%.

Dependent Variable	Change in Bank Lending					
	Exporter FE (1)	Non-Exporter FE (2)	Large FE (3)	Small FE (4)	Old FE (5)	Young FE (6)
Intermediate exposure	0.060	0.091***	0.093**	0.067***	0.091**	0.083***
	(0.057)	(0.015)	(0.035)	(0.022)	(0.036)	(0.018)
Low exposure	0.047	0.159	0.104	0.136	0.160	0.077
	(0.232)	(0.098)	(0.149)	(0.100)	(0.158)	(0.138)
Overdraft	0.683***	0.305***	0.571***	0.121***	0.486***	0.305***
	(0.142)	(0.049)	(0.081)	(0.037)	(0.090)	(0.052)
Factoring	0.082	−0.039	0.036	−0.034	0.022	−0.015
	(0.081)	(0.047)	(0.051)	(0.056)	(0.053)	(0.054)
Leasing	0.112	0.022	0.095*	−0.029	0.045	0.076
	(0.095)	(0.056)	(0.050)	(0.102)	(0.059)	(0.078)
Export loan	−0.066		−0.129	−0.501	−0.119	−0.264
	(0.126)		(0.116)	(0.448)	(0.119)	(0.267)
Collateral	0.106**	0.046*	0.077*	0.041*	0.084**	0.038
	(0.047)	(0.026)	(0.038)	(0.023)	(0.040)	(0.026)
Bank size	−0.022	−0.001	−0.002	−0.012	−0.002	−0.021
	(0.069)	(0.025)	(0.048)	(0.019)	(0.050)	(0.026)
Return on assets	0.341	0.407	0.347	0.042	0.407	0.210
	(0.656)	(0.390)	(0.476)	(0.305)	(0.473)	(0.404)
Firm fixed effects	Y	Y	Y	Y	Y	Y
Loan controls	Y	Y	Y	Y	Y	Y
Bank controls	Y	Y	Y	Y	Y	Y
Observations	6,696	24,646	15,642	15,700	15,428	15,914
R^2	0.45	0.62	0.48	0.74	0.52	0.62

is above the median of \$69,157 and as small otherwise. I define a firm as old if firm age is above the median age and as young otherwise. I add controls for firm fixed effects and the full set of loan and bank controls.

Columns (3) and (4) report the results by firm size. I find that intermediate exposure banks increase lending to large firms by 9.3% and to small firms by 6.7% relative to high exposure banks. I find that low exposure banks

increase lending to large firms by 10.4% and to small firms by 13.6% relative to high exposure banks. The differences between large and small firms are not statistically significant. Columns (5) and (6) report the results by firm age. I find that intermediate exposure banks increase lending to old firms by 9.1% and to young firms by 8.3% relative to high exposure banks. I find that low exposure banks increase lending to old firms by 16.0% and to young firms by 7.7% relative to high exposure banks. Again, the differences are not statistically significant.

The results show that there is no statistically significant difference in the lending of intermediate and low exposure banks by firm age, firm size, and export status. One possible reason for this finding is that I restrict my sample to firms that borrow from more than one bank. As a result, the firms in my sample are significantly larger and older than the average firm, which may reduce the variation across firm types. Also, firms that borrow from more than one bank can more easily switch across banks.

To assess the importance of my sample selection, I estimate regressions by firm type for the full sample. The full sample includes firms with a single loan relationship, which yields 86,346 loan relationships by 69,661 firms. I include the full set of loan, bank, and firm controls. I do not include firm fixed effects because these are collinear with the liquidity shock for firms with a single loan relationship.

Table VII presents the results. I find stronger effects for exporters, large firms, and old firms than in Table VI. Intermediate exposure banks increase lending to exporters by 12.1% relative to 5.7% for non-exporters. In addition, they increase lending to large firms by 8.5% relative to 5.4% for small firms, and to old firms by 9.3% relative to 5.1% for young firms. I find a similar pattern for low exposure banks. Low exposure banks increase lending to exporters by 22.2% relative to 11.9% for non-exporters, to large firms by 16.2% relative to 8.4% for small firms, and to old firms by 17.4% relative to 8.7% for young firms. The differences are marginally statistically significant for intermediate exposure banks but not for low exposure banks.

These results relate to findings from previous studies. Previous studies show that larger, older, and export-oriented firms can switch more easily after liquidity shocks. I find similar results in the sample of firms with at least one loan but not in the sample of firms with at least two loans. Hence, my results suggest that firm age, firm size, and export status have no independent effect on access to borrowing after liquidity shocks for firms with two or more loan relationships before liquidity shocks.

C.3. Robustness Results

To further check for robustness, I estimate the main regression using an alternative measure of the liquidity shock: the change in the share of liabilities funded internationally. This measure is complementary to the exposure measure used in the main analysis because it uses variation both within and across bank types. I estimate the same specifications as in Table V.

Table VII

Transmission of Liquidity Shock to Peruvian Bank Lending by Firm Type (All Firms)

The regressions in this table examine the impact of exposure to the liquidity shock on bank lending by export status, firm size, and firm age. I define firms as exporters if they take out export loans before the liquidity shock and as non-exporters otherwise. I define firms as large if firm size is above the median firm size and as small otherwise. I define firms as old if firm age is above median firm age and as young otherwise. This table includes all firms. I define a loan as a single bank-borrower pair. The dependent variable is the change in the natural logarithm of total amount outstanding. All monthly data are collapsed and time-averaged 1 year before and 1 year after the Russian default. All columns include controls for loan characteristics, bank characteristics, and firm characteristics. The control variables are the same as in Table V. All variables are defined in the Appendix. Standard errors in brackets are clustered at the bank level. *** Significant at 1%; ** significant at 5%; and * significant at 10%.

Dependent Variable	Change in Bank Lending					
	Exporter (1)	Non-Exporter (2)	Large (3)	Small (4)	Old (5)	Young (6)
Intermediate exposure	0.121***	0.057***	0.085***	0.054***	0.093***	0.051**
	(0.039)	(0.016)	(0.015)	(0.019)	(0.020)	(0.021)
Low exposure	0.222	0.119*	0.162*	0.084	0.174	0.087
	(0.220)	(0.065)	(0.088)	(0.073)	(0.105)	(0.069)
Overdraft	0.506***	0.153***	0.233***	0.100**	0.225***	0.123*
	(0.146)	(0.045)	(0.074)	(0.042)	(0.047)	(0.061)
Factoring	−0.04	−0.113**	−0.139***	−0.051	−0.117***	−0.080*
	(0.047)	(0.046)	(0.038)	(0.048)	(0.033)	(0.044)
Leasing	0.024	−0.047	−0.038	−0.023	−0.024	−0.080**
	(0.053)	(0.037)	(0.037)	(0.062)	(0.045)	(0.039)
Export loan	0.043		−0.163	−1.235***	−0.166	−0.614***
	(0.109)		(0.165)	(0.381)	(0.220)	(0.193)
Collateral	0.016	−0.005	0.033***	−0.022	−0.004	−0.005
	(0.030)	(0.015)	(0.012)	(0.017)	(0.013)	(0.017)
Bank size	0.023	0.017	0.03	0.001	0.019	0.003
	(0.060)	(0.015)	(0.024)	(0.016)	(0.027)	(0.014)
Return on assets	0.445	0.332**	0.312*	0.225	0.356	0.248*
	(0.483)	(0.150)	(0.211)	(0.153)	(0.228)	(0.137)
Firm controls	Y	Y	Y	Y	Y	Y
Loan controls	Y	Y	Y	Y	Y	Y
Bank controls	Y	Y	Y	Y	Y	Y
Observations	8,414	77,932	42,610	43,736	42,954	43,392
R^2	0.11	0.04	0.06	0.04	0.05	0.04

Table VIII presents the results. Column (1) shows that a one-standard-deviation increase in the share of liabilities financed internationally reduces average loan size by 3.3%. Column (2) shows that the coefficient of interest remains stable after including loan controls. The coefficients on loan controls are similar to the corresponding coefficients in Table V. Column (3) adds controls for bank characteristics. Again, the coefficient of interest remains stable and statistically significant. The coefficients on bank characteristics are

Table VIII
Transmission of Liquidity Shock to Peruvian Bank Lending (Alternative Measure)

The regressions in this table examine the impact of exposure to the liquidity shock on bank lending. I restrict the data to firms that borrow from more than one bank (73% of lending). I define a loan as a single bank-borrower pair. The dependent variable is the change in the natural logarithm of total amount outstanding. The variable "Change in international borrowing" is measured as the change in the share of bank assets funded internationally after the liquidity shock. All monthly data are collapsed and time-averaged 1 year before and 1 year after the Russian default. Columns (1)–(3) include controls for firm fixed effects. Columns (2)–(4) include controls for loan characteristics. Columns (3) and (4) include controls for bank characteristics. The control variables are the same as in Table V. All variables are defined in the Appendix. Standard errors in parentheses are clustered at the bank level. *** Significant at 1%; ** significant at 5%; and * significant at 10%.

Dependent Variable	Change in Bank Lending			
	FE (1)	FE (2)	FE (3)	OLS (4)
Change in international borrowing	0.558***	0.491**	0.511***	0.258
	(0.190)	(0.249)	(0.249)	(0.199)
Overdraft		0.389***	0.397***	0.288***
		(0.075)	(0.071)	(0.065)
Factoring		0.011	0.018	−0.102**
		(0.051)	(0.050)	(0.033)
Leasing		0.077	0.057	0.027
		(0.054)	(0.048)	(0.038)
Export loan		−0.177	−0.151	−0.074
		(0.149)	(0.133)	(0.127)
Collateral		0.086***	0.074***	0.032**
		(0.024)	(0.025)	(0.013)
Bank size			−0.030	−0.006
			(0.024)	(0.019)
Return on assets			0.149	0.462
			(0.576)	(0.435)
Firm fixed effects	Y	Y	Y	N
Firm controls	N	N	N	Y
Loan controls	N	Y	Y	Y
Bank controls	N	N	Y	Y
Observations	31,342	31,342	31,342	31,342
R^2	0.55	0.56	0.56	0.06

similar to Table V. Column (4) estimates the specification without controlling for firm fixed effects. The coefficient of interest decreases but remains positive. Overall, this result indicates that changes in access to international funding can explain changes in lending by Peruvian banks.

A possible concern with my results is that I use a single event, namely, the Russian default, to identify the impact of a liquidity shock on lending. If there are differential trends across banks before the Russian default, I may incorrectly attribute these trends to the liquidity shock. To test for differential

Table IX
Transmission of Liquidity Shock to Peruvian Bank Lending (Placebo Test)

The regressions in this table examine the impact of exposure to the liquidity shock on bank lending in the 2-year period before the Russian default. I restrict the data to firms that borrow from more than one bank (73% of lending). I define a loan as a single bank-borrower pair. The dependent variable is the change in the natural logarithm of total amount outstanding. I assume a placebo cutoff 1 year before the liquidity shock. All monthly data are collapsed and time-averaged 1 year before and 1 year after the placebo cutoff. Columns (1)–(3) include controls for firm fixed effects. Columns (2)–(4) include controls for loan characteristics. Columns (3) and (4) include controls for bank characteristics. The control variables are the same as in Table V. All variables are defined in the Appendix. Standard errors in brackets are clustered at the bank level. *** Significant at 1%; ** significant at 5%; and * significant at 10%.

Dependent Variable	Change in Bank Lending			
	FE (1)	FE (2)	FE (3)	OLS (4)
Intermediate exposure	0.012	0.007	0.019	0.029
	(0.033)	(0.031)	(0.033)	(0.027)
Low exposure	−0.035	−0.050	−0.031	−0.008
	(0.042)	(0.041)	(0.052)	(0.058)
Overdraft		0.531***	0.521***	0.572***
		(0.153)	(0.158)	(0.117)
Factoring		0.255	0.254	0.337***
		(0.137)	(0.141)	(0.117)
Leasing		0.147	0.164	0.285**
		(0.148)	(0.146)	(0.114)
Export loan		0.318	0.312	0.392**
		(0.193)	(0.200)	(0.146)
Collateral		0.073***	0.073***	0.043***
		(0.017)	(0.016)	(0.013)
Bank size			0.030	−0.573
			(0.649)	(0.586)
Return on assets			−0.665***	−0.414*
			(0.227)	(0.252)
Firm fixed effects	Y	Y	Y	N
Firm controls	N	N	N	Y
Loan controls	N	Y	Y	Y
Bank controls	N	N	Y	Y
Observations	27,977	27,977	27,977	27,977
R^2	0.53	0.54	0.54	0.06

trends prior to the liquidity shock, I estimate a placebo regression using data for the 2-year period before the Russian default. I assume that the placebo cutoff date is 1 year before the Russian default. I estimate the same specifications as in Table V.

Table IX presents the results. Column (1) finds no economically or statistically significant effect of bank exposure on lending. The coefficients on intermediate and low exposure banks are 1.2% and −3.5%, respectively.

Column (2) adds controls for loan characteristics. The coefficients on intermediate and low exposure banks decrease to 0.7% and −5.0%, respectively. Column (3) adds bank controls and the coefficients remain stable. Column (4) estimates the regression without firm fixed effects and finds similar coefficients. These results indicate that there are no significant differential trends by bank exposure in the 2-year period before the liquidity shock.

I also check the robustness to using alternative cutoffs for the grouping of domestically owned banks into high and low exposure banks. For the main specification in Table V, the cutoff is the median international borrowing of 6.2%. Using alternative cutoffs of 0%, 2%, 4%, and 8%, I find quantitatively and qualitatively similar results. The reason for this robustness is that most domestically owned banks close to the cutoff borrow from a specific group of international lenders. Using the bank-to-bank loan data, I find that the domestically owned banks around the cutoff borrow mostly from multinational financial institutions such as the World Bank and the Inter-American Development Bank. These lenders also provided stable financing after the Russian default, which explains why the results are robust to the choice of the cutoff.

D. Third Stage: Transmission to Peruvian Firms

This section uses firm-level data to estimate the impact of changes in lending by Peruvian banks on real outcomes of Peruvian firms. If there are no frictions in lending, then firms can offset the negative liquidity shock by switching across banks. However, if there are frictions that prevent firms from switching across banks, then the liquidity shock affects the allocation of credit across firms and, as a result, affects real firm outcomes such as loan default and firm survival.

To test for the impact of the liquidity shock on real outcomes, I use OLS to estimate

$$\Delta Y_j = \gamma_E \boldsymbol{E}_j + + \varepsilon_j, \tag{3}$$

where ΔY_j is the change in outcome variable Y_j of firm j, and $\boldsymbol{E}_j$ is firm j's share of borrowing from intermediate and low exposure banks before the liquidity shock, respectively. The exposure variable $\boldsymbol{E}_j$ measures the extent to which a firm had established relationships with a specific type of bank before the liquidity shock.

I do not control for firm fixed effects in regression (3) because the unit of observation is a firm rather than a loan relationship. Hence, I cannot separately identify the exposure variable $\boldsymbol{E}_j$ from firm fixed effects. The identification assumption is thus stronger than in the loan-level regressions and requires that changes in credit demand are uncorrelated with bank exposure $\boldsymbol{E}_j$ conditional on observables. The results from my loan-level regression (2) provide some assurance on the validity of this assumption because the coefficients of interest

are robust to replacing firm fixed effects with firm controls. This result indicates that it is unlikely that the analysis is confounded by changes in credit demand. For consistency with the loan-level regressions, I restrict the sample to firms that borrow from more than one bank.

I use three variables to measure the impact of the liquidity shock on Peruvian firms. The first variable is the change in total borrowing, which measures the impact of the liquidity shock on access to bank lending. I compute the change in borrowing as the difference in the natural logarithm of total firm borrowing before and after the liquidity shock. The second variable is loan default, which measures whether a firm enters financial distress after the liquidity shock. I compute loan default as an indicator variable for whether a loan is more than 60 days delinquent and calculate the average loan default for each firm. The third variable is firm survival, which measures whether a firm continues to operate after the liquidity shock. I compute firm survival as an indicator variable for whether a firm is operating in 2005 based on official tax records. I note that loan default and firm survival do not capture the effect on firms that avoid loan default or business closure by cutting back on their investments or other business expenses. I therefore interpret these outcome measures as lower bounds of the real effect of the liquidity shock.

Table X presents the results of regression (3). Columns (1) and (2) estimate the impact on total firm borrowing. I find that a one-standard-deviation increase in borrowing from intermediate exposure banks before the liquidity shock increases total borrowing after the liquidity shock by 3.0%. I find no statistically significant effect of borrowing from low exposure banks before the liquidity shock. The results are robust to controlling for firm characteristics. Columns (3) and (4) estimate the impact on loan default. I find that a one-standard-deviation increase in borrowing from intermediate exposure banks reduces loan default by 1.1 percentage points. A one-standard-deviation increase in borrowing from low exposure banks reduces loan default by 1.2 percentage points. The results are robust to controlling for firm characteristics. Columns (5) and (6) estimate the impact on firm survival. I find that a one-standard-deviation increase in exposure to intermediate exposure banks increases firm survival by 1.4 percentage points. I find no statistically significant impact of low exposure banks on firm survival. The results are robust to controlling for firm characteristics.

These results suggest that firms borrowing from intermediate and low exposure banks experience better real outcomes relative to borrowers from high exposure banks. Interestingly, the results are stronger for intermediate relative to low exposure banks, which is different from the loan-level regressions. This finding may be due to lack of firm fixed effects in the firm-level regressions. If firms that borrow from low exposure banks have lower credit demand after the liquidity shock than firms that borrow from intermediate exposure banks, then we would expect the impact of low exposure banks to be attenuated in the firm-level regressions relative to the loan-level regressions. Indeed, this explanation is consistent with the summary statistics, which suggest that

Table X

Transmission of Liquidity Shock to Peruvian Firms

The regressions in this table examine the impact of exposure to the liquidity shock on Peruvian firms. All regressions are at the firm level. I restrict the data to firms that borrow from more than one bank (73% of lending). The dependent variable in Columns (1) and (2) is the change in the natural logarithm of total borrowing. The dependent variable in Columns (3) and (4) is the change in the share of borrowing in default. The dependent variable in Columns (5) and (6) is an indicator variable for whether a firm is operating in 2005. The data are collapsed and time-averaged 1 year before and 1 year after the Russian default. The variable "Intermediate exposure" is borrowing from intermediate exposure banks as a share of total borrowing before the liquidity shock. The variable "Low exposure" is total borrowing from low exposure banks as a share of total borrowing before the liquidity shock. Columns (2), (4), and (6) include controls for firm characteristics. The control variables are the same as in Table V (loan value-weighted at the firm level). Standard errors in parentheses are clustered at the firm level. *** Significant at 1%; ** significant at 5%; and * significant at 10%.

Dependent Variable	Change in Lending		Loan Default		Firm Survival	
	(1)	(2)	(3)	(4)	(5)	(6)
Intermediate exposure	0.083***	0.081***	−0.029***	−0.029***	0.040***	0.042***
	(0.015)	(0.015)	(0.011)	(0.012)	(0.013)	(0.013)
Low exposure	−0.004	−0.007	−0.124***	−0.079**	−0.067	−0.015
	(0.064)	(0.067)	(0.046)	(0.046)	(0.049)	(0.051)
Overdraft		0.101***		0.085***		−0.277***
		(0.040)		(0.025)		(0.028)
Factoring		−0.175***		0.014		−0.040***
		(0.021)		(0.015)		(0.016)
Leasing		0.213***		−0.090**		0.080***
		(0.054)		(0.034)		(0.031)
Export loan		0.081		−0.219***		0.149***
		(0.089)		(0.057)		(0.049)
Collateral		0.008		0.032***		−0.012
		(0.014)		(0.010)		(0.011)
Firm controls	N	Y	N	Y	N	Y
Observations	14,657	14,657	14,657	14,657	9,307	9,307
R^2	0.01	0.06	0.01	0.04	0.01	0.16

low exposure banks lend to smaller firms relative to intermediate exposure banks.[13]

To check for robustness, I conduct a placebo test using a cutoff 1 year prior to the Russian crisis (similar to Table IX). I find that the coefficient on intermediate exposure banks is close to zero and precisely estimated for all outcome variables. In contrast, I find that low exposure banks have higher default rates and lower survival rates in the placebo analysis although none of these results is statistically significant.

[13] I also estimate regression (3) for the sample of all firms. Consistent with the interpretation above, I find similar results for intermediate exposure banks and weaker results for low exposure banks. The estimation results are available in the Internet Appendix.

Overall, my results indicate that Peruvian firms cannot offset the liquidity shock by switching across banks and that the liquidity shock negatively affects access to credit, loan repayment, and firm survival.

V. Conclusion

In this paper, I analyze the transmission of bank liquidity shocks across countries. My results establish the transmission of a liquidity shock originating in one country, Russia, to another country, Peru. The transmission channel is through international lending among banks. The transmission is strongest for domestically owned banks that borrow internationally, intermediate for foreign-owned banks, and weakest for locally funded banks. In short, these results suggest that lending between international banks establishes a transmission channel for bank liquidity shocks and that foreign bank ownership mitigates, rather than amplifies, the transmission through this channel.

A question that arises from my analysis is whether the results are relevant for other financial institutions. My analysis indicates that bank ownership can play an important role in mitigating the transmission of shocks because bank owners provide implicit guarantees to insure against liquidity shocks. Indeed, the provision of such implicit guarantees is common among financial institutions, which often provide support to their subsidiaries during times of financial distress. Hence, such implicit guarantees are likely to also affect financial institutions in other areas such as their portfolio allocation and the choice of their organizational structure. The impact of implicit guarantees is thus an interesting question for future research.

Another question that arises from my analysis is whether foreign bank ownership is more efficient than domestic bank ownership for banks that borrow internationally. It is difficult to judge from the results in this paper whether domestic owners are inefficient, because my analysis is conditional on a liquidity shock. If domestically owned banks provide other benefits, such as better relationship banking, then the ownership structure with both foreign- and domestically owned banks may be an efficient equilibrium outcome. However, over the last two decades we have experienced a large increase in the market shares of foreign-owned banks in emerging markets, which is consistent with a comparative advantage of foreign-owned banks relative to domestically owned banks.

Appendix

This Appendix presents definitions for the variables used throughout the paper. Bank characteristics are computed as of 12/31/1997 or for the calendar year 1997. Loan and firm characteristics are computed based on monthly data.

Variable	Definition
	Panel A: Bank Characteristics
Market share	Bank market share
International owner and zero otherwise	Indicator variable equal to one if a Peruvian bank has an international owner that holds 50% or more of equity
International lender	International financial institution that provides bank-to-bank lending to a Peruvian bank
Total assets	Total bank assets
Equity stake otherwise	Indicator variable equal to one if a bank-to-bank loan is provided by the bank's international owner and zero
Liquid assets/Assets	Liquid assets as a share of assets
Credit/Assets	Bank lending as a share of assets
International debt/Assets	Debt financed by international lenders as a share of assets
Deposits/Assets	Demand deposits as a share of assets
Equity/Assets	Equity as a share of assets
Return on assets	Net profit divided by assets
	Panel B: Loan Characteristics
Intermediate exposure	Indicator variable equal to one if a Peruvian bank is foreign-owned and zero otherwise
Low exposure	Indicator variable equal to one if a domestically owned Peruvian bank has below-median international debt to assets and zero otherwise
Loan size	Total loan amount outstanding per bank-borrower relationship before the liquidity shock
Maturity	Maturity in months
Overdraft	Overdraft as a share of total loan size
Factoring	Factoring as a share of total loan size
Term loan	Term lending as a share of total loan size
Leasing	Leasing as a share of total loan size
Export loan	Export and import loans as a share of total loan size
Currency	Indicator variable equal to one if loan is denominated in U.S. dollars and zero otherwise
Collateral	Collateral as a share of total loan size (set equal to one if the ratio is larger than one)
Oldest lender	Indicator variable equal to one for the bank with the longest lending relationship and zero otherwise
Share of total borrowing	Loan size as a share of total firm borrowing
	Panel C: Firm Characteristics
Firm borrowing	Total loan amount per firm
Loan relationships	Number of bank-borrower relationships
Firm age	Years since incorporation according to tax records
Located in Lima	Indicator variable equal to one if the firm is located in Lima and zero otherwise
Loan default	Share of borrowing in default
Firm survival	Indicator variable equal to one if a firm was operating in 2005 and zero otherwise

REFERENCES

Ashcraft, Adam, 2005, Are banks really special? New evidence from the FDIC-induced failure of healthy banks, *American Economic Review* 95, 1712–1730.

Ashcraft, Adam, 2006, New evidence on the lending channel, *Journal of Money, Credit, and Banking* 38, 751–776.

Arena, Marco, Carmen Reinhart, and Francisco Vazquez, 2007, The lending channel in emerging economies: Are foreign banks different? Working paper, University of Maryland.

Ashcraft, Adam, and Murillo Campello, 2007, Firm balance sheets and monetary policy transmission, *Journal of Monetary Economics* 54, 1515–1528.

Bekaert, Geert, Campbell R. Harvey, and Angela Ng, 2005, Market integration and contagion, *Journal of Business* 78, 1–31.

Berger, Allen, Leora Klapper, and Gregory Udell, 2001, The ability of banks to lend to informationally opaque small businesses, *Journal of Banking and Finance* 25, 2127–2167.

Bernanke, Ben, 1983, Nonmonetary effects of the financial crisis in the propagation of the Great Depression, *American Economic Review* 73, 257–276.

Bernanke, Ben, and Alan Blinder, 1988, Credit, money and aggregate demand, *American Economic Review* 78, 435–439.

Bernanke, Ben, and Alan Blinder, 1992, The federal funds rate and the channels of monetary transmission, *American Economic Review* 82, 901–921.

Bernanke, Ben, and Mark Gertler, 1989, Agency costs, net worth, and business fluctuations, *American Economic Review* 79, 14–31.

Bertrand, Marianne, Esther Duflo, and Sendhil Mullainathan, 2004, How much should we trust difference in differences estimates? *Quarterly Journal of Economics* 119, 249–275.

Campello, Murillo, 2002, Internal capital markets in financial conglomerates: Evidence from small bank responses to monetary policy, *Journal of Finance* 57, 2773–2805.

Castillo, Paul, and Daniel Barco, 2008, Facing up a sudden stop of capital flows: Policy lessons from the 90's Peruvian experience, Working paper, Central Bank of Peru.

Cetorelli, Nicola, and Linda Goldberg, 2010, Banking globalization and monetary transmission, Working paper, New York Federal Reserve Bank.

Chava, Sudheer, and Amiyatosh Purnanandam, 2011, The effect of banking crisis on bank-dependent borrowers, *Journal of Financial Economics* 99, 116–135.

Claessens, Stijn, and Kristin Forbes, 2001, *International Financial Contagion* (Kluwer Academic Publishers, Norwell, MA).

Detragiache, Enrica, and Poonam Gupta, 2004, Foreign banks in emerging market crises: Evidence from Malaysia, Working paper, International Monetary Fund.

Detragiache, Enrica, Thierry Tressel, and Poonam Gupta, 2008, Foreign banks in poor countries: Theory and evidence, *Journal of Finance* 63, 2123–2160.

Diamond, Douglas, and Raghuram Rajan, 2001, Banks, short term debt and financial crises: Theory, policy implications and applications, *Carnegie Rochester Conference on Public Policy* 54, 37–71.

Eichengreen, Barry, Andrew Rose, and Charles Wyplosz, 1996, Contagious currency crises: First tests, *Scandinavian Journal of Economics* 98, 463–484.

Forbes, Kristin, 2004, The Asian flu and Russian virus: The international transmission of crises in firm-level data, *Journal of International Economics* 63, 59–92.

Forbes, Kristin, and Roberto Rigobon, 2002, No contagion, only interdependence: Measuring stock market co-movements, *Journal of Finance* 56, 2223–2261.

Gan, Jie, 2007, The real effects of asset market bubbles: Loan- and firm-level evidence of a lending channel, *Review of Financial Studies* 20, 1941–1973.

Glick, Reuven, and Andrew Rose, 1999, Contagion and trade: Why are currency crises regional? *Journal of International Money and Finance* 18, 603–617.

Goldberg, Linda, 2002, When is U.S. lending to emerging market volatile? in Edwards, Sebastian and Jeffrey Frankel, eds., *Preventing Currency Crises in Emerging Markets* (University of Chicago Press, Chicago).

Gormley, Todd, 2010, The impact of foreign bank entry in emerging markets: Evidence from India, *Journal of Financial Intermediation* 19, 26–51.

Holmstrom, Bengt, and Jean Tirole, 1997, Financial intermediation, loanable funds, and the real sector, *Quarterly Journal of Economics* 112, 665–691.

Iyer, Rajkamal, and Jose-Luis Peydro, 2011, Interbank contagion at work: Evidence from a natural experiment, *Review of Financial Studies* 24, 1337–1377.

Jotikasthira, Chotibhak, Christian Lundblad, and Tarun Ramadorai, 2010, Asset fire sales and purchases and the international transmission of financial shocks, Working paper, University of North Carolina.

Karolyi, Andrew, 2003, Does international financial contagion really exist? *International Finance* 6, 179–199.

Kashyap, Anil, Owen Lamont, and Jeremy Stein, 1994, Credit conditions and the cyclical behavior of inventories, *Quarterly Journal of Economics* 109, 565–592.

Kashyap, Anil, and Jeremy Stein, 2000, What do one million observations on banks have to say about the transmission of monetary policy, *American Economic Review* 90, 407–428.

Khwaja, Asim, and Atif Mian, 2008, Tracing the impact of bank liquidity shocks: Evidence from an emerging market, *American Economics Review* 98, 1413–1442.

Mian, Atif, 2006, Distance constraints: The limits of foreign lending in poor economies, *Journal of Finance* 61, 1465–1505.

Paravisini, Daniel, 2008, Local bank financial constraints and firm access to external finance, *Journal of Finance* 63, 2160–2193.

Peek, Joe, and Eric Rosengren, 1997, The international transmission of financial shocks: The case of Japan, *American Economic Review* 87, 495–505.

Peek, Joe, and Eric Rosengren, 2000a, Collateral damage: Effects of the Japanese bank crisis on real activity in the United States, *American Economic Review* 90, 30–45.

Peek, Joe, and Eric Rosengren, 2000b, Implications of globalisation of the banking sector: The Latin American experience, *New England Economic Review* September/October, 45–62.

Shleifer, Andrei, and Daniel Treisman, 2000, *Without a Map: Political Tactics and Economic Reform in Russia* (MIT Press, Cambridge, MA).

Stein, Jeremy, 1998, An adverse selection model of bank asset and liability management with implications for the transmission of monetary policy, *RAND Journal of Economics* 29, 466–486.

Superintendence of Banking, Insurance and Pension Funds, 2006, The impact of economic and political shocks on banking in Peru: 1998–2001, in *History of Banking Regulation and Banking Supervision in Peru*.