Tracing the Impact of Liquidity Infusions by the Central Bank on Financially Constrained Banks: Evidence from a Natural Experiment

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Abstract

Using data on foreign borrowing by Russian banks, I identify banks that were financially constrained at the onset of the sudden stop caused by the collapse of the Lehman Brothers in September 2008. In a natural experiment set-up, I trace the impact of liquidity infusions by the Central Bank of Russia (CBR) on banks' funding and lending decisions. Applying the difference-in-difference method, I find that financially constrained banks increased their demand for central bank funding relatively more than non-constrained banks after the crisis. Secondly, I find that despite the fact that financially constrained banks obtained CBR funding, they nevertheless cut their lending to corporate borrowers in a short-term maturity segment relatively more than non-constrained bank. My last finding is that financially constrained banks increased lending to corporate borrowers in the long-term maturity segment. This result is puzzling and is probably due to the fact that banks were forced to extend the terms of credit to existing borrowers after the crisis.

JEL classification: G21, E44
Keywords: banks; financial constraints; natural experiment.

1 Introduction

Traditionally banks fund their business by issuing demand deposits which are more liquid than their assets. Starting from a seminal contribution by Diamond and Dybvig (1983) economists have built a solid understanding of how the run of depositors can cause a banking crisis and what policy measures are need to prevent such a crisis. In recent decades, banks have increasingly relied on non-deposit liabilities to finance their business. Gropp and Heider (2009) demonstrate a significant shift in the capital structure of US and European banks in the direction of more capital markets funding between 1991 and 2004. Using US banking data Hale and Santos (2009) estimate that bond financing relative to deposits went from 3.5% in 1988 to 9% in 2007.

The recent financial crisis highlighted the role of bank's capital structure in transmitting financial market shocks to the real economy. Following the collapse of the Lehman Brothers in 2008, a number of studies investigated this link and found a strong relationship between banks' reliance on capital markets financing and their lending policies. Ivashina and Scharfstein (2010) demonstrate that US banks with more short-term debt financing relative to demand deposits experienced problems rolling over their debt and cut their lending significantly more than banks with a higher proportion of demand deposits on their liabilities. In a cross-country study, Raddatz (2010) finds that, in the aftermath of the Lehman collapse, banks that relied on international wholesale capital markets experienced a larger decline in their stock prices than other banks, which had an impact on their capital ratios.

After the crisis central banks across the globe responded to capital market misallocations with massive liquidity infusions into the banking system. A number of studies investigate the effectiveness of these interventions in a macroeconomic context by looking at the dynamics of interest rate spreads. (Taylor and Williams (2009), Brunnermeier (2009)). To my knowledge, there are no studies that investigate the effectiveness of such interventions in view of the balance sheets of individual banks.

In this respect, the Russian context provides a unique setup for a natural experiment aimed at answering the following question: what was the impact of the Russian central bank's interventions on banks' funding and lending policies given the exogenous variation in financial constraints among banks and the unexpected sudden stop of external financing at the end of 2008?

Before laying out the empirical setup and methodology of my study, let me explain

why the Russian banking sector is a good case study for gauging the impact of a central bank's liquidity infusions on banks' balance sheets during the financial crisis.

First of all, using US or European banking data might pose a substantial identification problem. Not only were banks in the industrialized countries differently exposed to capital market shocks affecting their funding constraints, but there was also a significant variation in the degree to which they invested in the housing-mortgages market on the assets side of their balance sheets. In view of this, it is difficult to distinguish between negative shocks to banks' assets, respective to their liabilities since both were present. For example Gan (2007) finds that, following the collapse of the Japanese real estate bubble, banks that were more involved in the real estate sector also had deeper lending cuts to the corporate sector. On the contrary, Russian banks did not invest in mortgage-backed securities originating in the US and their asset operations were domestically oriented.

Second, the Russian banking system relied heavily on external borrowing from international capital markets. Russian banks issued Eurobonds, took syndicated loans and borrowed from foreign banks on the interbank money market. Using comprehensive data on international syndicated loans, De Haas and van Horen (2008) found that Russian syndicated borrowing represented 33% of the global total in 2005-2008, when the US and the Euro-15 countries were excluded.

Third, following the sudden collapse of the Lehman Brothers and the shut-down of the international capital markets, large dollar-denominated liabilities of the banking sector became a concern for the Central Bank of Russia (CBR). The CBR started to simultaneously sell dollars from its international reserves on the FX market[1] and to infuse ruble liquidity into the banking system trough Repo auctions among private banks. These auctions provided banks with credit both on a secured and unsecured basis and allowed them to purchase US dollars from the CBR in order to repay foreign loans.

These three factors explain why the experience of the Russian banking system provides an ideal laboratory for studying how banks with different financial constraints responded to central bank interventions.

The sudden stop of external financing to Russian banks in late 2008 was not caused by domestic fundamentals and can therefore be considered exogenous in char-

[1] From the peak of $ 596.6 bln. in August 2008 the international reserves of the CBR went down to $ 384.1 bln. in March 2009.

acter. For the purposes of our study, we need to identify a pre-determined variable for measuring cross-country variation among banks after the sudden stop. A recent study of financially constrained firms by Almeida et al. (2009) suggests that variation among firms with respect to long-term debt maturing immediately after the unanticipated crisis may be a suitable variable. This study shows that as decisions about long-term borrowing were made ex ante before the crisis, and the crisis came unexpectedly, firms with a large fraction of debt maturing during the collapse of the capital market were more constrained than otherwise similar firm whose debt matured outside of the crisis event window.

I employ a similar strategy and divide Russian banks into two groups on the basis of variations in the amount of foreign debt that matured within two quarters after the Lehman Brothers collapse and the sudden stop of external financing. Banks with a ratio of more than 2% of foreign loans expiring within 6 months after the crisis are allocated to the "treatment group", while banks whose ratio of such loans is less than 2% are allocated to the "control group". Using the difference-in-difference matching estimator, I investigate if banks belonging to the first group behaved differently from those in the second group.

The first outcome variable I investigate is cumulative net borrowing from the CBR during the six-month period prior to and the six-month period after the sudden stop. The reason for my decision to study banks' participation in CBR auctions is twofold. First, the CBR does not reveal information on its FX interventions. However, if it can be shown that that banks with a high amount of foreign debt maturing after the crisis borrowed significantly more from the CBR than other banks, this could indicate that they used these funds to buy dollars on the FX market in order to repay foreign debt. Rajan and Tokatlidis (2005) argue that, in the case of a sudden stop, emerging market economies with dollarized banking systems experience a dollar shortage. In this respect, my study contributes to large body of literature that investigates sudden stops in an emerging market context by looking at massive non-IMF interventions by domestic central banks. Secondly, since the CBR has the third largest foreign exchange reserves in the world, its policy of simultaneously pursuing interventions on the FX market and infusions into domestic currency liquidity could simply be considered a means of extending dollar loans to financially constrained banks. This parallels Fed's liquidity infusions with the difference being that the amount of dollars that the CBR can inject into the banking system is constrained by the size of its

vast but limited reserves. As banks' liabilities are denominated in dollars, and the interventions of the CBR are conducted in dollars, my study also has the potential to contribute to the literature on large policy interventions in closed economies.

The second outcome variable in my study is cumulative volume of credit extended to non-financial borrowers during the six months that preceded and the six months that followed the sudden stop. There is a growing body of evidence that, contrary to the ideal Modigliani-Miller world assumption, the two sides of a bank's balance sheet are interrelated. Exploiting a natural experiment setup, a number of recent papers demonstrate that exogenous variations in banks' financial constraints significantly impacts their investment decisions. For example, using data on allocation of government funds across banks in Argentina, Paravisini (2008) estimates that there is an immediate expansion of lending of $0.66 for every dollar of external finance. Khwaja and Mian (2008) examine the impact of liquidity shock on banks induced by government constraints on dollar deposits following unanticipated nuclear tests in Pakistan. Iyer and Peydro (2010) find that variation in interbank exposure to a suddenly collapsed bank in India has real economic effect on loan growth.

The main assumptions underlying my study are: Russian banks belonging to the "treatment" group experienced dollar shortage after the sudden stop since they were unable to roll-over their foreign debt. However, CBR interventions mitigated this constraint as the foreign debt of these banks was substituted by CBR funding. While the average maturity of Eurobonds issued by Russian banks is 6.13 years, and the average maturity of syndicated loans 1.8 years in my sample, loans provided by the CBR do not extend more than 1 year. One would expect that this maturity mismatch would have an impact on the amount of loans granted by banks to the corporate sector in different maturity segments. By distinguishing the cumulative volume of credit extended to non-financial borrowers for up to 1 year, as well as more than 1 year, I will be able to test if an exogenous shift in the maturity structure of banks' liabilities has an impact on the maturity structure of their lending.

2 Sudden stop and central bank's interventions

2.1 Lehman Brothers bankruptcy

When Henry Paulson was asked to define the worst moment of the recent liquidity crisis his reply was: "...September 17, 2008 when the capital market froze, when there started to be the run on the money markets, banks stopped to lend to each other..." [Wessel (2010)].

Picture A1 in the appendix displays dynamics of the LIBOR and Overnight Indexed Swap (OIS). A number of recent studies [Taylor and Williams (2009), McAndrews et al. (2008)] uses the spread between the two indictors as a measure of liquidity and counterparty risk premia in the banking system. One can observe that over the year 2008 prior to Lehman Brothers collapse on September 15th the LIBOR-OIS spread was stable, which suggests that the Lehman Brothers bankruptcy was unanticipated by financial markets. Figure 2A in the appendix plots dynamics of the sovereign CDS spreads on Russian and Mexican debt. Firstly, a sharp increase in the risk premium on sovereign debt in the last quarter of 2008 means that the emerging markets were effectively shut down from the international capital markets. Secondly, the period immediately prior to the Lehman's bankruptcy was characterized by very narrow CDS spreads and benign borrowing conditions for emerging markets suggesting that a stop in international capital flows was indeed sudden.

2.2 Interventions by the Central Bank of Russia

Capital account liberalization in 2006 combined with solid macroeconomic performance of Russia due to favorable terms of trade resulted in high external borrowing by the private sector. According to the CBR estimates foreign liabilities of the Russian banking sector represented 19% of total liabilities in August 2008, while individual deposits represented 24.5% of bank's liabilities. Following a sudden-stop of international capital flows in September 2008 the CBR became concerned with inability of banks to roll-over foreign debt. This resulted in two policy measures. On the one hand the CBR started a massive sale of its official currency reserves, which peaked in August 2008 at $ 596.6 billion and were ranked third in the world. As can be seen from figure A3 in the appendix the level of reserves bottomed in March 2009 at $ 384.1 billion, which implies a total transfer of $ 200 billion to the private sector

by the CBR.

On the other hand the CBR started massive injections of domestic currency liquidity into the banking system. As can be seen from figure A4 prior to Lehman Brothers the CBR was constantly absorbing excess liquidity from the banking sector. The average size of absorption was 0.5 trillion rubles (approximately $ 20 billion exchange rate) per period. The situation considerably changed in September 2008 when CBR started conducting refinancing auctions with banks on both collaterized and uncollaterized basis. The refinancing operations of the banking system peaked in January 2009 at 3.5 trillion rubles (approximately $ 112 billion).

The simultaneous injection of rubles and dollars into the banking system allowed banks facing foreign dbet roll-over problems to repay their foreign debt. This makes Russia an interesting case to study the impact of liquidity injections by monetary authority on financially constrained banking system.

3 Data description

The data set I use includes monthly observations on all Russian banks' balance sheets and all Eurobond and syndicated loans issued during the period 2004-2010. I have obtained data from three sources. The data on banks' balance sheets I use has been compiled by the CBR on the basis of reports on monthly transactions submitted to the CBR by individual banks. This data covers all accounting variables that banks report to the CBR according to the "Accounting Rules for Banks Operating in the Russian Federation." The two other sources of data are Bloomberg and Cbonds. These information agencies compile data on all Eurobonds and syndicated loans issued by Russian banks. The main variables in both data sets overlap but some details of the bond contracts are better represented in one comparing to the other.

As regards data selection criteria, I first compiled variables that represent foreign borrowing on the basis of banks' balance sheet data. There are three major variables: capital market transactions that represent Eurobond issuance; foreign bank credit and deposits that represent term loans from foreign banks (syndicated and non-syndicated); and interbank market transactions. As the following step, I calculated the value of all foreign liabilities with a maturity of more than 6 months in August 2008, and determined the ratio of this variable with respect to total assets. I dropped all banks whose value on this variable is less than 3%. A total of 99 banks remained

in the final sample.

Because the difference-in-difference method is valid only if all banks in a sample are as similar as possible, I divided my data on banks with a high level of foreign borrowing into two sub-samples. This was done with reference to the existing literature on empirical corporate finance, which holds that companies that have entered foreign capital markets are more transparent and safe than others [see Schmukler and Vesperoni (2006)]. Accordingly, the first sub-sample in my study includes banks that issued Eurobonds or syndicated loans and had them outstanding in August 2008 (36 banks), while the second sub-sample includes banks that only borrowed from foreign banks through the interbank market (63 banks). Summary statistics for some of the main capital ratios is provided in the appendix.

4 Empirical Design

4.1 The "Experiment"

The main idea of my natural experiment setup is to find a variable that exhibited predetermined variation during the unexpected sudden stop of external financing. As discussed before, the proportion of long-term debt maturing after the crisis is a good candidate since decisions about long-term borrowing were made ex ante before the crisis. Since the sudden stop was unexpected, banks with a large fraction of foreign debt maturing during the collapse of the capital market were more constrained than otherwise similar banks whose debt matured outside of the crisis event window. In each of the two sub-samples, I allocate banks with a ratio of more than 2% of foreign loans expiring within 6 months after the crisis into the "treatment group", while banks whose ratio of such loans is less than 2% are placed in the "control group". This setup allows us to determine whether there is a casual link between the level of financial constraint that banks experienced after the sudden stop and the outcome variables of the study, i.e. cumulative borrowing from the central bank and lending to the corporate sector.

Using the difference-in-difference (D-in-D) matching estimator, I investigate if banks belonging to the “treatment group” behaved differently from those in the “control group”. The specification of the D-in-D method can be found in Bertrand *et all.* (2004).

$$Y_{i\tau} = \alpha + \beta_1 TREAT + \beta_2 \tau + \beta_3(\tau \times TREAT) + \beta_4 X_{i\tau} + \varepsilon_{it}$$

where indictor variable TREAT takes value 1 if bank belongs to a "treatment group" and zero if control. This variable captures possible differences between the two groups prior to the sudden stop. The indicator variable τ takes value 1 if observations belong to the six month time period *after* the sudden stop (September 2008 to February 2009) and zero if it belongs to the six month time period *before* the stop (April 2008 to August 2008). This variable captures aggregate factors that would change in Y even in the absence of a sudden stop. The main coefficient of interest is on the interaction term β_3. It captures all variation in outcome variables specific to the treatments (relative to controls) in the period after the sudden stop (relative to the period before):

$$\widehat{\beta}_3 = (\overline{Y}_{2,B} - \overline{Y}_{1,B}) - (\overline{Y}_{2,A} - \overline{Y}_{2,A})$$

$X_{i\tau}$ - represents a set of control variables. At this point I use two variables: deposits-to-assets and government securities holdings-to-assets ratio. Both of the variables are motivated by Gan (2007) and Ivashina and Scharfstein (2010).

$Y_{i\tau}$ - represents two outcome variables: cumulative net borrowing from the CBR in the period before and after the sudden stop; cumulative volume of credit extended to non-financial borrowers in the period before and after the sudden stop. The last variable is used in a study of Ivashina and Scharfstein (2010) for syndicated loans market underwritten by banks in the US.

4.2 Net Borrowing from the Central Bank

As a robustness check of the experiment result presented further I perform the so-called *placebo* test. The idea is to apply the D-in-D method to the identified "treatment" and "control" groups for periods outside of the crisis window. I calculate values for the outcome variables for the six-month period one year before the crisis (October 2007 to March 2008) and for the six-month period right before the crisis (April 2008 to August 2008). The results of the placebo tests for two sub-samples are reported in Tables 1.

[Table 1 about here]

As one can see there is no systematic difference between "treated" and "control"

groups in periods outside of the crisis window as all D-in-D estimates are insignificant. The next step is to run the real experiment for periods *before* and *after* the crisis.

[Table 2 about here]

The results demonstrate that banks that experienced a higher level of financial constraint due to a high proportion of foreign debt maturing immediately after the crisis (the "treatment group") obtained significantly more funding from the CBR than other banks (the "control group"). This finding suggests that since the "treated" banks were unable to roll-over foreign debt, they used CBR financing to buy dollars at the FX market for the purpose of repaying their debt[2]. It is clear that the CBR liquidity infusions organized as repo auctions were mostly absorbed by financially constrained banks. The drawdown of Russia's international reserves holdings that accompanied these auctions suggests that they were aimed at preventing dollar shortage in the banking system.

4.3 Lending to non-financial corporate sector

4.3.1 Lending with maturity up to 1 year

I apply the same empirical strategy to another outcome variable by first running the placebo test on periods outside of the crisis window.

[Table 3 about here]

The estimation results indicate the banks in experimental groups of both sub-samples were not significantly different from each other.

[Table 4 about here]

The estimation results of the experiment suggest that, in both sub-samples, "treated" banks reduced their corporate lending in the 1-year maturity segment relative to "control" banks. The result is statistically significant only for the sub-sample of banks that did not issue Eurobonds or syndicated loans. This is probably due to the small size of the sub-sample of banks that entered capital markets.

This finding suggests that, even though financially constrained banks obtained more funding from the CBR than non-constrained banks, they still significantly cut their lending to the corporate sector. This means that financial frictions were present even after the liquidity infusions by the central bank. In other words, the fact that

[2] The negative sign here indicates an increase in liabilities.

banks were able to substitute their liabilities through CBR funding did not affect their lending decisions. (I must note that in order to make this argument with more certainty, I need to control for the cost of different sources of funding, which I did not yet do).

4.3.2 Lending with maturity more than 1 year

[Table 5 about here]

Placebo test indicate that there is no difference between banks in a pre-crisis period.

[Table 6 about here]

Contrary to my expectations, banks in the "treatment" group increased their lending in the long-term credit segment. In order to investigate this issue further, I must check whether this cumulative increase represented a new credit increase or whether banks were forced to extend the terms of existing credit lines to borrowers who were unable to pay after the crisis. If the latter is true, it is not clear why banks in the "treatment" group extended the term of their existing debt more than banks in the "control" group in the post-crisis period.

Yet another possibility is that financially constrained banks were more concerned with the credit-quality of their borrowers and extended long-term credit only to high quality borrowers. Diamond (1991) predicts that low-credit quality firms prefer to borrow short-term, while firms with better credit standing prefer to borrow long-term.

The main takeaway is the following: On the liabilities side, financially constrained banks substituted long-term foreign liabilities with short-term CBR credit after the sudden stop. On the assets sides, these banks cut credit to corporate borrowers in the short-term maturity segment, but increased them in the long-term segment. If this maturity mismatch of assets and liabilities was voluntary, it means that the quality of corporate borrowers was the most important factor determining banks' lending decision after the crisis. If the increase of lending in the long-term segment was forced (which I think is most likely), it means that these banks will face a higher maturity mismatch in the future and that the central bank will have to roll-over credit lines for an extended period of time.

5 Conclusion

Using the data on foreign borrowing by the Russian banks I identify banks that were more financially constrained at the onset of the sudden stop caused by the collapse of the Lehman Brothers in September 2008. In a natural experiment set-up I trace the impact of liquidity infusions by the Central Bank of Russia (CBR) on bank's funding and lending decisions. Using the difference-in-difference framework I find that financially constrained banks increased their demand for central bank funding relatively more than the non-constrained banks after the crisis. This result suggests that banks whose foreign debt was maturing after the sudden stop used the CBR funding to buy dollars and repay their debt. Secondly, I find that despite the fact that financially constrained banks obtained most of the CBR funding they nevertheless, cut their lending to corporate borrowers in a short-term maturity segment relatively more than non-constrained banks. My last finding is that financially constrained banks increased lending to corporate borrowers in the long-term maturity segment. This result is puzzling and is probably due to the fact that banks were forced to extend the terms of credit to existing borrowers after the crisis.

As mentioned in the introduction a number of recent studies identify a casual link between funding constraints of banks and their lending decisions. My study contributes to this literature by demonstrating that after the sudden stop even in case of massive liquidity infusions by the central bank financial frictions remain present and have an impact on banks' lending policies.

6 Appendix A

Figure A1. Dynamics of 1-month LIBOR and 1-month OIS in USD

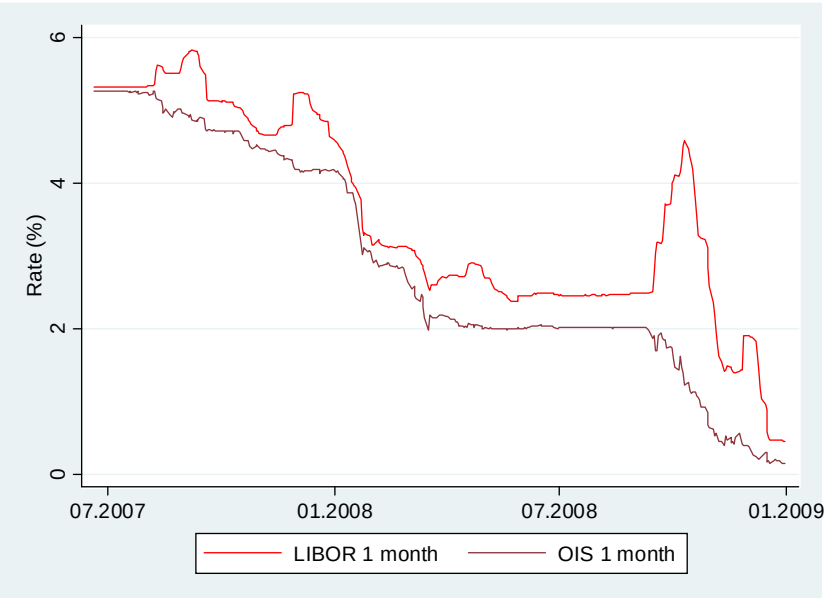

Figure A2. Dynamics of sovereign CDS spreads for Russia and Mexico

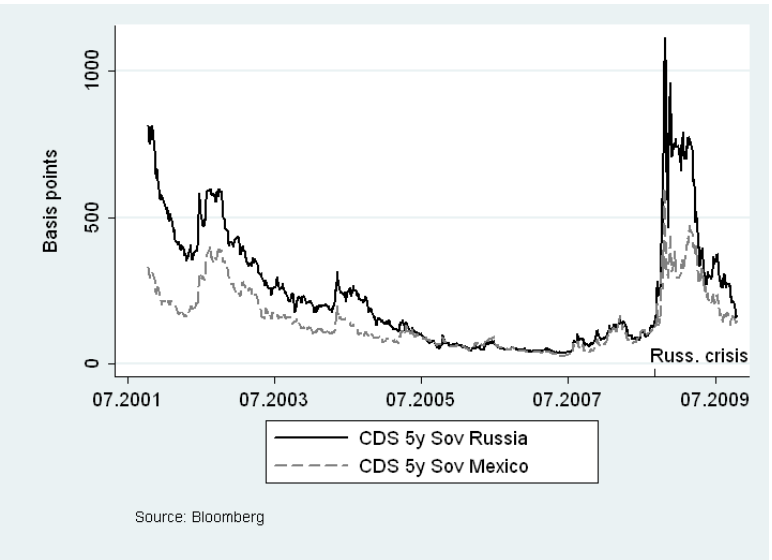

Figure A3. Average montly level of offical foreign exchange reserves of the Central Bank of Russia

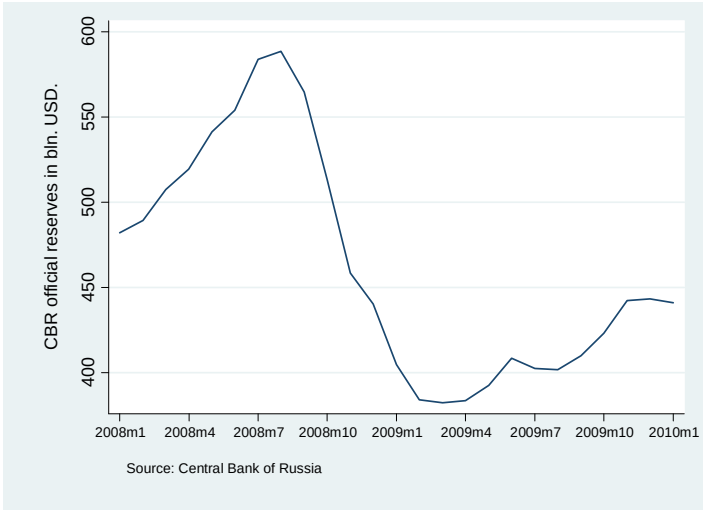

Figure A4. Refinancing by the Central Bank of Russia, in trillions RUB

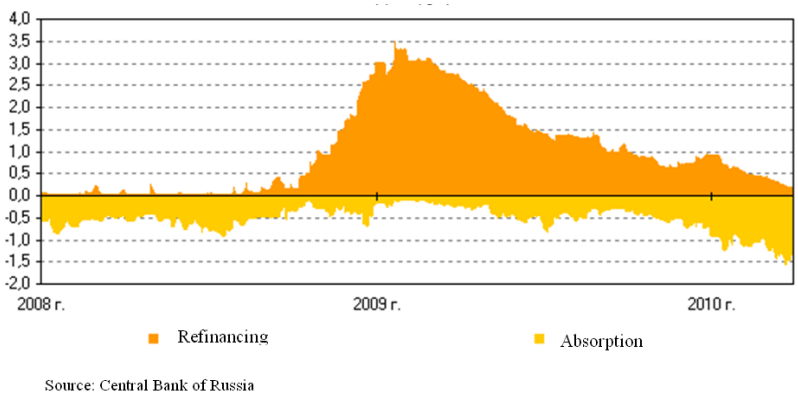

Table A1. Summary statistics of Eurobond and syndicated loans issuance by Russian banks[a] during Dec. 2003 – Feb. 2010

	Eurobonds in USD		Eurobonds in EUR		Syndicated loans in USD		Syndicated loans in EUR	
Bank name	Total volume (mln.$)	Aver. durat. (years)	Total volume (mln.€)	Aver. durat. (years)	Total volume (mln.$)	Aver. durat. (years)	Total volume (mln.€)	Aver. durat. (years)
VTB	11,810	9.3	2,830	3.4	2,450	2.6		
Gazprombank	4,720	4.6	350	2.5	1,600	2.5		
Bank Moskvy	1,750	7.5			2,622	2.4		
Alfa bank	4,975	4.2	375	5	2,520	1.1		
Rosbank	580	6.6			370	1.5	50	4
Uralsib	290	3			2,477	1.5		
MDM	3,625	2	225	5.1	2,778	2.5		
Promsvjazbank	1,320	5.4			1,835	2		
Nomos-bank	861	3.9			740	1.2		
VTB Severo-Zapad	700	6.5			310	1.5		
VTB24	800	22.5			730	4.5		
Petrokommerts	770	2.9			397	1.8		
Rosselhoz bank	5,550	7.5			520	2.3		
Ak Bars	1,005	3						
Russkij standart	3,810	3.8	947	7.9	775	1		
Zenit	325	3			783	1.1	93	1
Transkredit bank	830	2.7			523	1.5		
Hanty-Mansijskij bank	100	10.2			191	1		
Sankt-Peterburg	350	5.1			300	1.7		
MBRR	310	5.4			50	3	65	0.8
Binbank	241	1.5	6	2	119	1		
Absoljut	511	1.7	5	1.5				
URSA	777	3.3	700	4	765	1.8		
Tatfondbank	545	2			36	1		
Avangard	11	1						
Probiznesbank	470	1.5	24	1.6	113	1.2		
Moskovskij Kreditnyj bank	100	3			471	2.7		
RosEvroBank	230	1.3			227	2.4		
SB bank	61	5.5			0			
TransKapital	275	6.5			192	1.4	1	4
BTA Rossija	100	5			67	1		
Tcentr-Invest	175	2.1			250	1.6		
Moskommerts	491	18.6						
Gazbank	100	3						
LOKO-bank	100	3.1			150	2		
Delta kredit	206	27.8			45	3.5		
Gorodskoj ipotechnyj	73	27.1						
Vostochnyj Express	43	10			10	1		
Total:	48,990		5,462		24,416		209	

Note: [a]The sample does not include Sberbank, VEB, Souz, Mezhprombank and foreign banks operating in Russia

Figure A5. Aggregate value of banks' liabilities from Eurobonds and Syndicated loans

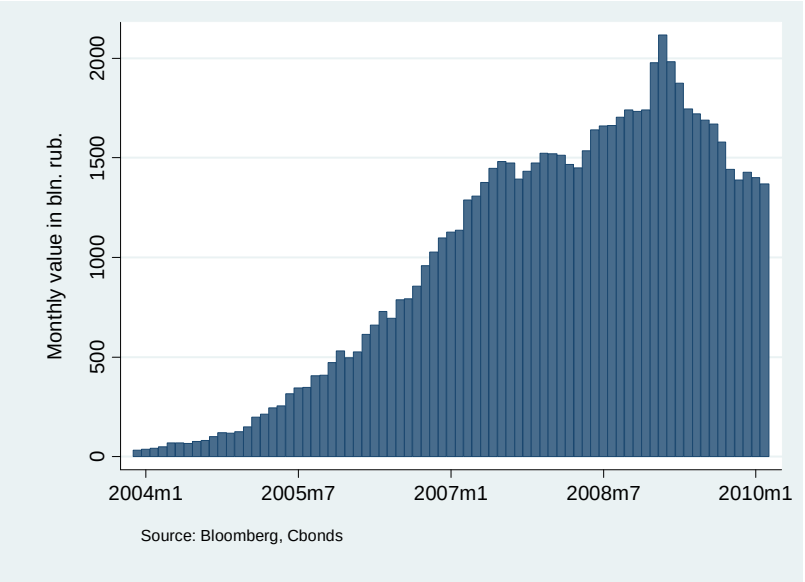

Figure A6. Aggregate monthly flow of funds for a sample of banks that used foreign capital markets borrowing

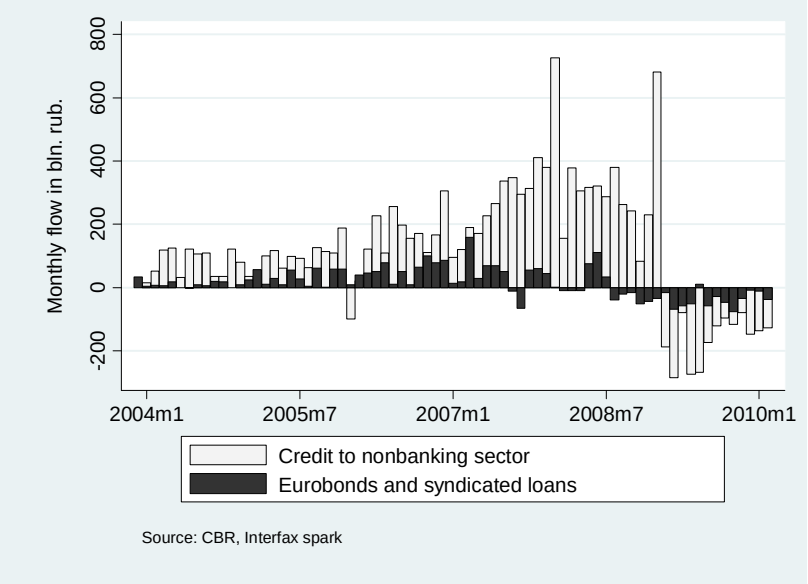

Table A2. Summary statistics for August 2008

	Banks that issued Eurobonds or syndicated loans		Banks that borrowed from interbank market	
	Treatment group	Control group	Treatment group	Control group
Numb. obs.	16	20	16	47
Total credit to assets ratio	0.671 (0.093)	0.704 (0.097)	0.668 (0.171)	0.657 (0.153)
Deposits to assets ratio	0.158 (0.084)	0.179 (0.148)	0.164 (0.142)	0.270 (0.156)
Foreign liabilities- to assets ratio	0.217 (0.086)	0.285 (0.219)	0.310 (0.205)	0.148 (0.165)

Table 1. Difference-in-Difference placebo test of Net Borrowing from the Central Bank (in billions of rubles)

Panel A. Sample of banks that issued Eurobonds or syndicated loans Average Cumulative Net Borrowing during Six months		
	1 year Before the crisis	6 months Before the crisis
Treated banks	4.1 (6.6)	-6.5 (6.0)
Control banks	3.1 (6.0)	-9.6 (5.6)
Difference at a point of time	1.0 (6.6)	3.1 (6.4)
Difference-in-Difference		2.0 (9.1)

Panel B. Sample of banks that borrowed from interbank market Average Cumulative Net Borrowing during Six months		
	1 year Before the crisis	6 months Before the crisis
Treated banks	-0.01 (0.2)	-0.11 (0.17)
Control banks	0.13 (0.14)	-0.17 (0.14)
Difference at a point of time	-0.15 (0.2)	0.06 (0.19)
Difference-in-Difference		0.21 (0.27)

Note: *** Denotes significance at 1%;** Denotes significance at 5%

Table 2. Difference-in-Difference of bank Net Borrowing from the Central Bank Before and After the Lehman Brothers collapse (in billions of rubles)

Panel A. Sample of banks that issued Eurobonds or syndicated loans Average Cumulative Net Borrowing during Six months		
	6 months Before the crisis	6 months After the crisis
Treated banks	-40.0 (25.0)	-110.0*** (29.0)
Control banks	-42.0* (23.0)	-43.0* (25.0)
Difference at a point of time	2.8 (27.0)	-65.0** (28.4)
Difference-in-Difference		-68.0* (38.0)

Panel B. Sample of banks that borrowed from interbank market Average Cumulative Net Borrowing during Six months		
	6 months Before the crisis	6 months After the crisis
Treated banks	-0.51 (0.8)	-4.0*** (0.82)
Control banks	-0.6 (0.6)	-1.1* (0.6)
Difference at a point of time	0.1 (0.8)	-3.0*** (0.8)
Difference-in-Difference		-3.1*** (1.2)

Note: *** Denotes significance at 1%;** Denotes significance at 5%

Table 3. Difference-in-Difference placebo test for Lending to non-financial corporate borrowers with up to 1 year maturity (in billions of rubles)

Panel A. Sample of banks that issued Eurobonds or syndicated loans Average Cumulative Lending during Six months		
	1 year Before the crisis	6 months Before the crisis
Treated banks	19.0*** (7.4)	22.0*** (6.6)
Control banks	15.0** (6.5)	11.0* (6.2)
Difference at a point of time	3.7 (7.2)	11.0 (7.0)
Difference-in-Difference		7.5 (9.9)

Panel B. Sample of banks that borrowed from interbank market Average Cumulative Lending during Six months		
	1 year Before the crisis	6 months Before the crisis
Treated banks	0.68 (0.8)	2.7*** (0.74)
Control banks	0.1 (0.5)	0.46 (0.6)
Difference at a point of time	0.6 (0.8)	2.2*** (0.8)
Difference-in-Difference		1.6 (1.1)

Note: *** Denotes significance at 1%;** Denotes significance at 5%

Table 4. Difference-in-Difference of bank Lending to non-financial corporate borrowers with up to 1 year maturity Before and After the sudden stop (in billions of rubles)

Panel A. Sample of banks that issued Eurobonds or syndicated loans Average Cumulative Lending during Six months		
	6 months Before the crisis	6 months After the crisis
Treated banks	24.0***	5.7
	(7.3)	(8.3)
Control banks	11.0	4.5
	(6.8)	(7.2)
Difference at a point of time	13.0	1.2
	(7.9)	(8.1)
Difference-in-Difference		-11.0
		(11.0)

Panel B. Sample of banks that borrowed from interbank market Average Cumulative Lending during Six months		
	6 months Before the crisis	6 months After the crisis
Treated banks	2.6**	-3.7***
	(1.3)	(1.3)
Control banks	0.45	-0.54
	(1.0)	(1.0)
Difference at a point of time	2.1	-3.1**
	(1.4)	(1.4)
Difference-in-Difference		-5.3***
		(1.9)

Note: *** Denotes significance at 1%;** Denotes significance at 5%

Table 5. Difference-in-Difference placebo test for Lending to non-financial corporate borrowers with more than 1 year maturity (in billions of rubles)

Panel A. Sample of banks that issued Eurobonds or syndicated loans Average Cumulative Net Borrowing during Six months		
	1 year Before the crisis	6 months Before the crisis
Treated banks	15.0*** (5.7)	14.0*** (5.7)
Control banks	6.5 (5.2)	8.1 (5.1)
Difference at a point of time	8.6 (7.7)	6.3 (7.6)
Difference-in-Difference		-2.3 (11.0)
Panel B. Sample of banks that borrowed from interbank market Average Cumulative Lending during Six months		
	1 year Before the crisis	6 months Before the crisis
Treated banks	0.43 (0.38)	0.82** (0.35)
Control banks	0.26 (0.28)	0.06 (0.28)
Difference at a point of time	0.17 (0.4)	0.76** (0.38)
Difference-in-Difference		0.59 (0.54)

Note: *** Denotes significance at 1%;** Denotes significance at 5%

Table 6. Difference-in-Difference of bank Lending to non-financial corporate borrowers with more than 1 year maturity Before and After the sudden stop (in billions of rubles)

Panel A. Sample of banks that issued Eurobonds or syndicated loans Average Cumulative Net Borrowing during Six months		
	6 months Before the crisis	6 months After the crisis
Treated banks	36.0*** (15.0)	69.0*** (17.0)
Control banks	30.0** (14.0)	35.0*** (14.0)
Difference at a point of time	5.8 (16.0)	34.0** (16.4)
Difference-in-Difference		28.0 (22.0)

Panel B. Sample of banks that borrowed from interbank market Average Cumulative Lending during Six months		
	6 months Before the crisis	6 months After the crisis
Treated banks	1.0** (0.4)	1.6*** (0.4)
Control banks	0.32 (0.33)	0.32 (0.33)
Difference at a point of time	0.68 (0.45)	1.3*** (0.4)
Difference-in-Difference		0.59 (0.62)

Note: *** Denotes significance at 1%;** Denotes significance at 5%

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