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 through Eurobond and syndicated loans issuance, 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, and also significantly increased holdings of market securities used as a collateral for the CBR credit. Secondly, I find that despite the fact that financially constrained banks obtained CBR funding, they nevertheless cut their lending to private entrepreneurs relatively more than non-constrained bank. My last finding is that after the sudden stop and a policy of quantitative easing all Russian banks turned from net borrowers to net lenders with respect to non-resident banks.

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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, the only recent study that investigate the effectiveness of such interventions in view of the balance sheets of individual banks is done by Giannetti and Simonov (2010). They use the Japanese bank-level data for studying another anti-crisis measure employed by monetary authorities - direct bank recapitalization.

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 its credit facilities in the form of auctions. 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 con-

[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.

straints 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 character. 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 foreign loans expiring within 1 year after the crisis above a specified threshold are allocated to the "treatment group", while banks whose ratio of such loans below a threshold 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 1 year period prior to and the 1 year 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 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 set of outcome variables in my study is cumulative volume of credit extended to different types of borrowers during 1 year that preceded and 1 year 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. I test if financially constrained banks cut their lending to different types of borrowers relatively more than unconstrained banks. The balance-sheet bank level data allows me to distinguish between the following groups of borrowers: 1) private non-finacial companies, 2) private entrepreneurs and 3) individuals. This categorization helps to identify groups of borrowers that are more vulnerable to tightening of the credit conditions following a sudden stop.

The last set of outcome variables includes change in total overdue credit in periods before and after the sudden stop, change in market securities holdings of banks, change in individual deposits held in banks and change in net interbank borrowing from foreign banks. Because these variables measure other important characteristics of banks one can test if there was a significant variation across treated and control

groups along other dimensions during the sudden stop. Estimates for this set of variables provides a robustness check for my main results on net borrowing from the central banks and lending to the private sector.

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 (e.g., 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.

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 US$ at current exchange rate) per period. The situation considerably changed in September 2008 when CBR started conducting refinancing auctions with banks on both collateralized 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 debt 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.

2.3 Background of Russian Quantitative and Qualitative Easing (QE)

Figure A4 plots the dynamics of CBR liquidity operations involving banks. As can be seen, until September 2008, the CBR was preoccupied with absorbing excess liquidity from the banking system through its deposit facilities. This excess liquidity was partly caused by heavy foreign borrowing. In September 2008, the situation reversed and the CBR started injecting liquidity through its standard and newly developed credit facilities. Let me overview major policy steps that were taken.

1. CBR Lombard credits

Lombard credit is a standard credit facility employed by central banks to inject liquidity into the banking system on a temporary basis. This facility has been used by the CBR for a long time, allowing banks to borrow funds from the CBR by providing highly liquid bonds as collateral. The vast majority of credits granted under this facility have duration of 1 week.

As can be seen in Figure A5 in the appendix, the total amount of funds granted by the CBR under this facility increased seven times between August and September 2008 (from 4 to 28.8 bln. RUR).

A few policy measures relating to Lombard credits, which were adopted by the CBR during the financial crisis, can be qualified as measures of qualitative easing:

- On October 14, 2008 the CBR lowered credit ratings requirements for securities provided as collateral from B+ to B;

- On October 21, 2008 the CBR added several issues of Municipal bonds to its Lombard list;

- On November 13, 2008 the CBR lowered credit ratings requirements for securities provided as collateral from B to B-;

- Between September 2008 and January 2009 the CBR extended the Lombard list of accepted securities multiple times[2].

2. CBR credit against "non-market" assets

After the beginning of the Global Financial Crisis in August 2007, Russian monetary authorities set-up a couple of new credit facilities, on which they heavily relied after the collapse of Lehman Brothers in September 2008. One of them was CBR credit facility against "non-market" assets, which was introduced on 17 November 2007. This facility allowed banks to provide promissory notes and loan agreements as collateral against CBR funding. The credit quality of assets accepted as collateral, haircuts and interest rates charged were pre-specified.

However, as can be seen in Figure A6 in the appendix, banks only began to make active use of this facility in September 2008, when the international capital markets effectively closed down. After this, the total amount of CBR credit against "non-market" assets doubled each month until the beginning of 2009. Only from September to October 2008, it went up from 14.5 bln. RUR to 51.7 bln. RUR. In addition to the increased demand for liquidity from banks, a few policy measures of qualitative easing adopted by the CBR also contributed to this development. Major measures of this kind included the following:

- On September 17, 2008 the CBR decreased by 20% the haircuts imposed on different type of collateral;

[2] A complete list and dated additions are available from the CBR's Weekly Banking Bulletin and can be provided by the author upon request

- On October 3, 2008 the CBR relaxed credit requirements on institutions whose promissory notes and loan agreements banks could put-up as collateral. The CBR also added a list of corporate bonds that became accepted as collateral;

- On December 16, 2008 the CBR extended the list of collateral accepted under this facility to include loan guarantees issued by other banks.

As can be seen from Figure A6, besides providing an additional channel for injecting liquidity into the banking system, this facility also extended the term of funding provided by the CBR. During the last quarter of 2008, most credits extended to banks through this facility had 3-6 months maturity.

3. CBR uncollateralized credit auctions

During the most acute stage of the financial crisis, in October 2008, the CBR created another credit facility – uncollateralized credit auctions, where banks may bid for CBR funding without putting up any collateral. The only requirement for participation in these auctions is that banks have an international credit rating that exceeds a certain level. Initially the minimum credit ratings accepted were B- assigned by Fitch Ratings or Standard&Poor's or B3 assigned by Moody's.

The auctions are organized in American style and auction parameters are preset in advance. For example, the CBR publicly announces the total amount of funding it will give out during the auction, the minimum interest rate it will accept and the length of credit it will grant. Qualified banks may submit bids for funding together with an indication of the interest rate they are willing to pay. The maximum bid amount for each bank is set according to a formula published by the CBR in its regulations. Following an auction, the CBR ranks bids submitted by banks with respect to the interest rate offered and accepts bids in this order (starting from the bid with the highest interest rate offer) until all bids are satisfied. In case banks overbid, the CBR stops the auction at the point when the preannounced amount of liquidity injection has been exhausted. Each bank whose bid was satisfied pays the interest rate it offered.

Figure A7 in the appendix provides summary statistics of all uncollaterized credit auctions conducted by the CBR during October 2008 –May 2009. In most cases, the total amount of bidding was within the limit of preannounced liquidity injections.

Several policy steps of qualitative easing were adopted with regard to this facility:

- Initially the maturity of credit under this facility was 5 weeks. However, on No-

vember 5, 2008, the CBR extended the term of uncollateralized credit to 6 months for banks with a minimum credit rating of BB- assigned by Fitch Ratings or Standard&Poor's or Ba3 assigned by Moody's;

- On November 12, 2008, in addition to banks that were assigned at least B- or B3 credit rating by international credit agencies, the CBR allowed banks that were assigned credit ratings by two domestic Russian agencies (RusRating and Expert RA) to participate in uncollaterized credit auctions with a 5 weeks' term;

- On December 12, 2008, the CBR added two other domestic credit agencies (National Rating Agency and AK&M) to the list of credit agencies whose ratings are acceptable for participation in uncollaterized auctions.

Russian banks that have not been granted credit ratings by international agencies are normally smaller and less transparent than those that have been granted such ratings. In view of this, the CBR's decision to expand the pool of eligible auction participants to include banks with credit ratings only from domestic agencies resulted in that more risky and less established banks could participate.

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.[3]" 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. The summary statistics on these data is provided in Table B1 in the appendix.

As regards data selection criteria, I first ranked over a 1000 Russian banks by their average asset size and picked top 350 banks. Secondly, using the CBR reports I

[3]This date set was recently used by Chernykh and Cole (2011) for studying the impact of deposit insurance introduction on bank lending. Other studies that use these data are Fungacova and Solanko (2008) and Berger *et al.* (2010).

have identified banks that have a licenses to conduct transactions with non-residents and had non-zero liabilities with respect to non-residents over 1 year prior to the sudden stop. A total of 174 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 (38 banks), while the second sub-sample includes banks that only borrowed from foreign banks through the interbank market (136 banks). Summary statistics for some of the main capital ratios is provided in the appendix in Table C2.

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.

For the fisrt sub-sample of 38 banks that issued Eurobonds or Syndicated loans prior to September 2008 I use Bloomberg and Cbonds data on debt structure and calculate a *Cumulative maturity flow of Eurobonds & Syndicated loans over 1 year /* $Assets_{t_0}$where 1 year covers a period after the sudden stop (Sep. 2008 -Aug. 2009) and $Assets_{t_0}$ are taken at the beginning of the period (September 2008). Banks with this ratio of more than 3% are allocated to the TREATMENT group (17 banks), while all other banks are allocated to a CONTROL group (21 banks). The upper panel of Table C1 in the appendix reports averages for both groups and the mean-comparison t-tests for difference at a point of time and for difference-in-difference.

As can be seen from the second column of the table the total maturity outflow of Eurobonds and syndicated loans was about 3.3% of assets for both treated and control groups in 1 year before the sudden stop. However, in 1 year after the sudden stop the average size of outflow for treated banks was 9.4% of assets while for control group 2.7%.

The second sub-sample of banks that borrowed from foreign banks through the interbank money market includes 136 banks. Since the flow of funds under debt obligations is not easily identifiable for this sub-sample I pursue another strategy to define financially constrained and unconstrained banks. Using monthly balance-sheet data I calculate *Net long-term borrowing from Non-resident banks/Assets* ratio for each banks in each month where *Net interbank loans* from non-resident banks with more than 3 month maturity are used. If during 1 year period prior to the sudden stop the average ratio exceeded 2% I allocate such bank to a TREATMENT group (26 banks). I use propensity score matching estimator and observable characteristics of banks to form a CONTROL group (26 banks) from the rest of the population[4]. As can be seen form the lower part of Table C1 the net long-term liability of treated banks to non-resident banks was 7.4% of their assets on average in a year before the sudden stop, while for the control group this ratio represented only 0.8% of assets. By construction one would expect the treated group of banks to be more financially constrained relative to the control group in case of a sudden stop of external financing.

In order for a natural experiment to be successful it is very important that treated and control subjects are not significantly different before the experiment along characteristics other than those that allocate them into treated and control groups (e.g., Gruber (1994) Almeida *et al.* (2009), Oosterbeek *et al.* (2010)). Table C2 in the appendix reports various asset and liability ratios for all subgroups of banks during 1 year before the sudden stop. As can be seen from mean-comparison t-test the difference between groups is not significantly different between treated and control groups for all cases except one. For smaller banks that only borrowed from non-residents through the interbank market the total lending to private entrepreneurs represented 4.5% of assets for the treated and only 1.1% of assets for the control groups.

[4]The logit single nearest-neighbour specification without replacement is used for calculating the propensity score and Deposit/Asset, Credit to non-banks/Assets, Overdue credit/Assets ratios are used as observable characteristics for matching.

4.2 Methodology

Using the difference-in-difference (D-in-D) 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 al.* (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 1 year time period *after* the sudden stop (September 2008 to August 2009) and zero if it belongs to the 1 year time period *before* the stop (September 2007 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 which are: a dummy variables for state-controlled banks, a dummy variable for banks affiliated with the state enterprises (e.g. railroads), a size of a bank's assets relative the largest state-controlled bank and deposits-to-assets ratio. These variables are standard for banking studies and among others are used in Gan (2007), Ivashina and Scharfstein (2010) and Chernykh and Cole (2011).

$Y_{i\tau}$ - represents three main groups of outcome variables, which were motivated in the introduction: 1) cumulative net borrowing from the CBR in the period before and after the sudden stop; 2) cumulative volume of credit extended to different types of private borrowers in the period before and after the sudden stop; 3) other important bank's balance-sheet variables which are used for robustness check of the main results.

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 private sector.

In order to account for the small-sample bias, I report bootstrapped standard errors for all specifications as suggested by Horowitz (2004).

5 Empirical Results

5.1 Net Borrowing from the Central Bank

The Treated banks in Panel A are those that within 1 year after a sudden stop were scheduled to repay on their Eurobond and syndicated loans a value which on average represented 9.4 % of their assets and which was 6.5% higher relative to the unconstrained banks form the control group.

As one can see from Panel A in Table 1 the value of long-term credit that financially constrained banks received from the CBR during 1 year period after a sudden stop was 12% of their assets, which was 4.7% higher relative to unconstrained banks[5].

The Treated banks in Panel B are defined as those which in a pre-crisis period were by 7% on average more dependent on external financing from non-resident banks than the control banks. Results form Panel B in Table 1 indicate that the treatment group of banks in this category did not bid significantly more for the CBR funding relative to the control group.

[Table 1 about here]

The results demonstrate that banks that entered international capital markets and 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. 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.

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

5.2 Lending to the private sector

5.2.1 Lending to non-financial corporate borrowers

I apply the same empirical strategy to another set of outcome variables - lending to different types of private borrowers.

[Table 2 about here]

The first variable I use is lending to non-financial corporate borrowers. As one can see from summary statistics depending on a sub-sample this variable accounts for 40-50% of banks' total assets and represents the largest part of their business. The estimation results in the second column of Table 2 demonstrate that there was a strong credit expansion during 1 year prior to a sudden stop across all groups of banks, which ranged from 11.5% to 19.8% of their initial assets in September 2007. In a year after a sudden stop the growth became negative and depending on a group was between 1.6% - 4.2% of banks' pre-crisis assets. However, as can be seen from the last row in each panel the D-in-D estimates are not statistically significant, which suggests that the decline in lending to corporate borrowers was not different across treatment and control group of banks for both sub-samples. For Panel A which represents large banks that borrowed trough international capital markets and received significantly more help from the CBR the D-in-D coefficient is 1.5% and has a positive sign. This result could be interpreted as a tentative evidence that the CBR liquidity infusions helped financially constrained banks to sustain lending to corporate borrowers at a level slightly higher relative to unconstrained banks.

One should keep in mind that even though during the crisis the demand for new credit declines banks often restructure the existing corporate debt and companies often draw down the existing credit lines at banks. As a result of these activities bank's balance sheet data could even indicate a credit expansion during the crisis. (This phenomenon is explained in Ivashina and Scharfstein (2010)). Anecdotal evidence suggests that Russian banks also did a lot of restructuring of the existing debt during the crisis period. However, there should be no predetermined bias across treated and control groups of banks that suggests that one group was more involved in debt restructuring than the other, even if this effect existed it should be absorbed by dummies for state-controlled and state affiliated banks.

5.2.2 Lending to private entrepreneurs

The results for total lending to private entrepreneurs provide a uniform picture for both sub-samples of banks. As can be seen from the second column in Panels A and B of Table 3 the credit expansion to private entrepreneurs in 1 year before the sudden stop was higher for both types of treated banks relative to control banks. The difference at a point of time between the groups is not statistically significant before the crisis, which validates the further analysis.

[Table 3 about here]

In one year after the crisis the treated banks cut their lending more and what is more important the D-in-D coefficients are negative for both sub-samples and are highly statistically significant. 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 private entrepreneurs. This cut was about 1.5% higher for treated banks relative to control banks.

For corporate borrowers the bank-firm relationship must be much stronger than for private entrepreneurs. This means that banks would have much less incentive to restructure the existing debt and roll it over for entrepreneurs than for corporate borrowers. In this environment one would expect that total change in lending to entrepreneurs during the crisis largely represents change (decline) in a new lending.

The significantly negative estimate of the D-in-D coefficient in Table 3 implies that financial frictions were still present and constrained banks decreased new lending to entrepreneurs significantly more than unconstrained banks even though they received more liquidity infusions from the central bank. In other words, an opportunity to substitute foreign liabilities for the CBR funding did not affect bank's lending decisions with respect to lending to this type of borrowers.

5.2.3 Lending to individuals

The next important type of private borrowers covers all private individuals. The balance sheet data on Russian banks does not distinguish between types of individual loans that were granted by banks, which means that the variable used in my study provides an aggregate measure of consumer loans, auto loans, mortgages and various other types of credit to individual borrowers.

The D-in-D estimates for this type of borrowers should be taken with the grain of salt. As can be seen from the second column of Table 4 in 1 year before the sudden stop the estimates of the difference between treated and control groups at a point of time are statistically significant. This undermines the logic of a natural experiment because the D-in-D coefficient is driven by pre-determined variation in the outcome variable.

[Table 4 about here]

As can be seen from Panel A of Table 4 for a sub-sample of large banks in a pre-crisis year the control group of banks on average increased their lending to individuals by 10% of their initial assets. For smaller banks in Panel B the pre-crisis results are the opposite, it is the treated group of banks increased their lending to individuals by 10% of their assets. This means that banks that have a stronger focus on lending to individuals were randomly distributed between treatment an control groups for sub-samples of large and small banks.

The statistically significant D-in-D estimates for change in lending to individuals give us the following interpretation. A group of banks which significantly more increased lending to private individuals in a period before the crisis also significantly more cut lending to individuals after the crisis. For larger banks it is the control group of banks that increased lending in 1 year before crisis by 9.5% of their initial assets and cut their lending in a year after the crisis by 7.2% of their assets. For smaller banks the treated group increased lending by 10.1% in a pre-crisis year and cut lending by 3.2% in a post-crisis year. The absolute size of D-in-D estimates for both sub-samples are about 7.8% of assets.

This result means that irrespective of constraints on foreign borrowing whichever group of banks conducted significantly more expansionary lending policy on a consumer credit market this group also more aggressively cut their lending to this type of borrowers.

5.3 Other Important Bank Variables Before and After the Sudden Stop

5.3.1 Overdue credit (Non-performing loans)

The bank-level data reports credit which is overdue for borrowers under different types of ownership structure. I calculate a measure of total overdue credit on bank's accounts which includes overdue credit by: private companies, individuals, state-owned enterprises and non-resident companies. I also add value of defaulted short-term promissory notes issued by companies and held by banks.

[Table 5 about here]

The estimation results in Table 5 indicate that growth of overdue credit in 1 year before the crisis was negative which means that the proportion of non-performing loans on banks accounts actually declined before the crisis. In a year after the crisis the growth of overdue credit was positive and varied form 2% to 3% of banks' initial assets.

One of the main concerns in banking studies is a sample-selection bias which could arise from the fact that banks that perform poorly during the crisis could have lent to low-quality firms before the crisis. Depending on data availability researchers address this issue in different ways. (e.g., Gan (1007), Khwaja and Mian (2008), Giannetti and Simonov (2010)). The fact that estimates of the difference in overdue credit between bank groups at a point of time and D-in-D coefficients are insignificant suggests that sample-selection bias is unlikely to be a major problem in my study. The growth of non-performing loans after the crisis was almost identical for treated and control groups of banks which means that there was no pre-determined variation in terms of credit quality of bank's clients across groups before the crisis.

5.3.2 Total individual deposits

Another indicator of sample-selection bias is a dynamics of individual deposits held in banks. If there is a pre-determined variation in credit quality of banks themselves than during the crisis one would expect a significantly stronger decline in deposits held by individuals in a weaker group of banks.

[Table 6 about here]

The estimation results reported in Table 6 indicate that there was an overall decline in deposits held in banks ranging from 4 to 7.3% of banks' initial assets but there was no significant variation across all groups of banks. This evidence suggests that banks are equally dispersed in terms of their quality across treatment and control groups of banks for both sub-samples.

5.3.3 Investment in market securities

Total investment in market securities includes government and non-government bonds as well as equities. As can be seen from the summary statistics in Table B3 investment into securities in 1 year before the crisis on average represented 8-10% of their total assets.

[Table 7 about here]

Results reported in Panel B of Table 6 demonstrate that there was no change in growth of investment in securities through time for both groups of banks. In a period before the sudden stop Treated bank increased their investment by 1.6% of their initial assets while control banks by 2.7 %. In a post crisis period these growth rates were unchanged.

We observe very different results in Panel A of the table for treated banks that entered Eurobonds and Syndicated loans. Relative to control group they significantly increased their holding of market securities over 1 year after the sudden stop. The D-in-D coefficient is 7.3% and statistically significant. This result is consistent with the fact that treated bank also significantly increased net borrowing from the CBR as was reported in Table 1. Because most of the CBR credit facilities require collateral the growth of investment in market securities by this group of banks suggests that they used these securities as collateral for obtaining the CBR credit.

5.3.4 Total net borrowing from non-resident banks

Figures A3-A4 in the appendix show that the Central Bank of Russia was conducting quantitative easing through two channels. On the one hand it injected ruble liquidity into domestic banks through its credit facilities and on the other hand it was selling its international foreign reserves to banks. Because banks keep most of their foreign currency holdings in non-resident banks I calculate net position of each bank against

non-resident banks. Deposits of all maturities held by Russian banks in non-resident banks enter with a positive sign, while liabilities of all maturities to non-resident banks enter with a negative sign.

[Table 8 about here]

Let me start with interpretation of results for smaller banks in Panel B of Table 8. Treated banks in this sub-sample have higher ratio of long-term liabilities to non-resident banks in a pre-crisis year by construction. The total growth of net liabilities to non-resident banks for them in a pre-crisis period was 9% of the initial assets. In a post crisis period change of net liabilities for this group of banks has a positive sign. The positive growth rate in a post-crisis period is rather small (0.7%) but nevertheless this indicates that banks that strongly relied on foreign borrowing before the crisis became net lenders to non-resident banks after the crisis.

Results for larger banks in Panel A of the Table 8 are not significant for D-in-D estimates but provide evidence on the overal behavior of banks. In a pre-crisis period the growth of net liabilities of this sub-sample ranged from 5 to 8 % of their initial assets. After the crisis and quantitative easining by the CBR both groups of banks become net lenders to non-resident banks. The net position of treated banks in non-resident accounts grew by 7.5% of their initial assets, while growth for the control group was 3.5%. These results demonstrate that banks used the CBR ruble infusions to obtain USD which were accumulated on banks' foreign accounts.

6 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 examine how lending to different types of private borrowers varied across constrained and non-constrained banks. The estimation results for non-financial corporate borrowers demonstrate that there was a strong credit expansion during 1 year prior to a sudden stop across all groups of banks. The estimate of the D-in-D coefficient for large banks that borrowed trough international capital markets has a positive sign but is not statistically significant. This result could be interpreted as a tentative evidence that the CBR liquidity infusions helped financially constrained banks to sustain lending to corporate borrowers at the same level as unconstrained banks.

The most pronounced results are found for lending to private entrepreneurs. The estimates of D-in-D coefficients are negative for both sub-samples of large and small banks and are highly statistically significant. 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 private entrepreneurs. In other words, an opportunity to substitute foreign liabilities for the CBR funding did not affect bank's lending decisions with respect to lending to this type of borrowers. Lending to individuals also exhibited an interesting variation after the sudden stop. I find that irrespective of constraints on foreign borrowing whichever group of banks conducted significantly more expansionary lending policy to individuals this group also more aggressively cut lending to this segment of the credit market after the crisis.

The last set of results supports my key findings. Financially constrained banks that entered Eurobonds and Syndicated loans significantly increased their holding of market securities over 1 year after the sudden stop relative to the control group. This result is consistent with the fact that this group of bank also significantly increased net borrowing from the CBR. Because most of the CBR credit facilities require collateral the growth of investment in market securities by this group of banks suggests that they used these securities as collateral for obtaining the CBR credit. Lastly, I find that in 1 year after the sudden stop and a policy of quantitative easining by the CBR all groups of banks become net lenders to non-resident banks. Banks used the CBR ruble liquidity infusions to acquire foreign currency and accumulated these holdings on their accounts in foreign banks.

7 Appendix A. Sudden Stop and the CBR Liquidity Injections

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

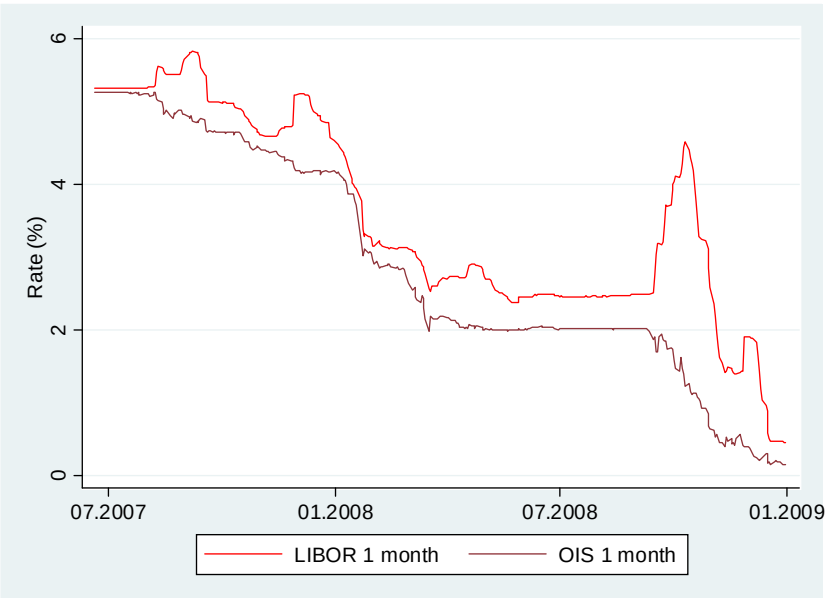


Figure A2. Dynamics of sovereign CDS spreads for Russia and Mexico

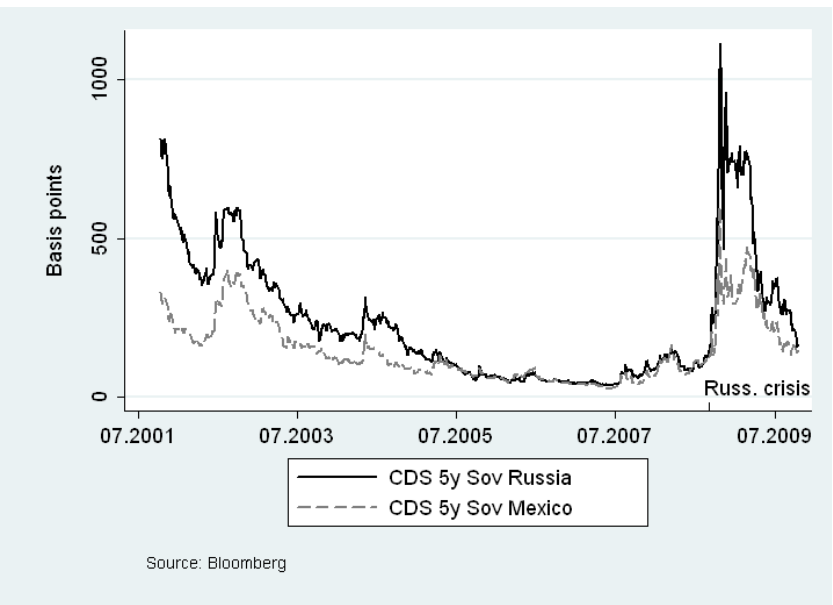


Figure A3. Average monthly level of official foreign exchange reserves of the Central Bank of Russia

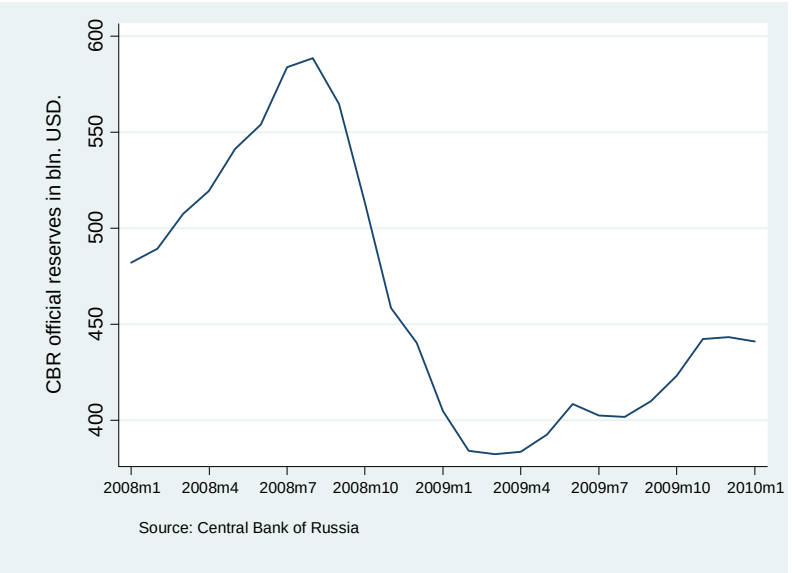
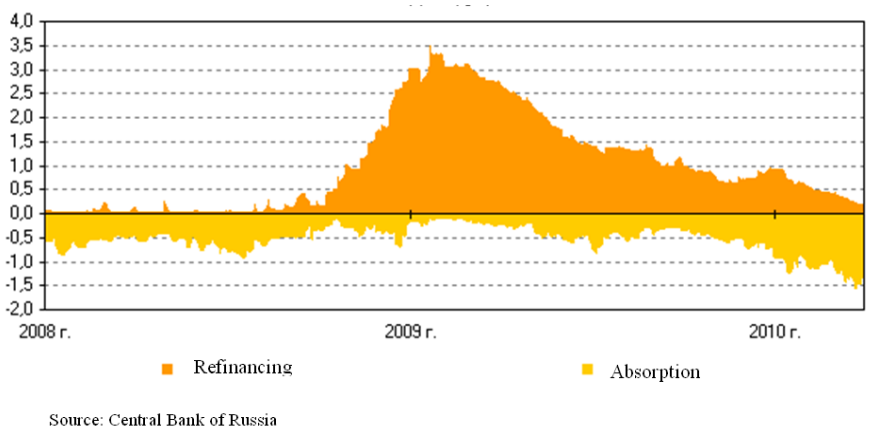


Figure A4. Refinancing by the Central Bank of Russia, in trillions RUB



Note: The total amount of refinancing includes the following credit facilities: 1) Intra-day and overnight credit; 2) repo auctions (average duration 3 days); 3) Lombard credit against bonds; 4) credit against "non-market" assets; 5) uncollaterized credit auctions

Figure A5. Total amount of credit provided to the banking sector by the Central Bank of Russia through Lombard credit facility

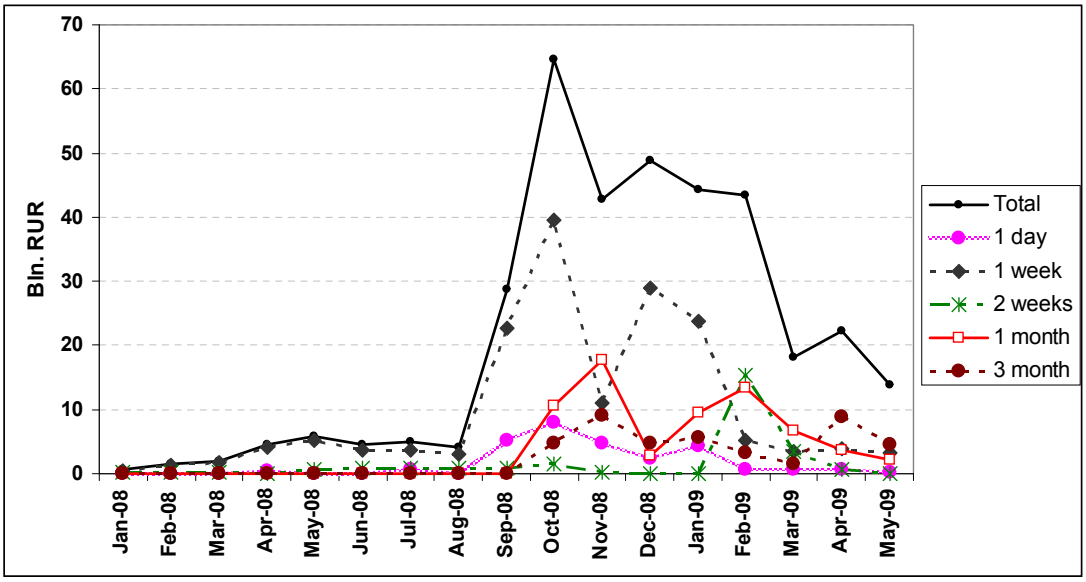


Figure A6. Total amount of credit provided to the banking sector by the Central Bank of Russia through Credit against "non-market" assets facility

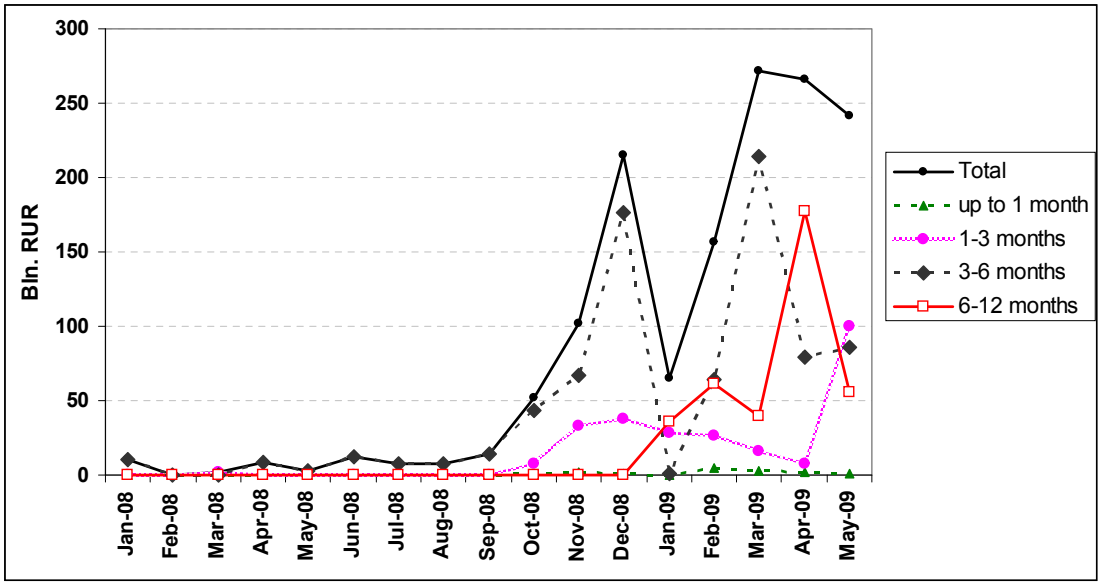
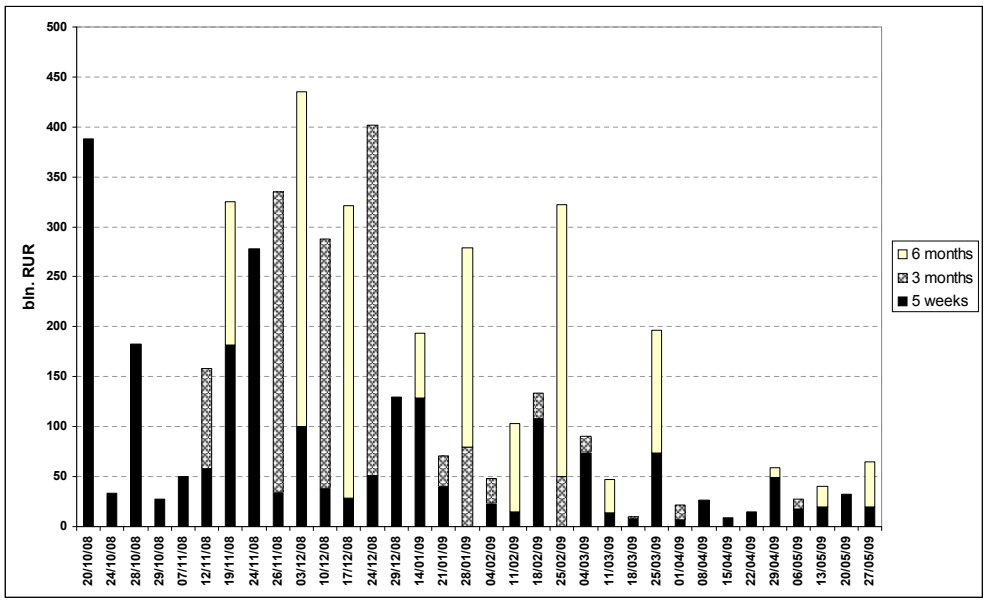


Figure A7. Total amount of credit provided to the banking sector by the Central Bank of Russia through uncollaterized credit auctions



8 Appendix B. Foreign Borrowing by Russian Banks

Table B1. 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	

Figure B1. Aggregate value of banks' liabilities from Eurobonds and Syndicated loans

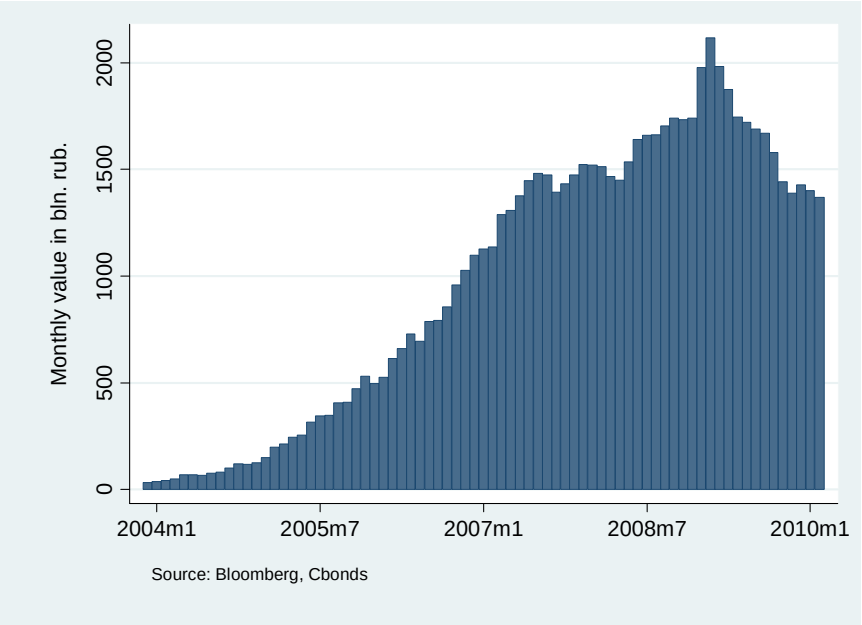
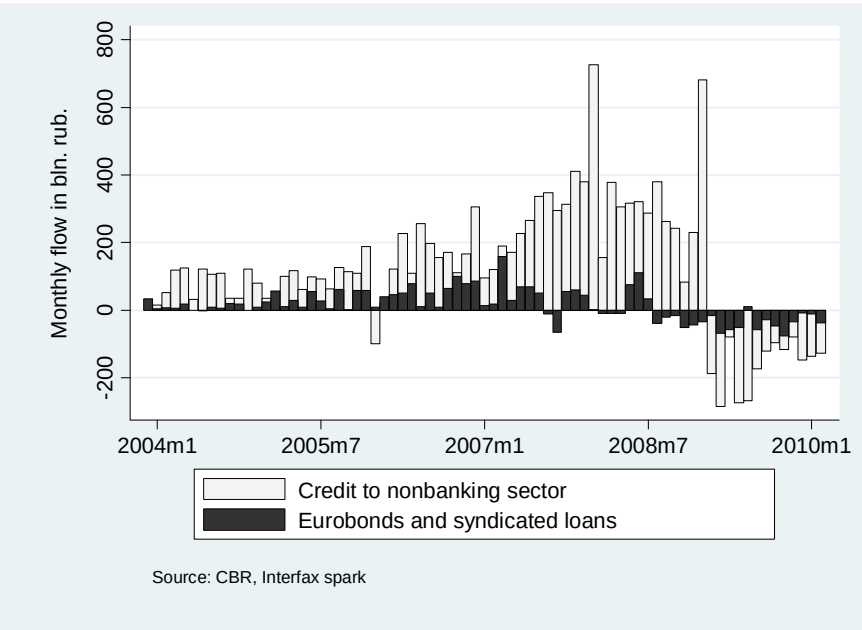


Figure B2. Aggregate monthly flow of funds for a sample of banks that used foreign capital markets borrowing



9 Appendix C. Identification of Treated and Control Banks

Table C1. Identification Strategy for Banks that Issued Eurobonds or Syndicated Loans

I use a sample of 38 banks without foreign-control that issued Eurobonds or Syndicated loans prior to Sep. 2008 and calculate a *Cumulative maturity flow of Eurobonds & Syndicated loans over 1 year/Assets*$_{t_0}$ where 1 year covers periods before the sudden stop (Sep. 2007- Aug. 2008) and 1 year after (Sep. 2008 -Aug. 2009) and $Assets_{t_0}$ are taken at the beginning of each period (Sep. 2007 and Sep. 2008 respectively). Banks with this ratio of more than 3% are allocated to the TREATMENT group (17 banks), while all other banks are allocated to a CONTROL group (21 banks). The table reports averages for both groups and the mean-comparison t-tests for difference at a point of time and for difference-in-difference

Cumulative maturity flow of Eurobonds & Syndicated loans over 1 year/Assets$_{t_0}$		
	1 Year Before	1 Year After
Treated banks	-0.034 (0.010)	-0.094 (0.011)
Control banks	-0.033 (0.011)	-0.027 (0.010)
Difference at a point of time	-0.001 (0.015)	-0.066*** (0.021)
Difference-in-Difference		**-0.065***** **(0.021)**

Identification Strategy for Banks that Only Borrowed from the International Interbank Market

I use a sample of 136 banks without foreign-control that did not issue Eurobonds or Syndicated loans but borrowed from foreign banks through the interbank money market prior to Sep. 2008 and calculate *Net long-term borrowing from Non-resident banks/Assets* ratio for each banks in each month where Net interbank loans from Non-resident banks with more than 3 month maturity are used. If during 1 year period prior to the crisis the average ratio exceeded 2% I allocate such bank to a TREATMENT group (26 banks). I use propensity score matching estimator and observable characteristics of banks to form a CONTROL group (26 banks) from the rest of the population.

Net long-term (from 3 months maturity) borrowing from Non-resident banks/Assets		
	1 Year Before	1 Year After
Treated banks	-0.074 (0.013)	0.001 (0.014)
Control banks	-0.008 (0.013)	0.000 (0.013)
Difference at a point of time	-0.067*** (0.018)	0.001 (0.021)
Difference-in-Difference		**0.068***** **(0.026)**

Table C2. Summary Statistics for Treated and Control banks during the Pre-crisis Year (September 2007-August 2008)

	Banks that issued Eurobonds or Syndicated loans			Banks that borrowed at international interbank market		
	Treated	**Control**	**t-stat**[a]	**Treated**	**Control**	**t-stat**[a]
Log assets	18.761	18.743	0.044	16.391	16.217	-0.766
Assets/ Sberbank assets[b]	0.040	0.038	-0.192	0.003	0.003	-0.793
Liability ratios[c]						
Deposit/Assets	-0.187	-0.225	0.907	-0.239	-0.194	1.004
Eurobonds/Assets	-0.111	-0.107	0.106			
Net non-resident interbank /Assets	-0.080	-0.096	0.471	-0.049	-0.004	3.495***
Net domestic interbank /Assets	-0.002	-0.015	1.073	-0.026	-0.024	0.090
Net CBR credit/ Assets	-0.002	-0.001	0.506	-0.001	-0.001	0.163
Asset ratios[c]						
Total credit to private companies/Assets	0.437	0.405	-0.663	0.427	0.499	1.510
Total credit to private entrepreneurs/Assets	0.017	0.017	-0.051	0.045	0.011	-2.369**
Total credit to individuals/Assets	0.148	0.220	1.619	0.150	0.112	-0.956
Total overdue credit/ Assets	0.012	0.019	0.619	0.015	0.016	0.232
Total holdings of securities /Assets	0.086	0.082	-0.581	0.096	0.099	0.197
N.banks/N. months	17/12	21/12		26/12	26/12	

Note: This tables reports 1 year averages for all sub-samples used in the study.
[a] Mean-comparison t-tests for differnce between treatment and control groups.
[b] Size of bank's assets relative to the largest state-owned bank whose share of deposits in 2008 was 51.5% (see Cole and Chernykh (2011)). Sberbank itself is excluded from this statistic.
[c] For Liability ratios all liabilitiy agregates are taken with a negative sign, for Asset ratios all asset agregates are taken with a positive sign

10 Appendix D. Empirical Results

Table 1. Difference-in-Difference Test for Net Long-Term Borrowing from the Central Bank Before and After the Sudden Stop

This table presents estimates of the average change of net long-term borrowing from the CBR through its anti-crisis credit facilities over 1 year relative to the bank's assets at the beginning of the year, where CBR deposit/loans with more than 3 month maturity are used and $Assets_{t_0}$ are taken at the beginning of each period (Sep. 2007 and Sep. 2008 respectively). The D-in-D specification includes dummies for state-owned and state-controlled banks, bank's asset size relative to Sberbank and Deposit/Asset ratio. The coefficients for these covariates are not reported in the table. All foreign controlled banks are excluded from the analysis.

ΔNet long-term borrowing from the CBR/Assets$_{t_0}$

Panel A. Sample of banks that issued Eurobonds or Syndicated loans

	1 Year Before	1 Year After
Treated banks	-0.015 (0.013[a])	-0.119 (0.033)
Control banks	-0.020 (0.015)	-0.077 (0.019)
Difference at a point of time	0.005 (0.007)	-0.042* (0.025)
Difference-in-Difference		**-0.047*** **(0.028)**

Panel B. Sample of banks that borrowed from the interbank market

	1 Year Before	1 Year After
Treated banks	-0.001 (0.008)	-0.036 (0.012)
Control banks	0.001 (0.006)	-0.049 (0.015)
Difference at a point of time	-0.002 (0.004)	0.014 (0.016)
Difference-in-Difference		**0.016** **(0.016)**

Note: * Denotes significance at 10%;** Denotes significance at 5%
[a] All standard errors are bootstrapped with 150 replications

Table 2. Difference-in-Difference Test for Total Lending to Non-financial Corporate Borrowers Before and After the Sudden Stop

This table presents estimates of the average change of total lending to corporate borrowers over 1 year relative to the bank's assets at the beginning of the year, where lending to non-financial private companies is used and $Assets_{t_0}$ are taken at the beginning of each period (Sep. 2007 and Sep. 2008 respectively). The D-in-D specification includes dummies for state-owned and state-controlled banks, bank's asset size relative to Sberbank and Deposit/Asset ratio. The coefficients for these covariates are not reported in the table. All foreign controlled banks are excluded from the analysis.

ΔTotal lending to companies/Assets$_{t_0}$

Panel A. Sample of banks that issued Eurobonds or Syndicated loans

	1 Year Before	1 Year After
Treated banks	0.125 (0.029)	-0.016 (0.052)
Control banks	0.131 (0.029)	-0.026 (0.035)
Difference at a point of time	-0.005 (0.042)	0.010 (0.040)
Difference-in-Difference		**0.015** **(0.061)**

Panel B. Sample of banks that borrowed from the interbank market

	1 Year Before	1 Year After
Treated banks	0.198 (0.120)	-0.042 (0.061)
Control banks	0.114 (0.042)	-0.019 (0.044)
Difference at a point of time	0.085 (0.118)	-0.023 (0.058)
Difference-in-Difference		**-0.107** **(0.124)**

Note: * Denotes significance at 10%;** Denotes significance at 5%
[a] All standard errors are bootstrapped with 150 replications

Table 3. Difference-in-Difference Test for Total Lending to Private Entrepreneurs Before and After the Sudden Stop

This table presents estimates of the average change of total lending to private entrepreneurs over 1 year relative to the bank's assets at the beginning of the year, where lending to individual entrepreneurs is used and $Assets_{t_0}$ are taken at the beginning of each period (Sep. 2007 and Sep. 2008 respectively). The D-in-D specification includes dummies for state-owned and state-controlled banks, bank's asset size relative to Sberbank and Deposit/Asset ratio. The coefficients for these covariates are not reported in the table. All foreign controlled banks are excluded from the analysis.

ΔTotal lending to entrepreneurs/Assets$_{t_0}$

Panel A. Sample of banks that issued Eurobonds or Syndicated loans

	1 Year Before	1 Year After
Treated banks	0.013 (0.004)	-0.007 (0.003)
Control banks	0.004 (0.005)	-0.000 (0.004)
Difference at a point of time	0.008 (0.005)	-0.007** (0.004)
Difference-in-Difference		**-0.016***** **(0.006)**

Panel B. Sample of banks that borrowed from the interbank market

	1 Year Before	1 Year After
Treated banks	0.014 (0.005)	-0.009 (0.004)
Control banks	0.005 (0.004)	-0.004 (0.003)
Difference at a point of time	0.009 (0.006)	-0.006 (0.004)
Difference-in-Difference		**-0.015***** **(0.007)**

Note: * Denotes significance at 10%;** Denotes significance at 5%
[a] All standard errors are bootstrapped with 150 replications

Table 4. Difference-in-Difference Test for Total Lending to Individuals Before and After the Sudden Stop

This table presents estimates of the average change of total lending to private individuals over 1 year relative to the bank's assets at the beginning of the year, where lending to private individual borrowers is used and $Assets_{t_0}$ are taken at the beginning of each period (Sep. 2007 and Sep. 2008 respectively). The D-in-D specification includes dummies for state-owned and state-controlled banks, bank's asset size relative to Sberbank and Deposit/Asset ratio. The coefficients for these covariates are not reported in the table. All foreign controlled banks are excluded from the analysis.

ΔTotal lending to individuals/Assets$_{t_0}$

Panel A. Sample of banks that issued Eurobonds or Syndicated loans

	1 Year Before	1 Year After
Treated banks	0.031 (0.028)	-0.057 (0.029)
Control banks	0.095 (0.037)	-0.072 (0.034)
Difference at a point of time	-0.063* (0.033)	0.015 (0.020)
Difference-in-Difference		**0.079**** **(0.035)**

Panel B. Sample of banks that borrowed from the interbank market

	1 Year Before	1 Year After
Treated banks	0.101 (0.034)	-0.032 (0.027)
Control banks	0.038 (0.016)	-0.017 (0.020)
Difference at a point of time	0.063** (0.031)	-0.014 (0.019)
Difference-in-Difference		**-0.077**** **(0.041)**

Note: * Denotes significance at 10%;** Denotes significance at 5%
[a] All standard errors are bootstrapped with 150 replications

Table 5. Difference-in-Difference Test for Total Overdue Credit Before and After the Sudden Stop

This table presents estimates of the average total overdue credit over 1 year relative to the bank's assets at the beginning of the year, where overdue credit includes credits to companies under all types of ownership structure as well as defaulted short-term promissory notes and $Assets_{t_0}$ are taken at the beginning of each period (Sep. 2007 and Sep. 2008 respectively). The D-in-D specification includes dummies for state-owned and state-controlled banks, bank's asset size relative to Sberbank and Deposit/Asset ratio. The coefficients for these covariates are not reported in the table. All foreign controlled banks are excluded from the analysis.

ΔTotal overdue credit/Assets$_{t_0}$

Panel A. Sample of banks that issued Eurobonds or Syndicated loans

	1 Year Before	1 Year After
Treated banks	-0.002 (0.007)	0.031 (0.010)
Control banks	-0.011 (0.016)	0.029 (0.016)
Difference at a point of time	0.009 (0.012)	0.002 (0.012)
Difference-in-Difference		**-0.006** **(0.015)**

Panel B. Sample of banks that borrowed from the interbank market

	1 Year Before	1 Year After
Treated banks	-0.008 (0.007)	0.018 (0.005)
Control banks	-0.003 (0.003)	0.023 (0.007)
Difference at a point of time	-0.005 (0.006)	-0.004 (0.007)
Difference-in-Difference		**0.001** **(0.008)**

Note: * Denotes significance at 10%;** Denotes significance at 5%
[a] All standard errors are bootstrapped with 150 replications

Table 6. Difference-in-Difference Test for Total Individual Deposits Before and After the Sudden Stop

This table presents estimates of the average change of banks' total deposits over 1 year relative to the bank's assets at the beginning of the year, where deposits held by private individuals in banks are included and $Assets_{t_0}$ are taken at the beginning of each period (Sep. 2007 and Sep. 2008 respectively). The D-in-D specification includes dummies for state-owned and state-controlled banks, bank's asset size relative to Sberbank and Deposit/Asset ratio. The coefficients for these covariates are not reported in the table. All foreign controlled banks are excluded from the analysis.

ΔTotal deposits/Assets$_{t_0}$

Panel A. Sample of banks that issued Eurobonds or Syndicated loans

	1 Year Before	1 Year After
Treated banks	-0.001 (0.020)	-0.053 (0.022)
Control banks	0.003 (0.020)	-0.073 (0.022)
Difference at a point of time	-0.003 (0.025)	0.020 (0.022)
Difference-in-Difference		**0.023** **(0.033)**

Panel B. Sample of banks that borrowed from the interbank market

	1 Year Before	1 Year After
Treated banks	0.035 (0.018)	-0.050 (0.019)
Control banks	0.008 (0.015)	-0.040 (0.023)
Difference at a point of time	0.027 (0.020)	-0.010 (0.028)
Difference-in-Difference		**-0.038** **(0.033)**

Note: * Denotes significance at 10%;** Denotes significance at 5%
[a] All standard errors are bootstrapped with 150 replications

Table 7. Difference-in-Difference Test for Total Investment into Securities Before and After the Sudden Stop

This table presents estimates of the average change of total investment into securities over 1 year relative to the bank's assets at the beginning of the year, where securities holdings include government and non-government bonds as well as equities and $Assets_{t_0}$ are taken at the beginning of each period (Sep. 2007 and Sep. 2008 respectively). The D-in-D specification includes dummies for state-owned and state-controlled banks, bank's asset size relative to Sberbank and Deposit/Asset ratio. The coefficients for these covariates are not reported in the table. All foreign controlled banks are excluded from the analysis.

ΔTotal investment into securities/Assets$_{t_0}$

Panel A. Sample of banks that issued Eurobonds or Syndicated loans

	1 Year Before	1 Year After
Treated banks	-0.007 (0.020)	0.067 (0.024)
Control banks	0.027 (0.014)	0.028 (0.016)
Difference at a point of time	-0.034 (0.023)	0.039 (0.029)
Difference-in-Difference		**0.073**** **(0.037)**

Panel B. Sample of banks that borrowed from the interbank market

	1 Year Before	1 Year After
Treated banks	0.016 (0.014)	0.015 (0.013)
Control banks	0.027 (0.023)	0.027 (0.021)
Difference at a point of time	-0.012 (0.024)	-0.012 (0.021)
Difference-in-Difference		**-0.000** **(0.032)**

Note: * Denotes significance at 10%;** Denotes significance at 5%
[a] All standard errors are bootstrapped with 150 replications

Table 8. Difference-in-Difference Test for Net Lending(+)/Borrowing (-) at Interbank Market with Non-resident Banks Before and After the Sudden Stop

This table presents estimates of the average change of banks' net position at interbank market with non-resident banks over 1 year relative to the bank's assets at the beginning of the year, where net positions is calculates as bank's deposits in non-resident banks minus bank's liabilities and $Assets_{t_0}$ are taken at the beginning of each period (Sep. 2007 and Sep. 2008 respectively). The D-in-D specification includes dummies for state-owned and state-controlled banks, bank's asset size relative to Sberbank and Deposit/Asset ratio. The coefficients for these covariates are not reported in the table. All foreign controlled banks are excluded from the analysis.

ΔNet total non-resid. interbank money market position/Assets$_{t_0}$

Panel A. Sample of banks that issued Eurobonds or Syndicated loans

	1 Year Before	1 Year After
Treated banks	-0.052 (0.034)	0.075 (0.030)
Control banks	-0.078 (0.053)	0.035 (0.030)
Difference at a point of time	0.026 (0.048)	0.040 (0.028)
Difference-in-Difference		**0.013** **(0.054)**

Panel B. Sample of banks that borrowed from the interbank market

	1 Year Before	1 Year After
Treated banks	-0.088 (0.033)	0.007 (0.019)
Control banks	-0.014 (0.015)	-0.005 (0.013)
Difference at a point of time	-0.074** (0.029)	0.013 (0.015)
Difference-in-Difference		**0.087***** **(0.033)**

Note: * Denotes significance at 10%;** Denotes significance at 5%
[a] All standard errors are bootstrapped with 150 replications

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