

# TRACING THE IMPACT OF CENTRAL BANK LIQUIDITY INFUSIONS ON FINANCIALLY CONSTRAINED BANKS: EVIDENCE FROM A NATURAL EXPERIMENT

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## 1. Introduction

When government-managed capital reallocations benefiting a particular group of banks occur, academics and policy makers often raise concerns about the necessity and consequences of such government interventions. Among others, Dell'Ariccia et al. (2008) and Kroszner et al. (2007) have dealt with this issue. They have demonstrated that industrial sectors that are more financially dependent on banks perform significantly worse than others during banking crises and that the magnitude of the real effect on these sectors caused by financial constraints is non-trivial. This paper seeks to explore this issue further and addresses the following questions: How effective are certain forms of government assistance in terms of distributing funds to distressed banks? Do government interventions help distressed banks to maintain lending to the real sector?

I investigate the effectiveness of government liquidity infusions into the banking system during financial distress. I look at the experience of the Russian banking system during the recent global financial crisis. Many Russian banks were heavily dependent on foreign borrowing prior to the crisis and were therefore directly affected by the sudden stop of external financing caused by the collapse of the Lehman Brothers in September 2008. In the aftermath of this event, the Russian Central Bank (CBR) allocated substantial financial assistance to domestic banks. Drawing on insights of Almeida et al. (2009) I use predetermined variation of foreign debt maturity across Russian banks in a period after the Lehman Brothers bankruptcy and identify a group of banks that were disproportionately affected by the sudden collapse of external financing due to inability to roll-over their foreign debt. Since decisions on long-term borrowing

were made *ex ante* and the crisis came unexpectedly, banks with a large fraction of foreign debt maturing during the shut down of the capital markets were more constrained than otherwise similar banks whose debt matured outside of the crisis event window. In a natural experiment setup, I compare affected and unaffected banks' participation in government bailout programs and their lending policies to different types of borrowers.

How significant was external financing for Russian banks? According to the CBR, foreign liabilities of the Russian banking sector accounted for 35% of country's total foreign debt in 2008. The growing financial globalization in recent decades has made it attractive for firms and banks from countries with less liquid capital markets to issue foreign currency debt in international capital markets. For example, using the comprehensive data on international syndicated loans, De Haas and van Horen (2008) report that Russian syndicated borrowing represented 33% of the global total in 2005–2008, when the US and the Euro-15 countries are excluded. After the capital account liberalization in July 2006, Russian banks increasingly borrowed in foreign currency from international capital markets by issuing Eurobonds and taking syndicated loans. Wholesale funding from foreign banks was also a significant source of financing.

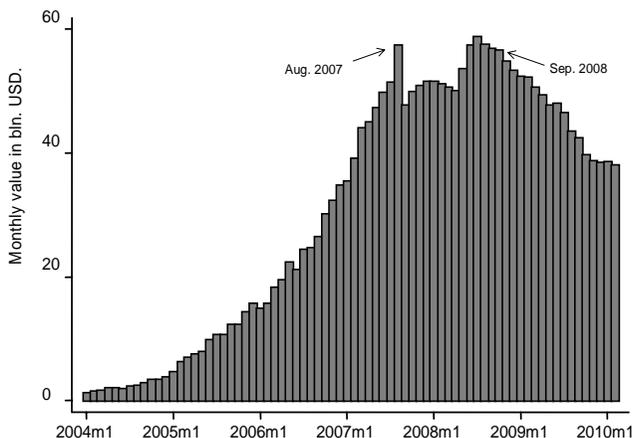
After the collapse of the Lehman Brothers in September 2008 and the subsequent shut down of international capital markets the inability of Russian banks to roll-over foreign debt became a concern for the CBR. It responded by heavy quantitative easing in two dimensions. On the one hand, it started selling its international reserves, which decreased from \$ 596,6 bln. in August 2008 to \$ 384,1 bln. in March 2009. On the other hand, it started ruble liquidity infusions into the banking system through newly established credit facilities. Against this background, I test whether Russian banks that were directly affected by the cut in external financing that followed the Lehman Brothers collapse bid more aggressively for CBR funding than other banks. Secondly, I investigate banks' lending policies with respect to different types of borrowers.

## **2. Background of Russian quantitative easing**

### **Foreign borrowing by Russian banks**

Capital account liberalization in 2006 combined with solid macroeconomic performance of Russia due to favorable terms of trade resulted in high foreign borrowing

by the private sector<sup>1</sup>. Figure 1 displays a spectacular growth of Russian banks' foreign liabilities until the beginning of the global financial crisis in August 2007, when Lehman Brothers filed for bankruptcy in September 2008.



**Fig. 1.** Aggregate value of banks' liabilities from Eurobonds and syndicated loans

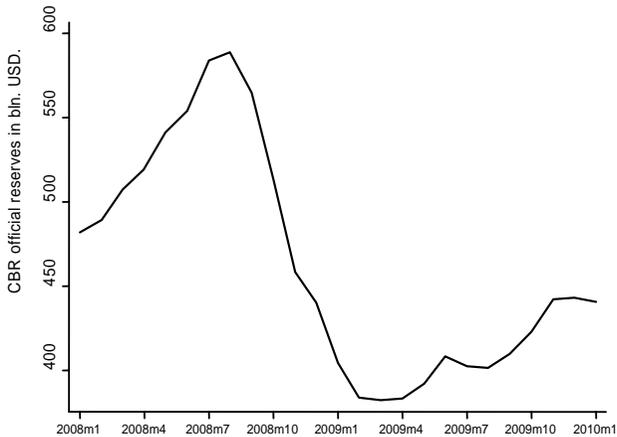
Source: Bloomberg, Cbonds.

## Interventions by the Central Bank of Russia

Following a sudden-stop of international capital flows in September 2008 the CBR became concerned with inability of banks to roll-over foreign debt. 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.

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<sup>1</sup> 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.



**Fig. 2.** Average monthly level of official foreign exchange reserves of the CBR

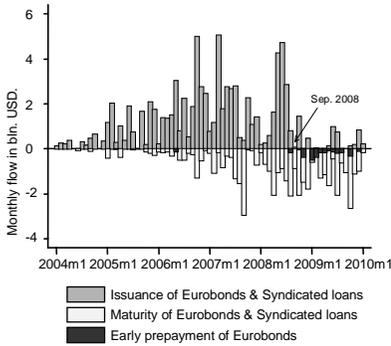
*Source:* Central Bank of Russia.

### 3. Data description

The data on banks' accounts has been compiled by the CBR on the basis of form 101 on monthly transactions submitted by individual banks. 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 in 2004–2010.

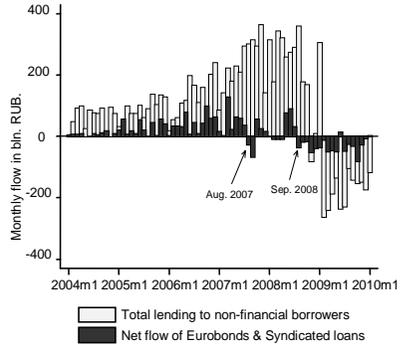
I first ranked over 1000 Russian banks by their average asset size and picked the top 350. Secondly, using the CBR reports, I identified banks that have been licensed to conduct transactions with non-residents and had non-zero liabilities with respect to non-residents during the 1 year preceding the sudden stop. A total of 174 banks remained in the final sample.

I divided my data on banks 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 [Schmukler, Vesperoni, 2006]. Accordingly, the first sub-sample includes large banks that issued Eurobonds or took syndicated loans and had them outstanding in August 2008 (36 banks), while the second sub-sample includes medium-sized banks that only borrowed from foreign banks through the interbank market (136 banks).



Source: Bloomberg, Cbonds

**Fig. 3.** Aggregate monthly flow of funds



Source: Bloomberg, Cbonds, CBR

**Fig. 4.** Net flow of foreign funds and total lending

## 4. Methodology

For the sub-sample of 38 banks that issued Eurobonds or took 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<sub>to</sub> where 1 year covers a period after the sudden stop (Sep. 2008 – Aug. 2009) and Assets<sub>to</sub> are taken at the beginning of the period (September 2008). Banks with average ratio of 9,5% are allocated to the «treated» group (17 banks), while all other banks are allocated to a «control» group (19 banks).

For the second sub-sample of banks that borrowed from foreign banks through the interbank money market I calculate Net long-term borrowing from Non-resident banks/Assets ratio for each bank in each month where Net interbank loans from non-resident banks with more than 3 month maturity are used. If during 1 year period preceding the sudden stop the average ratio 7,5% I allocate such bank to a «treated» 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<sup>2</sup>. 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.

<sup>2</sup> The logit single nearest-neighbor 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.

Using the difference-in-difference (D-in-D) estimator, I investigate if banks belonging to the «treated» group behaved differently from those in the «control» group.

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

TREAT takes value 1 if bank belongs to a «treated» group and zero if control.  $\tau$  takes value 1 if observations belong to the 1 year time period after the sudden stop (September 2008 to August 2009) and zero if they belong to the 1 year time period before the stop (September 2007 to August 2008). The main coefficient of interest is on the interaction term  $\beta_3$ . 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).

$X_{it}$  – represents a set of control variables: a dummy variables for state-controlled banks and for banks affiliated with the state enterprises, a size of a bank's assets relative the largest state-controlled bank and deposits-to-assets ratio.

$Y_{it}$  – represents outcome variables, which were motivated in the introduction.

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

### Net borrowing from the Central Bank

Table 1 reports D-in-D estimates of net long-term borrowing from the CBR through its new credit facilities. The value of CBR credit that large and financially constrained banks received from the CBR after the sudden stop was 12% of their pre-crisis assets. The D-in-D estimate for this sub-sample is 4,5% and is significant at 10%<sup>3</sup>.

Estimates for mid-sized banks indicate that although banks in this category made active use of the CBR facility, the treated banks did not receive significantly more funding than banks in the control group.

### Lending to non-financial corporate borrowers

I separate loans granted by banks into three categories: 1) short-term lending (all loans below 1 year maturity); 2) medium-term lending (all loans between 1 and 3 years maturity); 3) long-term lending (all loans with maturity longer than 3 years).

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<sup>3</sup> The negative sign here indicates an increase in liabilities.

**Table 1.**

**Estimation results**

		Pre-crisis year		Difference in pre-crisis year	Crisis year		Difference in crisis year	Difference-in-Difference
		Treated banks	Control banks		Treated banks	Control banks		
<b>Δ Net long-term borrowing from the CBR/Assets to</b>								
Maturity longer than 3 months	Large banks	-0,016 (0,012)	-0,022 (0,014)	0,006 (0,010)	-0,120 (0,030)	-0,081 (0,019)	-0,039* (0,023)	-0,045* (0,026)
	Medium banks	-0,001 (0,008)	0,001 (0,006)	-0,002 (0,004)	-0,036 (0,012)	-0,049 (0,015)	0,014 (0,016)	0,016 (0,016)
<b>Δ Total lending to companies/Assets to</b>								
Short-term (up to 1 year)	Large banks	0,087 (0,021)	0,083 (0,020)	0,004 (0,029)	-0,055 (0,028)	-0,057 (0,018)	0,002 (0,032)	-0,002 (0,038)
	Medium banks	0,151 (0,095)	0,077 (0,038)	0,074 (0,094)	-0,073 (0,049)	-0,075 (0,042)	0,001 (0,045)	-0,072 (0,103)
Medium-term (1 to 3 years)	Large banks	0,033 (0,011)	0,037 (0,017)	-0,004 (0,019)	0,031 (0,012)	0,031 (0,014)	-0,001 (0,013)	0,004 (0,022)
	Medium banks	0,048 (0,028)	0,037 (0,015)	0,037 (0,015)	0,037 (0,015)	0,055 (0,021)	-0,024 (0,024)	-0,035 (0,037)
Long-term (more than 3 years)	Large banks	0,017 (0,009)	0,015 (0,010)	0,002 (0,007)	0,021 (0,009)	0,007 (0,010)	0,014 (0,013)	0,012 (0,014)
	Medium banks	0,010 (0,018)	-0,003 (0,009)	0,013 (0,013)	-0,009 (0,015)	0,003 (0,008)	-0,012 (0,012)	-0,024* (0,014)
<b>Δ Total lending to individuals/Assets to</b>								
Short-term (up to 1 year)	Large banks	-0,004 (0,014)	0,008 (0,011)	-0,012 (0,016)	-0,027 (0,014)	-0,037 (0,018)	0,010 (0,012)	0,022 (0,022)
	Medium banks	0,044 (0,015)	0,026 (0,011)	0,018 (0,015)	-0,017 (0,011)	-0,004 (0,008)	-0,013 (0,008)	-0,031* (0,017)
Medium-term (1 to 3 years)	Large banks	0,031 (0,019)	0,071 (0,033)	-0,040 (0,030)	-0,035 (0,021)	-0,045 (0,030)	0,009 (0,019)	0,050 (0,035)
	Medium banks	0,057 (0,027)	0,012 (0,016)	0,045* (0,024)	-0,015 (0,021)	-0,013 (0,017)	-0,002 (0,012)	-0,046* (0,025)
Long-term (more than 3 years)	Large banks	-0,003 (0,006)	-0,017 (0,016)	0,014 (0,012)	-0,005 (0,006)	-0,012 (0,008)	0,007 (0,005)	-0,007 (0,012)
	Medium banks	0,000 (0,000)	-0,002 (0,002)	0,001 (0,001)	-0,001 (0,000)	-0,001 (0,000)	0,000 (0,000)	-0,001 (0,001)
<b>Δ Total lending to entrepreneurs/Assets to</b>								
All maturities	Large banks	0,013 (0,004)	0,005 (0,005)	0,008 (0,005)	-0,007 (0,003)	0,001 (0,004)	-0,008** (0,004)	-0,015*** (0,005)
	Medium banks	0,014 (0,005)	0,005 (0,004)	0,009 (0,006)	-0,009 (0,004)	-0,004 (0,003)	-0,006 (0,004)	-0,015*** (0,007)
<b>Δ Net total interbank money market position with non-residents/Assets to</b>								
All maturities	Large banks	-0,039 (0,035)	-0,033 (0,032)	-0,006 (0,036)	0,088 (0,029)	0,047 (0,023)	0,041* (0,025)	0,047 (0,043)
	Medium banks	-0,088 (0,033)	-0,014 (0,015)	-0,074** (0,029)	0,007 (0,019)	-0,005 (0,013)	0,013 (0,015)	0,087*** (0,033)

Note: Bootstrapped standard errors are reported in parenthesis.

\* Denotes significance at 10%; \*\* Denotes significance at 5%; \*\*\* Denotes significance at 1%.

There was a strong credit expansion in short-term lending across all groups of banks during the year preceding the sudden stop. It ranged from 8% to 15% of the assets banks held in September 2007. During the year after the sudden stop, growth turned negative. Depending on the group of banks, it ranged between -5,5% and -7,5% of their pre-crisis assets<sup>4</sup>. However, the D-in-D estimates are not statistically significant, which suggests that the decline in short-term lending to corporate borrowers was not different across treated and control banks.

The medium-term lending grew at the same pace in the pre-crisis and crisis periods (3–5% of initial assets). In this context, it should be noted that even if the demand for a new credit declines during a crisis, banks often restructure existing corporate debt, and firms tend to draw down the existing credit lines at banks. As a result, bank balance sheet data may even indicate credit expansion during a crisis [Ivashina, Scharfstein, 2010].

The estimates of long-term lending demonstrate that banking business in this maturity was anemic for all banks in both periods.

## **Lending to individuals**

The long-term lending parallels the results for corporate borrowers, i.e. non-significant growth across all banks for all periods. All action with respect to individual lending was concentrated in the medium-term maturity segment. The growth rates in the pre-crisis period were of the same magnitude as that of medium-term corporate lending (3 to 5% of initial assets). However, after the sudden stop, medium-term lending to individuals turned negative (-1,5% to -4,5% of assets), while medium-term corporate lending maintained the same pace as before<sup>5</sup>.

Short-term lending to individuals exhibited a similar boom and bust pattern for all banks.

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<sup>4</sup> Industries that normally borrow on a short-term basis, such as retailers, represented a significant portion of the clients of Russian banks prior to the crisis. According to the July 2008 CBR Bulletin on Banking Statistics, bank lending to corporate borrowers was divided among different industries in the following way: 1) 26% retailers and wholesalers; 2) 20% manufacturing and commodity extraction; 3) 16% construction and real estate; 4) 8% electricity and transport; 5) 6,6% agriculture; 6) 23,4% other industries.

<sup>5</sup> The pre-crisis credit expansion to individuals in the medium-term maturity can be explained by the extraordinary boom in auto sales and auto loans issuance that Russia enjoyed at that time. According to PricewaterhouseCoopers (PwC), the volume of car sales in Russia exhibited the following dynamics: 2 million units in 2006, 2,8 million units in 2007 and in 2008, 1,4 million units in 2009. PwC reported that car sales in Russia exceeded sales in Germany in the first half of 2008, making Russia the biggest car market in Europe during that period. In July 2008, PwC issued a report entitled «Is Russia the Largest Car Market in Europe?» According to PwC estimates, 31% of car sales in 2008 were financed by bank loans. In 2009 this figure dropped to 10%. The average price of a car sold in Russia fell from \$21,7 thousands in 2008 to \$18 thousands in 2009.

## Lending to private entrepreneurs

Previous studies have offered many reasons to consider small firms as having weaker bank-client relationships than large corporate borrowers (e.g., [Gertler, Gilchrist, 1985; Gan, 2007]). This implies that this group of borrowers is less likely to restructure their previous debt and is more vulnerable to cuts in external financing. The results for total lending to private entrepreneurs provide a uniform picture for both sub-samples of banks and suggest that, even though financially constrained banks obtained more funding from the CBR than non-constrained banks, they still cut their lending to this group of borrowers who were less likely to restructure their previous debt<sup>6</sup>.

## Total net borrowing from non-resident banks

The CBR conducted quantitative easing through two channels. On the one hand, it injected ruble liquidity into domestic banks through its credit facilities. On the other hand, it sold one third its international foreign currency reserves.

In an environment where the ruble devalued by 30% with respect to USD, one would expect banks to decrease all foreign currency liabilities and accumulate foreign currency assets. Net position in relation to non-resident banks is a variable that tracks foreign currency assets of banks. I use the deposits of all maturities held by Russian banks in non-resident banks with a positive sign, as well as all liabilities to non-resident banks of all maturities with a negative sign.

Mid-sized treated banks have a higher ratio of long-term liabilities to non-resident banks in the pre-crisis year by construction. During the crisis period, the growth rate of deposits in non-resident banks exceeded the growth rate of liabilities for this group of banks (as indicated by the positive sign) during that period.

The net indebtedness of large banks in relation to non-residents grew by 3–4% of their initial assets in the pre-crisis year. After the crisis and the beginning of quantitative easing by the CBR, both treated and control groups of banks became net lenders to non-resident banks. The net position of treated banks in non-resident accounts grew by 8,8% of their initial assets, while growth for the control group was 4,7%.

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<sup>6</sup> Unlike banks in industrialized countries, Russian banks lend a relatively small fraction of their loan portfolio to entrepreneurs (1,5% of assets).

## 6. Conclusion

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 made by the CBR on banks' funding and lending decisions. I find that demand for CBR funding increased relatively more among banks that were affected by the sudden stop than among those that were not affected by it during the year following the crisis. This means that the government assistance, which was distributed in a way that allowed banks to choose how much funding to ask for, primarily went to banks that were most affected by the sudden stop.

The estimation results for non-financial corporate borrowers suggest that there was strong credit expansion across all banks during the year preceding the sudden stop. In the following year, all banks substantially cut short-term lending to corporate borrowers, but maintained positive growth in the medium-term maturity segment. The D-in-D estimates suggest that there was no significant variation across banks, which could be interpreted as tentative evidence that the CBR liquidity infusions helped financially constrained banks to sustain lending to corporate borrowers at the same level as unconstrained banks. Lending to entities that are expected to have weaker banking relationships, such as individuals and entrepreneurs exhibited a more pronounced boom and bust cycle.

I find that during the year that followed the crisis, when the CBR engaged in quantitative easing that involved domestic currency infusions into banks and sale of international reserves, all banks in my sample substantially increased their holdings of foreign currency on accounts in non-resident banks. This suggests that government assistance was used by banks not only for foreign debt repayment but also for foreign currency hoarding.

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