Are banks peer disciplined? Evidence from Russia

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Market discipline is usually studied in retail or corporate deposits markets, while an interbank loan market is left aside. Banks' ability to exert market discipline is taken for granted, as they are expected to have enough proficiency and expertise to assess correctly riskiness of their counterparties. However, the "crises of trust" - as the one in 2004 in Russia - creates some doubts on whether efficient peer monitoring and peer discipline exist: the interbank loan market may be frozen in response to external information signal unrelated to banks' current reliability. This seems to be one of the reasons for the interbank loan markets to be extremely fragile during financial instability periods, undermining smooth functioning of the whole banking system, as banks are tightly interconnected. We provide some evidence for market discipline in the Russian interbank market. We show that the only mechanism that functions is the price-based one: more reliable banks enjoy lower interest rates. The quantitative discipline functions only for the largest borrowers. In general, decisions on credit limits are based not on changes in counterparty's riskiness but on other information like reputation, soft information or public announcements that may be even unrelated to particular banks.

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I. Introduction

The interbank loan market plays an important role for efficient functioning of the whole financial system. It allows distributing liquidity among banks by means of transferring funds from liquidity rich to liquidity poor credit institutions. At the same time, it increases linkages among banks and could have a significant contagion effect. Thus, it is essential to have an adequate level of its supervision and regulation.

An important issue for regulators is to understand whether disciplining mechanisms inherent in the interbank loan market work efficiently. In particular, this refers to peer monitoring among banks. Loans provided in this market are uninsured. As a result, financial institutions have incentives to monitor their counterparties and "punish" them for excessive risk-taking. Market discipline is usually studied in the markets for retail or corporate deposits. The interbank loan market is often disregarded, as banks' ability to discipline their counterparties is taken for granted. However, the "crises of trust", that happened in Russia in 2004, casts doubt on efficient peer monitoring and shows that this mechanism may not work. In a theoretical paper by Rochet and Tirole (1996) the authors stress that efficiency of peer monitoring substantially decreases if there is some government intervention such as state insurance of interbank claims or "too-big-too fail" policy.

The aim of this paper is to check whether there exists any market discipline in the Russian interbank market. This is an important policy issue. The Russian interbank market is rather fragile during stress periods. Thus, knowledge of whether and to what extent disciplining mechanisms work in this market could shed light on how to improve its regulation.

Our results add to two streams of literature. First of all, we improve understanding of mechanisms that lie behind the decisions of banks as market network participants. Secondly, we add to the literature that tests efficiency of market discipline in different banking markets.

This paper is organized as follows. Section II covers two sets of literature we add to. The first set deals with decision-making in the market for interbank loans. The second one is dedicated to market discipline measurement. Section III describes the Russian interbank market. Section IV presents our data and describes econometric models we estimate. Section IV demonstrates the main results, section VI shows some robustness checks and section VII concludes.

II Literature

Interbank loan market

In theoretical research devoted to the interbank market it is often assumed that there is perfect competition and banks are price takers (cf. ((Ho, Saunders, 1985)), (Clouse, Dow, 202)). Thus, the discipline in the market of the wholesale funding takes the form of force liquidation (quantity discipline) of a credit institution (cf. (Calomiris, Kahn, 1991), (Huang, Ratnovski, 2010)).

Interestingly, in (Huang, Ratnovski, 2010) it is shown that the presence of noisy public signals (such as credit ratings of banks, general market indicators and etc.) can reduce incentives for the monitoring efforts of wholesale funding providers. Early liquidation of a bank can be more favourable for them (at the expense of depositors that supply long-term money) than implementing monitoring which requires acquirement of costly information.

Nevertheless, some empirical evidences confirm not only the existence of the quantity discipline, but also the presence of the price discipline which means that costs of borrowings in the interbank market significantly differ based on banks' credit risk levels.

The first empirical analysis in this direction was carried out in (Furfine, 2001). In the paper the US overnight federal funds market as on the 31st December 1997 is examined. Loans provided in this market are uncollateralized exposing banks to substantial credit risk. In order to carry out the analysis an econometric model is employed with an interest rate as a dependent variable. Explanatory variables include indicators of borrower credit risk (profitability, loan quality, capitalization level), borrower and lender characteristics (market share, dummy variable reflecting different size categories of banks and others), transaction characteristics (time of payment flows and others), indicators of borrowers and lenders relationship (number of transactions between a particular pair of banks and others) and, finally, dummy variable reflecting each of the 61 days under consideration. The results confirm the presence of the price discipline. The price of loans depends on credit risk of a borrower. For very risky institutions the discipline is of the quantity nature, meaning that a bank with high probability of default cannot attract any funds regardless of the interest rate.

The same conclusion is made in (King, 2008) where quarterly financial data of the US banks for the period 1986-2005 are analyzed. Using the Heckman's two-stage procedure the author examines dependence of the interbank borrowing interest rates on a risk level of banks. As a proxy for the risk level the failure probability (produced by the Federal Reserve's System) is taken. Control variables include indicators of banks' size and liquidity position, time dummies

and some others. Both the price and the quantity discipline appear to be relevant. An interesting result is that the price discipline has increased substantially after the legislation changes in the early 1990s (the aim of which was to shift the burden of banks' failure to uninsured creditors).

The hypothesis of existence of the peer monitoring is confirmed also for the Portuguese (cf. (Cocco et al., 2009)) and the Italian interbank markets (cf. (Angelini et al., 2009)). Interestingly, in both papers the results show the importance of banks' size in determining interest rates. This could be explained by the reliance of market participants on the "too-big-to fail" policy.

The analysis of market discipline among banks could be done using a different approach. The idea behind it is to examine the banks' risk level and its determinants. Such research is presented, among others, in (Liedorp et al., 2010) and (Dinger, Hagen, 2009). However, they come to different conclusions. In the former paper the investigation is carried out based on quarterly bilateral data from the Dutch interbank market for the period 1Q1998-4Q2008. The aim is to examine the effect of other banks' risk on the risk of an individual bank. The panel data model with the fixed effect is used. The risk of a bank is measured using z-score which is the ratio of return on assets (ROA) plus capital adequacy ratio (CAR) divided by the standard deviation of ROA. However, the authors assume the normal distribution of ROA, which is not very plausible. Explanatory variables include CAMEL[3] indicators, bank size (expressed as logarithm of total assets), share of interbank lending and borrowing in total assets, weighted z-scores of other banks (weights are taken from the interbank matrix) and several others. According to the results, the hypothesis about the peer monitoring is not supported. Risk levels of banks increase when shares of interbank lending and borrowing grow up, thus, confirming the presence of the contagion effect on the market rather than peer monitoring.

The latter paper examines Central and East European countries for the period 1995-2004. Lending on the interbank market in these countries has longer maturities as compared to the developed ones. Proxies for the banks' risk level include such ratios as loan-loss reserves to total loans, loan loss provisions to total loans and net charge-offs to equity. Explanatory variables include a ratio of bank's net interbank assets to total assets, bank size, capital level, foreign ownership indicators, several macroeconomic indicators and some others. Using instrumental variables econometric model the authors come to a conclusion that banks, which borrow on the interbank market, are less risky as compared to all the other banks. This supports the peer-monitoring concept.

The existing evidences confirm the presence of market discipline among banks for some economies. However, the empirical research is still moderate. Moreover, the results are not

[3] CAMEL stands for capitalization, asset quality, managerial quality, earning and liquidity.

universal; they vary among countries, which could be explained by the different market structures, different level of the economic development and etc.

Market discipline measurement

There are three market discipline mechanisms that are usually studied (mostly in markets for bank deposits). Disciplining by price means that lenders charge higher interest rates to riskier banks because these interest rates contain risk premia (among the first papers providing evidence of price disciplining by depositors in the USA are (Hannan, Hanweck, 1988); (Ellis, Flannery, 1992)). Disciplining by quantity takes place, in turn, when depositors tend to withdraw their funds if bank fundamentals demonstrate greater risks (the first papers dealing with this mechanism are (Jordan, 2000); (Goldberg, Hudgins, 1996)). Consequently, it becomes more difficult for a bank to raise additional deposits. Some authors combine both approaches (*e.g.,* (Park, 1995); (Park, Peristiani, 1998)) and demonstrate that riskier banks offer higher deposit interest rates while also accumulating smaller amounts of deposits. Another way to discipline banks might be called a maturity shift: depositors may switch from long-term deposits to less risky short-term or even on-call deposits when faced with additional risk-taking by banks (cf. (Murata, Hori, 2006) for Japan, (Semenova, 2007) for Russia).

Case studies dedicated to identifying the presence of market discipline in different countries have proliferated in recent times. The existence of market discipline was substantiated for developed countries like Switzerland (Birchler, Maechler, 2001), New Zealand (Wilson, Rose, Pinfold, 2004) and Japan (Murata, Hori, 2006, Hoshi, 2006), as well as for some developing countries: Argentine, Chile, Mexico (Martinez Peria, Schmuckler, 2001), Bolivia (Ioannidou, de Dreu, 2006), Colombia (Barajas, Steiner, 2000), India (Chipalkatti, Ramesha, Rishi, 2007), Turkey (Ungan, Caner, 2004) and Uruguay (Goday, Gruss, Ponce 2005). In particular, they show that market discipline exists even in the market for small insured deposits. "All-around-the-globe" studies ((Demirgüc-Kunt, Huizinga, 1999), (Hosono, Iwaki, Tsuru, 2004)) allow of some cross-country comparisons. They demonstrate that a quantity-based approach is the most appropriate one for developing economies, where, due to information asymmetry and a lack of transparency in financial markets, interest rates are unlikely to reflect information about bank risks. Conversely, a mixed approach is the best one for developed countries.

The papers on this topic do not differ much by econometric models they employ. However, it's important to shortly describe these models. It will help to understand why the methodology presented in this paper has been chosen. Before the papers by Martinez Peria and

Schmuckler ((Martinez Peria, Schmuckler 1999, 2001)) were published, dependent variables were estimated in two steps. In the first step, a probability of bank failure was determined. In the second, an estimate of dependent variables according to the failure probability and some other factors, unrelated to bank fundamentals, was constructed. However, Martinez Peria and Schmuckler noted that this approach failed to explicitly demonstrate whether changes in the dependent variables were mostly caused by a particular bank fundamental. So, they reverted to a one-step model. This approach has been adopted by most of their followers. Our study also contains an econometric model that explicitly demonstrates the relationship between dependent variables and bank fundamentals as well as macroeconomic characteristics.

There is no paper dealing with market discipline and the Russian market for interbank loans. However, there are some studies providing evidence on market discipline in the markets for bank deposits. The results are somewhat ambiguous. . Some authors conclude that there is no market discipline — either quantitative or price – in the Russian market for bank deposits (for example, (Hosono, Iwaki, Tsuru, 2004) based on 1995-2002 data), others, on the contrary, demonstrate the existence of market discipline by quantity and by price, even in the market for retail deposits (for example, (Karas, Pyle, Schoors, 2006) based on 1999-2002 data; (Peresetsky, Karminsky, Golovan, 2007) based on 2002–2004 data; (Semenova, 2007) based on 2006-2006 data)).

III Russian interbank loan market

In order to better understand the empirical results presented in this paper it is worth examining the history and main characteristics of the interbank market in Russia.

The Russian interbank loan market was established at the end of 1980s with the creation of a two-tiered banking system in the USSR, which occurred in 1987 after introduction of the appropriate legislation[4]. According to (IMF, 2010), the interbank market in Russia is relatively small, not enough transparent and highly segmented. There exist quite many regional and industrial clusters within the market (cf. (Birjukova, Kovalenko, 2011)).

During the period of its existence the Russian interbank market experienced several crises. The first one occurred in 1995. At the beginning of the 1990s banks received substantial profits from inflation rents and hard currency speculations. Starting from 1994 inflation as well as exchange rate volatility began to decline. A lot of banks found themselves in a tight liquidity

[4] Resolution of the Council of Ministers No 821 "About the modernization of the banking system in the country and strengthening their influence on the increasing the efficiency of the economy", 17 July 1987; "Law on Cooperation" and the Resolution of the Council of Ministers No 1061 "About the ratification of the charter of the Gosbank USSR", 1988

position and started to borrow heavily from the interbank market. This finally led to the crises in 1995 when several hundreds of banks collapsed (cf. (OECD, 1997)).

The next crisis severely affecting the interbank market was the financial crisis 1998. It was catalyzed by the Asian currency crisis and a fall in oil prices that led to the loss of confidence in emerging markets. Consequently, the foreign capital flowed out of the Russian financial markets, stock market significantly fell and in August 1998 the Government announced the devaluation of the currency, default on its obligation and introduction of capital controls (cf. (Europa Publications Limited 1999)), which practically froze the activity in the financial markets including the interbank one.

The crisis that occurred in the interbank market in 2004 could be called "the crisis of trust" or credibility gap (cf. (CBR, 2004)). The Central Bank of Russia (CBR) withdrew a license from a bank due to money laundering issues. Later on there appeared negative rumors and fictitious black lists which included different banks, thus, undermining the confidence among credit institutions. As a result, the interbank turnover decreased by 12.2% in May and by 13.3% in June 2004 (cf. (CBR, 2004)). However, due to measures undertaken by the CBR (such as reduction of reserve requirements, compensation of deposits held in insolvent banks and etc.) the situation was resolved by the end of August 2004 (cf. (CBR, 2004)).

When the global financial crisis took place in 2007-2009 it was again the lack of confidence among banks that intensified the problems. An access to the interbank market was closed for small and medium sized banks, while liquidity was concentrated in the largest ones (cf. (Fungácová, Solanko, 2008)). The government had to provide substantial liquidity support in order to restore the financial system including the interbank market.

The above described history and characteristics of the Russian interbank market reveal its inefficiency and limitations. The lack of transparency and confidence prevents the effective distribution of liquidity among banks. To understand how to improve the regulation in an appropriate way it is important to investigate if and to what extent the internal disciplining mechanisms, such as peer monitoring, work in the this market.

In order to participate in the interbank loan market banks have to establish credit limits for the counterparties with whom they are going to work. Transactions can be executed either directly among banks (using, for example, an information system Reuters) or employing broker services and/or electronic communication networks. Banks can also borrow from the CBR at a fixed interest rate or on the auction. The CBR manages and stabilizes the interbank market using such a mechanism as an interest rate corridor (cf. (Moiseev, 2008)). The upper bound is

represented by the CBR overnight interest rate, while the lower bound – by the call deposit or tom-next[5] interest rates.

The Russian interbank market is rather segmented with 30 banks having more than 70% of total claims and liabilities in this market (cf. (CBR, 2012)). In January[6] 2012 the average daily turnover[7] amounted to 1 trillion RUB (approximately 26 billion EUR). Operations were mainly in form of overnight loans (90.04%, see Fig. 1**Error! Reference source not found.**), out of which 89.82% was attributed to deposit transactions. The breakdown of maturities, excluding overnight operations, is presented in Fig.2: the dominant category was 1 week (46.96%) followed by other short-term maturities less than 6 months (19.20%).

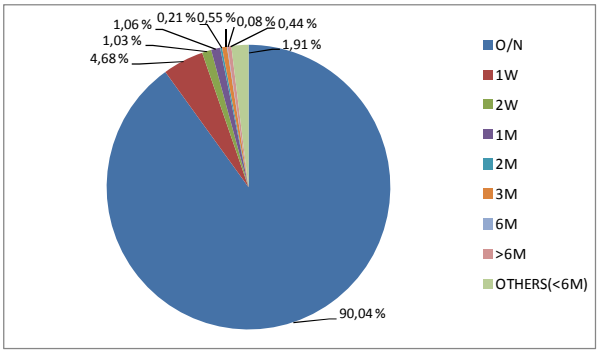

Fig. 1 Interbank market: maturity breakdown

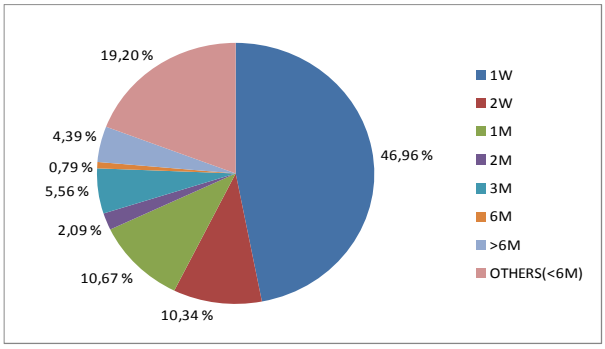

Fig. 2 Interbank market: maturity breakdown (without overnight operations)

Interbank credit operations were divided between deposits (89.60%) and REPO[8] transactions (10.40%). Short-term maturities prevail in both types of operations: overnight loans amounted to 90.26% and 88.12% correspondingly (see Fig. 3, Fig. 4

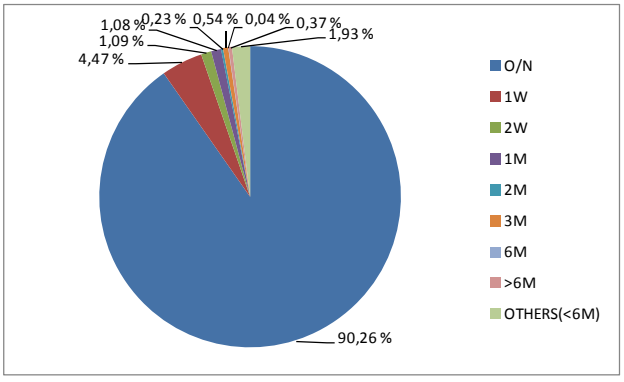

Fig. 3 Deposit operations: maturity breakdown

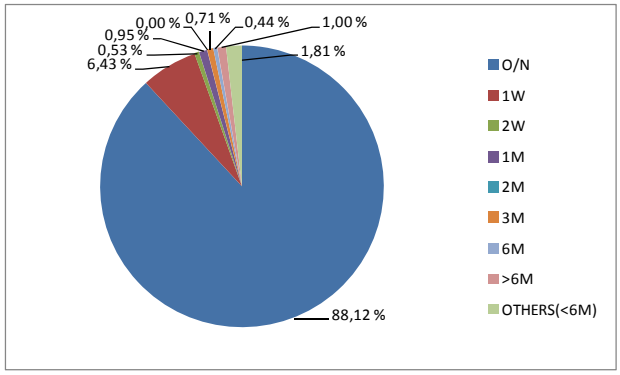

Fig. 4 REPO operations: maturity breakdown

[5] A transaction which is executed tomorrow with a delivery on the next business day

[6] The data is taken from the website of the Central Bank of Russia http://www.cbr.ru/statistics/?Prtid=finr (section "Денежный рынок" ("Money Market")).

[7] The turnover includes only operations not secured by any collateral or guarantees.

[8] REPO – repurchase agreement where one party (borrower) sells securities to another party (lender) with an agreement to buy them back at a specific date and price. The first REPO transaction was executed by the US Federal Reserve in 1918 (cf. (Choudhry, 2006)).

More than a half of the turnover was with non-residents. However, the share of non-residents was decreasing during the last two years from 69.26% in January 2010 to 53.32% in January 2012. Operations with non-residents were mainly in form of deposit transactions (99.56%).

The prevailing currencies (see Fig.5) in the market were RUB (47.69% of all the transactions), USD (28.96%) and EUR (22.91%). The situation had changed as compared to the beginning of 2010. In January 2010 the share of transactions in RUB was only 32.93%, while the shares of operations in USD and EUR were 34.18% and 32.58% correspondingly.

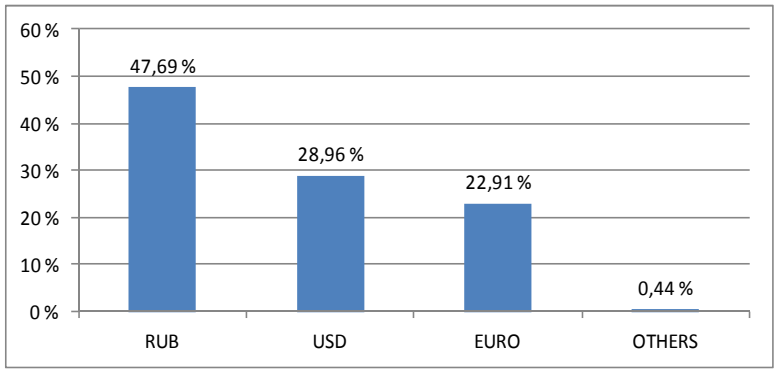

Fig. 5 Interbank market: currency breakdown

Dynamics of the interbank interest rates reflects the liquidity situation in the banking system. The average interbank rate substantially increased in the second half of 2008 with the maximum level of 16.30% in January 2009 (see Fig. 6) showing substantial liquidity difficulties of banks. The situation stabilized in 2010 with the interest rate being around 2-3%. However, in the second half of 2011 there was again the shortage of liquidity in the system and the interest rate increased up to 5.4% in December 2011. Fig.7 shows that the interest rate dynamics was virtually the same for different types of loans.

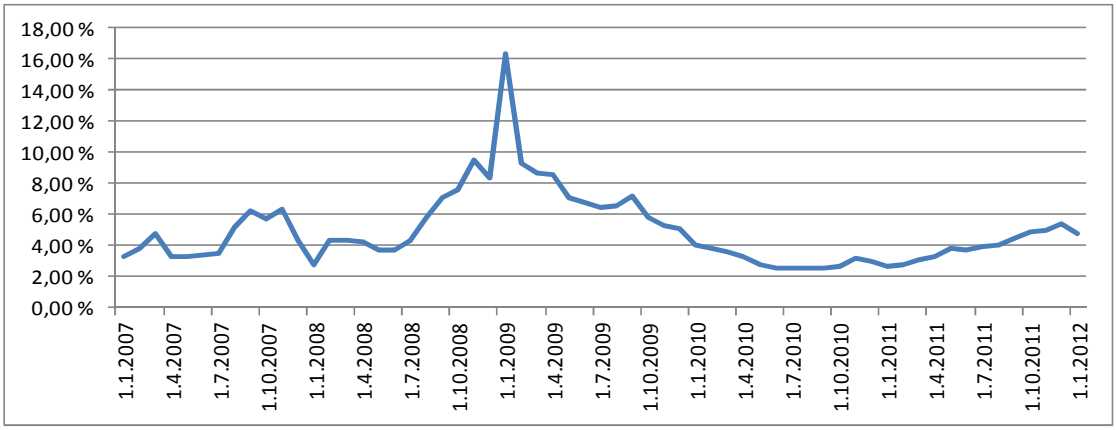

Fig. 6 Average interbank rate on 1 day loan in Rubbles

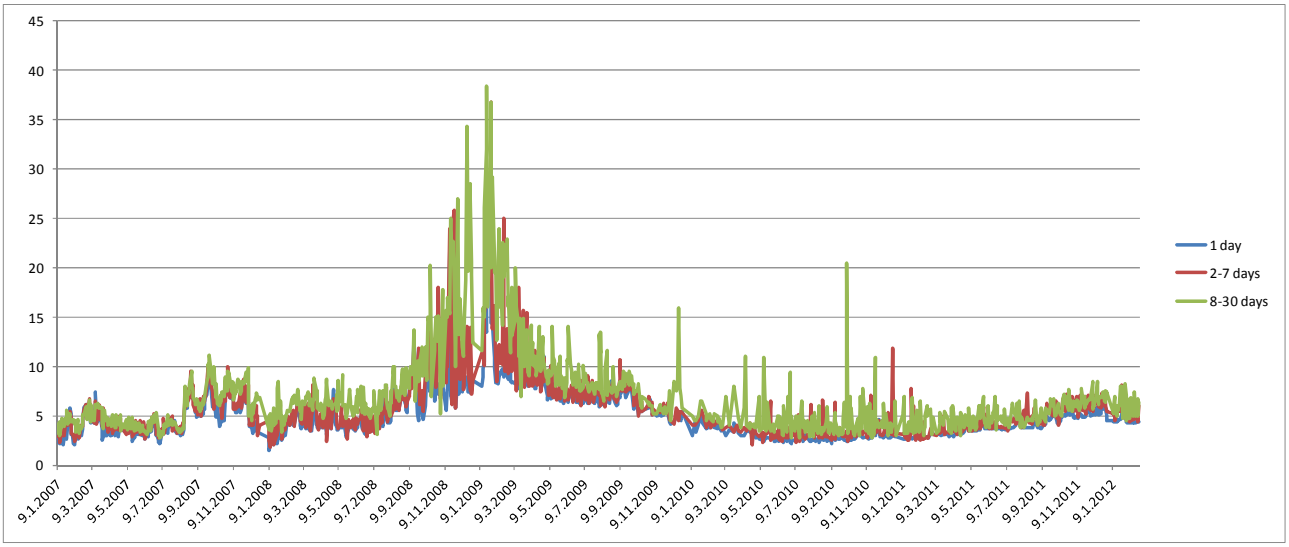

Fig. 7 Dynamics of the Moscow InterBank Actual Interest Rates

IV Data and Methodology

We use bank-specific data from the Mobile database ("Banks and Finance" Analytical System). This database contains a set of bank characteristics and ratios originating from financial statements collected regularly by the CBR. To check whether banks discipline each other after financial turmoil, we use data covering 7 quarters following the period of the recent financial crisis in Russia – from the 1st quarter 2010 to the 3d quarter 2011.

We follow the existing studies in choosing an econometric model and estimate the following reduced-form equation to analyze market discipline:

$$MD_{i,t} = \alpha_i + \mu' BF_{i,t-1} + \beta Size_{i,t-1} + \rho Involved_{i,t-1} + \theta_1' Dummy\_Quarter_t + \\ + \theta_2' Dummy\_Quarter_t * Involved_{i,t-1} + \varepsilon_t$$

$MD_{i,t}$ represents market discipline variables. For quantity-based mechanism the dependent variable is the growth rate of loans received by a bank *i* from other banks in quarter *t*. For price-based mechanism we use an average loan price measured as a ratio of interest payments by bank *i* divided by the average loan amount for quarter *t*.

$BF_{i,t-1}$ stands for a vector of bank fundamentals. We use a set of variables consistent with the CAMEL model. For capital adequacy (*C*) we take the bank capital to risk-weighted assets ratio. It is called "N1" and is calculated according to the guidelines of the CBR[9]. For asset quality (A) we use the reported share of bad loans in total loans. For management quality (M) the personnel expenses to total assets ratio is employed. An alternative measure is the personnel

[9] The minimum required level is 10% (for banks with total capital below 180 million RUB the minimum level is 11%)

expenses to total profit before taxes ratio. Earnings (E) are measured by ROA, while an alternative variable is the return on working assets. Finally, for liquidity (L) we use the short-term (liquid) assets to short-term liabilities ratio. This is the "N3" ratio calculated according to the CBR guidelines[10].

As the information reaches market participants later than the reporting date, the vector $BF_{i,t-1}$ is included into regression with a lag. This lag is approximately two months. Thus, regressing on the previous period variables seems to be reasonable.

If the discipline does not exist, the coefficients accompanying bank fundamentals will be found insignificant.

Size reflects a bank´s size. It is measured as the share of bank's assets in total assets of the banking system.

Involved is a measure of bank's exposure to the interbank loan market. It stands for the share of loans provided by other credit institutions in the total bank's liabilities.

To control for the factors which are not bank fundamentals, but do influence the depositor decision-making process we introduce Dummy variables for each of the quarters (*Dummy_quarter*). We also control for the influence of quarter-to-quarter changes in exposure to the market by means of including the intersection variables (*Dummy_quarter*Involved).*

It is important to mention that not all banks participate in the interbank loan market. Thus, in order to eliminate the selection bias problem, we estimate the Heckman correction model conditioning the errors on the bank participation (measured by *Participation* dummy). We also cluster errors by banks to concentrate on inter-bank differences.

Table 1 the definitions and provides the descriptive statistics of all the variables in the model.

Table 1 Descriptive statistics

Variable	*Description*	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
dloansbybanks_growth	growth rate of loans received by a bank from other credit institutions	1879	0.262644	5.009969	-1	200.5
loanprice	ratio of interbank loan interest payments over total loans received by a bank from other credit institutions	1869	0.028259	0.042225	0	0.470075
n1_lag	capital adequacy ratio. N1	5304	27.6546	23.58193	0	198
bloan_share_lag	share of bad loans in total loans	5304	0.047885	0.0725	0	1

[10] It should be more or equal to 15%

perexp_lag	personnel expenses to total assets ratio	5286	0.007108	0.005949	0.00000821	0.126381
pe_eff_lag	personnel expenses to profit before taxes ratio	5285	3.905429	62.58359	-2096.286	2609.692
roa_lag	net profit to total assets ratio	5286	0.002017	0.014621	-0.3774115	0.843243
rowa_lag	net profit to working assets ratio	5286	0.005233	0.045583	-1.046354	1.257498
n3_lag	ratio of short-term assets over short-term liabilities, N3	5304	73.01584	48.66897	0	200
share_a_lag	share of bank´s total assets in total assets of the whole banking system	5304	0.001129	0.011653	0.000000342	0.344531
involved	share of loans received from other credit institutions in total liabilities of a bank	5304	0.03396	0.096907	0	0.787509
participation	=1 if loans received from other banks are different from zero	5304	0.351433	0.477463	0	1
moscow	=1 if bank is registered in Moscow	5304	0.497738	0.500042	0	1

V Results

Estimation results are presented in Table 2. First of all, we discuss the disciplining mechanism by price. According to all model modifications the CAMEL variables are jointly significant at 1 percent confidence level and this proves the existence of price disciplining. In particular banks with the higher capital adequacy ratio enjoy lower average interest rates. This means that when interbank loan market runs smoothly and there are no sudden-stops the interest rates are adjusted according to banks' reliability. All other components of the CAMEL model – taken separately - fail to influence prices in expected way. For instance, higher liquidity results into higher interest rates. However the effect itself is close to zero.

However, there is no evidence of quantitative market discipline for the Russian interbank market during the period under consideration. The bank fundamentals are jointly insignificant at the 10 percent confidence level. This result suggests that lenders' decisions are based on soft information (such as reputation, bank's credit history and etc.) or external signals (such as ratings or some public announcements). The only significant bank fundamental is again capital adequacy. The banks with higher N1 enjoy more intensive inflow of bank loans.

The results might seem surprising as interbank market participants are usually considered as the most effective ones in disciplining. Nevertheless, our results correspond well to the 2004 "Crisis of trust" in Russia. At that time the CBR announced the existence of the so called blacklist. It included banks that were under special control and treatment due to lack of financial

stability or due to money-laundering involvement. Those banks were considered to be close to license cancellation. The blacklist itself was not revealed. The situation was aggravated by the Alfa-bank case. Alfa-bank is one of the largest privately owned Russian banks. One of the respected business magazines published an article where it was mentioned that this bank faced financial problems and was suffering from liquidity shortage. This information triggered a bank run which forced Alfa-bank to attract additional funds from foreign investors to repay all the deposits. All these events led to the "freeze" of the interbank market as no one was sure of whether the counterparties were reliable enough.

Our results show that the trust crisis may occur again due to some external factors and information signals, as the absence of quantitative discipline makes the market extremely fragile.

Table 2 Results of Heckman estimation (s.e. in brackets)

	LOANGROWTH				LOANPRICE			
	I♦	*II*♦	*III*♦	*IV*♦	*I*	*II*	*III*	*IV*
n1_lag	0.011 [0.006]***	0.01 [0.006]***	0.011 [0.007]***	0.011 [0.006]***	-0.001 [0.000]*	-0.001 [0.000]*	-0.001 [0.000]*	-0.001 [0.000]*
bloan_share_lag	-0.357 [0.902]	-0.328 [0.901]	-0.272 [0.920]	-0.244 [0.921]	0.005 [0.016]	0.005 [0.016]	0.004 [0.015]	0.004 [0.015]
perexp_lag	25.091 [18.641]	25.24 [18.749]			-0.677 [0.198]*	-0.664 [0.198]*		
pe_eff_lag			0.001 [0.001]	0.001 [0.001]			0 [0.000]	0 [0.000]
roa_lag	21.046 [17.030]		20.272 [16.934]		0.018 [0.115]		0.064 [0.122]	
rowa_lag		9.597 [8.349]		9.192 [8.252]		0.038 [0.053]		0.057 [0.057]
n3_lag	-0.008 [0.006]	-0.008 [0.006]	-0.009 [0.006]	-0.009 [0.006]	0.000 [0.000]***	0.000 [0.000]***	0.000 [0.000]***	0.000 [0.000]***
share_a_lag	-0.717 [0.325]**	-0.689 [0.316]**	-0.768 [0.331]**	-0.742 [0.321]**	-0.041 [0.009]*	-0.041 [0.009]*	-0.04 [0.009]*	-0.04 [0.009]*
involved	-3.525 [2.188]	-3.597 [2.248]	-3.716 [2.304]	-3.786 [2.367]	0.132 [0.041]*	0.132 [0.042]*	0.122 [0.033]*	0.123 [0.033]*
Q	+	+	+	+	+	+	+	+
Q*involved	+	+	+	+	+	+	+	+
_cons	0.543 [0.410]	0.537 [0.403]	0.632 [0.437]	0.627 [0.432]	-0.001 [0.004]	-0.001 [0.004]	-0.005 [0.004]	-0.005 [0.004]
arthrho_cons	-0.059 [0.030]**	-0.059 [0.030]**	-0.051 [0.031]	-0.051 [0.031]	2.419 [0.192]*	2.417 [0.193]*	2.455 [0.200]*	2.453 [0.201]*
lsigma_cons	1.662 [0.426]*	1.662 [0.426]*	1.662 [0.426]*	1.662 [0.426]*	-3.003 [0.095]*	-3.004 [0.095]*	-3.002 [0.096]*	-3.002 [0.096]*
N	5,108	5,108	5,108	5,108	5,107	5,107	5,107	5,107
N_Clust	982	982	982	982	982	982	982	982
Chi2	34.782	34.7875	33.9965	34.2091	84.1428	83.9059	88.2093	88.0648
Chi2_C	3.9558	3.9423	2.6325	2.6234	159.3765	156.8759	150.3278	149.4866
P_C	0.0467	0.0471	0.1047	0.1053	0	0	0	0
Rho	-0.059	-0.0588	-0.0508	-0.0506	0.9843	0.9842	0.9854	0.9853

*** $p<0.1$; ** $p<0.05$; * $p<0.01$

♦- CAMEL variables are jointly insignificant

VI Robustness checks

This section presents the results of two robustness checks. First of all estimate the market discipline for Moscow banks only. Secondly, connecting our estimations with CBR 2012, we study the market discipline for top-30 banks in the market.

Table 3 presents the means of all key variables for all the interbank market participants, as well as for Moscow participants and top-30 banks (most of them are also based in Moscow).

Table 3. Variable means for all the market participants compared to Moscow banks and top-30 banks

	All participants		***Moscow participants***		***Top-30 participants***	
Variable	*Obs*	*Mean*	*Obs*	*Mean*	*Obs*	*Mean*
dloansbybanks_growth	1680	0,412207	948	0,3219427	163	0,1466904**
loanprice	1670	0,027921	939	0,026728***	159	0,0121321*
n1_lag	1864	20,82779	1025	21,89854*	163	16,43558*
bloan_share_lag	1864	0,049362	1025	0,0529702*	163	0,0627428*
perexp_lag	1852	0,005237	1013	0,0047443*	159	0,002972
pe_eff_lag	1851	2,306939	1013	3,777758***	159	1,461043
roa_lag	1852	0,002355	1013	0,0027239	159	0,002457
rowa_lag	1852	0,004573	1013	0,0051907	159	0,004735
n3_lag	1864	72,07833	1025	77,7561*	163	75,80368
share_a_lag	1864	0,002991	1025	0,0045306*	163	0,0265716*
involved	1864	0,093203	1025	0,1184607*	163	0,2494482*
moscow	*1864*	*0,54989*	*1025*	*1*	*163*	*0,87117*
,,*** - difference in means is significant at 1%, 5%, 10% confidence level respectively*						

Disciplining Moscow banks

Moscow banks constitute approximately a half of the interbank market participants. This subsample includes banks acting in the more tightly-competitive market. These banks are larger and more involved into the market; they demonstrate higher capital adequacy and liquidity ratios, as well as higher asset and management quality than on average (see Table 3). They enjoy lower interest rates, but loan growth is not statistically different.

Table 4 presents the results for the subsample of the Moscow banks. The results generally confirm the already obtained ones. There is still no quantitative discipline. Although higher capital adequacy adds to loans growth, bank fundamentals taken together are jointly statistically insignificant.

However, we find the evidence of discipline by price. The banks with higher capital adequacy or liquidity enjoy lower interest rates. The latter relationship is, though, sensitive to the model specification. The former one is stable across specifications.

Price discipline estimation results provide some evidence for too-big-to-fail hypothesis. Larger banks, other things being equal, enjoy cheaper loans and the effect is much higher than that provided by capital adequacy.

Table 4. Results of Heckman estimation for Moscow banks (s.e. in brackets)

	LOANGROWTH				LOANPRICE			
	I♦	*II*♦	*III*♦	*IV*♦	*I*	*II*	*III*	*IV*
n1_lag	0.006 [0.003]***	0.006 [0.003]***	0.006 [0.003]***	0.006 [0.003]***	-0.001 [0.000]*	-0.001 [0.000]*	-0.001 [0.000]*	-0.001 [0.000]*
bloan_share_lag	0.074 [1.168]	0.081 [1.168]	0.262 [1.205]	0.266 [1.207]	0.006 [0.020]	0.006 [0.020]	0.005 [0.019]	0.005 [0.019]
perexp_lag	29.088 [27.219]	29.197 [27.309]			-0.504 [0.278]***	-0.49 [0.272]***		
pe_eff_lag			-0.001 [0.001]	-0.001 [0.001]			0 [0.000]	0 [0.000]
roa_lag	4.185 [10.634]		3.994 [10.691]		0.158 [0.165]		0.157 [0.184]	
rowa_lag		1.579 [3.971]		1.322 [3.903]		0.087 [0.071]		0.088 [0.081]
n3_lag	-0.003 [0.001]**	-0.003 [0.001]**	-0.003 [0.001]**	-0.003 [0.001]**	-0.000 [0.000]*	-0.000 [0.000]*	0.000 [0.000]	-0.000 [0.000]
share_a_lag	-0.52 [0.253]**	-0.515 [0.254]**	-0.592 [0.253]**	-0.587 [0.253]**	-0.052 [0.012]***	-0.052 [0.012]***	-0.051 [0.012]***	-0.051 [0.012]***
involved	-2.389 [0.928]**	-2.398 [0.931]***	-2.515 [1.038]**	-2.523 [1.042]**	0.091 [0.070]	0.091 [0.070]	0.097 [0.072]	0.096 [0.072]
Q	+	+	+	+	+	+	+	+
Q*involved	+	+	+	+	+	+	+	+
_cons	0.213 [0.144]	0.212 [0.145]	0.301 [0.160]*	0.301 [0.161]*	0.005 [0.005]	0.005 [0.005]	0.002 [0.005]	0.002 [0.005]
arthrho_cons	-0.083 [0.037]**	-0.083 [0.037]**	-0.056 [0.033]***	-0.056 [0.033]***	2.532 [0.305]***	2.547 [0.308]***	2.529 [0.306]***	2.547 [0.310]***
lsigma_cons	0.751 [0.211]***	0.751 [0.211]***	0.751 [0.211]***	0.751 [0.211]***	-2.995 [0.123]***	-2.994 [0.123]***	-2.998 [0.124]***	-2.997 [0.124]***
N	2,551	2,551	2,551	2,551	2,551	2,551	2,551	2,551
N_Clust	498	498	498	498	498	498	498	498
Chi2	38.4055	38.2529	39.0627	38.7766	60.7351	60.6083	68.4761	67.6297
Chi2_C	4.8873	4.8941	2.8468	2.8428	68.9741	68.554	68.5311	67.7088
P_C	0.0271	0.0269	0.0916	0.0918	0	0	0	0
Rho	-0.0824	-0.0824	-0.0562	-0.0562	0.9874	0.9878	0.9874	0.9878

*** $p<0.1$; ** $p<0.05$; * $p<0.01$

♦- CAMEL variables are jointly insignificant

Disciplining top-30 banks

In this section we use a different Heckman correction to estimate the market discipline. We condition the results on the banks' top-30 position according to the volumes of loans received in the interbank market.

Top-30 banks hold the major proportion of the interbank loans, amounting up to 90% of the market. They attract cheaper funds, demonstrating, however much lower loan growth rates than other participants (see Table 3). Surprisingly these banks are smaller in terms of asset share and less reliable in terms of capital adequacy and asset quality.

Table 5 presents the results. They provide the evidence for quantitative market discipline, which seems to function only for the largest borrowers. The banks with higher capital adequacy demonstrate higher loan growth and CAMEL variables are jointly significant at 1 per cent confidence level.

Disciplining by price is even more pronounced for the largest borrowers. Besides N1, which reduces the cost of loans, the quality of assets as well as liquidity influences the interest rates. Higher share of bad loans and lower liquidity ratio increase the risk premia make interbank loans more costly

This model specification again proves the too-big-to-fail hypothesis: banks with higher share of total assets enjoy lower interest rates. However, for the top-30 banks this effect is much lower than the disciplining effect of the asset quality changes.

Table 5. Results of Heckman estimation, top-30 banks (s.e. in brackets)

	LOANGROWTH				LOANPRICE			
	I	*II*	*III*	*IV*	*I*	*II*	*III*	*IV*
n1_lag	0.036	0.036	0.021	0.021	-0.000	-0.000	0.000	0.000
	[0.009]*	[0.009]*	[0.006]*	[0.006]*	[0.000]***	[0.000]***	[0.000]	[0.000]
bloan_share_lag	-1.488	-1.496	-1.223	-1.198	0.058	0.058	0.062	0.063
	[0.943]	[0.960]	[0.797]	[0.789]	[0.021]*	[0.022]*	[0.019]*	[0.020]*
perexp_lag	42.536	41.457			0.316	0.4		
	[17.865]**	[17.945]**			[0.310]	[0.309]		
pe_eff_lag			0.073	0.072			-0.001	-0.001
			[0.019]*	[0.019]*			[0.000]	[0.001]
roa_lag	-7.436		8.332		0.392		0.416	
	[8.403]		[7.849]		[0.225]*		[0.182]**	
rowa_lag		-2.784		3.658		0.104		0.125
		[3.857]		[3.734]		[0.091]		[0.079]
n3_lag	-0.005	-0.005	-0.003	-0.003	-0.000	-0.000	0.000	-0.000
	[0.001]*	[0.001]*	[0.001]*	[0.001]*	[0.000]	[0.000]	[0.000]*	[0.000]*
share_a_lag	0.063	0.051	-0.068	-0.051	-0.012	-0.011	-0.008	-0.007
	[0.327]	[0.326]	[0.281]	[0.275]	[0.006]*	[0.006]*	[0.006]	[0.006]
involved	-1.616	-1.619	-0.892	-0.898	-0.033	-0.031	-0.041	-0.04
	[0.443]*	[0.446]*	[0.358]**	[0.358]**	[0.019]*	[0.023]	[0.011]***	[0.011]***
Q	+	+	+	+	+	+	+	+
Q*involved	+	+	+	+	+	+	+	+
_cons	-0.108	-0.101	-0.087	-0.094	0.01	0.01	0.01	0.01
	[0.180]	[0.182]	[0.146]	[0.145]	[0.004]**	[0.005]*	[0.003]***	[0.003]***
arthrho_cons	-0.005	-0.012	0.087	0.095	0.496	0.578	0.388	0.419
	[0.162]	[0.159]	[0.180]	[0.179]	[0.588]	[0.713]	[0.253]	[0.270]
lsigma_cons	-0.81	-0.809	-0.849	-0.848	-4.881	-4.856	-4.908	-4.889

	[0.129]*	[0.129]*	[0.140]*	[0.141]*	[0.185]*	[0.188]*	[0.161]*	[0.156]*
N	5,300	5,300	5,300	5,300	5,300	5,300	5,300	5,300
N_Clust	983	983	983	983	983	983	983	983
Chi2	47.971	49.9266	93.3592	94.7077	70.9547	72.6807	82.0274	71.8399
Chi2_C	0.0008	0.0056	0.2326	0.281	0.7133	0.6582	2.3438	2.4054
P_C	0.9771	0.9403	0.6296	0.5961	0.3983	0.4172	0.1258	0.1209
Rho	-0.0046	-0.0119	0.0866	0.0944	0.4593	0.5215	0.3695	0.3958
*** $p<0.1$; ** $p<0.05$; * $p<0.01$								

VII Conclusion

An interbank market is an important part of any financial system. It plays an essential role in distributing liquidity among banks. However, it could also be a source of significant contagion effect, thus, intensifying financial instability.

The effective functioning of the interbank market depends on the disciplining mechanisms inherent in it. The risk of contagion could be substantially lowered if banks have enough information in order to exert market discipline. Conversely, if disciplining mechanisms do not work, the tighter regulation is required to reduce negative consequences for the whole financial system.

This paper presents some evidence with respect to market discipline in the Russian market for interbank loans. This is an important issue for the Russian authorities as the Russian interbank market has always been rather fragile and tends to be “frozen” rather quickly due to external shocks.

We show that the mechanism present in the Russian interbank market is the price discipline when the more reliable credit institutions can borrow at lower interest rates. At the same time, there is no evidence concerning the quantitative discipline. Banks establish or close credit limits not according to the counterparties` risk characteristics, but based on external information such as reputation, rumors or public news. Our results remain stable for different proxies for bank earnings and management quality as well as for a subsample of Moscow banks.

The pronounced quantitative disciplining works only for 30 largest borrowers. In the same time they are more tightly disciplining by price: their counterparties, when pricing loans, take into account virtually the whole range of CAMEL model bank fundamentals, namely capital adequacy, liquidity and asset quality. This is good news from the market stability point of view as the most active borrowers are disciplined by both price (ex-ante) and quantity (ex-post).

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