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Market discipline is usually studied in the retail or the corporate deposit markets, while the interbank loan market is disregarded. Banks' abilities to exert market discipline are taken for granted, as they are expected to have the expertise to assess correctly the riskiness of other banks. However, the "crises of trust" (as one in 2004 in Russia) create some doubts as to whether efficient peer monitoring and peer discipline exist: the interbank loan market may be frozen in response to external information which is unrelated to the banks' current reliability. This seems to be one of the reasons for the interbank loan markets being extremely fragile during periods of financial instability, undermining the 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 disciplinary mechanism that functions is a 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 another bank's riskiness but on other information like reputation, soft information or public announcements that may be even unrelated to a particular bank.

JEL Classification: G21, G01, P2.

Keywords: market discipline, interbank market, Russia

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Introduction

The interbank loan market plays an important role in the efficient functioning of the whole financial system. It allows the distribution of 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 can have a significant contagion effect. Thus, it is essential to have an adequate level of supervision and regulation.

An important issue for regulators is to understand whether the disciplining mechanisms inherent in the interbank loan market work effectively. 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 those they are lending to 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 a bank's ability to discipline their other banks is taken for granted. However, the "crises of trust", that occurred in Russia in 2004, casts doubt on efficient peer monitoring and shows that this mechanism may not work. In a theoretical paper Rochet and Tirole (1996) stress that the efficiency of peer monitoring substantially decreases if there is some government intervention such as state insurance of interbank claims or a "too-big-too fail" policy.

The aim of this paper is to check whether there is any market discipline in the Russian interbank market. This is an important policy issue as the Russian interbank market is rather fragile during periods of financial distress. 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 the understanding of the 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 is dedicated to market discipline measurement. Section III describes the Russian interbank market. Section IV presents our data and describes the econometric models we estimate. Section IV gives the main results, Section VI shows some robustness checks and Section VII concludes.

Literature

Interbank Loan Market

In the 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 (2002)). 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 the credit ratings of banks, general market indicators etc.) can reduce incentives for the monitoring efforts of wholesale funding providers. The 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 acquiring costly information.

Nevertheless, some empirical evidence confirms not only the existence of the quantity discipline, but also the presence of price discipline which means that costs of borrowing in the interbank market differs significantly differ based on a bank's 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 the 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 borrower and lender relationships (number of transactions between a particular pair of banks and others) and, finally, a dummy variable reflecting each of the 61 days under consideration. The results confirm the presence of price discipline. The price of loans depends on credit risk of a borrower. For very risky institutions the discipline is quantative, meaning that a bank with a 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 two-stage procedure the author examines the dependence of the interbank borrowing interest rates on the risk level of banks. As a proxy for the risk level the failure probability (produced by the Federal Reserve System) is taken. Control variables include indicators of banks' size and liquidity position, time dummies and some others. Both price and quantity discipline appear to be relevant. An

interesting result is that the price discipline has increased substantially after legislation changes in the early 1990s (the aims of which were to shift the burden of banks' failure to uninsured creditors).

The hypothesis of the existence of peer monitoring is confirmed also for the Portuguese (cf. Cocco et al. (2009)) and 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.

Market discipline among banks can be analysed using a different approach. The idea behind this 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 the 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 the share of interbank lending and borrowing grow, 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 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 the bank's net interbank assets to total assets, bank size, capital level, foreign ownership indicators, several macroeconomic indicators. Using instrumental variable econometric model the authors come to the 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 evidence confirms the presence of market discipline among banks for some economies. However the amount of empirical research is still moderate. Moreover the results are not universal; they vary among countries, which could be explained by the different market structures, the different levels of the economic development etc.

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

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 premiums (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. Global studies (Demirgüc-Kunt, Huizinga (1999); Hosono, Iwaki, Tsuru (2004)) allow for some cross-country comparisons. They demonstrate that a quantity-based approach is the most appropriate one for developing economies, where interest rates are unlikely to reflect information about bank risks due to information asymmetry and a lack of transparency in financial markets. Conversely a mixed approach is the best one for developed countries.

The papers on this topic do not differ much in the econometric models they employ. However, it is important to briefly 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 (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 the studies that followed. Our study also contains an econometric model that explicitly demonstrates the relationship between dependent variables and bank fundamentals as well as macroeconomic characteristics.

There are no papers dealing with market discipline and the Russian market for interbank loans. However, there are some studies providing evidence of 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 (2010) based on 1999-2002 data; Peresetsky, Karminsky, Golovan (2007) based on 2002–2004 data; Semenova (2007) based on 2006-2006 data).

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 the 1980s with the creation of a two-tiered banking system in the USSR after introduction of the appropriate legislation[4]. According to the IMF (2010) the interbank market in Russia is relatively small, not transparent enough and highly fragmented. There are quite a large number of regional and industrial clusters within the market (cf. Birjukova, Kovalenko (2011)).

During its existence the Russian interbank market has 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 position and started to borrow heavily on the interbank market. This finally led to the crisis of 1995 when several hundreds of banks collapsed (cf. OECD (1997)).

[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

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

The crisis that occurred in the interbank market in 2004 could be called "a 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 rumors and fictitious black-lists appeared undermining the confidence of credit institutions. As a result the interbank turnover decreased by 12.2% in May 2004 and by 13.3% in June (cf. CBR (2004)). However due to measures undertaken by the CBR (such as the reduction of reserve requirements, the compensation of deposits held in insolvent banks 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. 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 history and characteristics of the Russian interbank market described above 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 discipline mechanisms, such as peer monitoring, work in this market.

In order to participate in the interbank loan market banks have to establish credit limits for the banks with whom they are going to work. Transactions can be executed either directly among banks (using, for example, an information system like Reuters) or employing broker services and/or electronic communication networks. Banks can also borrow from the CBR at a fixed interest rate or at 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 call deposit or tom-next[5] interest rates.

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

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**Ошибка! Источник ссылки не найден.**), 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%).

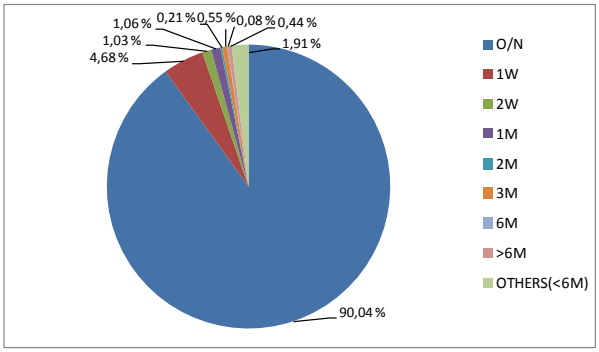

Fig. 1 Interbank market: maturity breakdown

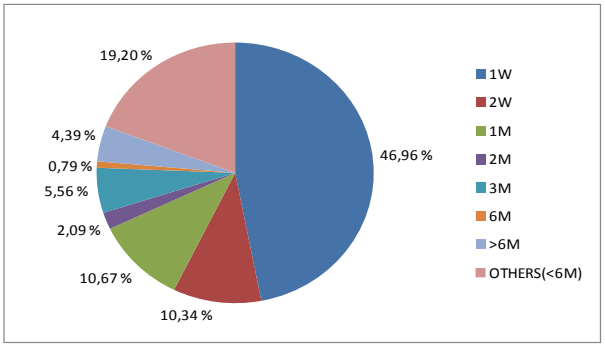

Fig. 2 Interbank market: maturity breakdown (without overnight operations)

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 and 4)

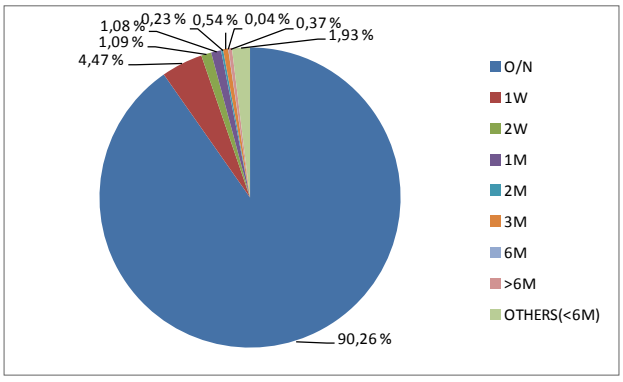

Fig. 3 Deposit operations: maturity breakdown

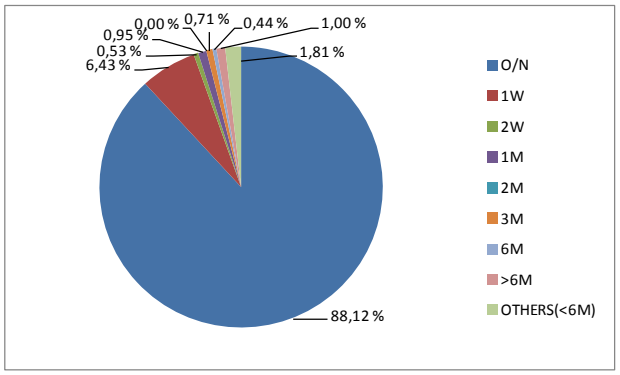

Fig. 4 REPO operations: maturity breakdown

More than a half of the turnover was with non-residents (foreign banks). However, the share of non-residents has decreased over the last two years from 69.26% in January 2010 to

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

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 has changed 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% respectively.

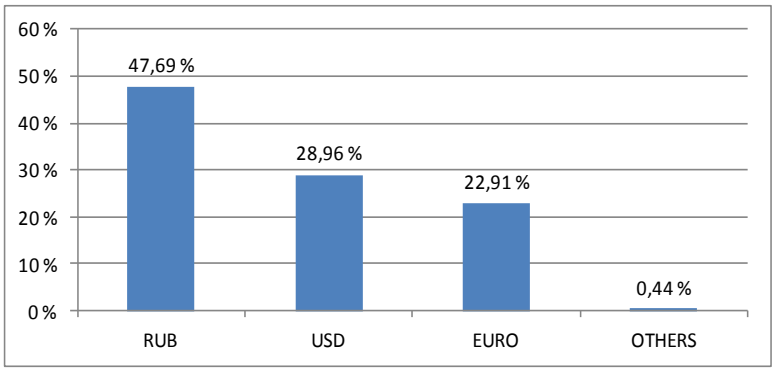

Fig. 5 Interbank market: currency breakdown

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

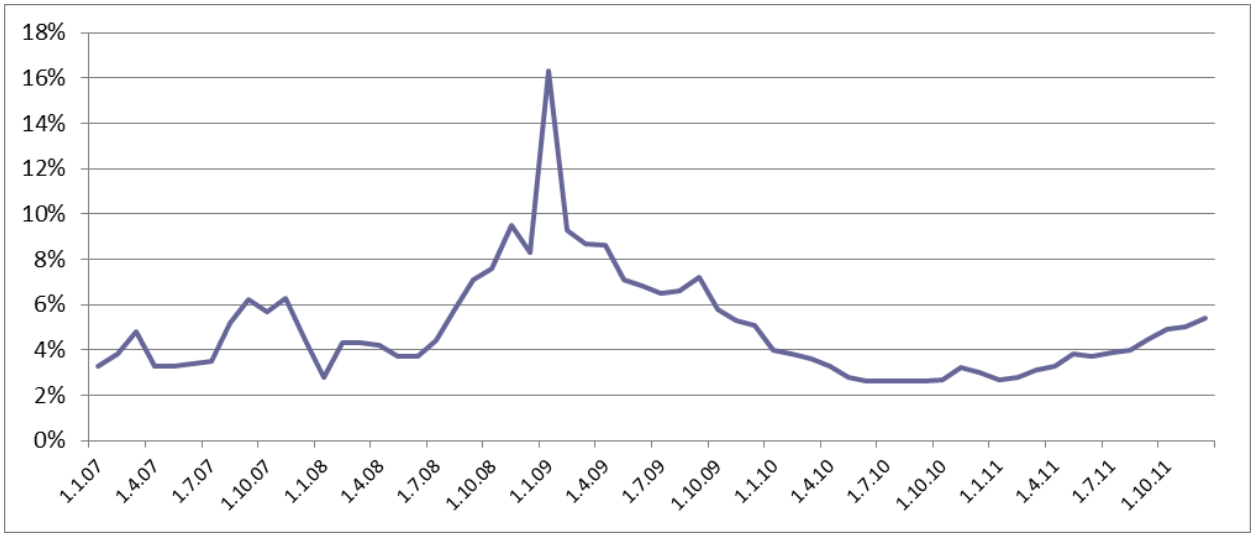

Fig. 6 Average interbank rate on 1 day loan in Rubbles

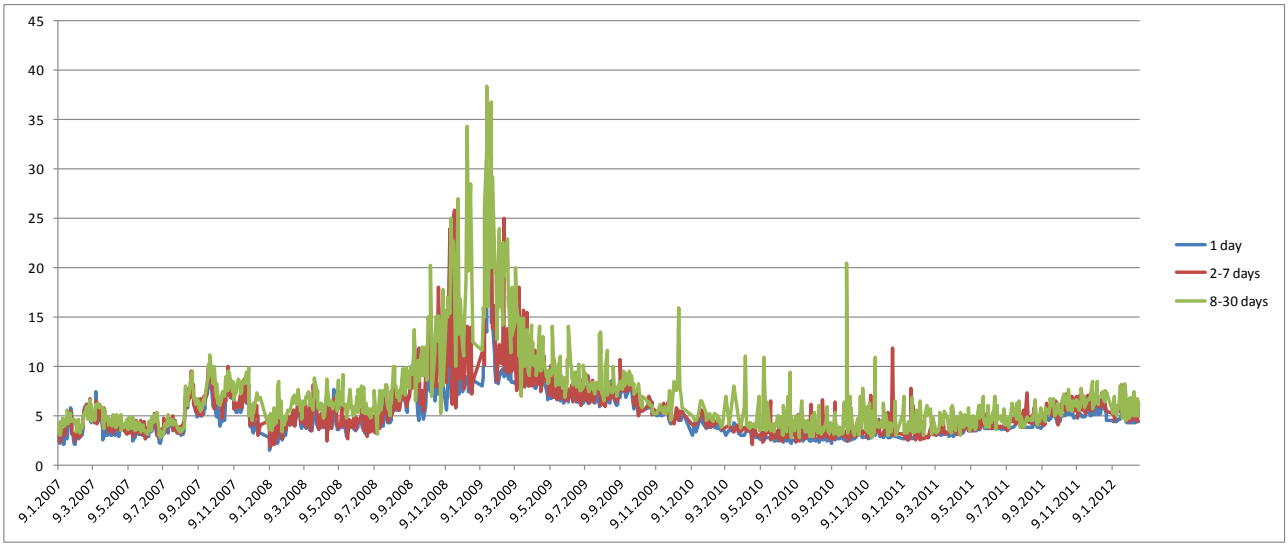

Fig. 7 Dynamics of the Moscow Interbank Actual Interest Rates

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, 1Q2010-3Q2011.

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

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

$MD_{i,t}$ represents market discipline variables. For a 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 the regression with a lag. This lag is approximately two months. Thus, using the previous period's variables seems to be reasonable.

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

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

Involved is a measure of a bank's exposure to the interbank loan market. It is the share of loans provided by other credit institutions in the bank's total 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. In order to eliminate the selection bias problem, we estimate the Heckman correction model conditioning the errors on bank participation (measured by *Participation* dummy). We also cluster errors by banks to concentrate on inter-bank differences.

Table 1 gives 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 at least 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 to short-term liabilities, N3	5304	73.01584	48.66897	0	200
share_a_lag	share of bank's total assets to 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 to 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

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 a higher capital adequacy ratio enjoy lower average interest rates. This means that when the 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 the 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 for the period under consideration. The bank fundamentals are jointly insignificant at a 10 percent confidence level. This result suggests that lenders' decisions are based on soft information (such as reputation, a bank's credit history 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 the most effective 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 black-list. It

included banks that were under special control due to lack of financial stability or an involvement in money-laundering. Those banks were considered to be close to license cancellation. The black-list itself was not revealed. The situation was aggravated by the Alfa-bank case. Alfa-bank is one of the largest privately owned Russian banks. A respected business magazine published an article where it was mentioned that this bank faced financial problems and was suffering from a lack of liquidity. 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 a "freeze" of the interbank market as no one was sure of whether the other parties were reliable enough.

Our results show that the trust crisis may occur again because of 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	0.01	0.011	0.011	-0.001	-0.001	-0.001	-0.001
	[0.006]***	[0.006]***	[0.007]***	[0.006]***	[0.000]*	[0.000]*	[0.000]*	[0.000]*
bloan_share_lag	-0.357	-0.328	-0.272	-0.244	0.005	0.005	0.004	0.004
	[0.902]	[0.901]	[0.920]	[0.921]	[0.016]	[0.016]	[0.015]	[0.015]
perexp_lag	25.091	25.24			-0.677	-0.664		
	[18.641]	[18.749]			[0.198]*	[0.198]*		
pe_eff_lag			0.001	0.001			0	0
			[0.001]	[0.001]			[0.000]	[0.000]
roa_lag	21.046		20.272		0.018		0.064	
	[17.030]		[16.934]		[0.115]		[0.122]	
rowa_lag		9.597		9.192		0.038		0.057
		[8.349]		[8.252]		[0.053]		[0.057]
n3_lag	-0.008	-0.008	-0.009	-0.009	0.000	0.000	0.000	0.000
	[0.006]	[0.006]	[0.006]	[0.006]	[0.000]**	[0.000]**	[0.000]***	[0.000]***
share_a_lag	-0.717	-0.689	-0.768	-0.742	-0.041	-0.041	-0.04	-0.04
	[0.325]**	[0.316]**	[0.331]**	[0.321]**	[0.009]*	[0.009]*	[0.009]*	[0.009]*
involved	-3.525	-3.597	-3.716	-3.786	0.132	0.132	0.122	0.123
	[2.188]	[2.248]	[2.304]	[2.367]	[0.041]*	[0.042]*	[0.033]*	[0.033]*
Q	+	+	+	+	+	+	+	+
Q*involved	+	+	+	+	+	+	+	+
_cons	0.543	0.537	0.632	0.627	-0.001	-0.001	-0.005	-0.005
	[0.410]	[0.403]	[0.437]	[0.432]	[0.004]	[0.004]	[0.004]	[0.004]
arthrho_cons	-0.059	-0.059	-0.051	-0.051	2.419	2.417	2.455	2.453
	[0.030]**	[0.030]**	[0.031]	[0.031]	[0.192]*	[0.193]*	[0.200]*	[0.201]*
lsigma_cons	1.662	1.662	1.662	1.662	-3.003	-3.004	-3.002	-3.002
	[0.426]*	[0.426]*	[0.426]*	[0.426]*	[0.095]*	[0.095]*	[0.096]*	[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

Robustness checks

This section presents the results of two robustness checks. First of all we 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 averages 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 half of the interbank market participants. This subsample includes banks acting in the more tightly-competitive interbank market. These banks are larger and more involved in 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 a subsample of Moscow banks. The results generally confirm those already obtained. There is still no quantitative discipline. Although higher capital adequacy adds to loan growth, bank fundamentals taken together are statistically insignificant.

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

Price discipline estimation results provide some evidence for the 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	0.006	0.006	0.006	-0.001	-0.001	-0.001	-0.001
	[0.003]***	[0.003]***	[0.003]***	[0.003]***	[0.000]*	[0.000]*	[0.000]*	[0.000]*
bloan_share_lag	0.074	0.081	0.262	0.266	0.006	0.006	0.005	0.005
	[1.168]	[1.168]	[1.205]	[1.207]	[0.020]	[0.020]	[0.019]	[0.019]
perexp_lag	29.088	29.197			-0.504	-0.49		
	[27.219]	[27.309]			[0.278]***	[0.272]***		
pe_eff_lag			-0.001	-0.001			0	0
			[0.001]	[0.001]			[0.000]	[0.000]
roa_lag	4.185		3.994		0.158		0.157	
	[10.634]		[10.691]		[0.165]		[0.184]	
rowa_lag		1.579		1.322		0.087		0.088
		[3.971]		[3.903]		[0.071]		[0.081]
n3_lag	-0.003	-0.003	-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	-0.52	-0.515	-0.592	-0.587	-0.052	-0.052	-0.051	-0.051
	[0.253]**	[0.254]**	[0.253]**	[0.253]**	[0.012]***	[0.012]***	[0.012]***	[0.012]***
involved	-2.389	-2.398	-2.515	-2.523	0.091	0.091	0.097	0.096
	[0.928]**	[0.931]***	[1.038]**	[1.042]**	[0.070]	[0.070]	[0.072]	[0.072]
Q	+	+	+	+	+	+	+	+
Q*involved	+	+	+	+	+	+	+	+
_cons	0.213	0.212	0.301	0.301	0.005	0.005	0.002	0.002
	[0.144]	[0.145]	[0.160]*	[0.161]*	[0.005]	[0.005]	[0.005]	[0.005]
arthrho_cons	-0.083	-0.083	-0.056	-0.056	2.532	2.547	2.529	2.547
	[0.037]**	[0.037]**	[0.033]***	[0.033]***	[0.305]***	[0.308]***	[0.306]***	[0.310]***
lsigma_cons	0.751	0.751	0.751	0.751	-2.995	-2.994	-2.998	-2.997
	[0.211]***	[0.211]***	[0.211]***	[0.211]***	[0.123]***	[0.123]***	[0.124]***	[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 market discipline. We condition the results on the banks' top-30 position according to the volumes of loans received in the interbank market.

The top-30 banks hold the major proportion of the interbank loans, amounting to 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 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. A higher share of bad loans and lower liquidity ratio increase the risk premiums and 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								

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 a 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 to exert market discipline. Conversely, if disciplining mechanisms do not work, 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 other parties' 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. At the same time they are more tightly disciplined by price: other banks, 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 a 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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