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Essays on the Russian Banking System

A Dissertation

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Doctor of Philosophy in Economics

by
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Chapter 1 Introduction

This thesis studies the recent developments in the Russian banking sector. In particular, we look at issues related to the introduction of deposit insurance, the role of state- and foreign-owned banks and some aspects of prudential supervision related to systemic stability.

Russia's deposit insurance (DI) legislation, which reached the statute books at the end of 2003, is perhaps the most important banking reform adopted in recent years. The system is intended to strengthen banking sector stability, to protect retail savers, to enhance competition and to foster financial deepening by mobilizing the large volume of unbanked savings held by Russian households (so-called 'mattress money') for intermediation by the financial system (Tompson, 2004).

Although DI schemes have proved increasingly popular around the world, there is growing concern that they can reduce incentives for depositors to monitor banks, while encouraging bankers to run greater risks and, thus, increasing the risk of financial instability. Whether this concern is justified depends on the actual willingness and ability of depositors to discipline their banks and is ultimately an empirical question.

In chapter 3, drawing on a unique database from the pre-deposit-insurance stage of Russia's post-communist transition, we investigate whether depositors did actually discipline private, domestic banks by withdrawing funds or requiring deposit rate premiums from less stable institutions. We do find that in spite of the country's apparent institutional immaturity, standard measures of the capacity to meet deposit obligations (e.g., capitalization and liquidity) correlate strongly with subsequent deposit inflows. But while evidence for quantity-based discipline is strong and robust, clear evidence that depositors "demand" higher deposit rates from less stable institutions is lacking.

In and of itself, the absence of price discipline should not be interpreted as suggesting that market discipline is weak. Indeed, the combination of strong evidence for quantity disciplining and nearly non-existent support for the standard form of price discipline is consistent with a different type of price discipline that, arguably, is more sophisticated than that uncovered in previous studies. Depositors, we say, exhibit this "sophisticated discipline" if they view the deposit rate as a complementary proxy for institutional stability and not purely as a mechanism through which banks compete for funds and offer compensation for risk or poor performance reflected in their fundamentals. So viewed, banks cannot necessarily expect to increase the net inflow of deposits, ceteris paribus, by raising deposit rates. More than just compensating for observable risk, raising rates may carry the suggestion of additional risk.[1] Testing this hypothesis, we estimate the deposit supply function and indeed show that, particularly for poorly capitalized banks, interest rate increases exhibit diminishing, and eventually negative, returns in terms of deposit attraction.

Overall, our results do suggest the possibility of a real cost in the form of reduced market discipline and subsequent moral hazard incentives as Russia recently moved forward with the introduction of widespread deposit insurance. This cost has, however, to be weighed against the benefits of enhanced stability and more intense competition due to the creation of a more level playing field between public and private banks. The moral hazard cost can in principle be minimized if reduced market discipline pressure is replaced by stronger regulatory pressure. The fact that during the introduction of DI relatively *few* banks failed to meet the admission criteria and lost the right to work with retail clients casts doubt on the CBR's determination to tighten

[1] Carree (2003) provides econometric-based evidence that Russian banks offering high deposit rates were likely to fail in the period 1994-1997. Two more recent examples of banks offering higher than average deposit rates and subsequently failing include Sodbiznesbank (license revoked in May 2004) and bank Granit (license revoked in May 2005). The risky credit strategy of the latter is described in a web-article available at http://www.banki.ru/news/daytheme/?id=46849. Both pieces of evidence grant support to the idea that higher deposit rates might be associated with higher risks.

regulatory oversight.

Two other, still heavily debated, policy initiatives relate to the role of state- and foreign-owned banks.

Partial public ownership in various forms remained a robust characteristic of the Russian banking sector throughout the transition. The Central Bank of Russia (CBR) has played an important role through the commercial banks under its direct control, namely Sberbank and Vneshtorgbank. In addition, government bodies at several levels own banks. There are examples of villages, provinces, cities, federal bodies and state firms in this position. At the beginning of 2002 for example, we find that the 27 banks that are majority owned by state bodies (out of 1277 banks in total) control 53% of banking assets and 39% of banking liabilities. Neglecting the CBR's commercial banking activities through Sberbank and Vneshtorgbank., the remaining 25 public banks hold no less than 6% of total banking assets and 8% of total banking liabilities.

There are good reasons for seeing state dominance as a problem. State ownership and state intervention in credit allocation tend to distort competition, to aggravate moral hazard by encouraging the expectation of a bailout, and to undermine the efficiency of intermediation, as banks often pursue policies that reflect the non-commercial requirements of the authorities rather than good commercial sense (Barth et. al., 2004; Sherif et.al., 2003). Russian state-owned banks (both federal and regional) have indeed derived substantial benefits from state ownership: in addition to the explicit state guarantee backing their retail deposits, which was scrapped only at the end of 2003, state-owned banks have enjoyed privileged access to state funds, de facto exemption from some regulatory norms and, on occasion, financial support from the state. There are, however, also costs to state ownership. State-owned banks have at times been required to perform unprofitable 'social functions' on behalf of the state or to adopt policies that reflect the requirements of macroeconomic management rather than profitability (Tompson, 2004).

Official policy is that state-owned banks should exist, if at all, to correct market failures: their activities should be specialized in sectoral and other niches which the market will not address on its own. The Russian authorities have long been committed to reducing the role of the state in the banking sector. The regulatory privileges enjoyed by state-owned banks have been reduced, and the adoption of DI legislation has deprived them of the explicit state guarantees. However, the process of divesting the state of its banks has been slow (Tompson, 2004).

There is still relatively little foreign involvement in the sector. At the beginning of 2005, non-residents owned stakes in 130 Russian credit institutions, of which 33 were wholly foreign-owned. The foreign share of the sector's total capital was estimated at around 5 per cent. This contrasts starkly with Central Europe, where local banking systems are now largely foreign-owned.

The Association of Russian Banks has consistently lobbied the government to limit foreign bank entry using the classic infant industry protection argument . The authorities have successfully resisted such pressures, with the 12 per cent ceiling on the foreign capital share in the sector being scrapped in 2002. The overall policy encourages greater foreign participation emphasizing the benefits foreign banks can bring to the sector in terms of skills, technology and credibility.

In chapter 4 we shed light on one specific aspect of this private/public/foreign ownership debate - the relative efficiency of different ownership structures. Estimating a cost frontier for all Russian banks we find that foreign banks are more efficient than domestic private banks, domestic private banks are not more efficient than public banks and the introduction of deposit insurance increased any existing efficiency gap between public and private banks. These results are not driven by the choice of production process, environment, risk preferences, activity mix, size, or econometric approach.

The result of foreign banks' superior efficiency is in line with most of the related literature on

transition countries. On the one hand, most shareholders of foreign banks are themselves banks. Consequently, these shareholders can provide their know-how in organization and risk analysis to their subsidiaries. On the other hand, foreign banks would benefit from better corporate governance as shareholders originating from Western economies would be more accustomed to monitoring bank managers.

But why, in contrast to the general prior, are private banks not more efficient than public banks in Russia? Implicit state guarantees may have rendered Russia's public banks' access to deposits less costly in terms of labor and physical capital, resulting in higher efficiency. A greater depositor base may in turn lead to a greater pool of loan applicants. Therefore, public banks may also benefit from granting a larger amount of loans than private banks for the same level of costs, because they must expend less effort to find borrowers. But if this explanation is true, the creation of a more level playing field via the introduction of a generalized deposit insurance scheme, no matter how incomplete, should have mitigated the efficiency difference, and yet we obtained the opposite result. So this explanation must be abandoned. Still deposit insurance may have played a role through moral hazard. In chapter 3 we provide strong evidence that Russian private domestic banks were subject to strong and sophisticated market discipline before the introduction of deposit insurance. This presumably forced them to improve their efficiency. The introduction of deposit insurance may however have reduced the pressure from market discipline, without replacing it with sufficiently strong regulatory pressure. In short, the introduction of deposit insurance may have introduced moral hazard, leading to more, rather than less, inefficient management practices in private banks.

Given the fact that Russian public banks are not more inefficient than private ones, the large state presence in the Russian banking sector is not necessarily the cause of its relative inefficiency and the well-known corollaries of lower credit levels and more financial instability.

The implication is that bank privatization will not necessarily improve the efficiency of the Russian banking system. Since the main inefficiency seems to reside with domestic private banks, the system's efficiency may benefit more from increased competition than from privatization. This can be achieved by creating a more level and more stable regulatory playing field for all banks, an objective the CBR is making progress on, and by opening the market to foreign competition.

Yet another policy initiative the CBR has been working on since 2002 is the reform of the system of prudential supervision. A particular emphasis in this new regulatory framework has been put on capital, traditionally perceived as a disincentive for banks (exploiting their limited liability) to take excessive risks (Tompson, 2004). Notably, post-reform prudential regulation in Russia is still largely focused on individual banks and pays little attention to systemic risk. This approach treats all banks as independent entities, taking into account neither their exposure to common risk factors, nor their physical interconnections through the interbank market. The latter, however, are widely believed to enhance the risk of systemic contagion.

Contagion through direct interbank exposures occurs if Bank A, for whatever reason, defaults on a payment to Bank B that produces a loss greater than B's capital and forces it to default on a payment to Bank C with losses that are larger than C's capital, and so on down the chain. Contagion may also run through indirect linkages. An adverse shock to one bank may create uncertainty about other banks that may be subject to the same shock. Since interbank market participants are generally risk averse and have asymmetric information about each other's financial health, individual banks may overreact to any negative news and withdraw their funds as quickly as possible. Such a generalized liquidity crunch may push a solvent institution into illiquidity and bankruptcy. The latter possibility suggests that adequate liquidity rather than capitalization might be a more important condition of survival in times of systemic distress.

In chapter 5 we suggest a new approach to modelling systemic risk on the interbank market.

Specifically, we enrich the literature with a new transmission channel of contagion, the liquidity channel. We apply this idea to the Russian banking sector and find that the liquidity channel contributes significantly to our understanding of both actual interbank market crises and individual bank defaults. The results corroborate the thesis that prudential regulation at individual bank level is insufficient to prevent systemic crises, because this approach neglects the potential of contagion. Especially bank-specific capital rules, no matter how sophisticated, will never suffice to prevent coordination failures on the interbank market, simply because capital is not a very important variable in assessing the risk of contagion and systemic meltdown. This is an important lesson in the aftermath of the subprime crisis, that appears to have been essentially a worldwide 'panic' scenario kick-started by the initial correlated default of some banks. In addition, our results suggest that the liquidity injections of a classical Lender of Last Resort can effectively mitigate coordination failures on the interbank market not only in theory, but also in practice. In short: liquidity matters.

Overall, this dissertation paints a rather familiar picture of the Russian banking system. Private banks do little financial intermediation, and, therefore, look inefficient by all standard measures of efficiency. Their wide-spread engagement in "non-traditional" activities (of legally dubious nature, according to some observers) causes lack of trust on the part of their peers and, thus, increases the risk of a systemic meltdown. Retail depositors are well aware of the problems in the banking sector and ruthlessly penalize banks for poor performance and excessive risks. In this light, the CBR's recent policies trying to foster financial intermediation by solving the aforementioned problems are most welcome.

The last but not least important contribution of this thesis is the construction of a consistent time series of balances and profit and loss accounts for a large cross-section of Russian banks. The next chapter starts with describing the data sources and the procedures applied for controlling

and aggregating the data. The resulting dataset constitutes a balanced and representative series of financial indicators covering the evolution of the Russian banking system over the last decade and offering great potential for future empirical research.

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Chapter 2 Heracles or Sisyphus? Finding, cleaning and reconstructing a database of Russian banks

2.1 Introduction

Empirical studies on transition countries have been plagued by the lack of reliable datasets. Limits in time and money rarely allow the construction of a dataset that meets the quality standards of academic research. Sometimes data do not seem to exist at all. The genesis of the Russian banking system, an economic experiment in banking on unprecedented scale, has not given birth to much empirical research exactly because of the lack of data. Very few researchers (see for example Schoors, 2000; others) were to gather some data on this very intriguing process.

We decided to put on the table a serious bid to construct a decent database that covers the majority of the Russian banking system and turn it into a user-friendly format. This has become possible because the banking system has become more transparent in the last seven years. In the aftermath of the 1998 meltdown, the Russian regulatory authorities and other market participants inside the country and abroad understood that the evaluation of the banking system's stability and risks was long overdue and required more transparent data. Also the scientific society has been paying more attention to transition economies and, specifically, to their financial systems. The resulting demand for reliable systematized data on Russian banks stimulated the Russian information agencies in cooperation with the Central Bank of Russia (CBR) to start gathering and providing such data on a regular basis.[2]

However, in this paper we show that although the Russian banking system exists for already more than ten years, data in a decent format have been available on the market for the last 4-5 years at best. For earlier periods one can buy unbalanced datasets, characterized by different

[2] It is worth mentioning that the first regular data is available on the market since the third quarter of 1995, that is immediately after the banking crisis of August 1995, while the data quality and completeness significantly improves in the first quarter of 1999 (particularly the data of the Interfaks agency starts in that period), that is after some recovery from the financial crisis of August 1998.

Table 2.1: Data Sources

Source	Period of coverage	Periodicity	Degree of aggregation
Mobile	Nov 95 – Aug 03	Monthly	Aggregated
KonfOb	Oct 95 – Jan 99	Quarterly	Detailed
Interfax	Apr 99 – Jan 03	Quarterly	Aggregated

numbers of banks, different and inconsistent formats and different periodicity. Since every serious study in banking demands dynamic analysis, we set on the Sisyphus task to construct one consistent and longer time series of a large cross-section of Russian banks than what is currently available on the market.

Section 2.2 presents the data collection and describes its representativeness. In section 2.3 we show how we aggregated the data and verified its internal consistency. Section 2.4 clarifies the methodology we used to convert the separate datasets into a single system of financial indicators. Section 2.5 concludes.

2.2 Data sources

We purchased data from the three Russian information agencies (see Table 2.1[3]).

The Mobile database contains a wide range of monthly financial indicators for all Russian banks (see Table A.4 for details). Unfortunately, out of the total 169 indicators claimed, only 27 are provided for the whole 8-year period. Another set of 34 indicators runs from January-February 1998 till August 2003. So for the period 1998-August 2003, 61 variables are available at every point in the time window. Furthermore, the majority of variables related to the Profit and Loss accounts (P&L) are available only on a quarterly basis and only since October 2000. Those P&L variables that are available monthly for earlier periods, are still absent for each last month of the quarter, that is for 1.04, 1.07, 1.10 and 1.01. P&L data are critical for most of our research purposes. Therefore, the Mobile dataset satisfies our data needs for the last 3 years only. Its main advantage though is related to its perfect transparency: the agency provides the complete

[3] The data on Profit and Loss accounts and regulatory ratios is provided by KonfOb since April 1997.

methodology it uses to aggregate the raw accounting data into the standard financial indicators as well as the links to the corresponding legislative acts, which the methodology is based on. Using that information we were able to build up the whole structure of the Mobile database (see Figures B.1, B.2 and B.3 for more detail). This proved to be crucial for the conversion of the datasets into a common format.

The KonfOb database contains for each bank-quarter a series of raw accounting data, stating the number of the account (or the sub-account) and the corresponding amount of roubles.[4] The data on the regulatory ratios of the CBR are also included. The Interfax agency provides us, in turn, with a wide set of aggregated financial indicators containing the major information from the Balance sheet, the P&L accounts and the regulatory standards (see Table A.5 for more detail). Interfax variables are available for every quarter claimed in Table 2.1.

In order to construct one consistent time series of data, we had to convert the detailed KonfOb data into the more condensed format of either Mobile or Interfax. We opt for Interfax what lets us avoid an undesirable break in the series of a number of important P&L variables (such as interest received/paid on loans/deposits of banks, firms, individuals etc.), as they are present in Mobile since October 2000 only. Another important advantage over Mobile is that Interfax presents a very detailed decomposition of major variables (e.g. loans, deposits, investments into securities, interest received/paid etc.) by counterparty including a subdivision into residents/non-residents, what is important for our research purposes.

Table 2.1 indicates that the KonfOb and Interfax databases complement each other almost perfectly, having a joint coverage of 7,5 years (Oct 1995 – Jan 2003) of quarterly data and since April 1997 representing practically the whole population of Russian banks (see Table 2.2). The main difficulty relates to their different formats of data representation.

[4] For 1998 we also have the decomposition of the total amount into roubles and foreign currency.

Table 2.2: Representativeness of KonfOb and Interfax

Date	Number of available banks	Number of existing banks	Number available / Number active, %
01.10.1995	787	2398	32,80%
01.01.1996	755	2297	32,90%
01.04.1996	753	2270	33,20%
01.07.1996	729	2158	33,80%
01.10.1996	763	2094	36,40%
01.01.1997	727	2033	35,80%
01.04.1997	1891	1940	97,50%
01.07.1997	1830	1845	99,20%
01.10.1997	1753	1766	99,30%
01.01.1998	1690	1707	99,00%
01.04.1998	1614	1643	98,20%
01.07.1998	1586	1600	99,10%
01.10.1998	1524	1533	99,40%
01.01.1999	1472	1483	99,30%
01.04.1999	1427	1439	99,20%
01.07.1999	1400	1409	99,40%
01.10.1999	1364	1388	98,30%
01.01.2000	1333	1350	98,70%
01.04.2000	1321	1340	98,60%
01.07.2000	1325	1335	99,30%
01.10.2000	1317	1324	99,50%
01.01.2001	1308	1323	98,90%
01.04.2001	1311	1322	99,20%
01.07.2001	1314	1327	99,00%
01.10.2001	1313	1325	99,10%
01.01.2002	1312	1328	98,80%
01.04.2002	1238	1334	92,80%
01.07.2002	1323	1343	98,50%
01.10.2002	1328	1338	99,30%
01.01.2003	1326	1341	98,90%
Average			93,10%

Note: Number of available banks includes only banks with an active licence. Source: Bank of Russia

2.3 Consistency of the KonfOb-dataset

In the face of the tremendous time and effort needed to convert the datasets to a common format (especially, taking into account the fact that the accounting standards in Russian banking underwent dramatic changes in 1998[5]) we wanted to have some confidence in the data. Therefore, we walked the extra mile of thoroughly testing it.

In order to check the internal consistency of the data, we first needed to construct the balance sheets and P&L accounts of each bank in each quarter from the raw accounting data of KonfOb. For the years 1995 – 1997, when the "old" accounting principles were still in place, this was accomplished according to the updated version of the August 1993 CBR instruction N 17 on the establishment of a common financial accounting system for commercial banks. For a number of accounts missing (mostly due to their abolishment) from the methodology of the Bank of Russia the method proposed by Androsov (1995) was used. The main sources used for the transformation of the 1998 data were the updated version of the October 1997 CBR instruction N 17 and the methodology proposed by Reschikova (1998). When there were differences between the sources the official methodology of the CBR was applied. Some lacking information, such as missing or wrong names of accounts, missing indication active/passive etc., was filled in with the help of the special literature (e.g. Tarakanova (1995), Kozlova (1999), Lavrushin (1999), December 2002 CBR Provision N 205-P, different editions of the Plan of Accounts).

We should mention that in almost all quarters (with the only exception of the first quarter of 1997) the data related to the P&L statement are provided by KonfOb for a significantly smaller number of banks than the data related to the balance sheet. As far as the main goal at this stage was to check the consistency of the data (and not to do any kind of analysis) we let all the banks

[5] We should note that in spite of the accounting switch the variables appearing under one name measure the same things across the different accounting standards as there exists a specific methodology (see Reschikova, 1998) allowing one to convert old financial accounts into the new ones. In those cases when matching failed (e.g. because the old accounts were not detailed enough) the constructed time series were left incomplete. This explains the empty cells in the last column of Figure B.4 (see below) indicating that matching was impossible.

stay in our sample irrespective of the completeness of the provided information.

As a second step, we verified the internal consistency of the KonfOb database by testing the following accounting identities[6]:

$\sum$ items of a category = subtotal

$\sum$ subtotals = total

$\sum$ assets = $\sum$ liabilities

$\sum$ revenues - $\sum$ costs = profit

Potential mistakes or typing errors were checked requiring bank's total assets and statutory capital to be positive. After removing non-functioning banks from the sample[7] all the conditions were satisfied indicating that the KonfOb database is internally consistent.

2.4 Conversion into a common format

The next step was to convert KonfOb into the format of Interfax. Unfortunately, the Interfax database contains only the names of the financial indicators but not the description of the method used to construct them. Even after a number of our special inquiries the agency refused to provide us with that kind of information. This left us with the necessity to work out the required methodology ourselves.[8] Obviously, it needed to stay as close as possible to the one used by the agency. At this stage the transparency of Mobile proved to be useful.

The Mobile database covers the period from November 1995 till August 2003, thus having a period overlap with each of the other two datasets. The aggregate indicators of Mobile and Interfax are not identical. However, for each variable (or combination of variables) from Interfax

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[6] We omit the description of such elementary tests as whether the account type (active/passive) in the database corresponds to its type from the official Plan of Accounts, whether the final balance under the account (active/passive) corresponds to its type, as well as the equality of the sum under the debit to the sum under the credit. After correcting some apparent typing errors all the specified tests were fulfilled.

[7] A bank is considered to be non-functioning if no changes can be observed in its financial statements during a number of subsequent periods and/or if its licence has been revoked.

[8] Elaborate attempts to relate the structure of the Interfaks database to the structure of the financial statements (Balance sheet and P&L report) were not only partially unsuccessful. In contrast to the lines of financial statements, the Interfaks indicators are not mutually exclusive, which seriously compromised our attempt to discover the necessary accounting relations.

the data allow us to construct an identical or very close combination of variables from Mobile. Knowing the construction methodology of Mobile (provided by the agency) we could then deduce the most probable methodology used by Interfax.

Thus, as a first step we create pairs: an indicator from Interfax – the corresponding combination of variables from Mobile.[9] For each pair the correlation coefficient is calculated, and if its value is equal (or close) to 1, the KonfOb data is converted into the format of Interfax using the methodology of Mobile.[10] Finally, as an additional test we compute the correlation coefficients between the transformed KonfOb data and the corresponding variables from Mobile. Note, however, that the availability of data in Mobile varies over time (see Table A.4), rendering the exact construction of desired combinations for all periods simply not feasible. Complete correlation is, therefore, for some variables technically impossible.

We present the correlation coefficients between Interfax and Mobile in Table 2.3 (column 4).[11] Almost all values being above 0,99 with only three falling short of 0,95 can be viewed as a comforting result.

These high values could, of course, partially be driven by the differences in bank size. To control for that, we also report the correlation coefficients between the ratios of the corresponding variables to total assets (column 5). Although being slightly lower, the corrected correlations still remain at sufficiently high levels to suggest that we have successfully mimicked the aggregation methodology used by Interfax.

Using the resulting methodology (see Figure B.4 for details[12]) we converted the KonfOb data

[9] The list of the resulting combinations is provided in Table A.6.

[10] Mobile provides the methodologies of aggregation based on the "old" as well as on the "new" accounting standards.

[11] For variables not available for the whole period 95-98 or 99-02 the correlations were taken based on the shorter series (e.g. for P&L variables available in Mobile since October 2000 the correlations were taken for the period October 2000-January 2003).

[12] One can use Figure B.4 to get a quick idea which of the constructed series is complete (i.e. available for the whole period 1995-2002) and which is not. Empty cells in the last column of Figure B.4 imply that the corresponding variables are available since 1998 only, because the matching between the new and old accounting standards was not possible. Filled cells in the same column indicate availability since October 1995 for the balance sheet items and since April 1997 for the P&L items and regulatory ratios.

Table 2.3: Correlation coefficients between Mobile and KonfOb/Interfaks

Variable (or combination)	KonfOb		Interfax	
	95-98	95-98 (ratios)	99-02	99-02 (ratios)
Capital	98,60%	99,50%	99,90%	98,30%
Deposits of individuals	100,00%	98,50%	100,00%	98,90%
Government securities	100,00%	99,70%	100,00%	100,00%
Corresp. accounts with other banks	99,90%	99,80%	99,90%	99,60%
Corresp. accounts with CBR	100,00%	100,00%	98,10%	99,80%
Corresp. accounts with commercial banks	99,80%	99,70%	99,90%	98,80%
Required reserves	100,00%	99,90%	100,00%	100,00%
Loans to nonbanks	99,30%	97,50%	99,90%	98,40%
Non-performing loans	100,00%	99,90%	89,90%	95,40%
Investments into promis. notes of banks	100,00%	100,00%	99,90%	99,90%
Liabilities	99,70%	98,80%	100,00%	98,40%
Term deposits	99,70%	86,60%	100,00%	94,90%
Term deposits of individuals	100,00%	97,40%	100,00%	98,90%
Profit before tax	100,00%	99,90%	99,90%	100,00%
Assets	99,80%		99,90%	
Loans to firms and individuals	99,50%	98,30%	99,90%	99,10%
Loans to domestic individuals			100,00%	99,60%
Investments into promis. notes			100,00%	100,00%
Interbank loans			96,70%	96,50%
Term deposits of 3 - 12 months			99,40%	93,80%
Term deposits of more than 1 year			96,10%	89,30%
Overdue liabilities			100,00%	85,70%
Interbank deposits			99,70%	99,60%
Claims of nonbanking sector			100,00%	98,90%
Settlement accounts			100,00%	99,40%
Debt securities issued			100,00%	100,00%
Certificates of savings issued			100,00%	100,00%
Personnel expenses			100,00%	100,00%
Interest received on loans to customers			100,00%	95,80%
Interest received on loans to banks			99,80%	94,00%
Interest paid on customer accounts			100,00%	100,00%
Interest paid on interbank deposits			100,00%	100,00%
Interest received on loans and deposits			100,00%	95,00%
Interest received from government and firms			100,00%	100,00%
Interest received from banks			100,00%	100,00%
Interest received from individuals			100,00%	100,00%
Interest paid on accounts, loans and deposits			100,00%	100,00%
Interest paid by government and firms			94,10%	97,80%
Interest paid on loans and deposits of CBR			100,00%	100,00%
Interest paid on loans and deposits of banks			92,80%	96,10%
Interest paid by individuals			100,00%	100,00%
Loans to banks of more than 1 year			100,00%	100,00%
Settlement accounts of government			99,80%	92,30%
Settlement accounts of firms and individuals			100,00%	98,60%

into the format of Interfax.[13] The correlation coefficients between transformed KonfOb variables and Mobile indicators are presented in Table 2.3 (columns 2 and 3). Generally, we consider the results to be satisfactory. Somewhat lower (and lacking) correlations are caused by the absence of the required data in Mobile (see above). In none of the cases could we identify any potential methodological problems or contradictions.

The next step is to put these data at work for empirical purposes. For illustration in Table A.7 we show how using the constructed database one can compute a set of variables, commonly used in empirical studies. However, from Tables A.4 and A.5 it should be obvious that the dataset allows calculation of much more variables than presented in Table A.7. For once, the main constraint seems to be the researcher's creativity rather than data availability.

2.5 Concluding Remarks

This paper describes the way we constructed a consistent time series of balances and profit and loss accounts for a large cross-section of Russian banks. We describe our data sources and the procedures applied for controlling and aggregating the data. The resulting dataset constitutes a balanced and representative series of financial indicators covering the evolution of the Russian banking system over the last decade and offering great potential for further empirical research.

[13] After merging the joint KonfOb-Interfaks dataset was slightly complemented with the data from Mobile. For example, this complementation took place in the third quarter of 1998, when the P&L data were absent in KonfOb but partially present in Mobile; namely, the data on profit were taken from Mobile.

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Appendix A Tables

Table A.4: Mobile database: list of variables

N	Since	Till	Variable
1	01.01.2002	01.08.2003	Letters of credit: claims
2	01.01.2002	01.08.2003	Letters of credit: obligations
3	01.11.1995	01.08.2003	Balance profit
4	01.01.2002	01.08.2003	Distribution of the profit (dividends included)
5	01.01.1998	01.08.2003	Net assets
6	01.11.1995	01.08.2003	Net profit
7	01.10.2000	01.07.2003	Income from investments in stocks
8	01.01.2002	01.08.2003	Income of future periods
9	01.01.2002	01.08.2003	Interbank deposits $>$ 1 year
10	01.01.2002	01.08.2003	Interbank deposits 3 - 12 months
11	01.02.1998	01.08.2003	Income from investments in securities
12	01.10.2000	01.07.2003	Income from investments in government securities
13	01.10.2000	01.07.2003	Income from investments in securities of local governments
14	01.06.2002	01.08.2003	Deposits of individuals (certificates of savings included)
15	01.01.1998	01.08.2003	Interest received on loans
16	01.01.1998	01.08.2003	Deposits of non-residents $<$ 3 months
17	01.01.1998	01.08.2003	Deposits of non-residents 3 months - 1 year
18	01.01.1998	01.08.2003	Deposits of non-residents $>$ 1 year
19	01.01.2002	01.08.2003	Deposits of firms $>$ 1 year
20	01.01.2002	01.08.2003	Deposits of firms 3 months - 1 year
21	01.01.2002	01.08.2003	Deposits of firms $<$ 3 months
22	01.01.1998	01.08.2003	Income from foreign currency operations
23	01.10.2000	01.07.2003	Income from operations with foreign currency
24	01.10.2000	01.07.2003	Income from the re-evaluation of foreign currency
25	01.10.2000	01.07.2003	Financing of social needs
26	01.11.1995	01.08.2003	Government securities
27	01.08.2000	01.08.2003	Securities of foreign governments
28	01.11.1995	01.08.2003	Interbank loans $>$ 30 days
29	01.01.1998	01.08.2003	Interbank loans of foreign banks $<$ 3 months
30	01.01.1998	01.08.2003	Interbank loans of foreign banks 3 months - 1 year
31	01.01.1998	01.08.2003	Interbank loans of foreign banks $>$ 1 year
32	01.08.2000	01.08.2003	Funds of other banks
33	01.08.2000	01.08.2003	Interbank loans $<$ 30 days
34	01.11.1995	01.08.2003	Loans to the economy
35	01.01.2002	01.08.2003	Loans to firms $<$ 3 months
36	01.06.2002	01.08.2003	Loans to the economy $>$ 3 years
37	01.01.2002	01.08.2003	Loans to firms 3 months - 1 year
38	01.01.2002	01.08.2003	Loans to individuals
39	01.06.2002	01.08.2003	Loans to individual entrepreneurs
40	01.06.2002	01.08.2003	Loans to individuals $>$ 1 year

41	01.06.2002	01.08.2003	Loans to individuals $<$ 3 months
42	01.06.2002	01.08.2003	Loans to individuals 3 months - 1 year
43	01.01.1998	01.08.2003	Loans to the economy $>$ 1 year
44	01.06.2002	01.08.2003	Loans to financial institutions (not banks) and funds
45	01.01.1998	01.05.1999	KK (not used)
46	01.11.1995	01.08.2003	Correspondent accounts with CBR
47	01.11.1995	01.08.2003	Correspondent accounts with other banks
48	01.11.1995	01.08.2003	Liquid assets
49	01.01.1998	01.08.2003	Highly liquid assets (according to N2)
50	01.01.1998	01.08.2003	Liquid assets (according to N3)
51	01.06.2001	01.08.2003	Liquid assets - Highly liquid assets
52	01.11.1995	01.12.1997	Highly liquid assets (according to N2)
53	01.11.1995	01.12.1997	Liquid assets (according to N3)
54	01.01.1998	01.08.2003	Leasing
55	01.11.1995	01.08.2003	Loans to other banks
56	01.01.2002	01.08.2003	Loans to other banks $>$ 1 year
57	01.01.2002	01.08.2003	Loans to other banks 3 months - 1 year
58	01.12.1995	01.08.2003	Monthly profit
59	01.01.1998	01.08.2003	Nongovernment securities
60	01.11.1995	01.08.2003	Nongovernment securities (before 1998)
61	01.08.2000	01.08.2003	Securities of non-residents
62	01.02.1999	01.08.2003	Risk-weighted assets
63	01.02.1999	01.08.2003	Risk-weighted assets (group 1)
64	01.02.1999	01.08.2003	Risk-weighted assets (group 2)
65	01.02.1999	01.08.2003	Risk-weighted assets (group 3)
66	01.02.1999	01.08.2003	Risk-weighted assets (group 4)
67	01.02.1999	01.08.2003	Risk-weighted assets (group 5)
68	01.02.1999	01.08.2003	Capital adequacy ratio
69	01.06.2002	01.08.2003	Individuals' deposits-to-capital ratio
70	01.02.1999	01.08.2003	Quick liquidity ratio (N2)
71	01.02.1999	01.08.2003	Current liquidity ratio (N3)
72	01.02.1999	01.08.2003	Long-term liquidity ratio (N4)
73	01.02.1999	01.08.2003	General liquidity ratio (N5)
74	01.06.2002	01.08.2003	Large-risks-to-capital ratio (N7)
75	01.02.1999	01.08.2003	Capital (for regulatory ratios calculation)
76	01.02.1999	01.08.2003	Highly liquid assets (according to N2)
77	01.02.1999	01.08.2003	Liquid assets (according to N3)
78	01.02.1999	01.08.2003	Demand liabilities (according to N2)
79	01.02.1999	01.08.2003	Demand liabilities (according to N3)
80	01.02.1999	01.08.2003	The sum of passive accounts
81	01.10.2000	01.07.2003	Operational income
82	01.02.1998	01.08.2003	Turnover on correspondent accounts
83	01.10.2000	01.07.2003	Operational expenses

84	01.11.1995	01.08.2003	Required reserves
85	01.11.1995	01.08.2003	Fixed assets
86	01.11.1995	01.08.2003	Demand liabilities
87	01.11.1995	01.12.1997	Demand liabilities (according to N2)
88	01.11.1995	01.12.1997	Demand liabilities (according to N3)
89	01.01.2000	01.05.2003	Correction 8991
90	01.10.2000	01.05.2003	Correction 8999
91	01.10.2000	01.07.2003	Interest received on loans to individuals
92	01.10.2000	01.07.2003	Interest received on loans to firms
93	01.10.2000	01.07.2003	Interest received on loans to credit institutions
94	01.10.2000	01.07.2003	Interest income from other sources
95	01.10.2000	01.07.2003	Interest received on other funds granted to banks
96	01.10.2000	01.07.2003	PDZS = PDZSB+PDZSF+PDZSO
97	01.10.2000	01.07.2003	Overdue interest received on loans to banks
98	01.10.2000	01.07.2003	Overdue interest received on loans to individuals
99	01.10.2000	01.07.2003	Overdue interest received on loans to firms
100	01.10.2000	01.07.2003	Interest from loans to banks
101	01.10.2000	01.07.2003	Interest from loans to clients
102	01.11.1995	01.08.2003	Other nonworking assets
103	01.10.2000	01.07.2003	The result of activities: loss
104	01.01.1998	01.08.2003	Nonperforming loans
105	01.06.2001	01.08.2003	Nonperforming loans to banks
106	01.01.1998	01.08.2003	Overdue promissory notes
107	01.11.1995	01.08.2003	Working assets
108	01.01.2002	01.08.2003	Expenses of future periods
109	01.02.1998	01.08.2003	Expenses from operations with securities
110	01.08.2000	01.08.2003	Overdue settlement documents
111	01.09.2001	01.08.2003	Settlement documents not paid in time
112	01.01.1998	01.08.2003	Loan loss reserves
113	01.02.1998	01.08.2003	Interest paid on loans
114	01.10.2000	01.07.2003	Interest paid on loans to banks
115	01.10.2000	01.07.2003	Interest paid on loans to nonbanks
116	01.10.2000	01.07.2003	Expenses from operations with securities
117	01.10.2000	01.07.2003	Interest paid on interbank deposits
118	01.07.2001	01.07.2003	Interest paid on loans from CBR
119	01.10.2000	01.07.2003	Interest paid on deposits of nonbanks
120	01.10.2000	01.07.2003	Interest paid on interbank loans
121	01.10.2000	01.07.2003	Interest paid on loans from nonbanks
122	01.10.2000	01.07.2003	Interest paid on deposits of individuals
123	01.10.2000	01.07.2003	Interest expenses from other sources
124	01.10.2000	01.07.2003	Other expenses
125	01.10.2000	01.07.2003	Interest paid on clients' accounts
126	01.07.2001	01.07.2003	Interest paid on overdue interbank loans

127	01.07.2001	01.07.2003	Interest paid on overdue loans from CBR
128	01.01.2001	01.01.2002	Interest paid on overdue loans from others
129	01.10.2000	01.07.2003	Personnel expenses
130	01.02.1998	01.08.2003	Expenses from operations with foreign currency
131	01.10.2000	01.07.2003	Expenses from foreign currency exchange
132	01.10.2000	01.07.2003	Expenses from the re-evaluation of foreign currency
133	01.11.1995	01.12.1997	Total assets
134	01.01.1998	01.08.2003	Obligations to supply money resources
135	01.01.1998	01.08.2003	Claims on money resources
136	01.01.2002	01.08.2003	Budget and budget funds accounts
137	01.01.2002	01.08.2003	Accounts of enterprises
138	01.11.1995	01.08.2003	Capital according to rules before 01.02.99
139	01.03.2003	01.08.2003	Capital according to rules since 01.05.02
140	01.01.2002	01.08.2003	Funds of the clients in use (for transactions)
141	01.01.1998	01.08.2003	Other funds of non-residents $<$ 3 months
142	01.01.1998	01.08.2003	Other funds of non-residents 3 months - 1 year
143	01.01.1998	01.08.2003	Other funds of non-residents $>$ 1 year
144	01.11.1995	01.08.2003	Total liabilities
145	01.01.1998	01.08.2003	Liabilities $>$ 1 year
146	01.01.1998	01.08.2003	Total liabilities + capital
147	01.07.1999	01.08.2003	Payment cards
148	01.01.2002	01.08.2003	Payment cards
149	01.01.2002	01.08.2003	Settlement accounts
150	01.10.2000	01.07.2003	The result of activities: profit
151	01.11.1995	01.08.2003	Statutory capital
152	01.04.1996	01.09.1997	Statutory capital (not used)
153	01.11.1995	01.08.2003	The summation of all active /passive accounts
154	01.01.1998	01.08.2003	Securities issued
155	01.01.1998	01.08.2003	The summation of all active accounts
156	01.02.2003	01.08.2003	The summation of all passive accounts
157	01.08.2000	01.08.2003	All securities issued
158	01.11.1995	01.08.2003	Deposits of individuals $>$ 30 days
159	01.01.2002	01.08.2003	Deposits of individuals $>$ 1 year
160	01.01.1998	01.08.2003	Deposits of individuals $<$ 30 days
161	01.01.2002	01.08.2003	Deposits of individuals 3 - 12 months
162	01.01.2002	01.08.2003	Deposits of individuals $<$ 3 months
163	01.01.2002	01.08.2003	Certificates of savings
164	01.11.1995	01.08.2003	Deposits of firms $>$ 30 days
165	01.01.1998	01.08.2003	Deposits of firms $<$ 30 days
166	01.01.1998	01.08.2003	Investments into promissory notes of banks
167	01.01.2002	01.08.2003	Investments into promissory notes
168	01.01.1998	01.08.2003	Investments into promissory notes of enterprises
169	01.01.1998	01.08.2003	Investments into promissory notes of enterprises $>$ 1 year

Table A.5: Interfaks database: list of variables

N	Description
if9999	Rank by assets
if0000	Bank's name
	1. Main characteristics of banks
if0101	Location
if0102	Registration number
if0103	Assets
if0104	Assets growth, %
if0105	Capital
if0106	Rank by capital
if0107	Capital growth, %
if0108	Before-tax profit
if0109	Rank by before-tax profit
	2. Volume and structure of claims of individuals
if0201	Deposits of individuals
if0202	Rank by deposits of individuals
if0203	Change in deposits of individuals, %
if0204	Rouble-denominated deposits of individuals
if0205	Change in rouble-denominated deposits of individuals, %
if0206	Dollar-denominated deposits of individuals
if0207	Change in dollar-denominated deposits of individuals ($), %
if0208	Payment cards
if0209	Share of individuals' deposits in liabilities, %
if0210	Individuals' deposits-to-capital ratio (obligatory regulation N11)
	3. Investments into government securities
if0301	Government securities
if0302	Rank by government securities
if0303	Change in government securities, %
if0304	Rouble-denominated government securities
if0305	Change in rouble-denominated government securities, %
if0306	Dollar-denominated government securities
if0307	Change in dollar-denominated government securities($), %
if0308	Promissory notes issued or guaranteed by government
if0309	Share of government securities in assets, %
if0310	Securities issued by regions and municipalities
	4. Claims on banks
if0401	Correspondent accounts with other banks
if0402	Share of CBR in correspondent accounts with other banks, 100%
if0403	Share of Russian banks in correspondent accounts with other banks, %
if0404	Share of foreign banks in correspondent accounts with other banks, %

if0405	Required reserves
if0406	Net interbank loans
if0407	Share of deposits with CBR in interbank loans, %
if0408	Share of domestic banks in interbank loans, %
if0409	Share of foreign banks in interbank loans, %
if0410	Net investments into marketable debt of banks
	5. Loans to nonbanks
if0501	Net loans to nonbanks
if0502	Change in net loans to nonbanks, %
if0503	Share of net loans to nonbanks in assets, %
if0504	Loans to domestic nonbanks
if0505	Share of federal government in loans to domestic nonbanks, %
if0506	Share of regional and local governments in loans to domestic nonbanks, %
if0507	Share of firms and individual entrepreneurs in loans to domestic nonbanks, %
if0508	Share of individuals in loans to domestic nonbanks, %
if0509	Loans to foreign nonbanks
if0510	Reserves for loans to and promissory notes issued by nonbanks
if0511	Non-performing loans
	6. Non-performing loans to nonbanks
if0601	Non-performing loans to domestic nonbanks
if0602	Change in non-performing loans to domestic nonbanks, %
if0603	Share of federal government in non-performing loans to domestic nonbanks, %
if0604	Share of regional governments in non-performing loans to domestic nonbanks, %
if0605	Share of firms in non-performing loans to domestic nonbanks, %
if0606	Share of individuals in non-performing loans to domestic nonbanks, %
if0607	Non-performing loans to foreign nonbanks
if0608	Change in non-performing loans to foreign nonbanks, %
if0609	Share of firms in non-performing loans to foreign nonbanks, %
if0610	Share of individuals in non-performing loans to foreign nonbanks, %
	7. Investments into promissory notes
if0701	Investments into promissory notes
if0702	Rank by investments into promissory notes
if0703	Share of promissory notes in assets, %
if0704	Share of promissory notes in loans, %
if0705	Share of government in promissory notes, %
if0706	Share of banks in promissory notes, %
if0707	Share of other issuers in promissory notes, %
if0708	Total turnover of promissory notes
if0709	Turnover of promissory notes issued by government
if0710	Turnover of promissory notes issued by banks
if0711	Turnover of promissory notes issued by others

	8. Interbank loans
if0801	Interbank loans
if0802	Rank by interbank loans
if0803	Share of interbank loans in assets, %
if0804	Share of loans to foreign banks in interbank loans, %
if0805	Share of loans to foreign banks of less than 1 week in interbank loans, %
if0806	Share of loans to foreign banks of 1 week to 1 year in interbank loans, %
if0807	Share of loans to foreign banks of more than 1 year in interbank loans, %
if0808	Share of nonperforming loans to foreign banks in interbank loans, %
if0809	Share of loans domestic banks in interbank loans, %
if0810	Share of loans to domestic banks of less than 1 week in interbank loans, %
if0811	Share of loans to domestic banks of 1 week to 1 year in interbank loans, %
if0812	Share of loans to domestic banks of more than 1 year in interbank loans, %
if0813	Share of nonperforming loans to domestic banks in interbank loans, %
	9. Assets denominated in foreign currency
if0901	Assets denominated in foreign currency
if0902	Share of foreign-currency-denominated assets in total assets, %
if0903	Share of loans to nonbanking sector in foreign-currency-denominated assets, %
if0904	Share of claims on banks in foreign-currency-denominated assets, %
if0905	Share of nonbank debt securities in foreign-currency-denominated assets, %
if0906	Share of other assets in foreign-currency-denominated assets, %
	10. Foreign assets
if1001	Claims on non-residents, total
if1002	Rank on claims on non-residents
if1003	Change in claims on non-residents, %
if1004	Claims on non-residents: loans to non-banking sector
if1005	Claims on non-residents: interbank loans and correspondent accounts
if1006	Share of non-residents in assets, %
if1007	Share of non-residents in loans to non-banking sector, %
if1008	Share of non-residents in interbank loans and correspondent accounts, %
	11. Term structure of liabilities
if1101	Liabilities
if1102	Rank on liabilities
if1103	Change in liabilities, %
if1104	Share of current and correspondent accounts in liabilities, %
if1105	Share of term deposits with maturity of less than 90 days in liabilities, %
if1106	Share of term deposits with maturity of 90 days to 1 year in liabilities, %
if1107	Share of term deposits with maturity of more than 1 year in liabilities, %
if1108	Share of debt securities with maturity of less than 90 days in liabilities, %
if1109	Share of debt securities with maturity of 90 days to 1 year in liabilities, %
if1110	Share of debt securities with maturity of more than 1 year in liabilities, %
if1111	Share of overdue liabilities in liabilities, %
if1112	Share of liabilities with uncertain term to maturity in liabilities, %

	12. Claims of banks
if1201	Claims of banks
if1202	Share of correspondent accounts in claims of banks, %
if1203	Share of correspondent accounts of domestic banks in claims of banks, %
if1204	Share of correspondent accounts of foreign banks in claims of banks, %
if1205	Share of interbank deposits in claims of banks, %
if1206	Share of deposits from central bank of Russia in claims of banks, %
if1207	Share of interbank deposits of domestic banks in claims of banks, %
if1208	Share of interbank deposits of foreign banks in claims of banks, %
	13. Claims of non-banking sector
if1301	Claims of nonbanking sector
if1302	Settlement accounts
if1303	Share of government in settlement accounts, %
if1304	Share of domestic firms in settlement accounts, %
if1305	Share of domestic individuals in settlement accounts, %
if1306	Share of foreign firms in settlement accounts, %
if1307	Share of foreign individuals in settlement accounts, %
if1308	Term deposits
if1309	Share of government in term deposits, %
if1310	Share of domestic firms in term deposits, %
if1311	Share of domestic individuals in term deposits, %
if1312	Share of foreign firms in term deposits, %
if1313	Share of foreign individuals in term deposits, %
	14. Debt securities issued
if1401	Debt securities issued
if1402	Rank on debt securities issued
if1403	Issued rouble-denominated promissory notes outstanding
if1404	Turnover on issued rouble-denominated promissory notes
if1405	Issued foreign-currency-denominated promissory notes outstanding
if1406	Turnover on issued foreign currency-denominated promissory notes
if1407	Certificates of deposit issued
if1408	Certificates of savings issued
if1409	Bonds issued
if1410	Share of debt securities in liabilities, %
	15. Liabilities denominated in foreign currency
if1501	Liabilities denominated in foreign currency
if1502	Share of foreign-currency-denominated liabilities in liabilities, %
if1503	Share of foreign-currency-denominated liabilities in deposits of nonbanks, %
if1504	Share of foreign-currency-denominated liabilities in claims of banks, %
if1505	Share of foreign-currency-denominated liabilities in issued debt securities, %
if1506	Share of foreign-currency-denominated liabilities in other liabilities, %

	16. Foreign liabilities
if1601	Total claims of non-residents
if1602	Change in claims of non-residents, %
if1603	Claims of non-residents: deposits from nonbanking sector
if1604	Claims of non-residents: "investment" and "special" accounts
if1605	Claims of non-residents: interbank deposits
if1606	Share of non-residents in liabilities, %
if1607	Share of non-residents in claims of nonbanking sector, %
if1608	Share of non-residents in interbank deposits, %
	17. Money market operations
if1701	Rouble-denominated interbank loans: balance
if1702	Rouble-denominated interbank deposits: balance
if1703	Rouble-denominated interbank loans: turnover
if1704	Rouble-denominated interbank deposits: turnover
if1705	Foreign-currency-denominated interbank loans: balance
if1706	Foreign-currency-denominated interbank deposits: balance
if1707	Foreign-currency-denominated interbank loans: turnover
if1708	Foreign-currency-denominated interbank deposits: turnover
if1709	Share of interbank loans in assets, %
if1710	Share of interbank deposits in liabilities, %
	18. Composition of profit
if1801	Profit before tax
if1802	Net interest margin
if1803	Net re-evaluation of assets
if1804	Net provisions for losses
if1805	Net income from other sources, total
if1806	Personnel expenses
if1807	Profit before provisions for losses and asset re-evaluation
	19. Composition of interest income and expenses
if1901	Interest income
if1902	Share of loans to customers in interest income, %
if1903	Share of interbank loans in interest income, %
if1904	Share of debt securities in interest income, %
if1905	Share of other sources in interest income, %
if1906	Interest expenses
if1907	Share of customer accounts in interest expenses, %
if1908	Share of interbank deposits in interest expenses, %
if1909	Share of debt securities in interest expenses, %
if1910	Share of other sources in interest expenses, %

	20. Composition of interest income by counterparty
if2001	Interest received on loans and deposits
if2002	Share of government in interest income, %
if2003	Share of central bank of Russia in interest income, %
if2004	Share of domestic banks in interest income, %
if2005	Share of foreign banks in interest income, %
if2006	Share of firms owned by federal government in interest income, %
if2007	Share of firms owned by local governments in interest income, %
if2008	Share of domestic private non-banking firms in interest income, %
if2009	Share of foreign non-banking firms in interest income, %
if2010	Share of individual entrepreneurs in interest income, %
if2011	Share of individuals in interest income, %
	21. Composition of interest expenses by counterparty
if2101	Interest paid on accounts, loans and deposits
if2102	Share of government in interest expenses, %
if2103	Share of central bank of Russia in interest expenses, %
if2104	Share of domestic banks in interest expenses, %
if2105	Share of foreign banks in interest expenses, %
if2106	Share of firms owned by federal government in interest expenses, %
if2107	Share of firms owned by local governments in interest expenses, %
if2108	Share of domestic private non-banking firms in interest expenses, %
if2109	Share of foreign non-banking firms in interest expenses, %
if2110	Share of individuals in interest expenses, %
	22. Regulation ratios
if2201	Capital adequacy ratio (N1)
if2202	Quick liquidity ratio (N2)
if2203	Current liquidity ratio (N3)
if2204	Long-term liquidity ratio (N4)
if2205	General liquidity ratio (N5)
if2206	Large-risks-to-capital ratio (N7)
if2207	Owner-related-credit-risks-to-capital ratio (N9.1)
if2208	Insider-related-credit-risks-to-capital ratio (N10.1)
if2209	Investment-to-shares-to-capital ratio (N12)
if2210	Issued-promissory-notes-to-capital ratio (N13)

Table A.6: Matching Interfaks and Mobile

Variable (or combination)	Interfax	Mobile
Capital	if0105	138
Deposits of individuals	if201+if1408	158+160
Government securities	if0301	26
Corresp. accounts with other banks	if0401	46+47
Corresp. accounts with CBR	if0402/100*if0401	46
Corr. accounts with other banks	(if0403+if0404)/100*if0401	47
Required reserves	if0405	84
Loans to nonbanks	if0504+if0509	34+44+168
Non-performing loans	if0511	104
Promis. notes of banks	if0706/100*if0701	166
Term deposits	if1308+if1407+if1408	158+160+164+165
Term deposits of individuals	(if1311+if1313)/100*if1308+if1408	158+160-163
Profit before tax	if1801	3
Loans to firms and individuals	(if0507+if0508)/100*if0504+if0509	34+168
Loans to domestic individuals	if0508/100*if0504	38-39
Investments into promis. notes	if0701	167
Interbank loans	if0801	55
Term deposits of less than 3 months	if1105/100*if1101	162+33+32-9-10-105
Term deposits of 3 - 12 months	if1106/100*if1101	10+20+161+30
Term deposits of more than 1 year	if1107/100*if1101	9+19+159+31
Overdue liabilities	if1111/100*if1101	105
Interbank deposits	if1205/100*if1201	32+28+33
Settlement accounts	if1302	136+137
Debt securities issued	if1401	157
Certificates of savings issued	if1408	163
Personnel expenses	if1806	129+25
Interest received on loans	if1902/100*if1901	101
Interest received on loans to banks	if1903/100*if1901	100
Interest paid on customer accounts	if1907/100*if1906	115
Interest paid on interbank deposits	if1908/100*if1906	114
Interest received	if2001	100+101
Interest received from state and firms	(if2002+if2006:if2009)/100*if2001	101-91-98
Interest received from banks	(if2003+if2004+if2005)/100*if2001	100
Interest received from individuals	(if2010+if2011)/100*if2001	91+98
Interest paid on loans and deposits	ifif2101	114+115
Interest paid by government and firms	(if2102+if2106:if2109)/100*if2101	119+121+123+125+128
Interest paid on deposits of CBR	if2103/100*if2101	118+127
Interest paid on deposits of banks	(if2104+if2105)/100*if2101	117+120+126
Interest paid by individuals	if2110/100*if2101	122
Loans to banks of more than 1 year	(if0807+if0812)/100*if0801	56
Settlement accounts of government	if1303/100*if1302	136

Table A.7: Variables construction

Variable	Construction Methodology
Deposits of CBR	if1206 * if1201
Deposits of banks	(if1207+if1208) * if1201
Deposits of all banks	if1205 * if1201
Deposits of government	if1303*if1302+if1309*if1308
Deposits of firms	(if1304+if1306)*if1302+(if1310+if1312)*if1308
Deposits of individuals	(if1305+if1307)*if1302+(if1311+if1313)*if1308
Deposits of individuals (2)	if201
Deposits of all nonbanks	if1301
Total loans (no government and CBR)	(if507+if508)*if504+if509+if801
Loans to banks	if801
Loans to government	(if505+if506)*if504
Loans to firms	if507*if504+if509
Loans to individuals	if508*if504
Loans to all nonbanks	if504+if509
Return on assets	diff (if108) / Average assets
Return on equity	diff (if108) / Average capital
Interest rate on total (no gov. and CBR) deposits	diff((if2104+...+if2110)*if2101)/Average deposits
Interest rate on deposits of CBR	diff(if2103*if2101)/Average deposits
Interest rate on deposits of banks	diff((if2104+if2105)*if2101)/Average deposits
Interest rate on deposits of all banks	diff(if1908*if1906)/Average deposits
Interest rate on deposits of government	diff(if2102*if2101)/Average deposits
Interest rate on deposits of firms	diff((if2106+...+if2109)*if2101)/Average deposits
Interest rate on deposits of individuals	diff(if2110*if2101)/Average deposits
Interest rate on deposits of individuals(2)	diff(if2110*if2101)/Average deposits
Interest rate on deposits of all nonbanks	diff(if1907*if1906)/Average deposits
Interest rate on total loans (no gov. and CBR)	diff((if2004+...+if2011)*if2001)/Average loans
Interest rate on loans to banks	diff((if2004+if2005)*if2001)/Average loans
Interest rate on loans to government	diff(if2002*if2001)/Average loans
Interest rate on loans to firms	diff((if2006+...+if2010)*if2001)/Average loans
Interest rate on loans to individuals	diff(if2011*if2001)/Average loans
Interest rate on loans to all nonbanks	diff(if1902*if1901)/Average loans
Personnel expenses / Assets	diff (if1806) / Average assets
Net interest income / Assets	diff (if1802) / Average assets
Net income from other sources / Assets	diff (if1805) / Average assets
Non-performing loans / Total loans	if511 / (if504 + if509)
Government securities / Assets	if301 / if103
Term deposits / Claims of nonbanking sector	if1308 / if1301
Superliquid assets / Assets	(if402*if401+if407*if406) / if103
Required reserves / Assets	if405 / if103

Note: 'diff' indicates the necessity to take first differences of the flow PNL variables reflected in financial statements in a cumulative manner (accumulated over quarters).

Appendix B Figures

Note for Figures B.1, B.2 and B.3: moving from the left to the right gives the decomposition of aggregate variables into their components e.g. Demand liabilities consist of Interbank loans < 1m, Funds of other banks, Budget accounts, Deposits of individuals and firms < 1m and Accounts of enterprises; the latter, in turn, includes Settlement accounts and Funds of clients in use. "-" in front of, e.g., Letters of credit indicates that it is only one of the many components of the Funds of clients in use. Arrows indicate additional structural relations. "*" - means that only a part of the variable truly belongs to the corresponding place on the scheme. Reference numbers are provided in brackets.

Note for Figure B.4: Account numbers used to construct the Interfax-like indicators from the KonfOb data are reported. D and C stand for the resulting sum under the debit and credit, respectively; A stands for active sub-accounts of the corresponding account.

Figure B.1: Mobile database structure: capital and profit

Capital (75,138,139)	Statutory capital (151)							
	Net profit (6)	Balance profit (3)	Oper. inc. (81)	Int. receiv. on loans (15)	Int. from loans to banks (100)	Int. receiv. on loans to credit institutions (93)		
						Int. receiv. on other funds granted to banks (95)		
						Overdue int. receiv. on loans to banks (97)		
					Int. from loans to clients (101)	Int. receiv. on loans to indiv. (91)		PDZS (96)
						Int. receiv. on loans to firms (92)		
						Overdue int. receiv. on loans to indiv. (98)		
						Overdue int. receiv. on loans to firms (99)		
						Int. inc. from other sources (94)		
				Inc. from invest. in secur. (11)	Inc. from invest. in stocks (7)			
					Inc. from invest. in gov. secur. (12)			
					Inc. from invest. in secur. of local gov.s (13)			
				Inc. from foreing curr. oper. (22)	Inc. from oper. with foreing curr. (23)			
					Inc. from the re-evaluation of for. curr. (24)			
			Oper. exp. (83)	Int. paid on loans (113)	Int. paid on loans to banks (114)	Int. paid on loans from CBR (118)		
						Int. paid on interb. loans (120)		
						Int. paid on overdue loans from CBR (127)		
						Int. paid on overdue interb. loans (126)		
						Int. paid on interb. deposits (117)		
					Int. paid on loans to nonbanks (115)	Int. paid on loans from nonbanks (121)		
						Int. paid on overdue loans from others (128)		
						Int. paid on clients' accounts (125)		
						Int. paid on deposits of indiv. (122)		
						Int. paid on deposits of nonbanks (119)		
						Int. exp. from other sources (123)		
				Exp. from oper. with secur. (109,116)				
				Exp. from oper. with for. curr. (130)	Exp. from for. curr. exchange (131)			
					Exp. from the re-evaluation of for. curr. (132)			
				Other exp. (124)	Pers. exp. (129)			
					Financing of social needs (25)			
				The result of activities: profit (150)				
				The result of activities: loss (103)				
		Distr. of the profit (div. included) (4)		Distr. of the profit (div. included) (4)				

Figure B.2: Mobile database structure: assets

Sum a/p accounts (153)	Sum active acc. (133,155)	Work. assets (107)	Gov. securit. (26)		Invest. into prom. notes (167)	Invest. into prom. notes of banks (166)		Overdue prom. notes (106)
			Secur. of for. gov. (27)			Invest. into prom. notes of enterp. (168)	- invest. into prom. notes of enterp. > 1 year (169)	
			Nongov. secur. (59,60)					
			Loans to economy (34)	Loans to indiv. (38)	Loans to indiv. <3m (41)	- loans to individual entrepreneurs (39)		
					Loans to indiv. 3-12m (42)			
					Loans to indiv. >12m (40)			
				Loans to firms	Loans to firms <3 m (35)			
					Loans to firms 3-12m (37)			
					Loans to economy >1y (43) (includes 40)	- loans to economy >3y (36)		
						- leasing (54)		
			Loans to other banks (55)	Loans to other banks 3-12m (57)				
				Loans to other banks >12m (56)				
		Nonwork. assets	Fixed assets (85)					
			Other nonwork. assets (102)	- req. reserves (84)				
		Other assets	Loans to fin.instit. (not banks) (44)					
			Corr. accounts	Corr. accounts with the CBR (46)				
				Corr. accounts with other banks (47)				
			Letters of credit: claims (1)					
			Secur. of nonresid. (61)					
			Expenses of fut. periods (108)					

Figure B.3: Mobile database structure: liabilities

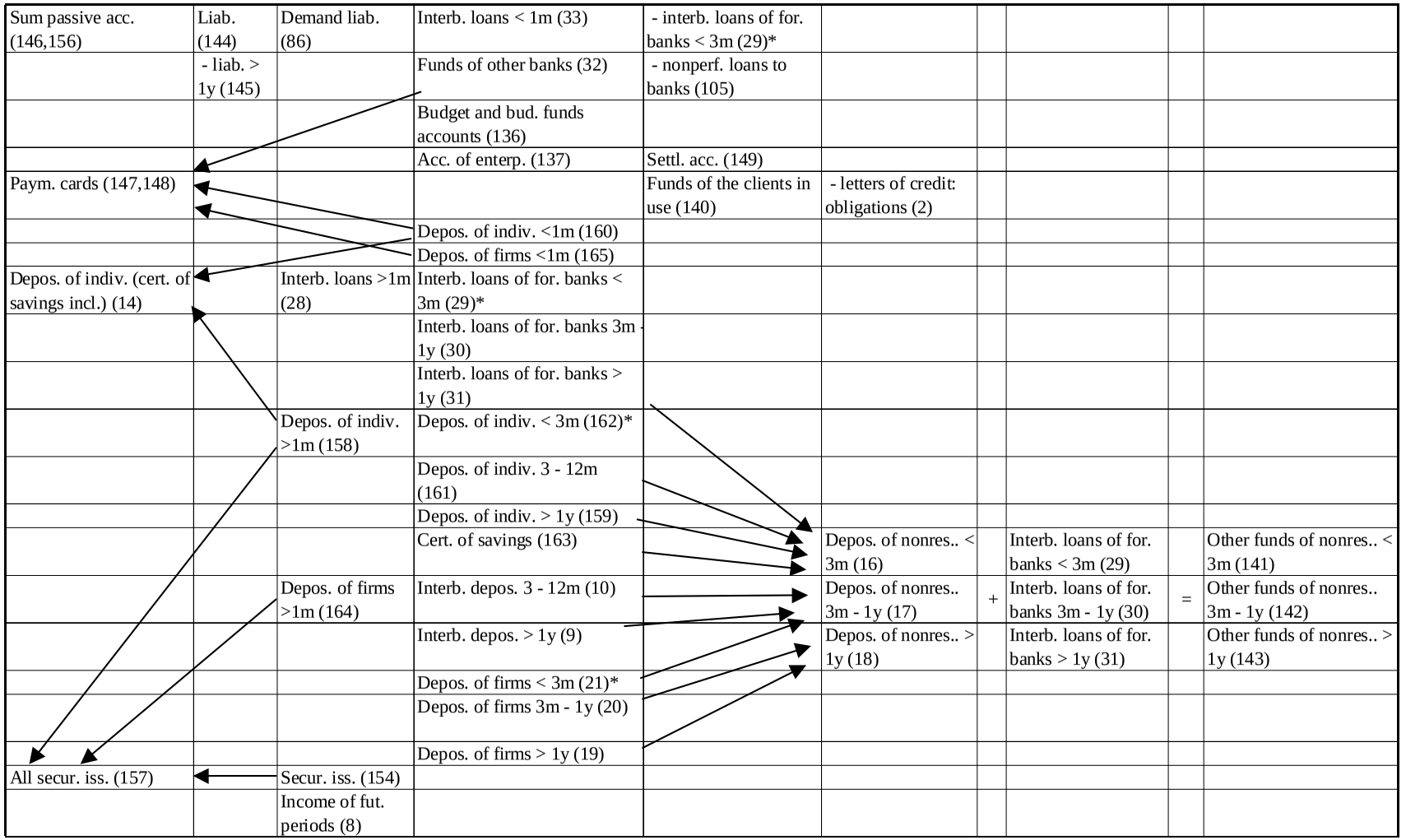

Figure B.4: Methodology used to translate the KonfOb database into the format of Interfaks

	New Plan of Accounts	Old Plan of Accounts
if0103	202+203A+204A+30102+30104+30106+30110+30114+30115+30118+30119+30202+30204+30206+30210+30213+30215+30221+30402+30404+30406+30409+30602+30605+31901+320A+...+324A+40109+40308+40310+40313+40908+441A+..+458A+460A+...+473A+47402+47404+47406+47408+47410+47413+47415+47417+47420+47423+47427+501A+...+519A+601+602+60302+60304+60306+60308+60310+60312+60314+60315+60317+60318+60321+60323+60337+60339+60341+60343+604+605+60606+60701+60801+60802+60901+60902+61001+61002+61003+61004+61005+61006+61007+61101+61102+61202+61309+61401+61402+61403-code 8914-code 8961	031+032+033+034+035+036+040+041+042+043+D044+D045+046+047+049+050+D054+055+056+059+060+061+062+063+064+072+074+D075+D076+077+D079+080+082+083+085+086+D154+D155+D156+D160+D161+D162+D163+D164+D165+167+D169+191+192+193+194+195+197+21+23+25+27+29+31+33+35+37+39+410+D411+D412+413+414+415+416+417+418+419+430+431+D432+433+434+435+436+437+438+439+45+47+49+51+53+55+57+59+610+611+612+613+615+616+618+619+620+627+630+650+651+652+653+654+655+660+D672+678+681+685+687+712+716+D721+D725+727+728+D729+76+77+780+790+791+D792+D794+804+806+808+816+D821+822+825+829+901+D902+D904+D905+D907+D908+D910+917+920+921+922+923+924+925+930+931+D932+933+937+940+941+942+D949+D992+D999
if0105	102+103+104 - 105+106+107 - 60319+(61305+61306+61307+61308 - code 8917 - 61405 - 61406 - 61407 - 61408)+(701 - 702)+(703 - 704 - 705) - code 8948 - code 8949 - code 8965 - code 8967+(code 8968 - code 8969) - code 8970 - code 8971 - code 8934 - 50802 - 50803 - 601A+60105-60201+code 8915	010+011+016+018-034-901+(C-D)949+(C-D)(019 and 017)+(C-D)662+(C-D)014+960+966+969-970-971-979+(C-D)(980 and 981)-950-951-code 8948 - code 8949 + code 8967+(code 8968 - code 8969) - code 8970 - code 8971 - 660
if0201	423+426	605+710+711+718+732+733+734+735
if0204	423+426 (roubles)	
if0206	423+426 (foreign currency)	
if0208	42308+42608	718
if0301	501A+502A+512A+513A	083+192+194
if0304	501A+502A (roubles)	
if0306	501A+502A (foreign currency)	
if0308	512A+513A	
if0310	50201A+513A	192
if0401	30102+30104+30106+30110+30114+30115+30118+30119	D(160+161+162+163+164+165)+167+D169+080+072+082+D411+D412
if0402	30102+30106	D161
if0403	30104+30110+30118	D(160+162+163+164+165)+167+D169+080+D411+D412
if0404	30114+30115+30119	072+082
if0405	30202+30204	681+816
if0406	31901+320A-32010+321A-32110+322A-32211+323A-32311+324A-32403+503A-50304+506A-50604+514A-51410+518A-51810	D054+822+D075+615+056+627-part of 945
if0407	31901	
if0408	320A-32010+322A-32211+32401-32403*32401/(32401+32402)+503A-50304+514A-51410	D054+822+056+627-part of 945
if0409	321A-32110+323A-32311+32402-32403*32402/(32401+32402)+506A-50604+518A-51810	D075+615 - part of 945
if0410	503A-50304+506A-50604+514A-51410+518A-51810	

if0501	40308+40310+441+442A-44210+443A-44310+444A-44410+...+457A-45707+458A-45818+460A-46008...+473A-47308+512A-51210+513A-51310+515A-51510+516A-51610+517A-51710+519A-51910	055+074+077+085+086+195+197+21+23+25+27+29+31+33+35+37+39+410+413+414+415+416+417+418+419+430+431+433+434+435+436+437+438+439+45+47+49+51+53+55+57+59+610+611+612+613+616+618+619+620+630+650+651+652+653+654+712+716+728+76+77+780+790+791+804+806+820+825-part of 945
if0504	441A+...+455A+45801…45815+460A+...+472A+512A+513A+515A	055+074+085+086+195+197+21+23+25+27+29+31+33+35+37+39+410+413+414+415+416+417+418+419+430+431+433+434+435+436+437+438+439+45+47+49+51+53+55+57+59+610+611+612+616+618+619+620+650+651+652+653+654+712+716+728+76+77+780+804+806+820+825
if0505	441+443A+445A+460A+462A+464A+45801+45803+45805+512A	804+806
if0506	442A+444A+448A+461A+463A+467A+45802+45804+45808+513A	
if0507	446A+447A+449A+450A+451A+452A+453A+454A+465A+466A+468A+469A+470A...+472A+515A+45806+45807+45809...+45814	055+074+085+086+195+197+21+23+25+27+29+31+33+35+37+39+410+413+414+415+416+417+418+419+430+431+433+434+435+436+437+438+439+45+47+49+51+53+55+57+59+610+611+612+616+618+619+620+650+651+652+653+654+712+728+76+77+780+820+825
if0508	455A+45815	716
if0509	40308+40310+456A+457A+45816+45817+473A+516A+517A+519A	77+613+630+790+791
if0510	44210+44310+44410+44509+44609+44709+44809+44909+45009+45109+45209+45309+45409+45508+45607+45707+45818+46008+46108+46208+46308+46408+46508+46608+46708+46808+46908+47008+47108+47208+47308+51210+51310+51510+51610+51710+51910	945
if0511	458A	055+620+780
if0601	45801+45802+45803+45804+45805+45806+45807+45808+45809+45810+45811+45812+45813+45814+45815	
if0603	45801+45803+45805	
if0604	45802+45804+45808	
if0605	45806+45807+45809+45810+45811+45812+45813+45814	
if0606	45815	
if0607	45816+45817	
if0609	45816	
if0610	45817	
if0701	512A+…+519A	085+086+195+197
if0705	512A+513A	
if0706	514A	
if0707	515A+516A+517A+518A+519A	

if0801	320A+321A+322A+323A+324A	D054+822+D075+615+056+627
if0804	321A+323A+32402	D075+615
if0805	32101+32102+32103+32301+32302+32303+32310	
if0806	32104+32105+32106+32107+32304+32305+32306+32307	
if0807	32108+32109+32308+32309	
if0808	32402	
if0809	320A+322A+32401	D054+822+056+627
if0810	32001+32002+32003+32201+32202+32203+32210	
if0811	32004+32005+32006+32007+32204+32205+32206+32207	
if0812	32008+32009+32208+32209	
if0813	32401	056+627
if0901	The summation of assets if0103 (foreign currency)	
if0903	40308+40310+441A+...+458A+460A...+473A+512A+513A+515A+516A+517A+519A (foreign currency)	
if0904	30102+30104+30106+30110+30114+30115+30118+30119+31901+320A+321A+322A+323A+324A +503A+506A+514A+518A (foreign currency)	
if0905	501+502A+504A+505A+507A+512A+513A+515A+516A+517A+519A (foreign currency)	
if0906	(if0103-if0903-if0904-if0905) (foreign currency)	
if1001	30114+30115+30119+321A+323A+32402+506A+518A+40308+40310+456A+457A+45816+45817+ 473A+516A+517A+519A+20312+20316+20318+505A+507A+510A+511A	072+082+D075+615+613+790+791+630+077+059
if1004	40308+40310+456A+457A+45816+45817+473A+516A+517A+519A	613+790+791+630+077
if1005	30114+30115+30119+321A+323A+32402+506A+518A	072+082+D075+615

if1101	20309+20310+20313+20314+30109+30111+30112+30113+30116+30117+30214+30220+30223+30401+30403+30405+30408+30601+30603+30604+30606+312+...+318+40101+40102-40103-40104+40105+40106+40107+40108-40109+40110-40111+40112+40113+40114+40201+40202+40203+40204+40205+40206+40301+40302+40306+40307+40309+40312+40314+404+...+408+40903+40904+40905+40906+40907-40908+40909+40910+40911+410+...+423+425+...+440+47401+47403+47405+47407+47411+47412+47414+47416+47418+47419+47422+47426+520+...+523+60301+60303+60305+60307+60309+60311+60313+60316+60322	C054+070+071+073+C075+C076+078+C079+081+084+087+088+090+(C-D)100+120+130+131+132+133+134+141+142+144+(C-D)145+149+157+158+C160+C161+C162+C164+C165+168+C169+(170-180)>0+196+199+20+22+24+26+28+300+301+32+34+36+38+40+42+44+46+48+50+52+54+56+58+600+601+602+603+604+605+606+607+608+609+614+623+624+631+632+634+64+671+673+69+70+710+711+713+714+715+717+718+720+C721+722+723+724+C725+726+C729+730+731+732+733+734+735+736+737+738+739+74+750+751+752+807+809+810+811+812+814+(C-D)817+818+819+823+824+900+C904+C905+C907+C910+915+C932+C992
if1104	20309+20310+20313+20314+30109+30111+30112+30113+30116+30117+30214+30220+30223+30401+30403+30405+30408+30601+30603+30604+30606+40101+40102-40103-40104+40105+40106+40107+40108-40109+40110-40111+40112+40113+40114+40201+40202+40203+40204+40205+40206+40301+40302+40306+40307+40309+40312+40314+404+...+408+40903+40904+40905+40906+40907-40908+40909+40910+40911	070+071+073+081+087+090+(C-D)100+120+130+131+132+133+134+141+142+144+(C-D)145+149+157+158+C160+C161+C162+C164+C165+168+C169+(170-180)>0+20+22+24+26+28+300+301+32+34+36+38+40+42+44+46+48+50+52+54+56+58+600+601+602+603+606+607+608+609+631+632+634+64+671+673+69+70+715+720+C721+722+723+724+C725+726+C729+74+750+751+752+807+810+811+812+814+(C-D)817+818+819+900+C992
if1105	31201+31202+31203+31204+31301+31302+31303+31304+31305+31401+31402+31403+31404+31405+31501+31502+31503+31504+31505+31510+31601+31602+31603+31604+31605+31610+410...426(01...03,08)+427...440(01...03)	C054+C075+604+605+614+710+711+713+714+717+718+732+733+734+735+736+737+738+739+823+824
if1106	31205+31206+31306+31307+31406+31407+31506+31507+31606+31607+410...440(04...05)	
if1107	31308+31309+31408+31409+31508+31509+31608+31609+410...440(06...07)	
if1108	52001+52002+52101+52102+52201+52202+52301+52302+52303	084+088+196+199+730+731
if1109	52003+52004+52103+52104+52203+52204+52304+52305	
if1110	52005+52006+52105+52106+52205+52206+52306+52307	
if1111	317+318	623+624
if1112	47401+47403+47405+47407+47411+47412+47414+47416+47418+47419+47422+47426+60301+60303+60305+60307+60309+60311+60313+60316+60322	C076+078+C079+809+C904+C905+C907+C910+915+C932
if1201	20313+20314+30109+30111+30112+30113+30116+30117+312+...+318	C054+073+C075+081+087+C160+C161+C162+C164+C165+168+C169+604+623+624+632+823+824
if1202	30109+30111+30112+30113+30116+30117	073+081+087+C160+C161+C162+C164+C165+168+C169+632
if1203	30109+30116	081+C160+C161+C162+C164+C165+168+C169
if1204	30111+30112+30113+30117	073+087+632
if1205	20313+20314+312+...+318	C054+C075+604+623+624+823+824
if1206	312+31701+31801	824+623+624
if1207	20313+313+315+31702+31802	C054+823
if1208	20314+314+316+31703+31803	C075+604

if1301	20309+20310+40101+40102+40105+40106+40107+40108-40109+40110-40111+40112+40113+40114+40201+40202+40203+40204+40205+40206+40301+40302+40306+40307+40309+40312+40314+404+...+408+40901+40902+40903+40904+40905+40906+40907-40908+40909+40910+40911+410+...+423+425+...+440	070+071+090+C100+120+130+131+132+133+134+141+142+144+(C-D)145+149+157+158+(170-180)>0+20+22+24+26+28+300+301+32+34+36+38+40+42+44+46+48+50+52+54+56+58+600+601+602+603+605+606+607+608+609+614+631+634+64+671+673+69+70+710+711+713+714+715+717+718+720+C721+722+723+724+C725+726+C729+732+733+734+735+736+737+738+739+74+750+751+752+807+810+811+814+(C-D)817+818+819+900
if1302	20309+20310+40101+40102+40105+40106+40107+40108-40109+40110-40111+40112+40113+40114+40201+40202+40203+40204+40205+40206+40301+40302+40306+40307+40309+40312+40314+404+…+408+40901+40902+40903+40904+40905+40906+40907-40908+40909+40910+40911	070+071+090+C100+120+130+131+132+133+134+141+142+144+(C-D)145+149+157+158+(170-180)>0+20+22+24+26+28+300+301+32+34+36+38+40+42+44+46+48+50+52+54+56+58+600+601+602+603+606+607+608+609+631+634+64+671+673+69+70+715+720+C721+722+723+724+C725+726+C729+74+750+751+752+807+810+811+814+(C-D)817+818+819+900
if1303	40101+40102+40105+40106+40107+40108-40109+40110-40111+40112+40113+40114+40201+40202+40203+40204+40205+40206+40301+40302+40306+40307+40309+40312+40314+404	090+C100+120+130+131+132+133+134+141+142+144+(C-D)145+149+157+158+(170-180)>0+692+693+694+699+726+741+746+747+749+750+751+752+807+814+(C-D)817+818+819
if1304	20309+40501+40502+40503+40504+40505+40601+40602+40603+40701+40702+40703+40801+40901+40902+40903+40904+40905+40906+40907-40908+40909+40911	070+071+20+22+24+26+28+300+301+32+34+36+38+40+42+44+460+461+465+466+467+48+50+52+54+56+58+600+601+602+606+607+608+609+640+641+642+671+673+690+691+695+696+697+698+700+701+702+703+704+705+706+707+708+709+720+C721+722+723+724+C725+C729+742+743+744+745+748+810+811+900
if1305	40802	468+643+644+715
if1306	20310+40804+40805+40806+40807+40910	603+631+634
if1307	40803	
if1308	410+...+440	605+614+710+711+713+714+717+718+732+733+734+735+736+737+738+739
if1309	410+...+413+427+…+430	
if1310	414+…+422+431+…+439	713+714+717+736+737+738+739
if1311	42301+42302+42303+42304+42305+42306+42307+42308	710+711+718+732+733+734+735
if1312	425+440	614
if1313	426	605
if1401	520+...+523	084+088+196+199+730+731
if1403	523 (roubles)	196
if1405	523 (foreign currency)	084
if1407	521	088+199+730+731
if1408	522	
if1409	522	
if1501	if1101 (foreign currency)	
if1503	410...440 (foreign currency)	
if1504	20313+20314+30109+30111+30112+30113+30116+30117+312...318 (foreign currency)	
if1505	520...523 (foreign currency)	
if1506	(if1101-if1503-if1504-if1505) (foreign currency)	

if1601	20314+30111+30112+30113+30117+314+316+31703+31803+40803+40804+40805+40806+40807+425+426+440	073+C075+087+603+604+605+614+631+632+634
if1603	425+426+440	605+614
if1604	40803+40804+40805+40806+40807	603+631+634
if1605	20314+314+316+31703+31803	C075+604
if1701	320A+...+324A (roubles)	
if1702	20313+20314+312...318 (roubles)	
if1705	320A+...+324A (foreign currency)	
if1706	20313+20314+312...318 (foreign currency)	
if1801	if1802+if1803+if1804+if1805	if1802+if1803+if1804+if1805
if1802	if1901-if1906	if1901-if1906
if1803	12601+13201-24201-25201	
if1804	29101-17101+29102-17102+29103-17103	
if1805	172-(24202+29201+29202+29203+29204+29205)+131+124+126 (without 12601)+17301+17305+17310+17311+17312+17313+17314+125+141+142+15101+15102+16101+16104+16105+17302+17303+17304+17306+17308+17316+17317+17318+17323+261+26214+293+25101+25102+25103+24106+24107+294+24203+24204+24205+24206+24207+281+27101+27102)	111+112+113+116+117+118+119-(020+050+060+070+207+209+211+212+213+214+216+218+219+220)
if1806	261+26214	020
if1807	if1802+if1805	if1802+if1805
if1901	if1902+if1903+if1904+if1905	if1902+if1903+if1904+if1905
if1902	111(without 11118, 11119)+112(without 11218, 11219)+113(without 11318, 11319)+114(without 11415, 11416)+17315	101+102+103+104+105+106
if1903	11118+11119+11218+11219+11318+11319+11415+11416+115+116	109
if1904	121+122+123	110
if1905	17307+17309	107+108+114
if1906	if1907+if1908+if1909+if1910	if1907+if1908+if1909+if1910
if1907	21104+21204+21304+221(without 22110, 22111)+222(without 22215, 22216)+223(without 22315, 22316)+231	201+202+203+204+206+215
if1908	21101+21102+21103+21201+21202+21203+21301+21302+21303+22110+22111+22215+22216+22315+22316	205
if1909	24101+24102+24103+24104+24105	208
if1910	29406	

if2001	111+112+113+114+115+116	if1902+if1903
if2002	11101+11102+11103+11104+11201+11202+11203+11204+11301+11302+11303+11304+11401+11402+11403+11404	
if2003	11501+11601	
if2004	11118+11218+11318+11415+11502+11602	109
if2005	11119+11219+11319+11416+11503+11603	
if2006	11105+11106+11107+11205+11206+11207+11305+11306+11307+11405+11406+11407	
if2007	11108+11109+11110+11208+11209+11210+11308+11309+11310+11408+11409+11410	
if2008	11111+11112+11113+11211+11212+11213+11311+11312+11313+11411+11412+11413	(101+…106) * if507/(if507+if508)
if2009	11116+11216+11316+11414	
if2010	11114+11214+11314	
if2011	11115+11117+11215+11217+11315+11317	(101+…106) * if508/(if507+if508)
if2101	211+212+213+221+222+223+231	201+202+203+204+205+206
if2102	22201+22202+22203+22204+22301+22302+22303+22304	206+(201+204)*if1303
if2103	21101+21201+21301	
if2104	21102+21202+21302+22110+22215+22315	205
if2105	21103+21203+21303+22111+22216+22316	
if2106	22101+22102+22103+22205+22206+22207+22305+22306+22307	
if2107	22104+22105+22106+22208+22209+22210+22308+22309+22310	
if2108	21104+21204+21304+22107+22108+22109+22211+22212+22213+22311+22312+22313	202+(201+204)*(if1304+if1306)
if2109	22114+22214+22314	
if2110	22112+22113+23101+23103	203+(201+204)*if1305

Chapter 3 Sophisticated Discipline in a Nascent Deposit Market: Evidence from Post-Communist Russia

3.1 Introduction

Depositors may penalize banks for undertaking risks, performing poorly or otherwise jeopardizing the value of their assets. By withdrawing funds or requiring deposit rate premiums from less stable institutions, their actions have the potential to increase allocative efficiency and mitigate moral hazard. But this sort of quantity or price-based discipline only materializes if depositors possess both the willingness and ability to monitor their banks. Whereas the former depends upon the degree to which deposits are believed to be protected by regulatory oversight and (explicit or implicit) insurance guarantees, the latter requires both access to and understanding of the relevant bank data. While not as much of a concern when depositors are experienced and mechanisms for disseminating financial information are reliable, the ability to discipline banks in settings in which these features are under-developed has been open to question. Indeed, doubts have been expressed as to the private sector's capacity for effective monitoring in countries in which informational structures – such as accounting rules and disclosure requirements – lag behind international standards (Levy-Yeyati et al., 2004). Careful empirical studies, however, that either confirm or cast doubt upon the ability of depositors to discipline banks in immature institutional environments are rare.

Post-communist Russia presents us with a worthy test case of depositors' capacity to provide discipline in a nascent market with under-developed institutions. Concurrent with the systemic transformation launched in the early 1990s, hundreds of private commercial banks entered its new, largely unregulated, deposit market. Not surprisingly, several significant banking crises ensued. And since monies held in non-state banks were uninsured, the country's depositors made quick acquaintance with the private costs of institutional failure. In other words, from soon after

the dawn of the new market era, depositors possessed ample motivation to penalize banks known to be performing poorly and/or assuming undue risks. But, as noted, the willingness to impose discipline on institutions recognized as less stable is not tantamount to the ability to do so.

Drawing on a unique database from the pre-deposit-insurance stage of Russia's post-communist transition, we investigate below whether depositors have actively disciplined private, domestic banks. And we do find that in spite of the country's apparent institutional immaturity, standard measures of the capacity to meet deposit obligations (e.g., capitalization and liquidity) correlate strongly with subsequent deposit inflows. But while evidence for quantity-based discipline is strong and robust, that for the standard form of price-based discipline is not. Clear evidence, that is, that depositors "demand" higher deposit rates from less stable institutions is lacking.

In and of itself, the absence of price discipline should not be interpreted as suggesting that market discipline is weak. Indeed, the combination of strong evidence for quantity disciplining and nearly non-existent support for the standard form of price discipline is consistent with a different type of price discipline that, arguably, is more sophisticated than that uncovered in previous studies. Depositors, we say, exhibit this "sophisticated discipline" if they view the deposit rate as a complementary proxy for institutional stability and not purely as a mechanism through which banks compete for funds and offer compensation for risk or poor performance reflected in their fundamentals. So viewed, banks cannot necessarily expect to increase the net inflow of deposits, ceteris paribus, by raising deposit rates. More than just compensating for observable risk, raising rates may carry the suggestion of additional risk. If so, standard tests for market discipline may not produce strong results and should be complemented by direct estimation of the deposit supply function. This would produce evidence consistent with sophisticated discipline if higher rates exhibited diminishing marginal, even negative, returns in terms of deposit attraction.

This article contributes to the general literature on market discipline in two important ways.

First, our data allow us to explore the impact of depositor type – i.e., household, firm or bank – on market discipline in a manner not done elsewhere. Second, we estimate depositors' supply function in order to evaluate whether or not the deposit rate is interpreted as a supplementary proxy for bank-level risk. In so doing, we present evidence consistent with this form of sophisticated discipline. The article is divided into five sections. Section 3.2 provides a review of the relevant literatures on market discipline and Russia's nascent banking sector. Section 3.3 discusses the empirical methodology, and section 3.4 presents the data and variables used in the subsequent analysis. We then present our empirical results in section 3.5, followed by conclusions in section 3.6.

3.2 Literature and Background

3.2.1 Market Discipline in Deposit Markets

Much of the evidence for deposit market discipline comes from countries with mature and relatively transparent banking sectors. For instance, a number of studies of partially uninsured large deposits in the United States demonstrate that a bank's cost of funds in one period is associated with previous period measures of depositor risk: low capital-assets ratios (Cook and Spellman, 1994; Hannan and Hanweck, 1988; Park and Peristiani, 1998); high variability of return on assets (Hannan and Hanweck, 1988); higher percentages of bad loans and, generally, lower return on assets (Cook and Spellman, 1994; Park and Peristiani, 1998); and greater exposure to junk bonds (Brewer and Mondschean, 1994). Cook and Spellman (1994), moreover, show that interest rates on wholly insured deposits at S&L's reflect capitalization and performance measures; even government sponsored "guarantees," after all, may not be ironclad. Finally, Park and Peristiani (1998) demonstrate a negative relationship between U.S. thrifts' predicted probability of failure and the subsequent growth of large uninsured deposits. Both price and quantity discipline, in other words, have been shown to prevail in the United States' banking sector, particularly with respect to deposits that are not fully insured. A recent study using cross-country panel data from

thirty-two OECD countries confirms the presence of market disciplining behavior in other mature institutional environments as well (Nier and Baumann, 2006).

A few empirically focused studies have pursued this theme in countries with less developed informational infrastructures. Controlling for the presence of deposit insurance and using data from a sample of both OECD and developing countries, Demirgüç-Kunt and Huizinga (2004) find a negative relationship between the implicit cost of bank funds and prior period measures of bank capitalization, profitability and liquidity. The evidence for quantity disciplining, however, is weaker. Indeed, they find no significant relationship between the net growth in bank deposits and earlier measures of either profitability or liquidity. Investigating experiences in Argentina, Chile and Mexico, Martinez-Peria and Schmukler (2001) turn up evidence consistent with the standard forms of both quantity and price discipline. Controlling simultaneously for several measures of bank stability and risk, they demonstrate that banks' deposits increase and their deposit rates generally decrease with a reduction in the percentage of non-performing loans and improvements in liquidity and capitalization. These authors also highlight how the relative magnitude of deposit market discipline increases after banking crises, suggesting that shocks to the sector breed greater depositor vigilance.

Most previous studies of deposit market discipline have not distinguished depositors by type. Although some have examined the role of actors holding deposits of different sizes (Cook and Spellman, 1994; Martinez-Peria and Schmukler, 2001), our data allow us to distinguish depositors by legal status – i.e., non-bank firm, bank or household. While likely to be correlated with deposit size, a party's legal identity may correlate with its willingness and ability to impose discipline. Relative to households, for instance, enterprise managers might be presumed to either have better access to or more appreciation for the financial information released by banks. They may also face lower costs of switching institutions, a potentially non-trivial consideration for households,

particularly those outside the largest urban areas where retail banking networks are poorly developed.

We are unaware of any previous study that empirically demonstrates a link between quantity discipline and deposit rates. Our inspiration here is drawn from a theoretical framework outlined by Hellman et al. (1998, 2000) in which

> . . . depositors can perfectly infer (from the bank's deposit rate and capital base) whether the bank will gamble or invest in the prudent asset . . . assumptions [chosen] not for realism but to consider an environment most conducive to solving the moral hazard problem via private monitoring (1998, p. 5).[14]

From our perspective, the important point in their stylized framework is that deposit rates and capitalization – both independently and through their interaction – determine the net inflow of deposits and, thus, the presence of market discipline. Higher interest rates, particularly for lower levels of capitalization, are interpreted as coincident with a riskier future lending strategy. Depositors, thus, weigh the benefits of higher rates against the increased potential for bank failure. The authors' caveat as to their assumption's realism clearly speaks to a lack of credulity in depositors' actual ability to read banks' behavior in this manner.[15] So to the extent that such sentiment as to depositor sophistication is widely held, it would seem reasonable to identify any empirical support for the actual interpretation of deposit rates in this manner as evidence of a sophisticated form of discipline.

3.2.2 Russia's Nascent Banking Sector

Russians' temporal experience with liberalized deposit markets has been brief and the country's

[14] In Hellman et al.'s model (1998, 2000), deposit rate competition among banks lowers their franchise value and, with it, incentives for making non-risky loans. The quote in the text above is taken from the working paper version (1998), which considers this competition in a world without deposit insurance. In an unpublished paper, Hanousek and Roland (2001) model a similar relationship and offer some empirical support from the Czech Republic.

[15] Stiglitz (1994), one of the article's co-authors, suggests in a book on post-communist reform that it would be unrealistic to rely on the private market to discipline banks: "Individuals have neither the capacity nor the incentive, even in the absence of deposit insurance, to monitor effectively (247)."

institutions to support depositor monitoring have had little time to develop. Indeed, Barth et al. (2004, 2006) recently ranked Russia in the bottom quintile of over one hundred countries on a "private sector monitoring" (PSM) index, a measure meant to capture the quality of institutions that facilitate deposit market discipline.[16] Although the ranking raises questions about Russian depositors' ability to monitor and discipline banks, it does not provide any sense of their interest in doing so. However, a brief review of Russia's post-communist financial sector development suggests that the intensity of this interest should not be under-estimated.

When financial markets were first permitted in the early 1990s, bank deposits, particularly those of households, were held almost exclusively by Sberbank, the state savings bank. But lax entry policies in the early transition period contributed to the quick development of a robust and competitive market for deposits. By early 1994, on the back of heavy advertising and relatively high interest rates, private banks had captured over half of the household deposit market. The era's mix of liberalized deposit rates, naïve depositors and over-burdened regulators proved dangerous. A system-wide liquidity crisis in 1995 led to bankruptcies of some of the country's largest private retail banks. Their failures followed by only a year the collapse of several high-profile pyramid schemes, the largest of which, MMM, contributed to the loss of savings of up to ten million Russians. In the popular mind, the promise of high returns on savings quickly became associated with institutional instability.

The image problem of private banks was furthered by the macroeconomic crisis of 1998.

[16] The following considerations are factored positively into a country's score on the PSM index: (1) whether a certified external audit of the bank's financial statement is required; (2) whether all of the ten biggest banks are rated by international rating agencies; (3) whether income statements include accrued or unpaid interest or principal on non-performing loans and whether banks are required to produce consolidated financial statements; (4) whether off-balance sheet items are disclosed to the public; (5) whether banks must disclose risk management procedures to the public; and (6) whether subordinated debt is allowable as a part of regulatory capital. The version of the PSM index presented in Barth et al. (2006) is slightly modified to include the percentage of the ten biggest banks rated by domestic rating agencies; since there is no entry for Russia in this sub-category, its PSM index is not reported. The authors' measures of bank transparency paint a similar picture. With respect to both the quality of its bank audit regime and its pace in adopting best practice accounting standards, Russia is ranked in the bottom third of countries surveyed. Barth et al.'s (2004) PSM index for Russia, 5, lags behind those of the countries covered in the analysis of Martinez-Peria and Schmukler (2001): Argentina and Chile, both 8, and Mexico, 6.

In August, the Russian government devalued the ruble and defaulted on its bond obligations. Because of their exposure to hard currency liabilities and ruble-denominated assets, including government securities, a number of banks were driven into insolvency. Again, many of the largest players on the retail market proved unable (or in some cases, unwilling) to meet their obligations to depositors (Perotti, 2003; Radaev, 2000; Schoors, 2001; Spicer and Pyle, 2002).

Russia's relatively short history with liberalized deposit markets explains both depositors' initial naivete in the face of high promised returns and the relative under-development of institutions that facilitate private sector monitoring (Barth et al., 2004 and 2006). But their experiences in the mid-1990s quickly heightened awareness of the private costs of bank failure. Circumstances taught them the benefits of carefully monitoring their financial institutions. Indeed, as has been demonstrated elsewhere, we suspect that the financial crises in Russia have precipitated more vigilant depositor discipline (Martinez-Peria and Schmukler, 2001). Moreover, the conflation of high interest rates with institutional instability that resulted from the crises of the mid-1990s suggests that deposit rates themselves might be interpreted, in part, as a proxy for otherwise unobservable bank risk.

3.3 Methodology

We start by investigating the evidence for market discipline generally and then proceed to look for it in the behavior of specific depositor groups. In so doing, we employ two standard sets of reduced form models:

$$\Delta D_{i,t} = \beta' Bank_{i,t-1} + d_t + v_i + e_{i,t} \tag{3.1}$$

$$i^d_{i,t} = \beta' Bank_{i,t-1} + d_t + v_i + \omega_{i,t} \tag{3.2}$$

with the number of banks i = 1,…,N and the number of observations per bank t = 1,…,T.[17]

[17] The panel is unbalanced because some banks fail, some merge, and some are founded during the sample period.

The left-hand side variables are, respectively, the first difference of the log of deposits held by bank i at time t, and the (implicit) real interest rate paid on those deposits. $Bank_{i,t-1}$ is a vector of bank-specific variables assumed exogenous and included with a quarterly lag to account for the fact that financial reports are not instantaneously made available to the public. Time dummies, d_t, control for macroeconomic shocks that influence the banking system as a whole.[18] And we allow for unobserved bank heterogeneity by introducing a bank-specific, time-invariant effect, v_i. The error terms, $e_{i,t}$ and $\omega_{i,t}$, are assumed to be independently distributed with mean zero and variance $\sigma^2_{i,t}$.

In both models 3.1 and 3.2, observing the coefficient estimates for the bank-specific variables provides the basis for tests of market discipline. Generally speaking, we look for statistically significant associations between those variables that measure a bank's capacity for responding to deposit withdrawals and its subsequent net deposit flows and deposit rates. All else equal, weaker banks are described as subject to market discipline if they experience less net growth in deposits or if they pay higher deposit rates. Depositors, that is, are presumed to react to the observed weakness by either (a) channeling monies away from weaker institutions or (b) requiring a deposit rate premium as compensation. The two dependent variables provide a more comprehensive test of market discipline than relying upon just one (Martinez-Peria and Schmukler, 2001).[19]

The data allow us to explore the impact of a financial crisis on market discipline by estimating model 3.1 for periods before and after the August 1998 ruble devaluation and sovereign debt repudiation. By splitting the post-crisis data into sub-periods, we check whether the documented effects remain stable over time. We also test the relationship between depositor identity and

[18] Controlling for time dummies in the models is equivalent to including all variables in deviations from their time-specific means. Consider model (1). In such a specification, risk measures do not affect the average deposit growth in the banking sector but rather the bank-specific deviations from that average. As long as banks maintain stronger than average fundamentals they enjoy higher than average deposit growth by "stealing" deposits from weak banks.

[19] Martinez-Peria and Schmukler (2001) note that using net deposit flows alone may not allow distinctions to be drawn between market and regulatory discipline. That is, regulatory pressure on under-capitalized banks could result in a bank deciding to reduce both its assets and liabilities, accomplishing the latter through reduced deposit rates.

market discipline by estimating separate models for both the deposits held by and the deposit rates paid to non-bank firms, households and banks. And last, we run the models both inclusive and exclusive of banks that are state owned or are "pocket banks" who gear lending activity to owners or company insiders.[20] With respect to all versions, we report within (fixed effects) or pooled estimates depending on whether the fixed effects are jointly significant.

We employ a new and separate model to test for sophisticated discipline in which the deposit rate itself serves as a complementary proxy of institutional stability. As such, rate increases amount to more than a means to attract deposits or offer compensation for increased risk, ceteris paribus. They are interpreted, as well, as coincident with an increase in risk not reflected in other observed measures (Hellman et al., 1998, 2000). If higher deposit rates, particularly in combination with other risk measures (e.g., low capitalization), are so interpreted, the effect of raising interest rates on the volume of deposits supplied will not necessarily be positive. The deposit supply curve, that is, may be backward bending.

We directly estimate the supply function employing the following two specifications:

$$\Delta D_{i,t} = \beta' Bank_{i,t-1} + \delta_1 i^d_{i,t} + \delta_2 (i^d_{i,t})^2 + d_t + v_i + \varepsilon_{i,t} \tag{3.3}$$

$$\Delta D_{i,t} = \beta' Bank_{i,t-1} + \delta_1 i^d_{i,t} + \delta_2 (i^d_{i,t})^2 + \delta_3 i^d_{i,t} * (1 - Cap_{i,t-1}) + \delta_4 i^d_{i,t} * (1 - Cap_{i,t-1})^2 + d_t + v_i + \varepsilon_{i,t} \tag{3.4}$$

where the real deposit rate, , its square and its interaction with a measure of bank capitalization, (with representing the capital-assets ratio) and its square, are included to test for the joint effect

[20] Small sample size prevents us from doing a meaningful analysis for the group of state-owned banks alone. In many emerging market economies, depositors' willingness and ability to monitor banks is influenced by the presence of large state-owned and/or foreign-owned banks. The deposits of the former often carry an implicit, if not explicit, insurance guarantee. And foreign banks may be recognized as already being exposed to discipline by the international markets on which their debt and equity trade (Caprio and Honohan, 2004). Relative to its level of development, however, Russia (during our period of analysis) had neither a relatively large state nor foreign-owned banking sector (Barth et al., 2006). In 2001, for example, over half of the banking system's assets were held at privately owned, domestic banks.

of price and risk measures and for the hypothesized backward-bending supply curve. $Bank_{i,t-1}$ is a vector of exogenous supply shifters – the same as employed in models 3.1 and 3.2, with the exception being that we exclude those regressors that had been either consistently insignificant or unstable and rarely significant in the prior estimations.

Our identification strategy (i.e., the choice of instruments for the endogenous deposit rate) relies on the assumption that a bank's demand for deposits is affected by the risk-return profile of its available investment opportunities. Since a bank's average lending rate reflects this risk-return profile, we regard the rate as a determinant of its demand for deposits.[21] On the other hand, it is difficult to fathom how lending rates would enter into depositors' supply decision. Although consumer lending rates are often advertised, consumer lending represented less than five percent of total bank loans during the period analyzed.[22] Of course, depositors could access the same data used here to calculate, with a lag, average lending rates. Though arguably possible, it would seem improbable that depositors actually use this approach to evaluate a bank's stability. Nevertheless, in unreported robustness tests, we included the lagged average (implicit) lending rate and found it entered the supply function regressions with a highly insignificant coefficient and had no impact on our main results.

We employ the Difference Generalized Method of Moments estimator (GMM) proposed by Arellano and Bond (1991). Terms involving the deposit rate are treated as endogenous. The bank's average (implicit) lending rate, its square, as well as suitably lagged values of endogenous variables are used as instruments. We employ the Hansen-Sargan test of over-identifying restrictions and the Arellano-Bond test of second-order serial correlation to test the validity of the chosen instruments. Finally, we split banks into sub-samples of small and large banks and check

[21] Considering the effect of the average (implicit) lending rate and the total demand for deposits, it is unclear to what extent it works through the demand for deposits of households, firms and/or banks. This uncertainty makes the overall average lending rate a weaker instrument for the implicit deposit rates that apply to actors of a particular type (i.e., households, firms or banks). Therefore, we estimate the supply function for all deposits together.

[22] See Berezanskaya (2003) for some further anecdotal evidence.

whether the documented effects depend on bank size.

3.4 Data and Variables

All banks are required to disclose their financial statements to the Central Bank of Russia (CBR). Balance sheet information and profit and loss accounts are reported, respectively, on monthly and quarterly bases and are made available to the public through several channels. Since 1999, the financial statements of most banks have been posted on the website of the CBR (www.cbr.ru). Banks publish their balances in the financial press such as the monthly financial periodical Den'gi i Kredit. Private information agencies, moreover, in cooperation with the CBR, gather raw, bank-specific accounting data to generate standardized financial indicators. Some of this processed data is made available for free (e.g. online at www.banks-rate.ru), whereas the most detailed information can only be accessed through fee-based channels.

The bank data used in the analysis here were made available to the authors by two established and highly respected private financial information agencies, Interfax and Mobile.[23] The former provides quarterly measures of bank balances and profit and loss accounts as well as bank-specific scores on a battery of regulatory standards from 1999 through 2002. The latter offers bank balances on a monthly basis from mid-1995 through 2002 and profit and loss accounts on a quarterly basis from October 2000 through 2002. As the profit and loss data are required for constructing implicit interest rates and efficiency ratios, we limit our analysis to quarterly observations. The absence of profit and loss data before 1999 inhibits us from investigating price discipline prior to that year.

We merge quarterly observations of the two datasets (both expressed in rubles) by date and bank registration number. For those cases in which a bank merged or was acquired, we treat the resulting larger bank as "new" from the standpoint of our sample. However, given the requisite

[23] For more information on these firms, see their respective websites at www.interfax.ru and www.mobile.ru. Karas and Schoors (2005) provide a detailed description of the datasets and confirm the consistency of different data sources.

differencing and lagging in our analysis, this requires dropping at least the first two observations for this "new" bank. To avoid this loss of data, we sum up the financial statements of the two merging banks for the two quarters preceding the merger and use those merged accounts as the needed lags.[24]

The bank-specific variables used in this paper include deposits and interest rates as well as measures of risk, performance and balance sheet structure. The average implicit interest rate that a bank offers on its deposits has been calculated by dividing interest expenses during a particular period by the corresponding level of deposits (Martinez-Peria and Schmukler, 2001).[25] Since our dataset disaggregates both interest expenses and deposits by the legal status of the depositor, the variables measuring deposit flows and interest rates can be constructed separately for non-bank firms, households and banks. Similar procedures were used to compute the implicit lending rate.

As depositors are hypothesized to react to observable data, we consider bank-specific measures of risk and performance that can be easily constructed using publicly available information (e.g., online at www.banks-rate.ru). Other, more sophisticated measures suggested in the literature could either not be constructed from the available data or did not exist on a comprehensive basis (e.g., bank ratings) over the sample period (Flannery and Sorescu, 1996; Sironi, 2003).

Capitalization, measured as the ratio of capital over assets, is expected to be positively associated with the subsequent growth of real deposits and inversely related to the next quarter's deposit rates. As much as any single measure of bank stability, it has been shown to serve as the basis for market discipline by depositors (Cook and Spellman, 1994; Hannan and Hanweck, 1988; Park and Peristiani, 1998; Martinez-Peria and Schmukler, 2001; Demirgüç-Kunt and Huizinga,

[24] Given the relatively small number of mergers and acquisitions (30) in comparison to the number of banks in our sample (about 1500), we do not expect that a different treatment of mergers would have a significant impact on our results.

[25] Taking into account the imperfect nature of such a measure, we had to drop unreasonable values and outliers to prevent them from driving our regression results. Given the high interest rates after the 1998 crisis we decided to treat all rates below 50% as reasonable. Other cut-off points were examined as well, but the regression results always remained qualitatively unchanged.

2004).

In general, one would expect liquidity to have the same effect as capitalization with respect to market discipline. Highly liquid banks, that is, should be considered more capable of accommodating unexpected withdrawals (Martinez-Peria and Schmukler, 2001; Demirgüç-Kunt and Huizinga, 2004). We therefore expect a bank's current liquidity ratio – i.e., the sum of its liquid assets divided by the sum of its liabilities on demand accounts and accounts up to 30 days – to be positively associated with deposit growth and negatively with interest rates, ceteris paribus.

The relationship of market disciplining behavior and a second measure of liquidity, excess reserves (relative to assets) deposited with the central bank, is not a priori clear. In a more mature market economy, we might expect excess reserves to measure the capacity to meet the demand for deposit withdrawals. We should consider, however, that Russian banks engaging in speculative activities and wishing to conceal the nature of their business often clear their position and park their monies with the CBR when the accounts are closed. High excess reserves may thus be related to greater risk and thus lower deposit growth and higher deposit rates. It is also possible that high excess reserves may be a function more of problems in the payment system than a desire to maintain excess liquidity for deposit withdrawals (Schoors, 2001).

Controls are also included for measures that directly capture bank performance. Higher returns relative to assets, we would expect, will increase the stability of deposit institutions and make them less prone to market disciplining (Demirgüç-Kunt and Huizinga, 2004). Moreover, the change in a bank's share of non-performing loans, a measure of a bank's most recent risk management practices, should be inversely related to deposit growth and positively associated with interest rates (Cook and Spellman, 1994; Martinez-Peria and Schmukler, 2001; and Park and Peristani, 1998).

We also take into account efficiency considerations by controlling for operational costs relative

to bank size. If we were to assume a homogenous level of service quality across banks, higher personnel expenses as a share of assets should be related to more sanctioning actions. Less cost-effective banks, that is, should be perceived as less stable and, thus, more prone to deposit outflows or pressure to raise deposit rates. On the other hand, since most Russian banks have been known to operate with poorly trained staffs, higher personnel costs may be interpreted as associated with a higher level of human capital and, thus, better asset management and a more stable institution. The expected sign, therefore, is not clear.

Variables capturing balance sheet structure are included as controls as well. Although the literature does not generally consider them as proxies for stability or performance in studies of market discipline, it is at least possible that, ceteris paribus, they could be interpreted as such. In this respect, the expected sign for loans to non-banks as a share of assets is not a priori clear, in part because we cannot distinguish loans either by risk or maturity. A high share of loans to non-banks could either signal greater credit risk or indicate a greater predisposition to engage in more traditional and, perhaps, less speculative activities. The relationship between lending to households as a share of all loans is similarly ambiguous. On the one hand, few Russians have well-developed credit records, making lending to them a risky proposition. However, loans to households may have shorter maturities and thus expose lenders to less liquidity risk.

Controls for the structure of bank liabilities are also included. Term deposits as a share of all non-bank claims partly capture the maturity structure of liabilities. Banks capable of attracting time deposits have effectively had their stability certified by previous depositors, thus making them potentially less prone to market discipline. However, since term deposits tend to command higher interest rates than demand deposits, the relationship between this variable and the standard form of price-based market discipline is not altogether clear. Growth in term deposits, all else equal, will produce higher payments to depositors. But to the extent that this growth is interpreted

as a signal of depositor-conferred stability, we would expect there to be downward pressure on any deposit risk premium. We thus do not have a clear expectation as to the sign on this variable.

Table C.1 summarizes our predictions for the signs of the coefficients on the right-hand side variables. Table C.2 presents summary statistics for all banks included in our sample. Deposit growth, interest rates and return on assets are all expressed in real terms using Consumer Price Index data from the CBR.[26] Deposit growth has been positive across all three depositor types but has been fastest over this period among households. As is apparent in rows 5 to 8, firm deposits represent the largest share of bank liabilities, followed by those of households and then banks. The negative values of implicit real interest rates in Table C.2 are consistent with the CBR's data on inflation and announced nominal deposit and lending rates. The lowest implicit real interest rates are paid on firms' deposits, whereas the highest are paid on inter-bank funds.

There are 155 banks in our sample that report negative capital at least once during the period under consideration, with most of these cases occurring in the aftermath of the 1998 financial crisis. Table C.3 presents the summary statistics for the pre- and the post-crisis periods separately. The standard deviation of key variables – e.g., capitalization and liquidity – is comparable across these periods.

As was noted in the previous section, we check the robustness of our empirical results by performing all estimations both with and without state-owned as well as "pocket" banks. Because of their access (real or presumed) to public resources, the former are generally believed to provide depositors with weak incentives for monitoring and disciplining (Caprio and Honohan, 2004; Nier and Baumann, 2006). Indeed, in Russia, state-owned banks have enjoyed a number of advantages over their private competitors, including privileged access to state funds, de facto exemption from some regulatory standards, and during the entirety of the period covered by our data, explicit

[26] Since inflation is not observable ex ante, we have to approximate the real return investors expect to earn on their deposits by the realized real rate ex post. Assuming rational actors with optimal inflation forecasts, however, any forecast errors – i.e., differences between expected and realized inflation – should be constant across actors and should be largely captured by time dummies in the regressions.

backing for their retail deposits (Tompson, 2004). For the purposes of our analysis, we can distinguish between two types of state-owned banks in Russia, those owned by the CBR and those owned by federal or regional authorities or other government entities.[27] The former (Sberbank, Vneshtorgbank and Vnesheconombank) have enjoyed the full and consistent backing of the CBR and so, considering them less likely to have been subject to market discipline, are excluded from our sample. The second group, however, includes institutions that have been allowed to fail (e.g., Unikombank, Soto-bank, Trade-bank), although the state formally guarantees their household deposits (Civil Code of Russia, article 840). We include these banks in the estimations since they may well have been disciplined by other depositor classes.[28]

To identify "pocket" banks, which have geared their lending activities heavily toward owners and insiders, we use two regulatory standards: owner exposure (the aggregate amount of credits and loans extended to the bank's shareholders or partners) and insider exposure (the aggregate amount of credits and loans extended to employees and managers).[29] The respective legal thresholds that are not to be exceeded are 50% and 3% of the bank's equity capital. First, we define an institution as a "pocket" bank if during our sample period it violates each of these two standards at least once. However, the number of banks identified by this procedure, roughly forty, is small. Considering, moreover, that banks might manipulate their books in order to satisfy these regulatory standards, we relaxed the definition by reducing the thresholds to 66% (definition 1) and further to 33% (definition 2) of the respective legal thresholds. We thus characterize an institution as a "pocket" bank if, during our sample period, it breaches each of these revised thresholds at least once.

3.5 Results

We lay out our main results in two sections. First, we present and discuss the standard market

[27] The list of state-owned banks was compiled from Sherif et al. (2003), Matovnikov (2002) and Mamontov (2005).
[28] Their exclusion however does not alter the results.
[29] For the official definition of these and other regulatory standards, see Bank of Russia Instruction No.1 of October 1, 1997, "On Bank Regulation Procedure" (an English version is available at www.cbr.ru).

discipline model, examining how measures of bank risk in one quarter relate to the subsequent quarter's net deposit flows and interest payments. In a second section, we test whether depositors interpret deposit rates as complementing standard measures of bank risk. To save space, the tables report only the variables of economic interest, not the time dummies.

3.5.1 Market discipline and depositor type

This section presents our findings as to whether or not we observe standard forms of market discipline behavior in Russia. Table C.4 displays estimation results for the deposit flow model 3.1 for the pre-crisis period (April 1997 – July 1998), the post-crisis period (October 1999 – January 2003) and 6 sub-periods after the crisis. In broad terms, the results confirm the presence of market discipline. Most notably, a higher capital-assets ratio and greater liquidity predict greater net deposit inflows in the subsequent period. Although these findings hold up both before and after the 1998 crisis, discipline exercised in response to these variables seems to have increased substantially in its aftermath.[30] This result is consistent with the proposition that crises breed greater depositor vigilance (Martinez-Peria and Schmukler, 2001). Further, the relationship between deposit flows and these two measures of bank risk is shown to be robust across all post-crisis sub-periods.

We also see evidence in support of the presence of market discipline both before and after the crisis in the negative and statistically significant correlation between deposit growth and the increase in non-performing loans. This relationship, however, is not as strong as the findings for capitalization and liquidity and is shown not to be robust to the segmentation of periods after 1998. And, interestingly, return on assets is not consistently correlated with net deposit inflows after the crisis, even though it was before. It is possible that Russian depositors have learned not to put too much weight on the profitability rates posted by Russian banks. Indeed, Malyutina and

[30] As suggested by the data in Table C.3, the difference between the pre- and post-crisis results is not a function of a change in the variance of the explanatory variables.

Parilova (2001) note that "It has already become a conventional wisdom that official figures for profits of Russian banks are the most manipulated and thus unreliable ones."

We should note, as well, that after the crisis excess reserves with the CBR are negatively associated with deposit inflows, which suggests that it might be interpreted as a proxy for a riskier asset management strategy. Moreover, one balance sheet structure variable – loans to non-bank firms as a share of total assets – was statistically insignificant before the 1998 crisis but becomes significant and positive in its aftermath. This latter finding is also at least consistent with the proposition that depositors feel safer with banks appearing to engage in more traditional and, perhaps, less speculative investment activities. Finally, we observe banks that pay their personnel more, ceteris paribus, are more successful in attracting funds.

In Table C.5, we lay out the results for the model that uses the deposit rate as the dependent variable. In terms of providing evidence for market discipline, the results are clearly weaker than those noted in Table C.4. Although the negative signs on the capitalization and liquidity measures are what we would expect if depositor discipline were present, the statistical significance of these associations is not strong and does not hold up to the decomposition across sub-periods. Specifically, there is no evidence that weakly capitalized banks pay higher interest rates to depositors as compensation. We also find only weak evidence that depositors accept higher interest rates in return for lower liquidity. Finally, we do not see any significant relationship between the dependent variable and either the bank's profitability or its increase in non-performing loans. The relatively high explanatory power of the regressions is largely due to time dummies. In sum, our results strongly confirm the presence of quantity discipline but offer little to no support for the standard form of price discipline.

In Table C.6, we repeat the main equations of Tables C.4 and C.5 for the three depositor types: non-bank firms, households and banks. The results confirming quantity discipline, particularly

in the post-crisis period, appear to be driven most strongly by the behavior of firms. As can be observed, firm deposits are much more sensitive to liquidity, the change in loan quality and the capital-assets ratio than those of households or banks. Households, however, do display some sensitivity to each of these measures, particularly in the post-crisis period. As depositors in other institutions, banks are shown to be responsive to capitalization in the post-crisis period but little else.

Disaggregated by depositor legal status, the results for the standard form of price discipline are, again, not as strong. Table C.6 demonstrates only weak and sporadic associations between increased bank risk and the "demands" of firms, households or banks for compensation in the form of higher deposit rates. Only among firms (but not households or banks), do we observe a negative and statistically significant association between capitalization and subsequent deposit rates. And only among households and banks (but not firms), do we see a similar relationship between these rates and liquidity. And, notably, with respect to non-performing loans and profitability, we do not observe any evidence for the standard form of price discipline among any of the depositor types.

We include Table C.7 to demonstrate the general robustness of our results to the exclusion of state banks and "pocket" banks, variously defined. Most notably, capitalization and liquidity remain strong predictors of deposit flows but, at most, only weak predictors of subsequent interest rates.

3.5.2 Sophisticated discipline

Among studies of deposit market discipline, our finding of strong evidence for quantity disciplining but weak support for the standard form of price discipline stands out as unique. But, as we noted earlier, this result should not be interpreted, in and of itself, as suggesting that market discipline is weak. Indeed, our finding is consistent with a different, perhaps more sophisticated, form of price discipline in which deposit rates represent more than just a mechanism for competing for funds and compensating depositors for observable risk.

We now explore the manner in which deposit rates might complement other variables that capture a bank's prospects for honoring its liabilities. Specifically, we ask whether these rates are interpreted as a signal of bank stability (Hellman et al., 1998 and 2000). If they are, we should not expect there to be a clear positive relationship between the rates a bank posts and its subsequent ability to attract deposits, perhaps especially for banks already viewed as weak with respect to other measures, such as capitalization.

Table C.8 presents estimations of the deposit supply function, using specifications 3.3 and 3.4. We first report results for all banks, then inclusive of just non-state banks and non-"pocket" banks, variously defined. Both specifications 3.3 and 3.4 allow for a non-linear relationship between interest rates and deposits such that after a certain "switching point" the slope of the supply curve can change sign. In specification 3.4, the interest rate is interacted with capitalization to investigate whether the price elasticity of deposit supply is sensitive to an observed measure of bank risk (Hellman et al., 1998 and 2000). All reported equations pass both the Hansen test of over-identifying restrictions and the Arellano-Bond test of second-order serial correlation at conventional significance levels.

The results in Table C.8 demonstrate a non-linear interest rate effect in the columns that represent specification 3.3, suggesting an implied switching point of six percent, above which increases in real interest rates produce negative returns with respect to deposit attraction.[31] In addition, in the columns that represent specification 3.4, we observe a joint effect of interest rates and capitalization on deposit growth. The implied switching point of roughly twelve percent appears stable across sample definitions. Both the independent and interaction effects of interest rates and bank capitalization can be viewed in Figures D.1 and D.2, which show the deposit growth plane in the interest rate/capitalization space, evaluated at the average values of the other independent variables. Figure D.1 shows the results for all banks in our sample and Figure D.2

[31] Roughly two percent of all observations (339 of 16518) are above this switching point.

shows them for banks that are neither state-owned nor "pocket" banks. At low and intermediate interest rate levels, a bank's deposit growth in response to interest rate hikes is positively correlated with bank capitalization. Moreover, higher capitalization is positively correlated with the switching point beyond which interest rate increases produce negative returns with respect to deposit attraction.

This evidence is consistent with depositors growing suspicious as interest rates rise. Their suspicion, moreover, that interest rate hikes might reflect new sources of bank risk, not otherwise observed, is sensitive to an observed measure that all our results have suggested is important to market disciplining behavior – i.e., capitalization. In other words, the evidence suggests that if depositors are confident in a bank's ability to meet deposit withdrawals, on the basis of its capital-assets ratio, they are more apt to view its rate increases as coincident with increases in the expected return on their deposits and, thus, increase their supply of deposits accordingly. But a bank which already has given depositors reason for suspicion, due to its lower capitalization, does not have the same ability to translate its increase in deposit rates into a corresponding increase in the expected returns and, thus, the deposits of its depositors.

Table C.9 demonstrates that our results are not driven by size effects. We split the sample into two sub-samples – the smallest 80% and the largest 20% – and re-estimate specification 3.3 for both. Although large banks' deposits are less sensitive to capitalization and liquidity than the deposits of small banks, both sub-samples show evidence of more sophisticated discipline. Small banks exhibit an implied switching point of five percent while large banks enjoy a higher switching point of eleven percent, above which increases in real interest rates produce negative returns with respect to deposit attraction. Figure D.3 shows deposit growth as a function of the deposit rate for large and small banks respectively, evaluated at the average values of the other independent variables. At low interest rates deposits of small banks grow faster than those of large

banks, but this deposit growth reaches a turning point if real interest rates exceed five percent. The lines cross at a real rate of about nine percent, above which the deposit growth of large banks really dominates the deposit growth of small banks.

One might well question the logic of the backward bending deposit supply curve since it might appear to be at odds with profit-maximizing behavior. If there are two interest rates that generate the same deposit inflow, why would a bank ever choose the higher one? We should recall here that in a nascent market environment, it is not unreasonable to expect that bank managers will still be learning about the nature of depositors' deposit supply function, particularly given its possible re-orientation in the aftermath of severe financial crises. In other words, given banks' imperfect information about what this function looks like, their behavior is not necessarily inconsistent with rationality.

3.6 Conclusion

Even though the deposit market in Russia is young and its supporting institutional / informational infrastructure is relatively immature, the country's depositors have developed the capacity to identify and discipline weaker banks. Banks net deposit inflows, specifically, have been shown to be highly sensitive to measures of bank capitalization, liquidity and changes in loan quality, particularly after the financial crisis of 1998. Quantity disciplining, moreover, appears to have been driven primarily by the behavior of non-bank firms and, to a lesser extent, households. This finding is consistent with firm managers having greater knowledge of the relevant banking data and its meaning. Nevertheless, the evidence that households have developed a capacity for disciplining banks is noteworthy and may in part be a reflection of their experience with bank failures earlier in the country's post-communist transition.

The strong presence of quantity discipline and the relative absence of price discipline, at least as traditionally conceived, present us with a combination of findings not observed in prior studies. Rather than interpreting the latter as weakening the case for market discipline, we view

it as consistent with a more subtle form of discipline than that which has been explored in other contexts. Indeed, we observe that the supply of deposits is highly sensitive to deposit rates and, importantly, that increases in those rates ultimately produce a decrease in deposit inflows. This effect, moreover, is particularly pronounced for banks already viewed as weak because of their low capitalization. The deposit rate, thus, appears to be viewed by depositors not solely as a bank's promised payment for funds but also as a proxy for otherwise unobservable risk. It is at least conceivable that because a subset of bank managers have yet to fully understand this interpretation, some banks may continue to raise their rates only to see their stock of deposits decline.

In terms of reduced market discipline and subsequent moral hazard incentives, our results do suggest a real cost as Russia now moves forward with the introduction of widespread deposit insurance. But more generally, given the doubt that has been expressed as to whether depositors in nascent markets will be both willing and able to discipline the banks entrusted with their funds, our findings offer support for the proposition that markets and market actors develop mechanisms and strategies to mitigate market failures with greater speed than perhaps initially thought. We should remember, however, that the post-communist experience with bank failures has imposed great costs across Russian society and effectively forced depositors to become the relatively quick learners and sophisticated discipliners that can now be observed in these data.

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Appendix C Tables

Table C.1: Empirical Predictions

Bank-specific explanatory variables	Expected sign in the equation for:	
	Deposit growth	Deposit rate
Capital / Total assets	+	-
Liquid assets / Demand liabilities	+	-
Change in loan quality	-	+
Return on assets	+	-
Excess reserves / Total assets	?	?
Loans to non-banks / Total assets	?	?
Loans to households / Loans to non-banks	?	?
Term deposits / Total deposits	+	?
Personnel expenses / Total assets	?	?
Deposit rate	+	Not included
Deposit rate^2	-	Not included

Table C.2: Summary Statistics: 1997-2002

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
Total deposit growth	26023	0,03	0,61	-7,73	12,96
Firm deposit growth	26011	0,03	0,72	-8,83	9,18
Household deposit growth	24187	0,05	0,89	-9,63	12,14
Bank deposit growth	9497	0	1,2	-13,06	12,91
Total deposits / Total assets	26023	0,4	0,2	0	0,98
Firm deposits / Total assets	26023	0,27	0,18	0	0,97
Household deposits / Total assets	26023	0,09	0,09	0	0,76
Bank deposits / Total assets	26023	0,05	0,1	0	0,93
Interest rate on total deposits	16858	-0,02	0,03	-0,07	0,44
Interest rate on firm deposits	16517	-0,03	0,02	-0,07	0,44
Interest rate on household deposits	15150	0	0,07	-0,07	0,48
Interest rate on bank deposits	7134	0,01	0,07	-0,07	0,46
Interest rate on total loans	16402	0,01	0,05	-0,07	0,45
Interest rate on firm loans	16263	0,01	0,05	-0,07	0,43
Interest rate on household loans	15038	0,02	0,06	-0,07	0,43
Interest rate on bank loans	8238	0,02	0,09	-0,07	0,47
Capital / Total assets	26023	0,28	0,2	-0,87	0,99
Liquid assets / Demand liabilities	26023	0,63	0,79	0	9,99
Bad loans / Total loans	26023	0,05	0,13	0	1
Return on assets	26023	-0,03	0,03	-0,5	0,93
Excess reserves / Total assets	26023	0,1	0,12	0	0,96
Loans to non-banks / Total assets	26023	0,41	0,2	0	0,99
Loans to households / Loans to non-banks	26023	0,12	0,19	0	1
Term deposits / Total deposits	26023	0,31	0,25	0	1
Personnel expenses / Total assets	16954	0,01	0,01	0	0,26

Note: The table presents the summary statistics of the bank-specific variables with each observation representing a measure for a single bank in a specific quarter. Only observations used in at least one of the regressions are included.

Table C.3: Summary Statistics: Pre-crisis and Post-crisis

	Pre-crisis					*Post-crisis*				
Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
Total deposit growth	9069	-0,07	0,69	-6,72	12,96	16954	0,08	0,55	-7,73	8,1
Firm deposit growth	9059	-0,06	0,86	-7,71	9,18	16952	0,07	0,64	-8,83	8,27
Household deposit growth	8471	-0,05	1,06	-9,63	12,14	15716	0,1	0,77	-8,72	10,27
Bank deposit growth	3607	-0,13	1,24	-8,84	7,57	5890	0,08	1,18	-13,06	12,91
Total deposits / Total assets	9069	0,33	0,19	0	0,95	16954	0,45	0,2	0	0,98
Firm deposits / Total assets	9069	0,2	0,16	0	0,93	16954	0,31	0,19	0	0,97
Household deposits / Total assets	9069	0,07	0,08	0	0,56	16954	0,09	0,1	0	0,76
Bank deposits / Total assets	9069	0,05	0,11	0	0,91	16954	0,04	0,09	0	0,93
Interest rate on total deposits						16858	-0,02	0,03	-0,07	0,44
Interest rate on firm deposits						16517	-0,03	0,02	-0,07	0,44
Interest rate on household deposits						15150	0	0,07	-0,07	0,48
Interest rate on bank deposits						7134	0,01	0,07	-0,07	0,46
Interest rate on total loans						16402	0,01	0,05	-0,07	0,45
Interest rate on firm loans						16263	0,01	0,05	-0,07	0,43
Interest rate on household loans						15038	0,02	0,06	-0,07	0,43
Interest rate on bank loans						8238	0,02	0,09	-0,07	0,47
Capital / Total assets	9069	0,3	0,22	-0,87	0,99	16954	0,27	0,19	-0,83	0,98
Liquid assets / Demand liabilities	9069	0,47	0,79	0	9,99	16954	0,71	0,79	0	9,99
Bad loans / Total loans	9069	0,06	0,16	0	1	16954	0,04	0,11	0	1
Return on assets	9069	-0,02	0,04	-0,41	0,93	16954	-0,04	0,03	-0,5	0,87
Excess reserves / Total assets	9069	0,06	0,09	0	0,88	16954	0,12	0,13	0	0,96
Loans to non-banks / Total assets	9069	0,4	0,21	0	0,99	16954	0,41	0,2	0	0,99
Loans to households / Loans to non-banks	9069	0,11	0,19	0	1	16954	0,12	0,19	0	1
Term deposits / Total deposits	9069	0,31	0,27	0	1	16954	0,31	0,24	0	1
Personnel expenses / Total assets						16954	0,01	0,01	0	0,26

Note: The table presents the summary statistics of the bank-specific variables with each observation representing a measure for a single bank in a specific quarter. Only observations used in at least one of the regressions are included.

Table C.4: Response of Growth of Total Deposits to Bank Risk Characteristics

Explanatory Variables	Pre-crisis	Post-crisis	Overlapping post-crisis supperiods (rolling window of one year)					
	Apr97-Jul98	Oct99-Jan03	Oct99-Jul00	Apr00-Jan01	Oct00-Jul01	Apr01-Jan02	Oct01-Jul02	Apr02-Jan03
Capital / Total assets	**0,212**	**0,693**	**1,2**	**1,372**	**1,398**	**1,502**	**1,66**	**2,035**
t-statistic	*4,57*	*10,06*	*6,12*	*6,26*	*6,54*	*5,82*	*5,05*	*7,78*
Liquid assets / Demand liabilities	**0,039**	**0,12**	**0,22**	**0,21**	**0,21**	**0,122**	**0,196**	**0,089**
t-statistic	*2,27*	*5,17*	*4,54*	*3,47*	*2,42*	*2,03*	*3,17*	*1,95*
Change in loan quality	**-0,648**	**-0,751**	**-1,04**	**-0,356**	**-0,591**	**-0,611**	**-0,285**	**-0,638**
t-statistic	*-5,95*	*-2,98*	*-2,27*	*-0,71*	*-1,12*	*-1,74*	*-1,29*	*-1,72*
Return on assets	**0,742**	**0,301**	**-0,107**	**-0,77**	**-2,678**	**-0,589**	**-0,691**	**0,823**
t-statistic	*2,78*	*0,55*	*-0,08*	*-0,69*	*-2,46*	*-0,6*	*-0,85*	*1,22*
Excess reserves / Total assets	**-0,094**	**-0,813**	**-1,369**	**-1,296**	**-1,356**	**-1,162**	**-0,841**	**-0,973**
t-statistic	*-0,79*	*-9,72*	*-7,02*	*-6,25*	*-6,81*	*-5,7*	*-4,06*	*-4,3*
Loans to non-banks / Total assets	**-0,038**	**0,286**	**0,87**	**0,567**	**0,185**	**0,265**	**0,364**	**0,408**
t-statistic	*-0,88*	*3,84*	*4,71*	*3,42*	*0,87*	*0,81*	*1,31*	*2,03*
Loans to hh / Loans to non-banks	**-0,005**	**0,011**	**0,058**	**0,142**	**0,131**	**0,059**	**-0,105**	**-0,112**
t-statistic	*-0,09*	*0,19*	*0,31*	*0,8*	*0,83*	*0,3*	*-0,48*	*-0,61*
Term deposits / Total deposits	**-0,024**	**-0,007**	**-0,007**	**0,368**	**0,341**	**0,085**	**0,194**	**0,291**
t-statistic	*-0,77*	*-0,13*	*-0,05*	*2,04*	*2,05*	*0,48*	*1,11*	*2,25*
Personnel expenses / Total assets		**6,19**	**6,953**	**8,017**	**11,164**	**14,542**	**21,005**	**15,595**
t-statistic		*4,21*	*2,4*	*1,93*	*2,84*	*5,52*	*6,94*	*5,03*
Number of observations	**9069**	**16954**	**4943**	**4883**	**4888**	**4902**	**4744**	**4674**
Number of banks	**1657**	**1386**	**1313**	**1267**	**1266**	**1265**	**1256**	**1259**
R-squared	**0,06**	**0,1**	**0,18**	**0,16**	**0,18**	**0,17**	**0,2**	**0,21**
F-test fixed effects (p-value)	**0,1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Note: The table reports regression results of the growth of total deposits on bank risk characteristics. Within (fixed effects) or pooled results are reported. When F-test in the last row indicates that the fixed effects are not jointly significant at 10 percent pooled OLS results are reported. Estimates for time dummies, fixed effects, and the constant term are not reported, even though they are included in the regressions. Robust t-statistics are in italics. The ratio of personnel expenses to total assets is not included in the pre-crisis specification because of the data limitations.

Table C.5: Response of Interest Rates Paid on Total Deposits to Bank Risk Characteristics

Explanatory Variables	*Post-crisis*	Overlapping post-crisis supperiods (rolling window of one year)					
	Oct99-Jan03	Oct99-Jul00	Apr00-Jan01	Oct00-Jul01	Apr01-Jan02	Oct01-Jul02	Apr02-Jan03
Capital / Total assets	**-0,004**	**-0,016**	**0,004**	**-0,016**	**-0,007**	**-0,01**	**-0,004**
t-statistic	*-1,13*	*-1,49*	*0,48*	*-2,12*	*-1,16*	*-1,3*	*-0,72*
Liquid assets / Demand liabilities	**-0,001**	**-0,001**	**-0,002**	**-0,001**	**-0,001**	**-0,001**	**-0,001**
t-statistic	*-1,81*	*-1,14*	*-1,41*	*-1,13*	*-0,57*	*-1,05*	*-0,56*
Change in loan quality	**-0,003**	**0,004**	**-0,011**	**0,006**	**0,004**	**-0,012**	**0**
t-statistic	*-0,64*	*0,59*	*-0,85*	*1,18*	*1,23*	*-0,88*	*0*
Return on assets	**-0,007**	**-0,004**	**0,026**	**0,018**	**-0,002**	**-0,001**	**-0,031**
t-statistic	*-0,48*	*-0,13*	*1,02*	*1,18*	*-0,18*	*-0,04*	*-0,54*
Excess reserves / Total assets	**-0,005**	**0,001**	**0,009**	**-0,01**	**0,004**	**-0,006**	**-0,001**
t-statistic	*-1,69*	*0,1*	*1,64*	*-2,02*	*0,88*	*-1,51*	*-0,3*
Loans to non-banks / Total assets	**0**	**-0,001**	**0,001**	**-0,011**	**-0,001**	**0,003**	**-0,002**
t-statistic	*0,13*	*-0,06*	*0,08*	*-1,14*	*-0,09*	*0,52*	*-0,5*
Loans to hh / Loans to non-banks	**0,01**	**0,008**	**-0,009**	**0,017**	**-0,002**	**0,005**	**0,003**
t-statistic	*2,08*	*1,17*	*-0,61*	*2,03*	*-0,48*	*1,4*	*1,12*
Term deposits / Total deposits	**0,024**	**0,023**	**0,008**	**0,015**	**0,01**	**0,01**	**0,005**
t-statistic	*8,12*	*2,94*	*1,48*	*2,77*	*2,04*	*3,46*	*1,81*
Personnel expenses / Total assets	**-0,458**	**-0,198**	**-0,044**	**-0,37**	**-0,069**	**-0,275**	**-0,211**
t-statistic	*-6,25*	*-1,86*	*-0,62*	*-3,31*	*-1,14*	*-2,98*	*-1,71*
Number of observations	**16858**	**4904**	**4859**	**4863**	**4874**	**4724**	**4658**
Number of banks	**1376**	**1302**	**1265**	**1264**	**1262**	**1253**	**1259**
R-squared	**0,3**	**0,14**	**0,12**	**0,34**	**0,69**	**0,56**	**0,74**
F-test fixed effects (p-value)	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Note: The table reports regression results of the interest rates paid on bank risk characteristics. Within (fixed effects) or pooled results are reported. When F-test in the last row indicates that the fixed effects are not jointly significant at 10 percent pooled OLS results are reported. Estimates for time dummies, fixed effects, and the constant term are not reported, even though they are included in the regressions. Robust t-statistics are in italics. Only results for the post-crisis period are reported due to the data limitations.

Table C.6: Split by Legal Status of Depositors

Explanatory Variables	Firms			Households			Banks		
	Deposit Growth		Deposit rate	Deposit Growth		Deposit rate	Deposit Growth		Deposit rate
	Pre-crisis	Post-crisis	Post-crisis	Pre-crisis	Post-crisis	Post-crisis	Pre-crisis	Post-crisis	Post-crisis
Capital / Total assets	**0,211**	**0,584**	**-0,009**	**0,069**	**0,277**	**-0,006**	**0,218**	**0,227**	**-0,018**
t-statistic	*4,04*	*7,95*	*-2,51*	*1,23*	*2,97*	*-0,62*	*1,77*	*2,26*	*-1,63*
Liquid assets / Demand liabilities	**0,069**	**0,132**	**0**	**0,035**	**0,06**	**-0,002**	**-0,08**	**-0,002**	**-0,003**
t-statistic	*3,34*	*5,74*	*0,52*	*1,23*	*2,75*	*-1,79*	*-1,39*	*-0,09*	*-1,96*
Change in loan quality	**-0,55**	**-0,784**	**0,001**	**-0,537**	**-0,285**	**-0,003**	**-0,388**	**-0,631**	**-0,004**
t-statistic	*-4,56*	*-3,65*	*0,68*	*-2,78*	*-2,2*	*-0,3*	*-0,94*	*-1,9*	*-0,18*
Return on assets	**0,81**	**0,05**	**0,01**	**1,39**	**0,561**	**0,012**	**0,332**	**1,405**	**0,043**
t-statistic	*2,18*	*0,09*	*1,95*	*3,94*	*1,66*	*0,45*	*0,25*	*1,83*	*0,8*
Excess reserves / Total assets	**-0,197**	**-1,028**	**0,003**	**-0,243**	**0,033**	**0,011**	**0,332**	**0,454**	**-0,012**
t-statistic	*-1,57*	*-10,93*	*1,77*	*-1,01*	*0,28*	*1,25*	*0,44*	*2,6*	*-0,76*
Loans to non-banks / Total assets	**-0,029**	**0,293**	**0,005**	**-0,078**	**0,242**	**0,01**	**-0,265**	**-0,013**	**0,004**
t-statistic	*-0,56*	*3,78*	*2,64*	*-1,34*	*2,83*	*1,23*	*-2,63*	*-0,17*	*0,39*
Loans to hh / Loans to non-banks	**-0,049**	**0,002**	**0,001**	**-0,1**	**-0,224**	**0,042**	**0,143**	**-0,168**	**-0,01**
t-statistic	*-0,76*	*0,03*	*0,4*	*-1,53*	*-2,64*	*4,83*	*0,89*	*-2,48*	*-0,8*
Term deposits / Total deposits	**0,201**	**0,515**	**0,009**	**-0,462**	**-1,024**	**0,012**	**-0,135**	**-0,12**	**0,006**
t-statistic	*4,9*	*8,5*	*5*	*-9,78*	*-13,91*	*1,85*	*-1,85*	*-2,29*	*0,91*
Personnel expenses / Total assets		**7,527**	**-0,06**		**0,143**	**-1,281**		**1,304**	**-0,438**
t-statistic		*4,65*	*-2,41*		*0,12*	*-6,49*		*0,79*	*-1,89*
Number of observations	**9059**	**16952**	**16575**	**8471**	**15716**	**15172**	**3607**	**5890**	**7148**
Number of banks	**1656**	**1386**	**1378**	**1598**	**1304**	**1301**	**834**	**872**	**1040**
R-squared	**0,05**	**0,12**	**0,57**	**0,06**	**0,04**	**0,24**	**0,03**	**0,01**	**0,1**
F-test fixed effects (p-value)	**0,35**	**0**	**0**	**0,98**	**0**	**0**	**1**	**1**	**0**

Note: The table reports regression results of deposit growth and interest rates on bank risk characteristics for firms, households and banks. Within (fixed effects) or pooled results are reported. When F-test in the last row indicates that the fixed effects are not jointly significant at 10 percent pooled OLS results are reported. Estimates for time dummies, fixed effects, and the constant term are not reported, even though they are included in the regressions. Robust t-statistics are in italics. The ratio of personnel expenses to total assets is not included in the pre-crisis specification because of the data limitations. Results for the interest rate regressions are reported for the post-crisis period only due to the data limitations.

Table C.7: Robustness checks

Explanatory Variables	*All Banks*		*Non-state Banks*		*Only Non-pocket banks*					
					Legal definition		*Definition 1*		*Definition 2*	
	D	*I*	*D*	*I*	*D*	*I*	*D*	*I*	*D*	*I*
Capital / Total assets	**0,693**	**-0,004**	**0,69**	**-0,004**	**0,699**	**-0,006**	**0,666**	**-0,006**	**0,667**	**-0,007**
t-statistic	*10,06*	*-1,13*	*9,98*	*-1,05*	*9,82*	*-1,43*	*8,57*	*-1,41*	*7,08*	*-1,35*
Liquid assets / Demand liabilities	**0,12**	**-0,001**	**0,122**	**-0,001**	**0,121**	**-0,001**	**0,134**	**-0,001**	**0,105**	**-0,001**
t-statistic	*5,17*	*-1,81*	*5,21*	*-2,16*	*5*	*-1,91*	*4,96*	*-1,95*	*3,71*	*-1,34*
Change in loan quality	**-0,751**	**-0,003**	**-0,753**	**-0,003**	**-0,739**	**-0,002**	**-0,651**	**-0,003**	**-0,277**	**-0,004**
t-statistic	*-2,98*	*-0,64*	*-2,97*	*-0,67*	*-2,7*	*-0,37*	*-2,12*	*-0,62*	*-0,88*	*-0,62*
Return on assets	**0,301**	**-0,007**	**0,333**	**-0,007**	**0,344**	**-0,004**	**0,309**	**-0,008**	**0,194**	**-0,004**
t-statistic	*0,55*	*-0,48*	*0,61*	*-0,46*	*0,6*	*-0,23*	*0,5*	*-0,49*	*0,27*	*-0,26*
Excess reserves / Total assets	**-0,813**	**-0,005**	**-0,821**	**-0,006**	**-0,815**	**-0,006**	**-0,842**	**-0,007**	**-0,757**	**-0,007**
t-statistic	*-9,72*	*-1,69*	*-9,69*	*-1,77*	*-9,4*	*-1,8*	*-8,51*	*-1,87*	*-6,21*	*-1,48*
Loans to non-banks / Total assets	**0,286**	**0**	**0,286**	**0**	**0,286**	**0,001**	**0,287**	**0,001**	**0,265**	**-0,002**
t-statistic	*3,84*	*0,13*	*3,8*	*0,04*	*3,69*	*0,32*	*3,19*	*0,19*	*2,25*	*-0,42*
Loans to hh / Loans to non-banks	**0,011**	**0,01**	**0,01**	**0,01**	**0,013**	**0,011**	**0,032**	**0,007**	**0,013**	**0,012**
t-statistic	*0,19*	*2,08*	*0,17*	*2,12*	*0,23*	*2,09*	*0,53*	*1,34*	*0,19*	*2,44*
Term deposits / Total deposits	**-0,007**	**0,024**	**-0,012**	**0,024**	**-0,007**	**0,024**	**-0,03**	**0,024**	**-0,059**	**0,023**
t-statistic	*-0,13*	*8,12*	*-0,23*	*8,08*	*-0,14*	*7,91*	*-0,48*	*7,07*	*-0,76*	*4,8*
Personnel expenses / Total assets	**6,19**	**-0,458**	**6,153**	**-0,457**	**6,167**	**-0,46**	**5,709**	**-0,419**	**5,48**	**-0,345**
t-statistic	*4,21*	*-6,25*	*4,15*	*-6,17*	*4,09*	*-6,09*	*3,35*	*-5,09*	*2,4*	*-3,68*
Number of observations	**16954**	**16858**	**16647**	**16552**	**16095**	**16003**	**12135**	**12054**	**7364**	**7300**
Number of banks	**1386**	**1376**	**1359**	**1349**	**1312**	**1303**	**1012**	**1004**	**647**	**639**
R-squared	**0,1**	**0,3**	**0,11**	**0,3**	**0,1**	**0,3**	**0,11**	**0,28**	**0,09**	**0,26**
F-test fixed effects (p-value)	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Note: The table reports regression results of deposit growth (D) and interest rates (I) on bank risk characteristics for the post-crisis period for different sub-samples of banks. Within (fixed effects) or pooled results are reported. When F-test in the last row indicates that the fixed effects are not jointly significant at 10 percent pooled OLS results are reported. Estimates for time dummies, fixed effects, and the constant term are not reported, even though they are included in the regressions. Robust t-statistics are in italics.

Table C.8: Supply of Total Deposits

Explanatory Variables	*All Banks*		*Non-state Banks*		*Only Non-pocket banks*					
					Legal definition		*Definition 1*		*Definition 2*	
Capital / Total assets	**2,11**	**2,31**	**2,11**	**2,29**	**2,09**	**2,26**	**2,08**	**2,26**	**1,97**	**2,10**
t-statistic	*13,09*	*10,51*	*13,08*	*10,61*	*13,09*	*10,45*	*11,48*	*9,06*	*9,65*	*7,84*
Liquid assets / Demand liabilities	**0,23**	**0,23**	**0,23**	**0,23**	**0,23**	**0,24**	**0,25**	**0,26**	**0,22**	**0,23**
t-statistic	*6,20*	*6,34*	*6,07*	*6,24*	*5,93*	*6,09*	*5,85*	*5,98*	*4,11*	*4,22*
Change in loan quality	**-0,77**	**-0,75**	**-0,76**	**-0,74**	**-0,75**	**-0,73**	**-0,61**	**-0,60**	**-0,28**	**-0,27**
t-statistic	*-2,81*	*-2,61*	*-2,78*	*-2,58*	*-2,60*	*-2,39*	*-1,95*	*-1,81*	*-0,81*	*-0,71*
Excess reserves / Total assets	**-1,54**	**-1,51**	**-1,54**	**-1,52**	**-1,55**	**-1,53**	**-1,60**	**-1,58**	**-1,46**	**-1,43**
t-statistic	*-12,79*	*-13,49*	*-13,10*	*-13,54*	*-13,09*	*-13,43*	*-11,96*	*-12,24*	*-9,04*	*-9,09*
Loans to non-banks / Total assets	**0,61**	**0,62**	**0,61**	**0,62**	**0,63**	**0,64**	**0,59**	**0,60**	**0,68**	**0,68**
t-statistic	*3,91*	*4,34*	*3,97*	*4,31*	*4,15*	*4,42*	*3,11*	*3,41*	*2,78*	*2,88*
Term deposits / Total deposits	**0,31**	**0,29**	**0,31**	**0,29**	**0,31**	**0,29**	**0,26**	**0,23**	**0,24**	**0,23**
t-statistic	*2,70*	*2,67*	*2,72*	*2,66*	*2,67*	*2,56*	*1,85*	*1,74*	*1,42*	*1,36*
Personnel expenses / Total assets	**14,46**	**14,09**	**14,27**	**13,92**	**14,31**	**13,97**	**13,76**	**13,57**	**13,31**	**12,96**
t-statistic	*5,04*	*5,07*	*5,01*	*5,00*	*4,98*	*4,94*	*4,21*	*4,20*	*2,87*	*2,84*
Interest rate	**14,56**	**22,94**	**13,51**	**21,65**	**13,15**	**21,17**	**14,61**	**21,92**	**12,44**	**16,15**
t-statistic	*1,95*	*2,97*	*2,04*	*2,85*	*2,11*	*2,84*	*2,09*	*2,65*	*2,08*	*2,14*
Interest rate^2	**-124,36**	**-98,47**	**-115,80**	**-94,10**	**-110,01**	**-91,08**	**-115,56**	**-96,87**	**-79,52**	**-65,30**
t-statistic	*-2,05*	*-2,33*	*-2,22*	*-2,47*	*-2,27*	*-2,49*	*-2,41*	*-2,53*	*-2,41*	*-2,34*
Interest rate * (1-Capital)		**-35,31**		**-33,96**		**-33,65**		**-31,67**		**-23,23**
t-statistic		*-2,20*		*-2,21*		*-2,19*		*-1,86*		*-1,46*
Interest rate * (1-Capital)^2		**23,74**		**23,23**		**23,66**		**21,95**		**17,42**
t-statistic		*2,21*		*2,21*		*2,26*		*1,93*		*1,71*
Number of observations	**16518**	**16518**	**16221**	**16221**	**15679**	**15679**	**11775**	**11775**	**7066**	**7066**
Number of banks	**1359**	**1359**	**1332**	**1332**	**1286**	**1286**	**987**	**987**	**622**	**622**
AR(2) p-value	**0,48**	**0,24**	**0,36**	**0,2**	**0,37**	**0,23**	**0,51**	**0,37**	**0,16**	**0,13**
Hansen test p-value	**0,16**	**0,1**	**0,16**	**0,1**	**0,11**	**0,09**	**0,57**	**0,37**	**0,51**	**0,3**
Implied switching point	**0,06**	**0,12**	**0,06**	**0,12**	**0,06**	**0,12**	**0,06**	**0,11**	**0,08**	**0,12**

Note: The table reports regression results of the growth of total deposits on bank risk characteristics, the deposit rate, and a number of interaction terms for different sub-samples of banks. The Difference GMM estimator is used. Terms involving deposit rate are treated as endogenous. Lending rate, its square and suitably lagged values of endogenous variables are used as instruments. Estimates for time dummies are not reported. Robust t-statistics are in italics. The 2nd order autocorrelation test tests the null hypothesis of no 2nd order autocorrelation in the differenced residuals. The Hansen test tests the validity of over-identifying restrictions and is robust to heteroscedasticity. Only results for the post-crisis period are reported due to the data limitations.

Table C.9: Supply of Total Deposits: Split by Total Assets

	Post-crisis	
Explanatory Variables	*Small banks*	*Big banks*
Capital / Total assets	**2,118**	**1,967**
t-statistic	*12,71*	*7,13*
Liquid assets / Demand liabilities	**0,244**	**0,013**
t-statistic	*6,42*	*0,24*
Change in loan quality	**-0,946**	**0,864**
t-statistic	*-3,66*	*1,21*
Excess reserves / Total assets	**-1,541**	**-1,059**
t-statistic	*-12,9*	*-4,13*
Loans to non-banks / Total assets	**0,677**	**0,293**
t-statistic	*4,45*	*1,1*
Term deposits / Total deposits	**0,278**	**0,46**
t-statistic	*2,25*	*2,52*
Personnel expenses / Total assets	**13,562**	**21,541**
t-statistic	*4,81*	*4,56*
Interest rate	**10,998**	**12,751**
t-statistic	*2,05*	*1,74*
Interest rate^2	**-103,078**	**-56,008**
t-statistic	*-2,39*	*-3,09*
Number of observations	**13215**	**3304**
Number of banks	**1194**	**382**
AR(2) p-value	**0,38**	**0,17**
Hansen test p-value	**0,16**	**0,81**
Implied switching point	**0,05**	**0,11**

Note: The table reports regression results of the growth of total deposits on bank risk characteristics, the deposit rate and deposit rate squared for different sub-samples of banks. The Difference GMM estimator is used. Terms involving deposit rate are treated as endogenous. Lending rate, its square and suitably lagged values of endogenous variables are used as instruments. Estimates for time dummies are not reported. Robust t-statistics are in italics. The 2nd order autocorrelation test tests the null hypothesis of no 2nd order autocorrelation in the differenced residuals. The Hansen test tests the validity of over-identifying restrictions and is robust to heteroscedasticity. Only results for the post-crisis period are reported due to the data limitations.

Appendix D Figures

Note for Figures D.1, D.2 and D.3: based on the estimated supply function for different interest rates and capitalisation the figures show implied deposit growth. Other regressors are assumed constant and are taken at their average values. Figure D.1 refers to Table C.8, specification for all banks; Figure D.2 refers to Table C.8, specification for non-insider banks based on definition 2; Figure D.3 refers to Table C.9.

Figure D.1: Implied Deposit Growth in the Deposit Rate – Capital Space

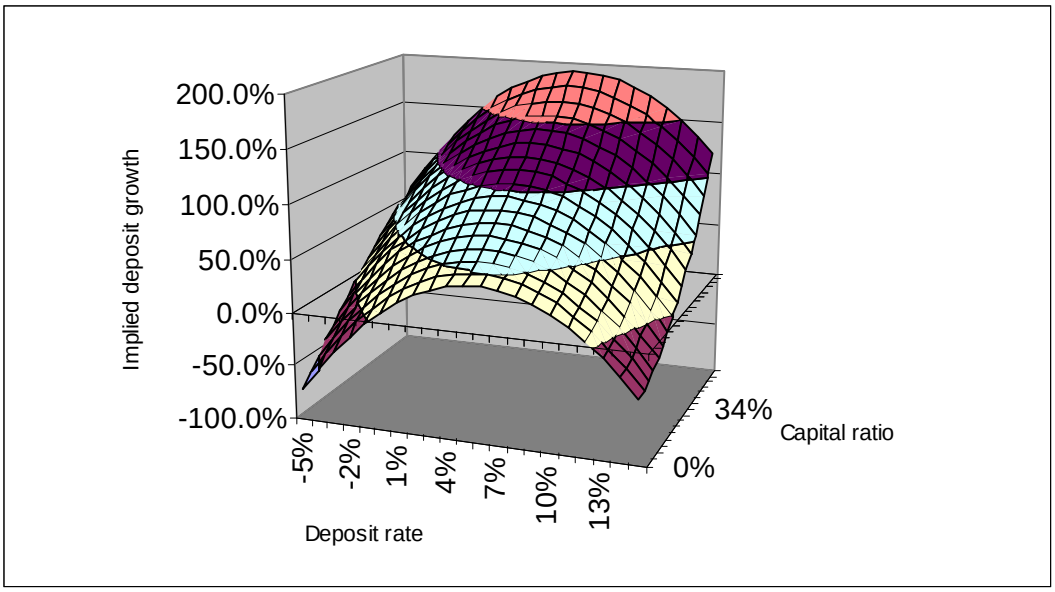


Figure D.2: Implied Deposit Growth in the Deposit Rate–Capital Space

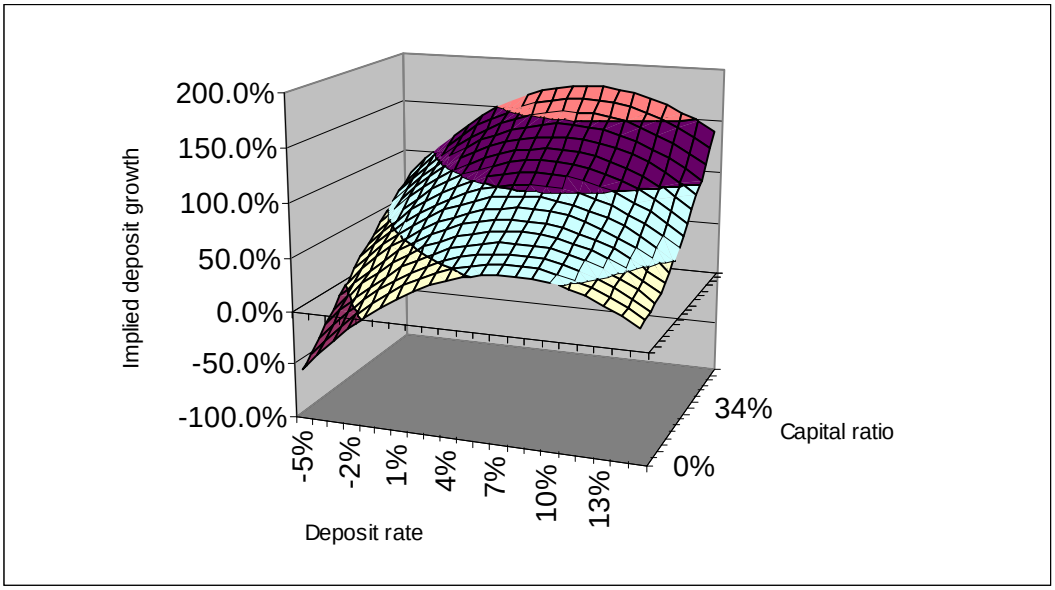
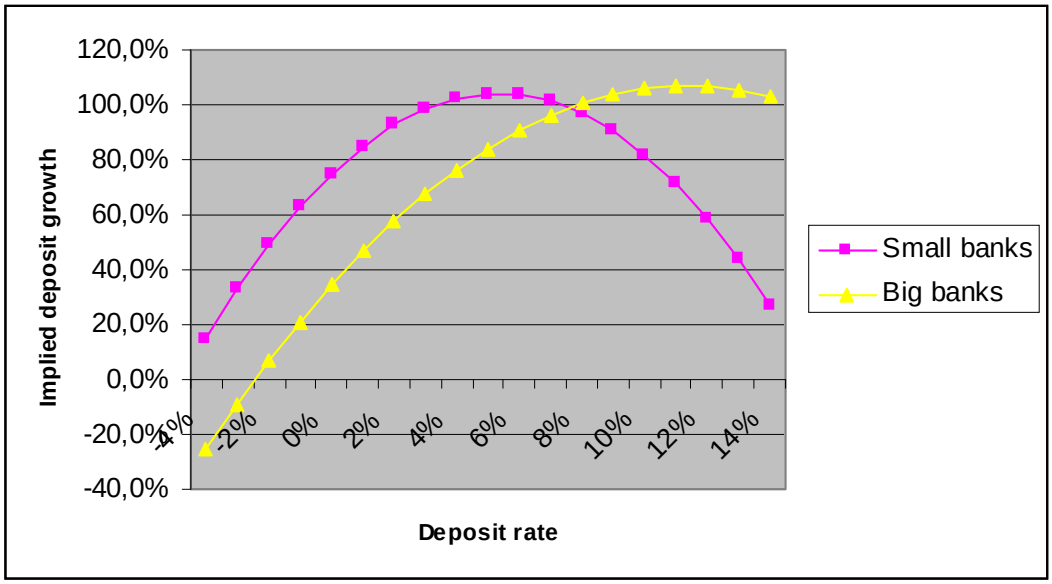


Figure D.3: Implied Deposit Growth: Split by Bank Size



Chapter 4 Are private banks more efficient than public banks? Evidence from Russia

4.1 Introduction

This paper assesses the efficiency of the nascent Russian banking system. The central question we pose is whether bank ownership has any effect on bank efficiency in Russia. We distinguish between foreign-owned banks (foreign banks), privately owned banks (private banks) and state-owned banks (public banks). We find that foreign banks are more efficient than domestic private banks and – surprisingly – that domestic private banks are not more efficient than domestic public banks. These results are not driven by differences in activity mix, risk preferences or bank environment, nor by the absence of explicit deposit insurance for domestic private banks.

Transition countries appear to be fertile testing grounds for comparative analysis of public and private banks' efficiency, but first appearances can be deceiving. Indeed, this comparative analysis failed to yield clear answers because in most countries foreign entry and bank privatization went hand in hand. As a consequence the empirical results for these countries were largely interpreted in terms of efficiency gaps between foreign and domestic ownership rather than between public and private ownership. In Russia however partial bank privatization was achieved relatively quickly, while foreign bank entry remained at a relatively low level in the first 15 years of transition . Still, partial public ownership in various forms remained a robust characteristic of the Russian banking sector throughout the transition.[32] The Central Bank of Russia (CBR) has played an important role through the commercial banks under its direct control, namely Sberbank and Vneshtorgbank. In addition, government bodies at several levels own banks. There are examples of villages, provinces, cities, federal bodies and state firms in this position. For

[32] The Central Bank of Russia (CBR) repeatedly showed its eagerness to restrict foreign entry to the banking sector. The Association of Russian Banks has consistently lobbied the government to limit foreign bank entry using the classic infant industry protection argument. Russia was ultimately forced to commit itself to a gradual opening of its financial market to foreign competition because of its desire to enter the WTO.

October 2001 for example, we find that the 27 banks that are majority owned by state bodies (out of 1277 banks in total) control 53% of banking assets and 39% of banking liabilities. Neglecting the CBR's commercial banking activities through Sberbank and Vneshtorgbank., the remaining 25 public banks hold no less than 6% of total banking assets and 8% of total banking liabilities. The Russian banking industry therefore presents us with the exceptional opportunity to disentangle efficiency differences between foreign, public and private banks for a sufficiently large number of banks. This study therefore complements the literature on foreign ownership and efficiency in emerging market economies and its conclusions contribute to our understanding of emerging-market-economy banking sectors.

Efficiency comparisons between public and private banks are cumbersome in emerging market economies because the two types of banks operate in different institutional environments; for example the implicit full deposit insurance typically enjoyed by public banks does not cover private banks. Any differences found in cost effectiveness between private and public banks may therefore be attributable to this difference in deposit insurance, which may render public banks' access to deposits less costly in terms of labor and physical capital. In Russia too, public banks were always covered, albeit implicitly, by deposit insurance, while household deposits held at private banks have been covered by deposit insurance only since 2004. To control for this we perform our estimations for two sub-samples, one before (2002) and one after (2006) the introduction of deposit insurance for household deposits at private banks. This allows us to assess whether any difference in efficiency may be partly attributable to differences in deposit insurance and whether the more level playing field of generalized deposit insurance for household deposits effectively reduces the efficiency difference.

In the following section we overview the bank efficiency literature related to our study. Section 4.3 presents the recent history of the Russian banking sector. This is followed by an overview of

the data in section 4.4 and the estimation methodology in section 4.5. Section 4.6 lays out the main results. Section 4.7 provides further robustness checks by repeating the analysis for a size -matched sample and employing a very different econometric approach. We end with concluding remarks in section 4.8.

4.2 Related literature

The empirical literature on privatization in transition countries has found that the method and timing of privatization are related to its performance effects. Frydman et al. (1999) find that privatization has no beneficial effect on performance if firms fall under the sway of insider owners (managers or employees), while the positive performance effect is pronounced if the firm is privatized to outsider owners. Brown et al. (2006) document that foreign privatization has larger productivity effects than domestic privatization in a set of four transition countries.

There is also ample evidence for transition countries that foreign firms are more efficient than domestic firms, be it in the banking sector or in other sectors. Foreign banks may be more efficient than domestic ones because of their more advanced technology, superior management practices, superior access to capital or implicit deposit insurance via the deep pockets of the foreign mother bank.

These economy-wide results are sustained by more detailed banking sector studies that apply stochastic frontier models. Weill (2003) shows in a study of the Czech Republic and Poland that foreign-owned banks are indeed more efficient than domestic-owned banks and that this is driven neither by differences in bank size nor by differences in the structure of activities. Hasan and Marton (2003) find in a Hungarian country-study that foreign banks were more efficient already in the period 1993-1997, early in transition. Fries and Taci (2005), in a study of 15 East European transition countries (including Russia), find that private banks are more cost efficient than state-owned banks. This confirms the result of Weill (2003) that privatized banks with majority foreign ownership are the most cost efficient. These are followed by newly established

private banks, both domestic and foreign owned, and finally by privatized banks with majority domestic ownership, though these are still more efficient than state-owned banks. Bonin et al. (2005a) analyze the effects of ownership on bank efficiency for a set of eleven transition countries for the period 1996-2000. They apply a stochastic frontier approach to compute bank-specific efficiency scores and relate these to ownership in second-stage regressions. Foreign-owned banks are again confirmed to be more cost-efficient and to collect more deposits and grant more loans than other banks. The magnitude of increased efficiency from foreign ownership is 6% or higher. State-owned banks are not appreciably less efficient than de novo domestic private banks, but they are clearly less efficient than those already privatized, which supports the idea that better banks were privatized first. In a companion paper with comparable methodology, Bonin et al. (2005b) analyze whether the method and timing of bank privatization affect bank efficiency. They find that voucher privatization does not lead to increased efficiency and early-privatized banks are more efficient than later-privatized banks.

Kraft, Hofler and Payne (2006) study the Croatian banking system and find that new private and privatized banks are not more efficient than public banks and that privatization does not immediately improve efficiency, while foreign banks are substantially more efficient than all domestic banks.

A number of studies apply data envelopment analysis to examine bank efficiency in Central and Eastern Europe. These include for example Grigorian and Manole (2006), who study 17 European transition countries, Jemric and Vujcic (2002), who look at Croatia, and Havrylchyk (2006), who studies Poland. In accordance with the findings of the stochastic frontier literature, all these studies find that foreign banks are more efficient than domestic ones. Grigorian and Manole (2006) find in addition that privatization does not automatically lead to higher efficiency, which is in line with Bonin et al. (2005a). This superior efficiency of foreign banks is however not always

found in other emerging market economies. Sensarma (2006) finds that in India foreign banks are less efficient than either public or private domestic banks.

Two studies investigate bank efficiency in Russia. Fries and Taci (2005) study the cost efficiency of banks from 15 post-communist countries including Russia, between 1994 and 2001. They apply the one-stage Battese-Coelli (1995) stochastic frontier model and find that foreign ownership and private ownership are both associated with greater efficiency. Their findings, however, are based on a cross-country sample and so need not hold equally for every country. This observation holds particularly for Russia, given their very limited sample of Russian banks (48 out of more than 1000 existing banks).

Styrin (2005) solves these problems by using a large dataset of Russian banks obtained from the Central Bank of Russia for the period 1999-2002. While efficiency scores are estimated in a first stage using the stochastic frontier approach, they are regressed on a set of potential determinants, including public ownership and foreign ownership, in a second stage. Public ownership is innovatively defined as actual affiliation with the state as measured by the ratio of interest income received from the government to total interest income. This paper concludes in favor of a greater efficiency of foreign banks, whereas public ownership is not significant for explaining efficiency. The econometric two-stage approach and the exclusion of physical capital from the list of inputs are the paper's major limitations.

We use a similar dataset extended to 2006 and adopt the one-stage approach proposed by Battese and Coelli (1995) to investigate the cost efficiency of Russian banks. Besides avoiding the limitations of previous studies we contribute to the literature by studying whether the introduction of generalized deposit insurance had any impact on banks' comparative efficiency.

4.3 History and problems of the Russian banking sector

The privatization of Russia's former 'spetsbanki'[33] was a relatively uncontrolled process

[33] In 1987 the Soviet Union turned its monobank system into a kind of two-tier banking system with a embryonal central

that started before 1990, the official start of the bank privatization process, and was largely accomplished by the end of 1991, when the Soviet system collapsed. This secessionist privatization yielded a few large successors (Sberbank, Vneshtorgbank, Mosbiznesbank, Promstroibank and SBS–Agro) and more than 600 relatively small successors. Most of these were reluctant to restructure, as mirrored in higher costs, higher loan rates, poorer loan quality and smaller capital buffers (see Schoors, 2003). Not surprisingly most of the smaller successors faltered during the period 1995-1998. In the aftermath of the August 1998 crisis, the larger successors were also swept away, with the notorious exceptions of Sberbank and Vneshtorgbank, which survived as daughters of the CBR and now control a considerable part of the Russian banking market.[34] At present, the vast majority of Russian banks are not burdened by lingering Soviet deficiencies. Most private banks are de novo banks, as the privatized 'spetsbanki' faltered in the period 1992-1999, and most public banks were created after the collapse of the Soviet Union, by government bodies such as state enterprises, cities and federal, regional or local governments (see Tompson, 2004 and Vernikov, 2007). In our sample we include 25 in the latter category. Still, the banking sector has faced serious problems throughout its history.

Early in transition, banks clearly preferred speculation to lending (Schoors, 2001). Bank lending to the non-financial sector shrank year after year as a share of total banking assets, up to 1999. In 2003, bank loans to the non- financial sector amounted to just 17.0% of GDP and financed as little as 4.8% of fixed investment.[35] Since then, the situation has improved. This reluctance to lend seems rational with hindsight. The presence of soft legal constraints (Perotti, 2002) rendered the enforcement of overdue claims difficult or impossible. Bank lending

bank (Gosbank) and specialized 'commercial banks'. The latter were Sberbank (the savings bank), Promstroibank (industry and construction), Zhilsotsbank (housing and communal financing), Agroprombank (Agriculture) and Vneshtorgbank.(foreign trade). These specialized banks are commonly referred to as 'spetsbanki'.

34 In its 2005 Annual Report, Sberbank claims to hold 54.2% of total retail deposits, 44.1% of consumer loans, 32.2% of corporate loans, 16.6% of government securities and 26.5% of total Russian banking assets. The share in ruble-denominated retail deposits is even higher - over 70%.

35 Data from the CBR Bulletin of Bank Statistics.

was further depressed by huge information asymmetries between banks and their prospective customers, and by a lack of screening and monitoring skills in the banks themselves and the economy at large. Banks were therefore unable to identify good potential borrowers (Brana, Maurel and Sgard, 1999), and often preferred not to lend at all. Moreover, the vast number of tiny banks and the lack of a transparent information system for credit histories may have contributed to lending restraint (Pyle, 2002).

The largest part of the lending went to connected agents, regardless of the viability of the lending project, and with only very weak monitoring incentives (Laeven, 2001). Many of the newly founded private banks were captured by their owners. Such "pocket banks" operated as treasuries for a firm or a group of firms rather than independent banks. Note that the government, too, is to some extent a connected party, because several banks were captured by local, regional, or national governments. At the start of 2003, federal or regional authorities held majority stakes in 23 banks, the regional authorities held minority stakes in several more banks, and a large number of state enterprises were part-owners of banks (Tompson, 2004).

The average loan quality was negatively affected by the combined problems of connected lending, soft legal constraints, information asymmetries and the lack of screening and monitoring skills. A leaked analysis of Russian banks after the crisis of August 1998 shows that the major problem for banks was not the devaluation loss or the government default on treasury bills, but bad loans hidden and accumulated during the preceding period.[36] Schoors and Sonin (2005) explain how the Russian banking system was stuck in a passivity trap, where it is rational for each individual bank to hide bad loans rather than collecting them. Economic growth after 2000 allowed Russian banks to 'grow' out of bad loans, but the problem of loan quality is still a latent threat to the Russian banking system.

The Russian banking sector has in the past suffered from poor capitalization, especially

[36] See 'The newly-wed and the nearly dead', Euromoney, June 1999.

considering the poor quality of assets and the large exposure to exchange rate risk. This overexposure was revealed when the devaluation in August 1998 changed the capital of many Russian banks from positive to negative overnight (Perotti, 2002). The CBR has steadily tightened capital standards since 1999, and Claeys and Schoors (2007) show that these standards are indeed enforced. As a result, capital levels have reached more acceptable levels. Still our data reveal that the average capitalization of the Russian banks is substantially higher than the weighted average capitalization, implying that capital buffers are lower in the banks that are most important for systemic stability.

The institutional stability of Russian banks has proven weak, with systemic problems in 1994, 1995, 1998 and 2004. Since 1992, more than 2000 Russian banks have been liquidated or have vanished. Sometimes this was due to a combination of the above-mentioned factors (poor capitalization, excessive speculative risk, endemic bad loans, connected lending, etc.), but there were also several instances of Ponzi schemes, where crooks cheated depositors and fled with their money. In the aftermath of the August 1998 crisis it became apparent that the soft legal constraints faced by banks encouraged asset stripping and left creditors to bear the brunt of the cost of failure (Perotti, 2002). Claeys and Schoors (2007) give an overview of the CBR's relatively weak prudential supervision and control during the first decade and show that rule-based enforcement of bank standards is difficult for the CBR because of conflicts with systemic stability concerns. Depositors reacted to this widespread institutional instability by either disciplining their banks in a sophisticated way[37] (Karas, Pyle and Schoors, 2006) or fleeing to the safe heavens of Sberbank and Vneshtorgbank that – like all public banks – were covered by an implicit state guarantee[38]

[37] By interpreting very high promised deposit rates as a proxy for institutional instability.

[38] Sberbank has a huge branch network and carries a government guarantee. The government lent credibility to this guarantee by supporting Sberbank when needed and using it as a device to absorb deposits from large defunct deposit banks in the aftermath of the 1998 crisis. The same holds for Vneshtorgbank, as demonstrated in the mini-crisis in May–July 2004, when Vneshtorgbank acquired Gutabank, one of the larger deposit banks under attack. As a result, Sberbank and Vneshtorgbank continue to dominate a highly concentrated deposit market.

(see OECD, 2004). Figure F.1 shows how Sberbank's share of private deposits[39] reached a peak of close to 80% in 1998.

The government wanted to restore some competition in the deposit market and reacted by providing a form of partial deposit insurance. The federal law on deposit insurance was introduced in 2003, but the system only became operational in September 2004.[40] Sberbank was initially exempted and kept its full state guarantee until 1 January 2007, when it finally became subject to the new deposit insurance scheme. Other regulatory advantages of Sberbank (for example lower required reserves on ruble deposits) were also abolished. This gradually more level playing field ensured that Sberbank's share of private deposits gradually fell during the last five years to the still-very-high level of about 50% in 2006 (see figure F.1).

In table E.1 we summarize some of the crucial indicators of recent developments in the Russian banking system. By early 2006 there were 1253 banks, among which only 1045 money deposit banks (covered by the deposit insurance scheme) with 3295 bank branches. More than 30% of these bank branches were however still operated by Sberbank, such that the average bank had about two branches. Clearly the average Russian bank is tiny by European or world standards. By 2006 the Russian market included 62 majority foreign-owned banks, but their branch network was still relatively underdeveloped. On the other hand banking has clearly revived during the last five years, with bank lending rising from 17% of GDP in 2001 to 32% in 2006 and private deposits rising from 8% of GDP to 14% over the same period. Average interest rates seem still high in nominal terms but are low once inflation is taken into account. Clearly Russian banks are increasingly playing their role as effective intermediaries between saving and investment, but the banking system still suffers from the predominance of tiny banks with underdeveloped branch networks, excessive concentration, and a lack of foreign competition. Although private deposit

[39] Both ruble- and foreign currency-denominated private deposits.

[40] Although an unrelated and opaque form of state guarantee was already granted to all banks in July 2004, to stop the unfolding banking panic.

collection is growing, it remains far behind corporate lending.

4.4 Data and variables

The quarterly bank balances and profit and loss accounts were made available to the authors by the financial information agency Interfax.[41] The chosen sample periods (2002 and 2006) are convenient to properly detect longitudinal effects of private ownership. Brown et al (2006) find that positive effects of domestic privatization appear immediately in Hungary, Romania, and Ukraine, but emerge only five years after privatization in Russia. In our study almost all remaining banks are de novo banks and the few remaining privatized banks are considered 10 years or more after privatization, so any positive efficiency effects are expected to have appeared by then.

The panel is unbalanced because some banks fail, some merge, and some are founded during the sample period. If a bank merged or was acquired, we treat the resulting larger bank as "new". To identify foreign banks, we use the quarterly lists of 100% foreign-owned banks provided by the CBR since 1999. The lists of banks with the state as a majority owner are available at two points in time, February 1, 2002 (Matovnikov, 2002) and July 1, 2005 (Mamontov, 2005). These lists reveal that the state ownership category remains stable over our sample period.

We do estimations for the periods before (2002) and after (2006) the introduction of deposit insurance in 2004. For each sub-period, we use a balanced panel which is more convenient for application of the Battese-Coelli (1995) model. As efficiency scores are relative measures of performance, we need to have comparable banks in terms of activities. We therefore keep only banks with more-than 10% shares of deposits and loans in total assets. Our final sample consists of 747 banks (including 19 public banks and 26 foreign banks) for 2002 and 471 banks (including 15 public banks and 20 foreign banks) for 2006.

The literature disagrees on the role of deposits in banks' production process. The classical

[41] Karas and Schoors (2005) provide a detailed description of the dataset and confirm its consistency with other data sources.

production approach treats deposits and loans as outputs, and labor and physical capital as inputs. The intermediation approach first used by Sealey and Lindley (1977) views banks as intermediaries between saving and investment in the economy, and treats earning assets as outputs and deposits as inputs.

The weak development of financial markets makes a clear focus on the lending and deposit activities of banks relevant for Russia. Therefore we tend to prefer the production approach in this paper. The intermediation approach has the disadvantage that deposits are neglected as an important output. But there is also an argument in favor of the intermediation approach. Public and foreign banks might have access to cheaper funding if depositors believe those banks to possess additional protection compared to private domestic banks. Public banks have enjoyed the explicit state guarantee backing their retail deposits, which was scrapped only at the end of 2003. In addition, their cost of funds is reduced by the perception that the state will stand behind them (Tompson, 2004). Foreign banks' deposits may also enjoy an implicit (by the mother bank) or an explicit deposit guarantee (in some countries, clients of foreign branches of domestic banks are covered by the national deposit insurance scheme). Such guarantees – perceived or real – could affect input prices for deposits, but this is not considered in the production approach, where the cost of deposits is not included in the total cost. This provides a rationale for the intermediation approach, which considers deposits as an input rather than an output and includes the cost of deposits in the measure of total costs. In robustness checks, we substitute the intermediation for the production approach. Our results are however robust to the choice of the production process. This is not unexpected, given the finding of Wheelock and Wilson (1995) and Berger et al. (1997) that the choice of approach may have a considerable impact on the level of efficiency scores but not on their rankings.

For the production approach, the output variables are total deposits and total loans. The input

prices are the price of physical capital, measured by the ratio of other operating expenses to fixed assets, and the price of labor, measured by the ratio of personnel expenses to total assets[42], as data on the number of employees is not available (Altunbas et al. 2000, Weill, 2003). As observed by Maudos et al. (2002), the latter ratio can be interpreted as labor cost per worker (personnel expenses to number of employees) adjusted for differences in labor productivity (number of employees to total assets), since it is the product of these ratios. Total costs are the sum of personnel expenses and other operating expenses. Controls for environment, risk preferences and activities mix include seven geographical district dummies, the log of total assets, the log of equity, the share of bad loans in total loans, and the percentage breakdown of banks' total deposits and loans by counterpart (households, firms, government, banks).

For the intermediation approach, the output variables are total loans and total securities, while input prices are the deposit rate (measured as the ratio of interest paid on deposits to interest bearing deposits), the price of physical capital (defined above), and the price of labor (defined above). Total costs are the sum of interest paid on deposits, personnel expenses and other operating expenses.

Table E.2 compares the means of key variables of private and public banks. Table E.3 does the same for domestic and foreign banks. Both public and foreign banks are much bigger, slightly less capitalized and more frequently located in the Moscow area, relative to their counterparts, respectively, private and domestic banks. These patterns are more pronounced in the second sub-period. Compared to private banks, public banks grant relatively more loans to companies and banks and relatively less loans to households. Not surprisingly, public banks rely relatively more on the government as a source of funding. Foreign banks are extremely active on the interbank market, in terms of both borrowing and lending, while domestic banks are predominantly occupied

[42] We use the Tukey box-plot to detect outliers: for each input price, we drop observations lying beyond the range defined by the first and third quartile minus/plus two times the interquartile range.

with core activities: granting loans to companies and individuals, and collecting core deposits. For all bank categories, household deposits have over time become a much more important source of funding.

4.5 Methodology

This section develops the methodology used to estimate cost efficiency of Russian banks. Cost efficiency refers to how close a bank's cost is to what an optimal bank's cost would be for producing the same bundle of outputs. It also concerns waste in the production process and the optimality of the chosen mix of inputs.

Several techniques have been proposed in the literature to measure efficiency with frontier approaches. While nonparametric approaches (e.g. DEA) use linear programming techniques, parametric approaches, such as the stochastic frontier approach, apply econometric tools to estimate the efficiency frontier. We adopt the stochastic frontier approach in our study, following many studies on banking efficiency in transition countries (Weill, 2003; Bonin et al., 2005a; Fries and Taci, 2005). In comparison to DEA, this approach has the advantage of disentangling inefficiency from statistical noise, taking exogenous events into account in the residual (distance from the efficiency frontier). In section 4.7 we also present DEA estimates as additional robustness checks.

The stochastic frontier approach assumes that total cost deviates from optimal cost by a random disturbance, v, and an inefficiency term, u. Thus the cost function is $TC = f(Y, P) + \varepsilon$ where TC represents total cost, Y is the vector of outputs, P the vector of input prices and ε the error term which is the sum of u and v. u is a one-sided component representing cost inefficiencies, meaning the degree of weakness of managerial performance. v is a two-sided component representing random disturbances, reflecting luck or measurement errors. u and v are independently distributed, with u assumed to have a truncated normal distribution and v to have a normal distribution. σv^2 and σu^2 are the respective variances of v and u. According to Jondrow et al. (1982), firm-specific

estimates of inefficiency terms can be calculated by using the distribution of the inefficiency term conditional on the estimate of the composite error term.

The more straightforward procedure is the so-called "two-stage procedure": in the first stage the stochastic frontier model is estimated, and in the second stage the efficiency scores obtained are regressed on a set of explanatory variables including ownership variables. Although often applied in the literature, this two-stage procedure presents two important econometric problems, as noted by Kumbhakar and Lovell (2000). First, it assumes that the efficiency terms are identically distributed in the estimation of the stochastic frontier model of the first stage, while in the second stage this assumption is contradicted by the fact that the regression of the efficiency terms on the explanatory variables suggests that the efficiency terms are not identically distributed. Second, the explanatory variables must be assumed to be uncorrelated with the variables of the cost frontier function, or else the maximum likelihood estimates of the parameters of the cost frontier function would be biased because of the omission of the explanatory variables in the first stage. But then, the estimated efficiency terms that are explained in the second stage are biased estimates, as they are estimated relative to a biased representation of the cost frontier.

Therefore, we chose the "one-stage procedure" proposed by Battese and Coelli (1995), which solves these econometric problems. They propose a procedure for panel data, in which the non-negative inefficiency term is assumed to have a truncated distribution with different means for each firm. As a result, the distributions of the inefficiency terms are not the same, but are expressed as functions of explanatory variables. The inefficiency terms are then independently but not identically distributed. They are obtained by truncation at zero of the $N(\mu_{it}, \sigma u^2)$ distribution: $\mu_{it} = z_{it}\ \delta$, where z_{it} is a vector of explanatory variables, and δ is a vector of parameters to be estimated.

The estimated model consists of the cost frontier function and an equation explaining

inefficiency. As is common in the literature on bank efficiency in transition countries (Weill, 2003, Bonin et al., 2005a, Fries and Taci, 2005), we use a standard translog specification of the cost frontier:

$$\ln\left(\frac{TC_{i,t}}{pk_{i,t}}\right) = \beta_0 + \sum_m \alpha_m \ln y_{m,i,t} + \frac{1}{2}\sum_m \sum_j \alpha_{m,j} \ln y_{m,i,t} \ln y_{j,i,t} + \beta_1 \ln\left(\frac{pl_{i,t}}{pk_{i,t}}\right) + \beta_2 \ln\left(\frac{pl_{i,t}}{pk_{i,t}}\right)^2 + \sum_m \gamma_m \ln\left(\frac{pl_{i,t}}{pk_{i,t}}\right) \ln y_{m,i,t} + \varepsilon_{i,t} \quad (4.1)$$

where TC is total cost, y_m m^{th} bank output $(m = 1, 2)$, pl the price of labor, pk the price of physical capital, and ε the composite error term. Inefficiency is a function of bank-specific variables:

$$u_{it} = \delta z_{it} + W_{it} \quad (4.2)$$

where u_{it} is the inefficiency, z_{it} is a $p * 1$ vector of explanatory variables, δ is a $1 * p$ vector of parameters to be estimated, W_{it} is a random variable defined by the truncation of the normal distribution with mean zero, and $\sigma^2 = \sigma_u^2 + \sigma_v^2$ is the variance.

4.6 Results

We estimate the efficiency model for the period before generalized deposit insurance (2002) and after generalized deposit insurance (2006) to see whether the implementation of deposit insurance has modified the differences in efficiency between banks with different types of ownership. In all estimations, we include bank ownership variables in the equation explaining inefficiency. Two alternative definitions of public ownership are employed. On the one hand, we include a dummy variable taking the value of one if the bank is publicly-owned. On the other hand, following Styrin (2005), we measure public ownership by the ratio of interest income received from the government to total interest income. Foreign ownership is taken into account through a dummy variable equaling one if the bank is foreign-owned.

Table E.4 presents the main results. Panel A gives the results for public banks defined according to ownership; panel B for public banks defined according to their activities. In the interpretation, one must keep in mind that the econometric model identifies inefficiency. Therefore a minus sign indicates that an increase in the explanatory variable implies lower inefficiency, i.e. higher efficiency.

The baseline specification (a) of panel A shows that foreign banks are more efficient than domestic private banks and public banks, and that public banks are more efficient than domestic private banks after the introduction of deposit insurance. Indeed, while the estimates for public ownership are negative and insignificant in specification (a), specification (d) indicates that the efficiency gap between public banks and domestic private banks becomes significant after the introduction of generalized deposit insurance. In an economic sense, the efficiency differences are considerable. This is also true in panel B where public banks are identified according to their activities rather than their ownership.

In the baseline specifications (a) and (d), we implicitly assume that the bank's environment (determined by its location) and risk preferences are management choices. One could however argue that environment is exogenous to management decisions. Consequently, the influence of environment should be disentangled, to get a satisfactory measure of bank efficiency. In this strand of literature, Dietsch and Lozano-Vivas (2000) have notably shown that environment can explain cross-country differences in bank efficiency. Furthermore, Hugues and Mester (1993) and Mester (1996) have shown that efficiency differences may also derive from differences in managers' risk preferences. Indeed the degree of risk aversion has an impact on cost efficiency. Risk-loving managers may keep the capital down to its cost-minimizing level (the regulatory threshold), while risk-averse managers may prefer to hold higher levels of capital. Consequently, by omitting the level of equity from the cost frontier, we may consider a bank inefficient although

it behaves optimally given the risk preferences of its managers. Berger and Mester (1997) provide an additional reason to include the level of equity in the estimation of the cost efficiency model, based on the fact that the bank's insolvency risk depends on the equity available to absorb losses. This insolvency risk may lead to higher bank costs.[43] This issue takes on particular importance in transition economies like Russia where the insolvency risk of banks is not negligible.

In specifications (b) before generalized deposit insurance and (e) after generalized deposit insurance, we therefore include some environmental variables in the cost frontier. We use information on the district of the bank, taking into consideration the geographical breakdown of Russia into 7 districts. We therefore include in the cost frontier 6 dummy variables, equaling one if the bank is located in the concerned district. In specifications (c) and (f), we include the logarithm of equity in the estimation of the cost frontier to control for risk preferences, in addition to environmental variables, following notably Mester (1996), Altunbas et al. (2000) and Weill (2003). All these specifications show that the baseline results are very robust. Foreign banks are consistently the most efficient ones, and public banks are consistently more efficient than domestic private banks.

This first set of results suggests that in Russia public banks are more rather than less efficient than domestic private banks. This is in accordance with Styrin (2005) but differs from Fries and Taci (2005). Note however that the latter study obtained results on a cross-country sample from 15 transition countries including only a very limited sample of Russian banks. In addition, our results surprisingly suggest that this efficiency advantage was enhanced rather than reduced by the implementation of the deposit insurance scheme.

Since the results in table E.4 do not take into account the possible effect of systematic differences in the deposit rate , table E.5 repeats the regressions of table E.4, applying the

[43] In our framework, higher solvency risk could affect the costs included in the cost function through higher labor costs and higher costs of physical capital (to convince depositors to make their deposits, banks with lower capital need to invest more in their branch networks).

intermediation approach instead of the production approach. In the intermediation approach the deposit rate[44] is an input cost in the cost function and the total deposit cost is included in the measure of total cost.

The estimates in table E.5 indicate that our unexpected results are very robust to the choice of a production process. Applying the intermediation approach, we again find that foreign banks exhibit superior efficiency, that public banks tend to be more efficient than domestic private banks, and that the latter efficiency gap becomes statistically significant after the introduction of deposit insurance. It is suggested therefore that the superior efficiency of public over private banks is not an inheritance of some communist past, but a fact of contemporaneous Russian banking markets.

One explanation for this puzzle could be that public and private banks have different sets of activities and that the typical activity mix of public banks involves fewer costs than that which is typical of private banks. In tables E.6 through E.9, we test this idea by including measures of the activity mix in the equation explaining inefficiency.

We consider the activity mix in the form of lending and deposit shares by type of customer (households, firms, government, banks) and the average loan quality (measured as the ratio of classified loans to total loans).[45] In tables E.6 and E.7 we apply the production approach, in tables E.8 and E.9 the intermediation approach. Tables E.6 and E.8 identify public banks by ownership, while tables E.7 and E.9 identify public banks by revealed activities involving the government. In each table we have 4 specifications. In specification (a) we include the regional dummies in the estimation of the efficient frontier and all the activity mix variables in the equation explaining inefficiency. In specification (b) we additionally include equity in the estimation of the efficient frontier. In specification (c) we include the regional dummies and the activity mix variables in the estimation of the efficient frontier, leaving only loan quality as an explanatory variable for

[44] Public banks could have systematically lower deposit rates than private banks.

[45] Since the bank share and the government share are zero for many banks, their sum is the omitted variable for both lending and deposits. The results do not change if instead households or firms are the excluded category.

the residual inefficiency. In specification (d) we include the regional dummies, equity and the set of activity mix variables in the estimation of the frontier, again leaving only loan quality as an explanatory variable for residual inefficiency. Our three main results are highly robust in all these exercises. Foreign banks are again more efficient than domestic private banks. Public banks tend to be more efficient than domestic private ones. This effect seems to be stronger after than before the introduction of deposit insurance. Moreover, the results are stronger rather than weaker in some cases. In table E.6, for example (production approach, public ownership), the public banks' superior efficiency becomes statistically evident even for the pre-deposit-insurance period. In table E.8 (intermediation approach, public ownership), the public banks become less inefficient than even the foreign banks in the pre-deposit-insurance period.

4.7 Further robustness checks

The summary statistics in table E.2 indicate that public banks are on average very large compared to domestic private banks. If scale economies are present in the Russian banking sector, these considerable size differences may explain our results. Note however that one could also hypothesize that large Russian private banks are less efficient than their smaller competitors. Claeys and Schoors (2007) find that large Russian banks enjoy regulatory forbearance from the part of the Central Bank of Russia. Having such soft legal constraints means that managers of larger banks are subject to less regulatory pressure. This gives the managers greater freedom to maximize the private benefits of control, which may come at the cost of lower efficiency. To control for the size effect we repeat our estimations for a size-matched sample. The matching procedure for the two sub-periods is as follows:

1. We exclude the largest public banks, Sberbank, Vneshtorgbank and Gazprombank from the two samples. They dominate the market and their special status (see above) may drive the results.

2. For each of the remaining public banks, we identify in each time period 20 size-matched

(size in terms of total assets) private domestic banks. Specifically, we select the closest 10 larger and the closest 10 smaller private domestic banks that have not been selected yet for the given period. This yields two lists of matching banks, one for the sample before deposit insurance and one for the sample after deposit insurance.

3. Finally, we balance the sample by dropping all banks that fail to show up in all 4 quarters of the sub-period.

This procedure yields 123 matching private domestic banks before deposit insurance (492 bank observations) and 141 matching private domestic banks after deposit insurance (564 bank observations). All foreign banks are retained in the sample. In table E.12 we present summary statistics for this matched sample. One observes that the size differences are now substantially smaller than in the full sample of table E.2.

In table E.10, we repeat the estimations with all possible controls of table E.6. In tables E.13 through E.15 we show the reproduced estimations with the size-matched datasets from the remaining tables E.7 through E.9. Our three main findings are robust, but the estimated efficiency gap becomes smaller in most specifications. The public bank variable remains negative in all specifications of all panels, although its significance falters in some specifications of the intermediation approach (see tables E.14 and E.15). Apparently the observed efficiency gap between public and private banks is not only driven by size differences or by the special position enjoyed by CBR-owned large public banks, but also by some genuine efficiency differences.

As a further robustness check we employed a two-stage DEA procedure. In the first stage we estimate time-specific bank efficiency scores for each quarter. We use the quarterly efficiency scores for each bank to compute its mean efficiency scores for each year (2002 before the reform, 2006 after the reform). In a second stage, we regress these mean efficiency scores on a set of determinants (public ownership, foreign ownership, activity) using a Tobit estimator. This exercise

was performed on both the full and size-matched samples. Results for the second stage Tobit regressions are presented in table E.11. Note that DEA is a totally different estimation strategy, often leading to quite different results. The interpretation of the signs is now different, since DEA measures efficiency rather than inefficiency and since the estimates are time-specific rather than panel estimates.

From table E.11 we observe that foreign banks are again found to be more efficient than domestic banks. The efficiency of publicly owned banks is never significantly different from that of private banks. The introduction of deposit insurance again seems to affect efficiency differences in favor of foreign banks and public banks. In the case of publicly owned banks, the signs of the estimates change from insignificantly negative in 2002 to insignificantly positive in 2006.

4.8 Concluding remarks

For the Russian banking market we document three highly robust results with respect to bank efficiency. Foreign banks are more efficient than domestic private banks (no surprise), domestic private banks are not more efficient than public banks (surprise) and the introduction of deposit insurance increased any existing efficiency gap between public and private banks (big surprise). These results are not driven by the choice of production process, environment, risk preferences, activity mix, size, or econometric approach.

This result of foreign banks' superior efficiency agrees with most of the related literature on transition countries. Namely, Weill (2003), Fries and Taci (2005) and Bonin et al. (2005a) come to similar conclusions based on samples of banks from various transition countries. This finding is also highly robust in the specifications that take account of environment, equity, size and structure of activities. It may find its origin in both reasons proposed by Weill (2003). On the one hand, most shareholders of foreign banks are themselves banks. Consequently, these shareholders can provide their know-how in organization and risk analysis to their subsidiaries. On the other hand, foreign banks would benefit from better corporate governance as shareholders originating from

Western economies would be more accustomed to monitoring bank managers.

But why are private banks not more efficient than public banks in Russia? This unexpected finding is neither in accordance with the general prior that public ownership is less efficient than private ownership, nor with the findings of Bonin et al. (2005a) and Fries and Taci (2005) for cross-country samples of banks from Central and Eastern European countries. Implicit state guarantees may have rendered Russia's public banks' access to deposits less costly in terms of labor and physical capital, resulting in higher efficiency. A greater depositor base may in turn lead to a greater pool of loan applicants. Therefore, public banks may also benefit from granting a larger amount of loans than private banks for the same level of costs, because they must expend less effort to find borrowers. But if this explanation is true, the creation of a more level playing field via the introduction of a generalized deposit insurance scheme, no matter how incomplete, should have mitigated the efficiency difference, and yet we obtained the opposite result. So this explanation must be abandoned. Still deposit insurance may have played a role through moral hazard. There is strong evidence that Russian private domestic banks were subject to strong and sophisticated market discipline before the introduction of deposit insurance (see Karas, Schoors and Pyle, 2006). This forced them to improve their efficiency. The introduction of deposit insurance may however have reduced the pressure from market discipline, without replacing it with sufficiently strong regulatory pressure. In short, the introduction of deposit insurance may have introduced moral hazard, leading to more, rather than less, inefficient management practices in private banks.

Alternatively, the observed increase in the efficiency gap between public and private banks may be due to increased switching costs (see Kim et al., 2003). These switching costs notably derive from costs linked to the time and effort needed to close an account and open it elsewhere, to become comfortable with unfamiliar procedures and new bank employees, and from costs

related to the loss of capitalized value of established relationships. Switching costs may also endogenously result from the fact that banks benefit from better information on their clients as compared to their competitors (Sharpe, 1990; Rajan, 1992). The widespread trust in public banks accumulated through their long dominance of the Russian retail markets and the renewed distrust of private banks after the 'mini-crisis' of May-July 2004 (see above) may have increased the costs of switching from public to private banks. More importantly, the several weeks of turbulence on the Russian inter-bank market triggered by the CBR's intervention in the case of a bank accused of money-laundering, reduced depositors' trust in the banking system and led to a "flight to quality", i.e. a shift of deposits from private to public banks.

Given the fact that Russian public banks are not more inefficient than private ones, the large state presence in the Russian banking sector is not necessarily the cause of its relative inefficiency and the well-known corollaries of lower credit levels and more financial instability. The implication is that bank privatization will not necessarily improve the efficiency of the Russian banking system. Since the main inefficiency seems to reside with domestic private banks, the system's efficiency may benefit more from increased competition than from privatization. This can be achieved by creating a more level and more stable regulatory playing field for all banks, an objective on which the CBR is making progress, and by opening the market to foreign competition. In this light, the CBR's relentless efforts[46] of the last years (2006-2007) to get rid of inefficient and fraudulent banks regardless of their size and the increasing access of foreign banks to the Russian banking sector may be more instrumental in boosting the sector's efficiency than yet another round of chaotic privatization.

[46] These efforts are deeply resented by some banks that fear losing their license and culminated in the brutal murder in October 2006 of the Mr. Kozlov, vice president of the CBR in charge of bank licensing policy. The CBR reacted by reinforcing its effort to sweep though the banking licenses.

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Appendix E Tables

Table E.1: Some Indicators of recent developments in the Russian banking sector

Data as at start of period unless otherwise indicated	***2001***	***2002***	***2003***	***2004***	***2005***	***2006***
Number of credit organizations	2126	2003	1828	1668	1518	1409
with banking license	1311	1319	1329	1329	1299	1253
license to attract private deposits	1239	1223	1202	1190	1165	1045
license to conduct foreign currency operations	764	810	839	845	839	827
general license	244	262	293	310	311	301
license for operations with precious metals	163	171	175	181	182	184
Foreign credit organizations with banking license	130	125	126	128	131	136
fully foreign owned	22	23	27	32	33	41
50 to 100% foreign owned	11	12	10	9	9	11
Total number of branches	3793	3433	3326	3219	3238	3295
of which branches of Sberbank	1529	1233	1162	1045	1011	1009
of which branches of fully foreign owned banks	7	9	12	15	16	29
Corporate Lending/GDP (eop)	17%	19%	22%	25%	27%	32%
Private deposits/GDP	8%	10%	11%	12%	13%	14%
Lending/Gross fixed capital formation (eop)	92%	105%	120%	137%	149%	177%
Inflation (eop)	18.6%	15.1%	12.0%	11.7%	10.9%	9.0%
Deposit rate (period average)	4.9%	5.0%	4.5%	3.8%	4.0%	4.1%
Lending rate (period average)	17.9%	15.7%	13.0%	11.4%	10.7%	10.5%

Note: Sources: Rosstat, CBR and International Financial Statistics (IMF). Lending defined as lending of deposit money banks to private and public enterprises, excluding financial companies.

Table E.2: Means of key variables for private and public banks

	2002		*2006*	
	Private banks	***Public banks***	***Private banks***	***Public banks***
Characteristics				
Total assets	1,213.56	17,585.80	2,934.71	160,481.92
Total costs (production)	49.26	593.51	142.65	6,575.91
Total costs (intermediation)	57.90	696.50	168.36	7,941.45
Loans	901.67	12,400.59	2,182.47	118,575.98
Deposits	855.46	9,406.17	2,278.33	127,781.46
Investment assets	73.60	2,283.15	380.68	29,776.67
Price of labor	0.0106	0.0105	0.0102	0.0078
Price of physical capital	1.8113	1.5108	1.8488	2.0085
Price of borrowed funds	0.0111	0.0089	0.0121	0.0110
Equity/total assets	0.2726	0.2348	0.1837	0.1297
Bad loans / loans	0.0184	0.0247	0.0189	0.0114
Loan activities				
Household loans / loans	0.0790	0.0232	0.1915	0.1474
Firm loans / loans	0.6649	0.6622	0.6292	0.6654
Government loans / loans	0.0108	0.0104	0.0066	0.0181
Bank loans / loans	0.2453	0.3042	0.1726	0.1691
Deposit activities				
Household dep./ deposits	0.2285	0.1267	0.4180	0.3526
Firm deposits / deposits	0.6080	0.5889	0.4796	0.3888
Government dep. /deposits	0.0262	0.1298	0.017	0.1232
Bank dep. / deposits	0.1373	0.1547	0.0908	0.1355
Environment				
Moscow area	0.5192	0.5789	0.3706	0.4667
Number of observations	2912	76	1824	60

Table E.3: Means of key variables for domestic and foreign banks

	2002		*2006*	
	Domestic banks	***Foreign banks***	***Domestic banks***	***Foreign banks***
Characteristics				
Total assets	1,385.31	8,414.93	7,521.01	17,674.06
Total cost (production)	55.35	277.95	332.89	677.80
Total cost (intermediation)	64.70	336.12	398.33	812.46
Loans	998.13	6,629.65	5,559.31	13,329.95
Deposits	860.11	6,975.06	5,902.71	14,675.99
Investment assets	111.20	645.49	1,243.35	2,974.54
Price of labor	0.0107	0.0077	0.0103	0.0073
Price of physical capital	1.7828	2.3836	1.8528	1.8800
Price of borrowed funds	0.0112	0.0088	0.0122	0.0096
Equity/total assets	0.2725	0.2462	0.1827	0.1677
Bad loans / loans	0.0184	0.0216	0.0172	0.0508
Loan activities				
Household loans / loans	0.0792	0.0337	0.1904	0.1838
Firm loans / loans	0.6718	0.4709	0.6360	0.5036
Government loans / loans	0.0112	0.0001	0.0073	0.0001
Bank loans / loans	0.2379	0.4954	0.1663	0.3125
Deposit activities				
Household dep./ deposits	0.2290	0.1401	0.4277	0.1498
Firm deposits / deposits	0.6150	0.4012	0.4809	0.3811
Government dep. /deposits	0.0299	0.0001	0.0159	0.0001
Bank dep. / deposits	0.1261	0.4585	0.0755	0.4691
Environment				
Moscow area	0.5118	0.7692	0.3503	0.9000
Number of observations	2884	104	1804	80

Table E.4: Inefficiency of public banks, production approach

						Panel A: Public banks defined as state-owned banks
Frontier characteristics	***Before generalized deposit insurance (2002)***			***After generalized deposit insurance (2006)***		
	(a)	***(b)***	***(c)***	***(d)***	***(e)***	***(f)***
	Baseline	***environment***	***Equity and environment***	***Baseline***	***environment***	***Equity and environment***
Intercept	Yes	Yes	Yes	Yes	Yes	Yes
Public banks	-2.321	-2.346	-2.226	-2.915***	-3.527***	-1.924***
	(1.37)	(1.38)	(1.24)	(4.19)	(4.34)	(4.04)
Foreign banks	-2.393*	-2.544***	-2.560	-6.325***	-6.594***	-4.788***
	(1.95)	(2.67)	(1.34)	(3.88)	(4.00)	(3.35)
Log-likelihood	-2203.909	-2192.782	-2189.672	-1278.612	-1270.417	-1200.630
Panel B: Public banks defined as banks that receive a high share of interest income from government bodies						
Intercept	Yes	Yes	Yes	Yes	Yes	Yes
Public banks	-2.125	-2.357	-2.172	-3.398***	-3.633***	-2.903***
	(0.88)	(1.01)	(0.84)	(4.35)	(3.70)	(4.66)
Foreign banks	-2.370**	-2.535***	-2.550	-6.519***	-6.739***	-4.965***
	(1.97)	(2.80)	(1.54)	(3.31)	(3.30)	(2.95)
Log-likelihood	-2205.207	-2194.002	-2190.745	-1282.249	-1274.881	-1202.208

Note: 'Environment' means that regional dummies are included in the estimation of the cost frontier. 'Equity' refers to the inclusion of the bank's equity in the estimation of the cost frontier. N=2988 for the first period, N=1884 for the second period. Absolute t-statistics in parentheses, *, **, *** denote an estimate significantly different from zero at the 10, 5 and 1 percent

Table E.5: Inefficiency of public banks, intermediation approach

						Panel C: Public banks defined as state-owned banks
Frontier characteristics	***Before generalized deposit insurance (2002)***			***After generalized deposit insurance (2006)***		
	(a)	***(b)***	***(c)***	***(d)***	***(e)***	***(f)***
	Baseline	***environment***	***Equity and environment***	***Baseline***	***environment***	***Equity and environment***
Intercept	Yes	Yes	Yes	Yes	Yes	Yes
Public banks	-3.018	-2.801	-2.507	-2.886***	-3.268***	-1.994***
	(1.60)	(1.58)	(1.35)	(4.01)	(2.90)	(4.10)
Foreign banks	-1.290**	-1.187*	-1.084**	-7.020***	-7.162***	-5.862***
	(2.08)	(1.66)	(2.41)	(3.63)	(2.66)	(3.82)
Log-likelihood	-1983.526	-1972.305	-1968.205	-1040.960	-1035.344	-1015.842
	Panel D: Public banks defined as banks that receive a high share of interest income from government bodies					
Intercept	Yes	Yes	Yes	Yes	Yes	Yes
Public banks	-0.776	-1.387	-1.134	-3.888***	-4.243***	-2.968***
	(0.53)	(0.85)	(0.74)	(3.54)	(3.80)	(4.52)
Foreign banks	-1.141	-1.071	-0.976	-7.093***	-7.240***	-5.943***
	(1.17)	(1.13)	(1.58)	(3.02)	(3.37)	(4.21)
Log-likelihood	-1986.681	-1975.090	-1970.917	-1042.721	-1037.439	-1016.970

Note: 'Environment' means that regional dummies are included in the estimation of the cost frontier. 'Equity' refers to the inclusion of the bank's equity in the estimation of the cost frontier. N=2988 for the first period, N=1884 for the second period. Absolute t-statistics in parentheses, *, **, *** denote an estimate significantly different from zero at the 10, 5 and 1 percent

Table E.6: Robustness to differences in activity mix. Panel A

				Pre-generalized deposit insurance (2002)
Frontier characteristics	***(a) environment***	***(b) equity and environment***	***(c) environment and activities***	***(d) equity and environment and activities***
Intercept	Yes	Yes	Yes	Yes
Public banks	-1.041**	-1.153***	-0.679**	-0.801**
	(2.04)	(3.06)	(2.03)	(2.23)
Foreign banks	-0.803***	-0.873***	-0.584**	-0.653
	(2.85)	(2.61)	(2.06)	(1.58)
Household deposits %	Yes	Yes	-	-
Firm deposits %	Yes	Yes	-	-
Household loans %	Yes	Yes	-	-
Firm loans %	Yes	Yes	-	-
Bad loans %	Yes	Yes	Yes	Yes
Log-likelihood	-2163.004	-2162.106	-2130.126	-2128.461
				Post-generalized deposit insurance (2006)
Intercept	Yes	Yes	Yes	Yes
Public banks	-2.699***	-1.739***	-5.397**	-2.859***
	(3.85)	(3.67)	(2.47)	(3.46)
Foreign banks	-4.514***	-3.885***	-7.153*	-5.523***
	(3.71)	(3.64)	(1.97)	(3.28)
Household deposits %	Yes	Yes	-	-
Firm deposits %	Yes	Yes	-	-
Household loans %	Yes	Yes	-	-
Firm loans %	Yes	Yes	-	-
Bad loans %	Yes	Yes	Yes	Yes
Log-likelihood	-1226;456	-1165.323	-1230.926	-1143.223

Note: Public banks defined as state-owned banks, production approach

Table E.7: Robustness to differences in activity mix. Panel B

				Pre-generalized deposit insurance (2002)
Frontier characteristics	***(a) environment***	***(b) equity and environment***	***(c) environment and activities***	***(d) equity and environment and activities***
Intercept	Yes	Yes	Yes	Yes
Public banks	-1.348	-1.561	-0.862	-1.137
	(1.24)	(1.58)	(0.95)	(1.53)
Foreign banks	-0.788***	-0.863**	-0.574**	-0.654*
	(2.89)	(2.52)	(2.05)	(1.70)
Household deposits %	Yes	Yes	-	-
Firm deposits %	Yes	Yes	-	-
Household loans %	Yes	Yes	-	-
Firm loans %	Yes	Yes	-	-
Bad loans %	Yes	Yes	Yes	Yes
Log-likelihood	-2163.432	-2162.537	-2130.490	-2128.775
				Post-generalized deposit insurance (2006)
Intercept	Yes	Yes	Yes	Yes
Public banks	-3.329***	-2.766***	-3.602	-2.855***
	(3.37)	(3.87)	(1.18)	(3.17)
Foreign banks	-4.553***	-4.001***	-5.611	-5.627**
	(3.35)	(3.63)	(1.39)	(2.43)
Household deposits %	Yes	Yes	-	-
Firm deposits %	Yes	Yes	-	-
Household loans %	Yes	Yes	-	-
Firm loans %	Yes	Yes	-	-
Bad loans %	Yes	Yes	Yes	Yes
Log-likelihood	-1231.047	-1167.378	-1235.123	-1145.789

Note: Public banks defined as banks that receive a high share of interest income from government bodies, production approach

Table E.8: Robustness to differences in activity mix. Panel C

				Pre-generalized deposit insurance (2002)
Frontier characteristics	***(a) environment***	***(b) equity and environment***	***(c) environment and activities***	***(d) equity and environment and activities***
Intercept	Yes	Yes	Yes	Yes
Public banks	-1.285***	-1.259**	-1.471	-1.447*
	(2.31)	(2.36)	(1.58)	(1.93)
Foreign banks	0.005	0.018	-1.609	-0.155
	(0.02)	(0.11)	(0.51)	(0.81)
Household deposits %	Yes	Yes	-	-
Firm deposits %	Yes	Yes	-	-
Household loans %	Yes	Yes	-	-
Firm loans %	Yes	Yes	-	-
Bad loans %	Yes	Yes	Yes	Yes
Log-likelihood	-1917.841	-1916.956	-1917.810	-1917.737
				Post-generalized deposit insurance (2006)
Intercept	Yes	Yes	Yes	Yes
Public banks	-1.957***	-1.857***	-2.244	-2.326***
	(2.57)	(5.08)	(1.60)	(3.88)
Foreign banks	-3.863***	-4.378***	-3.924**	-6.275***
	(2.93)	(10.40)	(2.07)	(3.14)
Household deposits %	Yes	Yes	-	-
Firm deposits %	Yes	Yes	-	-
Household loans %	Yes	Yes	-	-
Firm loans %	Yes	Yes	-	-
Bad loans %	Yes	Yes	Yes	Yes
Log-likelihood	-951.341	-932.902	-998.824	-975.377

Note: Public banks defined as state-owned banks, intermediation approach

Table E.9: Robustness to differences in activity mix. Panel D

				Pre-generalized deposit insurance (2002)
Frontier characteristics	***(a) environment***	***(b) equity and environment***	***(c) environment and activities***	***(d) equity and environment and activities***
Intercept	Yes	Yes	Yes	Yes
Public banks	-0.967	-0.890	-1.320	-1.267
	(1.53)	(1.47)	(1.10)	(1.17)
Foreign banks	0.054	0.067	-0.125	-0.118
	(0.24)	(0.38)	(0.53)	(0.59)
Household deposits %	Yes	Yes	-	-
Firm deposits %	Yes	Yes	-	-
Household loans %	Yes	Yes	-	-
Firm loans %	Yes	Yes	-	-
Bad loans %	Yes	Yes	Yes	Yes
Log-likelihood	-1919.707	-1918.822	-1919.208	-1919.153
				Post-generalized deposit insurance (2006)
Intercept	Yes	Yes	Yes	Yes
Public banks	-2.670**	-2.824***	-2.518	-2.978***
	(2.28)	(3.98)	(1.36)	(2.81)
Foreign banks	-3.892***	-4.359***	-3.847***	-6.380***
	(2.77)	(3.85)	(2.76)	(2.76)
Household deposits %	Yes	Yes	-	-
Firm deposits %	Yes	Yes	-	-
Household loans %	Yes	Yes	-	-
Firm loans %	Yes	Yes	-	-
Bad loans %	Yes	Yes	Yes	Yes
Log-likelihood	-953.868	-934.310	-1000.718	-976.560

Note: Public banks defined as banks that receive a high share of interest income from the government bodies, intermediation approach

Table E.10: Size-matched results. Panel A

				Pre-generalized deposit insurance (2002)
Frontier characteristics	***(a) environment***	***(b) equity and environment***	***(c) environment and activities***	***(d) equity and environment and activities***
Intercept	Yes	Yes	Yes	Yes
Public banks	-2.130	-2.153***	-0.226	-0.244
	(1.14)	(2.73)	(0.66)	(0.57)
Foreign banks	0.412	0.384	0.039	0.012
	(0.64)	(1.32)	(0.11)	(0.04)
Household deposits %	1.594	1.035	-	-
	(0.71)	(1.46)		
Firm deposits %	6.439	6.175***	-	-
	(1.23)	(3.26)		
Household loans %	2.130	2.681*	-	-
	(1.17)	(1.92)		
Firm loans %	2.226	2.639**	-	-
	(1.36)	(2.23)		
Bad loans %	11.841	15.918**	6.168	6.742
	(1.47)	(2.53)	(1.62)	(1.22)
Log-likelihood	-397.439	-397.026	-390.969	-390.955
				Post-generalized deposit insurance (2006)
Intercept	Yes	Yes	Yes	Yes
Public banks	-0.331*	-0.190**	-1.406**	-1.280**
	(1.95)	(1.96)	(2.06)	(2.27)
Foreign banks	-1.433***	-0.907***	-2.660*	-1.987**
	(6.74)	(11.58)	(1.94)	(2.36)
Household deposits %	-0.815***	0.030	-	-
	(3.60)	(0.36)		
Firm deposits %	-0.222	0.154**	-	-
	(1.16)	(2.48)		
Household loans %	0.718***	0.293	-	-
	(2.69)	(1.64)		
Firm loans %	0.813***	0.416***	-	-
	(3.57)	(3.69)		
Bad loans %	0.018	0.207	-3.215	-4.126
	(0.03)	(1.08)	(0.89)	(1.06)
Log-likelihood	-360.661	-332.218	-349.916	-339.517

Note: Public banks defined as state-owned banks, production approach

Table E.11: Robustness to other econometric techniques: DEA

				Panel A: Public banks defined as state-owned banks, full sample		
Frontier characteristics	***Before generalised deposit insurance (2002)***			***After generalised deposit insurance (2006)***		
	(a)	***(b)***	***(c)***	***(d)***	***(e)***	***(f)***
Intercept	Yes	Yes	Yes	Yes	Yes	Yes
Public banks	-0.007	-0.0233	-0.021	0.014	0.013	0.013
	(0.32)	(1.16)	(1.07)	(0.68)	(0.63)	(0.61)
Foreign banks	0.055***	0.008	0.008	0.145***	0.135***	0.135***
	(3.03)	(0.44)	(0.45)	(8.00)	(6.66)	(6.67)
Activities	-	Yes	Yes	-	Yes	Yes
Bad loans	-	-	Yes	-	-	Yes
Log-likelihood	733.983	776.945	785.229	525.603	538.238	538.296
				Panel B: Public banks defined as state-owned banks, size-matched sample		
Intercept	Yes	Yes	Yes	Yes	Yes	Yes
Public banks	-0.023	-0.034	-0.033	0.024	0.018	0.017
	(0.68)	(1.01)	(1.00)	(0.78)	(0.63)	(0.60)
Foreign banks	0.055*	0.005	0.004	0.152***	0.128***	0.112***
	(1.90)	(0.18)	(0.12)	(6.11)	(4.31)	(3.70)
Activities	-	Yes	Yes	-	Yes	Yes
Bad loans	-	-	Yes	-	-	Yes
Log-likelihood	85.342	93.296	94.764	130.483	147.455	149.411

Note: 'Environment' means that regional dummies are included in the estimation of the cost frontier. 'Equity' refers to the inclusion of the bank's equity in the estimation of the cost frontier. N=747 for the first period, N=471 for the second period. Absolute t-statistics in parentheses, *, **, *** denote an estimate significantly different from zero at the 10, 5 and 1 percent

Table E.12: Means of key variables for private and public banks, size-matched sample

	2002		2006	
	Private banks	**Public banks**	**Private banks**	**Public banks**
Characteristics				
Total assets	5,151.91	7,401.68	8,121.43	32,322.32
Total costs (production)	203.89	281.03	388.71	1,108.36
Total costs (intermediation)	240.25	339.56	459.19	1,352.25
Loans	3,911.10	4,898.84	6,058.27	23,751.46
Deposits	3,763.33	5,315.51	6,332.80	25,765.57
Investment assets	325.33	915.25	1,143.52	5,345.11
Price of labor	0.0083	0.0112	0.0087	0.0087
Price of physical capital	2.4495	1.2885	2.1035	1.5660
Price of borrowed funds	0.0105	0.0086	0.0125	0.0111
Equity/total assets	0.2149	0.2313	0.1448	0.1341
Bad loans / loans	0.0207	0.0229	0.0203	0.0107
Loan activities				
Household loans / loans	0.0495	0.0248	0.1632	0.1591
Firm loans / loans	0.6163	0.6586	0.6431	0.6606
Government loans / loans	0.0099	0.0111	0.0074	0.0189
Bank loans / loans	0.3243	0.3055	0.1862	0.1614
Deposit activities				
Household dep./ deposits	0.1977	0.1204	0.3755	0.3561
Firm deposits / deposits	0.5180	0.5858	0.4606	0.3872
Government dep. /deposits	0.0359	0.1438	0.0186	0.1452
Bank dep. / deposits	0.2484	0.1501	0.1454	0.1115
Environment				
Moscow area	0.6016	0.5882	0.5106	0.4167
Number of observations	492	68	564	48

Table E.13: Further size-matched results. Panel B

				Pre-generalized deposit insurance (2002)
Frontier characteristics	***(a) environment***	***(b) equity and environment***	***(c) environment and activities***	***(d) equity and environment and activities***
Intercept	Yes	Yes	Yes	Yes
Public banks	-2.934	-3.236**	-0.993	-0.994
	(1.40)	(2.03)	(0.43)	(0.45)
Foreign banks	0.655	1.050	0.065	0.045
	(1.01)	(1.62)	(0.26)	(0.12)
Household deposits %	2.451	3.363**	-	-
	(1.28)	(1.97)		
Firm deposits %	7.025*	7.719***	-	-
	(1.80)	(2.62)		
Household loans %	2.563	3.115**	-	-
	(1.47)	(2.19)		
Firm loans %	2.356*	2.064	-	-
	(1.83)	(2.43)		
Bad loans %	13.430***	7.458	6.477	6.806
	(2.14)	(4.39)	(1.50)	(1.15)
Log-likelihood	-399.040	-397.810	-390.961	-390.958
				Post-generalized deposit insurance (2006)
Intercept	Yes	Yes	Yes	Yes
Public banks	-0.386	-0.232	-3.680*	-2.779*
	(0.93)	(0.93)	(1.91)	(1.70)
Foreign banks	-1.221***	-0.940***	-1.943**	-1.490**
	(6.42)	(18.57)	(2.41)	(2.27)
Household deposits %	-0.586**	-0.036	-	-
	(2.23)	(0.95)		
Firm deposits %	-0.049	0.107***	-	-
	(0.27)	(2.72)		
Household loans %	0.718***	0.665***	-	-
	(2.81)	(4.11)		
Firm loans %	0.808***	0.329***	-	-
	(3.72)	(5.13)		
Bad loans %	-0.251	0.881***	-4.794	-5.458
	(0.24)	(4.89)	(0.93)	(0.77)
Log-likelihood	-365.493	-320.609	-350.452	-340.378

Note: Public banks defined as banks that receive a high share of interest income from government bodies, production approach

Table E.14: Further size-matched results. Panel C

				Pre-generalized deposit insurance (2002)
Frontier characteristics	***(a) environment***	***(b) equity and environment***	***(c) environment and activities***	***(d) equity and environment and activities***
Intercept	Yes	Yes	Yes	Yes
Public banks	-2.431	-3.593	-5.097	-5.466**
	(1.36)	(1.19)	(0.60)	(2.06)
Foreign banks	-0.008	0.158	0.503	1.609*
	(0.02)	(0.51)	(0.33)	(1.65)
Household deposits %	-0.407	0.126	-	-
	(0.36)	(0.07)		
Firm deposits %	0.045*	6.680	-	-
	(1.76)	(1.48)		
Household loans %	-1.657	-2.028	-	-
	(0.74)	(1.58)		
Firm loans %	0.527	0.241	-	-
	(0.93)	(0.32)		
Bad loans %	9.552**	7.142	17.085	-0.539
	(2.10)	(1.56)	(0.79)	(0.14)
Log-likelihood	-327.203	-326.982	-333.275	-331.822
				Post-generalized deposit insurance (2006)
Intercept	Yes	Yes	Yes	Yes
Public banks	-1.304	-1.393*	-1.478	-1.619
	(1.62)	(1.87)	(0.68)	(1.20)
Foreign banks	-2.031**	-2.080*	-2.760	-2.668
	(2.03)	(1.85)	(0.82)	(1.25)
Household deposits %	-4.213**	-4.195**	-	-
	(2.34)	(2.11)		
Firm deposits %	0.181	0.255	-	-
	(0.35)	(0.69)		
Household loans %	1.548**	1.606*	-	-
	(1.99)	(1.94)		
Firm loans %	1.538*	1.450**	-	-
	(1.91)	(2.19)		
Bad loans %	0.404	0.242	-4.044	-4.117
	(0.15)	(0.15)	(0.63)	(0.90)
Log-likelihood	-220.328	-218.397	-205.273	-200.991

Note: Public banks defined as state-owned banks, intermediation approach

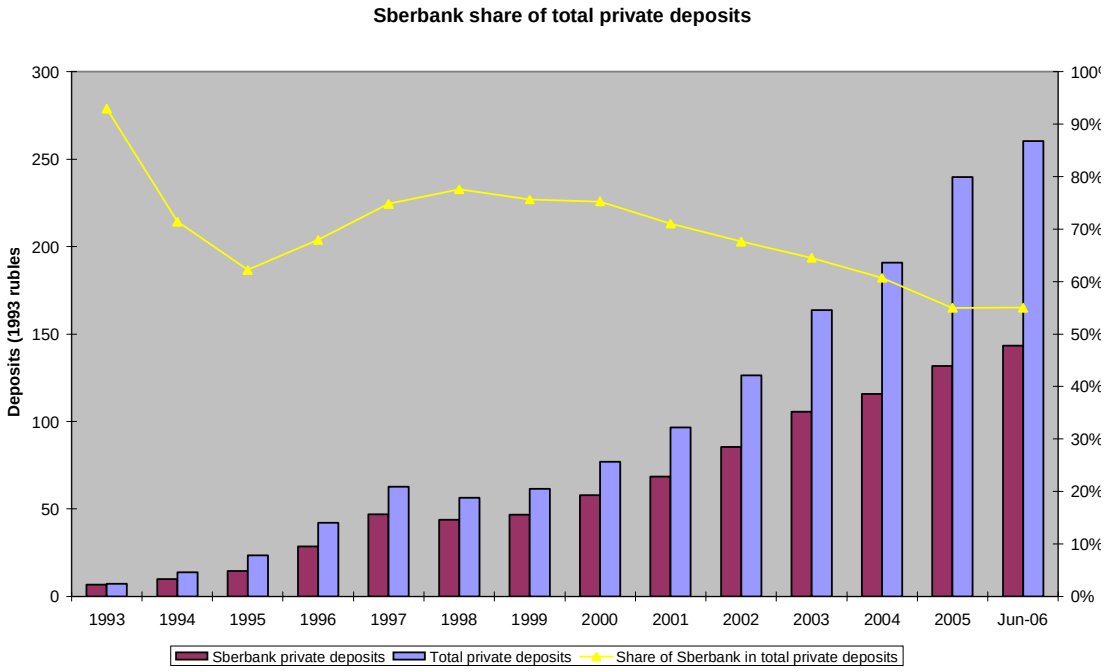
Table E.15: Further size-matched results. Panel D

				Pre-generalized deposit insurance (2002)
Frontier characteristics	***(a) environment***	***(b) equity and environment***	***(c) environment and activities***	***(d) equity and environment and activities***
Intercept	Yes	Yes	Yes	Yes
Public banks	-3.323	-4.430	-13.875	-13.125***
	(1.34)	(0.66)	(1.21)	(2.57)
Foreign banks	0.127	0.353	0.685	1.840*
	(0.42)	(0.35)	(1.06)	(1.93)
Household deposits %	0.276	0.846	-	-
	(0.23)	(0.29)		
Firm deposits %	4.403*	6.259	-	-
	(1.72)	(0.67)		
Household loans %	-1.394	-1.884	-	-
	(0.85)	(0.55)		
Firm loans %	0.422	0.212	-	-
	(1.09)	(0.30)		
Bad loans %	9.870**	8.760	15.098	1.318
	(2.02)	(1.09)	(1.54)	(0.53)
Log-likelihood	-331.408	-331.208	-334.246	-332.787
				Post-generalized deposit insurance (2006)
Intercept	Yes	Yes	Yes	Yes
Public banks	-1.464	-1.382	-2.555	-1.690
	(0.93)	(0.98)	(0.54)	(1.28)
Foreign banks	-1.775*	-1.832*	-2.449	-2.392
	(1.91)	(1.68)	(0.80)	(1.52)
Household deposits %	-3.826**	-3.849**	-	-
	(2.39)	(2.26)		
Firm deposits %	0.674	0.791	-	-
	(1.50)	(1.37)		
Household loans %	1.539*	1.622*	-	-
	(1.90)	(1.94)		
Firm loans %	1.686**	1.634**	-	-
	(2.41)	(2.06)		
Bad loans %	0.191	0.033	-4.504	-4.400
	(0.09)	(0.01)	(0.48)	(1.21)
Log-likelihood	-223.653	-222.113	-205.615	-201.543

Note: Public banks defined as banks that receive a high share of interest income from government bodies, intermediation approach

Appendix F Figures

Figure F.1: Sberbank's dominance in personal deposit market



Chapter 5 Liquidity Matters: Evidence from Interbank Market

5.1 Introduction

There is an apparent puzzle at the heart of the 2007-2008 credit crisis. The 2007 estimates of the likely total losses on subprime mortgages were roughly equivalent to a single day's movement in the U.S. stock market (Adrian and Shin, 2008).[47] The resulting conventional wisdom in policy circles up to the summer of 2007 was that the subprime exposure was too small to lead to widespread problems in the financial system. Yet, reality proved different. The credit crisis developed with a ferocity that led some observers to characterize it as one of the worst financial shocks that the United States has confronted since the Great Depression (Mishkin, 2008).

The presumption that subprime exposures did not pose a serious threat to the financial system could be justified by the "domino" model of financial contagion. This model works through direct credit losses depleting bank capital: Bank A, for whatever reason, defaults on a payment to Bank B that produces a loss greater than B's capital and forces it to default on payment to Bank C with losses that are larger than C's capital, and so on down the chain (see Allen and Gale (2000) for a theoretical model).

The "domino" model of contagion seems, however, to be a poor description of reality. The crucial variable in this model is capital, measuring banks' ability to absorb losses and prevent the propagation of the shock. According to Adrian and Shin (2008) the capital of financial institutions was large enough to absorb subprime losses without difficulty, yet this hardly stopped contagion from spreading through the financial system. Furthermore, simulation studies by several central banks relying on the "domino" model uncovered limited risk of a systemic meltdown (see Sheldon and Maurer (1998) for Switzerland, Furfine (2003) for the U.S., Upper and Worms (2004) for

[47] Upwards revised estimates reported in Greenlaw et. al. (2008) still remain small in relative terms.

Germany, Lelyveld and Liedorp (2006) for the Netherlands, and Degryse and Nguyen (2007) for Belgium). These estimates of *limited* systemic risk contrast sharply with the broad financial disruption experienced in 2007-2008.

One potential reason for the seeming empirical irrelevance of the "domino" model of contagion is its focus on just one propagation mechanism - through *direct* interbank linkages. De Bandt and Hartmann (2000) identify another fundamental channel of contagion in banking markets which relies on more *indirect* interconnections. This second, "information", channel relates to contagious withdrawals (runs) when depositors are imperfectly informed about the type of shocks hitting banks (idiosyncratic or systemic) and about their physical exposures to each other (asymmetric information). Rochet and Vives (2004) model a "modern" form of such bank runs where large well-informed investors refuse to renew their credit on the interbank market. An adverse shock to one bank may create uncertainty about other banks that may be subject to the same shock. Since interbank market participants are generally risk averse and have asymmetric information about each other's financial health, banks may overreact to any negative news and withdraw their funds as quickly as possible. Such a generalized liquidity crunch may push a solvent institution into illiquidity and bankruptcy.

In this paper we supplement the traditional "domino" model of contagion, henceforth referred to as "capital" channel, with the "information", or "liquidity", channel, and apply it to the Russian interbank market. We undertake a stylized exercise - resembling a stress test - in which we simulate the consequences of non-repayment of interbank loans of an individual bank on the solvency and liquidity of its bank lenders. Lenders rendered by the encountered credit loss either insolvent or illiquid default on their own obligations and, thus, lead to further rounds of losses and failures. Exploiting monthly data on bilateral interbank exposures we quantify the potential damage such contagion effects could produce for the Russian banking system in 1998-2004.

In line with previous studies our simulations reveal limited potential for contagion through the direct capital channel. The capital channel partially captures the 1998 interbank crisis, but completely misses the 2004 interbank meltdown. In contrast, we document substantial potential for contagion through indirect liquidity channel. The liquidity channel not only captures the 1998 crisis but also the 2004 crisis very accurately. The results are robust to the definition of the initial shock (either the failure of a single bank or the correlated default of a number of banks).

Next to correctly identifying periods of intrinsic instability on a system level, our simulations produce bank-specific failure frequencies that possess predictive power for real bank defaults beyond that contained in bank fundamentals. More importantly, our approach reveals that the Central Bank of Russia's (CBR) liquidity injections were effective in stabilizing the interbank market, lending support to the thesis that LOLR interventions can correct coordination failures on the interbank market.

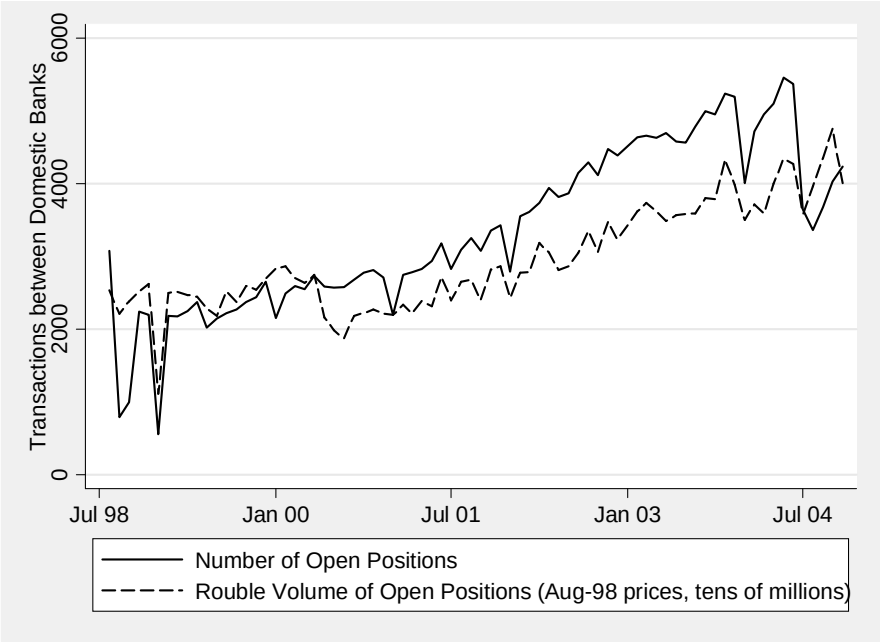
5.2 Russian Interbank Market

Two established and highly respected private financial information agencies Banksrate.ru and Mobile provided us with monthly bank balances and monthly reports "On Interbank Loans and Deposits" (official form's code 0409501) for the period August 1998 - November 2004.[48] The latter report provides information on banks' gross interbank positions split by counterparty enabling us to reconstruct the exact matrix of interbank exposures at the beginning of each month. Balance sheets of foreign banks and off-balance-sheet positions are not available.

Our simulations distinguish between two types of shocks, idiosyncratic and systemic, and two types of risk, solvency risk and liquidity risk. Such distinctions capture the differences between the two crises that hit the Russian banking sector in August 1998 and summer 2004, both resulting in the collapse of the interbank market. While the 2004 crisis was mainly triggered by rumors

[48] For more information on the data providers see their respective websites at www.banks-rate.ru and www.mobile.ru. Karas and Schoors (2005) provide a detailed description of Mobile database.

Figure 5.1: Liquidity Drains on the Russian Interbank Market



associated with a single bank failure, the 1998 turmoil resulted from a fundamental systemic shock having direct effects on banks' solvency. Figure 5.1 demonstrates the periods of low interbank market activity that followed both shocks together with a lesser-scale liquidity drain in the end of 2003. In all 3 cases, the volume of interbank lending decreases by less than the number of outstanding contracts consistent with the idea that in times of distrust big banks decrease their lending to each other by less than their lending to smaller banks.

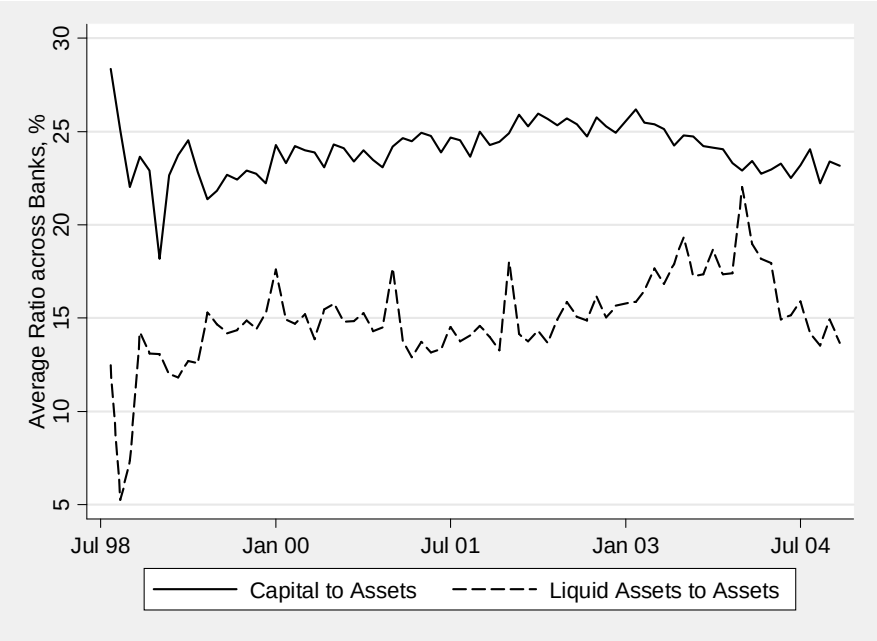
The roots of the 1998 crisis go back to 1996 when the government's desperate need for money in the run-up to the presidential elections led to very high yields on treasury bills (GKOs). In the beginning of 1996 the average lending rate on loans to the real economy was 60% per annum, while the yield on GKOs was around 100% per annum. Moreover, incomes from GKO investment were tax deductible. In the second half of 1996 Russian banks began borrowing actively on foreign markets (currency loans from foreign banks and Eurobonds). The huge difference between domestic and foreign interest rates in combination with relatively stable rouble exchange rate, guaranteed by the ruble corridor policy (a crawling currency band), ensured huge

profits. When the GKO market was opened to foreigners in 1997, the desire of foreign investors to hedge their ruble investments was met by Russian counterparties, who took short positions in forward contracts on foreign currency. The Russian banks, involved in this trade, carried a huge amount of fundamentally uncovered currency risk. In the beginning of 1998 the share of foreign currency denominated liabilities significantly exceeded rouble denominated liabilities. In a vain attempt to reduce the currency mismatch in their books, banks began extending foreign currency denominated loans to domestic borrowers. In fact, by shifting currency risk to their borrowers, banks substituted it by credit risk, because after the rouble devaluation most of the borrowers defaulted.

The Asian crisis and dwindling yields on GKOs made Russian government debt securities less attractive to foreigners and provoked capital outflow. Protecting the rouble from devaluation, the CBR lost a large share of its international reserves. At the same time the Russian government faced problems to roll over its GKO debt. In August 1998 the CBR's exchange rate policy became untenable. Although GKO yields soared to 100% per annum and more, banks were liquidating their positions. On 17 August 1998, Russia abandoned its exchange rate regime, defaulted on its domestic public debt and declared a moratorium on all private foreign liabilities, which was equivalent to an outright default. The Russian bank sector was hit severely by the uncovered forward contracts on foreign currency, the government default on GKOs and the subsequent bank runs (Perotti, 2002). The crisis completely paralyzed the interbank market. The recovery took more than one year.

The 'mini-crisis' of 2004 was sparkled by unexpected regulatory action. In May 2004 the CBR closed a bank accused of money laundering while the head of the Federal Service for Financial Monitoring (FSFM) Mr. Zubkov announced that his Service suspected about a dozen banks in money laundering and sponsorship of terrorism, without naming the 'dirty dozen'. Several

Figure 5.2: Financial Crises and Banks' Health



inconsistent 'black lists' began circulating the banking community as bankers tried to guess which banks were suspected by the FSFM. Mutual suspicion led to a drying up of liquidity on the interbank market, putting pressure on the hundreds of smaller banks that are highly dependent on it. The crisis of confidence provoked runs on several large banks among which were Guta Bank and Alfa Bank. Being severely hit by the liquidity shock and abrupt withdrawal of a number of large depositors, Guta Bank found itself on the edge of bankruptcy and was acquired by the state-owned Vneshtorgbank at a symbolic price.

Figure 5.2 confirms that the 2004 crisis mainly resulted in the drain of liquidity, while in 1998 the latter combined with serious solvency problems.

In between the two crises the interbank market has considerably grown and gained importance as a source of funding for Russian banks. Figure 5.1 shows that both the number and the inflation-adjusted volume of domestic transactions more than doubled since January 1999, the point when interbank market stability hindered by the 1998 turmoil was already largely restored. The number of market participants rose from about 650 in January 1999, a half of all existing

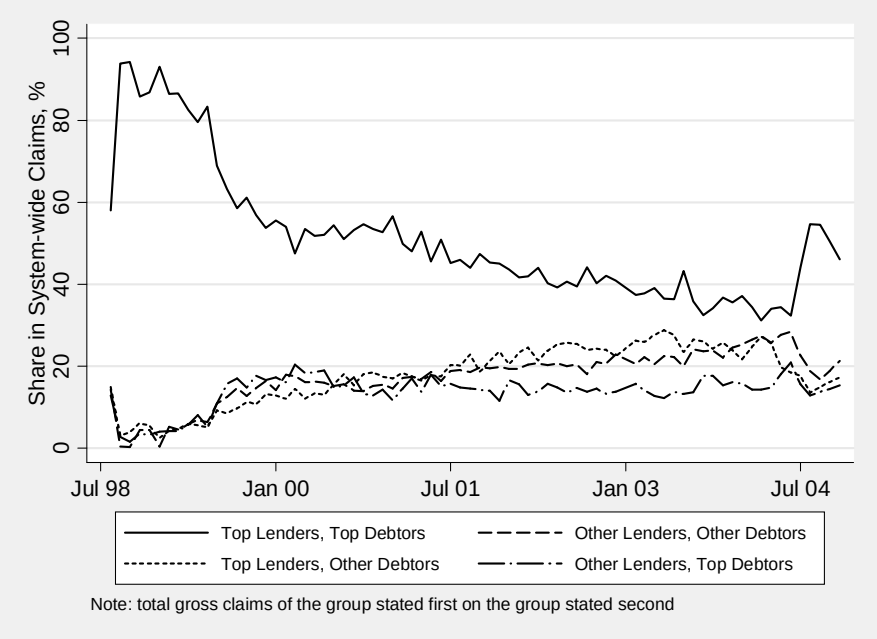
banks at that time, to well above 900, representing three quarters of all banks in May 2004.

The average Russian bank has been a net borrower on the interbank market with a growing net liability position. While the average share of interbank claims in total assets remained relatively constant around 5-6%, the average share of interbank obligations rose from about 6% in 1999 to 8% in 2004. A rather opposite trend of declining interbank market involvement took place for the 40 biggest banks. Their average share of interbank obligations in total assets fell from 25% in 1999 to 10% in 2001 and remained around that level till 2004. The corresponding share of interbank claims decreased from 10-12% in 1999-2001 to 7-9% in 2002-2004. Thus, while big banks on average reduced their reliance on the interbank market as a net source of funding, small banks enhanced it.

The growing number of market participants and the easier access of small banks to the interbank market show up in a decreasing market concentration as demonstrated by Figure 5.3. The volume of transactions between the top 40 lenders and the top 40 borrowers accounted for more than 80% of system-wide interbank claims in 1999 but diminished to less than 40% by May 2004. The other three lines representing total gross claims of top lenders on non-top borrowers and of non-top lenders on both groups of borrowers display the opposite increasing trend. Figure 5.3 provides further evidence that in periods of turmoil primarily small banks are left aside. The resulting rise in market concentration is evident for both the post-1998 crisis period and the turbulent summer of 2004.

Top lenders and top debtors are likely to contribute most to contagion. Defaulting top debtors deliver major credit losses and infect many other banks while top lenders are potentially the most dangerous panic makers having claims, and hence the ability to run, on numerous counterparties. Figure 5.4 focuses on the top debtors and top lenders' ability to spread contagion to the rest of the system. In each month we sort banks by one of the four indicators: their share in system-wide

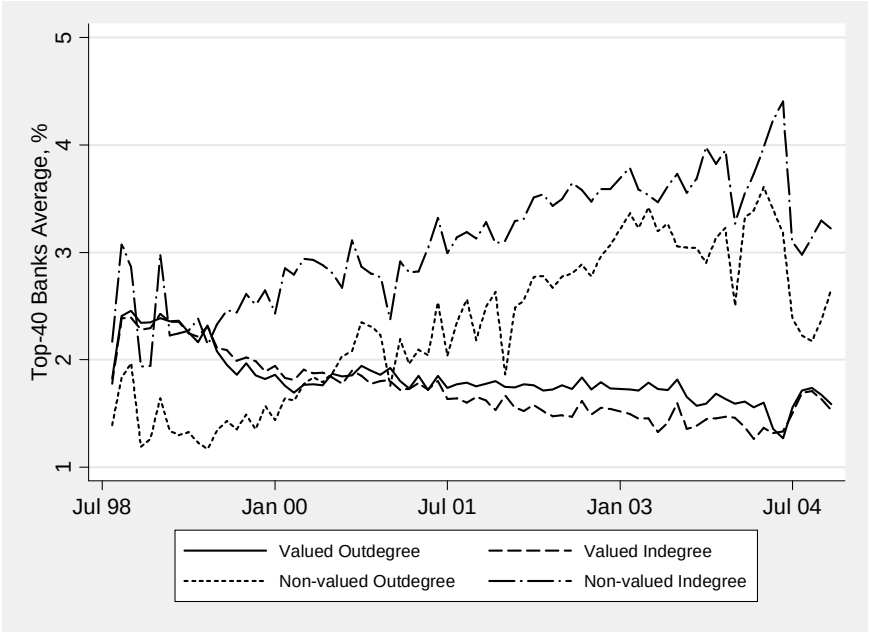
Figure 5.3: Global Domestic Exposures



interbank claims (valued outdegree), their share in system-wide interbank liabilities (valued indegree), the percentage of market participants they have as counterparties on their asset side (non-valued outdegree) and similarly for the liability side (non-valued indegree). In the social network terminology these four indicators are examples of the so called centrality indices. Each measure considers transactions between domestic banks only. We (arbitrarily choose to) keep the biggest forty values of each indicator and take the average across them. We finally plot those averages over time.

Two opposite trends are evident from Figure 5.4. While the valued indices decreased over time, the non-valued ones noticeably rose. Banks with the biggest interbank obligations (valued indegree) could in case of default on average deliver a credit loss of 2-2,5% of the total interbank market volume in 1998-1999 but only 1-1,5% in 2004. Similarly banks with the biggest interbank claims (valued outdegree) could on average withdraw 2-2,5% of the total interbank market volume from their counterparties in 1998-1999 but only 1-1,5% in 2004. On the other hand, banks with the biggest number of counterparties on their liability side (non-valued indegree) could in case

Figure 5.4: Market Concentration and Contagion



of default on average spread contagion to 2-3% of all the market participants in 1998-1999 but to almost double so much in 2004. Banks with the biggest number of counterparties on their asset side (non-valued outdegree) could run on 1-2% of the market participants in 1998-1999 and again on almost double so much in 2004. Overall these figures suggest that while the magnitude of potential shocks has diminished over time, the risk of being hit by a shock has grown. This observation is in line with the decreasing market concentration detected in Figure 5.3. More links between banks imply that losses are absorbed by a larger number of counterparties but also that more banks get infected.

A few of the biggest Russian banks have ensured that the total volume of transactions with foreign counterparties has always exceeded the total volume of domestic transactions, both in terms of borrowing and lending, although only by a small margin during the second half of our sample period. For an average bank, however, less than 20% of interbank activities involve a foreign counterparty. Thus, the major contribution of foreign banks to our contagion exercise relates to their powerful ability to run on big domestic banks.

Few Russian banks have permanent relationships with other banks. Considering only the bilateral links that show activity in at least one period, only 25% of the bilateral links are active in more than one third of the observed periods, while only 12% of the bilateral links are active in more than a half of the observed periods. Such an unstable market structure no doubt adds to the variability of contagion risk over time.

5.3 Baseline simulations

The following matrix summarizes the types of data used in our exercise:

$$L = \begin{pmatrix} 0 & y_{12} & y_{13} & y_{14} \\ y_{21} & 0 & y_{23} & y_{24} \\ y_{31} & y_{32} & 0 & y_{34} \\ y_{41} & y_{42} & y_{43} & 0 \end{pmatrix} \begin{matrix} c_1 & l_1 \\ c_2 & l_2 \\ c_3 & l_3 \\ c_4 & l_4 \end{matrix}$$

where L is the matrix of interbank exposures with y_{ij} representing gross claims of bank i on bank j. Banks don't lend to themselves, hence $y_{ij} = 0$ if $i = j$. c_i and l_i are, respectively, bank's i capital and liquid assets (cash + reserves). The net exposure (NE) on the interbank market can be computed for bank i as $NE_i = \sum_{j=1}^{n} y_{ji} - \sum_{j=1}^{n} y_{ij}$. If $NE_i > 0$, bank i is a net borrower on the interbank market, otherwise it is a net creditor.

The anatomy of a crisis is determined by the initial shock (first-round defaults) and the propagation mechanism (further rounds of contagious defaults). In the baseline simulations we model the initial shock as a sudden single bank's default on its interbank obligations (idiosyncratic shock). Each remaining bank suffers a credit loss equal to its total gross claims on the first-round domino.[49]

Capital channel of contagion assumes credit losses deplete bank capital. If losses exceed capital an institution turns insolvent and, in turn, defaults on its own interbank obligations. In case such second-round defaults occur the associated credit losses further deplete the surviving banks' capital and possibly lead to further rounds of insolvencies. Formally, in each round of contagion

[49] The assumption that a bank loses its total gross claims on the defaulting institution is consistent with the evidence on actual recovery rates. The CBR reports that only 3% of interbank claims on failed institutions were recovered in the process of bank liquidation in the period 2001-2003 (Vedomosti, 2003, N 121 (921)). In other words, loss given default on interbank claims was almost 100%.

the following rule determines defaulting institutions:

Capital channel ('passive banks' scenario):

$$d_i = \begin{array}{l} 0 \text{ if } \sum_{j=1}^{N} y_{ij}^f \leq c_i \\ 1 \text{ if } \sum_{j=1}^{N} y_{ij}^f > c_i \end{array}$$

where y_{ij}^f are claims of bank i on failed bank j and d_i is a default indicator with $d_i = 1$ for failed banks. In this manner contagion propagates through the system until no more failures occur. Capital channel is *indiscriminate* as it assumes *all insolvent banks* are forced into immediate bankruptcy. We call simulations of this purely mechanical capital channel the 'passive banks' scenario.

Liquidity channel of contagion assumes credit losses trigger runs on infected banks. When one bank experiences an adverse shock, uncertainty is created about other banks potentially subject to the same shock. Many of the interbank market participants are risk averse and would rather be safe than sorry. In periods of uncertainty and mutual suspicion they might overreact to any negative news and run on potentially infected institutions by not prolonging outstanding credits and withdrawing funds on current accounts. Banks, exposed to a run but having insufficient liquid assets to cover their net interbank exposure, fail.[50] In case such second-round failures occur the associated credit losses trigger new runs and possibly lead to further rounds of failures. Formally, in each round of contagion the following rule determines defaulting institutions:

Liquidity channel:[51]

$$d_i = \begin{array}{l} 0 \text{ if uninfected or } NE_i \leq l_i \\ 1 \text{ if infected and } NE_i > l_i \end{array}$$

Note that liquidity channel does *discriminate* between infected and uninfected banks. We consider two definitions of infected banks. The first assumes a panic-like environment with the initial shock destroying all trust in the banking system, in effect, *contaminating all banks*.

[50] Virtually all interbank lending in Russia is overnight or very short-term (up to a week). It is thus reasonable to assume that over a short time span all interbank deposits/loans can be withdrawn/not renewed.

[51] Because the definition of illiquid bank considers *net* interbank exposure, the simulated bank defaults due to liquidity problems are invariant to whether we explicitly allow for the bilateral setoff - netting - of interbank positions or not.

Simulations of what we call a 'panic' scenario combine both channels of contagion with this first treatment of *all* banks as infected. The following rule determines defaulting institutions in each round of contagion:

Both channels ('panic' scenario):

$$d_i = \begin{array}{l} 0 \text{ if } \sum_{j=1}^{N} y_{ij}^f \leq c_i \text{ and } NE_i \leq l_i \\ 1 \text{ if } \sum_{j=1}^{N} y_{ij}^f > c_i \text{ or } NE_i > l_i \end{array}$$

Our second definition assumes that market participants distinguish between illiquid banks *in trouble* (suffering credit losses) and illiquid banks showing *no signs of trouble*, and only run on the former. Banks that are exposed to credit losses therefore fail because of 1) the direct impact of the credit loss (the capital channel) and 2) the indirect impact on the exposed bank's liquidity driven by other banks' reactions on its credit loss (the liquidity channel). Simulations of what we call an 'active banks' scenario combine both channels of contagion with this second definition of infected banks. The following rule determines defaulting institutions in each round of contagion:

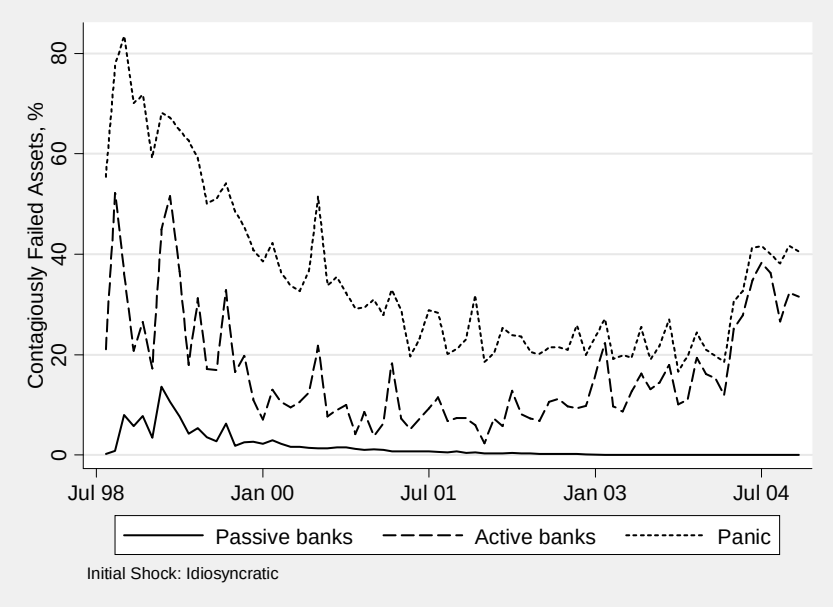
Both channels ('active banks' scenario):

$$d_i = \begin{array}{l} 0 \text{ if } \sum_{j=1}^{N} y_{ij}^f \leq c_i \text{ and } (NE_i \leq l_i \text{ or } \sum_{j=1}^{N} y_{ij}^f = 0) \\ 1 \text{ if } \sum_{j=1}^{N} y_{ij}^f > c_i \text{ or } (NE_i > l_i \text{ and } \sum_{j=1}^{N} y_{ij}^f > 0) \end{array}$$

Note that the 'active banks' default rule delivers at least the same contagious defaults as the 'passive banks' rule and possibly more. The 'panic' scenario (hence, the name) delivers maximum contagion.

When computing a bank's net interbank exposure we take into account claims on and debts to only *non-failed* banks. Here we assume, first, that defaulting institutions do not honour any of their obligations and, second, that all other banks will postpone paying their debts to these institutions. The latter assumption is plausible in the short run because troubled banks are not strong enough to collect these payments quickly. By the time the temporary administration, appointed by the judge, has built the list of creditors and borrowers and has started to clean up the mess, the banking crisis has already run its course. Note that this assumption of postponed

Figure 5.5: Contagion in Alternative Scenarios



debt repayment makes the remaining banks more liquid ceteris paribus. It is therefore a very conservative assumption that makes sure we do not overstate the severity of a crisis.

Throughout the simulations we never allow foreign banks to fail, but we do allow foreign banks to run on domestic banks, i.e. claims on and debts to foreign banks enter the calculation of domestic banks' net interbank exposure. The two CBR-owned banks, Sberbank and Vneshtorgbank, known to have enjoyed the full and consistent backing of the CBR, are not allowed to fail. In each month we compute system-wide assets by summing up assets of all banks having an open interbank position, excluding Sberbank and Vneshtorgbank.

In each period we let every bank perform the role of the exogenously failing initial domino, track the resulting contagion effects as defined above, and compute the share of failed assets in system-wide assets, excluding the initial domino. For each month for each initially failed bank we get 3 estimates of contagion corresponding to the three scenarios: 'passive banks', 'active banks' and 'panic'. For each month and scenario we then compute the average across the 5% worst estimates of contagion. Figure 5.5 plots those averages for each of the three scenarios over time.

Using the single solvency condition for tracking bank failures proves sufficient to capture the post-1998 crisis period when solvency problems were indeed a major issue for many banks. We find that across the 5% worst-case simulations the average share of system-wide bank assets failed due to contagion in the 'passive banks' scenario fluctuates around 10% following the crisis of August 1998 and gradually declines to negligible levels by 2000. This share remains virtually zero from then onwards, showing no signs of trouble even around the summer of 2004.

Allowing banks to run on each other not only increases the size of contagion but, importantly, also points out the system's intrinsic instability in both 1998 and 2004. Indeed the estimate of contagion, provided by the simulations of the 'active banks' scenario, declines from 50% in September 1998 to about 10% by 2000, stays at low levels till end 2003 and then rises again to a peak of 40% in July 2004. The simulations of the 'panic' scenario exhibit similar dynamics, but larger levels of contagion in every period. Given the estimated system's intrinsic instability in 2004 it is, with hindsight, not so surprising that the license withdrawal from a medium-sized bank and rumors that more banks would follow sufficed to trigger a systemic crisis. Clearly the liquidity channel of contagion, incorporated in the active banks scenario and the panic scenario, contributes to our understanding of real life systemic crises on the interbank market.

5.4 Alternative Initial Shock

In the baseline simulations we model the first-round shock as an *exogenous* failure of a *single* bank. This approach implicitly treats all banks as equally likely to fail in the first round. It further restricts the scope of the initial shock to a failure of only one institution.

In this section we relax the above mentioned restrictions and model the initial shock as a joint default of several banks (systemic shock). Initial dominoes are determined randomly on the basis of banks' individual failure probabilities. The latter, in turn, are assumed to be driven by individual bank characteristics (unconditional part) as well as by macroeconomic

Table 5.1: Regressors in Failure Prediction Model

Regressor	Measure of	Expected Sign
Net Income / Assets	Profitability	-
Capital / Assets	Solvency risk	-
Reserves / Assets	Liquidity risk	-
Treasury Bonds / Assets	Liquidity risk	-
Loans to Non-banks / Assets	Credit risk	-
Bad Loans / Assets	Credit risk	+
Non-bank Deposits / Assets	Funding costs	-
State Deposits / Assets	Funding costs	-
Log (Assets)	Systemic importance	-
Bank Deposits / Assets	Systemic importance	-

environment. The unconditional part is derived as a fitted probability from a probit model,[52] while macroeconomic environment is modelled as a random realization of a common risk factor. Such treatment is consistent with a one-factor version of the CreditRisk+ model (see Gordy (2002) for a general presentation of the CR+ model).[53] Given that other credit risk models like KMV or CreditMetrics require banks to be listed or to have credit ratings, conditions not fulfilled for most Russian banks, CreditRisk+ is the best available alternative to simulate bank defaults.

5.4.1 Unconditional Default Probabilities

Using a panel of all Russian banks for the period August 1998 - November 2004 we run probit regressions of a binary variable equal to one in the month of a bank's license withdrawal on a list of bank specific variables.[54] Table 5.1 reports the list of right-hand side variables and their expected effect on the failure probability. All these variables have already been successfully employed in bank failure prediction models for Russian banks (see Golovan et al., 2003, Lanine and Vander Vennet, 2006).

Net income to total assets proxies bank's profitability and is expected to negatively affect its probability of failure. Capital serves as a buffer against losses, hence, higher capital to assets ratio

[52] Hamerle and Rösch (2004) advocate probit models for parameterizing CR+.

[53] We draw inspiration from Elsinger et al. (2006) who study contagion in the Austrian banking system and use CreditRisk+ to model business cycle effects on average industry defaults.

[54] Limiting bank failures to true bankrupties, thus, discarding licence revokals due to mergers and compulsory/voluntary liquidation, does not produce substantially different failure predictions and is not considered in the paper. Introducing bank-specific effects into the probit model doesn't significantly alter the results either.

should result in a lower probability of default.

Highly liquid banks should be more capable of accommodating unexpected deposit withdrawals. Thus, we expect a higher share of reserves in total assets to be associated with lower default probabilities. Although government bonds are generally considered as risk-free secondary reserves, the government default on its debt in August 1998 severely hit many Russian banks and brought them on the edge of bankruptcy. Thus, the sign for the second measure of liquidity, treasury bonds divided by total assets, is not a priori clear.

A high share of bad loans in total assets indicates poor credit quality and is expected to increase the probability of failure. A high share of loans to non-banks in total assets could either signal greater exposure to credit risk or indicate a greater predisposition to engage in more traditional and, perhaps, less speculative activities. The expected sign of this latter variable, therefore, is not clear.

Two cheapest sources of funding are non-bank deposits and state deposits. Thus, we expect a higher share of either deposit type in total assets to be associated with lower funding costs and, therefore, with lower default probabilities. Moreover, the CBR may be reluctant to revoke licenses from banks that are heavily involved in channelling budget funds, providing an additional rationale for including the share of state deposits in the failure model.

Money centre banks borrowing a lot on the interbank market and big banks represent a threat to the systemic stability, and the CBR might be reluctant to withdraw their licenses. Thus, the share of bank deposits in total assets and the log of assets are both expected to negatively affect the probability of failure.

Results of the basic probit regression are reported in the first column of table 5.2. Most coefficients are significant with the expected signs. Higher profitability, capitalization, liquidity in the form of cash or investment into government securities, better loan quality and extensive use of

cheap budget and deposit funding reduce the probability of default. Involvement into traditional banking activities such as granting loans signals less speculation and less risks. Money centre banks borrowing a lot on the interbank market and big banks represent a threat to the systemic stability and are unlikely to lose their license.

For each period we compute each bank's unconditional default probability as a fitted probability from the probit regression. As individual bank characteristics vary over time, so do their unconditional default probabilities.

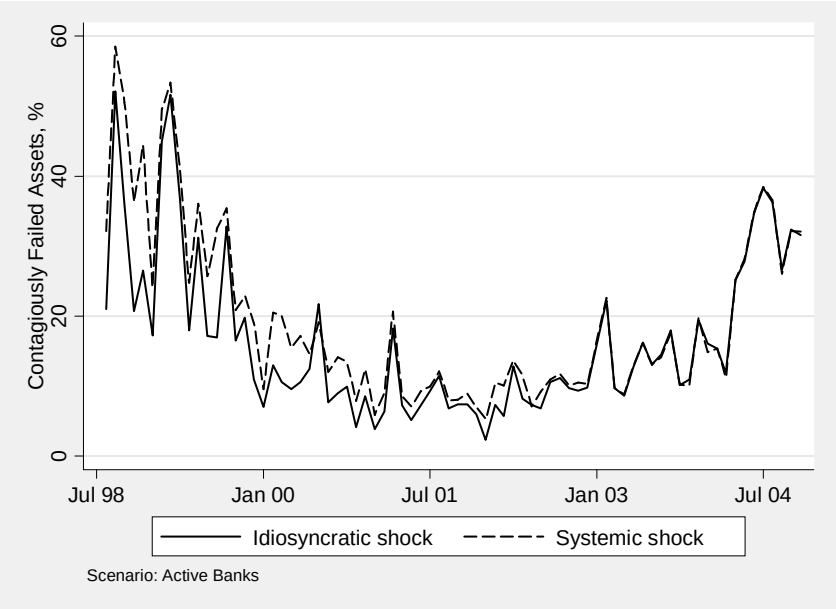
5.4.2 Simulations with Systemic Shock

We assume that banks' actual default probabilities equal their unconditional default probabilities multiplied by a random common risk factor x.[55] The latter is a gamma distributed variable with mean one and variance one as suggested for one-factor models in the CR+ manual, Section A7.3. The common factor serves as a scaling factor. For $x > 1$ all individual default probabilities increase above their unconditional counterparts; for $x < 1$ all default probabilities fall. This approach captures the typical business cycle effects on average bank defaults: default rates increase in recessions and decrease in booms. Thus, random realizations of x correspond to different states of macroeconomic environment: $x > 1$ to bad times, $x < 1$ to good times.

We simulate one set of 1000 random realizations of the common factor x. For each period and each scenario these 1000 values of x result in 1000 initial shocks, and, thus, 1000 simulations of contagion. In each simulation initial dominoes are determined by random Bernoulli draws with the success probability for each bank equal to its rescaled default probability (i.e. unconditional default probability times the common factor realization). The propagation of the shock follows the same basic rules outlined for the baseline simulations. In each month for each of the 1000 initial shocks we get 3 estimates of contagion corresponding to the three scenarios: 'passive banks',

[55] Lesko et al. (2004) show that, though the single risk factor approach overestimates the portfolio risk, the overestimation error is small if it is applied to firms operating in one country.

Figure 5.6: Contagion with Alternative Shocks



'active banks' and 'panic'. For each month and scenario we then compute the average across 50 (= 5%*1000) worst estimates of contagion.

Our estimates of contagion turn out to be robust to the definition of the shock. Figure 5.6 reports one example for the 'active banks' scenario. Results for other scenarios paint the same picture and are available from the authors on request.

5.5 Empirical Relevance

5.5.1 Actual Bank Defaults

We have already shown that our simulations correctly identify periods of intrinsic instability on a system level. Can they also contribute to our understanding of individual bank failures?

We define a bank's exposure to contagion risk as a percentage of simulations in which a bank fails due to contagion. For each bank in each month we compute four versions of this risk measure corresponding to the different combinations of initial shock and scenario assumed in the simulations: 'active banks' with idiosyncratic shock (AB-IS), 'active banks' with systemic shock (AB-SS), 'panic' with idiosyncratic shock (P-IS) and 'panic' with systemic shock (P-SS).

We add those measures of contagion risk sequentially to the basic failure prediction model.

Table 5.2: Failure Prediction Model

	(1)	(2)	(3)	(4)	(5)	(6)
Regressor	Basic	Basic	AB-IS	AB-SS	P-IS	P-SS
Net Income	-0.93***	-1.25**	-1.26**	-1.17**	-1.25**	-1.28**
Capital	-0.77***	-0.92***	-0.93***	-0.92***	-0.72***	-0.69***
Reserves	-2.26***	-2.10***	-2.06***	-2.06***	-1.41***	-1.39***
Treasury Bonds	-1.85***	-3.81***	-3.89***	-4.04***	-3.85***	-4.06***
Loans to Non-Banks	-0.95***	-1.18***	-1.19***	-1.19***	-1.17***	-1.16***
Bad Loans	0.88***	1.56***	1.56***	1.55***	1.34***	1.22***
Non-bank Deposits	-0.90***	-0.74**	-0.74**	-0.73**	-0.52*	-0.48
Size	-0.09***	-0.08***	-0.08***	-0.09***	-0.07***	-0.06***
State Deposits	-0.40	-0.76	-0.74	-0.74	-0.66	-0.74
Bank Deposits	-0.43**	-0.78**	-0.87**	-0.88***	-1.42***	-1.43***
Contagion Risk (AB-IS)			1.70*			
Contagion Risk (AB-SS)				1.80***		
Contagion Risk (P-IS)					0.50***	
Contagion Risk (P-SS)						0.85***
Observations	100086	52457	52457	52457	52457	52457
Pseudo R2	0.25	0.24	0.24	0.24	0.25	0.26

Note: The table reports probit regressions of the binary variable equal to one in the month of a bank's licence revokal on a list of bank-specific variables. Data is monthly for August 1998 - November 2004. Column 1 reports results for the panel of all Russian banks. Columns 2-6 report results for the panel of banks active on the interbank market. Size is the log of assets. Contagion risk is the percentage of simulations, in which a bank fails due to domino-effects. Other explanatory variables are rescaled by total assets. Constants are not reported. *** p<0.01, ** p<0.05, * p<0.1

Columns 3-6 of Table 5.2 report the results for the sample of banks active on the interbank market. To facilitate comparison we also reestimate the basic model for this constrained sample of banks and report the results in column 2.

Bank fundamentals show up consistently with expected signs. Remarkably, our measures of contagion risk are always positive and significant indicating that banks, often failing in our simulations, do fail in reality.[56] The statistical significance of those measures survives the presence of an extensive list of bank fundamentals, suggesting they truly capture some exposure to systemic risk, not easily derived from bank balance sheets alone.

5.5.2 Actual Runs on Interbank Market

Liquidity channel of contagion relies on the assumption that in times of uncertainty and mutual suspicion interbank market participants run on each other. How relevant is this assumption?

In a recent paper Castiglionesi and Navarro (2007) model a core-periphery structure of the

[56] If we take the average reported coefficient on contagion risk in columns 3-6 to be roughly 1, then an increase in the percentage of simulations in which a bank fails due to contagion by 1% would increase the odds of failure by 1%.

interbank market. In their model when default probabilities are high safe banks (the core) try to limit their exposure to systemic risk by disconnecting from risky banks (the periphery). Such disconnection results in a flight to quality and a higher market concentration as only safe units remain connected.

This idea seems very relevant for the Russian interbank market, which is known to have a tier structure. The top tier (the core) consists of about 40 biggest banks[57] and accounts for the bulk of interbank lending. Those top-tier banks are generally perceived as relatively safe as reflected in their lower cost of borrowing on the interbank market. All other banks (the periphery) are generally viewed as risky, pay higher interest rates and are particularly exposed to runs in times of distress. Figure 5.3 has already shown evidence of rising market concentration in both 1998 and 2004 consistent with the idea that in turbulent times the core tries to disconnect from the periphery. We now provide some econometric-based evidence for this 'run to quality' assumption.

If the perception of higher systemic instability causes safe units to disconnect from the risky ones, then the moves in our measure of systemic distress should *precede* changes in market concentration. We test this idea by running Granger causality regressions. Our measure of market concentration is the volume of transactions between the top 40 lenders and the top 40 borrowers depicted in Figure 5.3. Our measure of systemic distress is depicted in Figure 5.5 under the 'active banks' scenario. Granger causality regressions include two lags of each variable and a time trend. We leave the first six months following the 1998 crisis out of our sample. In those months the interbank market was almost non-existent and excessive volatility of our systemic risk measure might distort the results.

We find that our measure of contagion risk Granger causes market concentration at the 1% level but not vice versa (results available on request). This evidence is consistent with the predictions

[57] Examples include Vnesheconombank, Sberbank, Gasprombank, Rosbank, Bank of Moscow, MDM, MMB, Petrocommerts, Surgutneftegasbank, Transcreditbank, Alfa Bank, Bank Zenit and several foreign-owned banks such as ING Bank and Raiffeisen Bank.

of Castiglionesi and Navarro (2007) and with the assumptions underlying our liquidity channel of contagion. The perception of higher systemic instability induces the core to disconnect from the periphery. This result is robust to using different measures of contagion ('active banks' scenario versus 'panic' scenario). It is also robust to supplementing regressions with controls for aggregate bank health, like average capitalization and average liquidity shown in Figure 5.2.

5.6 Lender of Last Resort

In what follows we focus on the 'active banks' scenario. We study the effect of the Central Bank's liquidity injections on systemic stability by constructing counterfactuals with respect to CBR's behavior. In the construction of these counterfactuals we treat both CBR-owned banks, Sberbank and Vneshtorgbank, as integral parts of the broad CBR. The CBR has extensively used both its daughters as a policy instrument, in particular encouraging them to provide liquidity to smaller banks during the turbulent summer of 2004. Both banks have in turn enjoyed the full and consistent backing of their parent.

Our first 'real CBR' counterfactual allows Sberbank and Vneshtorgbank neither to fail nor to run on other banks. This counterfactual essentially interprets all interbank loans of the two CBR-owned banks as emergency liquidity injections. Compared to baseline simulations, this restriction makes private banks less vulnerable to the liquidity channel of contagion, as they can no longer be run on by the two CBR-owned banks.

We further simulate what would have happened in terms of contagion risk if the broad CBR (including its daughters) would not have provided any emergency liquidity as a Lender of Last Resort (LOLR). The simplest way to model this 'absent CBR' counterfactual is to allow the CBR (together with its daughters) to run on other banks. Such a run would deplete banks' liquidity buffers by exactly the amount of any prior CBR lending, making them more vulnerable to contagion. In these simulations Sberbank and Vneshtorgbank are no different from other banks, and thus are allowed to both fail and run.

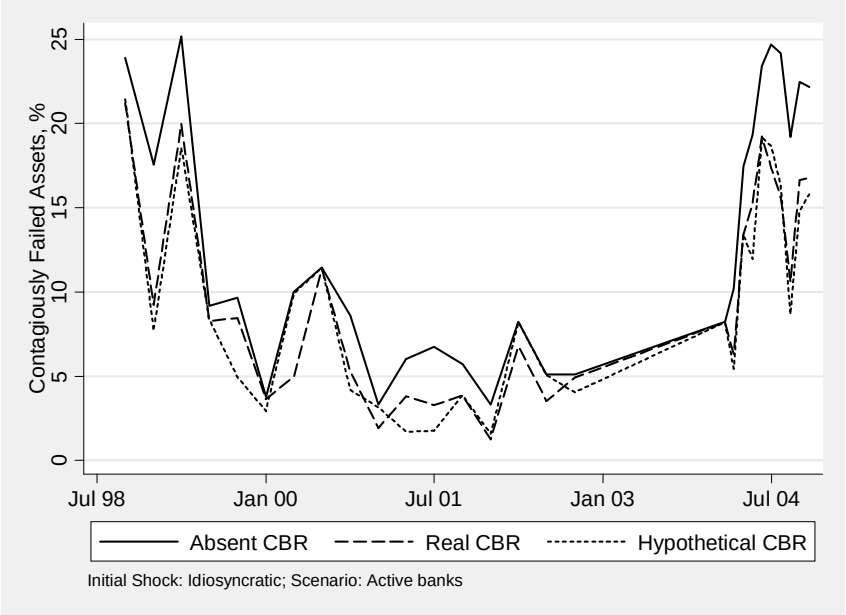
In a third counterfactual we assess whether a 'hypothetical CBR' could have increased the system's intrinsic stability by optimally redistributing the available liquidity among banks. Technically, in each period we lower all banks' liquidity positions by their borrowings from the broad CBR, essentially treating those borrowings as LOLR liquidity injections. We compute the total monthly amount of these injections and redistribute them towards banks with the biggest partial contributions to contagion. The latter are computed for each bank-month as an average reduction in systemic risk caused by the exogenously imposed immunity of that bank to contagion.[58] Then we sort banks in a descending order by their average partial contribution to contagion and redistribute liquidity. We increase the liquidity holdings of the bank ranked first to the amount sufficient to cover its all interbank obligations. In this manner we ensure that the bank with the largest partial contribution to contagion never fails because of insufficient liquidity. We do the same for banks ranked second, third etc. until the cumulative counterfactual liquidity injection equals the total amount of broad CBR liquidity injections available in the respective period. We then rerun the simulations with these adjusted liquidity positions. This procedure basically amounts to optimizing the stability effect of the broad CBR's liquidity injections by redistributing them to the banks of our choice, without manipulating the magnitude of liquidity injection itself.

Limited data on CBR lending allows us to run the experiment for 27 out of total 75 periods: quarterly for October 1998-October 2002 and monthly for February-November 2004. Because in the 'absent CBR' counterfactual Sberbank and Vneshtorgbank are allowed to fail, their assets are also included in system-wide assets. That makes sure our measure of contagion is always bounded between zero and one.

Figure 5.7 reports the results for the three counterfactuals with an idiosyncratic shock. The

[58] Specifically, in each simulation, sequentially for each contagiously failing bank, we impose its survival, rerun the simulation, and compute by how much the share of contagiously failed assets drops relative to the original simulation. These reductions in contagion are then averaged across simulations for each bank-month.

Figure 5.7: Liquidity Redistribution Experiment



results reveal that the CBR's liquidity injections contributed considerably to the mitigation of systemic risk, specifically in times of crisis. Our 'optimal' redistribution of liquidity could at best have lead to a marginal improvement in the system's stability. Provided that we can inject the same amount of liquidity as the broad CBR, we conclude that the Russian LOLR performed well in distributing it to banks whose stability was most beneficial to the stability of the system. This lends support to the thesis that the liquidity injections of a LOLR can effectively mitigate coordination failures on the interbank market (Rochet and Vives, 2004).

5.7 Conclusions

In this chapter we enrich the literature with a new transmission channel of contagion on the interbank market, the liquidity channel. We apply this idea to the Russian banking sector and find that the liquidity channel contributes significantly to our understanding of both actual interbank market crises and individual bank defaults. The results corroborate the thesis that prudential regulation at individual bank level is insufficient to prevent systemic crises, because this approach neglects the potential of contagion. Especially bank-specific capital rules, no matter how

sophisticated, will never suffice to prevent coordination failures on the interbank market, simply because capital is not a very important variable in assessing the risk of contagion and systemic meltdown. This is an important lesson in the aftermath of the subprime crisis, that appears to have been essentially a worldwide 'panic' scenario kick-started by the initial correlated default of some banks. In addition, our results clearly suggest that the liquidity injections of a classical LOLR can effectively mitigate coordination failures on the interbank market not only in theory, but also in practice. In short: liquidity matters.

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