Risk-taking by Russian Banks: Do Location, Ownership and Size Matter?

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The Russian banking sector has experienced enormous growth rates during the last 6–7 years. The rapid growth of assets has, however, contributed to a decrease in the capital adequacy ratio, thus influencing the ability of banks to cope with risk. Using quarterly data spanning from 1999 to 2007 on all Russian banks, we investigate the relationship between bank characteristics and risk-taking by Russian banks. The analysis of financial ratios reveals that, on average, the risk levels are still below those observed in Central and Eastern Europe. Combining the group-wise comparisons of financial ratios and the results of insolvency risk analysis based on fixed effects vector decomposition, three main conclusions emerge. First, controlling for bank characteristics, large banks have higher insolvency risk than small ones. Second, foreign-owned banks exhibit higher insolvency risk than domestic banks and large state-controlled banks are, unlike other state-controlled banks, more stable. Third, we find that the regional banks engage in significantly more risk-taking than their counterparts in Moscow.

Keywords: bank risk-taking, banks in transition, Russia.

1. Introduction

Banking sectors in most countries of the Commonwealth of the Independent states (CIS), Russia included, have experienced nearly phenomenal growth rates during recent years. As a consequence of the dramatically improved macroeconomic situation

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and important legislative changes, the ratio of banking sector assets in Russian GDP grew annually by more than 2 percentage points between 2001 and 2007. This ratio exceeded 60 percent by the end of 2007. Simultaneously, bank credit to the private sector has more than doubled to 30 percent of GDP.

With the rapid growth of total assets, deposits and loan stocks, Russian banks are increasingly assuming their role as financial intermediaries channeling household deposits and foreign borrowing into domestic corporate credits. This necessarily causes changes in the banks' assets and liability structures, attitudes towards risk-taking and risk management. Rapid credit growth is likely to increase (potential) banking sector risks. On the other hand, the ongoing financial deepening also indicates that the Russian banking sector is beginning to have an impact on private sector (both corporate and individual) behaviour and investments. That is, banks in Russia as well as in most other transition economies, are starting to look like banks elsewhere. They are by no means problem-free, but the challenges they need to tackle are similar to what banks in other emerging economies face. Given their growing role in economic development, surprisingly little is known about these banks' risk-taking behaviour.

The development of the banking sector in transition economies, as well as the financial sector in general, have been studied extensively. Barisitz (2008) and Bonin and Wachtel (2003) [5, 11] provide excellent recent overviews. Many studies focus on the effects of bank privatization on their performance in transition countries [8, 9], but until recently risk-taking by banks in transition has been a largely neglected area of research. Recent literature on the Russian banking sector has focused on bank supervision and the introduction of the deposit insurance system [14, 18, 42], market discipline and deposit interest rates [31, 39] and the efficiency of banks [1, 2, 19, 33].

A handful of recent papers provide cross-country evidence on bank risk-taking in emerging economies. Haselmann and Wachtel (2007) [28] use several accounting measures of bank risk to examine the risk-taking behaviour of banks in 20 transition countries including Russia. They analyze differences in risk measures by bank ownership, size and market share. Using survey data from the EBRD, they complement the analysis with various measures of institutional quality. The results suggest that there is no group of banks with excessive risk-taking and that an unsound institutional environment leads to higher capital holdings and less credit risk-taking by banks. Maechler et al. (2007) [36] examine the effect of various types of financial risks on the bank stability in 18 Central and Eastern European economies. Their results indicate that foreign banks tend to have a higher risk profile than domestic ones but there is no significant difference between the risk profiles of larger and smaller banks. Furthermore, credit growth relates to greater bank stability and only the acceleration of growth seems to add vulnerability.

To the best of our knowledge, no study on bank risk-taking has focused on Russia or any other CIS country. However, with its 1100 banking institutions, Russia in particular provides an extremely rich test case for analyzing risk-taking. Additionally, the large number of bank failures (more than 300 since year 2000[1)]) highlights the fact that banking in Russia is still riskier than in most developed countries. Therefore examining the determinants of risk-taking is crucial for understanding the prospects for future economic growth. Furthermore, if Russia is to become a global financial centre,

[1)] For more details see: www.banki.ru.

a goal clearly stated by, e.g., President Medvedev in spring 2008, we need to know much more about the behaviour of Russian banking institutions.

Currently the Russian banking sector is extremely fragmented, with a few large banks and a great number of very small ones. Especially in comparison with Central European transition economies, the state has retained a large share of control whereas the role of foreign banks has been very limited. These two structural features have often been mentioned as the main hindrances to further banking sector reform and growth. In this paper we discuss the extent to which the characteristic features of the sector determine the risk-taking behaviour of Russian banks.

We use a large panel of practically all Russian commercial banks covering the post-1998-crisis period, from April 1999 to April 2007. The large, Moscow-based and state-controlled banks form the backbone of the Russian banking sector. In line with previous literature, we therefore focus on the effects of bank size and ownership structure on bank risk-taking. Furthermore, we control for the location of the banks to see if Moscow-based banksdiffer in their risk-taking habits. Additionally, we are able to examine the influence of what probably was the most important institutional change during the period, the introduction of a deposit insurance scheme, on the risk-taking of Russian banks.

In measuring risk-taking, we use two approaches. First, we conduct a univariate analysis of traditional financial risk ratios based on accounting data. Second, we run a regression analysis of bank insolvency risk measured by the z-score indicator. The two approaches produce similar results. First, risk-taking increases with size. Second, controlling for other bank characteristics, banking institutions located outside Moscow tend to bear higher risks. And finally, ownership does matter for risk taking. Surprisingly, foreign-owned banks are found to be more risk-taking than other banks.

The next section provides a brief overview of the Russian banking sector. Section three describes the data and provides group-wise comparisons of financial risk measures by size and ownership categories and by location, as well as by inclusion in the deposit insurance scheme. Section four complements the previous results with a z-score analysis and section five concludes the analysis.

2. Banking industry in Russia

After the crisis-ridden 1990's, especially the deep recession and financial collapse of 1998, the Russian economy has grown annually by more than six percent since 2000. The banking system has experienced rapid growth since 2001, when the sector recovered from the insolvencies and the complete lack of trust created by the 1998 turmoil. Trust in counterparties is still fairly low especially at the interbank markets and the sector is prone to rumors. This was exemplified in the summer 2004 when rumors and tight liquidity created a «mini-crisis» in the banking industry. The effects were, however, not long-lasting. Bank credit to the private sector as a ratio to GDP has more than doubled during the last decade. This is very rapid growth even compared to the fast-growing emerging economies of Central and Southeastern Europe. The resulting financial deepening has been supported by a stable macroeconomic environment, increasing incomes and institutional reforms.

Continuous economic growth, rising real incomes, declining inflation and public sector surpluses have enabled fast increases in the private sector credit share. The majority of credits are financed by private sector deposits, which have increased by

10 per cent annually during the last six years [16]. Also net foreign borrowing has increased, even though the level of total foreign liabilities in Russian banks is still relatively modest at on average below 20% of total liabilities.

Table 1.

Banking system indicators , % of GDP

	2004	2005	2006	2007	2008
Total assets	42,1	41,7	44,8	51,9	61,0
net foreign asset position	−1,4	−1,9	−2,7	−5,9	−9,0
credit to the private sector	20,2	22,8	25,2	29,9	37,2
o/w enterprises	18,3	19,6	20,3	22,9	28,2
o/w households	1,9	3,2	4,9	7,0	9,0
deposits by the public	23,6	24,4	27,3	32,0	37,0
o/w households	11,5	11,6	12,8	14,2	15,6

Note: Data concerns beginning of each period.

Source: Central Bank of Russia.

Furthermore, a number of important institutional reforms have undoubtedly helped fuel banking sector growth. The most important one was the introduction of the deposit insurance system (DIS). The federal law on compulsory deposit insurance was adopted in December 2003. The law made the formerly implicit guarantee of state-controlled banks explicit and outlined clear rules for banks entering the system. The Deposit Insurance Authority began its operations in 2004, and by the end of March 2005 the first 824 banks were admitted into the system. Most of the rejected banks were small, as the banks already admitted accounted for 98 percent of household deposits. This did raise some concerns on the entry requirements not being interpreted rigorously enough.

By the end of September 2005, when the deadline for joining the system expired, 927 banks out of the 1150 applicants were admitted [14][2)]. During 2006–2007 Central Bank of Russia (CBR) gradually revoked the licenses to attract household deposits from banks not included in the system. Initially private deposits up to RUR 100000 were covered in full. Later the coverage limit was raised to RUR 190000 in August 2006 and to RUR 400000 in March 2007[3)]. During 2003–2005 also several other important laws, e.g., clarifying the rules for mortgage lending and mortgage-backed securities, were enacted. The law from 2005 gave the framework for the operations of private credit bureaux.

[2)] In order to pacify depositors during the mini-banking crisis of summer 2004, the government enacted a law granting temporary deposit insurance to all banks. Therefore, irrespective of possible inclusion in the deposit insurance system, all Russian banks were guaranteed blanket deposit insurance for deposits up to RUR 100000 from July 2004 until the end of 2006.

[3)] The limit was further raised to RUR 700000 in October 2008. See: http://www.asv.org.ru/insurance/.

During the last few years Russian banks have intensively diversified into household lending, especially mortgages, as well as lending to SMEs. Credit maturities have also increased and maturities of over three years are not uncommon. The volumes of mortgage lending are, however, still tiny as less than 10% of homes in Russia are bought using a mortgage (Interfax, 2008). Another remarkable recent trend is the continuing de-dollarization of banking assets and liabilities. Like many transition countries, Russia was heavily dollarised and immediately after the 1998 crisis the use of dollars was very widespread. The share of foreign currency loans has now stabilized at below 25% of corporate loans. Corporate borrowers typically have a significant portion of their earnings in foreign currencies, so currency mismatches should not pose a systemic risk.

In light of all these changes, the structure of the Russian banking sector has remained surprisingly unchanged. The large, state-controlled banks still dominate the market. Even though the number of banks has decreased from 2084 at the end of 2000 to a mere 1243 by the end of 2007, the great majority of the banks are still tiny and can hardly be called banks. At the end of 2007 some 900 banks had the right to attract household deposits and only 300 banks had a general banking license. The foreign ownership share remained fairly limited as evidenced by the Table 2 below. There were 202 banks with a foreign ownership at the end of 2007, 62 of them fully foreign-owned.

Table 2.

Bank ownership in selected countries in 2005

	Number of banks	Number of foreign-owned banks, % of total	Asset share of foreign-owned banks, % of total	Domestic credit to private sector (% of GDP)
Estonia	13	77	99,4	57
Slovak Republic	23	70	97,3	34,7
Czech Republic	36	75	84,4	35,7
Lithuania	12	50	91,7	41,3
Hungary	38	71	82,6	49,8
Poland	61	82	74,2	29,2
Latvia	23	43	57,9	59
Slovenia	25	36	22,6	56,4
Russia	1253	4	8,3	26,1

Source: EBRD Transition Report 2006.

Our dataset ends in April 2007, just before the the global credit crunch caused by the subprime market problems in the US started to evolve. Initially the Russian banking industry was only mildly affected, in large part thanks to increasing crude oil prices that provided ample liquidity in the domestic market. Along with falling crude oil prices and drastically deteriorating situation at the international financial markets also the Russian banking sector began to face serious problems by the end of 2008.

3. Measuring risk – financial and regulation ratios

3.1. Data

Our dataset covers most of the banks operating in Russia over the period of April 1999 – April 2007. It consists of banks' quarterly balance sheets and profit and loss accounts. Regulatory ratios calculated by the Central Bank of Russia (CBR) are also partially included in our data and we use them in the analysis to support our main results. The data are provided by the financial information agency Interfax and originated in the Central Bank of Russia. For a more detailed description of the dataset used, see Karas and Schoors (2005) [32]. As the sample period starts in 1999, our results are not directly influenced by the financial crises of August 1998. The data constitutes an unbalanced panel, because there were banks entering and leaving the market due to mergers or failures. A brief overview of the main variables based on summary statistics is provided in Table A.1 in the appendix.

The banks are divided into different subgroups by size, ownership and location as well as inclusion in the deposit insurance system. We use the book value of total bank assets as a measure of size[4]. Bank size is especially important in Russia, where a handful of the largest banks account for most of the banking sector assets. At the end of 2006, large state-controlled banks accounted for about 40% of the sector assets [15]. Taking into account the overly concentrated nature of the Russian banking sector, we separate for the three largest banks (Sberbank, VTB and Gazprombank). In general, due to more possibilities for diversification and better access to financial markets, large banks are supposed to be less risky. Nevertheless, as Demsetz and Strahan (1997) [24] point out, large banks offset their potential benefits from diversification with lower capital ratios and more risky loan portfolios. Also empirical evidence on the relationship between size and risk has produced slightly mixed results [28, 29].

As for ownership, we distinguish among three ownership groups to determine majority ownership: state-controlled, foreign and domestic private banks. The foreign ownership dummy variable is based on the CBR data on 100% foreign-owned banks published quarterly. State-controlled banks are defined using the list provided in Vernikov (2007)[5]. Due to its special role as a state development bank, we do not include Vneshekonombank (VEB).

Ownership may be important for risk-taking behaviour for various reasons. State-owned banks are often assumed to take higher risks than the private ones. The underlying reasons differ according to one's view on the character of state-owned banks. Sapienza (2004) [41] distinguishes three alternative views. The social view suggests that state banks intervene to correct for the market failure caused by private

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[4] We first separate the three largest banks as a group of their own. The rest of the banking sector is divided into three groups. Small banks are those with total assets below 33rd percentile, medium banks have assets between 33rd and 66th percentiles and the large ones have total assets above the 66th percentile in every time period. Alternative measures of size based on the market share of the aggregate domestic credit as well as participation in the interbank market provide us with a very similar distribution of banks into subgroups and therefore we only use total assets as a proxy for bank size.

[5] This list largely overlaps with the other lists of state-controlled banks used by Karas et al. (2008) [33]. Moreover, our number also corresponds to the number of government-controlled banks in the Bank Supervision Report (2006).

banks, which «cherry-pick» the best customers and would leave the not very profitable ones without financial services. This view implies that state banks are engaged in more risky and less profitable operations but possibly enjoy soft budget constraints. The political view sees state banks as well as state enterprises more as a mechanism for pursuing politicians' private interests, such as maximizing employment or delivering favours for political protégées. This view implies that state banks may be forced to lend on a non-commercial basis i.e. due to political or other reasons. The agency view sees state banks as basically benevolent maximizers of social welfare but plagued by corruption and misallocation. Recent evidence from industrialized countries [20, 29] suggests that state-owned banks typically exhibit higher risk than other types of banks.

Studies on transition economies have, however, produced mixed results [21, 36]. In transition economies state-owned banks may be less efficient and more risk-prone due to Soviet legacies, unrestructured management or soft budget constraints. These findings, usually based on Central European countries (see e.g. [8]), are challenged by Karas et al. (2008) [33], who show that in Russia state-owned banks are not less efficient than domestic private banks.

Foreign-owned banks may have a different risk profile due to less local expertise and fewer local connections compared to the domestically owned banks. Their operations may also be less risky since they might often be able to cherry pick the most creditworthy borrowers in an emerging market [7]. Additionally, these banks can often rely on strong parent companies to provide them with access to better risk management techniques and possible diversification of country risk. On the other hand, foreign ownership may aggravate risks if parent banks tend to stress rapid credit growth in order to relieve tightening interest margins at home. Moreover, integration into the global financial system has also highlighted new issues related to risk management and financial vulnerability.

Foreign bank entry has been one of the decisive factors shaping banking sector development in Central and Eastern European transition countries. The available empirical evidence supports the common view that foreign-owned banks are more efficient than other types of banks in these countries ([5, 8, 9] and references therein). Furthermore, there is a growing literature exploring the effects of the presence of foreign-owned banks on domestic credit markets in emerging economies[6)]. The role of foreign-owned banks in Russia has been dramatically different from those in the Central European banking sector. The share of foreign capital in the Russian banking sector was tiny up until spring 2007 as no major privatizations had taken place. The Russian banking sector is clearly more distant (both geographically and culturally) and therefore less attractive than the new and prospective EU member countries. Moreover, acquiring a large market share is not as easy as it was in Central Europe. Nevertheless, the foreign-owned banks operating in Russia may be extremely important as a benchmark for domestic ones and it is therefore most interesting to examine if they differ in their risk-taking.

[6)] Mostly the results on the benefits of the foreign bank presence are mixed. Detragiache et al. (2008) [25] show that banks give fewer loans after being acquired by a foreign investor. Clarke et al. (2005) [17] find that foreign banks make more loans to SMEs than domestic ones. Foreign banks may be reluctant to lend to opaque borrowers, but induce domestic banks to lend to them [22]. Giannetti and Ongena (2008) [26] suggest that foreign banks enhance access to credit, especially where financial development is low.

The division by ownership and size is rather standard. A bank's location within a single country and its inclusion in the deposit insurance scheme are more specific to Russia. Economic developments in different parts of Russia vary a lot. About half of the Russian banks are located in Moscow. The other half, located in the other regions of the Russian Federation, are mainly small banks constituting only 15% of the total banking sector assets. It has been occasionally argued that regional banks are more inclined to lend to local enterprises and to small and medium-sized businesses, thereby promoting growth more than Moscow-based banks. Moscow-based banks, on the other hand, are more active in interbank money markets. If true, this should also be reflected in differences in risk measures. Therefore we split the sample into two depending on the location of the bank's headquarters in Moscow or elsewhere in the Russian Federation. The division into regional and non-regional banks is unavoidably somewhat arbitrary as a large number of banks headquartered both in and outside Moscow have wide networks outside their home region. But the division used is the best available approximation for Moscow and non-Moscow banks. If the banks do not differ in their risk-taking based on the location of their headquarters, the division should not be significant in our analysis. But, as will be seen, the statistically significant result survives all our robustness checks.

Russia adopted a deposit insurance system in 2004 with the majority of banks screened and admitted into the system by end-March 2005. The deposit insurance system was expected to increase the confidence in and stability of the banking sector, as well as to level the playing field between large and small banks. The academic literature on deposit insurance increasingly emphasizes that explicit deposit insurance has the potential to affect bank risk-taking. Since it reduces depositors' incentives to monitor banks, it may encourage risk-taking and imprudent banking practices. The Russian data offers us a unique opportunity to test whether the introduction of a deposit insurance system affects bank risk-taking in the short run. We consider two groups of banks based on the point at which they entered the system. We create a dummy variable indicating if the bank was included into the system in the «first wave», by end – March 2005. Inclusion of the banks in the deposit insurance system is defined using the information from the Russian Deposit Insurance Agency.

3.2. Risks faced by banks and corresponding financial ratios

Banking is by nature a business of balancing risks. There is, however, no single, universal measure that could be used to assess risk-taking behaviour by banks. Thus, we rely on two different approaches. The first one is based on a univariate analysis of financial risk ratios, which are either calculated using the accounting data or belong to the regulatory ratios used by the central bank. We analyze different categories of financial risk separately by employing the relevant financial ratios as well as regulation ratios used by the CBR (for definitions, see Table A.8 with a description of variables in the appendix). Furthermore, we also test the significance of the differences in financial risk ratios among different subgroups of banks[7]. The second approach, discussed in section four, relies on the regression analysis of bank insolvency risk as measured by the z-score indicator.

[7] We use a nonparametric K-sample test on the equality of medians.

Capitalization

Capitalization is calculated as a ratio of equity to total assets and it serves to measure leverage risk. Due to rapid asset growth, the level of capitalization declines during the period analyzed (see Table A.2 in the appendix). Capitalization is, however, still higher than in most other transition countries as reported in Haselmann and Wachtel (2007) [28]. On average, capitalization decreases with size and thus small banks tend to have higher capital ratios than larger banks. This is in line with the «too big to fail» hypothesis as well as with the perceived difficulties smaller banks face in accessing interbank markets in Russia. Larger banks in general have better opportunities for risk diversification and thus also benefit from lower costs of funding [37].

The capitalization of private banks is significantly higher than that of state and foreign banks during the whole period under review. These banks, unlike state-controlled or foreign banks, usually do not have a kind of «backup» in the form of the state or a strong parent company abroad. That is most probably the reason why they hold a higher proportion of equity capital. Foreign banks are slightly better capitalized than state banks, which is consistent with the results for the CIS in [21]. Banks located outside Moscow tend to maintain lower equity, but the gap between regional and Moscow banks has decreased since 2006 and thus the difference between these two groups of banks is no longer significant. Banks included in the DIS maintain a significantly lower equity than the other banks. There are two possible explanations for this. The first one concerns moral hazard issues connected with the participation in the deposit insurance scheme. The other is selection bias. It indicates that the banks entering the system were the better ones, which, based on their results, were obvious candidates for inclusion immediately when the system was introduced.

The CBR regulation ratio N1 used to assess capital adequacy[8)] confirms these trends as well. Even though the capital adequacy ratio has declined in recent years, its average value of 14,5% for November 2006 [15] still clearly exceeds the minimal requirements set by the central bank[9)]. This indicates that Russian banks on average tend to keep slightly higher capital buffers than banks in the EU-25 countries as Jokipii and Milne (2008) report [30]. It is, however, clear that relatively large capital buffers at the beginning of our sample period are a natural reaction to the uncertainty following the crisis of 1998. The gradual decrease of capital buffers is then to a certain extent the result of the improvements in the macroeconomic environment. Nevertheless, it may also indicate that the operations of Russian banks are becoming more efficient or that the institutional environment is improving [10, 28]. The unfavourable global development resulting from the sub-prime crisis and liquidity problems in the second half of 2007 made banks more cautious again and the majority of banks increased their capital adequacy ratios towards the end of 2007 [16].

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8) Unlike the indicator of capitalization, the N1 ratio is for most of the banks available only until 2005.

9) The Financial Stability Report 2006 issued by the central bank reports that according to Bank of Russia Instruction № 110_I, dated January 16, 2004, the minimum capital adequacy ratio for a bank (N1) is 10% if the bank has a capital of at least 5 million euros and 11% if the bank has a capital of less than 5 million euros. Only 11 credit institutions violated the capital adequacy ratio in 2006 and 19 in 2005 (Bank of Russia Financial Stability Report, 2006).

Credit risk

Analyzing credit risks is becoming increasingly important in Russia due to its rapid credit growth. The increase in the loans to total assets ratio (see Table A.3 in the appendix) suggests that the growth of lending has been higher than the growth in total assets, implying a gradual shift towards riskier operations of banks. Domestic banks have significantly higher lending ratios than foreign banks, whereas regional banks tend to lend more than Moscow-based ones[10]. On average, however, the total loans to total assets ratio in our sample is comparable with the sample of transition economies as reported in Haselmann and Wachtel (2007) [28]. Similar to our expectations, banks that belong to the deposit insurance system lend more. There are again two possible explanations for this. The first one suggests that banks in the DIS may take more risks as they are backed up by the system. The latter indicates that insured banks are on average better and more efficient and therefore they are able to bear higher risks.

One of the most commonly used indicators of credit risk is the ratio of nonperforming loans (NPL) to total loans. The share of NPLs in Russia has indeed increased during the last years, but the levels are not yet anywhere close to becoming alarming. The median levels based on our calculations (see Table A.4 in the appendix) are still below the quality level of 1,5 per cent recommended by Grier (2001) [27]. It is, however, necessary to bear in mind that this is an ex post measure of the risks assumed by banks. When considering banks by ownership, state-controlled banks exhibit a significantly higher ratio of nonperforming loans than others. One might take this as indirect evidence of state-controlled banks' lending, willingly or unwillingly, to any customer, also to the uncreditworthy one. It is, however, interesting to note that the share of NPLs among the state-controlled banks has stayed basically unchanged in recent years. The recent increase in the NPL share has been caused mainly by private domestic banks. On the other hand, foreign banks have the lowest level of NPLs, which may reflect their relatively short period of operation on the Russian market, better credit risk management, or both.

The ratio of NPLs is increasing with the bank's size, which suggests that larger banks are able to sustain a larger proportion of NPLs. The difference between small and large banks is, however, gradually decreasing. The shrinking of this gap is the result of both an increase in the NPL ratio of small banks and a decrease among the large ones. Despite this development, the variation between banks of different sizes still remains significant. There are significant differences in the proportion of NPLs by location as well. Even though regional banks still tend to have a larger ratio of NPLs, similar to when we account for size, the gap between Moscow and regional banks has decreased recently. There are also differences between banks that are part of the deposit insurance system and the ones that are not. The ones included in the scheme have in general higher nonperforming loan ratios, which can be a natural consequence of higher lending by these banks.

Since banks with nonperforming loans are obliged to make loan loss provisions, a comparable measure of credit risk is the ratio of loan loss reserves to total loans. Its development basically corresponds to changes in the proportion of nonperforming

[10] The underlying reasons for the different asset structure of regional and Moscow-based banks may include variations in fixed assets like buildings and branch-office networks. This issue would clearly merit a study of its own.

loans (see Table A.4 in the appendix). The proportion of loan loss reserves in total loans is the lowest for the foreign-owned banks. Even though the proportion of loan loss reserves was the highest for the three largest banks in 1999, nowadays this ratio is basically the same for banks of all sizes. This seems to serve as evidence for the special position of these state-controlled banks. The loan loss indicator further suggests that the deposit insurance scheme implementation contributed to changes in loan loss reserves. Before the deposit insurance scheme was implemented, loan loss reserves were significantly higher for the banks that later entered the scheme. However, with the implementation of the scheme, reserves in the banks not included in the system increased and they are higher compared to the banks that are part of the DIS.

Maximum large credit risk is a regulation ratio that measures the proportion of the total amount of large credit risks[11)] in a bank's equity capital. It increases over time and tends to be higher for the state-controlled banks and for the regional banks. This could indicate that these banks have close connections with large state-controlled or regional companies. The maximum large credit risk ratio is also higher for larger banks with the exception of the three largest ones. Moreover, it is significantly lower for the banks outside the deposit insurance system, which once again indicates that banks that are part of the system are able to engage in relatively more risky activities.

Even though our analysis of credit risk measures suggests that the operations of state-controlled banks tend to be relatively riskier than the others, the comparison of the credit risk indicators to the corresponding figures in other countries as well as to the critical values indicated in the literature suggest no excessive risk-taking. Our results are thus in line with the CBR [15] in that, on average, the credit risk of Russian banks remains moderate.

Liquidity risk

The Russian banking sector's liquidity as measured by the ratio of liquid to total assets has decreased slightly in recent years, but its level, reported in Table A.6 in the appendix, is still comparable to the other transition countries as well as to the quality level recommended by Grier (2001) [27]. An analysis of the regulatory ratios of quick and current liquidity (see Table A.8 in the appendix for detailed definitions) confirms that they have remained basically unchanged. Foreign banks and Moscow-based banks exhibit the highest level of liquidity during the whole period under review. One possible explanation for this phenomenon is that Moscow-based banks are on average less engaged in traditional banking operations (collecting retail deposits and channeling them into corporate loans) than regional banks. Furthermore, Moscow-based banks tend to be more active in interbank money markets and therefore have a larger proportion of their assets in a highly liquid form. This difference in bank operations is reflected in the increasing gap in the liquidity indicator between Moscow and regional banks. The finding is a corollary to the finding that, on average, the share of loans in total assets is lower for Moscow-based banks than for the other banks. Unlike the divisions by region and ownership, the distribution of banks by size does not indicate any significant differences in liquidity for banks of various sizes.

11) Large credit is the total sum of the bank's risk-weighted claims to one borrower (or a group of related borrowers) on credits.

Moreover, in line with the other credit risk indicators, the banks included in the deposit insurance scheme hold lower levels of liquidity and the gap between them and the other Russian banks has been increasing since 2005.

In general, high liquidity ratios can be interpreted as having a positive influence on stability at certain levels of liquidity. In the case of emerging economies, liquidity ratios may also be higher if the government does not actively intervene to meet funding gaps, financial institutions are risk-averse or if there are not enough opportunities for hedging [38]. In that case excessive liquidity could indicate structural problems. A bank may be highly liquid simply because: 1) it cannot rely on well-functioning interbank markets or other secondary markets such as those for securities; 2) it prefers to distance itself from «traditional» banking operations such as lending in favour of trading in, e.g., government securities; or 3) both.

Despite sufficient liquidity in general, there has been a lack of efficient mechanisms for interbank intermediation of liquidity. The Russian interbank market is relatively small even in comparison to other emerging markets [38]. This is especially the result of high segmentation and low trust on the interbank market [5], even among the big state-controlled banks. Russian banks are highly liquid but the banking system as a whole is not. Due to the lack of trust, the banking system is vulnerable to occasional liquidity shocks as experienced in summer 2004 and autumn 2007. This clearly complicates banks' liquidity management as well as the conduct of monetary policy in Russia.

Market risk

The net interest margin[12)] as a percentage of loans is often used as a proxy for the efficiency of financial intermediation, thus uncovering the health of the banking sector. Higher margins indicate lower efficiency and lower competition within the sector and thereby possibly also higher risk. Our analysis indicates that foreign banks have significantly lower net interest margins than private banks, even though recent developments suggest that the net interest margins of foreign banks have increased to the level of state-controlled ones (see Table A.7 in the appendix). In this respect, lower margins most probably reflect the greater efficiency of foreign banks which is connected to the support and know-how from their parent companies. Our indicators are thus in line with Karas et al. (2008) [33], who find that Russian state banks are more efficient than domestic private banks. The net interest margin decreases with the bank's size and therefore it is the lowest for the group of the three largest banks. Regional banks used to have significantly higher net interest margins. However, the situation has changed recently and consequently Moscow-based banks have slightly higher margins, which may suggest increasing efficiency and/or competition. After the implementation of the DIS, the net interest margins of the banks included in it decreased and became significantly lower than the margins of the other banks. This development may indicate a positive impact of the DIS introduction on the banking sector's competition and efficiency; however, more investigation is necessary to confirm this result.

12) The net interest margin is calculated as the difference between the interest income from loans to customers and the interest expense paid on customer deposits.

To sum up, the analysis of ratios measuring financial risk confirms significant differences among groups of Russian banks by size, location, ownership and participation in the DIS. Nevertheless, it is only based on the comparisons of unconditional medians. The following regression analysis provides more insight by uncovering also conditional correlations.

4. Measuring risk – bank insolvency risk (z-score)

In addition to the four classes of bank risk ratios, we use a measure for insolvency risk developed by Boyd and Graham (1988)[13)] [12] that has been increasingly used in the banking literature. Different modifications of z-scores have been applied in the empirical cross-country [13, 20, 21, 29, 36] as well as single-country studies [34, 35].

The insolvency risk measure («z-score» hereafter) is a statistic indicating the probability of bankruptcy (bank failure). The z-score for each bank i at quarter j is calculated as:

$$Z_{ij} = (ROA_{it} + EQTA_{it}) \,/\, \sigma(ROA)_{it}, \quad (1)$$

where ROA_{it} and $(ROA)_{it}$ are sample estimates of the four quarters moving average and the four quarters standard deviation of bank i's returns on assets at quarters t to $t - 3$ and $EQTA_{it}$ is the four quarters moving average of the equity capital to assets ratio. A bank's return on assets is calculated as its one-quarter profit before taxes on the quarter's average total assets. A bank's equity to assets ratio is calculated as the equity capital on total assets at the end of a given quarter. As we used the four quarters (backward-looking) moving averages in constructing our insolvency measure as well as explanatory variables, the time span of our analysis effectively covers the years 2000–2006.

Statistically speaking, the z-score represents the number of standard deviations returns would have to fall in order to deplete a bank's equity, under the assumption of normality of the bank's returns. Boyd et al. (2006) [13], however, argue that *«it (the z-score) does not require that profits be normally distributed to be a valid probability measure; indeed, all it requires is the existence of the first four moments of the return distribution»*. A higher z-score corresponds to a greater distance to equity depletion and therefore to lower risk and higher bank stability.

The z-score measure inherently depends on the assumption that the ROA, relying on profit and loss data, gives a useful approximation of a bank's financial health. Since our data is based on Russian accounting system standards, which stress formal reporting rather than economic meaning, it may be questioned whether our data fulfils that requirement [5]. Nevertheless, as we only compare Russian banks with each other, possible flaws in the accounting standards should not be over-emphasized. Moreover, we use the z-score indicator to uncover statistically significant conditional correlations, not causality.

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13) This measure originated as a predictor of corporate bankruptcy [3].

4.1. Methodology

Our focus is on the effects of a bank's size, ownership, location and inclusion in the deposit insurance scheme on its insolvency risk (z-score). The bank's size is measured by a continuous variable (logarithm of total assets) whereas ownership, location and inclusion in the deposit insurance scheme are proxied by using corresponding dummy variables. The dummy variable for inclusion in the deposit insurance scheme is fully time-invariant whereas the dummy variables for ownership and location exhibit very little if any within variation. Therefore a standard fixed-effects model is likely to lead to inefficient estimates with very large standard errors[14].

We remedy the problem by applying the fixed effects vector decomposition (FEVD) approach by Plümper and Tröger (2007) [40]. The approach suggests estimating the model in three steps. First, our dependent variable is regressed only on the cross-section fixed effect and the time-varying factors. Second, the estimated fixed effect (unit effect) is decomposed into the part explained by the time-invariant variables and the unexplainable part (error term). Finally, the model including the unexplained part of the fixed effect is re-estimated by pooled OLS. By design, the remaining error term is no longer correlated with time-invariant variables. Plümper and Tröger (2007) [40] show that FEVD estimates are superior (in root mean squared errors) to the traditional fixed effects estimation. In running the FEVD estimations, we use STATA's FEVD module.

We estimate the following model:

$$\ln(z)_{it} = \alpha_i + \beta_1 Size_{it} + \beta_2 (BankSpec)_{it} + \beta_3 (IA)_{it} + \beta_4 (seas)_t + \beta_5 (Owner)_i + \beta_6 (\text{Region})_i + \beta_7 (DepInsurance)_i + \varepsilon_{it}, \quad (2)$$

where

- z is the z-score for bank i at time t calculated as indicated in the equation (1);
- *size* stands for the logarithm of total assets of bank i at time t;
- *bankSpec* is a set of bank i's specific ratios at time t including liquidity, credit growth and the share of loans to individuals in total loans;
- *IA* is a set of interaction dummy variables between a bank's size and bank-specific factors;
- *owner* is a set of dummy variables distinguishing among foreign, state-controlled and private banks;
- *region* is a dummy variable indicating Moscow headquarters of bank i at time t;
- *seas* stands for seasonal (i.e. quarterly) dummy variables;
- *depInsurance* is a dummy variable indicating inclusion in the first wave of the deposit insurance system.

All the variables used in the regressions are four-quarter moving averages. Z-score and total asset variables are in natural logarithms. Bank-specific factors include credit

[14] For recent discussions on fixed-effect models with time invariant variables, see, e.g., [6, 43]. For a classic textbook approach using Hausman-Taylor procedures, see [44, p. 235–238].

growth, the liquidity ratio and the share of loans to individuals in total loans. A bank's size, ownership, location and inclusion in the first wave of the deposit insurance system are defined as in the analysis of bank risk ratios in the previous section. To remove potential outliers, 0,5% of both tails of each variable in every quarter was removed. Table A.8 in the appendix gives details of the variables used in the regressions.

A priori, the sign of the coefficient on a bank's size is indeterminate because large banks may be either stabilizing or risky for the banking system, as our previous analysis of risk ratios suggests. Bank-specific risks are captured by the measures of credit risk and liquidity risk. Credit risk is proxied by bank-by-bank credit growth as well as the ratio of loans to individuals to total loans. Liquidity risk is controlled for by introducing the liquidity ratio (liquid assets/total assets) to the model. A priori we do not have an expectation of the sign for these variables.

4.2. Estimation results

In order to analyze the relationship between a bank's size, ownership and location and the risk measured by the z-score, we estimate the model of equation (2) employing the fixed effects vector decomposition described above. The main results are shown in Table 3 below.

Several interesting findings emerge. First, the results consistently indicate that larger banks have significantly lower z-scores and thus higher insolvency risk[15]. Second, somewhat unexpectedly, foreign-owned banks consistently bear higher insolvency risk than domestic private banks. This result is fully in line with some earlier studies on emerging economies using z-scores as the risk measure [36]. The result naturally reflects the limitations of the risk measure used, as it partly originates from the lower capitalization ratios of the foreign banks. Furthermore, it is necessary to bear in mind that due to data limitations, our foreign ownership dummy variable only accounts for banks that are fully foreign-owned. The overall effect of state ownership on a bank's insolvency risk is positive, i.e. state-controlled banks tend to be more stable. To investigate this result more closely, we add the interaction term of size and state control to our model. This interaction is positive and highly significant. At the same time, the estimated coefficient for the state-controlled dummy variable becomes negative. This indicates that only large state-controlled banks are driving our results and they are more stable than other state-controlled banks.

Third, the Moscow-based banks are always more stable than the regional banks. Based on the data available to us we can not determine the ultimate reason for this significant difference. The higher levels of capitalization in Moscow banks certainly play a role. The underlying reasons may include differences in bank operations, differences in banks' clientele and differences in bank supervision and regulation. Answering the highly interesting question on why the regional differences emerge would clearly merit a study of its own. Finally, similar to our expectations, banks that became part of the deposit insurance system in the first wave are more stable.

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[15] The z-score regressions are based on the full set of commercial banks, including the three large ones. As a robustness check we did run the estimations without the big three banks, but the results stay unchanged.

Finally, we conclude that the bank-specific characteristics do have a significant role in explaining insolvency risk. In line with earlier literature (e.g. [36]), we find that higher liquidity implies higher insolvency risk. We include an interaction variable of bank size and liquidity, which confirms that large liquid banks are more stable. The growth of a bank's loan stock is used to control for the credit risk. In line with Maechler et al. (2007) [36], its impact is positive in our estimations and this indicates higher stability. This result holds true for Moscow-based banks, while for regional banks the estimated coefficient is negative. We also control for the interaction of bank size and credit growth to see if credit growth affects small banks differently. We find that large banks with high credit growth are in fact more stable than the rest of the sector.

Table 3.

Estimation results

	Estimated coefficient
Size (total assets)	−0,262***
Loans to households (prop. of loans)	−0,355***
Liquidity (liquid to total assets)	−0,616***
Credit growth	0,015***
OWNERSHIP, LOCATION AND DEPOSIT INSURANCE	
Deposit insurance	0,104***
Foreign bank	−0,572***
State-controlled bank	−0,534***
Moscow-based bank	0,501***
INTERACTIONS	
Size and liquidity	0,054***
Size and credit growth	0,003***
Size and state-controlled	0,100***
Number of observations	27353
R^2	0,426

Note: The table contains results for the FEVD regression. We report estimated coefficients as well as their significance (***significant at 1%, ** significant at 5% and * significant at 10%). Seasonal and yearly dummy variables as well as a constant term are included but not reported.

We test the robustness of our empirical results using several techniques.

- First, the results are robust to the exclusion of the three largest state-controlled banks (Sberbank, Gazprombank, VTB) from the sample.
- We split the sample into Moscow-based and regional banks. The FEVD regression model is run for the two subgroups separately. Except for the significance of credit

growth, other results for both subgroups are in line with the results of the main model reported above. Nevertheless, the model seems to fit a little bit better the Moscow-based banks, which account for about 85% of the banking sector assets.

- Finally, the results for the subsample of the 300 largest banks also correspond to our main results reported in Table 3. They only differ in the sign of the deposit insurance scheme dummy variable. In this case it is negative, which means that the banks that entered the system in the first wave are more risky. This is in line with the results of univariate analysis of financial ratios performed in the first part of the paper.

4.3. Z-score components

The z-score measure consists of three main components: the return on assets, capitalization and the volatility of the ROA. In order to investigate the contribution of each of them to explaining differences in the banks' stability, we run our basic model using all of these components as a dependent variable. This approach is in line with previous literature [21, 36]. We report the results of the z-score component regressions in the following, Table 4.

The first component of the z-score measure is capitalization[16]. In this case, the fit measured by R^2 is the highest of all the z-score components. The estimated coefficients are larger than for the other z-score components and almost all of them are significant. The estimated coefficients are mostly in line with the results of the main model, which indicates that the majority of the main results are driven by the contribution of the capitalization ratio. Larger banks have lower capitalization and this result undoubtedly drives our final result that banks with a higher amount of total assets are in general less stable. More liquid banks have lower capitalization, which indicates that banks substitute between liquidity and solvency risk. Nevertheless, liquid large banks tend to have higher capitalization. Both state-controlled and foreign ones are in general better capitalized than private ones. The effect of deposit insurance participation on capitalization is significantly negative. Banks in the deposit insurance system do seem to substitute deposit insurance for capital, or put in other words, take more risks for the same level of capital. This result is in line with earlier literature [23].

The second column contains results for the regression with the ROA as the dependent variable. Similar to the capitalization component of the z-score, almost all the estimated coefficients are significant for the ROA. However, the majority of their signs differ from the results in the main z-score regression. Higher credit growth as well as a higher share of loans to individuals in a bank's loans portfolio are positively related to profitability. Higher liquidity positively influences profitability as measured by the ROA. Given the fact that the average real interest rate on corporate loans was close to zero for much of the period, this is not entirely surprising. Many banks make more than half of their revenues from foreign currency operations. When accounting for a bank's ownership, foreign banks and state-controlled banks have a significantly higher ROA than domestic private ones. Large state-controlled banks are, however, less profitable. Banks included in the DIS in the «first wave» have significantly higher pro-

[16] Capitalization is, similar to the calculation of the z-score, calculated as the four-quarter moving average. The other z-score components, the ROA and volatility of the ROA, are calculated in the same way.

fitability than the others, which is in line with our previous result indicating that better banks entered the system first. Moscow-based banks are in general less profitable.

Table 4.

Z-score component regressions

	Capitalization	ROA	Volatility of ROA
	Estimated coefficient	Estimated coefficient	Estimated coefficient
Size (total assets)	−0,085***	0,0002***	−0,003***
Loans to households	−0,076***	0,005***	0,001**
Liquidity	−0,181***	0,003***	0,0004
Credit growth	0,003***	0,0002***	−0,0002***
OWNERSHIP, LOCATION AND DEPOSIT INSURANCE			
Deposit insurance	−0,010***	0,001***	−0,002***
Foreign bank	0,092***	0,002***	0,009***
State-controlled bank	0,082***	0,004***	0,006***
Moscow-based bank	0,134***	−0,003***	0,001***
INTERACTIONS			
Size and liquidity	0,002**	−2,8E−05	−0,001***
Size and credit growth	−3,0E-04***	−2,3E-05***	−1,2E-05
Size and state-controlled	0,001	−0,001***	−0,0005**
Number of observations	27353	27353	27353
R^2	0,785	0,356	0,361

Note: The table contains estimation results of the model described above for different z-score components. We report the estimated coefficients as well as their significance (* significant at 10%, ** significant at 5% and *** significant at 1%). Seasonal and yearly dummy variables as well as a constant term are included but not reported.

The last component of our risk measure is the volatility of the ROA as measured by the standard deviation. Most of the estimated coefficients in this regression are significant but have a different sign than the results presented in our main model. They are also lower in absolute values and therefore, unlike the measure of capitalization, they contribute less to the main results. Thus, the analysis of the z-score components indicates that the differences in the risk profiles of banks are mostly driven by the differences in capitalization.

5. Conclusion

Favourable macroeconomic conditions and important regulatory reforms have backed the rapid growth of Russia's banking sector during this decade. As the economy is increasingly monetized, the role of banks and other financial intermediaries in supporting the continuous growth of investments and private consumption is gaining more importance. Therefore the stability of the banking sector is even more crucial. Compared to most European countries the Russian banking sector is still rightfully characterized as small, regionally fragmented and dominated by a few large state-controlled entities.

On average, the Russian banking sector is believed to be in good financial shape as evidenced also by the Banking Supervision Reports of the CBR. For this paper we use a bank-level dataset on all Russian banks to examine how various measures of risk vary with a bank's size, ownership, location and inclusion in the deposit insurance system. The main objective is the detailed examination of how these various groups of banks differ in their attitudes to risk. We employ two approaches; group-wise comparisons of financial ratios and regression analysis using a z-score measure of bank insolvency risk. The analysis of financial ratios reveals that even though the ratios point to increasing risk over time, they are still on average well on the safe side within all groups of banks. The average levels are all above the regulatory minima set by the Russian Central Bank. Moreover, they are comparable to other transition economies. The rapid growth of the banking sector has not led to excessive risk-taking on average.

The regression analysis of the bank insolvency measure (z-score) proved to be a useful means of deepening the results of group-wise comparisons. Controlling for bank characteristics, large banks in Russia have higher insolvency risk than small ones. Second, in line with the previous literature on emerging economies, foreign-owned banks exhibit higher insolvency risk than domestic banks. Even though the foreign bank presence may in general greatly increase banking sector efficiency and widen the range of banking services available, foreign-owned banks in Russia seem to bear higher risks. The same holds true for the state-controlled banks; however, the large state-controlled banks are more stable than the others. Third, we find that the regional banks are significantly more prone to risk-taking than their counterparts in Moscow. Regional banks only account for a small fraction of the total banking sector assets, thus this finding should not be alarming for the banking sector as a whole.

All in all, we find that risk-taking by Russian banks is approaching levels comparable to other emerging economies. Further, factors similar to those in emerging European economies seem to explain levels of insolvency risk in Russia. We also briefly examined if inclusion in the Russian deposit insurance scheme has influenced a bank’s insolvency risk. The results are mixed and further research on this topic is clearly needed.

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Appendix

Table A.1.

Summary statistics of the main variables

Variable	Obs	Mean	Median	Std. dev.
Z-score (ln)	34700	4,25	4,20	1,24
Total assets	41382	4105	307	52706
Liquidity ratio	41380	0,33	0,28	0,22
Loan loss provisions	40130	0,07	0,03	0,12
Credit growth	33969	4,64	0,39	209,05
GDP growth	40971	0,02	0,06	0,10

Note: Summary statistics for the observations that are actually used in the z-score regression are not significantly different from these figures.

Table A.2.

Capitalization ratio of banks by ownership, region, size and inclusion in DIS

CAPITALIZATION		1999	2000	2001	2002	2003	2004	2005	2006	2007
TOTAL SAMPLE	obs.	1469	1322	1312	1237	1327	1323	1238	856	1015
	med	0,362	0,333	0,318	0,322	0,303	0,278	0,243	0,187	0,190
OWNERSHIP GROUPS										
Private	obs.	1420	1271	1258	1182	1265	1258	1170	795	946
	med	0,366	0,337	0,323	0,329	0,306	0,281	0,246	0,191	0,190
State-controlled	obs.	30	30	32	30	33	32	32	29	32
	med	0,287	0,287	0,250	0,250	0,232	0,222	0,177	0,138	0,150
Foreign	obs.	19	21	22	25	29	33	36	32	37
	med	0,111	0,175	0,236	0,258	0,239	0,236	0,206	0,177	0,160
medians significantly different		yes	yes	yes	yes	yes	yes	yes	yes	yes
REGION										
Moscow-based banks	obs.	567	570	586	614	643	661	620	357	469
	med	0,378	0,359	0,350	0,354	0,328	0,308	0,275	0,195	0,190
Regional banks	obs.	588	591	595	598	684	662	618	499	546
	med	0,359	0,315	0,297	0,298	0,284	0,251	0,213	0,182	0,178
medians significantly different		no	yes	yes	yes	yes	yes	yes	no	no
SIZE CATEGORIES										
Small	obs.	489	440	436	411	439	439	412	285	338
	med	0,539	0,454	0,434	0,439	0,407	0,381	0,330	0,269	0,280
Medium-sized	obs.	490	441	438	413	444	442	413	285	338
	med	0,387	0,349	0,306	0,307	0,301	0,281	0,237	0,180	0,190

Continued

CAPITALIZATION		1999	2000	2001	2002	2003	2004	2005	2006	2007
Large	obs.	487	438	435	410	441	439	410	283	336
	med	0,235	0,227	0,243	0,259	0,240	0,217	0,182	0,142	0,130
The Big 3	obs.	3	3	3	3	3	3	3	3	3
	med	0,112	0,244	0,248	0,254	0,183	0,180	0,128	0,128	0,160
medians significantly different		yes	yes	yes	yes	yes	yes	yes	yes	yes
DEPOSIT INSURANCE SCHEME (DIS)										
Included in DIS	obs.					801	801	802	649	632
	med					0,284	0,255	0,213	0,172	0,162
Not included in DIS	obs.					419	522	436	207	172
	med					0,367	0,338	0,312	0,258	0,251
medians significantly different						yes	yes	yes	yes	yes

Note: In order to utilize all the available data, all the indicators are calculated at the end of the first quarter of each year.

Table A.3.

Loans to assets ratio by bank ownership, location, size and participation in the deposit insurance scheme

LOANS TO ASSETS RATIO		1999	2000	2001	2002	2003	2004	2005	2006	2007
TOTAL SAMPLE	obs.	1469	1326	1313	1238	1331	1326	1238	856	1015
	med	0,481	0,428	0,485	0,521	0,535	0,555	0,582	0,614	0,627
OWNERSHIP GROUPS										
Private	obs.	1420	1275	1259	1183	1269	1261	1170	795	946
	med	0,481	0,431	0,491	0,524	0,538	0,556	0,584	0,616	0,628
State-controlled	obs.	30	30	32	30	33	32	32	29	32
	med	0,431	0,418	0,474	0,520	0,531	0,591	0,594	0,633	0,669
Foreign	obs.	19	21	22	25	29	33	36	32	37
	med	0,428	0,276	0,257	0,294	0,414	0,309	0,368	0,500	0,495
medians significantly different		no	yes	yes	yes	yes	yes	no	no	yes
REGION										
Moscow-based banks	obs.	567	571	586	615	646	663	620	357	469
	med	0,425	0,401	0,451	0,493	0,496	0,506	0,515	0,550	0,561
Regional banks	obs.	588	593	595	598	685	663	618	499	546
	med	0,462	0,437	0,505	0,541	0,564	0,596	0,635	0,651	0,659
medians significantly different		yes	yes	yes	yes	yes	yes	yes	yes	yes

Continued

LOANS TO ASSETS RATIO		1999	2000	2001	2002	2003	2004	2005	2006	2007
SIZE CATEGORIES										
Small	obs.	489	442	437	412	443	442	412	285	338
	med	0,503	0,436	0,499	0,496	0,487	0,516	0,554	0,598	0,552
Medium-sized	obs.	490	442	438	413	444	442	413	285	338
	med	0,486	0,459	0,479	0,522	0,555	0,578	0,585	0,62	0,631
Large	obs.	487	439	435	410	441	439	410	283	336
	med	0,443	0,395	0,478	0,538	0,545	0,568	0,596	0,622	0,671
The Big 3	obs.	3	3	3	3	3	3	3	3	3
	med	0,332	0,363	0,472	0,530	0,437	0,577	0,590	0,495	0,486
medians significantly different		yes	yes	no	no	yes	yes	no	no	yes
DEPOSIT INSURANCE SCHEME										
Included in DIS	obs.					801	801	802	649	632
	med					0,556	0,583	0,610	0,631	0,654
Not included in DIS	obs.					419	525	436	207	172
	med					0,490	0,497	0,503	0,516	0,595
medians significantly different						yes	yes	yes	yes	yes

Note: In order to utilize all the available data, all the indicators are calculated at the end of the first quarter of each year.

Table A.4.

Nonperforming loans to total loans by bank ownership, location, size and the deposit insurance scheme

NONPERFORMING LOANS		1999	2000	2001	2002	2003	2004	2005	2006	2007
TOTAL SAMPLE	obs.	1423	1275	1265	1181	1280	1277	1226	853	1009
	med	0,019	0,008	0,004	0,003	0,003	0,003	0,005	0,009	0,007
OWNERSHIP GROUPS										
Private	obs.	1374	1226	1214	1128	1220	1214	1159	792	940
	med	0,019	0,008	0,004	0,003	0,003	0,003	0,005	0,009	0,007
State-controlled	obs.	30	30	31	30	33	32	32	29	32
	med	0,022	0,014	0,005	0,014	0,009	0,008	0,008	0,010	0,008
Foreign	obs.	19	19	20	23	27	31	35	32	37
	med	0,000	0,000	0,000	0,002	0,000	0,000	0,000	0,003	0,001
medians significantly different		no	yes	no	yes	yes	yes	yes	no	yes
REGION										
Moscow-based banks	obs.	537	541	559	575	612	630	608	356	464
	med	0,001	0,000	0,000	0,000	0,001	0,001	0,002	0,009	0,006
Regional banks	obs.	575	574	578	582	668	647	618	497	545
	med	0,040	0,018	0,009	0,006	0,006	0,006	0,008	0,009	0,008
medians significantly different		yes	yes	yes	yes	yes	yes	yes	no	yes
SIZE CATEGORIES										
Small	obs.	454	408	403	367	406	406	403	282	333
	med	0,036	0,012	0,008	0,000	0,002	0,001	0,003	0,008	0,005
Medium-sized	obs.	482	432	428	404	436	433	410	285	337
	med	0,011	0,008	0,003	0,003	0,004	0,003	0,004	0,007	0,005
Large	obs.	484	432	431	407	435	435	410	283	336
	med	0,020	0,007	0,003	0,004	0,005	0,005	0,007	0,010	0,009
The Big 3	obs.	3	3	3	3	3	3	3	3	3
	med	0,149	0,046	0,023	0,027	0,019	0,017	0,015	0,012	0,012
medians significantly different		yes	no	no	yes	yes	yes	yes	yes	yes
DEPOSIT INSURANCE										
Included in DI	obs.					797	798	802	647	630
	med					0,005	0,005	0,007	0,008	0,009
Not included in DI	obs.					403	419	424	205	172
	med					0,001	0,001	0,002	0,010	0,005
medians significantly different						yes	yes	yes	no	yes

Note: In order to utilize all the available data, all the indicators are calculated at the end of the first quarter of each year.

Table A.5.

Loan loss provisions by bank ownership, location, size and participation in the deposit insurance scheme

LOAN LOSS PROVISIONS		1999	2000	2001	2002	2003	2004	2005	2006	2007
TOTAL SAMPLE	obs.	1423	1275	1264	1181	1280	1277	1226	853	1009
	med	0,054	0,043	0,030	0,025	0,024	0,025	0,033	0,036	0,038
OWNERSHIP GROUPS										
Private	obs.	1374	1226	1213	1128	1220	1214	1159	792	940
	med	0,055	0,043	0,030	0,025	0,025	0,025	0,035	0,038	0,039
State-controlled	obs.	30	30	31	30	33	32	32	29	32
	med	0,061	0,042	0,025	0,031	0,027	0,022	0,025	0,029	0,032
Foreign	obs.	19	19	20	23	27	31	35	32	37
	med	0,018	0,037	0,022	0,013	0,015	0,011	0,005	0,011	0,012
medians significantly different		yes	no	no	yes	no	no	yes	yes	yes
REGION										
Moscow-based banks	obs.	537	541	559	575	612	630	608	356	464
	med	0,025	0,022	0,016	0,018	0,024	0,022	0,039	0,053	0,051
Regional banks	obs.	575	574	578	582	668	647	618	497	545
	med	0,081	0,063	0,038	0,030	0,025	0,026	0,030	0,030	0,032
medians significantly different		yes	yes	yes	yes	no	no	yes	yes	yes
SIZE CATEGORIES										
Small	obs.	454	408	403	367	406	406	403	282	333
	med	0,068	0,056	0,032	0,018	0,017	0,019	0,028	0,030	0,039
Medium-sized	obs.	482	432	428	404	436	433	410	285	337
	med	0,038	0,037	0,027	0,025	0,023	0,021	0,030	0,036	0,037
Large	obs.	484	432	430	407	435	435	410	283	336
	med	0,057	0,043	0,030	0,030	0,031	0,032	0,042	0,042	0,039
The Big 3	obs.	3	3	3	3	3	3	3	3	3
	med	0,199	0,090	0,067	0,060	0,054	0,061	0,037	0,037	0,036
medians significantly different		yes	yes	no	yes	yes	yes	yes	yes	no
DEPOSIT INSURANCE SCHEME										
Included in DIS	obs.					797	797	802	647	630
	med					0,026	0,027	0,031	0,032	0,036
Not included in DIS	obs.					403	480	424	206	172
	med					0,021	0,021	0,042	0,066	0,059
medians significantly different						yes	yes	yes	yes	yes

Note: In order to utilize all the available data, all the indicators are calculated at the end of the first quarter of each year.

Table A.6.

Liquidity ratio by bank ownership, location, size and participation in the deposit insurance scheme

LIQUIDITY RATIO		1999	2000	2001	2002	2003	2004	2005	2006	2007
TOTAL SAMPLE	obs.	1469	1326	1311	1238	1331	1326	1238	856	1015
	med	0,236	0,301	0,291	0,283	0,284	0,281	0,256	0,222	0,220
OWNERSHIP GROUPS										
Private	obs.	1420	1275	1257	1183	1269	1261	1170	795	946
	med	0,231	0,299	0,287	0,279	0,276	0,278	0,255	0,221	0,220
State-controlled	obs.	30	30	32	30	33	32	32	29	32
	med	0,334	0,328	0,315	0,325	0,296	0,269	0,224	0,195	0,180
Foreign	obs.	19	21	22	25	29	33	36	32	37
	med	0,420	0,590	0,521	0,518	0,429	0,405	0,334	0,230	0,260
medians significantly different		yes	yes	yes	yes	yes	yes	yes	no	no
REGION										
Moscow-based banks	obs.	567	571	586	615	646	663	620	357	469
	med	0,279	0,344	0,338	0,321	0,334	0,335	0,322	0,278	0,280
Regional banks	obs.	588	593	595	598	685	663	618	499	546
	med	0,259	0,296	0,271	0,258	0,247	0,240	0,201	0,187	0,180
medians significantly different		no	yes	yes	yes	yes	yes	yes	yes	yes
SIZE CATEGORIES										
Small	obs.	489	442	437	412	443	442	412	285	338
	med	0,184	0,249	0,253	0,274	0,281	0,277	0,253	0,234	0,290
Medium-sized	obs.	490	442	437	413	444	442	413	285	338
	med	0,218	0,295	0,289	0,284	0,277	0,291	0,263	0,230	0,220
Large	obs.	487	439	434	410	441	439	410	283	336
	med	0,298	0,370	0,323	0,288	0,288	0,279	0,254	0,200	0,180
The Big 3	obs.	3	3	3	3	3	3	3	3	3
	med	0,406	0,283	0,304	0,261	0,354	0,273	0,265	0,230	0,230
medians significantly different		yes	yes	yes	no	no	no	no	no	yes
DEPOSIT INSURANCE (DI)										
Included in DI	obs.					801	802	802	649	632
	med					0,265	0,268	0,226	0,199	0,185
Not included in DI	obs.					419	434	436	206	172
	med					0,316	0,329	0,336	0,315	0,290
medians significantly different						yes	yes	yes	yes	yes

Note: In order to utilize all the available data, all the indicators are calculated at the end of the first quarter of each year.

Table A.7.

Net interest margin to total loans by bank ownership, location, size and participation in the deposit insurance scheme

NET INTEREST MARGIN		1999	2000	2001	2002	2003	2004	2005	2006	2007
TOTAL SAMPLE	obs.	1423	1277	1262	1181	1280	1277	1229	761	942
	med	0,023	0,035	0,029	0,036	0,033	0,029	0,028	0,025	0,024
OWNERSHIP GROUPS										
Private	obs.	1374	1229	1211	1129	1221	1214	1161	709	878
	med	0,023	0,036	0,030	0,036	0,033	0,029	0,028	0,025	0,024
State-controlled	obs.	30	29	31	30	33	32	32	25	32
	med	0,042	0,046	0,034	0,041	0,030	0,024	0,023	0,018	0,020
Foreign	obs.	19	19	20	22	26	31	36	27	32
	med	0,016	0,015	0,016	0,013	0,014	0,012	0,013	0,017	0,020
medians significantly different		yes	yes	yes	yes	yes	yes	yes	yes	yes
REGION										
Moscow-based banks	obs.	537	544	560	575	612	630	611	311	434
	med	0,014	0,020	0,018	0,028	0,026	0,025	0,028	0,025	0,026
Regional banks	obs.	575	574	578	583	668	647	618	450	508
	med	0,046	0,053	0,040	0,044	0,038	0,032	0,027	0,024	0,023
medians significantly different		yes	yes	yes	yes	yes	yes	no	no	yes
SIZE CATEGORIES										
Small	obs.	454	411	405	368	406	406	406	246	286
	med	0,040	0,053	0,040	0,048	0,047	0,039	0,036	0,032	0,032
Medium-sized	obs.	482	431	425	403	436	433	410	263	327
	med	0,030	0,039	0,031	0,036	0,032	0,029	0,028	0,023	0,024
Large	obs.	484	433	429	407	435	435	410	249	326
	med	0,016	0,024	0,024	0,029	0,027	0,024	0,023	0,021	0,019
The Big 3	obs.	3	2	3	3	3	3	3	3	3
	med	0,006	0,006	0,008	0,021	0,015	0,014	0,017	0,018	0,014
medians significantly different		yes	yes	yes	yes	yes	yes	yes	yes	yes
DEPOSIT INSURANCE SCHEME										
Included in DIS	obs.	777	778	785	733	797	799	802	587	694
	med	0,033	0,040	0,035	0,038	0,033	0,029	0,026	0,024	0,022
Not included in DIS	obs.	349	347	356	355	403	418	424	173	217
	med	0,023	0,028	0,024	0,033	0,031	0,029	0,031	0,028	0,029
medians significantly different		yes	yes	yes	yes	yes	no	yes	yes	yes

Note: In order to utilize all the available data, all the indicators are calculated at the end of the first quarter of each year.

Table A.8.

Variable description

VARIABLE	DESCRIPTION
Size	total assets, mln.RUB
Capitalization	ratio of equity to total assets
Loans to assets	ratio of total loans (to nonfinancial clients) to total assets
Nonperforming loans	ratio of nonperforming loans to total loans
Loan loss provisions	ratio of loan loss provisions to total loans
Liquidity ratio	ratio of liquid assets to total assets
Loans to individuals	ratio of loans to individuals to total loans
Net interest margin	the difference between interest income from loans to customers and interest expense paid on customer deposits as a proportion of total loans
Credit growth	annual change in loans to nonfinancial clients
Oil price	average export price for crude oil for preceding quarter ($ per ton), Rosstat
GDP growth	quarterly growth of real GDP, Rosstat
DUMMY VARIABLES	
Foreign bank	100% foreign owned bank as reported quarterly by the CBR
State-controlled bank	bank included in the list of state banks by Vernikov (2007)
Moscow bank	bank's headquarters are located in Moscow
Big 3	three largest banks by assets: Sberbank, VTB and Gazprombank
Deposit insurance system	bank entered DIS before the end of the first quarter of 2005
REGULATION RATIOS	
N1 – capital adequacy ratio	bank's equity capital to the overall risk-weighted assets minus the sum of the reserves created for the depreciation of securities and possible losses
N2 – quick liquidity ratio	sum of the bank's highly liquid assets to the sum of the bank's liabilities on demand accounts
N3 – current liquidity ratio	sum of the bank's liquid assets to the sum of the bank's liabilities on demand account and accounts up to 30 days
N7 – maximum large credit risk	percentage of the total amount of large credit risks (which is the sum of the bank's risk-weighted claims to one borrower) in the bank's equity capital

Risk-taking by Russian Banks: Do Location, Ownership and Size Matter?

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The Russian banking sector has experienced enormous growth rates during the last 6–7 years. The rapid growth of assets has, however, contributed to a decrease in the capital adequacy ratio, thus influencing the ability of banks to cope with risk. Using quarterly data spanning from 1999 to 2007 on all Russian banks, we investigate the relationship between bank characteristics and risk-taking by Russian banks. The analysis of financial ratios reveals that, on average, the risk levels are still below those observed in Central and Eastern Europe. Combining the group-wise comparisons of financial ratios and the results of insolvency risk analysis based on fixed effects vector decomposition, three main conclusions emerge. First, controlling for bank characteristics, large banks have higher insolvency risk than small ones. Second, foreign-owned banks exhibit higher insolvency risk than domestic banks and large state-controlled banks are, unlike other state-controlled banks, more stable. Third, we find that the regional banks engage in significantly more risk-taking than their counterparts in Moscow.

Keywords: bank risk-taking, banks in transition, Russia.

1. Introduction

Banking sectors in most countries of the Commonwealth of the Independent states (CIS), Russia included, have experienced nearly phenomenal growth rates during recent years. As a consequence of the dramatically improved macroeconomic situation

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and important legislative changes, the ratio of banking sector assets in Russian GDP grew annually by more than 2 percentage points between 2001 and 2007. This ratio exceeded 60 percent by the end of 2007. Simultaneously, bank credit to the private sector has more than doubled to 30 percent of GDP.

With the rapid growth of total assets, deposits and loan stocks, Russian banks are increasingly assuming their role as financial intermediaries channeling household deposits and foreign borrowing into domestic corporate credits. This necessarily causes changes in the banks' assets and liability structures, attitudes towards risk-taking and risk management. Rapid credit growth is likely to increase (potential) banking sector risks. On the other hand, the ongoing financial deepening also indicates that the Russian banking sector is beginning to have an impact on private sector (both corporate and individual) behaviour and investments. That is, banks in Russia as well as in most other transition economies, are starting to look like banks elsewhere. They are by no means problem-free, but the challenges they need to tackle are similar to what banks in other emerging economies face. Given their growing role in economic development, surprisingly little is known about these banks' risk-taking behaviour.

The development of the banking sector in transition economies, as well as the financial sector in general, have been studied extensively. Barisitz (2008) and Bonin and Wachtel (2003) [5, 11] provide excellent recent overviews. Many studies focus on the effects of bank privatization on their performance in transition countries [8, 9], but until recently risk-taking by banks in transition has been a largely neglected area of research. Recent literature on the Russian banking sector has focused on bank supervision and the introduction of the deposit insurance system [14, 18, 42], market discipline and deposit interest rates [31, 39] and the efficiency of banks [1, 2, 19, 33].

A handful of recent papers provide cross-country evidence on bank risk-taking in emerging economies. Haselmann and Wachtel (2007) [28] use several accounting measures of bank risk to examine the risk-taking behaviour of banks in 20 transition countries including Russia. They analyze differences in risk measures by bank ownership, size and market share. Using survey data from the EBRD, they complement the analysis with various measures of institutional quality. The results suggest that there is no group of banks with excessive risk-taking and that an unsound institutional environment leads to higher capital holdings and less credit risk-taking by banks. Maechler et al. (2007) [36] examine the effect of various types of financial risks on the bank stability in 18 Central and Eastern European economies. Their results indicate that foreign banks tend to have a higher risk profile than domestic ones but there is no significant difference between the risk profiles of larger and smaller banks. Furthermore, credit growth relates to greater bank stability and only the acceleration of growth seems to add vulnerability.

To the best of our knowledge, no study on bank risk-taking has focused on Russia or any other CIS country. However, with its 1100 banking institutions, Russia in particular provides an extremely rich test case for analyzing risk-taking. Additionally, the large number of bank failures (more than 300 since year 2000[1)]) highlights the fact that banking in Russia is still riskier than in most developed countries. Therefore examining the determinants of risk-taking is crucial for understanding the prospects for future economic growth. Furthermore, if Russia is to become a global financial centre,

[1)] For more details see: www.banki.ru.

a goal clearly stated by, e.g., President Medvedev in spring 2008, we need to know much more about the behaviour of Russian banking institutions.

Currently the Russian banking sector is extremely fragmented, with a few large banks and a great number of very small ones. Especially in comparison with Central European transition economies, the state has retained a large share of control whereas the role of foreign banks has been very limited. These two structural features have often been mentioned as the main hindrances to further banking sector reform and growth. In this paper we discuss the extent to which the characteristic features of the sector determine the risk-taking behaviour of Russian banks.

We use a large panel of practically all Russian commercial banks covering the post-1998-crisis period, from April 1999 to April 2007. The large, Moscow-based and state-controlled banks form the backbone of the Russian banking sector. In line with previous literature, we therefore focus on the effects of bank size and ownership structure on bank risk-taking. Furthermore, we control for the location of the banks to see if Moscow-based banksdiffer in their risk-taking habits. Additionally, we are able to examine the influence of what probably was the most important institutional change during the period, the introduction of a deposit insurance scheme, on the risk-taking of Russian banks.

In measuring risk-taking, we use two approaches. First, we conduct a univariate analysis of traditional financial risk ratios based on accounting data. Second, we run a regression analysis of bank insolvency risk measured by the z-score indicator. The two approaches produce similar results. First, risk-taking increases with size. Second, controlling for other bank characteristics, banking institutions located outside Moscow tend to bear higher risks. And finally, ownership does matter for risk taking. Surprisingly, foreign-owned banks are found to be more risk-taking than other banks.

The next section provides a brief overview of the Russian banking sector. Section three describes the data and provides group-wise comparisons of financial risk measures by size and ownership categories and by location, as well as by inclusion in the deposit insurance scheme. Section four complements the previous results with a z-score analysis and section five concludes the analysis.

2. Banking industry in Russia

After the crisis-ridden 1990's, especially the deep recession and financial collapse of 1998, the Russian economy has grown annually by more than six percent since 2000. The banking system has experienced rapid growth since 2001, when the sector recovered from the insolvencies and the complete lack of trust created by the 1998 turmoil. Trust in counterparties is still fairly low especially at the interbank markets and the sector is prone to rumors. This was exemplified in the summer 2004 when rumors and tight liquidity created a «mini-crisis» in the banking industry. The effects were, however, not long-lasting. Bank credit to the private sector as a ratio to GDP has more than doubled during the last decade. This is very rapid growth even compared to the fast-growing emerging economies of Central and Southeastern Europe. The resulting financial deepening has been supported by a stable macroeconomic environment, increasing incomes and institutional reforms.

Continuous economic growth, rising real incomes, declining inflation and public sector surpluses have enabled fast increases in the private sector credit share. The majority of credits are financed by private sector deposits, which have increased by

10 per cent annually during the last six years [16]. Also net foreign borrowing has increased, even though the level of total foreign liabilities in Russian banks is still relatively modest at on average below 20% of total liabilities.

Table 1.

Banking system indicators , % of GDP

	2004	2005	2006	2007	2008
Total assets	42,1	41,7	44,8	51,9	61,0
net foreign asset position	−1,4	−1,9	−2,7	−5,9	−9,0
credit to the private sector	20,2	22,8	25,2	29,9	37,2
o/w enterprises	18,3	19,6	20,3	22,9	28,2
o/w households	1,9	3,2	4,9	7,0	9,0
deposits by the public	23,6	24,4	27,3	32,0	37,0
o/w households	11,5	11,6	12,8	14,2	15,6

Note: Data concerns beginning of each period.

Source: Central Bank of Russia.

Furthermore, a number of important institutional reforms have undoubtedly helped fuel banking sector growth. The most important one was the introduction of the deposit insurance system (DIS). The federal law on compulsory deposit insurance was adopted in December 2003. The law made the formerly implicit guarantee of state-controlled banks explicit and outlined clear rules for banks entering the system. The Deposit Insurance Authority began its operations in 2004, and by the end of March 2005 the first 824 banks were admitted into the system. Most of the rejected banks were small, as the banks already admitted accounted for 98 percent of household deposits. This did raise some concerns on the entry requirements not being interpreted rigorously enough.

By the end of September 2005, when the deadline for joining the system expired, 927 banks out of the 1150 applicants were admitted [14][2)]. During 2006–2007 Central Bank of Russia (CBR) gradually revoked the licenses to attract household deposits from banks not included in the system. Initially private deposits up to RUR 100000 were covered in full. Later the coverage limit was raised to RUR 190000 in August 2006 and to RUR 400000 in March 2007[3)]. During 2003–2005 also several other important laws, e.g., clarifying the rules for mortgage lending and mortgage-backed securities, were enacted. The law from 2005 gave the framework for the operations of private credit bureaux.

[2)] In order to pacify depositors during the mini-banking crisis of summer 2004, the government enacted a law granting temporary deposit insurance to all banks. Therefore, irrespective of possible inclusion in the deposit insurance system, all Russian banks were guaranteed blanket deposit insurance for deposits up to RUR 100000 from July 2004 until the end of 2006.

[3)] The limit was further raised to RUR 700000 in October 2008. See: http://www.asv.org.ru/insurance/.

During the last few years Russian banks have intensively diversified into household lending, especially mortgages, as well as lending to SMEs. Credit maturities have also increased and maturities of over three years are not uncommon. The volumes of mortgage lending are, however, still tiny as less than 10% of homes in Russia are bought using a mortgage (Interfax, 2008). Another remarkable recent trend is the continuing de-dollarization of banking assets and liabilities. Like many transition countries, Russia was heavily dollarised and immediately after the 1998 crisis the use of dollars was very widespread. The share of foreign currency loans has now stabilized at below 25% of corporate loans. Corporate borrowers typically have a significant portion of their earnings in foreign currencies, so currency mismatches should not pose a systemic risk.

In light of all these changes, the structure of the Russian banking sector has remained surprisingly unchanged. The large, state-controlled banks still dominate the market. Even though the number of banks has decreased from 2084 at the end of 2000 to a mere 1243 by the end of 2007, the great majority of the banks are still tiny and can hardly be called banks. At the end of 2007 some 900 banks had the right to attract household deposits and only 300 banks had a general banking license. The foreign ownership share remained fairly limited as evidenced by the Table 2 below. There were 202 banks with a foreign ownership at the end of 2007, 62 of them fully foreign-owned.

Table 2.

Bank ownership in selected countries in 2005

	Number of banks	Number of foreign-owned banks, % of total	Asset share of foreign-owned banks, % of total	Domestic credit to private sector (% of GDP)
Estonia	13	77	99,4	57
Slovak Republic	23	70	97,3	34,7
Czech Republic	36	75	84,4	35,7
Lithuania	12	50	91,7	41,3
Hungary	38	71	82,6	49,8
Poland	61	82	74,2	29,2
Latvia	23	43	57,9	59
Slovenia	25	36	22,6	56,4
Russia	1253	4	8,3	26,1

Source: EBRD Transition Report 2006.

Our dataset ends in April 2007, just before the the global credit crunch caused by the subprime market problems in the US started to evolve. Initially the Russian banking industry was only mildly affected, in large part thanks to increasing crude oil prices that provided ample liquidity in the domestic market. Along with falling crude oil prices and drastically deteriorating situation at the international financial markets also the Russian banking sector began to face serious problems by the end of 2008.

3. Measuring risk – financial and regulation ratios

3.1. Data

Our dataset covers most of the banks operating in Russia over the period of April 1999 – April 2007. It consists of banks' quarterly balance sheets and profit and loss accounts. Regulatory ratios calculated by the Central Bank of Russia (CBR) are also partially included in our data and we use them in the analysis to support our main results. The data are provided by the financial information agency Interfax and originated in the Central Bank of Russia. For a more detailed description of the dataset used, see Karas and Schoors (2005) [32]. As the sample period starts in 1999, our results are not directly influenced by the financial crises of August 1998. The data constitutes an unbalanced panel, because there were banks entering and leaving the market due to mergers or failures. A brief overview of the main variables based on summary statistics is provided in Table A.1 in the appendix.

The banks are divided into different subgroups by size, ownership and location as well as inclusion in the deposit insurance system. We use the book value of total bank assets as a measure of size[4]. Bank size is especially important in Russia, where a handful of the largest banks account for most of the banking sector assets. At the end of 2006, large state-controlled banks accounted for about 40% of the sector assets [15]. Taking into account the overly concentrated nature of the Russian banking sector, we separate for the three largest banks (Sberbank, VTB and Gazprombank). In general, due to more possibilities for diversification and better access to financial markets, large banks are supposed to be less risky. Nevertheless, as Demsetz and Strahan (1997) [24] point out, large banks offset their potential benefits from diversification with lower capital ratios and more risky loan portfolios. Also empirical evidence on the relationship between size and risk has produced slightly mixed results [28, 29].

As for ownership, we distinguish among three ownership groups to determine majority ownership: state-controlled, foreign and domestic private banks. The foreign ownership dummy variable is based on the CBR data on 100% foreign-owned banks published quarterly. State-controlled banks are defined using the list provided in Vernikov (2007)[5]. Due to its special role as a state development bank, we do not include Vneshekonombank (VEB).

Ownership may be important for risk-taking behaviour for various reasons. State-owned banks are often assumed to take higher risks than the private ones. The underlying reasons differ according to one's view on the character of state-owned banks. Sapienza (2004) [41] distinguishes three alternative views. The social view suggests that state banks intervene to correct for the market failure caused by private

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[4] We first separate the three largest banks as a group of their own. The rest of the banking sector is divided into three groups. Small banks are those with total assets below 33rd percentile, medium banks have assets between 33rd and 66th percentiles and the large ones have total assets above the 66th percentile in every time period. Alternative measures of size based on the market share of the aggregate domestic credit as well as participation in the interbank market provide us with a very similar distribution of banks into subgroups and therefore we only use total assets as a proxy for bank size.

[5] This list largely overlaps with the other lists of state-controlled banks used by Karas et al. (2008) [33]. Moreover, our number also corresponds to the number of government-controlled banks in the Bank Supervision Report (2006).

banks, which «cherry-pick» the best customers and would leave the not very profitable ones without financial services. This view implies that state banks are engaged in more risky and less profitable operations but possibly enjoy soft budget constraints. The political view sees state banks as well as state enterprises more as a mechanism for pursuing politicians' private interests, such as maximizing employment or delivering favours for political protégées. This view implies that state banks may be forced to lend on a non-commercial basis i.e. due to political or other reasons. The agency view sees state banks as basically benevolent maximizers of social welfare but plagued by corruption and misallocation. Recent evidence from industrialized countries [20, 29] suggests that state-owned banks typically exhibit higher risk than other types of banks.

Studies on transition economies have, however, produced mixed results [21, 36]. In transition economies state-owned banks may be less efficient and more risk-prone due to Soviet legacies, unrestructured management or soft budget constraints. These findings, usually based on Central European countries (see e.g. [8]), are challenged by Karas et al. (2008) [33], who show that in Russia state-owned banks are not less efficient than domestic private banks.

Foreign-owned banks may have a different risk profile due to less local expertise and fewer local connections compared to the domestically owned banks. Their operations may also be less risky since they might often be able to cherry pick the most creditworthy borrowers in an emerging market [7]. Additionally, these banks can often rely on strong parent companies to provide them with access to better risk management techniques and possible diversification of country risk. On the other hand, foreign ownership may aggravate risks if parent banks tend to stress rapid credit growth in order to relieve tightening interest margins at home. Moreover, integration into the global financial system has also highlighted new issues related to risk management and financial vulnerability.

Foreign bank entry has been one of the decisive factors shaping banking sector development in Central and Eastern European transition countries. The available empirical evidence supports the common view that foreign-owned banks are more efficient than other types of banks in these countries ([5, 8, 9] and references therein). Furthermore, there is a growing literature exploring the effects of the presence of foreign-owned banks on domestic credit markets in emerging economies[6)]. The role of foreign-owned banks in Russia has been dramatically different from those in the Central European banking sector. The share of foreign capital in the Russian banking sector was tiny up until spring 2007 as no major privatizations had taken place. The Russian banking sector is clearly more distant (both geographically and culturally) and therefore less attractive than the new and prospective EU member countries. Moreover, acquiring a large market share is not as easy as it was in Central Europe. Nevertheless, the foreign-owned banks operating in Russia may be extremely important as a benchmark for domestic ones and it is therefore most interesting to examine if they differ in their risk-taking.

[6)] Mostly the results on the benefits of the foreign bank presence are mixed. Detragiache et al. (2008) [25] show that banks give fewer loans after being acquired by a foreign investor. Clarke et al. (2005) [17] find that foreign banks make more loans to SMEs than domestic ones. Foreign banks may be reluctant to lend to opaque borrowers, but induce domestic banks to lend to them [22]. Giannetti and Ongena (2008) [26] suggest that foreign banks enhance access to credit, especially where financial development is low.

The division by ownership and size is rather standard. A bank's location within a single country and its inclusion in the deposit insurance scheme are more specific to Russia. Economic developments in different parts of Russia vary a lot. About half of the Russian banks are located in Moscow. The other half, located in the other regions of the Russian Federation, are mainly small banks constituting only 15% of the total banking sector assets. It has been occasionally argued that regional banks are more inclined to lend to local enterprises and to small and medium-sized businesses, thereby promoting growth more than Moscow-based banks. Moscow-based banks, on the other hand, are more active in interbank money markets. If true, this should also be reflected in differences in risk measures. Therefore we split the sample into two depending on the location of the bank's headquarters in Moscow or elsewhere in the Russian Federation. The division into regional and non-regional banks is unavoidably somewhat arbitrary as a large number of banks headquartered both in and outside Moscow have wide networks outside their home region. But the division used is the best available approximation for Moscow and non-Moscow banks. If the banks do not differ in their risk-taking based on the location of their headquarters, the division should not be significant in our analysis. But, as will be seen, the statistically significant result survives all our robustness checks.

Russia adopted a deposit insurance system in 2004 with the majority of banks screened and admitted into the system by end-March 2005. The deposit insurance system was expected to increase the confidence in and stability of the banking sector, as well as to level the playing field between large and small banks. The academic literature on deposit insurance increasingly emphasizes that explicit deposit insurance has the potential to affect bank risk-taking. Since it reduces depositors' incentives to monitor banks, it may encourage risk-taking and imprudent banking practices. The Russian data offers us a unique opportunity to test whether the introduction of a deposit insurance system affects bank risk-taking in the short run. We consider two groups of banks based on the point at which they entered the system. We create a dummy variable indicating if the bank was included into the system in the «first wave», by end – March 2005. Inclusion of the banks in the deposit insurance system is defined using the information from the Russian Deposit Insurance Agency.

3.2. Risks faced by banks and corresponding financial ratios

Banking is by nature a business of balancing risks. There is, however, no single, universal measure that could be used to assess risk-taking behaviour by banks. Thus, we rely on two different approaches. The first one is based on a univariate analysis of financial risk ratios, which are either calculated using the accounting data or belong to the regulatory ratios used by the central bank. We analyze different categories of financial risk separately by employing the relevant financial ratios as well as regulation ratios used by the CBR (for definitions, see Table A.8 with a description of variables in the appendix). Furthermore, we also test the significance of the differences in financial risk ratios among different subgroups of banks[7]. The second approach, discussed in section four, relies on the regression analysis of bank insolvency risk as measured by the z-score indicator.

[7] We use a nonparametric K-sample test on the equality of medians.

Capitalization

Capitalization is calculated as a ratio of equity to total assets and it serves to measure leverage risk. Due to rapid asset growth, the level of capitalization declines during the period analyzed (see Table A.2 in the appendix). Capitalization is, however, still higher than in most other transition countries as reported in Haselmann and Wachtel (2007) [28]. On average, capitalization decreases with size and thus small banks tend to have higher capital ratios than larger banks. This is in line with the «too big to fail» hypothesis as well as with the perceived difficulties smaller banks face in accessing interbank markets in Russia. Larger banks in general have better opportunities for risk diversification and thus also benefit from lower costs of funding [37].

The capitalization of private banks is significantly higher than that of state and foreign banks during the whole period under review. These banks, unlike state-controlled or foreign banks, usually do not have a kind of «backup» in the form of the state or a strong parent company abroad. That is most probably the reason why they hold a higher proportion of equity capital. Foreign banks are slightly better capitalized than state banks, which is consistent with the results for the CIS in [21]. Banks located outside Moscow tend to maintain lower equity, but the gap between regional and Moscow banks has decreased since 2006 and thus the difference between these two groups of banks is no longer significant. Banks included in the DIS maintain a significantly lower equity than the other banks. There are two possible explanations for this. The first one concerns moral hazard issues connected with the participation in the deposit insurance scheme. The other is selection bias. It indicates that the banks entering the system were the better ones, which, based on their results, were obvious candidates for inclusion immediately when the system was introduced.

The CBR regulation ratio N1 used to assess capital adequacy[8)] confirms these trends as well. Even though the capital adequacy ratio has declined in recent years, its average value of 14,5% for November 2006 [15] still clearly exceeds the minimal requirements set by the central bank[9)]. This indicates that Russian banks on average tend to keep slightly higher capital buffers than banks in the EU-25 countries as Jokipii and Milne (2008) report [30]. It is, however, clear that relatively large capital buffers at the beginning of our sample period are a natural reaction to the uncertainty following the crisis of 1998. The gradual decrease of capital buffers is then to a certain extent the result of the improvements in the macroeconomic environment. Nevertheless, it may also indicate that the operations of Russian banks are becoming more efficient or that the institutional environment is improving [10, 28]. The unfavourable global development resulting from the sub-prime crisis and liquidity problems in the second half of 2007 made banks more cautious again and the majority of banks increased their capital adequacy ratios towards the end of 2007 [16].

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8) Unlike the indicator of capitalization, the N1 ratio is for most of the banks available only until 2005.

9) The Financial Stability Report 2006 issued by the central bank reports that according to Bank of Russia Instruction № 110_I, dated January 16, 2004, the minimum capital adequacy ratio for a bank (N1) is 10% if the bank has a capital of at least 5 million euros and 11% if the bank has a capital of less than 5 million euros. Only 11 credit institutions violated the capital adequacy ratio in 2006 and 19 in 2005 (Bank of Russia Financial Stability Report, 2006).

Credit risk

Analyzing credit risks is becoming increasingly important in Russia due to its rapid credit growth. The increase in the loans to total assets ratio (see Table A.3 in the appendix) suggests that the growth of lending has been higher than the growth in total assets, implying a gradual shift towards riskier operations of banks. Domestic banks have significantly higher lending ratios than foreign banks, whereas regional banks tend to lend more than Moscow-based ones[10]. On average, however, the total loans to total assets ratio in our sample is comparable with the sample of transition economies as reported in Haselmann and Wachtel (2007) [28]. Similar to our expectations, banks that belong to the deposit insurance system lend more. There are again two possible explanations for this. The first one suggests that banks in the DIS may take more risks as they are backed up by the system. The latter indicates that insured banks are on average better and more efficient and therefore they are able to bear higher risks.

One of the most commonly used indicators of credit risk is the ratio of nonperforming loans (NPL) to total loans. The share of NPLs in Russia has indeed increased during the last years, but the levels are not yet anywhere close to becoming alarming. The median levels based on our calculations (see Table A.4 in the appendix) are still below the quality level of 1,5 per cent recommended by Grier (2001) [27]. It is, however, necessary to bear in mind that this is an ex post measure of the risks assumed by banks. When considering banks by ownership, state-controlled banks exhibit a significantly higher ratio of nonperforming loans than others. One might take this as indirect evidence of state-controlled banks' lending, willingly or unwillingly, to any customer, also to the uncreditworthy one. It is, however, interesting to note that the share of NPLs among the state-controlled banks has stayed basically unchanged in recent years. The recent increase in the NPL share has been caused mainly by private domestic banks. On the other hand, foreign banks have the lowest level of NPLs, which may reflect their relatively short period of operation on the Russian market, better credit risk management, or both.

The ratio of NPLs is increasing with the bank's size, which suggests that larger banks are able to sustain a larger proportion of NPLs. The difference between small and large banks is, however, gradually decreasing. The shrinking of this gap is the result of both an increase in the NPL ratio of small banks and a decrease among the large ones. Despite this development, the variation between banks of different sizes still remains significant. There are significant differences in the proportion of NPLs by location as well. Even though regional banks still tend to have a larger ratio of NPLs, similar to when we account for size, the gap between Moscow and regional banks has decreased recently. There are also differences between banks that are part of the deposit insurance system and the ones that are not. The ones included in the scheme have in general higher nonperforming loan ratios, which can be a natural consequence of higher lending by these banks.

Since banks with nonperforming loans are obliged to make loan loss provisions, a comparable measure of credit risk is the ratio of loan loss reserves to total loans. Its development basically corresponds to changes in the proportion of nonperforming

[10] The underlying reasons for the different asset structure of regional and Moscow-based banks may include variations in fixed assets like buildings and branch-office networks. This issue would clearly merit a study of its own.

loans (see Table A.4 in the appendix). The proportion of loan loss reserves in total loans is the lowest for the foreign-owned banks. Even though the proportion of loan loss reserves was the highest for the three largest banks in 1999, nowadays this ratio is basically the same for banks of all sizes. This seems to serve as evidence for the special position of these state-controlled banks. The loan loss indicator further suggests that the deposit insurance scheme implementation contributed to changes in loan loss reserves. Before the deposit insurance scheme was implemented, loan loss reserves were significantly higher for the banks that later entered the scheme. However, with the implementation of the scheme, reserves in the banks not included in the system increased and they are higher compared to the banks that are part of the DIS.

Maximum large credit risk is a regulation ratio that measures the proportion of the total amount of large credit risks[11)] in a bank's equity capital. It increases over time and tends to be higher for the state-controlled banks and for the regional banks. This could indicate that these banks have close connections with large state-controlled or regional companies. The maximum large credit risk ratio is also higher for larger banks with the exception of the three largest ones. Moreover, it is significantly lower for the banks outside the deposit insurance system, which once again indicates that banks that are part of the system are able to engage in relatively more risky activities.

Even though our analysis of credit risk measures suggests that the operations of state-controlled banks tend to be relatively riskier than the others, the comparison of the credit risk indicators to the corresponding figures in other countries as well as to the critical values indicated in the literature suggest no excessive risk-taking. Our results are thus in line with the CBR [15] in that, on average, the credit risk of Russian banks remains moderate.

Liquidity risk

The Russian banking sector's liquidity as measured by the ratio of liquid to total assets has decreased slightly in recent years, but its level, reported in Table A.6 in the appendix, is still comparable to the other transition countries as well as to the quality level recommended by Grier (2001) [27]. An analysis of the regulatory ratios of quick and current liquidity (see Table A.8 in the appendix for detailed definitions) confirms that they have remained basically unchanged. Foreign banks and Moscow-based banks exhibit the highest level of liquidity during the whole period under review. One possible explanation for this phenomenon is that Moscow-based banks are on average less engaged in traditional banking operations (collecting retail deposits and channeling them into corporate loans) than regional banks. Furthermore, Moscow-based banks tend to be more active in interbank money markets and therefore have a larger proportion of their assets in a highly liquid form. This difference in bank operations is reflected in the increasing gap in the liquidity indicator between Moscow and regional banks. The finding is a corollary to the finding that, on average, the share of loans in total assets is lower for Moscow-based banks than for the other banks. Unlike the divisions by region and ownership, the distribution of banks by size does not indicate any significant differences in liquidity for banks of various sizes.

11) Large credit is the total sum of the bank's risk-weighted claims to one borrower (or a group of related borrowers) on credits.

Moreover, in line with the other credit risk indicators, the banks included in the deposit insurance scheme hold lower levels of liquidity and the gap between them and the other Russian banks has been increasing since 2005.

In general, high liquidity ratios can be interpreted as having a positive influence on stability at certain levels of liquidity. In the case of emerging economies, liquidity ratios may also be higher if the government does not actively intervene to meet funding gaps, financial institutions are risk-averse or if there are not enough opportunities for hedging [38]. In that case excessive liquidity could indicate structural problems. A bank may be highly liquid simply because: 1) it cannot rely on well-functioning interbank markets or other secondary markets such as those for securities; 2) it prefers to distance itself from «traditional» banking operations such as lending in favour of trading in, e.g., government securities; or 3) both.

Despite sufficient liquidity in general, there has been a lack of efficient mechanisms for interbank intermediation of liquidity. The Russian interbank market is relatively small even in comparison to other emerging markets [38]. This is especially the result of high segmentation and low trust on the interbank market [5], even among the big state-controlled banks. Russian banks are highly liquid but the banking system as a whole is not. Due to the lack of trust, the banking system is vulnerable to occasional liquidity shocks as experienced in summer 2004 and autumn 2007. This clearly complicates banks' liquidity management as well as the conduct of monetary policy in Russia.

Market risk

The net interest margin[12)] as a percentage of loans is often used as a proxy for the efficiency of financial intermediation, thus uncovering the health of the banking sector. Higher margins indicate lower efficiency and lower competition within the sector and thereby possibly also higher risk. Our analysis indicates that foreign banks have significantly lower net interest margins than private banks, even though recent developments suggest that the net interest margins of foreign banks have increased to the level of state-controlled ones (see Table A.7 in the appendix). In this respect, lower margins most probably reflect the greater efficiency of foreign banks which is connected to the support and know-how from their parent companies. Our indicators are thus in line with Karas et al. (2008) [33], who find that Russian state banks are more efficient than domestic private banks. The net interest margin decreases with the bank's size and therefore it is the lowest for the group of the three largest banks. Regional banks used to have significantly higher net interest margins. However, the situation has changed recently and consequently Moscow-based banks have slightly higher margins, which may suggest increasing efficiency and/or competition. After the implementation of the DIS, the net interest margins of the banks included in it decreased and became significantly lower than the margins of the other banks. This development may indicate a positive impact of the DIS introduction on the banking sector's competition and efficiency; however, more investigation is necessary to confirm this result.

12) The net interest margin is calculated as the difference between the interest income from loans to customers and the interest expense paid on customer deposits.

To sum up, the analysis of ratios measuring financial risk confirms significant differences among groups of Russian banks by size, location, ownership and participation in the DIS. Nevertheless, it is only based on the comparisons of unconditional medians. The following regression analysis provides more insight by uncovering also conditional correlations.

4. Measuring risk – bank insolvency risk (z-score)

In addition to the four classes of bank risk ratios, we use a measure for insolvency risk developed by Boyd and Graham (1988)[13)] [12] that has been increasingly used in the banking literature. Different modifications of z-scores have been applied in the empirical cross-country [13, 20, 21, 29, 36] as well as single-country studies [34, 35].

The insolvency risk measure («z-score» hereafter) is a statistic indicating the probability of bankruptcy (bank failure). The z-score for each bank i at quarter j is calculated as:

$$Z_{ij} = (ROA_{it} + EQTA_{it}) \,/\, \sigma(ROA)_{it}, \quad (1)$$

where ROA_{it} and $(ROA)_{it}$ are sample estimates of the four quarters moving average and the four quarters standard deviation of bank i's returns on assets at quarters t to $t - 3$ and $EQTA_{it}$ is the four quarters moving average of the equity capital to assets ratio. A bank's return on assets is calculated as its one-quarter profit before taxes on the quarter's average total assets. A bank's equity to assets ratio is calculated as the equity capital on total assets at the end of a given quarter. As we used the four quarters (backward-looking) moving averages in constructing our insolvency measure as well as explanatory variables, the time span of our analysis effectively covers the years 2000–2006.

Statistically speaking, the z-score represents the number of standard deviations returns would have to fall in order to deplete a bank's equity, under the assumption of normality of the bank's returns. Boyd et al. (2006) [13], however, argue that *«it (the z-score) does not require that profits be normally distributed to be a valid probability measure; indeed, all it requires is the existence of the first four moments of the return distribution»*. A higher z-score corresponds to a greater distance to equity depletion and therefore to lower risk and higher bank stability.

The z-score measure inherently depends on the assumption that the ROA, relying on profit and loss data, gives a useful approximation of a bank's financial health. Since our data is based on Russian accounting system standards, which stress formal reporting rather than economic meaning, it may be questioned whether our data fulfils that requirement [5]. Nevertheless, as we only compare Russian banks with each other, possible flaws in the accounting standards should not be over-emphasized. Moreover, we use the z-score indicator to uncover statistically significant conditional correlations, not causality.

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13) This measure originated as a predictor of corporate bankruptcy [3].

4.1. Methodology

Our focus is on the effects of a bank's size, ownership, location and inclusion in the deposit insurance scheme on its insolvency risk (z-score). The bank's size is measured by a continuous variable (logarithm of total assets) whereas ownership, location and inclusion in the deposit insurance scheme are proxied by using corresponding dummy variables. The dummy variable for inclusion in the deposit insurance scheme is fully time-invariant whereas the dummy variables for ownership and location exhibit very little if any within variation. Therefore a standard fixed-effects model is likely to lead to inefficient estimates with very large standard errors[14].

We remedy the problem by applying the fixed effects vector decomposition (FEVD) approach by Plümper and Tröger (2007) [40]. The approach suggests estimating the model in three steps. First, our dependent variable is regressed only on the cross-section fixed effect and the time-varying factors. Second, the estimated fixed effect (unit effect) is decomposed into the part explained by the time-invariant variables and the unexplainable part (error term). Finally, the model including the unexplained part of the fixed effect is re-estimated by pooled OLS. By design, the remaining error term is no longer correlated with time-invariant variables. Plümper and Tröger (2007) [40] show that FEVD estimates are superior (in root mean squared errors) to the traditional fixed effects estimation. In running the FEVD estimations, we use STATA's FEVD module.

We estimate the following model:

$$\ln(z)_{it} = \alpha_i + \beta_1 Size_{it} + \beta_2 (BankSpec)_{it} + \beta_3 (IA)_{it} + \beta_4 (seas)_t + \beta_5 (Owner)_i + \beta_6 (\text{Region})_i + \beta_7 (DepInsurance)_i + \varepsilon_{it}, \quad (2)$$

where

- z is the z-score for bank i at time t calculated as indicated in the equation (1);
- *size* stands for the logarithm of total assets of bank i at time t;
- *bankSpec* is a set of bank i's specific ratios at time t including liquidity, credit growth and the share of loans to individuals in total loans;
- *IA* is a set of interaction dummy variables between a bank's size and bank-specific factors;
- *owner* is a set of dummy variables distinguishing among foreign, state-controlled and private banks;
- *region* is a dummy variable indicating Moscow headquarters of bank i at time t;
- *seas* stands for seasonal (i.e. quarterly) dummy variables;
- *depInsurance* is a dummy variable indicating inclusion in the first wave of the deposit insurance system.

All the variables used in the regressions are four-quarter moving averages. Z-score and total asset variables are in natural logarithms. Bank-specific factors include credit

[14] For recent discussions on fixed-effect models with time invariant variables, see, e.g., [6, 43]. For a classic textbook approach using Hausman-Taylor procedures, see [44, p. 235–238].

growth, the liquidity ratio and the share of loans to individuals in total loans. A bank's size, ownership, location and inclusion in the first wave of the deposit insurance system are defined as in the analysis of bank risk ratios in the previous section. To remove potential outliers, 0,5% of both tails of each variable in every quarter was removed. Table A.8 in the appendix gives details of the variables used in the regressions.

A priori, the sign of the coefficient on a bank's size is indeterminate because large banks may be either stabilizing or risky for the banking system, as our previous analysis of risk ratios suggests. Bank-specific risks are captured by the measures of credit risk and liquidity risk. Credit risk is proxied by bank-by-bank credit growth as well as the ratio of loans to individuals to total loans. Liquidity risk is controlled for by introducing the liquidity ratio (liquid assets/total assets) to the model. A priori we do not have an expectation of the sign for these variables.

4.2. Estimation results

In order to analyze the relationship between a bank's size, ownership and location and the risk measured by the z-score, we estimate the model of equation (2) employing the fixed effects vector decomposition described above. The main results are shown in Table 3 below.

Several interesting findings emerge. First, the results consistently indicate that larger banks have significantly lower z-scores and thus higher insolvency risk[15]. Second, somewhat unexpectedly, foreign-owned banks consistently bear higher insolvency risk than domestic private banks. This result is fully in line with some earlier studies on emerging economies using z-scores as the risk measure [36]. The result naturally reflects the limitations of the risk measure used, as it partly originates from the lower capitalization ratios of the foreign banks. Furthermore, it is necessary to bear in mind that due to data limitations, our foreign ownership dummy variable only accounts for banks that are fully foreign-owned. The overall effect of state ownership on a bank's insolvency risk is positive, i.e. state-controlled banks tend to be more stable. To investigate this result more closely, we add the interaction term of size and state control to our model. This interaction is positive and highly significant. At the same time, the estimated coefficient for the state-controlled dummy variable becomes negative. This indicates that only large state-controlled banks are driving our results and they are more stable than other state-controlled banks.

Third, the Moscow-based banks are always more stable than the regional banks. Based on the data available to us we can not determine the ultimate reason for this significant difference. The higher levels of capitalization in Moscow banks certainly play a role. The underlying reasons may include differences in bank operations, differences in banks' clientele and differences in bank supervision and regulation. Answering the highly interesting question on why the regional differences emerge would clearly merit a study of its own. Finally, similar to our expectations, banks that became part of the deposit insurance system in the first wave are more stable.

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[15] The z-score regressions are based on the full set of commercial banks, including the three large ones. As a robustness check we did run the estimations without the big three banks, but the results stay unchanged.

Finally, we conclude that the bank-specific characteristics do have a significant role in explaining insolvency risk. In line with earlier literature (e.g. [36]), we find that higher liquidity implies higher insolvency risk. We include an interaction variable of bank size and liquidity, which confirms that large liquid banks are more stable. The growth of a bank's loan stock is used to control for the credit risk. In line with Maechler et al. (2007) [36], its impact is positive in our estimations and this indicates higher stability. This result holds true for Moscow-based banks, while for regional banks the estimated coefficient is negative. We also control for the interaction of bank size and credit growth to see if credit growth affects small banks differently. We find that large banks with high credit growth are in fact more stable than the rest of the sector.

Table 3.

Estimation results

	Estimated coefficient
Size (total assets)	−0,262***
Loans to households (prop. of loans)	−0,355***
Liquidity (liquid to total assets)	−0,616***
Credit growth	0,015***
OWNERSHIP, LOCATION AND DEPOSIT INSURANCE	
Deposit insurance	0,104***
Foreign bank	−0,572***
State-controlled bank	−0,534***
Moscow-based bank	0,501***
INTERACTIONS	
Size and liquidity	0,054***
Size and credit growth	0,003***
Size and state-controlled	0,100***
Number of observations	27353
R^2	0,426

Note: The table contains results for the FEVD regression. We report estimated coefficients as well as their significance (***significant at 1%, ** significant at 5% and * significant at 10%). Seasonal and yearly dummy variables as well as a constant term are included but not reported.

We test the robustness of our empirical results using several techniques.

- First, the results are robust to the exclusion of the three largest state-controlled banks (Sberbank, Gazprombank, VTB) from the sample.
- We split the sample into Moscow-based and regional banks. The FEVD regression model is run for the two subgroups separately. Except for the significance of credit

growth, other results for both subgroups are in line with the results of the main model reported above. Nevertheless, the model seems to fit a little bit better the Moscow-based banks, which account for about 85% of the banking sector assets.

- Finally, the results for the subsample of the 300 largest banks also correspond to our main results reported in Table 3. They only differ in the sign of the deposit insurance scheme dummy variable. In this case it is negative, which means that the banks that entered the system in the first wave are more risky. This is in line with the results of univariate analysis of financial ratios performed in the first part of the paper.

4.3. Z-score components

The z-score measure consists of three main components: the return on assets, capitalization and the volatility of the ROA. In order to investigate the contribution of each of them to explaining differences in the banks' stability, we run our basic model using all of these components as a dependent variable. This approach is in line with previous literature [21, 36]. We report the results of the z-score component regressions in the following, Table 4.

The first component of the z-score measure is capitalization[16]. In this case, the fit measured by R^2 is the highest of all the z-score components. The estimated coefficients are larger than for the other z-score components and almost all of them are significant. The estimated coefficients are mostly in line with the results of the main model, which indicates that the majority of the main results are driven by the contribution of the capitalization ratio. Larger banks have lower capitalization and this result undoubtedly drives our final result that banks with a higher amount of total assets are in general less stable. More liquid banks have lower capitalization, which indicates that banks substitute between liquidity and solvency risk. Nevertheless, liquid large banks tend to have higher capitalization. Both state-controlled and foreign ones are in general better capitalized than private ones. The effect of deposit insurance participation on capitalization is significantly negative. Banks in the deposit insurance system do seem to substitute deposit insurance for capital, or put in other words, take more risks for the same level of capital. This result is in line with earlier literature [23].

The second column contains results for the regression with the ROA as the dependent variable. Similar to the capitalization component of the z-score, almost all the estimated coefficients are significant for the ROA. However, the majority of their signs differ from the results in the main z-score regression. Higher credit growth as well as a higher share of loans to individuals in a bank's loans portfolio are positively related to profitability. Higher liquidity positively influences profitability as measured by the ROA. Given the fact that the average real interest rate on corporate loans was close to zero for much of the period, this is not entirely surprising. Many banks make more than half of their revenues from foreign currency operations. When accounting for a bank's ownership, foreign banks and state-controlled banks have a significantly higher ROA than domestic private ones. Large state-controlled banks are, however, less profitable. Banks included in the DIS in the «first wave» have significantly higher pro-

[16] Capitalization is, similar to the calculation of the z-score, calculated as the four-quarter moving average. The other z-score components, the ROA and volatility of the ROA, are calculated in the same way.

fitability than the others, which is in line with our previous result indicating that better banks entered the system first. Moscow-based banks are in general less profitable.

Table 4.

Z-score component regressions

	Capitalization	ROA	Volatility of ROA
	Estimated coefficient	Estimated coefficient	Estimated coefficient
Size (total assets)	−0,085***	0,0002***	−0,003***
Loans to households	−0,076***	0,005***	0,001**
Liquidity	−0,181***	0,003***	0,0004
Credit growth	0,003***	0,0002***	−0,0002***
OWNERSHIP, LOCATION AND DEPOSIT INSURANCE			
Deposit insurance	−0,010***	0,001***	−0,002***
Foreign bank	0,092***	0,002***	0,009***
State-controlled bank	0,082***	0,004***	0,006***
Moscow-based bank	0,134***	−0,003***	0,001***
INTERACTIONS			
Size and liquidity	0,002**	−2,8E−05	−0,001***
Size and credit growth	−3,0E-04***	−2,3E-05***	−1,2E-05
Size and state-controlled	0,001	−0,001***	−0,0005**
Number of observations	27353	27353	27353
R^2	0,785	0,356	0,361

Note: The table contains estimation results of the model described above for different z-score components. We report the estimated coefficients as well as their significance (* significant at 10%, ** significant at 5% and *** significant at 1%). Seasonal and yearly dummy variables as well as a constant term are included but not reported.

The last component of our risk measure is the volatility of the ROA as measured by the standard deviation. Most of the estimated coefficients in this regression are significant but have a different sign than the results presented in our main model. They are also lower in absolute values and therefore, unlike the measure of capitalization, they contribute less to the main results. Thus, the analysis of the z-score components indicates that the differences in the risk profiles of banks are mostly driven by the differences in capitalization.

5. Conclusion

Favourable macroeconomic conditions and important regulatory reforms have backed the rapid growth of Russia's banking sector during this decade. As the economy is increasingly monetized, the role of banks and other financial intermediaries in supporting the continuous growth of investments and private consumption is gaining more importance. Therefore the stability of the banking sector is even more crucial. Compared to most European countries the Russian banking sector is still rightfully characterized as small, regionally fragmented and dominated by a few large state-controlled entities.

On average, the Russian banking sector is believed to be in good financial shape as evidenced also by the Banking Supervision Reports of the CBR. For this paper we use a bank-level dataset on all Russian banks to examine how various measures of risk vary with a bank's size, ownership, location and inclusion in the deposit insurance system. The main objective is the detailed examination of how these various groups of banks differ in their attitudes to risk. We employ two approaches; group-wise comparisons of financial ratios and regression analysis using a z-score measure of bank insolvency risk. The analysis of financial ratios reveals that even though the ratios point to increasing risk over time, they are still on average well on the safe side within all groups of banks. The average levels are all above the regulatory minima set by the Russian Central Bank. Moreover, they are comparable to other transition economies. The rapid growth of the banking sector has not led to excessive risk-taking on average.

The regression analysis of the bank insolvency measure (z-score) proved to be a useful means of deepening the results of group-wise comparisons. Controlling for bank characteristics, large banks in Russia have higher insolvency risk than small ones. Second, in line with the previous literature on emerging economies, foreign-owned banks exhibit higher insolvency risk than domestic banks. Even though the foreign bank presence may in general greatly increase banking sector efficiency and widen the range of banking services available, foreign-owned banks in Russia seem to bear higher risks. The same holds true for the state-controlled banks; however, the large state-controlled banks are more stable than the others. Third, we find that the regional banks are significantly more prone to risk-taking than their counterparts in Moscow. Regional banks only account for a small fraction of the total banking sector assets, thus this finding should not be alarming for the banking sector as a whole.

All in all, we find that risk-taking by Russian banks is approaching levels comparable to other emerging economies. Further, factors similar to those in emerging European economies seem to explain levels of insolvency risk in Russia. We also briefly examined if inclusion in the Russian deposit insurance scheme has influenced a bank’s insolvency risk. The results are mixed and further research on this topic is clearly needed.

* *
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Appendix

Table A.1.

Summary statistics of the main variables

Variable	Obs	Mean	Median	Std. dev.
Z-score (ln)	34700	4,25	4,20	1,24
Total assets	41382	4105	307	52706
Liquidity ratio	41380	0,33	0,28	0,22
Loan loss provisions	40130	0,07	0,03	0,12
Credit growth	33969	4,64	0,39	209,05
GDP growth	40971	0,02	0,06	0,10

Note: Summary statistics for the observations that are actually used in the z-score regression are not significantly different from these figures.

Table A.2.

Capitalization ratio of banks by ownership, region, size and inclusion in DIS

CAPITALIZATION		1999	2000	2001	2002	2003	2004	2005	2006	2007
TOTAL SAMPLE	obs.	1469	1322	1312	1237	1327	1323	1238	856	1015
	med	0,362	0,333	0,318	0,322	0,303	0,278	0,243	0,187	0,190
OWNERSHIP GROUPS										
Private	obs.	1420	1271	1258	1182	1265	1258	1170	795	946
	med	0,366	0,337	0,323	0,329	0,306	0,281	0,246	0,191	0,190
State-controlled	obs.	30	30	32	30	33	32	32	29	32
	med	0,287	0,287	0,250	0,250	0,232	0,222	0,177	0,138	0,150
Foreign	obs.	19	21	22	25	29	33	36	32	37
	med	0,111	0,175	0,236	0,258	0,239	0,236	0,206	0,177	0,160
medians significantly different		yes	yes	yes	yes	yes	yes	yes	yes	yes
REGION										
Moscow-based banks	obs.	567	570	586	614	643	661	620	357	469
	med	0,378	0,359	0,350	0,354	0,328	0,308	0,275	0,195	0,190
Regional banks	obs.	588	591	595	598	684	662	618	499	546
	med	0,359	0,315	0,297	0,298	0,284	0,251	0,213	0,182	0,178
medians significantly different		no	yes	yes	yes	yes	yes	yes	no	no
SIZE CATEGORIES										
Small	obs.	489	440	436	411	439	439	412	285	338
	med	0,539	0,454	0,434	0,439	0,407	0,381	0,330	0,269	0,280
Medium-sized	obs.	490	441	438	413	444	442	413	285	338
	med	0,387	0,349	0,306	0,307	0,301	0,281	0,237	0,180	0,190

Continued

CAPITALIZATION		1999	2000	2001	2002	2003	2004	2005	2006	2007
Large	obs.	487	438	435	410	441	439	410	283	336
	med	0,235	0,227	0,243	0,259	0,240	0,217	0,182	0,142	0,130
The Big 3	obs.	3	3	3	3	3	3	3	3	3
	med	0,112	0,244	0,248	0,254	0,183	0,180	0,128	0,128	0,160
medians significantly different		yes	yes	yes	yes	yes	yes	yes	yes	yes
DEPOSIT INSURANCE SCHEME (DIS)										
Included in DIS	obs.					801	801	802	649	632
	med					0,284	0,255	0,213	0,172	0,162
Not included in DIS	obs.					419	522	436	207	172
	med					0,367	0,338	0,312	0,258	0,251
medians significantly different						yes	yes	yes	yes	yes

Note: In order to utilize all the available data, all the indicators are calculated at the end of the first quarter of each year.

Table A.3.

Loans to assets ratio by bank ownership, location, size and participation in the deposit insurance scheme

LOANS TO ASSETS RATIO		1999	2000	2001	2002	2003	2004	2005	2006	2007
TOTAL SAMPLE	obs.	1469	1326	1313	1238	1331	1326	1238	856	1015
	med	0,481	0,428	0,485	0,521	0,535	0,555	0,582	0,614	0,627
OWNERSHIP GROUPS										
Private	obs.	1420	1275	1259	1183	1269	1261	1170	795	946
	med	0,481	0,431	0,491	0,524	0,538	0,556	0,584	0,616	0,628
State-controlled	obs.	30	30	32	30	33	32	32	29	32
	med	0,431	0,418	0,474	0,520	0,531	0,591	0,594	0,633	0,669
Foreign	obs.	19	21	22	25	29	33	36	32	37
	med	0,428	0,276	0,257	0,294	0,414	0,309	0,368	0,500	0,495
medians significantly different		no	yes	yes	yes	yes	yes	no	no	yes
REGION										
Moscow-based banks	obs.	567	571	586	615	646	663	620	357	469
	med	0,425	0,401	0,451	0,493	0,496	0,506	0,515	0,550	0,561
Regional banks	obs.	588	593	595	598	685	663	618	499	546
	med	0,462	0,437	0,505	0,541	0,564	0,596	0,635	0,651	0,659
medians significantly different		yes	yes	yes	yes	yes	yes	yes	yes	yes

Continued

LOANS TO ASSETS RATIO		1999	2000	2001	2002	2003	2004	2005	2006	2007
SIZE CATEGORIES										
Small	obs.	489	442	437	412	443	442	412	285	338
	med	0,503	0,436	0,499	0,496	0,487	0,516	0,554	0,598	0,552
Medium-sized	obs.	490	442	438	413	444	442	413	285	338
	med	0,486	0,459	0,479	0,522	0,555	0,578	0,585	0,62	0,631
Large	obs.	487	439	435	410	441	439	410	283	336
	med	0,443	0,395	0,478	0,538	0,545	0,568	0,596	0,622	0,671
The Big 3	obs.	3	3	3	3	3	3	3	3	3
	med	0,332	0,363	0,472	0,530	0,437	0,577	0,590	0,495	0,486
medians significantly different		yes	yes	no	no	yes	yes	no	no	yes
DEPOSIT INSURANCE SCHEME										
Included in DIS	obs.					801	801	802	649	632
	med					0,556	0,583	0,610	0,631	0,654
Not included in DIS	obs.					419	525	436	207	172
	med					0,490	0,497	0,503	0,516	0,595
medians significantly different						yes	yes	yes	yes	yes

Note: In order to utilize all the available data, all the indicators are calculated at the end of the first quarter of each year.

Table A.4.

Nonperforming loans to total loans by bank ownership, location, size and the deposit insurance scheme

NONPERFORMING LOANS		1999	2000	2001	2002	2003	2004	2005	2006	2007
TOTAL SAMPLE	obs.	1423	1275	1265	1181	1280	1277	1226	853	1009
	med	0,019	0,008	0,004	0,003	0,003	0,003	0,005	0,009	0,007
OWNERSHIP GROUPS										
Private	obs.	1374	1226	1214	1128	1220	1214	1159	792	940
	med	0,019	0,008	0,004	0,003	0,003	0,003	0,005	0,009	0,007
State-controlled	obs.	30	30	31	30	33	32	32	29	32
	med	0,022	0,014	0,005	0,014	0,009	0,008	0,008	0,010	0,008
Foreign	obs.	19	19	20	23	27	31	35	32	37
	med	0,000	0,000	0,000	0,002	0,000	0,000	0,000	0,003	0,001
medians significantly different		no	yes	no	yes	yes	yes	yes	no	yes
REGION										
Moscow-based banks	obs.	537	541	559	575	612	630	608	356	464
	med	0,001	0,000	0,000	0,000	0,001	0,001	0,002	0,009	0,006
Regional banks	obs.	575	574	578	582	668	647	618	497	545
	med	0,040	0,018	0,009	0,006	0,006	0,006	0,008	0,009	0,008
medians significantly different		yes	yes	yes	yes	yes	yes	yes	no	yes
SIZE CATEGORIES										
Small	obs.	454	408	403	367	406	406	403	282	333
	med	0,036	0,012	0,008	0,000	0,002	0,001	0,003	0,008	0,005
Medium-sized	obs.	482	432	428	404	436	433	410	285	337
	med	0,011	0,008	0,003	0,003	0,004	0,003	0,004	0,007	0,005
Large	obs.	484	432	431	407	435	435	410	283	336
	med	0,020	0,007	0,003	0,004	0,005	0,005	0,007	0,010	0,009
The Big 3	obs.	3	3	3	3	3	3	3	3	3
	med	0,149	0,046	0,023	0,027	0,019	0,017	0,015	0,012	0,012
medians significantly different		yes	no	no	yes	yes	yes	yes	yes	yes
DEPOSIT INSURANCE										
Included in DI	obs.					797	798	802	647	630
	med					0,005	0,005	0,007	0,008	0,009
Not included in DI	obs.					403	419	424	205	172
	med					0,001	0,001	0,002	0,010	0,005
medians significantly different						yes	yes	yes	no	yes

Note: In order to utilize all the available data, all the indicators are calculated at the end of the first quarter of each year.

Table A.5.

Loan loss provisions by bank ownership, location, size and participation in the deposit insurance scheme

LOAN LOSS PROVISIONS		1999	2000	2001	2002	2003	2004	2005	2006	2007
TOTAL SAMPLE	obs.	1423	1275	1264	1181	1280	1277	1226	853	1009
	med	0,054	0,043	0,030	0,025	0,024	0,025	0,033	0,036	0,038
OWNERSHIP GROUPS										
Private	obs.	1374	1226	1213	1128	1220	1214	1159	792	940
	med	0,055	0,043	0,030	0,025	0,025	0,025	0,035	0,038	0,039
State-controlled	obs.	30	30	31	30	33	32	32	29	32
	med	0,061	0,042	0,025	0,031	0,027	0,022	0,025	0,029	0,032
Foreign	obs.	19	19	20	23	27	31	35	32	37
	med	0,018	0,037	0,022	0,013	0,015	0,011	0,005	0,011	0,012
medians significantly different		yes	no	no	yes	no	no	yes	yes	yes
REGION										
Moscow-based banks	obs.	537	541	559	575	612	630	608	356	464
	med	0,025	0,022	0,016	0,018	0,024	0,022	0,039	0,053	0,051
Regional banks	obs.	575	574	578	582	668	647	618	497	545
	med	0,081	0,063	0,038	0,030	0,025	0,026	0,030	0,030	0,032
medians significantly different		yes	yes	yes	yes	no	no	yes	yes	yes
SIZE CATEGORIES										
Small	obs.	454	408	403	367	406	406	403	282	333
	med	0,068	0,056	0,032	0,018	0,017	0,019	0,028	0,030	0,039
Medium-sized	obs.	482	432	428	404	436	433	410	285	337
	med	0,038	0,037	0,027	0,025	0,023	0,021	0,030	0,036	0,037
Large	obs.	484	432	430	407	435	435	410	283	336
	med	0,057	0,043	0,030	0,030	0,031	0,032	0,042	0,042	0,039
The Big 3	obs.	3	3	3	3	3	3	3	3	3
	med	0,199	0,090	0,067	0,060	0,054	0,061	0,037	0,037	0,036
medians significantly different		yes	yes	no	yes	yes	yes	yes	yes	no
DEPOSIT INSURANCE SCHEME										
Included in DIS	obs.					797	797	802	647	630
	med					0,026	0,027	0,031	0,032	0,036
Not included in DIS	obs.					403	480	424	206	172
	med					0,021	0,021	0,042	0,066	0,059
medians significantly different						yes	yes	yes	yes	yes

Note: In order to utilize all the available data, all the indicators are calculated at the end of the first quarter of each year.

Table A.6.

Liquidity ratio by bank ownership, location, size and participation in the deposit insurance scheme

LIQUIDITY RATIO		1999	2000	2001	2002	2003	2004	2005	2006	2007
TOTAL SAMPLE	obs.	1469	1326	1311	1238	1331	1326	1238	856	1015
	med	0,236	0,301	0,291	0,283	0,284	0,281	0,256	0,222	0,220
OWNERSHIP GROUPS										
Private	obs.	1420	1275	1257	1183	1269	1261	1170	795	946
	med	0,231	0,299	0,287	0,279	0,276	0,278	0,255	0,221	0,220
State-controlled	obs.	30	30	32	30	33	32	32	29	32
	med	0,334	0,328	0,315	0,325	0,296	0,269	0,224	0,195	0,180
Foreign	obs.	19	21	22	25	29	33	36	32	37
	med	0,420	0,590	0,521	0,518	0,429	0,405	0,334	0,230	0,260
medians significantly different		yes	yes	yes	yes	yes	yes	yes	no	no
REGION										
Moscow-based banks	obs.	567	571	586	615	646	663	620	357	469
	med	0,279	0,344	0,338	0,321	0,334	0,335	0,322	0,278	0,280
Regional banks	obs.	588	593	595	598	685	663	618	499	546
	med	0,259	0,296	0,271	0,258	0,247	0,240	0,201	0,187	0,180
medians significantly different		no	yes	yes	yes	yes	yes	yes	yes	yes
SIZE CATEGORIES										
Small	obs.	489	442	437	412	443	442	412	285	338
	med	0,184	0,249	0,253	0,274	0,281	0,277	0,253	0,234	0,290
Medium-sized	obs.	490	442	437	413	444	442	413	285	338
	med	0,218	0,295	0,289	0,284	0,277	0,291	0,263	0,230	0,220
Large	obs.	487	439	434	410	441	439	410	283	336
	med	0,298	0,370	0,323	0,288	0,288	0,279	0,254	0,200	0,180
The Big 3	obs.	3	3	3	3	3	3	3	3	3
	med	0,406	0,283	0,304	0,261	0,354	0,273	0,265	0,230	0,230
medians significantly different		yes	yes	yes	no	no	no	no	no	yes
DEPOSIT INSURANCE (DI)										
Included in DI	obs.					801	802	802	649	632
	med					0,265	0,268	0,226	0,199	0,185
Not included in DI	obs.					419	434	436	206	172
	med					0,316	0,329	0,336	0,315	0,290
medians significantly different						yes	yes	yes	yes	yes

Note: In order to utilize all the available data, all the indicators are calculated at the end of the first quarter of each year.

Table A.7.

Net interest margin to total loans by bank ownership, location, size and participation in the deposit insurance scheme

NET INTEREST MARGIN		1999	2000	2001	2002	2003	2004	2005	2006	2007
TOTAL SAMPLE	obs.	1423	1277	1262	1181	1280	1277	1229	761	942
	med	0,023	0,035	0,029	0,036	0,033	0,029	0,028	0,025	0,024
OWNERSHIP GROUPS										
Private	obs.	1374	1229	1211	1129	1221	1214	1161	709	878
	med	0,023	0,036	0,030	0,036	0,033	0,029	0,028	0,025	0,024
State-controlled	obs.	30	29	31	30	33	32	32	25	32
	med	0,042	0,046	0,034	0,041	0,030	0,024	0,023	0,018	0,020
Foreign	obs.	19	19	20	22	26	31	36	27	32
	med	0,016	0,015	0,016	0,013	0,014	0,012	0,013	0,017	0,020
medians significantly different		yes	yes	yes	yes	yes	yes	yes	yes	yes
REGION										
Moscow-based banks	obs.	537	544	560	575	612	630	611	311	434
	med	0,014	0,020	0,018	0,028	0,026	0,025	0,028	0,025	0,026
Regional banks	obs.	575	574	578	583	668	647	618	450	508
	med	0,046	0,053	0,040	0,044	0,038	0,032	0,027	0,024	0,023
medians significantly different		yes	yes	yes	yes	yes	yes	no	no	yes
SIZE CATEGORIES										
Small	obs.	454	411	405	368	406	406	406	246	286
	med	0,040	0,053	0,040	0,048	0,047	0,039	0,036	0,032	0,032
Medium-sized	obs.	482	431	425	403	436	433	410	263	327
	med	0,030	0,039	0,031	0,036	0,032	0,029	0,028	0,023	0,024
Large	obs.	484	433	429	407	435	435	410	249	326
	med	0,016	0,024	0,024	0,029	0,027	0,024	0,023	0,021	0,019
The Big 3	obs.	3	2	3	3	3	3	3	3	3
	med	0,006	0,006	0,008	0,021	0,015	0,014	0,017	0,018	0,014
medians significantly different		yes	yes	yes	yes	yes	yes	yes	yes	yes
DEPOSIT INSURANCE SCHEME										
Included in DIS	obs.	777	778	785	733	797	799	802	587	694
	med	0,033	0,040	0,035	0,038	0,033	0,029	0,026	0,024	0,022
Not included in DIS	obs.	349	347	356	355	403	418	424	173	217
	med	0,023	0,028	0,024	0,033	0,031	0,029	0,031	0,028	0,029
medians significantly different		yes	yes	yes	yes	yes	no	yes	yes	yes

Note: In order to utilize all the available data, all the indicators are calculated at the end of the first quarter of each year.

Table A.8.

Variable description

VARIABLE	DESCRIPTION
Size	total assets, mln.RUB
Capitalization	ratio of equity to total assets
Loans to assets	ratio of total loans (to nonfinancial clients) to total assets
Nonperforming loans	ratio of nonperforming loans to total loans
Loan loss provisions	ratio of loan loss provisions to total loans
Liquidity ratio	ratio of liquid assets to total assets
Loans to individuals	ratio of loans to individuals to total loans
Net interest margin	the difference between interest income from loans to customers and interest expense paid on customer deposits as a proportion of total loans
Credit growth	annual change in loans to nonfinancial clients
Oil price	average export price for crude oil for preceding quarter ($ per ton), Rosstat
GDP growth	quarterly growth of real GDP, Rosstat
DUMMY VARIABLES	
Foreign bank	100% foreign owned bank as reported quarterly by the CBR
State-controlled bank	bank included in the list of state banks by Vernikov (2007)
Moscow bank	bank's headquarters are located in Moscow
Big 3	three largest banks by assets: Sberbank, VTB and Gazprombank
Deposit insurance system	bank entered DIS before the end of the first quarter of 2005
REGULATION RATIOS	
N1 – capital adequacy ratio	bank's equity capital to the overall risk-weighted assets minus the sum of the reserves created for the depreciation of securities and possible losses
N2 – quick liquidity ratio	sum of the bank's highly liquid assets to the sum of the bank's liabilities on demand accounts
N3 – current liquidity ratio	sum of the bank's liquid assets to the sum of the bank's liabilities on demand account and accounts up to 30 days
N7 – maximum large credit risk	percentage of the total amount of large credit risks (which is the sum of the bank's risk-weighted claims to one borrower) in the bank's equity capital