

Survival of Russian banks: how efficient are the control measures?

Angel Barajas

Universidad de Vigo, Vigo, Spain and

Department of Finance, HSE University, Moscow, Russian Federation

Victor Krakovich

HSE University Saint Petersburg, Sankt-Peterburg, Russian Federation, and

Félix J. López-Iturriaga

Department of Finance and Accounting, University of Valladolid, Valladolid, Spain and

HSE University Perm, Perm, Russian Federation

Abstract

Purpose – In this paper, the authors study the failure of Russian banks between 2012 and 2019.

Design/methodology/approach – The authors analyze the entire population of Russian banks and combine a logit model with the survival analysis.

Findings – In addition to the usual determinants, the authors find that not-failed banks have higher levels of fulfillment of the Central Bank requirements of solvency, liquidity, provide fewer loans to their shareholders and own more shares of other banks. The results of this study suggest an asymmetric effect of the strategic orientation of banks: whereas the proportion of deposits from firms is negatively related to the probability of failure, the loans to firms are positively related to bankruptcies. According to this research, the fact of being controlled by a foreign bank has a significant negative relationship with the likelihood of failure and moderates the effect of bank size, performance and growth on the bankruptcy likelihood.

Practical implications – On the whole, the results of this study support the new Central Bank rules, but show that the thresholds imposed by the Russian regulator actually do not make a difference between failed and not failed banks in the short and medium term.

Originality/value – The authors specially focus on the effectiveness of new rules issued by the Central Bank of Russia in 2013.

Keywords Bankruptcy, Bank failure prediction, Capital adequacy, Russia

Paper type Research paper

1. Introduction

According to the official statistics of Russian Central Bank [1], in 2013, there were 953 banks in the Russian Federation. Seven years later, only 427 banks remained. The Russian banking system seems to mimic with some lag the trend in other institutional settings such as the USA or the European Union. Eurostat reports, in the same period, the number of banks decreased from 7,727 to 5,442, i.e. a reduction of 29.6%. Within the EU – considering the data from the



JEL Classification — E58, G21, G33

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Statistical Data Warehouse of the European Central Bank [2] – this fall is stronger in countries such as the Netherlands (65.6%), Denmark (37.9%) or France (34.5%). Especially significant is the case of the Spanish saving banks (*Cajas de ahorro*), some hundred-year old deposit institutions that merged or were acquired by commercial banks. Thus, at the light of what happened in European countries some years earlier, it could be of interest to understand the process of banking restructuring in other countries as Russia. Furthermore, this process of shrinking of the banking system has not ended in Russia, so that a better knowledge of the recent past could provide the policy makers with effective tools to guide forthcoming episodes.

In this paper we study the failure of Russian banks between 2012 and 2019. The wave of failures among Russian banks can have dramatic social consequences and be detrimental for the stability of the financial system as a whole (Fungáčová and Weill, 2013). However, at the same time, the banking concentration can strengthen the financial system because bigger banks have better chances to diversify their risk, and it is easier to monitor a reduced number of banks (Etudaiye-Muhtar and Abdul-Baki, 2021). Although there are a number of papers about bankruptcy prediction in Russian banks, most of them are based on outdated data, so that there is room for new evidence. The appointment of Elvira Nabiullina the head of the Central Bank of Russia (CBR) in 2013 is a turning point in the financial history of Russia and has resulted in a far-reaching process of cleaning the country's banking sector (Fojcik, 2019; The Economist, 2017). With the exception of Mäkinen and Solanko (2018) and Zubarev and Bekirova (2020), who analyze information for the 2013–2017 and 2013–2019 periods, the prior studies use data sets well before the new policy [3]. Malyutina and Parilova (2001) show that, both before the 1998 crisis and right after it, the Russian regulator followed forbearance policy and followed discretion rather than a rule to withdraw the banking license. Besides, the too-big-to-fail mantra seemed to be important for the CBR and Bochenkova (2017) states that noncompliance with the risk-regulating norms can have led sometimes to higher survival chances.

The CBR has established a set of rules to monitor the activity of the banks, being the guidelines N199-I of 29.11.2019 the most recent version. These rules are aimed to control for sufficiency of capital, current and long-term liquidity, large credit risks, the amount of loans, the bank guarantees provided to the bank's shareholders, the cumulative risk for bank insiders, and the use of the bank's funds to purchase shares of other legal entities. To the best of our knowledge, these norms have received scarce attention in other failure prediction models, and we extend our field of knowledge by testing the effect of these rules on the probability of bank survival. Thus, we address the following two research questions: (1) which are the main characteristics of Russian banks that allow predicting the bankruptcy likelihood; and (2) whether the fulfillment of the CBR assures the survival of financial institutions.

We combine a logit model with the survival analysis and study three sets of banks characteristics: the usual financial issues such as size, growth and profitability, the strategic orientation in deposits and loans and the characteristics related to the ownership of the bank. We try to fill three gaps in the literature on banks failure prediction. First, we consider the bank strategic orientation (i.e. corporate oriented vs. retail banking) to know whether the type of bank business can have any relationship with the likelihood of failure. Second, we develop our analysis in the framework of the CBR new policy and check whether the fulfillment of the financial requirements is enough to avoid the bankruptcy, and to which extent these requirements can serve as an early warning signal. Third, we combine two empirical methods (logistic regression and survival analysis) to reinforce the reliability of our results.

Our research shows that not-failed banks are significantly larger and more profitable. These banks also have higher levels of fulfillment of the CBR requirements of solvency, liquidity, provide fewer loans to their shareholders and own more shares of other banks. We also find an asymmetric effect of the strategic orientation of banks: whereas the proportion of deposits from firms is negatively related to the probability of failure, the loans to firms are

positively related to bankruptcies. According to our research, the fact of being controlled by a foreign bank has a significant negative relationship with the likelihood of failure. Not only is there a direct relationship but the foreign ownership also moderates the effect of bank size, performance and growth on the bankruptcy likelihood.

The next section of the paper presents the framework of the Russian financial system and reviews the literature. [Section 3](#) describes the main aspects of the methodology. We report univariate analyses, discuss multivariate results, and present several additional analyses in [section 4](#). Finally, [section 5](#) concludes.

2. Theoretical background

2.1 *The Russian banking system*

The commercial banking sector in Russia is young. Under the centralized planned economy in 1986, the former USSR had just four banks; all of them were state-owned and each one was dedicated to a certain function [\[4\]](#). [Karminsky and Kostrov \(2017\)](#) identify four stages in the development of the commercial banking sector in Russia: the period from 1988 to 1999 can be considered the formation, followed by a rapid development between 2000 and 2008. Then, the 2008–2009 financial crises appeared and, finally since 2010, the banking industry is in a restructuring process.

In the first years of the current century, along with a fast-economic growth, the banking regulations were substantially improved. Private deposit insurance and Basel I compliance were enacted. The CBR introduced curators for each bank who individually monitored prudential ratios on a daily basis ([Lanine and Vennet, 2006](#)). Russia was severely affected by the 2007–2008 world financial crises and the CBR bailed out several systemic banks ([Fidrmuc and Süss, 2011](#)). The latest years have witnessed a strengthening of the regulation adopted by the CBR, especially after the appointment of Elvira Nabiullina as the head of the CBR in 2013. The so-called “cleaning up” policy entered into force and, in the period 2013–2020, on average 67 banks per year disappeared in Russia.

This policy implies removing the unsustainable players from the Russian financial sector. On top of that, the Central Bank works on the improvement of the banking regulation (e.g. adoption of Basel III), supporting the competition (e.g. promoting of free interbank payment system for private clients), the adoption of new technologies (e.g. blockchain and biometric identification) and fostering banks transparency (e.g. publishing financial statements monthly and quarterly of each commercial bank on the Central Bank website).

2.2 *Literature review*

The research on bank’s failure prediction model has a longstanding tradition and, so far, there is no single universally accepted method and the choice can be affected a number of different factors ([Kovacova et al., 2019](#); [Moreno et al., 2022](#); [Wu et al., 2010](#)). [Alaka et al. \(2018\)](#) classify the models of bankruptcy prediction into two groups: the statistical tools and the artificial intelligence methods. Among the first ones, they underline the multiple discriminant analysis and logistic regression. Although the discriminant analysis was the primary method, the research has shifted to logit analysis and neural networks ([Bellovary et al., 2007](#)). The logistic regression outperforms the discriminant analysis in the way it involves qualitative alongside quantitative variables.

The predictive accuracies of different models seem to be generally comparable, although artificially intelligent expert system models perform marginally better than statistical models ([Jing and Fang, 2018](#); [Tseng and Hu, 2010](#)). However, [Le and Viviani \(2018\)](#) found that there is not a big difference in the prediction accuracy between neural network methods and the traditional logistic regression. Moreover, the traditional logistic regression models perform

quite well and machine learning techniques can just help to detect the most difficult cases. Some recent examples of authors who employ the logit regression are [Betz *et al.* \(2014\)](#), [Lin and Yang \(2016\)](#) and [Pessarossi *et al.* \(2020\)](#) in the international arena. This method has been widely used in the research on the Russian banking system by [Claeys and Schoors \(2007\)](#), [Fidrmuc and Süß \(2011\)](#), [Fungáčová and Weill \(2013\)](#), [Karminsky and Kostrov \(2017\)](#), [Lanine and Vennet \(2006\)](#), [Peresetsky *et al.* \(2011\)](#), [Styrin \(2005\)](#), [Zakirova *et al.* \(2018\)](#), [Zhivaikina and Peresetsky \(2017\)](#) and [Zubarev and Bekirova \(2020\)](#) for the Russian case.

An important issue in the models of bankruptcy prediction is the selection of factors. A large group of literature uses the so-called CAMEL (Capital, Asset Quality, Management, Earnings and Liquidity) indicators ([Petropoulos *et al.*, 2020](#)). Consistently with this view, the models of bankruptcy prediction of Russian banks have highlighted the role of financial indicators as determinants of bankruptcy. The liquidity and the liquidity creation are the main factors for [Fidrmuc and Süß \(2011\)](#) and [Zubarev and Bekirova \(2020\)](#), although earnings, the assets quality and the capital adequacy are also important determinants ([Lanine and Vennet, 2006](#)). In addition, the impact of capital adequacy and earnings decreases with the lag length, such that the level of liquidity is the only significant indicator for longer lags ([Mäkinen and Solanko, 2018](#)). [Zubarev and Bekirova \(2020\)](#) find some evidence that excessive reserves are an important indicator of default as well, which can be due to the possible losses these reserves are supposed to make up for. Interestingly, [Bochenkova \(2017\)](#) and [Malyutina and Parilova \(2001\)](#) report a change in the Central Bank or Russia procedures since the violation of prudential factors did not mean the bank's closure. Tighter competence in the banking system is also positively related to the probability of failure ([Fungáčová and Weill, 2013](#)).

The size of the bank has been one of the most usual determinants of failure probability. As far as Russian banks are concerned, there is no unanimity in the literature regarding this effect. Whereas [Claeys and Schoors \(2007\)](#) and [Fungáčová and Weill \(2013\)](#) find a negative impact of the bank's size on the probability of failure, the lack of significance of this variable in the research of [Lanine and Vennet \(2006\)](#) and [Karminsky and Kostrov \(2017\)](#) suggests that there is no "too-big-to-fail" effect in Russia. The difference in the results might be due to the different set of variables and time periods. Another explanation could be the indirect effect of bank's size since the impact of some financial characteristics is moderated by the size of the entity, making the small and medium-size entities more vulnerable ([Zubarev and Bekirova, 2020](#)).

We expand the set of explanatory variables with two additional types: the ownership structure and the strategical orientation of the bank. The relationship between the ownership structure and the failure likelihood in Russian banks has not yet been analyzed. Related research is that of [Karas *et al.* \(2010\)](#) and [Belousova *et al.* \(2021\)](#), who study the relationship between bank efficiency and find that foreign banks are more efficient than domestic banks.

As far as the bank strategy is concerned, prior literature has analyzed the weight of deposits and loans on the balance sheet but, as far as we are aware, the structure of deposits and loans has not yet taken into account. We posit that when developing the strategy, bank's managers have to decide on the key client segments. This decision is twofold: deposits attraction and loans allocation. For most of the banks the primary segments are individuals and firms. Regarding deposits, [Karminsky and Kostrov \(2017\)](#) highlight the role of the deposits insurance. Firms' deposits are not covered by this insurance, such that firms will be more selective when choosing their bank. In addition, although borrowing from individuals could be cheaper, large exposure to deposits of individuals makes a bank vulnerable to bank runs. Thus, deposits from individuals could enhance the bank's risk appetite. Loans to individuals also have been proved to be riskier than loans to firms in Russia. Although theoretically loans to individuals are more transparent and have higher resistance to abrupt loss of value, the empirical evidence shows that the proportion of this kind of loans on the loan portfolio tends to increase the probability of bank failure for the model with two-quarters

horizon ([Karminsky and Kostrov, 2017](#)). In a more recent study, [Zubarev and Bekirova \(2020\)](#) report that lower proportion of the deposits from individuals and higher proportion of deposits from firms in bank's liability portfolio reduces the failure probability.

3. Empirical methods

3.1 Data set

We have collected a panel data set containing quarterly observations for all Russian banks with license at the beginning of the period of study. The initial number of banks was 954. The observation period is from December 31st 2012 to December 31st 2019. The combination of 954 banks with 29 quarters results in a total sample of 13,578 bank-quarter observations. Our dataset structure is similar to previous studies on the Russian banks probability of default ([Karminsky and Kostrov, 2013, 2014, 2017](#)). If a bank has operated during the whole analyzed period, there will be 29 observations for it. Otherwise, there is data until its failure. The data were collected from the CBR database and Spark database. We picked the data for the variables of interest and merged the separate quarterly data sets into a single one using a script in R programming language. The data on ownership structure were taken from [Karas and Vernikov \(2019\)](#).

3.2 Variables

There is a wide range of variables that can help predict bank failures ([Isik and Uygur, 2021](#)). We define FAILURE, a dummy variable that equals one for all outcomes that mean a failure of the bank strategy. We consider a bank has failed when it stops its operations as independent entity and lose its license. It can be due to voluntary liquidation, license withdrawal by the CBR or supervisory mergers when the failing bank is merged with a more stable, usually bigger, bank.

We consider three sets of independent variables: balance sheet variables that are descriptive of the financial situation of the bank, variables concerning the bank strategical orientation, and variables on the ownership structure (See Appendix for a complete definition of variables). Regarding the financial variables, we select those included in the Central Bank guidelines N199-I to monitor banks activity. These rules aim to control for capital adequacy, current and long-term liquidity, large credit risks, the amount of loans, the bank guarantees provided to the bank's shareholders, the cumulative risk for bank insiders, and the use of the bank's own funds to purchase shares of other legal entities.

First, we use the bank size (SIZE) defined as the log of total assets in Russian rubles. The growth of assets (GROWTH) is defined as the quarterly growth of total assets. Additionally, we also consider the quarterly growth of deposits (DEPOSGROWTH) and of loans (LOANSGROWTH). The return on assets (ROA) is the ratio of earnings before taxes and depreciation over total assets. We define CAPITAL as the ratio of equity to total assets. The Russian Central Banks requires this ratio to be higher than 8% weighted by risk level. LIQ is our measure of current liquidity, i.e. the ratio between assets and liabilities for up to 30 days. We also control for risk accumulation with RISKS, which is the maximum amount of loans, bank guarantees and sureties provided by the bank to its shareholders. This ratio may not exceed 50%. We also introduce the use of the bank's own funds to purchase shares of other legal entities (SHARES). According to the CBR, the aggregate risk of bank investments in shares of other legal entities may not exceed 25% of equity. To avoid any bias due to outliers we drop out the observations beyond the 1 and 99% percentiles.

To measure the strategic orientation of a bank we use two criteria: the deposits portfolio and the loan portfolio. The CBR provides information about the amount of deposits that come both from firms and from individuals. The same information is available about the loans that

are lent to firms and to individuals. Thus, we define CORPDEPOS as the deposits from corporations over the sum of deposits from firms and individuals. Similarly, CORPLOAN is the fraction of loans lent to firms over the sum of loans to firms and individuals.

We use two variables on the ownership structure of the bank. FORCON is a dummy variable that equals 1 when the bank is controlled by a foreign bank that owns more than 50% of the shares and 0 otherwise. FORSUB is a dummy variable that equals 1 when the bank is a subsidiary of a foreign privately-owned bank, and 0 otherwise.

3.3 Method

We first run a descriptive analysis to check whether there are significant differences between the failed and the non-failed banks. This analysis is only a first step and is aimed to shed some initial light on the possible factors explaining the different bankruptcy probability. Secondly, we run an explanatory analysis using the logit regression. Among the possible statistical (i.e. non artificial intelligence based) methods for bank failure prediction, the logit model is likely to be the most popular, especially in Russian samples (Karminsky and Kostrov, 2014, 2017; Peresetsky *et al.*, 2011). We then run some additional analyses: the Kaplan–Meier survival estimate and the Cox regression hazard model. The aim of these latest analyses is to check the robustness of our results and to provide some additional clues about the policies of the CBR. The survival analysis is a more and more common technique in the financial field to estimate the treatment effect on survival after adjusting for other explanatory variables (Caselli *et al.*, 2021). The Kaplan–Meier survival estimate is commonly used to analyze time to event data and to compare two groups of subjects. The Kaplan–Meier survival curve is used to determine the fraction of banks surviving a specified event, during a given period. The Cox regression hazard model explores the relationship between the survival of a bank and the explanatory variables. The dependent variable is the hazard function at a given time t . The advantage of the Cox regression is that the model considers that the effect of time on the hazard of an event changes with time. This form of analysis also allows estimation of the hazard (risk) of default for a bank considering its characteristics (Caselli *et al.*, 2021).

On top of the usual control variables (i.e. size, growth and performance) we first introduce the effect of the measures required by the CBR (solvency, liquidity, credit concentration, shares of other firms, etc.) as shown in Model 1. In this model, CV_i is the vector of control variables and N_i are the regulatory variables. Then we study some issues related to the bank strategy such as the loan and deposit orientation (corporations *vs.* individuals) as shown in Model 2. In Models 3 and 4 we study the effect of the growth and the ownership structure (FORCON and FORSUB are the dummy variables to control for the bank ownership structure, respectively). Some of these models also include interacted variables to check the specific influence of some factors.

$$\text{Logit}(p_i) = \beta_0 + \beta_1 \cdot CV_i + \beta_2 \cdot N_i \quad (1)$$

$$\text{Logit}(p_i) = \beta_0 + \beta_1 \cdot CV_i + \beta_2 \cdot \text{Corporate Deposits} + \beta_3 \cdot \text{Corporate Loans} \quad (2)$$

$$\text{Logit}(p_i) = \beta_0 + \beta_1 \cdot CV_i + \beta_2 \cdot \text{Growth Deposits} + \beta_3 \cdot \text{Growth Loans} \quad (3)$$

$$\text{Logit}(p_i) = \beta_0 + \beta_1 \cdot CV_i + \beta_2 \cdot \text{FORCON} + \beta_3 \cdot \text{FORSUB} \quad (4)$$

4. Results

4.1 Descriptive analysis

In Table 1, we report the main descriptive statistics (mean, standard deviation and quartiles) of our variables. These values are similar to those of previous research (Zubarev and Bekirova, 2020). Table 2 shows the results of the test of means comparisons between the

Table 1.
Descriptive statistics

Variable	# Obs	Mean	Std. Dev.	Q25	Q50	Q75
FAILURE	13,578	0.411	0.492			
SIZE	13,578	22.705	1.842	21.387	22.406	23.764
GROWTH	13,578	0.026	0.125	−0.037	0.015	0.071
ROA	13,578	0.006	0.020	0.001	0.005	0.012
CAPITAL	13,578	24.965	17.200	13.068	18.222	30.885
LIQ	13,578	148.520	112.833	84.598	113.622	165.000
RISKSH	13,578	1.719	4.427	0.000	0.000	0.430
SHARES	13,578	0.841	2.908	0.000	0.000	0.000
CORPDEPOS	13,376	0.304	0.320	0.059	0.178	0.454
CORPLOANS	13,515	0.718	0.258	0.593	0.796	0.916
DEPOSGROWTH	13,375	1.974	92.564	−0.046	0.017	0.091
LOANSRGROWTH	13,517	0.073	3.857	−0.048	0.011	0.073

Note(s): Mean standard deviation and quartiles of the main variables. FAILURE is a dummy variable that equals 1 if the bank has failed during the analysis period, and 0 otherwise; SIZE is the log of total assets (in Russian rubles), GROWTH is the quarterly growth of total assets, ROA (return on assets) is the ratio earnings before taxes and depreciation over total assets, CAPITAL is the ratio of equity to total assets (%), LIQ is the ratio assets over liabilities for up to 30 days (%), RISKSH is the ratio of loans, bank guarantees and sureties provided to the bank shareholders over their total value, SHARES is the ratio of the amounts bank spends to purchase shares of other legal entities to its capital; CORPDEPOS is the proportion of deposits from firms over the sum of deposits from firms and from individuals; CORPLOANS is the proportion of loans to firms over the sum of loans to firms and to individuals; DEPOSGROWTH is the rate of quarterly growth of deposits; LOANSRGROWTH is the rate of quarterly growth of loans

Table 2.
Means comparisons

Variable	Non-failed	Failed	t-test	Variable	Non-failed	Failed	t-test
SIZE	22.947	22.014	31.80***	SHARES	0.893	0.666	5.20***
GROWTH	0.034	0.040	−0.99	CORPDEPOS	0.346	0.282	12.49***
ROA	0.009	0.002	10.46***	CORPLOANS	0.744	0.728	4.19***
CAPITAL	27.149	25.299	6.65***	DEPOSGROWTH	0.288	0.021	1.73*
LIQ	164.99	139.99	13.37***	LOANSRGROWTH	0.019	0.014	1.67**
RISKSH	1.566	1.897	−4.62***				

Note(s): Test of means comparison between failed and non-failed banks. FAILURE is a dummy variable that equals 1 if the bank has failed during the analysis period, and 0 otherwise; SIZE is the log of total assets (in Russian rubles), GROWTH is the quarterly growth of total assets, ROA (return on assets) is the ratio earnings before taxes and depreciation over total assets, CAPITAL is the ratio of equity to total assets (%), LIQ is the ratio assets over liabilities for up to 30 days (%), RISKSH is the amount of loans, bank guarantees and sureties provided to the bank shareholders, SHARES is the use of the bank's own funds to purchase shares of other legal entities; CORPDEPOS is the proportion of deposits from firms over the sum of deposits from firms and from individuals; CORPLOANS is the proportion of loans to firms over the sum of loans to firms and to individuals; DEPOSGROWTH is the rate of quarterly growth of deposits; LOANSRGROWTH is the rate of quarterly growth of loans. ***, ** and * for 99%, 95% and 90% confidence level

failed and the non-failed banks. The picture that emerges is that of significant differences in terms of size, growth, performance, solvency and liquidity. Non-failed banks are significantly larger and more profitable. The test of means comparisons also show that non-failed banks have higher levels of fulfillment of the CBR requirements of solvency, liquidity, provide less guarantees to their shareholders, and own more shares of other banks. On the contrary, failed banks seem less oriented to corporations given the lower proportion of both deposits from firms and of loans to firms (as opposed from and to individuals).

We also report the correlation matrix among the variables (Table 3). Although the correlation coefficients are low, we compute the variance inflation factor (VIF) to test the lack

	FAILURE	SIZE	GROWTH	ROA	CAPITAL	LIQ	RISKSH	SHARES	CORPDEPOS	CORPLOANS	DEPOSGROWTH
SIZE	-0.2057										
GROWTH	0.0007	0.0737									
ROA	-0.0981	0.0127	0.0903								
CAPITAL	-0.079	-0.4958	-0.0412	0.0821							
LIQ	-0.1092	-0.0046	-0.0417	-0.0025	0.1978						
RISKSH	0.0353	-0.0207	-0.0024	-0.0343	-0.031	-0.0492					
SHARES	-0.0317	0.3021	0.0054	-0.0397	-0.1625	-0.0046	0.0268				
CORPDEPOS	-0.1064	0.1216	0.0472	0.0782	0.1898	-0.0248	0.0021	0.0032			
CORPLOANS	0.0423	-0.0243	0.0153	0.0007	0.0663	-0.1258	0.0178	-0.0074	0.11		
DEPOSGROWTH	-0.0075	0.038	0.4001	0.0647	-0.018	0.0092	0.0016	-0.0009	0.0786	0.0062	
LOANSGROWTH	0.0267	0.0464	0.2594	0.0301	-0.0833	-0.1129	0.0113	0.0028	0.0331	0.069	0.1677

Note(s): Matrix of correlations. FAILURE is a dummy variable that equals 1 if the bank has failed during the analysis period, and 0 otherwise; SIZE is the log of total assets (in Russian rubles), GROWTH is the quarterly growth of total assets, ROA (return on assets) is the ratio earnings before taxes and depreciation over total assets, CAPITAL is the ratio of equity to total assets (%), LIQ is the ratio assets over liabilities for up to 30 days (%), RISKSH is the amount of loans, bank guarantees and sureties provided to the bank shareholders, SHARES is the use of the bank's own funds to purchase shares of other legal entities; CORPDEPOS is the proportion of deposits from firms over the sum of deposits from firms and from individuals; CORPLOANS is the proportion of loans to firms over the sum of loans to firms and to individuals; DEPOSGROWTH is the rate of quarterly growth of deposits; LOANSGROWTH is the rate of quarterly growth of loans. ***, ** and * for 99%, 95% and 90% confidence level

Table 3.
Correlation matrix

of multicollinearity in our estimates, and we find that VIF values are all below 2. Given that a lack of multicollinearity is broadly accepted when VIF values are under 5 (Studenmund, 1997), we determine that multicollinearity is not an issue with our sample.

4.2 Explanatory analysis

We follow a parsimonious pattern and initially run a series of models to test the effect of each variable (columns 1–5 in Table 4) before a joint estimate of the effect of all the variables (Column 6). In Column (1), we report the results for the basic determinants of the likelihood of bankruptcy: the size of the bank, the growth (of assets) and the ROA. As expected, the performance and the size of the bank have a negative relationship with the probability of bankruptcy. Similar results for the ROA have been reported by Lanine and Vennet (2006). As far as the relationship between bank failures and bank size, whereas Lanine and Vennet (2006) and Karminsky and Kostrov (2017) fail to find any significant relationship, Fungáčová and Weill (2013) report a negative effect of bank size on the probability of bankruptcy.

In column (2) we introduce the effect of bank solvency measured as the equity-to-assets ratio (CAPITAL). We find a negative and statistically significant coefficient for CAPITAL, so that the more the equity of the bank, the lower the probability of default. This result corroborates those of Peresetsky *et al.* (2011). In column (3), we test the effect of liquidity (LIQ). Our negative and significant coefficient is similar to that of Lanine and Vennet (2006), for

	(1)	(2)	(3)	(4)	(5)	(6)
GROWTH	0.001 (0.151)	0.038 (0.155)	0.003 (0.151)	0.003 (0.152)	0.007 (0.152)	0.043 (0.155)
ROA	−14.10*** (1.007)	−12.13*** (1.014)	−14.02*** (1.008)	−14.03*** (1.007)	−13.95*** (1.007)	−11.999*** (1.016)
SIZE	−0.236*** (0.011)	−0.378*** (0.014)	−0.240*** (0.011)	−0.236*** (0.011)	−0.248*** (0.011)	−0.385*** (0.014)
CAPITAL		−0.026*** (0.001)				−0.025*** (0.001)
LIQ			−0.001*** (0.000)			−0.000 (0.000)
RISKSH				0.009** (0.004)		0.005 (0.004)
SHARES					0.030*** (0.007)	0.026*** (0.007)
Intercept	3.528*** (0.292)	7.457*** (0.373)	3.768*** (0.297)	3.508*** (0.292)	3.781*** (0.298)	7.618*** (0.376)
# obs.	13,578	13,578	13,578	13,578	13,578	13,578
Likelihood ratio	1803.26***	2133.1***	1826.4***	1808.16***	1821.7***	2169.06***
Pseudo R ²	0.0981	0.1171	0.0992	0.0983	0.0991	0.1180
Correct %	65.15	66.75	65.16	65.25	65.29	66.91
VIF	1.01	1.01	1.01	1.01	1.01	1.02

Note(s): Estimated coefficients (std. errors) of the logit estimation of Model 1. The dependent variable is FAILURE, a dummy variable that equals 1 if the bank has failed during the analysis period, and 0 otherwise; SIZE is the log of total assets (in Russian rubles), GROWTH is the quarterly growth of total assets, ROA (return on assets) is the ratio earnings before taxes and depreciation over total assets, CAPITAL is the ratio of equity to total assets, LIQ is the ratio assets over liabilities for up to 30 days (%), RISKSH is the amount of loans, bank guarantees and sureties provided to the bank shareholders, and SHARES is the use of the bank's own funds to purchase shares of other legal entities. All the estimates include quarterly time dummy variables. ***, ** and * for 99%, 95% and 90% confidence level

Table 4.
Explanatory analysis:
Baseline analysis

whom bank failures are mainly caused by insufficient liquidity, although deteriorated profits and low levels of capital adequacy are also important predictors.

Interestingly, the credits to shareholders (RISKSH) have a positive relationship with the probability of failure (column 4). As far as the use of bank funds to purchase shares of other legal entities (SHARES) is concerned, the results in Column 5 suggest a positive relationship with the failure probability. This result can be understood as a confirmation of the suitability of the measures of the CBR since both the credits to shareholders and the purchase of shares of other entities can lead to much risk concentration and exacerbate the risk of bank failure. When all the variables are included together in one single model (column 6), most of the conclusions remain: the negative effect of the performance, the size and the solvency of the bank, along with the positive effect of the shares of other banks.

The explanatory power of our model can be assessed with two indicators. First, the pseudo- R^2 coefficient, which is close to the one of [Fidrmuc and Süß \(2011\)](#) and slightly higher than that of [Zubarev and Bekirova \(2020\)](#). Second, and more importantly, the proportion of observations correctly classified. Our models correctly classify around two-thirds of the observations (between 65.15 and 66.91%). In this case, there can be two types of errors. On the one hand, the type I error arises when the model wrongly classified as not failed a bank that actually went bankruptcy. On the other hand, the type II error is the wrong classification as failed of a bank that actually did not go bankruptcy. Most studies assert that the cost of type I error is greater than the cost of the type II error ([Fidrmuc and Süß, 2011](#)). Although not tabulated, the performance of our models is due to the ability to identify the failed banks, avoiding the type I error. Indeed, our models correctly identify around 75% of the bankruptcies but the rate of non-failed banks correctly classified is around 58%.

We now analyze the strategic orientation of the banks in the sense of the choice between firms and individuals for the deposits and loans. The analysis of the relationship between deposits and banking failure in Russia has been previously done by [Konstandina \(2007\)](#), who has shown the relevance of deposits to avoid bankruptcies. Our results, reported in [Table 5](#), show an asymmetric effect of such orientation. Regarding the proportion of deposits from firms, results reported in columns 1 and 3 show a negative relationship with the probability of failure. The explanation can be on the coverage of individuals' deposits by the deposit insurance, which can have a moral hazard effect and incentivize the risk taking of banks. On the contrary, the loans to firms are positively related to bankruptcies (columns 2 and 3). These results are consistent with those of [Karminsky and Kostrov \(2017\)](#), who state that in comparison with loans to firms, loans to individuals are more transparent and have higher resistance to abrupt loss of value. This assessment is corroborated in column (4), in which two dummy variables have been created on the basis of the median value of the proportion of deposits from firms and the proportion of loans to firms (HIGHCORPDEPOS and HIGHCORPLOANS). These dummy variables equal one when such proportion is over the median value, and zero otherwise.

As far as the growth of assets is concerned, our baseline estimates did not show any significant relationship with the likelihood of bankruptcy. We now wonder whether this lack of significance can be due to an asymmetric effects conditional on the banks' characteristics. Thus, in column 5 of [Table 5](#) we interact the GROWTH variable with the two dummies on the orientation to firms in the deposits and the loans portfolios. The results reveal relevant insights. The negative (positive) and significant coefficient of GROWTH·HIGHCORPDEPOS (GROWTH·HIGHCORPLOAN) suggest that assets growth amplifies the asymmetric effect of the strategic orientation to firms. It means that the growth of assets reduces even more the risk of the banks that borrow most of the deposits from the firms, but the growth of assets increases the risk of the banks that lend most of the loans to the firms.

We revisit the issue of the growth again by testing whether the growth of deposits and the growth of loans can have any effect. To this purpose, we define DEPOSGROWTH and

	(1)	(2)	(3)	(4)	(5)
SIZE	−0.225*** (0.011)	−0.235*** (0.011)	−0.223*** (0.011)	−0.218*** (0.011)	−0.218*** (0.011)
GROWTH	0.078 (0.155)	−0.001 (0.153)	0.066 (0.156)	0.029 (0.155)	0.245 (0.276)
ROA	−14.082*** (1.031)	−14.322*** (1.017)	−14.244*** (1.038)	−14.641*** (1.036)	−14.691*** (1.036)
CORPDEPOS	−0.650*** (0.061)		−0.687*** (0.062)		
CORPLOANS		0.406*** (0.075)	0.515*** (0.077)		
HIGHCORPDEPOS				−0.427*** (0.039)	−0.405*** (0.040)
HIGHCORPLOANS				0.241*** (0.038)	0.228*** (0.039)
GROWTH · HIGHCORPDEPOS					−0.858*** (0.313)
GROWTH · HIGHCORPLOANS					0.517* (0.310)
Intercept	3.462*** (0.299)	3.217*** (0.299)	3.064*** (0.306)	3.199*** (0.301)	3.194*** (0.301)
# obs.	13,376	13,515	13,340	13,340	13,430
Likelihood ratio	1892.64***	1004.4***	1732.37***	1909.08***	1918.27***
Pseudo R2	0.1045	0.0985	0.0970	0.1056	0.1061
Correct %	65.51	65.25	65.88	66.15	64.52
VIF	1.01	1.01	1.01	1.01	1.03

Note(s): Estimated coefficients (std. errors) of the logit estimation of Model 2. The dependent variable is FAILURE, a dummy variable that equals 1 if the bank has failed during the analysis period, and 0 otherwise; SIZE is the log of total assets (in Russian rubles), GROWTH is the quarterly growth of total assets, ROA (return on assets) is the ratio earnings before taxes and depreciation over total assets; CORPDEPOS is the proportion of deposits from firms over the sum of deposits from firms and from individuals; CORPLOANS is the proportion of loans to firms over the sum of loans to firms and to individuals. All the estimates include quarterly time dummy variables. ***, ** and * for 99%, 95% and 90% confidence level

Table 5.
Explanatory analysis:
strategic orientation on
clients

LOANSGROWTH as the quarterly rate of growth of deposits and loans, respectively. In columns 1 and 2 of Table 6, we test the isolated effect of each variable, and in column 3, we introduce both variables jointly. As it can be seen, both variables exhibit a different impact: while the growth of deposits has not any significant relationship with the probability of failure, the growth of loans is positively related to such probability.

We also address the effect of the ownership structure. We introduce the fact of a Russian bank being related to a foreign bank, either as controlled by a foreign bank (FORCON) or as a subsidiary of a foreign privately-owned bank (FORSUB). The results are reported in Table 7. In columns 1 and 2, we test the separated effects of each variable, and in column 3, they are jointly introduced. We can see that the fact of being controlled by a foreign bank has a significant negative relationship with the likelihood of failure.

In order to study more in-depth the effect of the control by a foreign bank, we define the variables SIZEFOR, GROWTHFOR, and ROAFOR as the interaction of SIZE, GROWTH and ROA with the dummy variable FORCON. The same is done for the ratios CAPITAL, LIQ, RISKSH and SHARES, and the variables CORPDEPOS and CORPLOANS. Table 8 shows the results of the new estimations. Since there are many coefficients, we focus on the most relevant ones. In column 1, we report the specific effect of the control variables (size, growth

	(1)	(2)	(3)
SIZE	−0.231*** (0.011)	−0.232*** (0.011)	−0.232*** (0.011)
GROWTH	0.079 (0.171)	−0.050 (0.164)	−0.003 (0.175)
ROA	−14.772*** (1.045)	−14.818*** (1.046)	−14.804*** (1.046)
DEPOSGROWTH	−0.049 (0.084)		−0.066 (0.084)
LOANSGROWTH		0.292** (0.131)	0.300** (0.132)
Intercept	3.437*** (0.298)	3.460*** (0.298)	3.457*** (0.299)
# Obs.	13,203	13,203	13,203
Likelihood ratio	1731.6***	1736.2***	1736.81***
Pseudo R2	0.0968	0.0970	0.0971
Correct %	65.05	65.17	65.20
VIF	1.13	1.05	1.13

Note(s): Estimated coefficients (std. errors) of the logit estimation of Model 3. The dependent variable is FAILURE, a dummy variable that equals 1 if the bank has failed during the analysis period, and 0 otherwise; SIZE is the log of total assets (in Russian rubles), GROWTH is the quarterly growth of total assets, ROA (return on assets) is the ratio earnings before taxes and depreciation over total assets; DEPOSGROWTH is the rate of quarterly growth of deposits; LOANSGROWTH is the rate of quarterly growth of loans. All the estimates include quarterly time dummy variables. ***, ** and * for 99%, 95% and 90% confidence level

Table 6.
Explanatory analysis:
growth

	(1)	(2)	(3)
SIZE	−0.235*** (0.011)	−0.237*** (0.011)	−0.236*** (0.011)
GROWTH	0.001 (0.152)	0.002 (0.152)	0.002 (0.152)
ROA	−14.163*** (1.007)	−14.107*** (1.007)	−14.164*** (1.007)
FORCON	−0.993*** (0.168)		−0.989*** (0.168)
FORSUB		0.130 (0.100)	0.114 (0.100)
Intercept	3.519*** (0.292)	3.538*** (0.292)	3.527*** (0.292)
# Obs.	13,578	13,578	13,578
Likelihood ratio	1843.31	1804.94***	1844.59***
Pseudo R2	0.1003	0.0982	0.1003
Correct %	65.46	65.16	65.49
VIF	1.00	1.00	1.01

Note(s): Estimated coefficients (std. errors) of the logit estimation of Model 4. The dependent variable is FAILURE, a dummy variable that equals 1 if the bank has failed during the analysis period, and 0 otherwise; SIZE is the log of total assets (in Russian rubles), GROWTH is the quarterly growth of total assets, ROA (return on assets) is the ratio earnings before taxes and depreciation over total assets; FORCON equals 1 when the bank is controlled by a foreign bank that owns more than 50% of the shares, and 0 otherwise; FORSUB equals 1 when the bank is a subsidiary of a foreign privately-owned bank, and 0 otherwise. All the estimates include quarterly time dummy variables. ***, ** and * for 99%, 95% and 90% confidence level

Table 7.
Direct influence of the
foreign ownership

	(1)	(2)	(3)
SIZE	−0.241*** (0.011)	−0.381*** (0.014)	−0.223*** (0.011)
SIZEFOR	0.503*** (0.097)		
GROWTH	−0.020 (0.152)	0.033 (0.155)	0.051 (0.156)
GROWTHFOR	4.199*** (1.916)		
ROA	−13.924*** (1.011)	−12.103*** (1.019)	−14.332*** (1.040)
ROAFOR	−49.460*** (13.777)		
CAPITAL		−0.025*** (0.001)	
CAPITALFOR		−0.014 (0.013)	
LIQ		−0.000 (0.000)	
LIQFOR		0.005** (0.003)	
RISKSH		0.005 (0.004)	
RISKSHFOR		0.019 (0.036)	
SHARES		0.021*** (0.007)	
SHARESFOR		0.309*** (0.070)	
CORPDEPOS			−0.698*** (0.062)
CORPDEPOSFOR			−0.934 (0.803)
CORPLOANS			0.554*** (0.078)
CORPLOANSFOR			−2.969*** (0.717)
FORCON	−12.588*** (2.273)	−1.874*** (0.418)	1.239* (0.625)
Intercept	3.649*** (0.294)	7.535*** (0.377)	3.036*** (0.306)
# Obs.	13,578	13,578	13,340
Likelihood ratio	1883.4***	2241.9***	1978.75***
Pseudo R2	0.1024	0.1219	0.1094
Correct %	65.42	67.17	66.21
VIF	5.42	2.17	4.09

Note(s): Estimated coefficients (std. errors) of the logit estimation of Model 4. The dependent variable is FAILURE, a dummy variable that equals 1 if the bank has failed during the analysis period, and 0 otherwise; SIZE is the log of total assets (in Russian rubles), GROWTH is the quarterly growth of total assets, ROA (return on assets) is the ratio earnings before taxes and depreciation over total assets; LIQ is the ratio assets over liabilities for up to 30 days (%), RISKSH is the amount of loans, bank guarantees and sureties provided to the bank shareholders, SHARES is the use of the bank's own funds to purchase shares of other legal entities; CORPDEPOS is the proportion of deposits from firms over the sum of deposits from firms and from individuals; CORPLOANS is the proportion of loans to firms over the sum of loans to firms and to individuals; FORCON equals 1 when the bank is controlled by a foreign bank that owns more than 50% of the shares, and 0 otherwise. XXXFOR means the interaction of the XXX variable with FORCON. All the estimates include quarterly time dummy variables. ***, ** and * for 99%, 95% and 90% confidence level

Table 8.
Indirect influence of the
foreign ownership

and profitability). These estimates suggest that a foreign bank controlling the Russian bank modifies the impact of the financial determinants. For instance, whereas the bank size has a negative relationship with the failure probability, this relationship switches into positive for banks under foreign control. On the contrary, the negative relationship of the performance (ROA) is amplified by the foreign control. Regarding the growth of the bank, whereas it does not have a general impact, the growth of banks under foreign control increases the probability of bankruptcy.

In column 2 of Table 8, we report the results of the solvency, liquidity and risk concentration. The most relevant result is the effect of the shares of other banks (SHARES): the positive coefficient of SHARESFOR reinforces the likelihood of failure in the banks controlled by a foreign bank. Finally, in column 3, we study the specific effect of the strategic orientation. Interestingly, the effect of the orientation to firms in the loans policy is reversed by the foreign control.

4.3 Additional analyses

Due to the nature of failure, performing a survival analysis of the banks can bring some light to understand what has happened in this industry since the appointment of the current head of the Central Bank in 2013. In January of that year, there were 953 banks, and only 427 of them were still active at the end of the first quarter of 2020. Table 9 shows the evolution of the failure and the survival probability since that moment.

Despite the rules set up by the CBR to avoid bankruptcies, it seems that the fulfillment of those rules does not assure the survival of the bank. The percentage of banks that fulfill those requirements is shown in Table 10. Given that most of the banks fulfill these requirements, their discriminant capacity is limited. Then we run a test of equality for the survival functions between the banks that fulfill each requirement and those that do not, whose results are reported in the fifth column. Interestingly, we observe that there are not significant differences between both groups in the case of five ratios. In the next step we change the limits imposed by the CBR and set them in the median value of the variables reported in Table 1. In this case, we find that significant differences appear in the survival probability for the purchase of own shares, instant and current liquidity. This means that the CBR should reconsider the limits set for the ratios.

Since the degree of fulfillment is very high, it seems that these factors do not bring enough discrimination power to distinguish the banks with high probability of failure. To address this issue we run a series of Kaplan–Meier survival estimates.

Time (years)	Initial sample	Fails	Survival	Std. error	95% confidence interval	
0	953	21	0.9780	0.0048	0.9664	0.9856
1	932	85	0.8888	0.0102	0.8671	0.9071
2	847	93	0.7912	0.0132	0.7640	0.8156
3	754	121	0.6642	0.0153	0.6333	0.6932
4	633	73	0.5876	0.0159	0.5557	0.6181
5	560	66	0.5184	0.0162	0.4862	0.5496
6	494	53	0.4627	0.0162	0.4308	0.4941
7	441	14	0.4343	0.0169	0.4001	0.467

Note(s): This table shows the number of existing banks at the beginning of each year and the bankruptcies during each year. The survivor function represents the probability that the bank is still alive after some specified time t

Table 9.
Survivor function of
banks in Russia
2013–2019

Table 10.
Fulfillment of the CBR
requirements and
difference in survival

Notation	Limit	Normative ratio	Degree of fulfillment (%)	Significant difference	Significant difference (changing limit)
n1.0	min 8%	Capital to assets	98.72	YES	YES
n10.1	max 3%	Cumulative risk for bank insiders	99.88	YES	YES
n12	max 25%	Purchase of own shares	99.97	NO	YES
n2	min 15%	Instant liquidity	98.99	NO	YES
n3	min 50%	Current liquidity	98.91	NO	YES
n4	max 120%	Long-term liquidity	99.95	NO	NO
n7	max 800%	Large credit risks	99.77	YES	YES
n9.1	max 50%	Loans to shareholders	99.98	NO	NO

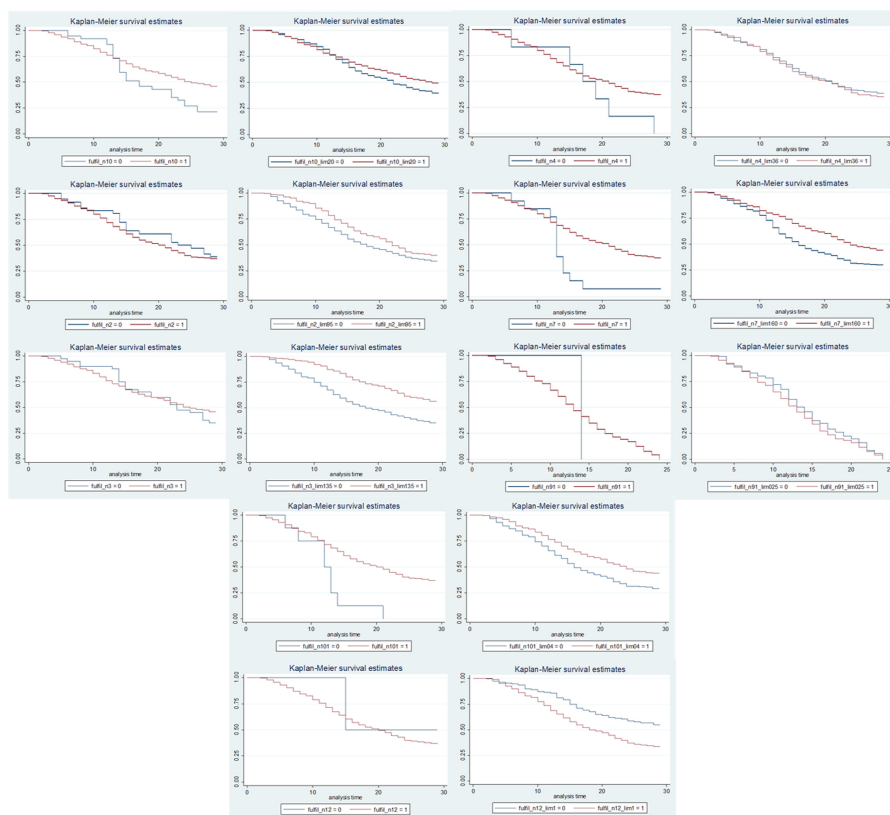
Note(s): This table shows the proportion of firm-year observations that fulfill the CBR requirements. The two right hand side columns report whether there are significant differences in the survival function depending on the fulfillment of the requirements. The minimum capital to the amount of its assets is set in 8%. The maximum risk with bank insiders is established in 3%. The CBR limits to 25% the proportion of investment in shares of other legal entities over equity (Purchase of shares), to 120% the ratio of long term credit to equity and liabilities (long term liquidity), to 800% the ratio of major credit risk to equity (large credit risk), and to 50% the ratio of loans to shareholders to equity. The CBR requires at least 15% in the ratio of highly liquid assets to liabilities (instant liquidity) and 50% in the ratio of liquid assets to liabilities (current liquidity)

In the top left chart in [Figure 1](#), we report the results of the survival analysis for the capital adequacy ratio. The CBR requires at least the ratio of equity to assets to be 8% weighted by risk level. The red (blue) line depicts the survival function of the banks that do (not) meet this ratio. It can be seen that, initially, the banks with the lowest level of equity have a higher survival. Nevertheless, after 12 quarters the survival rates switch dramatically and, after 30 quarters, the survival probability of the banks that fulfill this requirement is twice as much as that of those whose equity is under 8% of risk-adjusted assets. Consequently, the capital adequacy requirement of 8% does not play a deterrent role of bank failure in the short and medium term. On the contrary, the second chart starting from the top left in [Figure 1](#) displays the survival function of banks with a capital adequacy of 20%. This level has been chosen discretionary because it is close to the average of all the banks reported in [Table 1](#). If this was the case, the banks with a capital adequacy ratio over 20% show a higher likelihood of survivor (red line) than those under this threshold throughout the time horizon.

We also run a Cox regression hazard model to check the influence of the strategic orientation ([Table 11](#)). This kind of analysis introduces the possibility of the time effect changing along the sample span. Coherently with the results reported in [Table 5](#), the results in columns 1, 3 and 4 show that a higher proportion of deposits from corporations decrease the risk of failure. On the contrary, as shown in columns 2, 3 and 4, the higher the proportion of loans to firms, the higher the bankruptcy probability.

5. Discussion

Before concluding, it could be interesting to discuss some of the findings shown in the previous section. The results presented in [Table 2](#), on the one hand, are consistent with those of [Karminsky and Kostrov \(2017\)](#) who report that a large share of deposits from individuals leads to a higher probability of bank failure. The underlying intuition is that, since firms are



Note(s): This figure displays the Kaplan-Meier survival function of Russian banks depending on the fulfillment of the different criteria set by the CBR. The first chart (top left) represents the survival estimates considering the capital adequacy requirement of 8% of risk weighted assets. The second chart shows the same survival estimates when the capital adequacy requirement is set at 20% (close to the median value). The rest of the charts represent the survival function for the different ratios controlled by the CBR and the new survival function considering new limits (see explanation in Table 10)

Figure 1.
Kaplan-Meier survival
estimates

not protected by the deposit insurance, they are more selective in their bank choice. In addition, large exposure to deposits of individuals makes a bank vulnerable to bank runs. On the other hand, these results deviate from their finding that larger share of loans to individuals tends to decrease the probability of bank failure. This deviation can be due to the different definition of variables: while these authors use the proportion of loans to individuals on assets, we use a more precise measure of loans orientation that is the proportion of loans to individuals on the whole loans' portfolio.

Although the growth of assets is not statistically different between both groups of banks, the deposits and the loans of non-failed banks grow more than those of the failed counterparts. These results corroborate that of (Mäkinen and Solanko, 2018), who find that the changes in the levels of the CAMEL indicators are significantly correlated with the probability of bank closure.

	(1)	(2)	(3)	(4)
SIZE	−0.129*** (0.0340)	−0.135*** (0.0328)	−0.126*** (0.0345)	−0.122*** (0.0344)
GROWTH	0.0390 (0.139)	0.0547 (0.162)	0.0593 (0.151)	0.0483 (0.154)
ROA	−14.28*** (2.381)	−15.15*** (2.299)	−14.40*** (2.377)	−14.84*** (2.316)
CORPDEPOS	−0.752*** (0.197)		−0.780*** (0.200)	
CORPLOANS		0.527** (0.230)	0.663*** (0.241)	
HIGHCORPDEPOS _{t-1}				−0.619*** (0.115)
HIGHCORPLOANS _{t-1}				0.368*** (0.109)
Observations	13,614	13,751	13,569	13,751

Note(s): Estimated coefficients (std. errors) of the Cox regression estimation. The dependent variable is FAILURE, a dummy variable that equals 1 if the bank has failed during the analysis period, and 0 otherwise; SIZE is the log of total assets (in Russian rubles), GROWTH is the quarterly growth of total assets, ROA (return on assets) is the ratio earnings before taxes and depreciation over total assets; CORPDEPOS is the proportion of deposits from firms over the sum of deposits from firms and from individuals; CORPLOANS is the proportion of loans to firms over the sum of loans to firms and to individuals; FORCON equals 1 when the bank is controlled by a foreign bank that owns more than 50% of the shares, and 0 otherwise. XXXFOR means the interaction of the XXX variable with FORCON. All the estimates include quarterly time dummy variables. ***, ** and * for 99%, 95% and 90% confidence level

Table 11.
Additional analysis:
strategic orientation
(Cox regression)

The performance of our logistic models is reasonably good due to their ability to identify the failed banks, avoiding the type I error. Our models identify bankruptcies correctly in around 75% of the cases but the rate of non-failed banks correctly classified falls below 60%.

Banks that borrow most of the deposits from firms diminish the risk of bankruptcy when their assets grow, but the risk of the banks that lend most of the loans to the firms increases when their assets grow. Continuing with growth, the probability of failure is not related significantly with the growth of deposits. However, the growth of loans is positively related to such probability. Thus, it seems that a policy of excessive loan granting is detrimental for the survival of the bank.

It has been found (Table 7) that being controlled by a foreign bank has a significant negative relationship with the likelihood of failure. This result is coherent with the research of Karas *et al.* (2010) and Belousova *et al.* (2021), who find that foreign banks are more efficient than Russian domestic banks. On the contrary, for a sample of Middle East and North African banks, Otero *et al.* (2020) find that banks with high institutional investors' stakes take more risk.

The positive coefficient of the interaction effect between the foreign control and the use of the bank's own funds to acquire shares of other entities reinforces the likelihood of failure in the banks controlled by a foreign bank. Thus, the use of Russian banks by foreign banks to expand their influence on other entities and corporations seems to increase the bankruptcy likelihood. Considering the specific effect of the strategic orientation, the effect of the orientation to firms in the loans policy is reversed by the foreign control, as if the choice of borrowers in these banks was more selective so that the orientation to firms as possible clients reduces the risk of bankruptcy.

6. Implications and conclusion

The models of bankruptcy predictions have a longstanding tradition in the financial research. Russia provides a unique setting to study bank failures for two reasons. On the one hand,

given the dimension of the financial system in absolute numbers, the number of banking crashes is considerable and can have dramatic consequences. On the other hand, it is a young financial system arisen after the fall of the Soviet Union, whose managers and supervisors may have not enough expertise, such that calls for new knowledge and insights. From this point of view, the study of the Russian case has policy implications for advancing regulation in the banking system of some East European countries such as Hungary (between 2013 and 2020 the number of banks fell in 70%), Croatia (31.4%) and Bulgaria (20%). Actually, the appointment of the current Head of the CBR in 2013 is a turning point in the policy of the main regulator, and we base on this fact to study the effect of the cleaning policy.

The research on bankruptcy prediction can be divided into two trends: the one on the situation of failed firms in order to find the symptoms and the one that compares the prediction accuracy of the different methods (Tseng and Hu, 2010). Our papers belong to the first stream and focuses on the characteristics of failed banks that can signal the forthcoming bankruptcy. In addition to the usual financial characteristics of banks (size, growth and performance), we have introduced three sets of possible determinants: the fulfillment of the rules recently issued by the CBR, the strategic orientation (in terms of loans and deposits from firms vs. individuals) and the ownership structure (in the sense of the foreign participation in the ownership).

Our research shows that not-failed banks are significantly larger and more profitable. These banks also have higher levels of fulfillment of the CBR requirements of solvency, liquidity. They provide fewer loans to their shareholders, and own more shares of other banks. We also find an asymmetric effect of the strategic orientation of banks: whereas the proportion of deposits from firms is negatively related to the probability of failure, the loans to firms are positively related to bankruptcies. The explanation could rely on the more in-depth supervision of firms whose deposits are not covered by the deposit insurance. The underlying intuition is that, since firms are not protected by the deposit insurance, they are more selective in their bank choice while the loans to individuals by their nature are more transparent relative to those to firms and have higher resistance to abrupt loss of value. In addition, large exposure to deposits of individuals can have a moral hazard effect and incentivize the risk taking of banks and make them vulnerable to bank runs. Further analysis revealed that the growth of assets reduces even more the risk of the banks that borrow most of the deposits from the firms, but the growth of assets increases the risk of the banks that lend most of the loans to the firms.

Finally, according to our research, the fact of being controlled by a foreign bank has a significant negative relationship with the likelihood of failure. Not only is there a direct relationship, but the foreign ownership also moderates the effect of bank size, performance and growth on the bankruptcy likelihood. Strategic orientation to loans to firms has reverse effect on the foreign controlled banks, as if the choice of borrowers in these banks was more selective so that the orientation to firms as possible clients reduces the risk of bankruptcy. We also found that the use of Russian banks by foreign banks to expand their influence on other entities and corporations seems to increase the bankruptcy likelihood.

Taken together, although the results apparently support the new CBR rules, our subsequent analyses show that the thresholds imposed by the Russian regulator actually do not make a difference between failed and not failed banks in the short and medium term. We found evidence suggesting that the capital adequacy requirement imposed by the CBR should be increased since the current 8% level does not work as an early warning signal for periods shorter than three years. The same applies to other requirements. As a direct implication of our study, we propose to reconsider those thresholds given the lack of predictive capacity. Thus, these requirements are a step in the right direction, but they should be augmented to prevent the bankruptcy of the fulfilling banks.

Notes

1. These statistics can be found in https://www.cbr.ru/eng/statistics/bank_sector/lic/
2. It can be consulted in <https://sdw.ecb.europa.eu/browse.do?node=9691593>
3. Zhivaikina and Peresetsky (2017) also use information from the period 2012–2016, but their objective is different to ours since they focus on the relationship between credit ratings and bank license withdrawal in a sample of 11 banks.
4. Gosbank played the role of Central Bank, Stroibank dealt with the corporate sector, Vneshtorgbank focused on international transactions, and Sberbank on retail banking and savings.

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Appendix

Abbreviation	Definition	Previous research
<i>Financial variables</i>		
SIZE	The log of total assets in Russian Rubles	Fungáčová and Weill (2013), Lanine and Vennet (2006), Karas <i>et al.</i> (2010), Mamonov (2019), Peresetsky <i>et al.</i> (2011) and Zubarev and Bekirova (2020).
GROWTH	Quarterly growth of total assets	Lanine and Vennet (2006), Mamonov (2019), Peresetsky <i>et al.</i> (2011) and Zhivaikina and Peresetsky (2017). Fungáčová and Weill (2013), Lanine and Vennet (2006), Karas <i>et al.</i> (2010), Mamonov (2019), Peresetsky <i>et al.</i> (2011) and Zubarev and Bekirova (2020)
DEPOSGROWTH	Quarterly growth of deposits	
LOANS GROWTH	Quarterly growth of loans	
ROA	Earnings before taxes and depreciation over total assets	
CAPITAL	The ratio of equity to total assets	
LIQ	Assets over liabilities for up to 30 days	Belousova <i>et al.</i> (2021), Karas <i>et al.</i> (2010) and Karminsky and Kostrov (2017) Belousova <i>et al.</i> (2021), Karas <i>et al.</i> (2010) and Karminsky and Kostrov (2017)
RISKSH	Maximum amount of loans, bank guarantees and sureties provided to the bank shareholders	
SHARES	Use of the bank's own funds to purchase shares of other legal entities	
<i>Strategic orientation</i>		
CORPDEPOS	Deposits from firms over the sum of deposits from firms and from individuals	
CORPLOAN	Loans to firms over the sum of loans to firms and to individuals	
<i>Ownership structure</i>		
FORCON	Equals 1 when the bank is controlled by a foreign bank that owns more than 50% of the shares, and 0 otherwise.	Karas <i>et al.</i> (2010) and Karminsky and Kostrov (2017)
FORSUB	Equals 1 when the bank is a subsidiary of a foreign privately-owned bank, and 0 otherwise	Belousova <i>et al.</i> (2021) and Karas <i>et al.</i> (2010)

Table A1.
Definition of variables

Corresponding author

Félix J. López-Iturriaga can be contacted at: felix.lopez@uva.es

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