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Commercial Banks' Mandatory Regulations Set by the Bank of Russia as Factors in Revoking Licenses

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ABSTRACT

All the Russian commercial banks, which have any types of license, whether basic or universal, must meet the mandatory standards set by the Bank of Russia. Otherwise they may face the risk of having their license revoked. The problem raised by the study relates to the question of whether it is possible for the Bank of Russia to strengthen its control over default factors in commercial banks through economic regulatory measures, such as monitoring compliance with banking regulations. The purpose of this work is to identify factors that influence the probability of license revocation for commercial banks in Russia during a period of relative stability in the banking system between 2016 and 2021. Special attention is paid to the reasons for the revocation of licenses and the analysis of factors related to compliance by commercial banks with basic standards of banking activity. The following methods were used: analysis of the reasons for the revocation of banking licenses, division of 244 banks that lost their licenses into two groups: those with license revoked for economic reasons, and those in connection with violations of legislation. A multinomial logistic regression was used to analyze the impact of banking regulations' value on the probability of license revocation. The econometric analysis showed that factors influencing the license revocations of Russian commercial banks, including those belonging to both groups considered, vary significantly. Not all indicators related to regulations and the probability of license revocation proved to be significant in this sample. Lowering the capital adequacy ratio significantly increases the risk of license revocation due to economic reasons. An increase in the maximum value of large credit risk also increases the likelihood of license withdrawal, regardless of reason.

Keywords: commercial banks; Bank of Russia; license revocation; capital adequacy ratio; liquidity ratio; large credit risk ratio

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INTRODUCTION

The stable state of the banking system is seen as one of the key factors in sustainable economic development. This is confirmed by the award of the Nobel Prize in Economics to American economists Ben Bernanke, Douglas Diamond, and Philip Dybvig in 2022 “for their research on banks and financial crises”.¹ Their work has shown the importance of banks in the economy and the need to avoid the collapse of commercial banks. It has also suggested measures to support banks during times of crisis, which have been put into practice in many countries

The Russian banking system has seen significant changes in terms of the structure and composition of credit institutions since 2013. This was due to the Bank of Russia’s revision of its approach to the reliability and transparency requirements for commercial banks. Then, the banking system faced one of the worst crises when, in early 2015, its profitability decreased almost to zero and for the category of “large private banks”, it was negative.² In the period from 2013 to 2015, 190 licenses were revoked from commercial banks and 27 banks voluntarily ceased their activities. In 2016 the economy and banking system recovered, but the license revocation process continued. In 2022, the Bank of Russia revoked the licenses of three banks, in 2023 three commercial banks were liquidated independently, in 2024 seven banks ceased to exist, including four that had their licenses revoked.³ Despite the decrease in the number of bank failures in the Russian Federation, it cannot be said that the banking business currently has no problems. The role of the regulator in monitoring the state of banks is crucial.

¹ The Nobel Prize in Economics was awarded for the study of financial crises on October 10, 2022. URL: <https://www.interfax.ru/world/867094> (accessed on 02.01.2024).

² Report on the development of the banking sector and banking supervision in 2015. Bank of Russia, 2016. URL: https://www.cbr.ru/Collection/Collection/File/24206/bsr_2015.pdf (accessed on 03.01.2024).

³ Defunct credit organizations. URL: <https://www.banki.ru/banks/memory/> (accessed on 15.07.2024).

In our work, we aimed to identify the factors that influence the likelihood of license revocation for commercial banks in the Russian Federation during a period of relative stability in the banking system from 2016 to 2021. We examined the reasons for license revocations and focused on analyzing factors related to compliance with basic banking regulations by commercial banks. These include capital adequacy, liquidity, and maximum size of large credit risk.

The main hypothesis of our study is that indicators of banking regulations are significant factors that may influence the probability of a bank’s bankruptcy. A decrease in capital adequacy and liquidity, as well as an increase in maximum large credit risk, are associated with a higher likelihood of bank failure for any official reason leading to license revocation.

LITERATURE REVIEW

In modern Russian and foreign scientific literature, there are numerous works dedicated to the issue of the likelihood of bankruptcy for commercial banks. This topic is closely related to assessing default factors. Traditionally, authors have focused on indicators related to a bank’s financial health of the bank itself [1–6] and its management effectiveness [7]. The research also includes parameters reflecting the state and competitive environment of the banking system [2–4, 8] and macroeconomic factors. [2, 5, 6, 9]. In addition, the authors also considered variables characterizing the regulator’s control of banking risks [2, 8, 10–12], the influence of monetary policy instruments [12, 13], as well as factors related to the political environment [9]. Some of the publications used by us in developing the approach for this study are reflected in *Table 1*.

Based on the description of the works presented in *Table 1*, we can conclude that in the classical approach to the problem of assessing the likelihood of bank failure, the authors consider financial indicators, most of

which are part of the CAMEL-indicators,⁴ as well as macroeconomic indicators and banking standards. The methods used to solve research problems vary. Traditionally, researchers have used logistic regression, binary and multiple choice models, panel data models, and impulse response models. However, in more recent works, economists are increasingly likely to incorporate machine learning algorithms into their methodological approaches or as the basis for their methods.

The research covers various countries and regions around the world, including several works dedicated to the analysis of the Russian banking system [1, 5, 15–18]. As a rule, studies are conducted over several years, close to the time of publication of a scientific work. However, there are also studies that focus on stable and crisis periods in economic development [2, 10, 13].

Let's take a closer look at the studies that focused on the regulatory indicators of banking activity. One of the significant factors that emerged from the research was the capital adequacy ratio, which was studied in relation to the probability of default for small regional cooperative banks in Italy between 1993 and 2011 [2]. In another study [6], based on statistics for 457 commercial banks from 20 countries in the period 2000–2019, it was shown that the regulator can reduce systematic risk by influencing the formation of banks' liquidity reserves, which is important in times of uncertainty.

The article [7] found that for European banks between 2006 and 2017, there was a significant probability of default with a high level of credit risk and liquidity problems. Qualified managers could not always prevent these defaults. A study [8], based on data from 156 American banks (78 of which went bankrupt between 2001 and 2015), found that one of the most

significant factors in assessing the likelihood of bankruptcy is the capital adequacy index. The authors of a study on commercial, cooperative, savings, and Islamic banks in 111 countries between 1998 and 2009 found that increased regulation of capital adequacy reduces the risk of bankruptcy [10]. A study of commercial banks in the Eurozone between 2008 and 2019 showed that the implementation of Basel III standards, which increase capital adequacy levels, significantly reduced CDS spreads, which can be interpreted as a reduction in the risk of commercial bank default [11]. An important aspect of our research was to consider the reasons for the revocation of licenses from Russian commercial banks. The authors of the study addressed this issue [16] and identified 10 different reasons. The most common reason is the violation of the requirements of Federal Law No. 115-FZ. A.A. Peresetsky [1] identifies two main reasons for this phenomenon: economic and legal, noting the significance of various factors for each one. A.V. Zubarev and K.D. Shilov [5] also recognize these reasons and highlight differences in the factors involved.

METHODOLOGICAL APPROACH AND STATISTICAL BASE OF THE STUDY

The Research Method

In this study, we used multinomial logistic regression because it was necessary to assess the impact of a commercial bank's standards on the likelihood of license revocation for various reasons. This type of regression does not require the assumption of normal distribution of variables, which makes it more flexible and less susceptible to outliers. Additionally, the logit model is more commonly used in scientific literature than the probit model because it is easier to interpret the results [19].

The multinomial logistic regression model (MNL) is a nonlinear model in terms of probabilities. That is, the effect of a change in one regressor on the dependent variable depends on the values of the other ones. This makes it difficult to interpret the individual effects of each regressor in the model [20].

⁴ Currently, the abbreviation of the indicators has been expanded and is used as CAMELS: Capital adequacy, Asset quality, Management efficiency, Earnings power, Liquidity, Sensitivity to market risk (capital adequacy, asset quality, management efficiency, profitability, liquidity, sensitivity to market risk). CAMEL was created by the Fed as a rating system for evaluating American banks.

Table 1

Review of the Banks' Failure Research

Authors	Countries, regions, time period	Factors of Failures	Methods	Key results
N. Soenen, R.V. Vennet [11]	The Eurozone, 2008–2018	Asset structure, sources of funding, income structure, capital adequacy	VAR model, CDS spreads	Basel III standards contribute to reducing the risk of the banking business
R.B. Abdesslem, I. Chkir, H. Dabbou [7]	16 European countries, 2006–2017	Indicators of credit risk and liquidity, managerial efficiency, monetary policy, macroeconomic indices	Dynamic panel regression, a generalized method	Credit risk is associated with management. Increased credit and liquidity risks increase the likelihood of bank bankruptcy
V. Lagasio, F. Pampurini, A. Pezzola, A.G. Quaranta [4]	The Eurozone, 2018 and 2020	Indicators of capital adequacy, asset quality, liquidity, market risk, profitability and price competition of Lerner and Boone	and Machine learning algorithms	The bank's default is explained by the indicators of capital adequacy of the first level, the share of risky assets and the average return on assets of the bank
A.V. Zubarev, K.D. Shilov [5]	The Russian Federation 2013–2021	Financial indicators of the banking business, macroeconomic indicators	Multinomial logistic regression	The factors of license revocation differ for different reasons – economic and legislative
B.N. Ashraf, C. Zheng, C. Jiang, N. Qian [10]	111 countries of the world, 1998–2009	Capital adequacy level, deposit insurance, banking sector indicators, macroeconomic indices	Panel regression, the least squares method	Increased capital regulation reduces the risk of bankruptcy in a stable period, and deposit insurance is necessary in times of crisis
P. Carmona, F. Climent, A. Momparler [8]	The USA, 2001–2015	Financial indicators of the banking business, capital adequacy standards of various levels	Machine learning method – gradient boosting method	The most significant factors are the profitability of operating assets, the amount of loan collateral, and the overall capital adequacy ratio
M. Myakinen, L. Solanko [14]	The Russian Federation, 2013–2017	Indicators of banks' condition: capital, asset quality, profitability, liquidity, bank size, credit activity, deposits	Linear probabilistic binary response model with fixed effects	The liquidity indicators, considered in dynamics, require the greatest attention
D.S. Mare [2]	Italy, 1993–2011	Macroeconomic indicators, capital adequacy level, income-expense ratio, bank size	Binomial logistic regression	Macroeconomic factors are more likely to determine the probability of default of small banks
A.A. Peresetsky [1]	The Russian Federation, 2005–2008	Financial indicators of banks, macroeconomic indicators, "unaccounted for" factors	Binary choice model, multinomial logistic regression	Bankruptcy factors are related to the reasons for license revocation (economic and withdrawal of funds); "unaccounted for" factors increase the likelihood of bankruptcy for fraudulent reasons

Source: Compiled by the authors based on the Reference list sources.

Table 2

List of Explanatory Variables

Variable	Description	Units of measure
Financial indicators		
ASSETS	Assets	thousand rubles
CASH	Cash	thousand rubles
CORR_CB	Funds in correspondent accounts with the Bank of Russia	thousand rubles
CORR_NOSTRO	Funds in nostro accounts with other banks	thousand rubles
BONDS	FLB value in the bank's assets	thousand rubles
STOCKS	The value of shares in the bank's assets	thousand rubles
LOANS_ENTITY	Loans to legal entities	thousand rubles
OVERDUE_LOANS_ENTITY	Overdue loans to legal entities	thousand rubles
LOANS_ENTREPR	Loans to individual entrepreneurs	thousand rubles
OVERDUE_LOANS_ENTREPR	Overdue loans to individual entrepreneurs	thousand rubles
LOANS_INDIVIDUAL	Loans to individuals	thousand rubles
OVERDUE_LOANS_INDIVIDUAL	Overdue loans to individuals	thousand rubles
FUNDS_ENTITY	Current funds of legal entities	thousand rubles
FUNDS_INDIVIDUAL	Current funds of individuals	thousand rubles
DEPOSITS_ENTITY	Time deposits of legal entities	thousand rubles
DEPOSITS_INDIVIDUAL	Time deposits of individuals	thousand rubles
OWN_FUNDS	Own funds	thousand rubles
NET_INTEREST	Net interest income	thousand rubles
NET_COMMISSION	Net commission income	thousand rubles
NET_PROFIT	Net profit	thousand rubles
Regulatory requirements		
N1	The Bank's capital adequacy ratio (H1.0)	percent
N3	The bank's current liquidity ratio (H3)	percent
N7	The standard of the maximum size of large credit risks (H7)	percent
Macroeconomic factors		
GDP	Real GDP growth rate	index
INCOME	The growth rate of real incomes of the population	index
CPI	Consumer Price Index	index

Source: Compiled by the authors.

We directly analyzed the nature and magnitude of the influence of each regressor on the dependent variable. We interpreted the coefficients based on their signs in the regression equation. Due to the complexity of the MNLM, we did not calculate marginal effects in this study. The coefficients were calculated for a large number of models evaluated with sequential inclusion of variables. Based on the minimum values of the Akaike information criteria (AIC) and Bayesian (BIC) [20], the best models were determined.⁵ After determining the three most suitable specifications, the Hosmer-Lemeshowe test was performed to analyze the reliability of the results obtained [21].⁶ The null hypothesis of the test is that there are no significant differences between the observed and modeled frequency distributions of the license revocation events for commercial banks [22]. Finally, an error matrix was created to analyze the predictive ability of the best model from the three previously proposed variations.

Selection of Factors

Considering the specific features of the Russian banking system as a research object, based on the works of authors in this area, and also based on publicly available statistics, we have identified three groups of variables that may influence the likelihood of commercial bank bankruptcy: 1) financial reporting indicators reflecting the specifics and results of the banking business; 2) standards established by the Bank of Russia and characterizing compliance with regulatory requirements; 3) macroeconomic indicators for the Russian Federation (*Table 2*).

During the econometric analysis, financial indicators were transformed using a logarithmic scale or converted into binary variables, in the presence of negative values. This was done for

indicators such as income from various sources and profits, for example.

Standards of Banking Activity

These variables were included in the model due to the importance of the central bank's role in commercial banking activities and the active efforts of the Bank of Russia to improve the national banking system.

The capital adequacy ratio (H1) considers the size of a bank's equity, risk ratios for assets, market risks, and reserves for potential losses in various activities. This high standard indicates the reliability of a bank, especially during unpredictable events. It may also be significant for the revocation of licenses due to economic reasons.

The current liquidity ratio (H3) measures the amount of liquid assets a bank has compared to its liabilities. The average volume of liquid funds available to a bank is an indicator of its sustainability. The standard for the maximum size of large credit risks (H7) is calculated and published by all commercial banks with a universal license, as well as by some previous ones. Despite the development of the banking and financial services market and the growth of its diversity, lending remains the main activity of the Russian banking industry.

Reasons for License Revocation

For our study, we included all banks that had their licenses revoked during the analyzed period, excluding those that underwent reorganization, ceased to exist due to a decision of shareholders, or were included in the list of systemically important banks identified by the Central Bank of the Russian Federation.

Official press releases from the Bank of Russia and other news announcements were analyzed for each bank that had its license revoked. Based on our research, we identified two main reasons for the revocation of licenses: economic and regulatory. In some cases, it was difficult to determine the exact cause, as it could be due to both economic difficulties and violation of regulations. Therefore,

⁵ The article provides the values of the information criteria for three models, the calculation is performed for all.

⁶ Pearson and Hosmer's Chi-square tests do not allow comparing competing model specifications with each other; they are already used for the selected best model based on AIC and BIC criteria [20].

Table 3

Statistics on the Reasons for the Revocation of Banking Licenses

Year	Reasons of the Revocation				Total
	Economic	Violation of the legislation	Mainly economic	Mainly violation of the legislation	
2016	19	32	11	30	92
2017	7	18	6	16	47
2018	5	15	5	21	46
2019	3	13	4	4	24
2020	6	8	0	1	15
2021	5	8	2	5	20
Total	45	94	28	77	244

Source: Compiled by the authors based on The memory book. URL: <https://www.banki.ru/banks/memory/> (accessed on 10.04.2024).

we classified the main reason as either economic or regulatory, depending on the circumstances. For example, if a bank resorted to asset withdrawal as a means to conduct questionable transactions from the perspective of the regulator, and if this occurred after the license had been revoked, the reason would be classified as primarily economic.

The most common formulations in the orders of the Bank of Russia when revoking a license for reasons of violation of the law were the following: “falsification of financial statements”, “violation of the law on money laundering”, “withdrawal of assets”, “withdrawal of highly liquid funds”, “questionable transit operations”, “cashing out”, “scheme operations”, “captive nature”, “opaque transactions”, “shadow currency exchange operations”.

Justifying the revocation of the license for economic reasons, such facts as “risky model”, “liquidity deficit”, “problem assets”, “loss of own funds” were stated.

Information Sources and Statistical Base

Available financial statements were used to collect statistical data. For existing banks,

data was collected for the period from January 1, 2016, to January 1, 2022. For non-operating organizations, data was limited to the latest reporting date prior to liquidation. All indicators (*Table. 2*) as well as information about non-functioning commercial banks, were found on the websites of the Bank of Russia, the Federal State Statistics Service, and KUAP banking analytics (kuap.ru) and the financial marketplace (banki.ru).

The sample includes 536 banks, of which 292 were active and 244 were liquidated as of January 1, 2022. A total of 2,350 observations were used for calculations.

ANALYSIS OF THE RESULTS OBTAINED

An analysis of information regarding the reasons for the revocation of licenses of Russian banks for the period 2016–2021 revealed that of the 317 banks that ceased to exist, only 73 did so voluntarily. The remaining 244 banks had their licenses revoked by the Bank of Russia. The results of the analysis of the reasons for license revocation are presented in *Table 3*.

Further calculations were carried out for three groups of banks: 1) currently operating,

Table 4

Mean Values of the Compulsory Standards by the Banking Groups

Bank status	Number of the banks	Capital adequacy ratio (H1.0)	Current liquidity ratio (H3)	Maximum amount of large credit risks (H7)
The bank is operating	292	30.95	265.41	149.01
The license was revoked for economic reasons	73	23.35	143.25	239.19
The license was revoked for reasons related to violation of the legislation of the Russian Federation	171	24.74	209.26	230.00

Source: Compiled by the authors based on КУАП (kuap.ru).

2) which have been deprived of their license for economic reasons and mainly due to such factors, and 3) which have been deprived of their licenses for reasons related to violations of legislation and primarily due to these facts. The average values of mandatory banking regulations were calculated for these three groups (see Table 4).

It should be noted that non-compliance with standards is rare, and all banks in the sample fulfilled the H7 standard. However, there are significant differences in average values between groups. For example, banks that have had their licenses revoked have an average capital adequacy ratio that is lower than that of existing banks, while the maximum size of their large credit risks is significantly higher. Then, a number of models of multinomial logistic regression were evaluated, where the dependent variable was the status of a commercial bank: 0 – currently operating, 1 – license revoked for economic reasons, 2 – license revoked for reasons of violation of legislation.⁷ Table 5 shows the results of evaluating the coefficients for the three models that were selected as the best based on the AIC

and BIC criteria.⁸ The models include, among other things, variables of the squares of the two standards to verify the presence of a nonlinear relationship between these regressors and the probability of revocation of the bank's license.

According to the AIC and BIC criteria, Model 2 is the most appropriate. Based on the Hosmer-Lemeshow test, the null hypothesis was accepted that there are no significant differences between the observed and predicted distribution of the number of revocations of licenses for commercial banks for various reasons.

In the multinomial logistic regression model, the coefficients presented in Table 5 cannot be directly interpreted in terms of their influence on the likelihood of license revocation [23]. The marginal effects, which are usually interpreted in conventional regression as the effect of a one percent change in a predictor variable on the outcome variable, depend on the values of the other predictors, making interpretation difficult. In these cases, it is common to calculate marginal odds ratios to better understand the relationship between the predictors and the outcome [23].⁹ The Appendix

⁷ Since the analysis was based on a multinomial logistic regression ($Y_i = j | X_{i,t}$) = $\frac{e^{\beta_j X_{i,t}}}{1 + \sum_{j=1}^K e^{\beta_j X_{i,t}}}$, $j=1..K$. In our case, $K=3$

(possible classes of variables). One class (reference or basic) is selected for evaluation and the probabilities of other events are considered relative to it – in our case, license revocation. The base class will be the value of the dependent variable equal to zero, in other words, the availability of a license from a commercial bank [5, 22].

⁸ We consistently evaluated multinomial logistic regression for more than 40 models, including all regressors and their combinations in turn, and evaluated AIC and BIC criteria for each model [22]. As a result, three models with the lowest criteria values were selected. The results of the evaluation of the AIC and BIC criteria for all modifications are available on request.

⁹ In this case, we are talking about “odd ratios” (marginal odds ratios), which, unlike “marginal ratios” (marginal effects), do not depend on the values of other regressors and can be used as an analysis of changes in the probability of license revocation when the regressor changes. This approach is described in more detail in [22].

Table 5

Multinomial Logistic Regression Coefficients

Variable	Model 1		Model 2		Model 3	
	Reason 1	Reason 2	Reason 1	Reason 2	Reason 1	Reason 2
ASSETS	-0.765**	0.002	-0.074**	0.01	-0.772**	-0.006
CASH	0.081	0.47*	0.08	0.476*	0.081	0.474*
CORR_CB	-0.02	-0.21*	-0.022	-0.207*	-0.019	-0.206*
CORR_NOSTRO	-0.21*	-0.15*	-0.21*	-0.153*	-0.212*	-0.153*
BONDS	0.05*	-0.045*	0.05*	0.956*	0.052*	-0.043*
STOCKS	0.07**	0.04**	0.074**	0.043**	0.074**	0.04**
LOANS_ENTITY	0.08	0.039	0.075	0.04	0.027	0.045
OVERDUE_LOANS_ENTITY	0.027	0.022	0.028	0.041	0.027	0.022
OVERDUE_LOANS_ENTREPR	-0.027	-0.067*	-0.026	-0.023*	-0.027	-0.067*
FUNDS_ENTITY	-0.02	-0.029	-0.013	-0.067	-0.0152	-0.031
FUNDS_INDIVIDUAL	-0.127	-0.033	-0.129	-0.029	-0.126	-0.029
DEPOSITS_INDIVIDUAL	0.023	-0.079*	0.024	-0.079*	0.024	-0.08*
DEPOSITS_ENTITY	0.053	-0.027	0.052	-0.026	0.053	-0.027
OWN_FUNDS	0.413	-0.376**	0.384	-0.397**	0.413	-0.383**
NET_INTEREST	-0.804*	0.059	-0.114*	0.06	-0.116*	0.06
NET_COMMISSION	-0.004	0.041	-0.003	0.045	-0.005	0.043
NET_PROFIT	-0.081*	-0.464	-0.809*	-0.047*	-0.804*	-0.469*
N1	-0.04**	-0.013	-0.032**	-0.009	-0.041**	-0.013
N1*N1	0.001	0.001			0.00092	0.000224
N3	-0.002	0.0001	-0.001	0.0004	-0.001	0.0003
N3*N3			0.00001	0.00001	0.00001	0.00001
N7	0.004*	0.003*	0.004*	0.004*	0.004*	0.004*
GDP	-34.8*	-30.503*	-34.781*	-30.698*	-34.75*	-30.675*
INCOME	-16.58*	-16.81*	-16.542*	-16.73*	-16.56*	-16.75*
CPI	-4.495	-6.24*	-4.509	-6.237*	-4.491	-6.23*
constant	27.5	24.971	27.234	24.604	27.54	24.803
Pseudo R ²	18.84	18.84	18.84	18.84	18.86	18.86
Number of degrees of freedom (df)	50		50		52	
AIC	1595.86		1595.72		1599.35	
BIC	1883.64		1883.50		1898.66	
The Hosmer's Lemeshowe Test	0.486		0.476		0.407	

Source: Calculated by the authors.

Notes: The group of operating banks was regarded as a basic class. Reason 1 – license revocation based on the economic reasons. Reason 2 – license revocation according to the legislative problems. *, ** – factor significance at 1 and 5 percentage levels.

Table 6

Error Matrix

Bank status	A bank operating (forecast)	A license is withdrawn for economic reasons (forecast)	A license is withdrawn for violation of the legislation reasons (forecast)
Operating bank (fact)	55.21	34.96	9.84
The license was revoked for economic reasons (fact)	4.23	94.37	1.41
The license was revoked for reasons related to legislation (fact)	11.76	32.35	55.88

Source: Calculated by the authors.

to this article provides estimates of the odds ratio for each of the three models. These estimates can be used to analyze the degree of influence that the considered regressors have on the value being studied. We have limited ourselves to analyzing the direct significance of the factors under consideration and the nature of their impact on the likelihood of license revocation for commercial banks.

In general, when considering the factors that significantly impact the likelihood of a license revocation, it is important to note that the state of the national economy is always a significant factor. During periods of steady economic growth, the chance of license revocation decreases, regardless of the specific reason. Additionally, the increase in investment activity by banks, including investments in stocks and bonds, is an indicator of a stable financial institution. Finally, any decrease in a bank's profits can affect the likelihood of license revocation, irrespective of the cause.

The revocation of a license due to violations of the law is related to several indicators, such as an increase in cash in the asset structure and a decrease in funds on individual accounts. Additionally, a decrease in equity is also a factor that can lead to the likelihood of losing a license due to economic reasons.

According to the estimates obtained, a decrease in the capital adequacy ratio (H1.0)

significantly affects the likelihood of license revocation for economic reasons, but this factor is not significant for the likelihood of license revocation for reasons of violation of legislation. The liquidity ratio (H3) did not turn out to be significant for the entire sample, as well as the modified indicators of the standards H1.0 and H3, taken as factors reflecting their likely nonlinear relationship with the dependent variable. At the same time, an increase in the standard for the maximum size of large credit risks (H7) leads to an increase in the likelihood of license revocation for all the reasons considered.

Finally, an error matrix has been calculated, which allows us to assess the ability to predict the likelihood of license revocation due to various reasons based on the model that has been constructed. This is presented in *Table 6*.

Table 6 shows that, based on Model 2, we can predict the probability of a commercial bank's license being revoked for economic reasons with an accuracy of 94.37%. However, other cases, such as whether a bank will remain among the current ones or commit an illegal act, are more difficult to predict.

CONCLUSIONS

In the Russian Federation, the performance of credit institutions is monitored and licenses can be revoked if necessary. The Bank of

Russia has the authority to revoke licenses from commercial banks for various reasons. There are two main categories of reasons that can lead to the revocation of a license: economic and legal violations.

During the relatively stable period between 2016 and 2021, there were 73 cases where banks lost their licenses due to economic issues, and 171 cases where the loss of the license was due to legal reasons.

The factors that influence the likelihood of a license being revoked vary. Banks that have had their licenses revoked due to economic issues are more likely to experience a decrease in assets, funds in correspondent accounts, and profits. Banks that face the threat of license revocation due to legal violations often experience an increase in cash assets and

difficulties accessing funding from individuals and entrepreneurs.

Focusing on banking regulations as factors, we found that not all of the reviewed regulations were significant in the sample under study. The hypothesis stated in the article was partially confirmed. Using the estimates obtained, we were able to demonstrate the importance of monitoring the capital adequacy ratio for banks experiencing financial difficulties. It is also essential for all banks to adjust their standards for the maximum size of large credit risks, as this is a crucial indicator for the banking sector. It may be beneficial for the Bank of Russia to monitor compliance with these standards and their modifications, as well as their approach to critical thresholds.

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Appendix

Odds Ratios for the Model Specifications under Consideration

Variable	Model 1		Model 2		Model 3	
	Reason 1	Reason 2	Reason 1	Reason 2	Reason 1	Reason 2
ASSETS	0.464**	1.002	0.48**	1.01	0.46**	0.993
CASH	1.08	1.60*	1.08	1.61*	1.084	1.61*
CORR_CB	0.979	0.809*	0.978	0.813*	0.981	0.813*
CORR_NOSTRO	0.808*	0.858*	0.807*	0.585*	0.809*	0.859*
BONDS	1.094*	1.095*	1.094*	1.095*	1.094*	1.095*
STOCKS	1.078**	1.043**	1.076**	1.043**	1.077**	1.04**
LOANS_ENTITY	1.07	1.03	1.078	1.04	1.081	1.049
OVERDUE_LOANS_ENTITY	1.027	1.023	1.028	1.023	1.027	1.023
OVERDUE_LOANS_ENTREPR	0.973	0.935*	0.974	0.935*	0.973	0.935*
FUNDS_ENTITY	0.984	0.971	0.987	0.968	0.984	0.969
FUNDS_INDIVIDUAL	0.881	0.967	0.878	0.971	0.882	0.971
DEPOSITS_INDIVIDUAL	1.03	0.923*	1.02	0.923*	1.023	0.923*

Appendix (continued)

Variable	Model 1		Model 2		Model 3	
	Reason 1	Reason 2	Reason 1	Reason 2	Reason 1	Reason 2
DEPOSITS_ENTITY	1.05	0.973	1.052	0.97	1.054	0.972
OWN_FUNDS	1.152	0.686**	1.468	0.672**	1.511	0.681**
NET_INTEREST	0.089*	1.06	0.892*	1.06	0.891*	1.062
NET_COMMISSION	0.995	1.04	0.996	1.04	0.996	1.044
NET_PROFIT	0.447*	0.628	0.445*	0.624*	0.447*	0.625*
N1	0.959**	0.987	0.967**	0.991	0.959**	0.987
N1*N1	1.001	1.001			1.001	1.001
N3	0.998	1.001	0.9985	1.00	0.998	1.00
N3*N3			1.001	1.001	1.001	1.001
N7	1.004*	1.001*	1.004*	1.004*	1.004*	1.004*
GDP	0.00001*	0.00001*	0.00001*	0.00001*	0.00001*	0.00001*
INCOME	0.00001*	0.00001*	0.00001*	0.00001*	0.00001*	0.00001*
CPI	0.011	0.002*	0.011	0.001*	0.011	0.001*
constant	9.08*10 ¹¹	6.65*10 ¹⁰	6.76*10 ¹¹	4.85*10 ¹⁰	9.1*10 ¹¹	5.91*10 ¹⁰

Source: Calculated by the authors.

Notes: The presented odds ratios can be interpreted in terms of the effect on the probability of an event occurring compared to the baseline level. For example, according to Model 1, a 1% increase in assets reduces the likelihood of license revocation due to economic reasons by 53.6%. (1–0.464) – the significance of factors at the 1st and 5th percentile levels.