BUFFER MODEL DETERMINATION OF SYSTEMIC STRATEGIC RISKS FOR BORROWERS IN FORCE MAJEURE CIRCUMSTANCES

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ABSTRACT

This study substantiates the concept of systemic strategic risks for borrowers and buffers systemic strategic risk in force majeure to the analyze the credit risk of banks. The authors studied the existing approaches used to assess the creditworthiness of borrowers and the credit risk of banks. The factors that influence the level of credit risk of borrowers are also identified. Quantitative and qualitative parameters of a borrower's creditworthiness, used in banking risk management, are also determined. An economic and mathematical model is proposed to determine the systemic strategic risk buffer for borrowers in force majeure circumstances. It is proposed that technology should be used to create a systemic strategic risk buffer for borrowers for hedging in force majeure circumstances as a monetary policy tool and include Basel III in the requirements of the banking agreement.

Contribution/Originality: The novelty of this study is the introduction of the new concept of the "systemic strategic risk of the borrower", which refers to the probability of bank losses in the event of systemic strategic events for borrowers, leading to the inability to repay loans.

1. INTRODUCTION

The modern economic monetary system is exposed to the risks of force majeure circumstances. In difficult isolation conditions, it is complicated for enterprises to maintain the competitiveness of their products and services and also ensure a continued production process. The issue of improving monetary policy instruments and lending at rates that are effective for the economy is actual. In these conditions, banks are forced to roll over loans and issue them at zero interest rates, but no liquidity buffer has been created for these processes. In accordance with the requirements of Basel III and the Central Bank of the Russian Federation (CBRF), banks are required to assess the creditworthiness of borrowers in order to form a reserve for possible losses on loans to minimize the credit risk of the bank. The main purpose of credit risk assessment is to assess the quality of capital and assets, assess the profile and size of the main banking risks accepted by the credit institution, assess the quality of their management, as well as the ability of the credit institution to carry out effective activities. Risk is a possible event, expected or unforeseen, that could have a negative impact on the capital and profit of a credit institution. Bank risk management

approaches, the adoption of which by credit institutions is not directly limited by the supervisor, are contained in the letters of recommendation of the Bank of Russia and in the documents of the Basel Committee on Banking Supervision (BCBS) (CBR.ru, 2015). The same applies to the questions of the borrowers being connected with each other, lending procedures for persons associated with a credit institution, assessing the quality of liquidity management, and a number of other activities of a credit institution. During an assessment of the activities and financial stability of a credit institution, the supervisor determines the risks that are inherent in its activities, measures their magnitude, identifies their concentration, evaluates the adequacy and degree of compliance with restrictions established by the credit institution, and evaluates the quality and effectiveness of the risk management and internal control systems. The aim of the study is to develop a method to determine the systemic strategic risk buffer of the borrowers for hedging force majeure situations. The share of operating credit institutions that made a profit in 2019 is 83%, the rest is attributed to losses. In 2021, this deteriorated, with 75% making a profit and 25% making a loss (see Table 1).

Table 1. Macroeconomic performance indicators of the banking sector of the Russian federation.

No.	Indicator	January 1, 2019	January 1, 2020	January 1, 2021	January 1, 2022
1	Banking sector assets (billion rubles)	86,232	88,796	103,842	120,310
	% of GDP	83.0	81.0	96.8	92.0
2	Reference: Total assets of the banking sector without deducting the formed reserves and income tax (billion rubles)	94,084	96,581	112,506	129,064
3	Corporate and retail loans, including overdue loans (billion rubles)	52,912	56,654	64,804	74,949
	% of GDP	50.9	51.7	60.4	57.3
	% of banking sector assets, including:	61.4	63.8	62.4	62.3
	Corporate loans and overdue debt (billion rubles)	38,011	39,004	44,760	50,346
	% of GDP	36.6	35.6	41.7	38.5
	% of banking sector assets, including:	44.1	43.9	43.1	41.8
	Loans to individuals, including overdue loans (billion rubles)	14,901	17,651	20,044	24,603
	% of GDP	14.3	16.1	18.7	18.8
	% of banking sector assets	17.3	19.9	19.3	20.4
3.1	Bank loans in investments of organizations of all forms of ownership in fixed capital (billion rubles)	1,531	1,436	1,530	1,698
	% of investments of organizations of all forms of ownership in fixed assets	11.2	9.8	9.9	9.8
4	Investments in securities (billion rubles)	11,484	12,012	16,151	17,289
	% of GDP	11.1	11.0	15.0	13.2
	% of banking sector assets	13.3	13.5	15.6	14.4
5	Deposits of individuals (billion rubles)	28,459	30,412	32,834	34,695
	% of GDP	27.4	27.7	30.6	26.5
	% of banking sector assets	33.0	34.2	31.6	28.8
6	Deposits and funds of corporate clients (billion rubles)	28,005	28,146	34,067	39,885
	As a % of GDP	27.0	25.7	31.7	30.5
	As a % of banking sector assets	32.5	31.7	32.8	33.2

The remainder of the article is set out as follows: The next section contains a review of the literature on the research topic; Section 3 presents an analysis of credit risk and methods for its assessment, the hypothesis of the research, the stages for determining the buffer of the systemic strategic risk of the borrower for hedging in extraordinary circumstances, and the model of the values of risk-weighted credit claims to the borrower; the fourth section presents the results of the quantitative and qualitative analyses of creditworthiness using the example of the

Russian company Russian Aircraft Corporation "MiG"; Section 5 is devoted to a discussion of the obtained results; and the final section presents the conclusions.

2. LITERATURE REVIEW

The research materials are based on the theory of management of economic systems principles, fundamental works of Russian and foreign authors devoted to the issues of strategic analysis, economic and mathematical analysis and risk management. Banking activities in Russia are implemented by a wide range of laws (Decree of the Government of the Russian Federation), for example, of 06.08.2015 No. 483-P, of 06.06.2017 No. 590-P, of 28.06.2017 No. 180-I and of 17.01.2005 No. 2-T (Decree of the Government of the RF, 2005, 2015, 2017a, 2017b). The works of many Russian and foreign researchers are devoted to the mechanisms of analysis of the bank's credit risk: Eremin, Moskvicheva, and Melik-Aslanova (2020); Gorelov, Davydov, Silaev, and Tikhonov (2018); Ryapukhin, Kabakov, and Zaripov (2019); Tarasova, Nikolenko, Gorbunov, and Semina (2018); Zaripov, Murakaev, and Ryapukhin (2020); Shabaltina, Egorova, Agaphonov, and Ermolina (2020); Nguyen, Marmier, and Gourc (2013); Chao and Franck (2012); Zaynullina (2021); Zelentsova and Tikhonov (2020); Gyazova and Gorelov (2021); Oskarsdóttir and Bravo (2021); Zhou, Fujita, Ding, and Ma (2021). In general, in scientific literature, risk is understood as the probability of deviations of actual performance from those expected under conditions of uncertainty. Financial risk appeared simultaneously with the formation of money circulation. Each factor is accompanied by risk factors (in external and internal environments), which are sources of the probabilistic occurrence of risk events. The financial and economic risk factors of the real sector of the economy are the composition structure of assets and liabilities, income and expenses of companies. On the part of the state, it is necessary to exercise control over the activities of economic entities associated with unjustified risk, potentially threatening the foundations of statehood and socio-economic security. Credit risk is the possibility of losses as a result of a borrower's failure to meet its obligations. Credit risk is present in the activities of real and financial sector entities. Identification and assessment of financial risks is a process of identifying an organization's exposure to uncertainty, which involves obtaining the most complete information about the organization, relevant financial and commodity markets, legislation, the social and political environments, as well as its development strategy and operational processes, including information about threats and opportunities to achieve its goals.

In this study, a multi-layer network model was developed to assess credit risk and the relationships between borrowers, and a quantitative assessment was carried out of the degree of risk of default of the borrower (Oskarsdóttir & Bravo, 2021). In the framework of forecasting borrowers' credit risk, the Bayesian approach is the most appropriate in various scenarios (Zhou et al., 2021). As a tool for making decisions to achieve the maximum level of fulfillment of obligations, a risk-oriented model is used to determine the existence of a connection between the enterprise project management system and the risk management system. This is achieved by analyzing the consequences of risk as an event using a synchronization of processes between risk management and the process schedule (Marmier, Gourc, & Laarz, 2013; Nguyen et al., 2013). The approach of the study is divided into three stages: conducting several case studies, writing a cross-case, and determining patterns. The key parameters for observing patterns are understanding risk, the sources of risk, and the risk management process (Chao & Franck, 2012; Ryapukhin et al., 2019). A qualitative assessment of the risks of various types of activities is undertaken using a survey with the following analysis system: no risk, minimal risk, average risk, risk above average and unacceptable risk (Gorelov et al., 2018; Zaynullina, 2021). The risk management process consists of standard stages: identification and analysis, choice of risk management method, application of the selected method, and monitoring of results. The identification and qualitative assessment of risks precede the quantitative assessment. The main goal of a qualitative assessment is to prioritize the identified risks, i.e., assign a digital rating to each of the risks and enter them into the register. The digital rating is expressed in points and reflects its significance and the need for further application of risk management procedures. Risk identification includes sources of uncertainty and risk,

consequences of risk realization, sources of information, numerical definition of risk, and mutual influence of risks on each other.

Strategic risk is the risk of losses to the enterprise as a result of mistakes when making decisions regarding a company's strategy, activities and development by not taking into account or insufficiently taking into account possible dangers that may threaten the company's performance (Gyazova & Gorelov, 2021; Shabaltina et al., 2020). The methods of individual expert risk assessment include interviews, questionnaires, SWOT analysis, BPEST analysis, PESTLE analysis and causal relation analysis (Eremin et al., 2020; Gorelov et al., 2018; Gyazova & Gorelov, 2021; Ryapukhin et al., 2019; Tarasova et al., 2018; Zelentsova & Tikhonov, 2020). A promising method for assessing financial indicators in the aggregate is the use of aggregated indicators, i.e., polynomial combinations of individual financial indicators, particularly linear combinations. To assess the impact of various risk factors on collateral indicators and determine sensitivity indicators, graphs and tables depicting the dependence of collateral indicators on risk factors are used.

The credit risk analysis mechanism for borrowers and banks is presented in the Basel III agreement. However, there are no recommendations for the formation of a security buffer from returned loans and interest for extraordinary circumstances, e.g., the COVID-19 pandemic, which led to defaults of borrowers and defaults of national economies. Therefore, it is necessary to review the rules for assessing the credit risk of borrowers and banks at the international level.

3. MATERIALS AND METHODS

Analysis of credit risk shows its impact on the economic situation of a credit institution, and the following factors should be considered:

1. Credit risk exists when a credit institution conducts almost any active transaction, as well as when a credit institution assumes contingent liabilities that involve the occurrence of credit risk in the performance of these obligations and in the conclusion of forward transactions.

2. The possibility of deterioration in the financial condition of a credit institution as a result of the implementation of credit risk should be assessed with the concentration of credit risk, including by economic sector, business lines, and volume of credit transactions with related borrowers and persons associated with a credit organization, including owners of a credit institution.

3. Assessment of the quality of assets of a credit institution from the standpoint of the level of credit risk, and measures of realized credit risk in most cases is crucial for making a judgment on the financial condition of a credit institution. Credit risk analysis is carried out on the basis of credit organizations' statements submitted to the Bank of Russia. The concentration of credit risk of a credit institution should be considered in relation to Decree of the Government of Russian Federation of 06.08.2015 №483-P, Decree of the Government of Russian Federation of 06.06.2017 №590-P:

   - Credit transactions with one borrower or a group of related borrowers.
   - Credit operations with persons associated with a credit institution, including the owners of a credit institution.
   - Presence of specialization in lending to enterprises of a certain industry of the economy and a certain region and on a particular loan product.
   - Loans granted to borrowers in foreign currency, if the sources of funds through which the borrower intends to repay these loans are denominated in Russian rubles (Burdina & Bondarenko, 2020; Shabaltina et al., 2020).

In international practice, a group of related borrowers of a credit organization is referred to as a legal entity that is connected in such a way that a deterioration in the financial situation of one borrower may result in failure of other borrowers to fulfill the obligations to the credit institution under its credit requirements (Eremin et al., 2020;

Zelentsova & Tikhonov, 2020). The financial crisis has shown that transactions with owners and other persons affiliated with a bank are, in general, substantially more risky than operations with third parties. An increased concentration of risks on businesses was characteristic of almost all credit organizations that experienced serious shocks during the crisis (Yakovlev, Streltsov, Izmailov, Ermolina, & Sunteev, 2020). Exactly this circumstance, along with the nature of the objects of investment in the vast majority of cases, was the main cause of their financial problems. In order to conceal the real concentration of risks in relation to the owners of credit organizations, as a rule, financing is carried out for companies that are not formally associated with the owners, but actually controlled by them. In this regard, the assessment of the level of risks on the owners of a credit institution should be based on meaningful approaches, that is not only by the criterion of legal ties or capital ties, but also on the basis of the actual ownership by individuals of a credit institution and related business. The basis for assessing the credit risk of a loan is the assessment of the financial position of the borrower and the quality of servicing the debt. When analyzing the financial position of a credit institution, we should refer to clauses 3.3. and 3.4. of Regulation No. 590-P and Regulation No. 626-P (Tarasova et al., 2018; Zaripov et al., 2020).

When assessing the adequacy of the created reserves for possible losses on loans with collateral, it is necessary to make sure that:

a) The credit institution pays attention to the analysis of the legal aspects related to the possibility of exercising its security rights and the circumstances regarding the borrower's lack of intention to prevent this.

b) If necessary, the credit institution will take timely and effective action to realize collateral rights.

c) There are no circumstances that may impede the realization by a credit institution of collateral rights.

Therefore, it is recommended to demand the creation of reserves. The risk level of implementing interim measures depends not only on the type of collateral, but also on the degree of good faith of the borrower/pledger. Legal risks are important, and the priority of the factor assessing the financial position and good faith of the borrower over the factor of collateral quality affects the conservative approach to assessing the quality of loan debt. When making a judgment on the necessary reserve for possible losses, taking collateral into account, the conservative principle "even good collateral does not make bad debt good" should be adhered to. In this study, the systemic strategic risk of the borrower is considered as the probability of bank losses upon the occurrence of systemic strategic events for the borrower, leading to the inability to repay loans. We consider it necessary to take into account the probability of a systemic strategic risk of the borrower when assessing the complex credit risk of the borrower and the bank. The hypothesis of the study is based on the need, under the present conditions, for the formation of a buffer of systemic strategic risk of the borrower for hedging force majeure situations.

The stages of analysis of the systemic strategic risk of the borrower are as follows:

• Obtain operational and objective information about the state and size of systemic strategic risk.

• Identify and analyze areas of systemic strategic risk.

• Carry out qualitative and quantitative assessments of systemic strategic risk.

• Establish the interconnections between individual types of risks in order to assess the impact of measures planned to limit one type of risk on the growth or decrease in the level of other risks.

• Create a system for monitoring and controlling systemic strategic risk at the stage of emergence of a negative trend.

In order to adjust the exposure of credit risk, banks have the option to create a buffer of the borrower's systemic strategic risk for hedging force majeure situations. The proposed security buffer is a reserve of funds in case the borrower fails to repay loan obligations for economic, political or medical reasons beyond their control. The size of the buffer should depend on the type of activity of the borrower and their eligibility level for state support. The study proposes that the size of the loan's interest rate should be dependent on the size of the systemic strategic risk of the borrower, which determines the size of the security buffer. Thus, in case of full compliance with the terms of the loan agreement and repayment of the loan and interest, the funds reserved in the security buffer

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should be returned to the borrowers. The stages of technology for determining a borrower's systemic strategic risk buffer for force majeure circumstances hedging are as follows:

Stage 1. Analyze the information from credit bureaus.

Stage 2. Assess the borrower's creditworthiness via a quantitative analysis of liquidity, profitability, financial stability and turnover.

Stage 3. Assess the borrower's creditworthiness via a qualitative analysis of the market, industry, management and government support.

Then, the total score and the rating of the borrower are determined.

Stage 4. Loss given default (LGD) (see Equation 1).

Stage 5. Determine the probability of default of the borrower and the systemic strategic risk of force majeure circumstances hedge:

- Determine the probability of default of the borrower (PD) (see Equations 1, 2 and 3).
- Define the systemic strategic risk (S) (see Equations 1, 2 and 3).

Stage 6. Determine the value of risk-weighted credit claims against the borrower, taking into account the systemic strategic risk of hedging force majeure situations (1,5) (Cr) (see Equation 1).

$$Cr = 12.5 * LGD * \left(N \left(\frac{N^{-1}(PD+S) + \sqrt{R(PD+S)} * N^{-1}(0.999)}{\sqrt{1-R(PD+S)}} \right) - (PD+S) \right) * \frac{1+(M-2.5)*b(PD+S)}{1-b(PD+S)} \quad (1)$$

$$R(PD+S) = 0.12 * \left(\frac{1-e^{-50*(PD+S)}}{1-e^{-50}} \right) + 0.24 * \left(1 - \frac{1-e^{-50*(PD+S)}}{1-e^{-50}} \right) \quad (2)$$

$$b(PD+S) = (0.11852 - 0.005478 * \ln(PD+S))^2; \quad (3)$$

where:

R is the value of the correlation index, $b(PD+S)$ is the maturity adjustment value, $N(x)$ is the standard normal distribution function, $N^{-1}(x)$ is the inverse standard normal distribution function, M is the period, and b is the correction factor established by the regulatory body to maintain the current level of minimum capital requirements while stimulating the introduction of more sensitive approaches to credit risk assessment. The value of the coefficient can be adjusted by the regulatory body.

Stage 7. Determine the exposure of credit risk needed to consider the systemic strategic risk of hedging force majeure situations (see Equation 4).

$$CRP = b*Cr*EAD, \quad (4)$$

where EAD is the default exposure of the organization.

Stage 8. Determine the estimated reserve and loan rate, considering the systemic strategic risk of hedging force majeure situations.

Stage 9. Determine the borrower's systemic strategic risk buffer for hedging force majeure circumstances as the difference between total loan payments, considering the probability of a systemic strategic risk and not taking into account the systemic strategic risk.

Stage 10. Create a systematic strategic risk buffer for the borrower for hedging force majeure circumstances by monthly deductions from paid interest.

Stage 11. If the loan has been repaid and no systemic strategic emergencies have occurred, the borrower's systemic strategic risk buffer for hedging emergencies is returned to the borrower in full.

4. EMPIRICAL RESULTS

Quantitative and qualitative analyses were carried out of the creditworthiness of the Russian Aircraft Corporation "MiG" in terms of liquidity, profitability, turnover, etc. This corporation has a modern design and an experimental base, well-equipped production facilities, effective financial and marketing structures, as well as a developed global system of technical support for its products.

The creation of the corporation's fighters is carried out using digital technologies at all stages of the life cycle, from development to after-sales service. The dynamics of the development of the industry and company management were studied. As a result, the borrower's financial condition was found to be very poor, with a total of 85 points in 2017 and 91 points in 2018. The study carried out the practical implementation of the mechanism for determining the value of risk-weighted credit requirements for the borrower and credit risk, taking into account the systemic strategic risk of hedging force majeure circumstances (see Table 2).

Table 2. Determination of credit risk taking into account systemic strategic risk.

Credit requirements of the organization (million rubles)	EAD	200	200	200
For a period of five years	M	5	5	5
44% default loss rate	LGD	0.44	0.44	0.44
Probability of default of the borrower and strategic risk	$PD+S$	5%	7%	9%
Probability of default of the borrower of 5%	PD	5%	5%	5%
Borrower strategic risk level of 2%	S	0%	2%	4%
b – correction factor, $b = 1.06$	-	1.06	1.06	1.06
Amount of credit risk	$CRP=b{\cdot}Cr{\cdot}EAD$	372.66	411.12	445.13
Cr	-	1.76	1.94	2.10
R	-	0.13	0.12	0.12
$\left(1 - \dfrac{1 - e^{-50*(PD+S)}}{1 - e^{-50}}\right)$	-	0.92	0.97	0.99
$e^{-50*(PD+S)}$	-	0.08	0.03	0.01
e^{-50}	-	0.00	0.00	0.00
$b(PD+S)$	-	0.08	0.07	0.06
x	-	-0.57	-0.42	-0.28
$N(x)$	-	0.28	0.34	0.39
$N^{-1}(PD+S)$	-	-1.64	-1.48	-1.34
$N^{-1}(0.999)$	-	3.09	3.09	3.09

Table 1 reflects the results of the study on a specific example.

Based on the value of credit risk, taking into account the systemic strategic risk of the borrower, a buffer of the borrower's systemic strategic risk is determined to hedge contingencies in the amount of 5% of the interest paid, which is returned to the borrower as a bonus subject to credit discipline.

5. DISCUSSION

In accordance with the requirements of Basel III and the CBRF, banks are required to assess the creditworthiness of borrowers in order to form a reserve to cover possible losses on loans to minimize the credit risk of the bank. However, as practice has shown, the modern economic system is not ready for the systemic risks of force majeure circumstances (e.g., the COVID-19 pandemic caused by the SARS-CoV-2 coronavirus). Also, banking regulators did not describe the technology for determining redundancy for systemic emergencies in their documents. These factors substantiate the relevance of the study. In this research, approaches to assessing the creditworthiness of borrowers and the credit risk of a bank were examined, and the CBRF's assessment and management of bank credit risk for active operations were analyzed.

In this study, the goal has been achieved; a model has been developed to create a buffer of the systemic strategic risk of the borrower for hedging force majeure circumstances, which can be used as an instrument of monetary policy. The study assessed the borrower's creditworthiness and credit risk, taking into account the systemic strategic risk and without. The practical implementation of the mechanism for determining the value of risk-weighted credit claims against the borrower and credit risk was carried out considering the systemic strategic risk of hedging force majeure circumstances. However, a method for determining the probability of a systemic strategic risk when creating a buffer of a systemic strategic risk of a borrower for hedging force majeure situations is not described.

6. CONCLUSIONS

The novelty of the study is the introduction of a new concept of "systemic strategic risk of the borrower", which refers to the probability of bank losses in the event of systemic strategic events for the borrower, leading to their inability to repay the loan. In addition, the expediency of creating a buffer of the borrower's systemic strategic risk for hedging emergency circumstances in the context of sanctions and other difficult economic situations is substantiated. The stages of the analysis of the systemic strategic risk of the borrower are determined, and an approach to determining the buffer is proposed.

The lending process is connected with the risk of non-repayment of the loan by the due date; there is a need for a more informed approach to determine the creditworthiness of the borrower and the credit risk of the bank. The modern economic system, along with others, is at risk of force majeure circumstances (e.g., the recent Covid-19 pandemic). In these conditions, the bank is forced to roll over loans and issue zero interest rates, but no liquidity buffer has been created for these processes. Bank risk management approaches are contained in letters of recommendation from the Bank of Russia and BCBS. The same applies to the questions of the borrowers being connected with each other, lending procedures for persons associated with a credit institution, assessing the quality of liquidity management and a number of other aspects of the activities of a credit institution.

This model makes it possible to make management decisions based on the analysis and comparison of all possible alternatives, allows the development of a system of preferences guided by the criterion for choosing the most cost-effective and least risky courses of action. Strategic risk management is recommended from the standpoint of a systematic approach. If we consider the proposed risk from the standpoint of methods for minimizing the negative impact of adverse events, it refers to risk avoidance methods that allow complete avoidance of the impact of adverse consequences of a risk situation. If we consider the ratio of the time of implementation of control measures and the onset of a risk situation, it refers to the methods of pre-event risk management. The use of the proposed risk management tools does not contradict the current legislation of the Russian Federation. Future research will continue in the direction of developing a financial risk management planning system, which will include a budget component for the development and implementation of a borrower's systemic strategic risk buffer system for hedging force majeure circumstances. This study provides an interpretation of the concept of a systemic strategic risk of the borrower. A model has been created to determine the buffer of the systemic strategic risk of the borrower to hedge force majeure circumstances of the presented reserve of funds in case the borrower is unable to repay loan obligations due to economic, political or medical reasons beyond his control. It is believed that the size of the buffer depends on the type of activity of the borrower and the level of state support they are entitled to. If the loan has been fully repaid in accordance with the terms of the loan agreement, the buffer will be returned to the borrower in full. The proposed model is suggested for use as an instrument of monetary policy.

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