ORIGINAL ARTICLE

Contact to corresponding author: gospodarchukgg@iee.unn.ru; Lobachevsky State University of Nizhni Novgorod, 603157, Nizhni Novgorod city, Beriozovskaya st., bld 110. Apt 113, Russian Federation

Galina Gospodarchuk
Lobachevsky State University of Nizhni Novgorod, Russian Federation
 orcid.org/0000-0003-3660-6779

Ekaterina Suchkova
National Research University "Higher School of Economics"
Nizhny Novgorod, Russian Federation
 orcid.org/0000-0001-5943-4645

Financial stability: problems of inter-level and cross-sectoral equilibrium

Abstract

Research background: As part of the creation of an effective mechanism for managing financial stability, the tasks of providing an inter-level and cross-sectoral financial equilibrium remain unresolved. So far, clear and unambiguous criteria for financial stability have not been formulated, with which monetary and prudential policies could be related, as well as measures to minimize systemic and individual risks. The problem of creating a system of indicators comes to the fore, allowing the creation of new effective instruments for regulation of financial flows that contribute to the prevention of financial crises.

Purpose of the article: The paper proposes a system of indicators of financial stability, which allows for solving the tasks of inter-level and cross-sectoral equilibrium in the selection of regulatory tools for monetary and prudential policy.

Methods: We have used real interest rates as a measure of financial stability at the macro level. The real rates have been calculated from time series with nominal interest rate and inflation in the credit market (divided into loans to financial and non-financial organizations and individuals), and in the bond market (divided into corporate, municipal, and federal bonds). The analysis of the market and institutional financial stability of the USA, Russia, Japan, Switzerland, Australia over the period 1984–2014 was done. Then, comprehensive investigation on the financial stability in the Russian Federation in 2014–2017 was conducted.

The results have been compared against financial stability of individual banks, which was measured using profit to risk ratio. The latter has been calculated from bank's financial reports using our method, which had been developed earlier.

Findings & Value added: We have developed criteria for qualitative assessment of financial stability and the risk map, which helps to identify the level of accumulated imbalances in the market and institutional environment, as well as in the levels and sectors of the economy. The criteria for selecting monetary and prudential regulatory instruments have been formulated depending on the amount of accumulated risks. The criteria for forming a portfolio of regulatory instruments with regard to their rigidity are proposed.

Introduction

The international community began to recognize the need to monitor the financial stability of the economy as a result of the financial crises of the 1990s. The subsequent crises of 1998 and 2008 confirmed the need to create mechanisms to control the financial stability of the participants of the financial system. The significant damage caused by these crises (see Haldane *et al.,* 2004; Allen & Gu, 2018; Cheng & Mevis, 2019), highlighted the need to develop a system of indicators that could assist policymakers in identifying the strengths and vulnerabilities of financial systems at both global and national levels.

As follows from publications (Schinasi, 2005; Dobravolskas & Seiranov, 2011; Cavelaars *et al.,* 2013; and others), ensuring financial stability has become the dominant goal in the economic policies of states over the past decade. Meanwhile, an analysis of the literature shows that the development of indicators of financial stability has not yet been completed. For instance, according to (Schinasi, 2005), the analysis of financial stability is still in its infancy. There is still no generally accepted model or analytical framework for assessing macroeconomic stability, and the development of financial indicators that could identify problems in the real sector of the economy has just started. According to Galati and Moessner (2018), Zulkhibri (2017), the literature on the effectiveness of macroprudential policies and its tools is still in its infancy and so far provides only limited guidance for political decision making. Theoretical studies of macroprudential policies render mixed results, and empirical studies on this issue are not definitive. Aspachs *et al.* (2007) note that there are still no obvious quantitative criteria for assessing financial stability.

Currently, the indicators of the stability of the banking sector of the economy are represented to the highest extent. This is evident from the materials of the International Monetary Fund (2006, 2018), Federal Reserve Board (2018), reports from central banks of different countries, as well as from the number of scientific publications on the analysis and prediction of

the financial sustainability of economic entities and their homogeneous groups. A rather narrow list of indicators is used to analyze the sector of non-bank financial organizations, the sector of non-financial corporations, the household sector, and the sector of non-profit organizations serving households, which is explained by the fragmentation of reporting data among different types of institutional units.

Indicators of volatility and cyclicality of financial markets used to measure financial stability at the macro level have drawbacks, as evidenced by the growth of publications on the improvement of these indicators, the majority of which feature recommendations to account for the particular features of the development of national economies (Sere-Ejembi *et al.,* 2014; Bouheni & Hasnaoui, 2017; Galstyan & Herzberg, 2018).

However, the inter-level analysis of financial stability still remains a complex and unsolved task. As noted by Schinasi (2005), the problems of balancing indicators of financial stability can be solved by creating a unified system of such indicators. However, the analysis of scientific publications on this topic shows that the methodology for the formation of such a system of indicators and criteria for assessing the overall financial stability have not yet been developed. This hinders the increase in the efficiency of financial regulation, since it makes it difficult to harmonize monetary and prudential policy instruments, as well as measures to minimize systemic and individual risks. Meanwhile, the problems of consolidating monetary and macro-prudential policies are becoming more and more relevant, as evidenced by scientific publications of recent years (see, for example, Tobias & Liang, 2016).

Thus, we can conclude that currently the major focus is put not on the problem of improving the assessment of financial stability in relation to each level and each sector of the economy, but to the problem of creating a methodology for developing a multi-functional indicator system, which can act as a platform for developing adaptive requirements and standards for the quality of financial regulation.

In this regard, this study will focus on the development of analytical tools that allow conducting a systematic assessment of financial stability and coordinating the goals and tools of monetary, macroprudential, and microprudential policies in order to reduce systemic risks.

To achieve this goal, we conducted a comparative analysis of the market and institutional financial stability of the USA, Russia, Japan, Switzerland, Australia over the period 1984–2014 using correlation analysis. We comprehensively investigated the financial stability in the Russian Federation in 2014–2017 using a multi-level cross-sectoral approach. We used real interest rates as a measure of financial stability at the macro level. Real rates

were calculated based on the time series with a nominal interest rate and inflation in the credit market (divided into loans to financial and non-financial organizations and individuals) and the bond market (divided into corporate, municipal, and federal bonds). The results were compared with the financial stability of individual banks, which was measured using the profitability/risk ratio. The latter was calculated based on the financial statements of banks using our method, which had been developed earlier.

Our study consists of several sections. The first section is a review of current research related to financial stability. The second section provides a conceptual framework for the development of analytical tools for a systematic assessment of financial stability and coordination of the goals and tools of monetary, macroprudential, and microprudential policies. The third section is the research itself, which addresses the following tasks: selection of financial stability indicators to create a system of these indicators; development of criteria for market and institutional balance of financial stability; determination of criteria for the selection of regulatory instruments; development of a risk map and identification of objects of monetary, macroprudential, and microprudential regulation. The next section is devoted to the testing of the developed analytical tools in relation to the Russian economy and the analysis of the results obtained. The last section contains a discussion of the research results and the main conclusions.

Literature review

The foundation for the effective regulation of financial stability is a properly constructed system of indicators, which allows for detecting and identifying sources and objects of the formation of financial imbalances. At present, scholars and practitioners of economics have developed a large number of private indicators and criteria for assessing the stability of financial markets, as well as the stability of their professional participants. However, so far, there has been proposed no integral indicator, which makes it possible to link these individual indicators into a single system.

The complexity of creating such an integral indicator is related, in our opinion, to the presence of fundamentally different theoretical and corresponding methodological approaches used in the development of private indicators (Table 1).

Table 1 shows that the indicators of financial stability are formed on the basis of two methodological approaches. The first approach involves analyzing the volatility of financial markets. Within this approach, two basic

concepts can be distinguished: the concept of "financial bubbles" and the concept of financial cycles.

Within the framework of the concept of "financial bubbles", as a rule, scholars analyze the indicators of growth in asset prices and the profitability of debt financial instruments (Sornette, 2017; Gospodarchuk & Gospodarchuk, 2017b).

Concepts of financial cycles involve the development of one or more indicators for early detection of crises. Among these concepts, the most widely used are signaling concepts, the authors of which believe that traditional macroeconomic indicators are sufficient to monitor financial stability. Their deviation from the threshold values already signals the emergence of the prerequisites for a crisis (Kaminsky, 1999). In particular, the analysis of the possibilities of using the debt service ratio (DS ratio) as an early indicator of the onset of financial crises, carried out by Drehmann and Juselius (2012), showed that the increase in DS ration relative to the long-term moving average has a good signal function. The debt service ratio exceeding the threshold of 4–6 pp in 2/3 of cases precedes the onset of the financial crisis in the next 1–2 years. In accordance with the recommendations of the Basel Committee on Banking Supervision (2010), the deviation of the actual values of the indicators from their threshold values should be used by central banks to plan the countercyclical capital buffer. Another common group of concepts that corresponds to the first methodological approach is the calculations of an aggregated index of financial stress based on economic and mathematical methods, including calculations based on binary trees, as done by Bouheni and Hasnaoui (2017); Illing and Ying (2006); Duca and Peltonen (2011). This group of concepts includes models of banking crises based on an assessment of banking risks (see Tsionas, 2014; Boudebbous & Jamel, 2013).

On the basis of institutional-oriented definitions, two methodological approaches to diagnosing financial stability have emerged: integrated and risk-oriented. In both cases, the object of study and evaluation is the financial condition of the institutional unit. At the same time, the assessment of the financial condition of economic sectors is carried out by aggregating data on the financial status of institutional units. At the same time, it should be noted that the number of indicators used to diagnose the sustainability of the economic sectors is significantly less than for their institutional units. For example, the assessment of the financial stability of the banking sector of the economy does not include the analysis of the quality of management due to the absence of a corresponding quantitatively measured indicator (International Monetary Fund, 2006).

Within the framework of an integrated approach, as a rule, the following aspects are investigated: sensitivity to external shocks (Frait & Komarkova, 2011) and the effects of "contamination" (Allen & Gale, 2004). These aspects are analyzed using such indicators as capital adequacy, asset quality, liquidity status, leverage, profitability level, and quality of management functions. The conclusion on the financial sustainability of economic entities is made on the basis of the compliance of the achieved values of financial indicators with the requirements for the quality of their activities and the quality of management of these activities. At the same time, to calculate the consolidated indicators, scholars use weighting methods and econometric models (see, for example, Bouheni & Hasnaoui, 2017).

Allen and Gale (2004) note that research has shown a tendency to shift from an integrated methodological approach to a risk-based approach, which is based on the idea of assessing the quality of risk management in economic sectors. Currently, the following risk-based concepts for diagnosing financial sustainability are applied more commonly:

− the concept of structural changes that assesses financial stability on the basis of changes in the volume of borrowings and risk assets (Bhattacharya *et al.,* 2015);
− the concept of default that assesses financial stability on the basis of a combination of profitability and probability of default (Aspachs *et al.,* 2007);
− the concept of regulatory and economic capital that evaluates financial stability based on the ratio of regulatory (economic) capital and magnitude of the risks (Basel Committee on Banking Supervision, 2004);
− the concept of leverage, which assesses financial stability on the basis of the ratio of borrowed funds and equity funds (King, 2010);
− the concept of debt limitation that assesses financial stability on the basis of the ratio of debt to income (Trichet, 2011).
− the concept of effective risk evaluating financial stability based on the ratio of profitability and risk (Gospodarchuk & Gospodarchuk, 2017a).

These concepts are used to analyze the sustainability of the banking sector, some segments of the non-bank financial organizations sector, and (partially) to analyze the stability of non-financial organizations.

Currently, a wide range of instruments for prudential financial stability regulation has been developed and is being applied in practice, the list of which was proposed by Group of Thirty (2010). Meanwhile, this list can be supplemented with instruments of monetary policy, which also have an impact on financial stability. In this regard, we consider it expedient to present all the regulatory instruments in the form of three groups: monetary policy instruments, macroprudential policy instruments, and micropruden-

tial policy instruments; aimed at reducing market, system and individual risks, respectively (table 2).

The selection of these or other instruments is based on the monitoring and analysis of changes in various risk indicators. At the same time, in many cases, several instruments are used to reduce financial instability, which contributes to the achievement of various intermediate goals. At the same time, a number of authors (Maes, 2010; Crockett, 2000; International Monetary Fund, 2013; Jenkins & Longworth, 2015) point out that the portfolio approach to the use of regulatory tools requires taking into account the mutual influence of monetary and prudential policies, as well as the harmonization of regulatory instruments used at different levels of the economy. Currently, three options are proposed for the coordination of monetary and prudential policies: the modified Jackson-Hole consensus, lean-against-the wind principle of monetary policy, and the statement that "Financial stability is identical to price stability" (Smets, 2014). Meanwhile, research and practice have not yet established an analytical framework, which would harmonize these tools not only between individual policies of central banks but also between levels and sectors of the economy.

Thus, the indicators of financial stability that have been developed so far are, in fact, relatively independent systems of indicators used separately for diagnosing market and institutional stability of the economy. It is not possible to give a systematic assessment of financial stability and coordinate the use of monetary, macro-prudential and micro-prudential policies in order to reduce systemic risks.

Research methodology

We assume that the indicators of financial stability used in the framework of different concepts have a moderately negative relationship with each other. Therefore, combining disparate indicators into the system will make it possible to establish more stringent requirements for financial stability and thereby improve the quality of its management. The practical implementation of this idea involves the following steps:
1. Selecting the indicators, which will be used to assess financial stability;
2. Testing the negative relationship between the selected indicators;
3. Proposing a method for combining indicators into a complete system;
4. Developing the rules for the consolidation and application of regulatory tools to reduce systemic risks, depending on the level of financial instability.

To test the negative relationship of the indicators, the following countries were selected: the USA, Russia, Japan, Switzerland, Australia. We made this selection based on the following considerations:

1. Availability of a sufficiently vast historical records on interest rates, inflation and key indicators of banks for selected countries. Therefore, we needed countries with a well-developed financial system and a system for collecting statistical data.
2. Representativeness of the sample, which should include countries from different regions.

The study period was limited by data availability. For instance, ROA for the banking system is not sufficiently available. For the USA it has been available since the 1980s, in the rest of the countries — since 1995 and 2001 (Table 3).

Research

Selecting the financial stability indicators

To assess financial stability, we use two indicators: the index of financial stability (IFS) and the profitability-risk ratio (PR).

IFS was proposed by us earlier (Gospodarchuk & Gospodarchuk, 2017b). It represents the real interest rate, the calculation algorithm of which has been modified as follows:

1. As an indicator of inflation, we didn't use the standard CPI, but a combined indicator, which includes the CPI, the increase in prices of stock market instruments and real estate prices;
2. The rates on loans and bond yields were used as nominal interest rates.

Negative values of this indicator signal the possibility to borrow at a rate lower than the return on assets. This leads to the inflation of bubbles in the economy. Negative IFS values lead to a gradual deterioration in financial stability. When these values are positive, financial stability improves. This indicator is leading. It is important to note that a short-term reduction in IFS does not create risks. The threat to financial stability emerges when this indicator stays in the negative zone for a longer period of time.

As a second indicator, we used the profitability/risk ratio (PR), which described in Gospodarchuk and Gospodarchuk (2017a). This indicator is calculated based on the financial statements of banks. Profit is an indicator of profitability, while the amount of risk assets of a bank indicates the risk. Thus, this PR indicator combines two separate indicators: the traditional indicator of the ratio of profitability to risk and the rate of return on assets.

The idea of using this indicator is that when the profitability is insufficient, banks cannot use their profit to cover risks taken, which, as a result, leads to a gradual deterioration in all indicators of the bank's performance. PR, as well as IFS, is the leading indicator. However, only when PR remains in the negative zone for a longer period of time, can we register a risk. Unlike IFS, it predicts financial stability from the "inside" of organizations, while IFS does it from the "outside".

Validation of the hypothesis

We verified the validity of the hypothesis by comparing indicators of the market and institutional financial stability. Here, we analyzed data for several countries. For this part of the study, we replaced the IFS and PR indicators by simplified versions: real rate (RR) and return on assets (ROA), respectively. This replacement was made for the following reasons:
1. These commonly used indicators are commonly available in their final form;
2. For this study, it was more important for us to cover the largest possible time interval, sacrificing accuracy a little;
3. The RR used is not significantly different from the original IFS. Until the beginning of 2000, there were no large bubbles in the markets, similar to the rise in oil prices by 2008. Therefore, the deviations of IFS from real rates are insignificant;
4. As for ROA, it differs from PR because it accounts for all the assets instead of only risky ones. If we assume that the ratio of risky assets to all assets of banks remains approximately the same, then the ROA indicator can be used instead of PR for the purposes of searching for correlation.

Table 3 shows the RR and ROA figures for certain countries. Correlation was calculated for the years, where the information is available for both indicators. The table shows that with the exception of Switzerland, the correlation between RR and ROA is negative. It follows that it is more profitable to have low real rates for the profitability of the banking sector. At the same time, low real rates are not beneficial in terms of financial stability.

Development of criteria for market and institutional
balance of financial stability

We propose to combine IFS and PR indicators as follows. First, the values of each of them must be ranked by level, highlighting 5 ranges for each

indicator. Secondly, it is necessary to combine said ranges into a table to present all 25 possible combinations of indicators (Table 4). Further, it is necessary to classify already obtained combinations by several levels of financial stability. In the simplest case, it is possible to identify the zone of "good" stability (shown in table 4 in grey). As long as the indicators remain in this zone, there are no long-term threats to financial stability.

Table 4 defines the criteria for market and institutional balance of financial stability, formed for the Russian economy.

IFS ranges have been formed with regard to the following: The "low" level of financial stability warns that negative real rates are unacceptable because such a situation creates the opportunity to speculate on a wide range of goods with borrowed funds. This can quickly lead to high inflation and the formation of pyramids. The remaining levels come with a fixed step of 2%. The step size is chosen for the following reasons:

1. The value of 2% is the stock necessary to more effectively prevent speculation without an excessive appreciation of loans. In the monetary policy for 2018–2020, the Bank of Russia also determines the allowable lower level of real interest rate reductions at 2% (Bank of Russia, 2018);
2. Levels of 2–4–6% correspond to the real rates observed in practice.

Ranges of institutional financial sustainability were formed with a step equal to 1.2%. The step size was chosen based on the following considerations. According to the statement of banks,[1] the average term of loans throughout the banking system is approximately 3 years. The average amount of reserves for possible losses on loans is 9.4% (including 10.3% for individuals). Assuming that future credit losses are approximately equal to the amount of reserves created, we find that banks will lose about 9.4% / 3 = 3.13% per year of the amount of loans issued. The profit of banks, used to calculate the PR indicator, has already been adjusted for this amount of created reserves. Therefore, if PR = 0, it means that the bank's revenues are barely enough to create reserves. If PR = 3.2%, then the bank can have double the reserves required. If PR = 6.4%, then the reserves can be in triple, and so on. Since double reserves themselves greatly reduce the risk of bankruptcy, we took the value of 3.6% (with some reserve) as a criterion of high stability and divided the interval from 0% to 3.6% into three equal intervals.

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[1] Aggregated reporting for Russian banks http://www.kuap.ru/banks/9999/balances/.

Determining the criteria for selecting regulatory instruments

Based on Table 4, it is possible to develop criteria for conducting other assessments. In particular, Tables 5–6 present the criteria for selecting regulatory instruments of the Central Bank depending on the strength of threats to financial stability.

We propose to introduce the regulatory instruments when the market financial stability index is equal to or below 4%, while the institutional financial stability index is equal to or lower than 2.4%. The measures of the Central Bank should be divided into the macro level and the micro level, that is why we have two tables. At the macro level, PR is calculated across the entire banking system. At the micro level, PR is calculated for each bank. IFS in both cases is calculated for the macro level. In some cases, it is possible to conduct a similar calculation at the intermediate level, when PR is calculated for homogeneous groups of banks.

In view of the fact that the risk zone is represented by three levels of financial stability, we consider it expedient to divide the existing regulatory instruments into three levels according to their degree of rigidity. These levels should be consistent with the tasks to reduce systemic and individual risks. The relationship between the levels of regulatory instruments and levels of financial stability is presented in Table 7.

Table 7 shows that the tightening of existing regulatory instruments is associated with a decrease in the levels of financial stability. In other words, instruments undergo the least tightening in the event when markets and financial institutions have satisfactory financial stability. Accordingly, the most stringent instruments are applied to markets and institutions when their financial stability becomes low. In accordance with this approach, anti-crisis tools should be included in the list of Level 1 regulatory instruments, which includes tightening of monetary policy, state support for participants in the financial market or a ban on all operations (license recall); Level 2 — instruments that limit certain types of financial transactions; Level 3 — instruments of a recommendatory nature with increased control over the operation of a regulated object.

Tightening of regulatory requirements should be introduced based on the results of the assessment of financial stability for the last 6 months, which, on the one hand, will ensure the timeliness of the measures taken, and, on the other hand, help avoid random fluctuations of the indicators. When making a decision regarding whether to tighten regulatory measures, regulators should remember that the use of such measures could adversely affect the stability of financial intermediaries that have already encountered problems. Therefore, it is very important to make the regulatory measures

proactive. This can be achieved by outlining quantified criteria for tightening regulatory instruments in monetary and prudential policies. Knowing in advance what the violation of these criteria entails, the management bodies of financial intermediaries are likely to take into account these criteria in their development strategies, as well as take timely measures to eliminate unduly assumed risks.

Development of a risk map and identification of monetary,
macroprudential and microprudential regulation objects

The development of a risk map is necessary in order to determine the objects of regulation. The development of a risk map should be preceded by the analysis of indicators of financial stability over a sufficiently long period of time (at least 4 years) in order to identify dangerous trends in the accumulation of risks. We have carried out a rough analysis of financial stability indicators in relation to the Russian economy over the period 2014–2017. Data sources are listed in Table 8.

In contrast to the correlation study, IFS was calculated using the proper algorithm (Gospodarchuk & Gospodarchuk, 2017b) since recently the CPI substantially differs from the rate of change in prices for investment assets. We will not provide the details of the IFS calculation since essentially they are a calculation of the weighted average over a large set of data.

Figures 1–3 show the total IFS and separate IFS for credit and bond markets for the period 2014–2017.

The idea of calculating private IFS is to check the presence of negative rates on each of the main types of credit market separately. That means the indicators are divided based on the source of credit funds. Division based on the type of investment is not advisable, since the specific type of asset on which the bubble is inflated is not important. Blowing out a bubble has little effect on the asset itself. It only leads to a temporary decrease in sales and does not create an avalanche effect.

Figure 1 shows that the bond market is more prone to bubbles. Issuers of bonds are large organizations and the state. In the state, the investment directions are tightly controlled, in private companies, there is a danger of their involvement in various risk schemes. IFS for different types of bonds is about the same, as can be seen in Figure 3. Figure 2 shows that the market for ordinary loans for large borrowers is at higher risk.

In general, the graphs show that at present there is no blowing up of bubbles, but a smooth deflation of the previous ones. This is facilitated by positive IFS values, and they are at a good level both on average and for individual markets. The decrease in IFS in early 2015 is due to a sudden

increase in inflation at the end of 2014. Low IFS did not contribute to the inflation of bubbles, as they remained low for less than a year.

The calculation of the PR indicator was also performed for the period 2014–2017 using the methodology given in Gospodarchuk and Gospodarchuk (2017a). To calculate the PR, we used indicators of earnings before tax and the magnitude of risks found from the formula for calculating the ratio of bank capital adequacy ratio with subsequent aggregation of individual indices. We performed the calculations for the banking sector highlighting state-owned banks, foreign banks, and systemically important banks.

Figures 4 and 5 show that the PR values have dropped. But even if we disregard them, the PR level is still very low. The maximum value of PR is about 3% — this is clearly not enough to cover banking risks. The end-of-the-period failures can be explained by the collapse of two large banks, PJSC Bank FC Otkrytie (8th place in terms of assets) and PJSC BINBANK (12th place in terms of assets) in the third quarter of 2017. In the Russian practice, when a particular bank shows unsatisfactory results and a growing number of problems, at some point in time, it faces a comprehensive audit, which results in the detection of non-earning loans (or assets). The depreciation of assets on the balance leads to a large loss, which in fact could have been accumulating for a long time before that.

As an example, we can provide PR for individual banks. Figure 6 shows the dynamics of the financial stability of PJSC Sberbank, the largest lending institution that ranks first in the rating of banks by assets. Sberbank of Russia is a state-owned bank and is included in the list of systemically important banks. Figure 7 shows the dynamics of the financial stability of AO Alfa-Bank. Alfa-Bank is another one of the largest banks in the Russian Federation. It ranks 6th among Russian banks in terms of assets. Both banks have a good reputation in terms of reliability.

Figure 6 and 7 show that both banks had an average PR of 2.5%–2.7%, which is higher than the performance of many other banks.

These calculations show that the selected indicators objectively reflect the state of the Russian banking system. Therefore, they can be used to measure financial stability. It should be noted that both indicators are aimed at predicting long-term trends, so their short-term falls do not signal problems. The graphs also show that both IFS and PR are briefly decreasing as a result of crisis processes. In times of crisis, indicators give false signals. But it is not a problem in this case, because after the crisis starts, it becomes well-known, so there is no need to predict it.

Based on the results of the calculation of financial stability indices in the period July-December 2017, using the criteria defining the risk zones (Table 5–6), we have compiled risk maps for the market and institutional stability of the Russian economy (Table 9–10).

The risk map of market financial stability was compiled as follows. The entire financial market was divided into sectors: the credit market and the bond market. The credit market was divided into segments: the market for loans to non-financial organizations, the market for loans to credit organizations, and the market for loans to individuals. The bond market was broken down into segments: the government bond market, the municipal bond market and the corporate bond market. Then, we calculated the monthly indexes of market financial stability (IFS) for the period from July to December 2017 for the entire financial market and each structural element of the financial market. The calculation period was limited to six months. We compared the obtained values of the IFS indices with the criteria of market and institutional balance of financial stability (Table 4) and determined the levels of financial stability both for the market as a whole and for each element of the financial market: high financial stability (*****), good financial stability (****), satisfactory financial stability (***), questionable financial stability (**), low financial stability (*). Then, we analyzed the obtained levels in order to identify threats to financial stability (the presence of levels of financial stability with ratings of "satisfactory", "questionable" and "low").

The IFS assessment according to the criteria in Table 4 shows that throughout the analyzed period, market financial stability was in the risk-free zone. That is, in fact, correct. Currently, Russian macroeconomic conditions do not contribute to the inflation of new bubbles in the markets. There was no need to apply the additional measures to improve the stability. This conclusion fully corresponds to the decision of the Bank of Russia on the transition from a moderately rigid to a neutral monetary policy starting 2018 (Bank of Russia, 2018).

The risk map of institutional financial stability was compiled as follows. The entire banking sector was divided into segments: systemically important banks, state-owned banks, banks with foreign capital and other banks. In addition, as case study, we singled out one large state-owned bank, Sberbank of Russia and one private bank, Alfa-Bank. Selection of individual banks was made in order to show that the developed methodology could be used not only in relation to individual segments of the banking sector, but also in relation to individual banks.

Further, we calculated the monthly indices of institutional financial stability (PR) for the period from July to December 2017 for the entire banking sector, each of its segments and for individual banks. The calculation period was limited to six months, since this period is sufficient to illustrate the method of generating a risk map (in practical work, as we noted earlier, this period should be at least 4 years). We compared the obtained PR values of the indices with the criteria of market and institutional balance of financial stability (Table 4) and determined the levels of financial sustainability both for the banking sector as a whole and for each of its elements: high financial sustainability (*****), good financial sustainability (****), satisfactory financial sustainability (***) , questionable financial stability (**), low financial stability (*). Then we analyzed the obtained levels in order to identify threats to financial stability (the presence of levels of financial stability with ratings of "satisfactory", "questionable" and "low").

Institutional financial stability varied. In table 10 grey marks regulatory objects that are in the risk-free zone. Overall, financial stability in the banking sector was low. Individual banks and groups of banks had a higher stability. Banks without state participation and foreign participation showed the worst result. These observations are in accordance with the quality ratings of banks, obtained by other means. Fact data confirm that the greatest number of violations and bankruptcies occurred among the "other" banks. The state does not pay them enough attention, unlike the large banks.

Based on the assessments made, the regulatory measures applied both to the banking system as a whole and to individual banks should be the same and consist in increasing profitability by optimizing the business model and minimizing losses from previously issued loans.

Discussion

The study found a negative correlation between the real rate (RR) and return on assets (ROA) of the banking sector in several countries. The use of such indicators to assess financial stability seems very promising since usually, the assessment methodologies use the indicators that have a positive correlation between themselves.

Calculations showed the presence of short-term failures in both indicators: IFS and PR. This must be considered if and when they are applied. It seems advisable to set a time lag of 6 months. That is, if within 6 months' indicators do not return to normal, then regulatory actions should be taken. We also see expedient to use a filter for known events. For example, if it is known that a particular bank showed large losses in a given quarter, then it

makes sense to calculate the PR in the banking system excluding this bank. This operation has the following meaning: since a loss-making bank requires a separate attention, it is of interest what happens to all other banks.

IFS and PR indicators are sensitive to crises. During the crisis, their values greatly deteriorate. If one measures the time lag using correlation, the result will confirm the lag of the indicators. However, this result is erroneous. The indicators are leading, and during a crisis, they take abnormal values simply because the initial indicators used to calculate them react to the crisis at different speeds. As a rule, inflation reacts faster than interest rates due to the presence of long-term loans with fixed rates. Therefore, during a crisis, IFS and PR indicators should not be used.

It is interesting to note that because of this effect, the correlation between IFS, PR and the crisis will be positive. Similarly, it turns out to be positive in many other indicators, which researchers use very commonly. A simple calculation of the correlation is not applicable to the selection of crisis indicators. It is necessary to use any other methods that do not take into account events occurring since the beginning of the crisis.

Conclusions

As a result of the study, we proposed a methodological approach to the formation of the integrated system of indicators of financial stability, including the principles, which can serve as a basis for the selection of indicators, as well as the rules and criteria for the coordination of these indicators among each other. At the same time, we proposed a methodological approach to the formation of portfolios of regulatory instruments of monetary and prudential policies depending on the risk zone in which the objects of regulation are located. Thus, our research develops a methodology for diagnosing and regulating financial stability.

The empirical part of the study proved the practical applicability of the proposed methodological approaches.

The practical significance of our study is that the system of indicators of financial stability, formed on the basis of the proposed methodological approach, allows applying a formalized approach to the selection of regulatory tools and their strength.

The proposed criteria for the selection of regulatory instruments (monetary and prudential), formed depending on the scale and depth of the imbalances identified, making it possible to more effectively influence the sources of systemic risk accumulation and thereby eliminate the threats to financial stability in a timely manner.

Limitations of the study are the following:

1. In the risk assessment, we proceeded from the traditional model of the bank, in which credit activity is the core business.
2. The study assumes that the reporting of banks, on the basis of which indicators are calculated, is reliable.

The analytical tools we proposed may be the subject of further research in part of its adaptation to the specifics of the monetary conditions of different countries. Summarizing the results of these studies will allow to form common standards and requirements for the regulation of financial stability at the level of national jurisdictions and thus contribute to the further improvement of Basel III standards.

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Acknowledgments

Annex

Table 1. Theoretical and methodological approaches to diagnosing the financial stability

Theoretical approaches*	Methodological approaches	Basic concepts
1. Definitions based on information characteristics	Aimed at the volatility of financial markets	Concepts of financial "bubbles" Concepts of financial cycles Signaling concepts The concepts of financial stress
2. Institutionally Oriented Definitions	Focused on the sustainability of institutional units and their homogeneous groups	Concepts that evaluate the financial condition of institutional units and their homogeneous groups
2.1. Related to the ability of institutional units to withstand shocks	Integrated (universal), oriented towards the external sources of instability in the form of shocks	Concepts evaluating sensitivity to external shocks
2.2. Associated with a low level of systemic and individual risks within an object the stability of which is investigated	Risk-oriented, taking into account the specifics of financial activity and focused on internal sources of instability in the form of risks	Concepts that assess the quality of risk management 1. The concept of structural change 2. The concept of default 3. The concept of regulatory and economic capital 4. The concept of leverage 5. The concept of debt limitation 6. The concept of effective risk

Note: * According to the classification proposed by Bardsen, Lindquist and Tsomocos (2008).

Table 2. Instruments for regulation of financial stability

Type of central bank policy	Object of regulation	Instruments of regulation	Terms of use
1.Monetary and credit	Interest rates	Refinancing instruments. Securities market operations. Required reserves. Monetary emission.	In case of deviation from the target level, defined by monetary and credit policy for the relevant year.
2. Macroprudential	Systemic risks	Requirements for the amount of capital, liquidity, and reserves for possible losses. Limits on the growth of loans. The cap on leverage. Changes in risk coefficients. Limits on open foreign-currency positions.	Along with the implementation of Basel II and Basel III requirements. When the threshold values are exceeded, which signals the accumulation of systemic risks.
3. Microprudential	Individual risks	Limits on a single operation. Limits on several operations. Limits on all operations.	Violation of normative requirements related to financial stability.

Table 3. Financial stability indices for the period 1984–2014,%

Year	USA		Russia		Japan		Switzerland		Australia	
	RR	**ROA**	**RR**	**ROA**	**RR**	**ROA**	**RR**	**ROA**	**RR**	**ROA**
1984	8.20	0.68			4.67		3.08		3.88	
1985	6.52	0.75			3.57		1.67		5.49	
1986	6.19	0.69			4.30		3.15		11.92	
1987	5.51	0.12			4.30		2.35		12.16	
1988	5.62	0.75			5.32		2.98		8.41	
1989	6.72	0.74			4.69		2.22		6.63	
1990	6.08	0.63			2.99		2.31		9.48	
1991	4.97	0.60			4.50		2.69		11.09	
1992	3.88	0.93			4.80		2.29		10.72	
1993	3.54	1.23			4.41		5.56		8.95	
1994	4.91	1.18			4.41		3.99		8.46	
1995	6.61	1.17	72.26		3.86	-0.43	4.27	-0.14	7.98	1.20
1996	6.33	1.21	69.28		4.06	0.03	4.70	0.27	8.04	0.71
1997	6.62	1.30	14.76		3.17	-0.53	4.80	0.22	6.85	0.79
1998	7.19	1.25	19.62		1.94	-0.75	4.90	0.71	5.86	0.38
1999	6.37	1.34	-18.95		2.37	0.09	4.19	0.91	5.34	0.09
2000	6.90	1.24	-9.63		3.52	-0.07	3.78	0.57	6.19	-0.44
2001	4.54	1.23	1.22	2.50	3.50	-0.69	2.74	0.63	5.01	0.42
2002	3.09	1.37	0.18	2.60	3.11	-0.76	3.25	0.62	2.12	1.14
2003	2.09	1.40	-0.71	2.60	3.37	-0.15	4.20	0.64	3.40	0.49
2004	1.55	1.35	-7.35	2.90	3.50	0.06	2.12	0.86	3.39	2.08
2005	2.88	1.34	-7.23	3.20	2.90	0.50	2.84	0.58	3.62	1.70
2006	4.74	1.35	-4.12	3.20	2.74	0.44	2.41	0.06	3.34	1.17
2007	5.25	1.15	-3.31	3.00	2.57	0.28	0.92	-1.66	2.40	0.86
2008	3.07	0.45	-4.86	1.80	2.63	-0.14	0.72	-0.22	3.03	0.61
2009	2.47	0.06	13.05	0.70	2.92	0.22	1.29	0.29	4.19	0.91
2010	2.00	0.58	-2.95	1.90	2.35	0.26	2.38	0.44	0.97	0.94
2011	1.16	0.88	-12.28	2.40	3.56	0.28	2.41	-0.26	6.04	0.80
2012	1.38	0.99	0.74	2.30	3.23	0.29	2.37	0.34	1.39	0.81
2013	1.61	1.08	4.48	1.90	2.19	0.31	2.87	0.36	5.01	0.88
2014	1.43	1.01	1.98	0.90	1.64	0.30	2.66	0.65	6.35	0.78
Correlation	-0.024		-0.659		-0.212		0.467		-0.285	

Sources: USA real interest rates: https://www.theglobaleconomy.com/USA/Real_interest _rate/; USA bank ROA: https://fred.stlouisfed.org/series/USROA; Russia real interest rates: https://time.graphics/ru/statistic/wb230378; Russia bank ROA: http://cbr.ru/analytics/ bnksyst/, http://cbr.ru/publ/nadzor/; Japan real interest rates: https://ycharts.com/indicators/ japan_real_interest_rate; Japan bank ROA: https://fred.stlouisfed.org/series/DDEI05 JPA156NWDB; Switzerland real interest rates: https://ycharts.com/indicators/switzerland_ real_interest_rate; Switzerland bank ROA: https://fred.stlouisfed.org/series/DDEI05CHA 156NWDB; Australia real interest rates: https://ycharts.com/indicators/australia_real_ interest_rate; Australia bank ROA: https://fred.stlouisfed.org/series/DDEI05AUA156 NWDB.

Table 4. Criteria of Market and Institutional balance of Financial Stability

		Market financial stability (IFS)				
		High **6% < IFS**	**Good** **6% ≥ IFS > 4%**	**Satisfactory.** **4% ≥ IFS > 2%**	**Questionable** **2% ≥ IFS > 0%**	**Low** **IFS ≤ 0%**
Institutional stability (PR)	High 3.6% < PR					
	Good 3.6% ≥ PR > 2.4%					
	Satisfactory. 2.4% ≥ PR > 1.2%					
	Questionable 1.2% ≥ PR > 0%					
	Low PR ≤ 0%					

Table 5. Criteria for selecting regulatory tools at the macro level

		Market financial stability (IFS)				
		High **6% < IFS**	**Good** **6% ≥ IFS > 4%**	**Satisfactory.** **4% ≥ IFS > 2%**	**Questionable** **2% ≥ IFS > 0%**	**Low** **IFS ≤ 0%**
Institutional stability (PR)	High 3.6% < PR	**1-st quadrant** (additional regulatory tools are not applied)		**2-nd quadrant** (transition to a more conservative monetary policy)		
	Good 3.6% ≥ PR > 2.4%					
	Satisfactory. 2.4% ≥ PR > 1.2%	**3-rd quadrant** (introduction of macro-prudential policy instruments aimed at increasing profitability and reducing bank losses)		**4-th quadrant** (transition to a more conservative monetary policy and the introduction of macro-prudential policy instruments aimed at restricting bank lending)		
	Questionable 1.2% ≥ PR > 0%					
	Low PR ≤ 0%					

Table 6. Criteria for selecting regulatory tools at the macro level

		Market financial stability (IFS)				
		High **6% < IFS**	**Good** **6% ≥ IFS > 4%**	**Satisfactory.** **4% ≥ IFS > 2%**	**Questionable** **2% ≥ IFS > 0%**	**Low** **IFS ≤ 0%**
Institutional stability (PR)	High 3.6% < PR	**1-st quadrant** (additional regulatory tools are not applied)		**2-nd quadrant** (additional regulatory tools are not applied)		
	Good 3.6% ≥ PR > 2.4%					
	Satisfactory. 2.4% ≥ PR > 1.2%	**3-rd quadrant** (measures aimed at identifying the causes and liquidation of losses, mainly optimization of business processes are applied to specific banks)		**4-th quadrant** (measures aimed at increasing control over the quality of newly issued loans and restricting high-risk investments are applied to specific banks)		
	Questionable 1.2% ≥ PR > 0%					
	Low PR ≤ 0%					

Table 7. Relation between the levels of regulatory instruments and levels of financial stability

Levels of financial stability	Level of applied instruments		
	1st level (high)	2nd level (medium)	3rd level (low)
Satisfactory			X
Questionable		X	
Low	X		

Table 8. Data sources used for calculations

Description	URL
MICEX Corporate Bond Index MICEXCBITR – historical data	http://moex.com/en/index/MICEXCBITR/archive/
MICEX Municipal Bond index MICEXMBITR – historical data	http://moex.com/en/index/MICEXMBITR/archive/
Russian Government Bond Index RGBITR – historical data	http://moex.com/en/index/RGBITR/archive/
Russian Federation state domestic debt – monthly data by Ministry of Finance	http://minfin.ru/ru/document/?id_4=93479
Moscow Exchange stock market capitalization data	http://moex.com/a3882
Stock market free-float coefficient data	http://moex.com/ru/listing/free-float.aspx
Reality price statistics for Moscow city	http://www.irn.ru/gd/
Real estate deals statistics by Federal service for state registration, cadaster and cartography	https://rosreestr.ru/site/open-service/statistika-i-analitika/statisticheskaya-otchetnost/

Table 9. Risk map of market financial stability for the second half of 2017

	July	August	September	October	November	December
Stability of financial market	*****	*****	*****	*****	*****	*****
	8.9	9.6	10.7	10.0	9.3	8.1
Stability of credit market	*****	*****	*****	*****	*****	*****
	9.3	10.0	11.0	10.3	9.7	8.3
Stability of bond market	****	*****	*****	*****	*****	****
	6.0	6.5	7.7	7.2	6.7	5.7
Stability of credit market of non-financial organizations	*****	*****	*****	*****	*****	*****
	7.9	8.9	10.1	9.3	8.7	7.5
Stability of credit market of credit institutions	*****	*****	*****	*****	*****	****
	6.5	7.3	8.6	7.8	7.3	5.6
Stability of market for loans to individuals	*****	*****	*****	*****	*****	*****
	13.1	13.3	14.2	13.4	12.6	11.3
Stability of government bond market		*****	*****	*****	*****	****
	5.8	6.4	7.5	7.0	6.6	5.6
Stability of municipal bond market	*****	*****	*****	*****	*****	****
	6.1	6.8	8.0	7.4	6.9	6.0
Stability of corporate bond market	*****	*****	*****	*****	*****	*****
	7.0	7.9	8.9	8.3	7.5	6.7

Notes: ***** - high financial stability; **** - good financial stability; *** - satisfactory financial stability; ** - questionable financial stability; * - low financial stability

Table 10. Risk Map of Institutional Financial Stability for the second half of 2017

	July	August	September	October	November	December
Stability of the banking system	*	*	*	**	**	**
	-0.7	-0.7	-0.7	1.0	1.0	1.0
Stability of systemically important banks	**	**	**	****	****	****
	0.0	0.0	0.0	2.9	2.9	2.9
Stability of state-owned banks	****	****	****	***	***	***
	2.6	2.5	2.6	2.0	2.0	2.0
Stability of foreign banks	***	***	***	****	****	****
	2.2	2.2	2.2	2.5	2.4	2.4
Stability of other banks	*	*	*	*	*	*
	-9.0	-9.0	-9.4	-1.9	-1.9	-1.9
Stability of Sberbank of Russia	*****	*****	*****	*****	*****	*****
	3.8	3.8	3.8	3.8	3.8	3.8
Stability of Alfa-Bank	*	*	*	*****	*****	*****
	-0.6	-0.6	-0.6	5.6	5.7	5.8

Notes: ***** - high financial stability; **** - good financial stability; *** - satisfactory financial stability; ** - questionable financial stability; * - low financial stability

Figure 1. Dynamics of the general stability index (IFS), indices of credit market and bond market stability
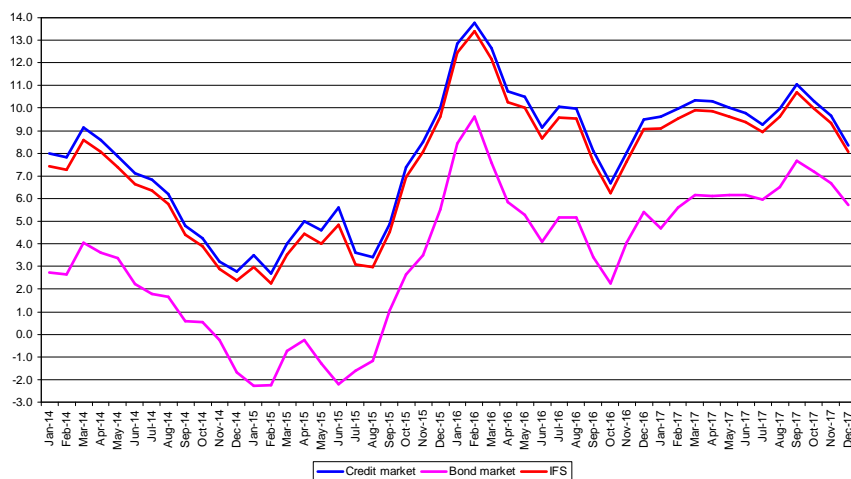
Figure 2. Dynamics of the credit market stability index for non-financial organizations, credit institutions and individuals
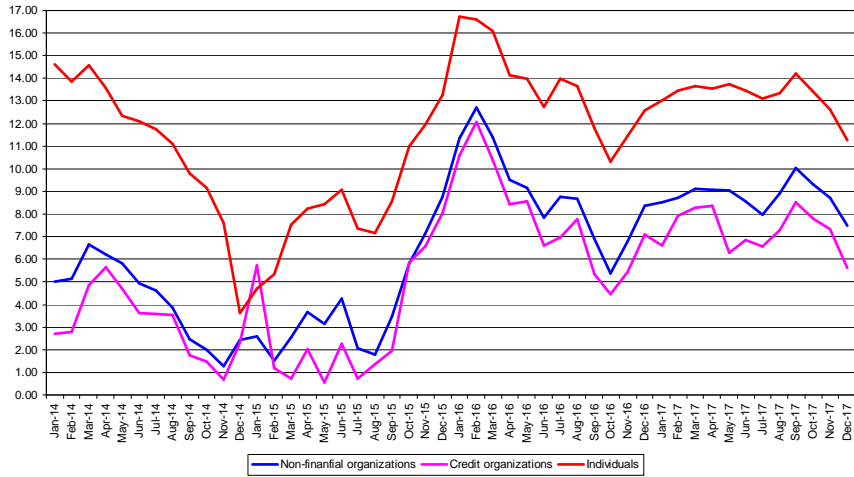

Figure 3. Dynamics of the stability index of the market for government bonds, municipal bonds and corporate bonds
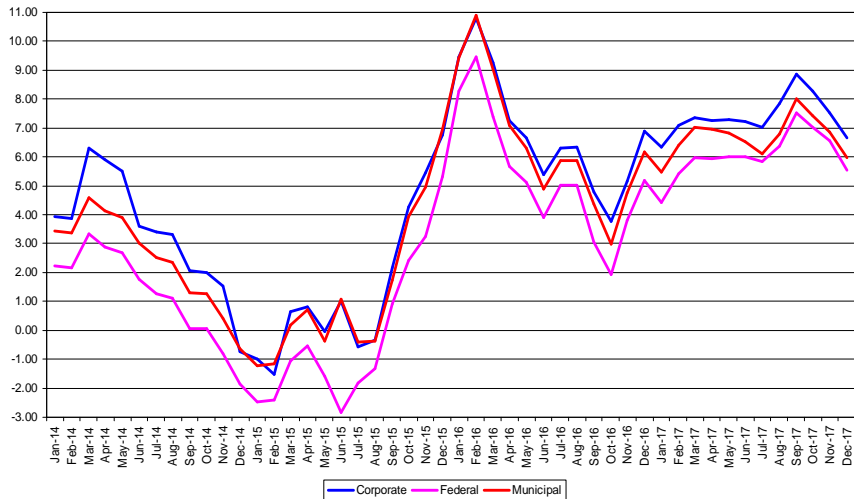
Figure 4. Dynamics of the financial stability index of all banks, state banks, banks with foreign participation and other banks
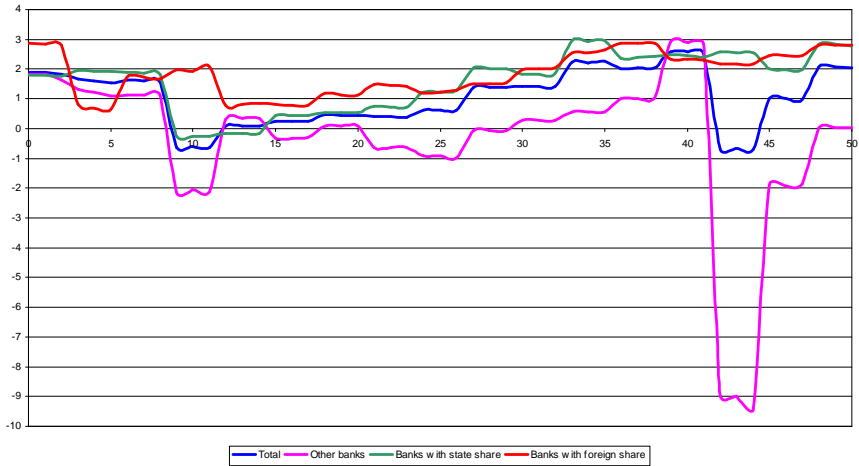

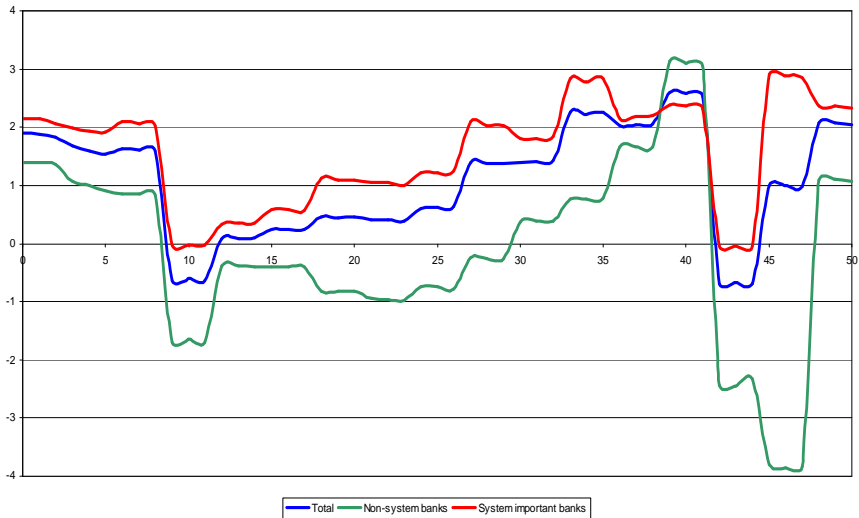**Figure 5.** Dynamics of the financial stability index of all banks, systemically important banks and other banks

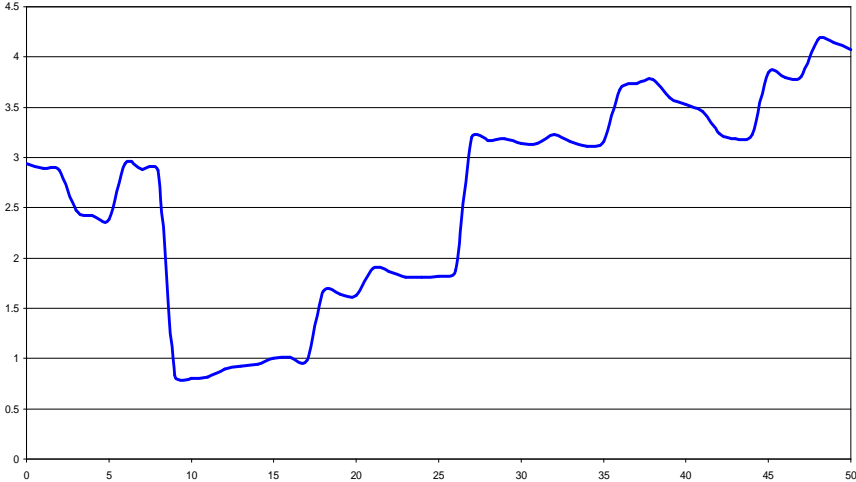**Figure 6.** Dynamics of the financial stability index of PJSC Sberbank

Figure 7. Dynamics of the financial stability index of JSC Alfa-bank