



Assessing the Financial Stability of Electric Power Organizations

Olga V. Borisova¹, Olga A. Kalugina^{1*}, Nikolay N. Kosarenko², Aleksandr V. Grinenko³, Izida I. Ishmuradova⁴

¹Financial University, Government of the Russian Federation, Moscow, Russia, ²Plekhanov Russian University of Economics, Moscow, Russia, ³Moscow State Institute of International Relations (MGIMO University), Moscow, Russia, ⁴Kazan (Volga region) Federal University, Kazan, Russia. *Email: kaluginaruc@mail.ru

Received: 10 January 2019

Accepted: 17 March 2019

DOI: <https://doi.org/10.32479/ijeeep.7729>

ABSTRACT

Nowadays the economic processes in any world economy are carried out at a rapid pace. They have a strong influence on the activities of companies. In this regard, the electric power companies have faced the issue of increasing the efficiency of companies and reducing the degree of dependence on external factors. Moreover, the successful operation of the majority of modern branches of the national economy depends on the efficient and smooth performance of this business. The purpose of the study is to improve the financial stability indicators of electric power companies. The base of the conducted study includes both general scientific and empirical methods: analysis, synthesis, generalization, modeling, observation, description, measurement, and comparison and the case method, which allow broadening the authors' understanding of the financial stability of the business, proposing its main criteria, and studying the aspects of the financial stability of business exemplified by electric power companies. The study carried out by the authors shows that the financial stability of the country is inextricably linked to the financial stability of organizations. Therefore, they need to be evaluated jointly. The relationship between macroeconomic indicators and the financial stability of business is defined by the authors. The concept of financial stability at the macro and micro levels is generalized. The indicators of financial diagnostics of organizations, characterizing their financial stability have been revealed. A model has been developed that allows determining the degree of the financial stability of electric power companies. The proposed model enables the selection of the most stable and steadily functioning electric power companies out of the significant number of ones in conditions of the uncertainty of the external environment. The results obtained by the authors will give an opportunity to identify not only the most stable business in the electric power industry but also, as a consequence, to determine the most attractive business model that should be adapted to other regions to minimize the adverse effects of situations related to uncertainty.

Keywords: Financial Stability, Indicators, Financial Conditions, Business Model, Electric Power Companies

JEL Classifications: D24, Q43, M31

1. INTRODUCTION

Smooth integration and globalization processes eliminate barriers formed over the years, getting in the way of the movement of capital, services, and goods. As a result, in many markets, there is an increase in competition in the conditions of limited business resource capacities (Firsova et al., 2018). It leads to a change in established economic ties and generates the development of crisis phenomena in organizations that negatively affect the financial stability of the economy of the countries and the world as a whole.

Today, financial stability and financial instability are widely viewed in the macroeconomic context. The existing methodology covers the economic, banking sectors and insurance market. In some works leading indicators are being studied. It allows predicting the onset of adverse events in the economy with various degrees of probability. However, due consideration is not given to organizations which are not operating in this field. Crisis processes in these organizations have a significant impact on a country's economy since they can be transferred from one organization to another, destabilizing economic processes at the macro level.

However, they are also crisis-prone and have a significant impact on the economy of the country. Thus, it is essential to develop a model that allows quickly and efficiently assessing the financial stability of organizations for the early identification of the problems and macroeconomic stabilization in general.

The research aims to improve the financial stability indicators of electric power companies. The object of the study is the financial stability of the electric power organizations in Russia. The subject of the research is the indicators of financial diagnostics of organizations, characterizing their financial stability.

2. LITERATURE REVIEW

The survey was based on central banks' reviews of different countries, from which reports on financial stability are developed. They made it possible to clarify the notion of financial stability at the macro-level. At the same time, the concept of financial stability at the micro level has been formed by the works on corporate financial diagnostics and anti-crisis management.

A significant contribution to the theory of financial stability was made by studies on the life cycle of the corporate sector and corporate bankruptcy. They have a substantial impact on the understanding the theory process associated with financial instability. The basis of the theoretical foundation of the research at the macro level was made by the following scientists: Moiseev et al. (2013), Lobanova (2013), Szunke (2014), Ermolaeva and Zavyalova (2015), Lvova (2016).

One of the first researchers in Russia who studied the issue of financial stability was Lakshina and Chekmareva (2005). In their work, they presented the concept of financial stability, summarizing the works of foreign authors, studied the issues of its assessment, indicated the main areas in which macroeconomic indicators should be studied to measure economic conditions by the Bank of Russia. They were focused on taking into account national peculiarities when assessing financial stability. However, they did not develop an author's indicator or model of its assessment. Later in the work of Lobanova (2013) the view of the Russian regulator (Bank of Russia) on the problem of financial stability, in particular, the concepts and critical characteristics, was presented; the government institution was identified that should take responsibility for the situation. However, there are no references to the database of research and suggestions regarding assessment models. Moiseev et al. (2013), examining the macro-prudential policy issues, summarized the financial stability reviews of various countries and concluded that they allow monitoring systemic risks, developing proposals for their regulation and reduction, and assessing the state of the financial system as an aggregate. However, the scientist did not indicate the shortcomings of the reports on the financial stability of various countries, did not summarize the indicators included in them, did not pay attention to the indicators allowing to predict financial stability. Szunke (2014) explored instability in the banking sector. A system of early warning indicators was presented, but there was no author's model or indicator enabling to show the situation promptly. The research one by Ermolaeva and Zavyalova (2015) presented interpretations

of financial stability from different studies, developed by central banks of different countries. A scheme for the development of financial instability was shown. However, the researchers did not pay attention to methods of assessing financial instability, did not study the leading indicators. Lvova (2016) conducted a detailed analysis of financial stability, summarized the methodology, and investigated the assessment indicators at the macro level. However, none of these works showed the dependence of macroeconomic stability on the state of an organization (corporation) or a model that allows determining the degree of its financial stability. The basis of all the studies was the works of Shinazi (2005), Crockett (1997), Foot (2003), Mishkin (1999), Ferguson (2002).

The concept of financial stability at the micro level is based on the works of corporate financial diagnostics and crisis management. A significant contribution to the theory of financial stability was made by studies on the life cycle of the corporate sector and corporate bankruptcy.

One of the first investigations on financial stability at the micro level in Russia was the work of Kormilitsyna (2011). She proposed a system of indicators that allowed assessing financial stability at the level of the organization. This study was of a theoretical nature, solid confirmation of the results was not presented. Panov (2013) considered the difference between the concepts of stability, financial capability, and reliability, developing the methodology of the issue. The object of the study was banks. The author did not consider the organization of other industries in his research. His work was purely theoretical.

Tuktarov and Tuktarov (2013) studied the financial security of the company and the factors affecting it, described the algorithm for constructing the model, however, there was no practical evidence of using the coefficients in work. Kochugueva et al. (2014) using the example of Russian companies attempted to determine which factors have an impact on the bankruptcy of organizations. However, the sample size of the companies, their industry sector, the software program for the logit model and the data that was initially used to build it, are not indicated.

In the work of Fedorova et al. (2016a) hypotheses related to the influence of internal and external factors on the bankruptcy of an organization were put forward and proved. One of the advantages of the presented research is clearly defined operating procedures, an indication of the sample size and type of activity of the organization, the names of the indicators tested in the models, and an estimate of the predictive accuracy presented. However, the model developed in the framework of the study cannot be used to predict the financial stability of electric power companies, since the sample was made for construction companies. Also, the model does not allow ranking organizations in case of the changes in their financial conditions.

Conducting research, most scientists used for the analyses the models by Altman (1968), Taffler and Tisshaw (1977), Ohlson (1980). It indicates sufficient stability in the methodology of the studied issue.

3. METHODOLOGY

The research is based on the following methods:

- General scientific methods: analysis, synthesis, generalization, analog approach, modeling, logical method and classification
- Empirical methods: observation, description, measurement, comparison, case method.
- An algorithm consisting of the following stages was used to highlight the research topic:
- The concept of financial stability at the macro and micro levels is generalized
- The relationship between macroeconomic indicators and financial stability of business is defined
- A model has been developed that allows determining the degree of financial stability of electric power companies.

4. RESULTS AND DISCUSSIONS

At the first stage of the study, we shall consider financial stability at the macro- and micro- levels. The concept of financial stability appeared at the macro-level. Nowadays, the research in the field of macroeconomic and financial stability has been carried out by the Financial Stability Board, the International Monetary Fund, the Bank for International Settlements, the World Bank, the European Central Bank, national central banks of different countries and other organizations. Recently, financial stability reviews have been regularly published by the central banks of the United Kingdom (since 1996), Sweden (since 1997), Hungary and Norway (since 2000), Austria and Spain (since 2001), Belgium, Denmark and France (since 2002), Canada and Finland (since 2003), Australia (since 2004), Russia (since 2012), etc. A report on the financial stability of the Eurozone is prepared by the ECB (Lakshina and Chekmareva, 2005).

The definitions of financial stability at the macro-level appeared in the central banks' reviews. In 2004, the European Central Bank, in its first review of financial stability, defined it as a state that can withstand shocks to the financial system. The Bank of Norway defines it as a condition in which the financial system is resistant to fluctuations in the economy, can carry out intermediary services, settle payments and redistribute risks (Panov, 2013).

All scientists carrying out the research on financial stability can be nominally divided into two groups: some economists in their studies adhere to the definition of financial stability (Crockett, 1997; Foot, 2003, etc.), the investigations of the rest are based on the term financial instability (Mishkin, 1999; Ferguson, 2002).

The standard feature of these definitions is that many of them are based on the functions of the financial system, which include the allocation of savings in business investments. They also emphasize the fact that the causes of instability are unexpected situations, which cannot be foreseen. The terms include references to the likely consequences of financial instability. Consequently, financial stability is understood as a criterion of reliability in the financial sector.

Shinazi (2005) in work "Preserving Financial Stability" identifies three functions of a financially stable system. Firstly, to facilitate

the efficient distribution of economic resources in space and time. These include financial and economic processes, such as saving and investment, lending and borrowing, the formation and distribution of liquidity, asset price formation, wealth accumulation and growth of output. The second function is the possibility of risk assessment, allocation, and management. The third function includes the preservation of the ability to perform the first and second functions in conditions of external shocks and imbalances of the economy.

A system of financial stability at the micro level should have a significant part of these characteristics. Financial stability at the macro level is characterized by the study of infrastructure, institutions, and markets. Malfunctioning in these elements affects the entire system, including the specific organization. Failure of one of the components does not mean the emergence of a threat to its stability if the system effectively performs the functions assigned to it. A stable financial system can limit and eliminate disproportions through the use of a self-correcting mechanism. It does not allow a crisis to arise. The system is considered stable if any shocks cannot cause damage to economic activity. At the same time, the financial stability of the organization should ensure: the excess of aggregate income over aggregate expenditure; the capital structure under which, asset finance is managed, taking into account the average market costs for capital maintenance at an average level of risk; sales growth over an extended period; the organization's optimal overall risk (Shinazi, 2005).

According to official representatives of the Central Bank of the Russian Federation, financial stability is the state of the financial system of the country, the region that must be resistant to shocks (Lobanova, 2013). These days, typical features of financial stability have been stated:

- The necessity for the financial system to perform its functions without failures, including the service of transforming savings into assets
- The financial system's resilience to external interferences
- Positive impact on the real economy.

It can be seen, that some of the standard features are aligned with the elements indicated in the work of Shinazi (2005). Some countries are calculating indicators that characterize "financial instability" at the macro-level. In particular, the Federal Reserve System describes this condition by the deviation of the financial asset prices from their fundamental values; market disruption and the accessibility of loan proceeds; upward and downward variations between aggregate expenditures and the equilibrium level of output.

Evaluation of financial stability is a complicated process due to the lack of a unified position, concerning the definitions, and the key factors affecting it. Lobanova (2013) argues that financial stability should be determined by "indicators of the financial standing, the sustainability of financial institutions and their counterparties from the real sector of the economy and the household sector." The IMF conducts an assessment of financial sustainability for this purpose. In particular, such indicators as the capital adequacy ratio, the share

of bad loans and troubled bank loans in the total volume of bank loans, the return on bank assets and their capital are determined.

At the governmental level, the central bank is responsible for financial stability. The IMF and the financial stability board conduct its evaluation and monitoring. Financial stability is closely related to the structure of the financial system.

Financial instability is actively studied today. For example, the European Central Bank sees the correlation between banking sector instability connected with the absence of a mechanism for efficient and timely distribution of resources between different sectors of the economy, consistent assessment and risk management or exclusion of shocks. The National Bank of Poland considers that financial instability is connected with the problems of the banking sector, in particular with inefficiency and insolvency, as well as the lack of the appropriate level of capital necessary to cover the losses and lack of liquidity of operating activities (Szunke, 2014). However, the study showed that the existing system of predicting the developing destabilization processes in the macroeconomy requires significant changes since it does not allow their timely detection and prevention. This is due primarily to the fact that most scientists study the methodology of the process (Moiseev et al., 2013; Lobanova, 2013; Szunke, 2014; Ermolaeva and Zavyalova, 2015), but the development of leading indicators and models remain outside their area of interest. One of such models is presented in the work of Lvova (2016).

The study carried out by the authors shows that the financial stability of the country is inextricably linked to the financial stability of organizations. Therefore, they need to be evaluated jointly. Considering the concept of financial stability at the micro level, we can see that the critical factor of financial stability is the composition of financial assets and asset profile, as well as the correctly chosen strategy for their management. It is explained by the facts that own financial resources of the company, in particular, profit, guarantee its stability in the market. However, opportunities to expand the business are limited due to the strict limit on using the company's funds. At the same time, the organization does not have the opportunity to increase the return on equity by the use of borrowed funds.

It should be noted that not only the profit margin is necessary, but also the structure of its use. It is advisable to make profits to improve the organization's financial stability in two ways:

- Economic and current performance (for the formation and increase of current assets, improvement of the companies' financial position and liquidity, etc.).
- Investment activities (capital expenditures and securities). Leverage ratio and borrowings affect the financial stability of the organization. The higher the volume of funds raised in foreign markets, the stronger the financial capacity of the organization. But the organization takes a higher financial risk. Paying off the part of the debt can be carried out from the reserve fund of the organization, which is an essential element and gives a guarantee to the creditors in case of financial losses and reduces the consequences caused by the unfavorable economic condition. The reserve fund is a fiscal

shield aimed at external investors' loss prevention in case of insufficient net profit.

The financial stability of the organization is affected by decisions about the types of products, services provided, and the technologies used. Consequently, the financially stable company is a company which:

- Develops a financial strategy aimed at optimization of capital structure
- Controls financial risks
- Does not change the structure under the influence of external changes
- Sustains business growth.

At the same time, the critical financial soundness indicators are those that characterize financial stability, economic and bankruptcy risks. When deciding on the financial stability of an organization, it is necessary to fulfill some criteria:

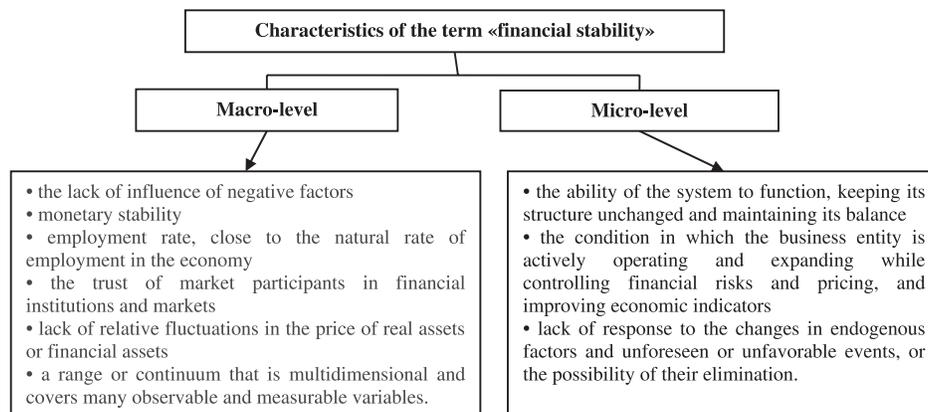
- Short-term and long-term loans which are required for the active growth
- The availability of reserve capital, allowing to perform obligations on time
- The absence of bankruptcy signs.

Figure 1 depicts the generalized characteristics of the term financial stability.

At the second stage of the research, we have determined the relationship between macroeconomic indicators and the financial stability of the business. The main indicator of financial stability at the macro level is gross domestic product (GDP). We have discovered how the increase in the global GDP depends on the GDP growth of the world's largest economies in Table 1.

There is a direct correlation between the increase in the global GDP and GDP growth in the United Kingdom (0.96), France (0.43), and Germany (0.416). The inverse correlation is typical for the growth of the global GDP and GDP of developing countries (Brazil [-0.64], India [-0.42], Indonesia [-0.212]). The analysis of Russia's GDP (2018) in US dollars, according to the IMF (2018), shows its significant correlation with global GDP (0.674). At the same time, Russia's GDP ranges from 1.6% (in 2016) to 2.8% (in 2012) of world GDP due to the change in the exchange rate of the Russian ruble to the US dollar, the imposition of sanctions, which affected GDP converted into US dollars.

Then we have examined the existence of the correlation between the macroeconomic indicators of financial stability and the performance indicators of the largest organizations. The study was conducted in 2017 (evidence from Russia); since the analysis of the financial stability reports of different countries differed, both in the number of indicators and the methodology for calculating them. The theoretical background was taken from German, Italian, Russian financial stability reviews (Financial Stability Review, 2016; Financial Stability Review, 2017; Information-analytical Materials, 2017); reports of Ministry of Economic Development of the Russian Federation - official website (2017), Federal State Statistics Service (2018), and Moscow Exchange (2017). The total

Figure 1: Characteristics of the term financial stability

Source: Authors' calculations

Table 1: GDP growth from 2007 to 2017 (%)

Country name	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
World GDP YoY % Chg	12.7	9.7	-5.2	9.7	11.1	2.3	2.8	2.7	-5.4	1.5	6.3
United States	1.8	-0.3	-2.8	2.5	1.6	2.2	1.7	2.6	2.9	1.5	2.3
France	2.2	-1.8	-1.0	2.3	1.6	0.1	1.1	0.9	1.0	1.2	2.8
Germany	2.3	-1.8	-3.0	4.5	2.4	0.1	1.3	1.6	1.3	1.8	2.9
Italy	-0.1	-3.5	-2.6	2.2	-1.1	-2.8	-0.8	0.2	1.2	1.1	1.6
United Kingdom	5.5	2.6	-2.4	5.1	3.8	2.3	3.5	4.4			
Japan	-0.2	-3.6	-3.6	1.3	-1.4	-0.4	2.7	2.0	2.8	1.4	2.0
China	13.9	7.1	11.9	9.9	8.8	8.1	7.7	7.2	6.8	6.8	6.8
Brazil	6.6	1.0	5.3	5.7	2.6	2.5	2.5	-0.2	-5.6	-2.5	2.1
India	9.6	5.8	7.7	8.7	6.5	4.4	4.6	5.3	-	-	-
Indonesia	5.6	7.0	5.6	6.5	5.9	5.9	5.6	5.1	5.2	4.9	5.2

Source: (Bloomberg, 2018). GDP: Gross domestic product

Table 2: European installed generating capacity (MW) from 2005 to 2016

Country	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	The rate of increase (%)
Germany	172976	169437	164803	153827	149615	180894	167550	156401	146850	141202	136884	133020	2.42
France	132522	131667	129519	130074	130237	127089	125946	122330	119382	118211	117520	117531	1.10
Italy	98527	101724	106803	109970	111460	122090	110127	105085	102268	97242	93138	89222	0.91
Spain	102241	103025	101838	101368	100990	105251	104237	99025	96077	91143	83668	78998	2.37
United Kingdom	88185	90208	93538	93127	96738	96247	96111	90202	88508	87038	86358	85166	0.32
Turkey	77531	72805	69408	63949	57037	52889	49502	44739	41796	40813	40543	38821	6.49

Source: (Bloomberg, 2018)

number of indicators was 129 items. We used data for 2005-2015 in our study.

As a result of the study, a strong correlation has been identified between the GDP estimates and the following financial indicators: Sales revenue (0.985), production cost (0.982), gross profit (0.995), selling and administrative expenses (0.985), current (0.986) and noncurrent assets (0.989), payable turnover (0.87) and receivable turnover (0.86), return on total assets (-0.82), sales margin (-0.92), indicators of own circulating assets (-0.919) and autonomy (-0.96), bills payable (0.98) and bills receivable (0.91).

The results obtained reveal the existing relationship between the GDP calculation methodology and the variables included. In particular, the calculation of GDP defines it as the difference between the output of products and services in the whole country and intermediate consumption. Hence, it contains the value added created by the organizations. Consequently, there

is a strong connection with most of the absolute indicators of Russian business. The presence of a strong correlation between GDP and working capital financed by equity to total assets ratio and autonomy ratio is associated with the companies' reaction to the change in macroeconomics. Also, the correlation of the performance indicators with the volumes of exports and imports, M2 money supply, the euro exchange rate, the deflator index "Fixed asset formation," the unemployment rate to the economically active population, the Index of economic freedom was revealed. At the same time, there were no high dependencies between performance indicators and deposit rates. Deposit rates affect only the balanced financial result of organizations (-0.57).

Moreover, the relationship between the change in indicators and the relative economic performance of organizations was identified. In particular, monetary growth, GDP growth, increase in real wages, exports and imports positively affect the increase in

revenues, assets, production costs, accounts payable and accounts receivable (Borisova, 2017). Thus, the macroeconomic indicators are related to financial indicators of the organizations. These links can be observed in every country of the world, only the degree of dependency and the list of indicators differ. Consequently, it is necessary to achieve financial stability in every industry and every organization for the country's economic stability.

The study has shown that financially stable organizations should not respond much to changes in macroeconomic indicators. Otherwise, they may have problems with the financial standing. Over time, they can be recognized as financially unstable. In our study, we will consider this issue as exemplified by the electric power industry. European installed generating capacity is presented in Table. 2.

Table 2 shows that electricity generation capacities in the countries differ and depend on domestic needs. The rate of increase in electricity generation also varies. Electricity generation is growing at the fastest rate in Turkey (by 6.49%), Germany (2.42%) and Spain (2.37%). The increase in generation is associated with an increase in domestic and external demand for resources. Individuals and legal entities generate electricity demand. We have considered it as exemplified by the production and distribution of electricity, gas, and water in Russia (Table 3).

Electricity generation capacity does not significantly exceed the electricity consumption volumes due to the sector-specific issues of the industry and the lack of opportunities to accumulate a significant amount of electricity. Table 3 reveals that from 52% to 54% of generated electricity is consumed in sectors related to the extraction of minerals, manufacturing activities, in the production and distribution of electricity, gas, and water. The organizations of transport and communications consume from 8.2% to 8.7% of power.

Organizations involved in other types of activities consume from 19.5% to 23.5% of electricity. Agriculture consumes from 1.4% to 1.7% of generated electricity; construction industry estimates from 1% to 1.2% of power. In general, legal entities consume from 75% to 77% of all electricity generated. The amount of energy consumed by the individuals amounts to 11.3%-13.7%. However, it is necessary to mention the stable dynamics of households to increase the amount of energy consumed over the past 13 years. Electric power transmission and distribution losses amount to approximately 10% of energy generation capacity

During the investigation (Table 4), a strong correlation between energy consumption (0.96) and generation (0.94) and global GDP was revealed. It shows a strong relationship between energy generation in Russia and the level of development of countries of the world.

Consequently, economic growth in most countries contributes to their growth. There is a healthy relationship between Russia's GDP and electricity generation capacity and electricity consumption. The connection can be seen examining the amounts of energy generated by thermal power plants and nuclear power plants.

Table 3: Production and distribution of electricity, gas, and water in Russia for 2005-2017 (mln. kWh)

Years	Generated electricity outside the Russian Federation	Electricity generated	Total electricity consumption	Including				Exported			
				Extraction of minerals, manufacturing activities, production and distribution of electricity, gas, and water	Agriculture, hunting, and forestry (production needs)	Construction	Transport and communications	Other types of economic activities	Population	Electric power losses	
2005	953.1	10.1	940.7	497.4	16.9	9.5	83.2	112.2	108.9	112.6	22.5
2006	995.8	5.1	980	534.1	16.8	10.5	85.9	112.6	112.5	107.6	20.9
2007	1015.3	5.7	1002.5	558.2	16.2	11.5	86.6	109.2	115.9	104.9	18.5
2008	1040.4	3.1	1022.8	570	15.5	12.1	86.7	112.2	117.1	109.2	20.7
2009	992	3.1	977.2	533.2	16.6	10.6	84	110.7	121.1	101	17.9
2010	1038	1.9	1020.6	554.4	15.9	10.7	88.4	119.2	127.1	104.9	19.3
2011	1054.8	10	1041.1	567.9	15.5	11.8	90.4	119.6	130.9	105	23.7
2012	1069.3	8.3	1063.3	573.1	15.3	12.4	91.1	127.4	137.3	106.7	14.3
2013	1059.1	11.5	1054.8	565	15.3	12.3	90.4	129	141	102.2	15.7
2014	1064.2	8.9	1065	561.1	15.9	12.8	90.3	132	146.2	106.9	8.1
2015	1067.5	8.8	1060.2	559.2	16.8	12.1	87.9	131.2	146.5	106.6	16.1
2016	1 090.9		1077.9								
2017	1091		1089.1								

Source: Federal State Statistics Service (2018)

Table 4: Dependence/correlation analysis between global GDP, Russia's GDP, energy generation and consumption

Indicator	Line 1	Line 2	Line 3	Line 4	Line 5	Line 6	Line 7
Global GDP, bln. USD	Line 1	1					
Russia's GDP, bln. RUB.	Line 2	0.94	1				
Electricity generation in Russia, (mln. kWh)	Line 3	0.95	0.92	1			
Including:	Line 4				1		
Thermal power plants	Line 5	0.85	0.73	0.96		1	
Hydropower plants	Line 6	-0.11	-0.04	-0.13		-0.24	1
Nuclear power plants	Line 7	0.83	0.90	0.77		0.59	-0.31
Electricity consumption in Russia, (mln. kWh)	Line 8	0.97	0.94	0.99		0.93	-0.06
							0.78

Source: Authors' calculations

Consequently, the financial standing of electric power organizations has a significant impact on the financial stability of Russia and the world as a whole. At the third stage, we have developed a model that allows us to determine the degree of the financial stability of electric power organizations. The research was based on the range of methodologies enabling economic analysis of the onset of the crisis.

Some methods are presented in the regulatory, legal acts of the Russian Federation. They determine the main criteria for the financial performance but they are not often used to identify bankruptcy.

Financial analysis methodology is based on the calculation of financial ratios (Beaver, 1966; Argenti, 1976; Durand, 1941) Companies' bankruptcy prediction was based on systematized, standardized and classified indicators. In recent times, correlation and regression, logit and probit models are getting popular. Bankruptcy prediction models are developed on their basis. We consider these models as extremely negative implications of companies' financial instability. They include internal factors (Altman, 1968) and macroeconomic indicators (Ohlson, 1980; Fedorova et al., 2016b; Bunn and Redwood, 2003; Hol, 2007; Wadhvani, 1986; Kochugueva et al., 2014).

Recently, dynamic models have been developed that allow providing financial analysis. By using the standard deviation index, the accuracy increases. The difference between the assessment of operating companies and bankrupt companies is increasing. But this approach makes the differences within each group less significant. However, these models take into account industry specifics that are present in electric power companies.

The conventional algorithm was used, to develop a model of the financial stability of electric power organizations (Rygin, 2013; Zhdanov and Afanaseva, 2011; Tuktarova and Tuktarov, 2013; Fedorova et al., 2016b).

At the first stage, financial data of organizations was collected. The source was the System of Professional Analysis of Markets and Firms. The largest organizations involved in the production and distribution of electricity, gas, and water in Russia within four years (from 2013 to 2016) were chosen for investigation. The selection criterion was the maximum value of assets and revenues. There were both operating organizations and bankrupt companies in the sample.

During the second stage the coefficients used in the models of financial analysis of bankruptcy prediction (according to the Altman Z Score Model (1968) (2-factor and 4-factor models of the Altman Z-score), Springate (1978), Lis (1972), Legault (1987), Taffler and Tisshaw (1977), Fedotova (2016), Davydova and Belikov (1999) and the final indicator (Z-score) were determined. At the third stage, the sample was prepared for analysis. Outliers in the statistical aggregate were removed. At the fourth stage, the modeling process was carried out. For this purpose, discriminant function analysis was used. It allowed determining the coefficients of the model. Obtained discriminant function made it possible to divide all organizations into groups. The discriminant function has the form:

$$d = a + b_1x_1 + b_2x_2 + \dots + b_nx_n,$$

Where d is a variable indicating which group, this observation belongs to; x_1, \dots, x_n and n are the values of the variables corresponding to the observations; constants b_1, \dots, b_n and a are the coefficients to be estimated using discriminant function analysis. The selection of variables for the model building was carried out by correlation.

The predictive power of existing models of financial diagnostics is different. Fedorova et al. (2016b) argue that the predictive power of bankruptcy models for companies is 66%. The results of probability on Taffler's model are recognized as one of the highest. We have researched on the of bankruptcy diagnostics of electric power companies in Russia (Table 5).

The best results were shown by three models (Springate model, Lis Model, Legault Model). The predictive power of these models is higher for bankrupt companies. For operating companies, the probability of incorrect diagnostics increases. Thus, from 19% to 31% of operating companies can be declared bankrupt when using these models. The use of other models tested by us is not advisable because prediction accuracy is low.

4.1. Building a Model

The coefficients for 8500 companies, 260 of which were in a state of bankruptcy were chosen as the object of the study. We have covered the period from 2015 to 2016. The source of information was the System of Professional Analysis of Markets and Companies (2018). Forty indicators and binary values have been tested. The studied indicators were taken from bankruptcy models. As a result, it has been revealed that it is impossible to build a linear model based on models for diagnostics of the financial condition of the company.

Table 5: Study of the predictive power of models of financial diagnostics

Years	Number of companies	Springate model	Lis Model	Legault Model	Irkutsk State Academy model	Fedotova Model	4-factor Z-score of Altman for the emerging markets	4-factor models of Altman for the developed markets	2-factor model of the Altman Z-score	Taffler Model
Bankrupt companies										
2013	171	12.28	9.94	6.43	97.08	99.42	51.46	28.07	100	80.12
2014	247	5.26	4.86	5.26	96.36	98.38	39.27	15.38	100	80.97
2015	279	5.02	5.38	5.38	98.21	98.57	36.56	14.34	99.6	84.23
2016	266	4.14	2.63	4.51	97.37	97.74	28.20	12.78	100	88.35
Operating companies										
2013	9821	30.78	28.08	18.79	97.87	99.63	71.72	53.14	99.9	87.66
2014	9636	28.60	25.85	17.00	97.58	99.48	69.55	51.20	99.9	87.59
2015	8119	28.88	24.41	13.20	98.28	99.69	69.59	50.20	99.9	88.71
2016	7956	30.18	25.16	13.40	98.39	99.60	70.90	51.29	99.8	89.08

Source: Authors' calculations

There was no linear relationship between the fact of bankruptcy and financial ratios. Further, the binary model was tested. It allowed all indicators of organizations to be divided into two groups regardless of their size: responsive to a stable situation and showing the degree of crisis. Therefore, to build a model for assessing the financial stability of companies, a composite indicator was compiled representing the sum of the binary indicators obtained by calculating indicators for the following groups:

1. Absolute and relative financial sustainability and solvency indicators: current liability ratio, financial stability index, solvency ratio, equity ratio (autonomy), current assets to equity ratio, working capital financed by equity to total assets ratio, financial leverage.
2. Liquidity ratios: Absolute liquidity ratio, quick I ratio, current liquidity ratio.
3. The results obtained from bankruptcy models: Springate model (1978), Lis and Legault model (1987)
4. Profitability ratios: ROA, ROE, return on total assets, the profitability of spending, profitability of sales, ROS, gross profit margin, gross profit margin of financial and management expenses, gross margin, the rate of acceptable growth (Viswanathan).

The final indicator reflects the facts that organizations have short-term liabilities, long-term liabilities, reserve capital, and net assets that exceed nominal capital.

Therefore, to build a model for assessing the financial stability of companies, a composite index representing the sum of the values of the binary coefficients was calculated. It helped to rank the companies according to the degree of financial stability.

Then, we have calculated a correlation matrix, which determines the tightness of the relationship between the composite index and the financial coefficients. As a result, three indicators were identified that have the most reliable link with the composite coefficient.

The regression statistics on the model is presented in Table 6.

The results of the dispersion analysis of the model are presented in Table 7. Critical F value accounts for 1.008, and the critical value for t-statistic is 1.96. Comparing these values with ones given in the table, we can see that the equation is statistically significant.

The coefficients on the model, their standard error, t-statistics are given in Table 8.

The obtained model has divided the statistical aggregate into eight groups (Table 9).

The results of the assessment of electric power companies on the proposed model for 2015-2016 show that when the value of the last indicator on the proposed model increases, the financial stability of the organizations under study increases. The organizations of the 6-8th groups should be recognized as the most stable ones, and their business model is the right one under current conditions.

The highest risk has organizations of the 1st and the 2nd groups. Almost every group has organizations that are in the process of bankruptcy. The only exception was group number 7. However, the probability for bankrupt companies being transferred to groups number 1 and 2 is much higher than for groups number 6 and 8.

The authors were interested in the finding that bankrupt companies were in group number 8 and 6. It requires further investigation. Some bankrupt companies in 2016 had no significant problems with financial indicators, and external management was introduced there in 2017. This information is not revealed in the System of Professional Analysis of Markets and Companies. As a result, similar cases appeared.

The model developed by the authors was tested for its correct work on the sample of companies for 2013 and 2014. The algorithm for calculating indicators to prove the correctness of the model was similar to the algorithm used to develop the model. The results obtained by the tested model were compared with the presence of bankruptcy facts in companies. The results are presented in Table 10.

Table 6: Regression statistics on the model

Indicator	Indicator figures
Multiple R	0.907
Multiple R ²	0.822
Normalized R ²	0.822
Standard error	2.338
Observations	16.620

Source: Authors' calculations

Table 7: Dispersion analysis of the proposed model

Indicator	df	SS	MS	F
Regression	3	419,738	139,912	25,606
Residual	16,616	90,790	5	
Total	16,619	510,529		

Source: Authors' calculations

Table 8: Coefficients on the model and descriptive statistics

Variable name	Coefficients	Standard error	t-statistic
Y- intercept	2.98	0.035	85.576
X 1 –equity ratio	4.95	0.042	117.926
X 2 –return on total assets	6.72	0.040	166.123
X 3 –capital ratio	2.36	0.047	50.473

Source: Own elaboration

Table 9: Grouping of electric power organizations

Group order number	Indicator figures according to the model	Number of organizations		The share of bankrupt companies in the group (%)
		In the group	Among them bankrupt companies	
1	2.99	3508	312	8.89
2	5.35	1836	74	4.03
3	7.94	138	4	2.90
4	9.71	1227	54	4.40
5	10.31	1492	26	1.74
6	12.07	4570	65	1.42
7	14.66	79	0	0.00
8	17.02	3770	10	0.27

Source: Authors' calculations

A new sample confirmed the dynamics. The error of getting bankrupt companies into groups 8 and 7 is <1.5%, in groups 6 and 5 is less than 8.5%.

5. CONCLUSION

The conducted research has shown that it is reasonable to study financial stability not only at the macro-level. The methodology for analyzing the issue at the macro level has already been developed. To assess the financial stability macroeconomic indicators that differ in the methods of calculation are used. In most studies, the assessment of financial stability involves regular monitoring of the banking sector with crucial macroeconomic indicators and the search of the leading indicators.

As a result of the analysis, the authors put forward a hypothesis about the impact of the performance of organizations of other industries on the financial stability of the country. Electric power organizations were chosen to prove the correlations.

The correlations revealed by the authors have shown a significant influence of the electric power companies on one of the world's leading indicators of financial stability-global GDP. In particular, there is a significant correlation between the leading economic indicators of these companies and GDP. As a result of the study, the authors have concluded that there is an impact of the financial stability of energy companies on the financial stability of the country. It is necessary to monitor not only the banking sector but also companies from other industries. Big business will have the most significant impact on macroeconomic indicators. Electric power organizations belong to big business. For online monitoring of the performance of these organizations, a model was proposed that allows determining the degree of financial stability, taking into account such parameters as liquidity, financial stability, profitability, etc. The model based on a sample study of Russian electric power companies for 2015-2016 was developed. The model is based on the regression dependence of indicators. As a result of building and testing a set of models, the best results were shown by the binary model based on the equity to total assets ratio, return on total assets and the difference between net assets and share capital. The results of this model were compared with the fact of bankruptcy in organizations. Checking the obtained model against the criteria of Multiple R-squared, standard error, t-statistics, Fisher criterion showed its significance. The coefficients obtained in the model fully meet the requirements

Table 10: Results of testing organizations for 2013 and 2014

Group order number	Indicator figures according to the model	The share of bankrupt companies in the group, %	
		2014	2013
1	2.99	52.23	38.60
2	5.35	15.38	18.71
3	7.94	9.72	15.79
4	9.71	7.69	12.28
5	10.31	5.67	5.85
6	12.07	8.10	7.60
7	14.66	0.00	0.58
8	17.02	1.21	0.58

Source: Authors' calculations

of regression statistics. The resulting model allowed us to divide the statistical sample into eight groups depending on the values received. The most significant number of bankrupt organizations was in the first and second groups, to which organizations with the worst indicators were assigned. Companies against which arbitration was initiated and the claim was sustained were referred to the bankrupt organizations. While conducting the study, the authors had to take into account that the data on bankruptcy in the System of Professional Analysis of Markets and Companies was regularly updated and companies against which the cases were initiated in 2017 had been recorded as bankrupt ones in earlier periods. We consider the companies in groups 6-8 to be the most stable ones. Their model of work should be applied most actively in the modern market. The presence of an insignificant number of bankrupt companies in the groups 6-8 is related to the fact that the System of Professional Analysis of Markets and Companies gives a list of problem businesses as on the last day of the statistical sampling. The investigation of bankrupt companies which were in the 6th -8th groups showed that they were not bankrupt in 2015-2016, but became bankrupt ones in 2017.

The developed model was tested for its correct work on the electric power organizations for the period from 2013 to 2014. As a result of the calculations, the distribution of companies by groups was similar to that obtained in 2015-2016. Bankrupt companies were in each group. The cause of it is identical to that described; the class frequency differed depending on the period. In 2014, the difference in class frequency amounted to a maximum of 10%, in 2013 it increased.

Regular calculations using the proposed model will allow identifying and eliminating the problems that arise at the micro level on a timely basis. As a result, the industry will develop more steadily and, as a consequence, the country's economy as a whole. Such models should be built for each sector to identify and solve problems of stabilizing the financial system promptly.

REFERENCES

- Altman, E.I. (1968), Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *Journal of Finance*, 23(4), 589-609.
- Argenti, J. (1976), *Corporate Collapse: The Causes and Symptoms*. New Jersey: McGraw-Hill.
- Beaver, H.W. (1966), Financial ratios as predictors of failure. *Empirical research in accounting, selected studies. Supplement to Journal of Accounting Research*, 3, 71-111.
- Bloomberg. (2018), Available from: <https://www.bloomberg.com>. [Last accessed on 2018 Jul 30].
- Borisova, O.V. (2017), Transformation of views: From financial sustainability to the financial stability of the business. *Journal of Economy and Entrepreneurship*, 12(3), 668-672.
- Bunn, P., Redwood, V. (2003), Company accounts based modelling of business failures and the implications for financial stability. *Bank of England Quarterly Bulletin*, 43(4), 462-463.
- Crockett, A. (1997), *Theory and Practice of Financial Stability*. Available from: <http://www.cepr.org/gei/6rep2.htm>. [Last accessed on 2017 Sep 28].
- Davydova, G.V., Belikov, A.Y. (1999), Methodology of quantitative assessment of the risk of bankruptcy of enterprises. *Risk management*, 3, 13-20.
- Durand, D.R. (1941), *Elements in Consumer Installment Financing*. New York: National Bureau of Economy Research.
- Ermolaeva, E.A., Zavyalova, Y.S. (2015), *Dynamics of Development of Financial Instability*. Moscow: Financial Business.
- Federal State Statistics Service. (2018), Available from: <http://www.gks.ru>. [Last accessed on 2018 Jul 30].
- Fedorova E.A., Lazarev M.P., Fedin A.V. (2016a), Forecasting the entity's bankruptcy in line with operating environment factors. *Financial analytics. Science and Experience*, 42, 2-12.
- Fedorova, E.A., Dovzhenko, SE, Fedorov, F.Y. (2016b), Bankruptcy prediction models for Russian enterprises: Specific sector-related characteristics. *Problems of Forecasting*, 3, 32-40.
- Ferguson, R. (2002), Should Financial Stability Be an Explicit Central Bank Objective? Paper presented to an International Monetary Fund conference on Challenges to Central Banking from Globalized Financial Markets, Washington, and D.C. Available from: <http://www.federalreserve.gov/boarddocs/speeches/2002/20021016/default.htm>. [Last accessed on 2017 Sep 28].
- Financial Stability Review. (2016), Deutsche Bundesbank Eurosystem. (2016), Available from: <http://www.bundesbank.de>. [Last accessed on 2017 Sep 29].
- Financial Stability Review. (2017), Banca D' Italia Eurosystem. Available from: <http://www.bankaditalia.it>. [Last accessed on 2017 Sep 29].
- Firsova, I.A., Vashbieva, D.G., Losyakov, A.V., Arhipova, V.S., Pavlushin, A.A. (2018), Development of "active consumer" concept on energy market. *International Journal of Energy Economics and Policy*, 8(3), 8-13.
- Foot, M. (2003), Protecting Financial Stability how Good are we at it? The University of Birmingham. Available from: <http://www.fsa.gov.uk/Pages/Library/Communicati-on/Speeches/2003/sp133.shtml>. [Last accessed on 2017 Sep 28].
- Hol, S. (2007), The influence of the business cycle on bankruptcy probability. *International Transactions in Operational Research*, 14(1), 75-90.
- Information-Analytical Materials. (2017), Review of Financial Stability. IV quarter 2016 I Quarter 2017. The Central Bank of the Russian Federation. Available from: http://www.cbr.ru/publ/stability/ofs_17-01.pdf. [Last accessed on 2017 Sep 29].
- Kochugueva, M.N., Kiseleva, N.N., Anpilov, S.M. (2014), Analyzing external and internal corporate factors of bankruptcy: Evidence from the Russian companies. *Vestnik of Samara State University*, 11(2), 25-36.
- Kormilitsyna, I.G. (2011), Financial Stability: Essence, factors, indicators. *Russian Journal of Money and Finance*, 35, 44-54.
- Lakshina, O.A., Chekmareva, E.N. (2005), Analysis of financial stability: Practice and Methodology. *Russian Journal of Money and Finance*,

- 10, 24-29.
- Legault, J. (1987) Warning System for Small Business Failures Bilanas, Június, 29-31. In: *Insolvency Prediction*, E. Sands and Associates Inc. Available from: <http://www.sands-trustee.com/insolart.htm>.
- Lis, M. (1972), Analysis of the Financial Condition of the Enterprise. Available from: <http://www.lfin.ru/?id=281&t=967>. [Last accessed on 2017 Oct 25].
- Lobanova, M.A. (2013), Financial Stability. *Russian Journal of Money and Finance*, 7, 51-64.
- Lvova, N.A. (2016), Financial Stability of Enterprises: A Methodology for Fundamental and Applied Research: Doctoral Dissertation. St. Petersburg.
- Ministry of Economic Development of the Russian Federation Official Website. (2017), Available from: <http://www.economy.gov.ru>. [Last accessed on 2017 Sep 29].
- Mishkin, F. (1999), Global financial instability: Framework, events, issues. *Journal of Economic Perspective*, 13, 3-20.
- Moiseev, S.R., Pantina, I.V., Gambarov, G.M., Pavshok, O.V., Musaeva, M.O., Snegova, E.A., Markov, K.V. (2013), Financial stability review, macroprudential policy. *Russian Journal of Money and Finance*, 9, 784-795.
- Moscow Exchange. (2017), Available from: <http://www.moex.com>. [Last accessed on 2017 Jul 30].
- Ohlson, J.A. (1980), Financial ratios and the probabilistic prediction of bankruptcy. *Journal of accounting research*, 18(1), 109-131.
- Panov, D.V. (2013), Banks financial stability: Methodological approach. *Socio-Economic Phenomena and Processes*, 5, 200-204.
- Russia's GDP. (2018), Available from: <http://www.surzhyk.info/vvp-rossii>. [Last accessed on 2018 Apr 6].
- Rygin, V.E. (2013), Bankruptcy risk assessment model of metallurgical enterprises. *Vestnik of the South-Russian state technical university (Novocherkassk polytechnic institute). Socio-Economic Sciences*, 5, 84-91.
- Shinazi, G. (2005), Preserving Financial Stability. Series "Issues of Economics." *International Monetary Fund*, 36, Available from: <http://www.imf.org>. [Last accessed on 2017 Sep 29].
- Springate, G.L.V. (1978), Predicting the Possibility of Failure in a Canadian Firm. New York: *Insolvency Prediction*, E. Sands and Associates Inc.
- Szunke, A. (2014), Changes in Monetary Policy after the Crisis towards Preventing Banking Sector Instability. Milan: University of Economics in Katowice.
- Taffler, R.J., Tisshaw, H. (1977), Going, going, gone four factors which predict. *Accountancy*, 88, 50-54.
- The System of Professional Analysis of Markets and Companies. (2018), Available from: <http://www.spark-interfax.ru>. [Last accessed on 2018 Jul 30].
- Tuktarova, P.A., Tuktarov, B.S. (2013), Regression models determine the risk of bankruptcy. *Vestnik UGATU Scientific Journal of Ufa State Aviation Technical University*, 17(7), 80-85.
- Wadhvani, S.B. (1986), Inflation, Bankruptcy Default Premia and the Stock Market. *The Economic Journal*, 96, 120-138.
- Zhdanov, V.Y., Afanaseva, O.A. (2011), Development of a model for the diagnosis of bankruptcy risk for airlines *Economic Systems Management: Electronic Scientific Journal*. Available from: <https://www.cyberleninka.ru/article/n/razrabotka-modeli-dagnostiki-riska-bankrotstva-dlya-aviapredpriyatij>. [Last accessed on 2017 Sep 29].