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## STUDYING THE BANKING INDUSTRY'S STABILITY THROUGH MARKET CONCENTRATION INDICES\*

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**Abstract.** The optimal market structure is one of the fundamental issues of economic theory. At that, companies' efficiency in the market is associated with resource availability as a whole and finance resources, in particular. The structure of the banking market in terms of commercial loans determines a number of parameters of the economic system, such as its stability, growth potential, entrepreneurial activity, the state of commodity markets, the competitiveness of companies, etc. A comparative analysis of countries in terms of the ratio of commercial loans to GDP allows us to identify promising markets and strategic avenues for the development of the global banking industry and investment policy. However, a lack of regular and timely statistical reviews often impedes the identification. With the view to performing a comparative analysis for the EA/EU macroregion, the authors attempt to establish the types of the banking market in Russia based on a fuzzy rank approach using the probability theory. Using the data for 2009–2018, the authors assess bank concentration in Russia by a number of indicators. During the period under review, the volume of commercial banking lending in Russia experienced a steady increase. At the same time, there is a clear downward trend in the number of banks; several local “breakdowns” happen once every two years, i.e. the compression rate is reducing. Within the framework of the accepted gradation, the values of concentration indices taken separately do not allow arriving at a firm conclusion, since they indicate contradictory statuses of the sectoral market type. The integrated approach proposed in the paper helped find that, despite a relatively large number of participants in the Russian banking market, it should be primarily identified with a monopoly. At that, the values of the Herfindahl-Hirschman Index (HHI) and standard concentration fall within the oligopoly boundaries. This indicates the fuzzy nature of the sectoral market. The empirical results obtained are of use when analyzing competition, developing antimonopoly regulation measures, adjusting the banking sector development strategy and investment policy.

**Keywords:** sectoral concentration; competition; stability; banking industry; commercial lending; economic growth; Russia; EA/EU macroregion

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## 1. Introduction

Banking systems of many countries are currently being transformed. Despite individual differences, there is a clear trend towards a decrease in the number of banks and an increase in concentration of banking assets (Berger, 2003; Pawlowska, 2017; Basten and Sánchez, 2018; Pak and Iwata, 2018). Qualitative structural shifts in the financial sector can boost a long-term potential of economic growth and its sustainability. Empirical studies, with some exceptions, prove that. A more developed sector of financial intermediation is able to transform savings into investments more effectively, redistribute risks between economic agents and ensure a rapid exchange of economic data (Mamonov et al., 2017; Tvaronavičienė et al., 2018).

As with any industry market, the banking market needs to maintain competition and prevent monopolism. The condition is due to the necessity to improve the sustainability of the institutional system and protect market participants and stakeholders. In practice, the parameters of the normal level of competition for a particular banking sector are difficult to establish because of a number of factors, the primary of which is that the results of the assessment of the banking competition level can differ significantly depending on the approach applied. When examining market competitiveness, the analysis of the concentration level is of special importance. The concentration of market participants shows the relative size and the number of companies in the industry. Based on the data on the share of banks in different market segments, it is possible to evaluate the intensity and heterogeneity of competition.

In terms of volumes, one of the most powerful segments is the market for bank loans, i.e. loans to enterprises and organizations. The ratio of bank loans to GDP is a key factor in the economic development. At the same time, the heterogeneous distribution of commercial loans may affect the national economy sustainability and its exposure to business risks. A comparative analysis of countries by the indicator allows us to identify promising markets and strategic avenues for the banking industry development. However, a lack of regular and timely statistical reviews often impedes the identification. For example, empirical and poorly structured statistical data serve as the basis for analytical research of the banking market in Russia. This makes it difficult to compare Russia and other countries. In order to resolve this problem, we establish the types of the banking market in Russia based on a fuzzy rank approach using the probability theory.

It is worth noting that the increment rate of loans in Russia outruns the increment rate of GDP; however, Russia demonstrates one of the lowest rates of this indicator among large developed and developing countries. The ratio of bank loans to GDP in Russia falls within 60–70%. For comparison: the same ratio in Europe is over 150%; China – over 190%; the USA – over 230%; Brazil – over 100% and India – over 75% (Legacy Square Capital, 2017). Such a spread in figures indicates that, when it comes to financing production, the credit potential of Russian banks is underused. At the same time, long-term lending is hindered by the low capitalization of banks with a scarcity of internal reserves for its growth, the short-term nature of their resources, which cannot be transformed into investments due to the lack of an effective refinancing and funding system (Mukhametshina, 2014).

According to Mamonov et al. (2017), Russia is able to enhance domestic credit to private sector from 60% of GDP to the optimal 95–100% of GDP. Since Russia is rather far from the optimal level, the expansion will be safe in terms of risks to macroeconomic stability (of course, if it is not of an explosive character). The growing credit availability in the domestic market will smooth the dynamics of commodity output (reduce GDP volatility by 1.3 percentage points) and cause a somewhat increase in long-term GDP growth rates (by 0.3 percentage points). For this reason, the market for bank loans to non-financial organizations and the public in Russia is the subject of the most acute competition (Krylova, 2009a). As a result, there is obvious concentration in the Russian banking sector and the role of large banks is increasing. Risk-tolerance is a related issue here, since the elevated competitiveness of banks encourages opportunistic behavior (Marinč, 2013). We will look at these and other trends in details later in the present paper when evaluating concentration and establishing the type of an industry market for the Russian banking sector.

Theoretical and empirical studies demonstrate that the competitive structure of the banking market has both positive and negative effects. In the literature review, we summarized some of the identified patterns while arguing the importance of concentration and centralization of bank capital as a factor influencing the most important economic processes.

## **2. Literature review**

Let us look at the views of economists on the nature of the processes of concentration and centralization of bank capital. According to Schlossberg (2004), concentration of bank capital is localization of the main mass of banking operations in a small number of large banks. Vishnever (2006) argues that the term “concentration” should be viewed as a process of enhancing a bank’s capital by capitalizing the share of value added. Centralization is an increase in capital preceded by consolidation of a number of smaller pieces into the large one (Krylova, 2009b).

There is a number of clear trends observed in the banking industry.

First, accumulation of bank capital is determined by the patterns of the expanded reproduction of all social capital under the specific historical conditions (Krylova, 2009a). The accumulation is ensured through a wide and more efficient use of the domestic funding sources (Medvedev, 2015).

Second, the problem of increasing concentration of bank assets is among the most urgent topics for scientific research conducted with a direct participation or assistance of central banks all over the world. The scrupulous attention of monetary authorities to this process is due to its possible positive and negative consequences for the monetary system and the entire national economy. The effects of increasing concentration in the banking industry (Berger, Demselz and Strahan, 1999), which sometimes have contradictory reasons, are the following: a drop in personal income and an adverse effect on the production volume (Jayaratne and Strahan, 1996; Shaffer, 1998; Collender and Shaffer, 2000); a fall in the business/entrepreneurial activity when it comes to starting new companies (Black and Strahan, 2000; Bonaccorsi and Dell’Ariccia, 2000; Kuzmin, 2018); a growing range and availability of banking services (Petersen and Rajan, 1995; DeYoung, Hunter and Udell, 2004); a rise in the financial leverage of companies, additional protection of creditors’ rights, but at the same time inadequate protection of property rights (González and González, 2008; Teresienè, 2018); increased consumer confidence (Idzik, 2017); the development of special forms of credit relations (Neuberger, Pedergrana and Rähke-Döppner, 2008); no strong need for measuring and regulating market power (Peláez and Peláez, 2009); strategic delay in entering the market (VanHoose, 2017); a destructive effect on credit availability for companies with financial constraints (Shikimi, 2013); etc.

Law and Singh (2014) point out that, if the state holds the largest portion of the bank capital, it increases interest rates, especially on mortgage, which lowers the standard of living of the population. Simoguk (2013) refutes this viewpoint by stating that monopolization in the banking sector guarantees interest rates to be stable and produces a positive trend in increasing interest rates on deposits, which leads to an increase in welfare.

Coricelli and Marc (2010), Cetorelli (2004) and Cetorelli and Strahan (2006) concentrate on examining the contradictions of theoretical modeling and empirical assessment of markets. They find that countries or regions with a more concentrated banking sector usually have more concentrated commodity markets. These findings emphasize the negative influence of banking concentration on economy and consequently on companies' performance and industrial development.

Hoxh (2013) looks at how the strengthening of banking competition and concentration affects the volatility of manufacturing sectors: banking concentration restrains the volatility of industries' growth, but as banking competition increases, so does the volatility of industries' growth. Pagano (1993) sticks to the same position and provides evidence of the adverse effect of the banking market's concentration on economic growth.

According to Svirydzienka and Yousef (2015), if banking concentration grows, it reduces economic sustainability, which, in turn, adversely affects not only the preservation of the growth potential, but also the ability to enter foreign markets (through the production of competitive goods/works/services). At the empirical level, industries that are more dependent on external financing grow faster than industry on average in countries with a high concentration in the banking market (Moiseev, 2008).

Mishkin (1992) comes up with similar ideas and associates banking concentration with the scale and scope of possible financial crises. Within the framework of the traditional theory of industrial organization, Moiseev (2008) suggests that large banks have a depressing effect on economy, and oligopoly (but not monopoly or perfect competition) is the structure of the banking market, which maximizes economic development.

Beck, Demircuc-Kunt and Levine (2006) hold opposite opinions. They suppose that current banking concentration leads to stability and consistency, which strengthens a country making it more attractive to foreign partners. At the same time, Hellman and DaRin (2002) propose a theory and empirical data demonstrating that more concentrated banking sectors encourage the development of new sectors and, thus, serve as catalysts for industrialization.

To explain these contradictions, it is noteworthy that the conditions for financial stability formed in developed countries are not always identical to those formed in transitional economies and can exert the opposite effect. In some cases, the consolidation of banks was a response to risk, uncertainty and increased competition; banking institutions, therefore, were forced to use the most cost-saving strategic tools to cut their costs and boost revenues (Ayadi, 2008).

Ely and Robinson (2005) believe that these processes are due to (1) the accelerated increase in the business scope and larger banks' capital mass driven by profit accumulation (direct concentration), and (2) acquisition of small banks by larger ones and creation of banking groups and concerns of banks (centralization). These processes are intertwined: mergers of banks usually stimulate an accelerated increase in their capital and income, and the rapid growth in the scale of economic operations allows restraining and dominating over competitors.

The literature review shows that over the last years competitiveness of national bank services markets has been analyzed using the Panzar-Rosse approach instead of concentration indicators (Bikker and Haaf, 2001; Coccorese, 2009; Anzoátegui, Martínez Peria and Melecky, 2010). Along with the method, the Bresnahan model (Rezitis, 2010) and the Barrush-Modeshtu model (Drobyshevsky and Paschenko, 2006) were also applied. The models for

measuring the degree of competition rely on the approaches of the new empirical theory of industry markets. They are based on the competition behavior of banks under the conditions where there are no ways to influence the outcome by utilizing the structural features of the market.

Quantitative concentration indicators, such as the concentration ratio, the Herfindahl-Hirschman index, the entropy index, the indices of Linda, Gini and Hall-Tideman, dispersion of market share distribution, the coefficient of variation, etc., are also traditionally used. According to Aliev (2017), the Herfindahl-Hirschman index (*HHI*) is the most optimal to evaluate concentration in the banking industry. The authors will try to neutralize the inconsistency of these methodological approaches through analyzing their assessment capabilities, limitations and applicability to the case under consideration.

### 3. Materials and Methods

As specified above, the structure of industry market is primarily characterized by its level of concentration. A number of studies (Shtapova, 2009; Ezrokh, 2013; Bikker, 2004; Edwards and Patrick, 2012; Blanco, 2011) support this view. At the same time, other distinguishing features of a market should be taken into account. The structure is also characterized by the three basic features: the number of suppliers (*N*), their market share (*S*) and concentration indices. It allows establishing the type of market under the conditionally permanent dynamics (Table 1). We propose considering several features underlying the conceptual understanding of the type of industry market.

**Table 1.** Distinguishing features of the main types of industry markets

Market type	Supply structure	Products/services	Barriers
Competition	A high number of suppliers with low quotas	Standardized	Low
Monopolistic competition	An average number of suppliers with medium quotas	Diversified	Low
Oligopoly	A low number of suppliers with high quotas	Standardized/diversified	Significant
Monopoly	Sole supplier	Exclusive	High

*Source:* (Avdasheva and Rozanova, 1998).

Kuzmin, Volkova and Fomina (2019) deal with the methods of the linear range approach.

The distribution of market shares is illustrated using the example of the cumulative Lorenz curve (Lorenz, 1905). The concentration ratio (*CR*) is calculated as the sum of the market share percentage held by the largest specified number of firms ( $n < N$ ) in an industry. The ratio indicates the proportions of the shares of the largest players and the shares of the smallest suppliers. This may cause inconsistencies when comparing different market spheres, which will not allow conducting research with the help of the method of known addition (Avdasheva and Rozanova, 1998). However, it is possible to calculate additional indicators applying the Herfindahl-Hirschman index, as well as the coefficients of market share dispersion, conditional concentration, etc.

Market share dispersion  $\sigma^2$  demonstrates a degree of discrepancy in the distribution of all market players' shares. The higher the dispersion value, the higher the market concentration. The major disadvantage of the approach is that it does not take into account the number of players (Avdasheva and Rozanova, 1998). In contrast, the Herfindahl-Hirschman index (*HHI*) is the optimal way to resolve the dispersion problem due to the quadratic formula (Hirschman, 1964):

$$HHI = \sum_{i=1}^N S_i^2 = N\sigma^2 + \frac{1}{N}. \quad (1)$$

If under perfect competition *HHI* is assumed to tend to zero, then if the index is 1, it is absolute monopoly. As a side note, the Federal Antimonopoly Service of the Russian Federation (FAS Russia order..., 2010) in its

calculations uses predominantly  $CR_3$  and  $HHI$ . The remaining indicators are supplementary. FAS Russia distinguishes between three levels of market concentration: high ( $CR_3 > 0,70$ ,  $HHI > 0,20$ ); moderate ( $CR_3 > 0,45$ ,  $HHI > 0,10$ ), and low ( $CR_3 < 0,45$ ,  $HHI < 0,10$ ).

The relative concentration ratio  $CRR_n$  is calculated as a ratio of the aggregated share  $n$  of the largest firms  $S_n^A$  to the share of their revenue  $Q_n^A$  (Besanko, 2009). The maximum share index  $I_{Smax}$  compares the market leader's share  $S_{max}$  with the average share  $S_a$ . Thus, under perfect competition, the index is 0, and under full monopoly, it is 1. Despite its simplicity, the index allows for both the measure of inequality and the number of players. However, there is a nuance here: the index does not take into account the ratio of outsiders (Cowell, 2011).

The *Gini* coefficient is related to the Lorenz curve and used to assess the inequality of the size of firms along with market share dispersion. The *Hall-Tideman/Rosenbluth index* is commonly used to calculate distribution of market players by shares. Under perfect competition, its value tends to 1 and falls (Hall and Tideman, 1967), if market concentration increases.

The *Linda's index* is aimed at comparing firms in the situation, where in the market there are more than one leader  $n > 1$ , and assessing their inequality. The index is a ratio between the market share of each supplier  $i$  with the market share of all market leaders from the 1st to the  $n$ -th (Linda, 1976):

$$L_{ind} = \frac{1}{n(n-1)} \sum_{i=1}^n \frac{S_i(n-i)}{(S_n^A - S_i)i}. \quad (2)$$

The value of the Linda's index is non-monotonic in relation to  $n$ . If the value of  $n$  increases from  $n=2$ , the value of  $L_{ind}$  decreases. The number of market leaders is the value of  $n$ , after which  $L_{ind}$  begins growing.

The *inverse share value index*  $I_{inv}$  (in percent) compares the sum of suppliers' inverse share values with the  $N^2/100$  index: if  $0.75 < I_{max} \leq 1$ , it is perfect competition; if  $0.5 < I_{max} \leq 0.75$ , it is monopolistic competition; if  $0.25 < I_{max} \leq 0.5$ , it is oligopoly (Cowell, 2011).

The perfect entropy ratio  $ER$  determines the average share of the firm and shows the entropy of shares distribution (Shannon, 1948). The higher  $ER$ , the lower market concentration and market power of each player. This ratio is used to compare the previous index between the markets. The closer  $ER$  to 0, the greater market concentration (Clarke, Davies and Waterson, 1984):

$$ER = \frac{\sum_{i=1}^N S_i \ln\left(\frac{1}{S_i}\right)}{\ln N}. \quad (3)$$

All these indices can be categorized into two groups: concentration indices ( $CR_n$ ,  $CRR$ ,  $HHI$ ,  $HT$ ) and share inequality indices ( $ER$ ,  $Gini$ ,  $L_{ind}$ ,  $I_{Smax}$ ,  $I_{inv}$ ,  $\sigma^2$ ). Each index has its own advantages and disadvantages by certain metrics (Table 2).



**Table 2.** Advantages and disadvantages of concentration indices

Parameter	Index/coefficient									
	CR <sub>n</sub>	CRR	HHI	HT	ER	Gini	L <sub>ind</sub>	I <sub>smax</sub>	I <sub>inv</sub>	σ <sup>2</sup>
Consistency (determines the development of outsiders)			+	+	+				+	+
Efficiency (determines the variability <i>S</i> )			+	+	+	+				+
Intuitivity (determines <i>N</i> and inequality)	+	+					+	+	+	
Behavior (determines the variability <i>N</i> and merger)					+		+			+

Source: generalized by the authors

Thus, there emerges the need for scaling the values of indices to level the disproportion of estimates. We have generalized the approaches to calculating coefficients and indices by producing a gradation of criteria indicating one of the three types of market: monopoly, oligopoly and monopolistic competition (Table 3).

**Table 3.** The matrix of criteria and boundaries of their values of indicators to determine the type of industry market

Index/coefficient	Aggregated type of market/criteria's boundaries					
	Monopoly		Oligopoly		Monopolistic competition	
	Lower	Upper	Lower	Upper	Lower	Upper
Concentration ratio <i>CR3</i>	70%	100%	45%	70%	0%	45%
Relative concentration ratio <i>CRR3</i>	0	0.5	0.5	1	1	+∞
The Herfindahl-Hirschman index <i>HHI</i>	1800	10000	1000	1800	0	1000
Dispersion of market share distribution	0.75	1.00	0.25	0.75	-∞	0.25
The Gini index	0.75	1.00	0.25	0.75	0.00	0.25
The Hall-Tideman index <i>HT</i>	0.75	1.00	0.25	0.75	-∞	0.25
Relative entropy <i>ER</i>	0.00	0.25	0.25	0.75	0.75	1.00
The maximum share index	0.75	+∞	0.50	0.75	-∞	0.50
The Linda's index	0	3	3	15	15	+∞
The inverse share value index	-∞	0.25	0.25	0.50	0.50	+∞

Source: generalized by the authors

In the present study, to resolve this task, the authors propose a method based on the probability theory. Using its provisions, the quantitative probability is established by the fact how close the current level of the indicator is to its boundary, which changes dynamically. Thus, even at the same or approximately the same values of the current level, probability may differ significantly depending on the dynamics of the boundary (threshold) level of the coefficient or index.

We believe that the search for the cumulative characteristic of the type of industry market should be carried out based on the Laplace distribution function (Kotz, Kozubowski, and Podgórski, 2001) and quadratic mean. The type of market will be determined as one of those presented, for which the calculated root mean square probability by the Laplace function is the highest. The mathematical representation of calculating probability by Laplace (Bening and Korolyov, 2008) takes into account such parameters as the lower and upper boundary of the acceptable range of fluctuations of the indicator values, the value of mean and standard deviation:

$$R(a < CP_i < BL_i) = 1 - \left[ L\left(\frac{BL_i - \bar{f}(CP_i)}{\delta(CP_i)}\right) - L\left(\frac{a - \bar{f}(CP_i)}{\delta(CP_i)}\right) \right], \quad (4)$$

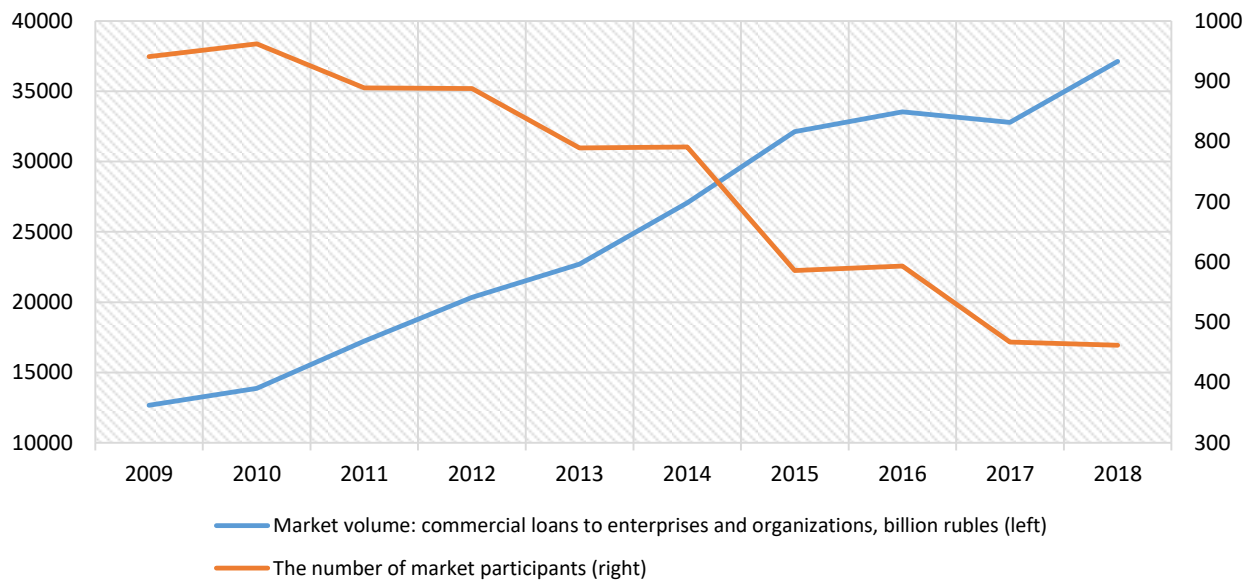
$$L(z) = \frac{1}{\sqrt{2\pi}} \int_0^z e^{-\frac{t^2}{2}} dt,$$

where  $R(a < f < BL_i)$  is probability within the range of the initial threshold value  $a$  and the boundary level  $BL$ ;  $L(z)$  is the Laplace function;  $a$  is the initial threshold value;  $\bar{f}(CP_i)$  is the indicator's average value for the period under consideration;  $\delta(CP_i)$  is the indicator's standard deviation for the period under consideration.

The research limitations of the approach reside in a number of provisions. The boundary level is a subjective characteristic and can vary. The quality and accuracy of the probability estimates are also affected by the completeness of the data collection. In the situations, where the period under consideration is short, the statistics of the current level of industry concentration coefficients and indices will be incomplete, and the correctness of the estimates of the market type is low.

#### 4. Results

To analyze concentration of the banking sector in Russia and establish the type of industry market, we should look at actual market data for the decade from 2009 to 2018 (Fig. 1). The main source data for the calculation are the market volume defined as a sum of commercial loans issued to enterprises and organizations by Russian banks during the reporting period.



**Fig. 1.** The volume of commercial banking lending market in Russia

Source: the data of the Central Bank of Russia.

The volume of commercial banking lending market in Russia experienced a steady growth throughout almost the whole period. A temporary decline in 2017 did not break the general trend and, as a result, it can be ignored. For the purpose of our study, the dynamics of the market volume is considered monotone positive. At the same time, the number of market participants is characterized by the dynamics opposite to that of the market volume. The number of players demonstrates a clear downward trend with several local “breakdowns” happening once every two years, i.e. the compression rate is reducing. The Russian banking system consists of a relatively large number of participants: there were 462 of them in 2018. The market is dominated by several large partly state-owned banks that hold about half of all banking assets (Anisimova and Vernikov, 2011; Chernikova and Zaernyuk, 2011), which is confirmed by official statistics. [Rezbaev (2013) hypothesizes that high concentration of assets in Russia during 2013–2015 was due to the lack of a clear concept for managing the federal treasury’s liquidity,



which resulted in the need to involve commercial banks in handling accounts of budgets of various levels and, primarily, the federal budget.] This process occurs firstly due to the fact that large banks increase their assets at a faster rate than small and medium-sized banks. This is a special feature of the Russian case of consolidation in comparison with consolidation of banking assets in developed countries. It is important to bear in mind that Russian banks are frequently interconnected through cross-ownership of shares or a single owner. This circumstance somewhat distorts the real picture of competition in the market.

Let us analyze concentration of the banking sector in Russia using industry indicators. The results of the calculations are supplied in Appendix A.

There was a constant upward trend in the concentration ratio during almost the entire period. This can be traced equally, and, therefore, is true for the values of the concentration ratios  $CR3$ ,  $CR4$ ,  $CR6$  and  $CR8$ . Throughout the period under consideration, the values of  $CR3$  fall within the range that corresponds to the boundaries of oligopoly (see Table 3). At that, there is observed a monotone approximation to the upper boundary of oligopoly/lower boundary of monopoly. In other words, if the dynamic persists, the market is expected to become monopolistic. Moreover, during the last two years of the period under discussion, this trend is present in  $CR8$ . Nevertheless, the concentration ratio of 2009–2018 indicates that the sector is oligopolistic. Now let us compare this conclusion with the data provided by other indicators. The relative concentration ratio displays inverse dynamics with respect to the concentration ratio. The values of the relative concentration ratio are in the range that corresponds to the boundaries of monopoly, while the general dynamics indicates its strengthening.

The Herfindahl-Hirschman index is directly related to the concentration ratio.  $HHI$  shows a steady growth. The values of the Herfindahl-Hirschman index are in the range of oligopoly boundaries. At that, the general dynamics of the period allows asserting that, if the trend persists, in the near future the lower boundary of monopoly (level 1800) will be forced. If the Herfindahl-Hirschman index indicates a certain type of industry market which contradicts the conclusions on other indicators, then the final decision on the type of market is made taking into account additional data.

According to the data obtained, the variance of market shares of participants in the Russian banking market increases along with the increase in the concentration ratio. For the purpose of the current analysis, the dynamics of the market share dispersion is considered monotone positive. Throughout the entire period under discussion, the values of the market share dispersion exceed 1, which indicates a monopoly market.

The inverse share value index demonstrates multidirectional, extremely unstable (near-sinusoidal) dynamics, which does not correlate with the dynamics of any of the indicators described above, including the concentration ratio. However, throughout the entire period of 2009–2018, the values of the index vary within the range of a monopoly type of market.

The dynamics of the coefficient of variation completely follows the dynamics of the concentration ratio. It grew during almost the whole period (excluding 2010 and 2016).

The values of the Gini Index during the period under review are within the range of the monopoly boundaries. At that, the general dynamics allows asserting that, if the trend continues, the movement will occur away from the lower limit of monopoly.

The maximum share index shows inverse dynamics in relation to the concentration ratio. The values of the index correspond to the monopoly boundaries. The index is expected to change towards the strengthening of monopoly, although in absolute terms, this change is insignificant and the values fluctuate around 0.99.

A different type of market is determined by the Hall-Tideman index. As the concentration ratio increases, so does the index, its dynamics is monotone positive. The index's level corresponds to monopolistic competition. The general dynamics makes it possible to claim that, if the emerging trend persists, the movement will occur towards the lower boundary of oligopoly. It is noteworthy that monopolistic competition here is in conflict with the type of market determined by the majority of other indicators.

The Linda's index is characterized by multidirectional, unstable dynamics in relation to the dynamics of the concentration ratio. It rose at the beginning of the period and declined at the end of the period. The Linda's index at the beginning of 2009–2013 was over 15 ( $>15$ ), which corresponded to monopolistic competition; in 2014–2018, it did not exceed 15, which indicated the oligopolistic type of market.

Thus, we can see that determining the type of industry market with the help of individual characterizing indicators leads to ambiguous and sometimes contradictory results. To arrive at the conclusion about the aggregated type of an industry market, we apply the probability approach and integration based on the root mean square. The calculated data are given in Table 4.

**Table 4.** Probability distribution of the main indicators of an industry market's concentration for the banking sector of commercial lending in Russia for 2009–2018

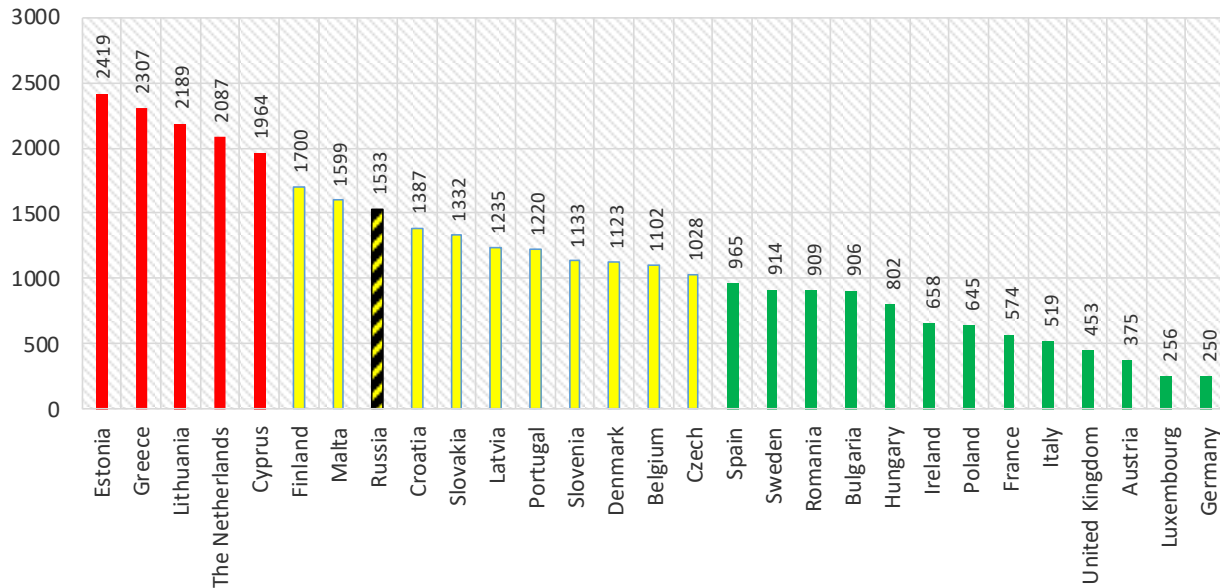
Index/coefficient	Monopoly	Oligopoly	Monopolistic competition
Concentration ratio $CR_3$	0.00	96.92	3.08
Relative concentration ratio $CRR_3$	99.99	0.01	0.00
The Herfindahl-Hirschman index $HHI$	0.04	99.79	0.17
Dispersion of market share distribution	0.00	0.00	100.00
The Gini index	100.00	0.00	0.00
The Hall-Tideman index $HT$	0.00	0.00	100.00
Relative entropy $E_R$	0.00	100.00	0.00
The maximum share index	100.00	0.00	0.00
The Linda's index	4.22	39.08	56.70
The inverse share value index	99.34	0.66	0.00
Root mean square	63.15	55.57	48.19

Source: calculated by the authors

As shown in Table 4, the maximum root mean square indicates a monopolistic type of market. Within the framework of the present analysis, this result will be considered aggregated and final.

## 5. Discussion

The Herfindahl-Hirschman index can be applied to perform a comparative regional analysis of the concentration level of homogenous markets. Look at the state of the banking industry in Russia and the EA/EU macroregion in 2009–2017 (Fig. 2; Appendix B). The EA/EU macroregion is a number of states included in the European Union and/or using euro as the official currency.



**Fig. 2.** The concentration level in the banking industry of the EA/EU and Russia in 2017 by the Herfindahl-Hirschman index (*HHI*)

*Source:* the data of the Eurostat, calculated by the authors.

As the data obtained show, the Herfindahl-Hirschman index of the banking industry in Russia falls within the boundaries of oligopoly. Fig. 2 illustrates that the banking sectors of only a few countries in the EA/EU region can be classified as monopolistic, namely Finland, Estonia, the Netherlands, Lithuania, and from the second half of the period under review – Malta and Cyprus. The Herfindahl-Hirschman index classifies the majority of the EA/EU banking sectors as monopolistic competition. These are primarily Germany, Luxemburg and Austria, where the concentration level of the banking sector is minimal.

While describing the dynamics of the banking sectors' development, it is worth noting that the countries with the maximum monopoly (Finland and Estonia) are characterized by a downward trend in the concentration level and in the future are likely to enter the zone of oligopoly, if the planned trends continue. The opposite situation is typical to the banking sector in Russia that demonstrates a virtually monotone growth in the concentration level. Although it remains in the oligopoly zone, if the planned trends persist, in the near future it can be considered completely monopolistic.

## Conclusions

Economic stability emerges under the influence a complex set of factors and conditions that among other things include the sectoral concentration of banks. From the perspective of volumes, a powerful segment is the market of bank loans (loans to enterprises and organizations). The ratio of bank loans to a country's GDP is a key factor in the economic development. As with any sectoral market, the banking service market needs to maintain competition and prevent monopolism. Traditionally, concentration is assessed according to quantitative indicators, such as the concentration ratio, the Herfindahl-Hirschman index, the entropy index, the indices of Linda, Gini and Hall-Tideman, dispersion of market share distribution, the coefficient of variation, etc.

To generalize about the calculated indices, we used an integrated calculation based on the Laplace distribution function. The method allowed us to calculate the probability value of attributing the Russian banking sector to a

particular type of industry market. We found that, despite a relatively large number of participants in the banking market in Russia, it should be more closely identified with a monopoly. At the same time, the values of the Herfindahl-Hirschman index, the standard concentration and some other indices are within the boundaries of oligopoly. This indicates that the nature of the sectoral market is fuzzy.

While comparing Russia with the EA/EU nations, we arrived at the following conclusions. Firstly, according to the Herfindahl-Hirschman index, the banking sectors of the majority of the EA/EU states are identified with monopolistic competition (Germany, Luxemburg, Austria, etc.). Secondly, the EA/EU countries with monopolistic banking sectors (Finland, Estonia, etc.) demonstrate a downward trend in the concentration level and in the future are likely to enter the zone of oligopoly, if the planned trends continue. Thirdly, the banking sector in Russia demonstrates a virtually monotone growth in the concentration level. Although it remains within the oligopoly zone, if the planned trends persist, in the near future it will be considered completely monopolistic.

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## Appendix A

**Table A1.** Sectoral coefficients and indices of the Russian commercial banking lending for the period of 2008–2018

Indicator	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Concentration ratio $CR_3$	50.6%	46.9%	47.9%	50.3%	51.5%	52.6%	54.6%	55.9%	58.6%	60.9%
Concentration ratio $CR_4$	54.7%	51.5%	52.5%	54.6%	55.9%	56.9%	60.7%	62.1%	63.3%	65.6%
Concentration ratio $CR_6$	60.7%	58.2%	59.1%	60.8%	63.0%	64.0%	68.8%	69.9%	71.7%	73.9%
Concentration ratio $CR_8$	64.5%	62.2%	62.9%	64.4%	66.7%	68.1%	73.6%	74.7%	76.9%	78.7%
Relative concentration ratio $CRR_3$	0.41	0.45	0.44	0.42	0.41	0.40	0.39	0.38	0.37	0.36
Relative concentration ratio $CRR_4$	0.39	0.41	0.41	0.39	0.38	0.38	0.36	0.35	0.36	0.34
Relative concentration ratio $CRR_6$	0.36	0.38	0.37	0.36	0.35	0.35	0.34	0.33	0.33	0.32
Relative concentration ratio $CRR_8$	0.35	0.36	0.36	0.35	0.35	0.34	0.33	0.32	0.33	0.32
The Herfindahl-Hirschman index $HHI$	1337.5	1182.4	1186.1	1310.6	1309.2	1389.6	1461.9	1434.2	1533.0	1584.1
Dispersion of market share distribution	1.41	1.22	1.32	1.46	1.64	1.74	2.47	2.39	3.24	3.38
The coefficient of variation (dispersion)	0.13%	0.11%	0.13%	0.14%	0.16%	0.17%	0.27%	0.26%	0.39%	0.40%
The Gini index	0.94	0.93	0.93	0.93	0.93	0.94	0.95	0.95	0.95	0.96
The Hall-Tideman index $HT$	0.017	0.015	0.017	0.016	0.019	0.020	0.033	0.034	0.044	0.049
Absolute entropy $E$	3.42	3.57	3.52	3.46	3.37	3.30	3.00	2.98	2.83	2.74
Relative entropy $E_R$	49.9%	51.9%	51.8%	50.9%	50.6%	49.4%	47.1%	46.6%	45.9%	44.6%
The maximum share index	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
The Linda's index	19	18	27	27	26	9	11	9	10	7

Indicator	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
The inverse share value index	0.1937	0.0223	0.1302	0.0353	0.1575	0.0316	0.0392	0.0216	0.0120	0.1674

Source: Calculated by the authors using the data provided by the Central Bank of Russia

## Appendix B

**Table B1.** The values of the Herfindahl-Hirschman Index (*HHI*) of a number of EA/EU countries and Russia in the banking sector for the period of 2009–2017

Country	2009	2010	2011	2012	2013	2014	2015	2016	2017
Estonia	3090	2929	2613	2493	2483	2445	2409	2406	2419
Greece	1183	1214	1278	1487	2136	2195	2254	2332	2307
Lithuania	1693	1545	1871	1749	1892	1818	1939	1938	2189
The Netherlands	2034	2049	2067	2026	2105	2131	2104	2097	2087
Cyprus	1085	1125	1030	1007	1645	1445	1443	1366	1964
Finland	3480	3830	3880	3250	3410	3630	3160	2300	1700
Malta	1250	1181	1203	1313	1458	1648	1620	1602	1599
Russia*	1337	1182	1186	1311	1309	1390	1462	1434	1533
Croatia	-	-	-	-	1384	1364	1396	1405	1387
Slovakia	1273	1239	1268	1221	1215	1221	1250	1264	1332
Latvia	1181	1005	929	1027	1037	1001	1033	1080	1235
Portugal	1150	1207	1206	1191	1197	1164	1215	1181	1220
Slovenia	1256	1160	1142	1115	1045	1026	1077	1147	1133
Denmark	1042	1077	1192	1130	1160	1190	1180	1224	1123
Belgium	1622	1439	1294	1061	979	981	998	1017	1102
Czech	1032	1045	1014	999	999	949	987	1009	1028
Spain	507	528	596	654	719	839	896	937	965
Sweden	899	860	863	853	876	880	866	845	914
Romania	857	871	878	852	821	797	860	894	909
Bulgaria	846	789	766	738	730	836	919	939	906
Hungary	864	828	848	873	862	792	763	787	802
Ireland	714	700	645	630	671	673	672	636	658
Poland	574	559	563	568	586	656	670	659	645
France	605	610	600	545	568	584	589	572	574
Italy	298	410	407	410	406	424	435	452	519
United Kingdom	467	523	519	527	525	462	438	422	453
Austria	414	383	423	395	405	412	397	358	375
Luxembourg	310	343	346	345	357	330	321	260	256
Germany	206	301	317	307	266	300	273	277	250

Source: Eurostat; calculated by the authors

Note. The color scale shows an increase in the index from green (minimum) to red (maximum); for Russia, the HHI is calculated by the amount of commercial loans issued by banks.