



UDK: 336.71/77(497.5)
DOI: 10.2478/jcbtp-2022-0006

Journal of Central Banking Theory and Practice, 2022, 1, pp. 131-150
Received: 31 August 2020; accepted: 09 March 2021

Mihovil Anđelinović*, **Mihaela Milec****,
Ksenija Dumičić***

* Department of Finance,
Faculty of Economics and
Business, University of Zagreb,
Croatia

E-mail:
mandelinovic@net.efzg.hr

** Deiloitte, Ltd.
Zagreb, Croatia

E-mail:
mihaela.milec@hotmail.com

*** Department of Statistics,
Faculty of Economics and
Business, University of Zagreb,
Croatia

E-mail:
kdumicic@net.efzg.hr

Analysis of the Assets, Credits and Deposits Concentration within the Croatian Banking System based on Selected Concentration Indices

Abstract: This paper analyses the concentration of the banking system in Croatia and the impact of concentration on stability of the economic system as a whole over the period since 2002 to 2017. The level of concentration is usually related to the competitiveness of a particular sector, in this case the banking system, which affects the development and health of the country's entire economic system. The banking system, as the basis for the development of all other sectors of the economy, has been analysed here in the context of the concentration trend and efficiency in the selected time period using selected concentration indices: Concentration Ratio, Herfindahl-Hirschman Index, the Gini coefficient and the entropy measure using the variables of total assets of banks, loans granted, and received deposits. This research concludes that in the considered period of nearly 20 years, Croatia was among the EU countries with increased concentration level of the banking system.

Key words: concentration, banking system, concentration indices, banks' assets, credits, deposits, Herfindahl-Hirschman index, Gini coefficient

JEL classifications: C43, D40, G21, L13

Introduction

The concentration indices represent an essential element of a competitiveness analysis of a particular sector and the level of competitiveness determines the market structure as well as the market power of a certain sector. The widespread trend of the consolidation of banks and an increased concentration indicate a changed market structure of the economy. Arif and Awwaliyah (2019), while analysing the influence of market structure on the profitability of the Islamic banking industry in Indonesia, noticed that a progressively concentrated market may have an effect on performance. The market power of the largest banks increased as well. The importance of the banking sector grows in bank-centric financial systems prevailing in Croatia and in most other European countries while the stability and the efficiency of the financial system represent the prerequisite for stability of an economy as a whole.

The higher borrowing rate indicates that the general public trusts the banking system which, is one of the essential prerequisites for its normal functioning but also entails the fear of the overoptimism of banks, i.e. insufficient regulatory requirements and granting too many loans to those who do not meet the criteria, which leads to an increase in the share of non-performing loans.

The research hypothesis of the paper is that the banking industry concentration in Croatia tends to increase over the period since 2002 to 2017, which was examined based on several variables and several concentration measures.

Literature overview

The banking system is of great importance for all national economies. According to Jakovčević (2001), the level of development of the banking system should in theory directly correlate with the level of the development of the economy since banks provide financial services to the real sector so their interdependence is direct. A healthy banking system is a prerequisite for a stable financial system. The financial stability can be defined as „the state of an undisturbed and efficient functioning of all the segments of a financial system (financial institutions, financial markets and financial infrastructure) in the process of resource allocation, risk assessment and management, payment execution as well as the resistance of the system to unexpected shocks”, underlines Dumičić (2015).

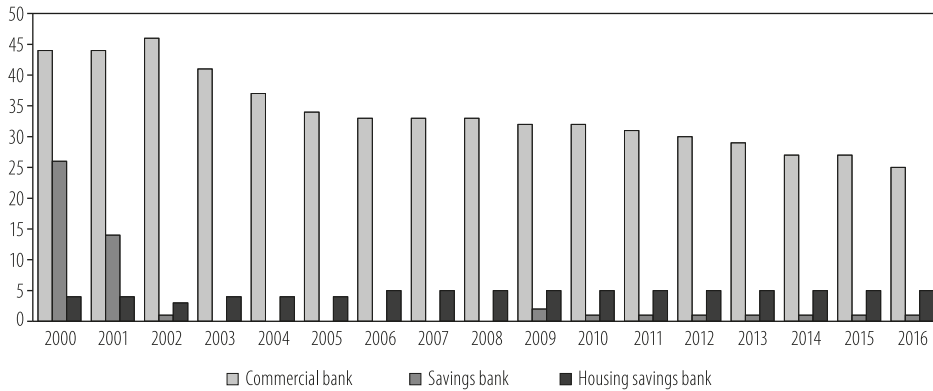
According to Ivanov (2017), the banking system in Croatia is composed of credit institutions having their head offices in the Republic of Croatia which, based on the Credit Institutions Act, may be established as a bank, savings bank or housing savings bank. According to Stipković and Bogdan (2017), the most important part of the financial system in Croatia, as well as the most prominent credit institutions based on their number, market share and the size of their assets have continuously been the commercial banks. Banks in Croatia are of a universal character, mostly founded as joint-stock companies. They are mostly privately owned by foreign entities. Prga and Šverko (2006) indicate that based on the ownership structure of the Croatian banking system and the level of its integration into the European banking system, there is a strong interaction of the changes on the European and the Croatian financial and banking market.

Over the last several years, the number of credit institutions in Croatia has decreased due to insolvency procedures, mergers and acquisitions of banks, i.e. the consolidation or mergers with foreign mother banks. In addition, there is also a higher level of concentration in the banking system, as underlined by Ivanov (2017).

There are numerous papers dealing with the issue of measuring concentration in the banking sector. Tipurić, Kolaković and Dumičić (2002) gave an overview of the banking industry concentration changes for banks in Croatia from 1993 to 2000, and up to 2002, as given in Tipurić, Kolaković and Dumičić (2003). Furthermore, Dumičić, Čeh Časni, and Čibarić (2008) conducted a comparative analysis of the bank concentration in selected South East European countries, while Dumičić, Pavković and Palić (2011), compared the bank concentration in selected European countries. Dumičić, Pavković, and Akalović Antić (2012) measured banking concentration in Croatia using a variety of concentration indices. Palić, Dumičić and Čurković (2016) analysed the banking sector assets concentration in Croatia from 2003 to 2014.

Data and methods

Official sources of data and information related to the banking system were used in this paper (Croatian National Bank, 1998, Croatian National Bank, 2003, Croatian National Bank, Annual Report (different issues), Croatian National Bank, the Bulletin (different issues), and the European Central Bank, 2018).

Graph 1: Trends in the number of credit institutions in Croatia in the period 2000-2017

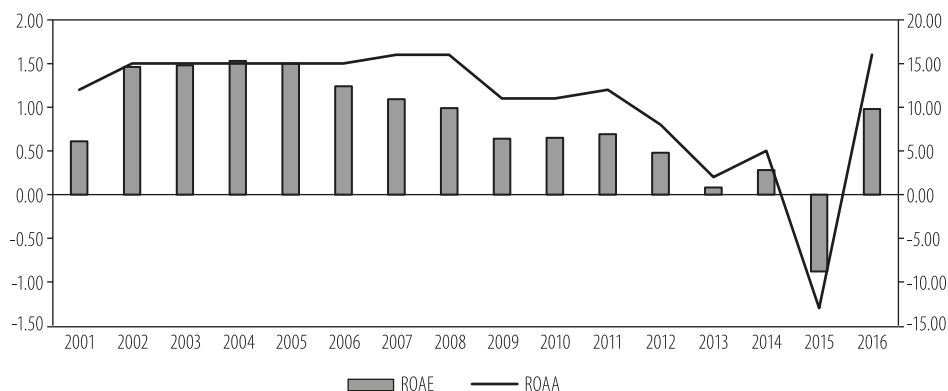
Source: Authors' creation, Croatian National Bank, the Bulletin (different issues)

Graph 1 shows a decrease in the number of all credit institutions in Croatia in the period from 2000 to 2017, especially as far as the savings banks, which almost completely disappeared after 2001, are concerned. That was a period of consolidation, i.e. harmonisation of the business activity of savings banks with the provisions of Article 119 of the 1998 Banking Act effective at the time. Accordingly, liquidation procedure was initiated in three savings banks, three savings banks were merged with commercial banks, and one savings bank merged with another housing savings bank. The remaining 7 out of 14 savings banks then registered their activity as commercial banks, which explains the increase in the number of banks in 2002 (Croatian National Bank, the Bulletin, 2003).

Graph 2 presents data on profitability of the banks in Croatia by means of profitability indicators ROAA (Return on Average Assets) and ROAE (Return on Average Equity).

Stojanović and Krišto (2016) analyse the efficiency of the financial structure and the development of the capital market union. According to Stojanović (2017), the ROAA is the most widely used accounting indicator of the banks' business performance based on the ratio of the net profit after taxation to average assets. It shows net profit as a percentage of the total average assets, i.e. how many lipas of net profit per each kuna of the total assets is realised by the bank management. The ROAA profitability indicator allows the comparison of banks' performance (Dumičić and Ljubaj, 2017).

Graph 2: ROAA and ROAE in the Croatian banking system in the period from 2001 to 2017



Source: Authors' creation, Croatian National Bank, the Bulletin (different issues)

The ROAE, on the other hand, is the ratio of net profit after taxation to average share capital and it is a basic measure of assessment of the bank management in favour of shareholders (Bayar, 2019). Higher values of the ROAA and the ROAE are a result of a riskier business activity and/or a higher quality of source and placement prices determination and/or relatively lower business costs, underlines Stojanović (2017). Graph 2 shows a negative value of both analysed profitability indicators related to the business activity of the banks in 2015 due to value adjustment and provision costs, mostly related to loan conversion costs

Furthermore, a sharper drop of the ROAE than the ROAA is observed in the period from 2006 to 2015. The ROAE directly depends on the level of the financial leverage so the banks with a higher degree of the financial leverage record a higher profit in good times and a higher loss in bad times. According to Ivanov (2017), the ROAA is deemed more important than the ROAE since it excludes the financial leverage impact.

Concentration of the Croatian banking system

Concentration is related to the control of an economic resource and exists when a small portion of the total number of units that control a resource controls the major part of that resource, as stated by Jakovčević, Dumičić and Anđelinović (2017). According to Tipurić, Kolaković and Dumičić (2002), economists usually measure the concentration in order to determine the market power in different industries. If the measuring of bank assets show that several banks possess the

same value of assets, then there is no concentration of total assets of banks. On the other hand, if one bank operated in a market and possessed 100% of the market share, the concentration measures would attain the values which would indicate a maximum concentration, as pointed out by Bahovec and Erjavec (2015).

Increased concentration in the banking sector is a consequence of consolidation of the banks. Consolidation enabled the banks to accomplish a rapid growth of their total assets, deposits, market share, as well as an entry to new financial markets and acquisition of new knowledge, competence and experience. However, numerous studies showed the absence of correlation between an increase in the effectiveness of banks and the size of banks, their specialisation or diversification of their total business activity but that is primarily explained by changes in the economy, i.e. changes in the monetary and fiscal policy and key economic indicators, as explained by Leko and Božina (2005). Besides the Croatian banking system analysis, there is an interesting analysis of the impact of bank concentration on the likelihood of a country suffering systemic bank fragility made on the Albanian banking system case study (Shijaku, 2017).

Concentration indices

According to Petrović and Ružić (2001), market concentration indices are measures used in industrial organisation economics with the aim of determining the level of market concentration. These measures show a market structure or indicate a market strength, i.e. the level of market competition among the participants in a certain industry. The selected concentration indices Šošić (2006), analysed in this paper are as follows: Concentration Ratio, Herfindahl-Hirschman Index, the Gini coefficient and the entropy measure.

The Concentration Ratio is a concentration measure which indicates the level of concentration held by n largest business entities in the industry for which concentration is calculated and can be randomly selected. In calculating the Concentration Ratio, all members of the set should be ordered by size from the largest to the smallest one. The sum of values r of the largest entities in the industry is divided by the sum of values of all entities, i.e. banks, in the industry, according to Bahovec and Erjavec (2015).

The formula for calculating the Concentration Ratio of the level r is shown as (1):

$$C_r = \frac{x_1 + x_2 + \dots + x_n}{T}, x_1 \geq x_2 \geq x_3 \geq \dots \geq x_N, \quad T = \sum_{i=1}^N x_i, \quad (1)$$

whereby C is a Concentration Ratio, r is a randomly selected number of the largest banks and T the total, in this case the value of the total variable under consideration for r banks.

Table 1 shows an increase of the share of assets of the four largest banks in the variable total assets of the banks from the beginning of the analysed period, from 58% in 2002 to 71% in 2017, with a simultaneous continuous decrease in the number of commercial banks from 43 to only 24. Likewise, the share of the largest bank in loans granted increased from 57% to 70%, while the share of deposits increased from 60% to 68% over the same analysed period.

Table 1: Concentration Ratio C_4 for the variables total assets, loans granted and received deposits in the Croatian banking system in the period from 2002 to 2017

Year	Number of banks	Concentration Ratio of total assets, loans and deposits		
		C_4 assets	C_4 loans	C_4 deposits
2002	46	58.59%	57.31%	60.08%
2003	41	61.61%	60.53%	61.27%
2004	37	64.90%	63.57%	65.05%
2005	34	64.69%	65.64%	65.21%
2006	33	64.12%	65.03%	64.38%
2007	33	63.90%	64.37%	64.43%
2008	33	64.82%	66.12%	64.41%
2009	32	65.15%	65.65%	66.89%
2010	32	64.96%	65.86%	66.18%
2011	31	67.59%	68.06%	67.95%
2012	30	66.88%	68.15%	67.56%
2013	29	66.82%	63.00%	67.03%
2014	27	66.59%	67.67%	65.62%
2015	27	67.50%	67.69%	66.82%
2016	25	68.20%	68.84%	67.10%
2017	24	71.63%	70.08%	68.08%

Source: Authors' creation, Croatian National Bank, the Bulletin (different issues).

The Herfindahl-Hirschman Index (HHI) is an absolute, most common and well-known concentration measure, often used in the USA as the criterion in deciding on whether mergers of banks are to be allowed or they would distort the competition, as underlined by Dumičić, Pavković and Akalović Antić (2012). The HHI is calculated as a sum of squares of market shares of all entities in the selected industry, which in this case is the banking sector. As opposed to the Concentration Ratio, the calculation using the HHI includes all entities of the analysed industry, with a greater emphasis being placed on larger entities, as indicated by Bahovec, Dumičić and Žalac (2011).

The HH Index, i.e. the sum of squares of market shares is shown as the formula 2:

$$H = \sum_{i=1}^N S_i^2, \quad (2)$$

whereby n is the number of banks in the industry, S_i the market share of the bank i . The HH Index is interpreted in relation to the value it attains.

Non-concentrated industries in which a larger number of entities with a lower market share prevail are marked by the HHI concentration index attaining the value lower than 1000, while highly concentrated industries have the HH Index higher than 1,800 and are characterised by having several entities which hold an important market share, as Tipurić, Kolaković and Dumičić (2002) point out.

Table 2: Herfindahl-Hirschman concentration index of total assets, loans and deposits in the Croatian banking system in the period from 2002 to 2017 and the first differences of the HH indices

Year	HH Index			First differences		
	Assets	Loans	Deposits	Assets	Loans	Deposits
2002	1,237.43	1,158.14	1,329.60	/	/	/
2003	1,270.95	1,263.63	1,304.61	33.52	105.49	-24.99
2004	1,363.14	1,328.12	1,388.50	92.19	64.49	83.89
2005	1,326.52	1,363.97	1,375.34	-36.63	35.85	-13.16
2006	1,296.69	1,333.99	1,309.22	-29.82	-29.98	-66.12
2007	1,277.73	1,295.97	1,276.36	-18.96	-38.01	-32.86
2008	1,308.86	1,343.18	1,259.61	31.12	47.20	-16.75
2009	1,366.40	1,409.01	1,448.31	57.54	65.83	188.70
2010	1,355.13	1,412.73	1,407.94	-11.27	3.72	-40.37
2011	1,419.18	1,438.97	1,440.64	64.05	26.24	32.70
2012	1,427.21	1,483.98	1,443.10	8.03	45.01	2.46
2013	1,440.48	1,492.68	1,424.77	13.27	8.70	-18.33
2014	1,423.86	1,471.97	1,385.36	-16.61	-20.71	-39.41
2015	1,462.77	1,526.52	1,425.19	38.91	54.55	39.83
2016	1,482.32	1,567.26	1,428.61	19.56	40.73	3.41
2017	1,595.39	1,581.48	1,475.61	113.07	14.02	47

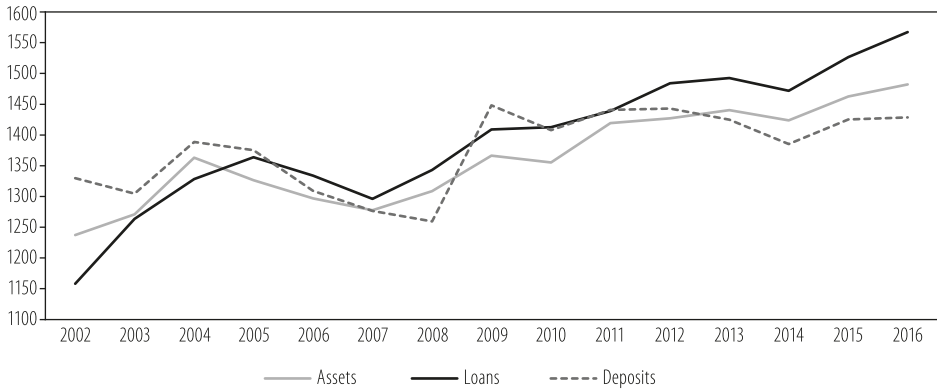
Source: Authors' creation, Croatian National Bank, the Bulletin (different issues)

Table 2 shows the increase of the Herfindahl-Hirschman concentration index in all the three analysed variables in 2017 in comparison to the initial analysed year of 2002, which confirms the described trends of the Concentration Ratio. The previously defined interval of the HH Index indicates that the value of the HH Index for the industries with a low level of concentration is lower than 1,000. For the Croatian banking system this value was not recorded in the analysed period.

Likewise, the value of the HH Index of 1,800 represents the upper limit for highly concentrated industries but neither that value was recorded in Croatia.

In 2002, the deposit concentration was higher than the asset concentration which was in turn higher than the loan concentration. In the last analysed year, the situation was reversed so the loan concentration was the highest, followed by the asset concentration and ultimately by deposit concentration, which corresponds to Concentration Ratio indices. These trends are shown in Graph 3 and they represent a more significant growth of credit activity of the largest banks than the growth of assets and deposits of these banks.

Graph 3: Trends in the HHI concentration index of total assets, loans and deposits in the Croatian banking system in the period from 2002 to 2017



Source: Authors' creation, Croatian National Bank, the Bulletin (different issues).

The Gini concentration coefficient pertains to a group of relative concentration measures or measures of inequality of a statistical series. It is derived from the Lorenz curve and represents a ratio of the area between the Lorenz curve and the line of perfect equality to the area below that line, according to Gogala (2001).

If the data are not clustered, the formula 3 is used to calculate the Gini coefficient:

$$G = \frac{2 \sum_{i=1}^N i * x_i - (N + 1) \sum_{i=1}^N x_i}{N \sum_{i=1}^N x_i}, \tag{3}$$

where N is the number of data, and xi are individual values of the variable. The Gini coefficient acquires the values between 0, when there is no concentration and the Lorenz curve coincides with the line of perfect equality, and 1 in case

of the maximum concentration and total monopoly, as explained by Dumičić, Pavković and Akalović Antić (2012).

When the value of the Gini concentration index is close to zero, the values of the series are evenly distributed and a developed competition is present. On the other hand, when the Gini coefficient attains the value 1, we have a monopoly. Values of the Gini coefficient for the variables total assets, loans and deposits in the period from 2002 to 2017 are presented in Table 3. The first differences which represent an increase of concentration in comparison to the previous year are marked in bold.

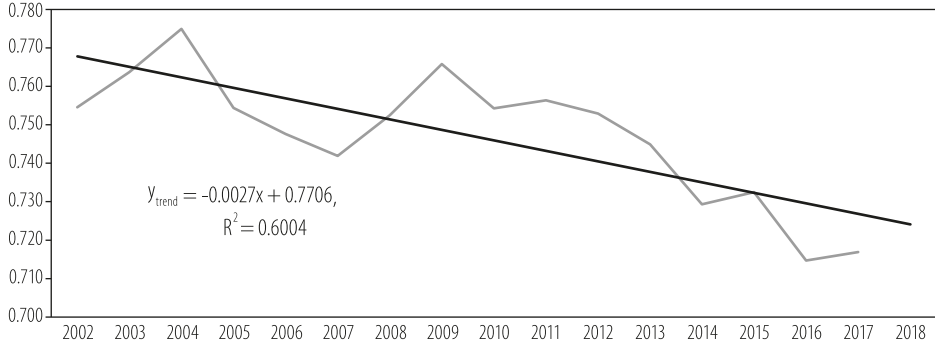
Table 3: Trends in the Gini concentration index (G) of total assets, loans and deposits in the Croatian banking system in the period from 2002 to 2017 and the first differences of the Gini coefficient

Year	Assets	Loans	Deposits	First differences		
				Assets	Loans	Deposits
2002	0.755	0.746	0.762	/	/	/
2003	0.764	0.758	0.763	0.009	0.012	0.001
2004	0.775	0.769	0.773	0.011	0.011	0.010
2005	0.754	0.760	0.753	-0.021	-0.009	-0.020
2006	0.748	0.753	0.742	-0.007	-0.007	-0.011
2007	0.742	0.744	0.738	-0.006	-0.009	-0.004
2008	0.752	0.755	0.742	0.011	0.011	0.003
2009	0.766	0.772	0.768	0.013	0.017	0.026
2010	0.754	0.764	0.754	-0.012	-0.008	-0.014
2011	0.756	0.765	0.756	0.002	0.001	0.002
2012	0.753	0.767	0.753	-0.003	0.001	-0.004
2013	0.745	0.737	0.739	-0.008	-0.030	-0.013
2014	0.729	0.736	0.723	-0.016	-0.002	-0.016
2015	0.732	0.739	0.725	0.003	0.003	0.002
2016	0.715	0.725	0.706	-0.018	-0.014	-0.018
2017	0.717	0.696	0.676	0.002	-0.003	0.003

Source: Authors' creation, Croatian National Bank, the Bulletin (different issues)

Graph 4 visually represents the data from Table 3, i.e. trend of the Gini coefficient related to the concentration of assets. The Ordinary Least Squares (OLS) estimated linear trend equation in this graph indicates that the value of the coefficient b for the selected period is -0.027 , with the coefficient of determination of 0.6004 , which means that the concentration for the variable total assets linearly decreased on average by 0.0027 per year in the period from 2002 to 2017. According to the trend, the estimate of the annual linear average concentration level for the variable total assets amounts to 0.7706 of the value of the Gini coefficient.

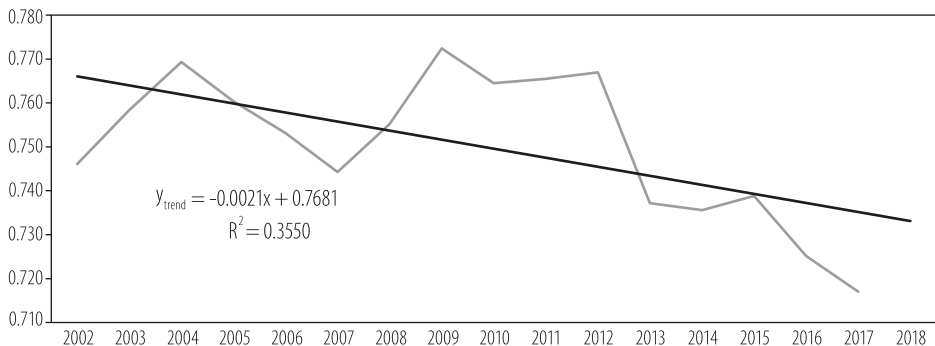
Graph 4: Gini coefficient (G) of the total asset concentration in the Croatian banking system in the period from 2002 to 2017 and the linear trendline forecast for 2018



Source: Authors' creation, Croatian National Bank, the Bulletin (different issues)

Graph 5 visually represents the value of the Gini coefficient from Table 3 for the variable loans granted. In the OLS estimated linear trend equation, with the coefficient of determination of 0.3550, the value of the trend coefficient b for the selected period is -0.0021 , which means that the concentration for the variable loans linearly decreased on average by 0.0021 yearly in the period from 2002 to 2017. According to the trend, the estimate of the total average concentration level for the variable loans amounts to 0.7681 .

Graph 5: Gini concentration coefficient (G) of loans in the Croatian banking system in the period from 2002 to 2017 and the linear trendline forecast for 2018

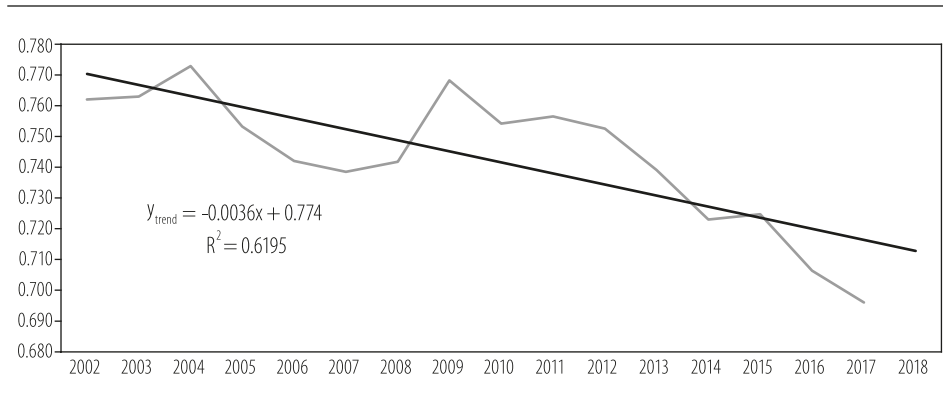


Source: Authors' creation, Croatian National Bank, the Bulletin (different issues)

Graph 6 presenting the Gini concentration coefficient for received deposits in the period from 2002 to 2017 and the OLS estimated linear trend for the period

from 2002 to 2018 shows a steeper downfall in relation to the variables loans and assets.

Graph 6: Gini concentration coefficient (G) of the deposits in the Croatian banking system in the period from 2002 to 2017 and the linear trendline forecast for 2018



Source: Authors' creation, Croatian National Bank, the Bulletin (different issues)

The forecasted linear trend estimates that the concentration of the variable deposits decreased linearly on average 0.00336 per year in the period from 2002 to 2017, with the coefficient of determination of 0.6195. According to the trend, the estimate for the variable loans on average amounts to 0.774.

The entropy measure represents the measure for the amount of unusable energy in a closed thermodynamic system, but that measure was adopted from information theories and it is used as a diversification measure in economics. It is calculated based on the formula:

$$H = \sum_{i=1}^n p_i \log_2 p_i, \quad (4)$$

where n is the number of banks in the banking system, and p_i market shares of the bank i . According to Bahovec and Erjavec (2015), the entropy measure is inverse to the concentration index and the entropy values vary from 0 when a total monopoly is present at the market and $\log_2 n$ when the concentration value is the lowest and market shares of all the banks are equal.

The entropy measure is interpreted inversely from the Gini concentration coefficient. The closer the value of the indicator is to zero, the more prominent is the level of monopoly, while on the other hand it can reach the value of $\log_2 n$ when

there are several entities with similar market share. Table 4 presents the trend in the entropy measure in the period from 2002 to 2007 for all selected variables and the calculated first differences. Negative values of the first differences, i.e. the increase in concentration based on the entropy measure in comparison to the previous year is shown in the table in bold characters.

Table 4: Trend in the entropy measure of total assets, loans and deposits in the Croatian banking sector in the period from 2002 to 2017 and the first differences of the entropy measure

Year	Entropy measures			First differences		
	Assets	Loans	Deposits	Assets	Loans	Deposits
2002	3.824	3.840	3.750	/	/	/
2003	3.631	3.640	3.625	-0.193	-0.200	-0.125
2004	3.433	3.458	3.437	-0.198	-0.182	-0.188
2005	3.455	3.386	3.430	0.021	-0.072	-0.006
2006	3.453	3.399	3.476	-0.002	0.013	0.046
2007	3.485	3.468	3.508	0.032	0.069	0.032
2008	3.467	3.440	3.532	-0.018	-0.028	0.024
2009	3.372	3.323	3.353	-0.094	-0.117	-0.179
2010	3.396	3.327	3.396	0.024	0.004	0.043
2011	3.349	3.289	3.348	-0.047	-0.038	-0.048
2012	3.330	3.247	3.333	-0.019	-0.042	-0.015
2013	3.332	3.187	3.359	0.001	-0.060	0.027
2014	3.322	3.281	3.356	-0.010	0.094	-0.004
2015	3.299	3.255	3.343	-0.022	-0.026	-0.013
2016	3.283	3.223	3.326	-0.017	-0.032	-0.017
2017	3.155	3.161	3.262	-0.128	-0.062	-0.064

Source: Authors' creation, Croatian National Bank, the Bulletin (different issues)

In the analysed period, there is mostly a decrease in the entropy measure largely for the loans variable, somewhat less for the assets and in comparison, to the loans and assets variables the deposits variable has the lowest level of concentration. The increased loans concentration in comparison to the concentration of deposits and assets can be viewed from the aspect of syndicated loans. Since only the largest banks are in the position to gather sufficient funds to finance large projects, smaller banks are limited to financing smaller amounts, mostly to natural persons and micro and small-sized enterprises.

All calculated concentration indices are summarised in the Table 5 for the variables total assets, loans and deposits of the banks in the first and the last analysed period, i.e. in 2002 and in 2017.

Table 5: Overview of the selected concentration indices for the variables total assets, loans and deposits of the banks in the first analysed year (2002) and the last analysed year (2017)

Index	Symbol and intervals	Index characteristic	Variable for the value	Value in 2002	Value in 2017	Direction the concentration movement
Concentration Ratio	$\frac{1}{n} \leq C_r \leq$	Value 0 – equality of concentration, value 1 – total monopoly	Assets	$C_1=58.59\%$	$C_1=71.63\%$	↑
			Loans	$C_1=57.31\%$	$C_1=70.08\%$	
			Deposits	$C_1=60.08\%$	$C_1=68.08\%$	
Herfindahl-Hirschman index	$\frac{1}{n} \leq HHI \leq 1$	The higher the value, the higher the concentration	Assets	1,237.43	1,595.39	↑
			Loans	1,158.14	1,581.48	
			Deposits	1,329.60	1,475.61	
Gini coefficient	$0 \leq G \leq 1$	Value 0 – equality of concentration, value 1 – total monopoly	Assets	0.755	0.717	↓
			Loans	0.746	0.696	
			Deposits	0.762	0.676	
Entropy measures	$0 \leq H \leq \log_2 n$	The higher the value, the lower the concentration	Assets	3.831	3.155	↑
			Loans	3.840	3.161	
			Deposits	3.750	3.262	

Source: Authors' creation, Croatian National Bank, the Bulletin (different issues)

Comparison of concentration of the banking systems of the European Union countries

The banking sectors in the European Union (EU) vary in size, efficiency, and level of internationalisation and capitalisation. There are significant differences among the financial markets within the EU, and the most prominent financial centre is London¹ where the majority of international banks, about 600 of them, are located, according to Lovrinović (2015). An insight into the characteristics of the EU banking system will be obtained by studying several features of the countries, i.e. several indicators of the financial system of individual countries. There are great differences among 28 member states in terms of their area, population, the level of development in general, and the level of development of the financial system in particular.

Table 6 provides an overview of the Concentration Ratio of 5 largest banks in each of the EU countries and the trend of the ratio in the period from 2013 to

¹ Analysis was done before Brexit was effective. Therefore, term EU in this paper considers 27 EU countries and the UK.

2017. Based on the Concentration Ratio C_5 , the lowest level of concentration of the banking system among the EU countries is found in Germany, where 5 largest banks hold only 30% of the total assets of all banks and that portion is almost constant. The highest concentration of assets is in Greece, where 5 largest banks hold 94% in 2013 (97 in 2017) of total assets of all banks, followed by Estonia, Lithuania, the Netherlands, while Croatia takes the sixth place with 72.9% (tenth place in 2017).

Table 6: Trends in the Concentration Ratio C_5 for EU and the absolute change in the Concentration Ratio C_5 in the period from 2013 to 2017

Country	Trends in Concentration Ratio C_5					Absolute change in 2017 compared to 2013
	2013	2014	2015	2016	2017	
Belgium	64.0	65.8	65.5	66.2	68.8	4.8
Bulgaria	49.9	55.0	57.6	58.0	56.5	6.6
Czechia	62.8	61.3	63.3	64.7	64.1	1.3
Denmark	68.4	68.1	67.8	68.3	65.7	-2.7
Germany	30.6	32.1	30.6	31.4	29.7	-0.9
Estonia	89.7	89.9	88.6	88.0	90.3	0.6
Ireland	47.8	47.6	45.9	44.3	45.5	-2.3
Greece	94.0	94.1	95.2	97.3	97.0	3.0
Croatia	72.9	72.3	72.7	73.0	72.8	-0.1
Spain	54.4	58.3	60.2	61.8	63.7	9.3
France	46.7	47.6	47.2	46.0	45.4	-1.3
Italy	39.6	41.0	41.0	43.0	43.4	3.8
Cyprus	64.1	63.4	67.5	65.8	84.1	20.0
Latvia	64.1	63.6	64.5	66.5	73.5	9.4
Lithuania	87.1	85.7	86.8	87.1	90.1	3.0
Luxembourg	33.7	32.0	31.3	27.6	26.2	-7.5
Hungary	51.9	52.5	53.3	53.4	52.9	1.0
Malta	76.5	81.5	81.3	80.3	80.9	4.4
Netherlands	83.8	85.0	84.6	84.7	83.8	0.0
Austria	36.7	36.8	35.8	34.5	36.4	-0.3
Poland	45.2	48.3	48.6	47.7	47.5	2.3
Portugal	70.3	69.2	72.3	71.2	73.1	2.8
Romania	54.4	54.2	57.4	59.1	59.4	5.0
Slovenia	57.1	55.6	59.2	61.0	61.5	4.4
Slovakia	70.3	70.7	72.3	72.7	74.5	4.2
Finland	57.0	59.6	58.9	9.1	48.4	-8.6
Sweden	58.3	58.5	57.8	56.3	58.2	-0.1
UK	43.7	38.9	37.0	35.5	36.9	-6.8

Source: Authors' creation, European Central Bank (2018)

Table 7 shows the value and trends of the Herfindahl-Hirschman Index in the period from 2013 to 2017 and the change in 2017 compared to 2013. As indicated, the lowest level of concentration was perceived in Germany, while Luxemburg also has a banking system with a low concentration. The country with the highest level of concentration in the European Union is Estonia, followed by Greece, then the Netherlands, Latvia, Cyprus, and Croatia as the sixth. The trend in the HH Index in the banking sector for Croatia amounted to 1,384 in 2013, increasing by no more than 3 units in 2017.

Table 7: Trends in the Herfindahl–Hirschman concentration index for the EU27 and the UK and the absolute change in the Herfindahl–Hirschman index in the period from 2013 to 2017

	Trends in HHI indices					Absolute change in 2017 compared to 2013
	2013	2014	2015	2016	2017	
Belgium	979	981	998	1,017	1,102	123
Bulgaria	730	836	919	939	906	176
Czechia	999	949	987	1,009	1,028	29
Denmark	1,160	1,190	1,180	1,224	1,123	-37
Germany	266	330	273	277	250	-16
Estonia	2,483	2,445	2,409	2,406	2,419	-64
Ireland	674	677	678	644	667	-7
Greece	2,136	2,195	2,254	2,332	2,307	171
Croatia	1,384	1,364	1,396	1,405	1,387	3
Spain	719	839	896	937	965	246
France	568	584	589	572	574	6
Italy	406	424	435	452	519	113
Cyprus	1,645	1,445	1,443	1,366	1,964	319
Latvia	1,037	1,001	1,033	1,080	1,235	198
Lithuania	1,892	1,818	1,939	1,938	2,189	297
Luxembourg	357	330	321	260	256	-101
Hungary	862	905	878	880	890	28
Malta	1,458	1,648	1,620	1,602	1,599	141
Netherlands	2,105	2,131	2,104	2,097	2,087	-18
Austria	405	412	397	358	375	-30
Poland	586	656	670	659	645	59
Portugal	1,197	1,164	1,215	1,181	1,220	23
Romania	821	797	860	894	910	89
Slovenia	1,045	1,026	1,077	1,147	1,133	88
Slovakia	1,215	1,221	1,250	1,264	1,332	117
Finland	960	1,000	970	640	630	-330
Sweden	876	880	866	845	914	38
UK	525	462	438	422	453	-72

Source: Authors' creation, European Central Bank (2018)

Conclusion

The notion of concentration always entails a negative connotation and a highly concentrated banking system is perceived as a cause of an inefficient functioning not only of a banking system but the economy as a whole where, due to that concentration, market competition is limited and availability of choice related to good services offered to the end user is reduced. Although the concentration in the banking system has been examined in various studies, the thesis that concentration has a negative effect on the stability of the financial system has not been proved. On the contrary, more concentrated banking systems have revealed to be more efficient, specialized and stable and it is those systems which can operate with reduced variable costs and finance large entrepreneurial projects since they hold a higher level of capital. As much as large specialised institutions offer benefits to the economy, have larger financial and expansion potential and are less likely to find themselves in financially unfavourable situations, the problem arises when they face a financial crisis.

To test the research hypothesis of this paper that the banking industry concentration in Croatia tended to increase steadily over the period since 2002 to 2017, several variables and several concentration measures were studied over time. The concentration of the Croatian banking system is measured based on the variables of total assets, loans granted and received deposits and it is measured using selected concentration indices. An increased concentration was noted when it was measured using the Concentration Ratio, the Herfindahl-Hirschman Index, and entropy measures, while for all the three analysed variables Gini coefficient acquires the values which indicate a slight decrease in concentration.

As far as the concentration of the Croatian banking system in comparison to other EU countries is concerned, Croatia holds the sixth position based on the Concentration Ratio of the banks' total assets C5 and the seventh position based on Herfindahl-Hirschman Index. To conclude, in the period 2002 to 2017, Croatia is found to have been among the EU countries with the increased concentration level of the banking system.

The limitation of this research may be overcome if more banking variables and statistical concentration measures were to be included and analysed over a longer term up to the recent period, so the authors plan to include them all to be able to make conclusions about recent dynamics of the banking concentration and competitiveness in the Croatian banking system.

References

1. Bahovec, V., Dumičić, K., Žalac, A. (2011). Trendovi u koncentraciji imovine mirovinskih fondova u Republici Hrvatskoj. *Zbornik Ekonomskog fakulteta u Zagrebu*, Sveučilište u Zagrebu, Ekonomski fakultet Zagreb, Vol. 9, No. 2, pp. 53-76.
2. Bahovec, V., Erjavec, N. (ur.) (2015) Statistika, Element, Zagreb
3. Bayar, Yilmaz (2019) : Macroeconomic, Institutional and Bank-Specific Determinants of Non-Performing Loans in Emerging Market Economies: A Dynamic Panel Regression Analysis, *Journal of Central Banking Theory and Practice*, ISSN 2336-9205, De Gruyter Open, Warsaw, Vol. 8, Iss. 3, pp. 95-110, <http://dx.doi.org/10.2478/jcbtp-2019-0026>
4. Croatian National Bank (1998). *Banking System in 1998*. Online available at: <https://www.hnb.hr/documents/20182/121873/s-002.pdf/8825c008-c6ed-45bd-9cd0-725bbc5f2e6b> (Accessed: 7th April 2018).
5. Croatian National Bank (2003). *Banks Bulletin*, No. 6, 2003, p. 46, Online available at: <http://old.hnb.hr/publikac/bilten-o-bankama/hbilten-o-bankama-6.pdf> (Accessed: 20th November 2018).
6. Croatian National Bank. Annual Report. (different issues), Online available at: <https://www.hnb.hr/analyses-and-publications/regular-publications/annual-report> (Accessed: 7th January 2019).
7. Croatian National Bank. *Banks Bulletin*, No. 31 (2018). Online available at: <https://www.hnb.hr/en/analyses-and-publications/regular-publications/banks-bulletin> (Accessed: 7th January 2019).
8. Dumičić, M. (2015) Kratak uvod u svijet makroprudencijalne politike, *HNB pregledi*, P-26, pp. 1-26.
9. Dumičić, M. and Ljubaj, I. (2017), Delayed Credit Recovery in Croatia: Supply or Demand Driven? *Journal of Central Banking Theory and Practice*, vol.7, no.1, 2018, pp.121-144. <https://doi.org/10.2478/jcbtp-2018-0006>
10. Dumičić, K., Čeh Časni, A., Čibarić, I. (2008). Comparative analysis of bank concentration in selected South East European Countries. Challenges of Economic Sciences in the 21st Century, Institute of Economic Sciences, Belgrade 2008. Proceedings of the International Scientific Conference on the Occasion of the 50th Anniversary of the IES, Editors: Guichard, J-P., Cantino, V.; Dutto, G., Radović-Marković, M., Redžepagić, S., Hanić, H., Beograd, 4 -5 December 2008, pp. 566-576.
11. Dumičić, K., Pavković, A., Akalović Antić, J. (2012). Mjerenje koncentracije u bankarstvu u Republici Hrvatskoj, *Zbornik Ekonomskog fakulteta u Zagrebu*, Sveučilište u Zagrebu, Ekonomski fakultet Zagreb, Vol. 10, No.2, pp. 117-136.

12. Dumičić, K., Pavković, A., Palić, I. (2011). Bank concentration in Europe – comparative analysis approach. *Proceedings of the International Conference on Economic Theory and Practice: Meeting the New Challenges*. Mostar, 11-12 November 2011, Ekonomski fakultet Mostar, pp. 245-257.
13. European Central Bank (2018). Statistical Data Warehouse, Online available at: <https://sdw.ecb.europa.eu/> (Accessed: 9th August 2018).
14. Gogala, Z. (2001). *Osnove statistike*, Sinergija, Zagreb.
15. Ivanov, M. (2017). *Analiza monetarnog sustava i ekonomske strukture, Pomoćni materijali za izučavanje*, Ekonomski fakultet Zagreb.
16. Jakovčević, D. (2001). Bankovni potencijal, poslovna spajanja banaka i razvitak hrvatskog gospodarstva, *Ekonomski pregled*, 52 (11-13), str. 1283-1302.
17. Jakovčević, D., Dumičić, K., Anđelinović, M. (2017). Measuring Recent Changes of Insurance Gross Premiums Distribution Using Ten Inequality Measures: Case Study of Croatia. *Economic Research / Ekonomska istraživanja*. Routledge, Taylor & Francis Group. Vol. 30 (2017), Issue 1- Part I; pp. 661-675. Online available at: <http://www.tandfonline.com/doi/full/10.1080/1331677X.2017.1305776?scrESCIoll=top&needAccess=true>. (Accessed: 17th January 2019).
18. Leko, V., Božina, L. (2005) *Novac, bankarstvo i financijska tržišta*, Adverta, Zagreb
19. Lovrinović, I. (2015). *Globalne financije*, Accent, Zagreb.
20. Palić, I., Dumičić, K., Čurković, M. (2016). The analysis of banking sector assets concentration measures in Croatia from 2003 to 2014. *Proceedings of the ISCCRO - International Statistical Conference in Croatia - Zagreb, Croatia, 05-06 May 2016; Conference Topic: „New Challenges of Official and Applied Statistics in European Union“ (ISCCRO'16)* (Eds.: K. Dumičić; N. Erjavec; M. Pejić Bach), Vol. 1, No. 1, pp. 152-158.
21. Petrović, S., Ružić, T. (2001) *Koncentracija banaka*, *Hrvatska pravna revizija*, No. 09/01, Zagreb
22. Prga, I., Šverko, I. (2006) *Izdvojeni aspekti razvoja bankovnog tržišta*, *Zbornik Ekonomskog fakulteta u zagrebu*, Vol. 4, No. 1, ppt. 263-270
23. Arif, M.N.R.A, Awwaliyah, T.R. (2019). Market Share, Concentration Ratio and Profitability: Evidence from Indonesian Islamic Banking Industry, *Journal of Central Banking Theory and Practice*, Vol. 8, No. 2, pp. 189-201.
24. Shijaku, G. Does Concentration Matter for Bank Stability? Evidence from the Albanian Banking Sector. *Journal of Central Banking Theory and Practice*, vol.6, no.3, 2017, pp.67-94. <https://doi.org/10.1515/jcbtp-2017-0021>
25. Stipković, P., Bogdan, Ž. (2017) *Pokazatelji hrvatskog bankovnog sustava i gospodarski rast*, *Zbornik Ekonomskog fakulteta Zagreb*, Vol. 15, No. 2, pp. 179-204

26. Stojanović, A. (2017). *Suvremene pojave u financijama*, Ekonomski fakultet Zagreb
27. Stojanović, A., Krišto, J. (2016). Učinkovitost financijske strukture i razvoj unije tržišta kapitala, *Aktualni problemi i izazovi razvoja financijskog sustava*, Zagreb, Ekonomski fakultet – Zagreb, pp. 3-22
28. Šošić, I. (2006). *Uvod u statistiku*. Školska knjiga, Zagreb.
29. Tipurić, D., Kolaković, M., Dumičić, K. (2002). Istraživanje promjena u koncentraciji hrvatske bankarske industrije 1993.-2000., *Ekonomski pregled*, Vol. 53, No. 5-6, pp. 470-494
30. Tipurić, D., Kolaković, M., Dumičić, K. (2003). Koncentracijske promjene hrvatske bankarske industrije u desetogodišnjem razdoblju (1993-2002). *Zbornik Ekonomskog fakulteta u Zagrebu*, Vol. 1, No. 1, pp. 1–20.