

ANALYSIS OF THE BANKING SYSTEM'S CONCENTRATION DEGREE IN EU COUNTRIES

Iulia Iuga¹

ABSTRACT: This paper focuses on four main fields of interest. The first part of the study is dedicated to an analysis of the specialized literature with a view to highlighting our research area. The second part concentrates on recent trends in the evolution of bank concentration indexes. The third part consists of an analysis of the key-indicators which influence the degree of bank concentration, while the last part of our paper establishes the relation between the Herfindahl index and the key-indicators (Total assets, Number of credit institutions, Population and Gross domestic product at market price) with the help of the correlation indexes. At the end of the study we present our conclusions. We find that the overall European banking market is not very concentrated.

Key words: concentration degree, index, correlation, influence.

JEL Codes: G21, L1, D40

Introduction

Economic integration in the European Union has aimed to favor competition in all industries including banking industries. A few studies in the specialized literature have come up with ways to measure bank concentration. The most popular were the Herfindahl-Hirschman Index (HHI) and the Gini coefficient (GC is a measure of inequality, rather than concentration).

Purpose: The purpose of this paper is twofold: on the one hand it seeks to investigate the degree of bank concentration in EU member states between 2005 and 2011 and on the other it analyzes the intensity of the relation between the key-indicators and the Herfindahl index.

Concentration Indexes: Different concentration indexes were suggested in the field of industrial organization economics. These measures are used to describe the structure of the market and/or as an indicator of market power or firm competition. Basically, concentration indexes try to measure the number and the relative inequality of firms. The most frequently used indexes are:

- *Concentration Ratio:* represents the percentage of total industry output which a given number of large firms account for. The *five-bank concentration ratio* (CR5) measures the relative weight of the first five banks on the overall banking system from the point of view of bank assets.
- *Herfindahl-Hirschman Index (HHI):* This measure is based on the total number and size distribution of banks in the banking system. It is computed as the sum of the squares of the relative size of all banks in the industry. Algebraically it is:

$$HHI = \sum_{i=1}^n (s_i)^2, \text{ where } \sum_{i=1}^n s_i = 1 \quad (1)$$

The HHI may be computed on a base of 1 or 1 000 or 10 000. HHI has certain theoretical mathematical and economic properties which make it a relevant measure of concentration.

There are other measures of concentration, e.g., the *Lorenz Curve*, *Gini Coefficient*, *Inverse Index* and *Entropy*. These measures, although having a different theoretical significance, are not as frequently used as the two indexes which we want to analyze in this paper: Concentration Ratio and

¹ "1 Decembrie 1918" University, Alba Iulia, Romania, e-mail: iuga_iulia@yahoo.com

the Herfindahl- Hirschman Index. Unlike the market share of the five largest banks in a country, the Herfindahl index will reflect changes in market structure, including amongst smaller banks.

Literature review

There are many studies on the structure of banking market in the banking system of developed economies. Yildirim (2007) examines the evolution of competitive conditions in the banking industries of 14 Central and Eastern European (CEE) transition economies for the period 1993-2000. Barbara Casu et. al. (2009) in his paper assessed the outcome of European Union (EU) deregulation and competition policies on the competitive conditions of the main EU banking markets. Nicola Cetorelli (2004) argues that the banking industry of European Union (EU) countries has been significantly deregulated in the early 1990s. Under the old regime, cross-border expansions were heavily constrained, while after deregulation, banks from EU countries have instead been allowed to branch freely into other EU countries.

There are a few studies which have analyzed bank concentration in the EU between 1990 and 2000. Other relevant studies were those performed by Fernandez de Guevara (2005) and Weill (2004) who concluded that while in the 1990s most mergers and acquisitions taking place in the EU banking industry were domestic and thus rather anticompetitive, this situation has changed in the 2000s with many major cross-border mergers and acquisitions which should enhance the degree of competition.

In his paper, Allen N. Berger (2004) advocates that the consolidation of banks around the world in the last few years intensified public policy debates with respect to the influence of concentration and competition on bank performance. In the light of these developments, the aforementioned paper analyzes the first piece of specialized writing on the impact of bank concentration and future competition.

Astrid A. Dick (2007) consolidates the idea that local banking markets describe huge differences in population size. In her paper she finds that the nature of competition on banking markets is astonishingly consistent. First of all, markets remain concentrated the same way, irrespective of their size. The findings suggest that banks use fixed-cost quality investments to capture the additional demand when market size grows, thereby raising barriers to entry.

H. Semih Yildirim's study (2007) concentrates on an analysis of the evolution of competitive conditions in the banking industries of 14 transition economies from Central and Eastern Europe for the period 1993-2000.

The empirical results of Mark Carlson (2006) suggest that the effects of the ramification towards competition were more important quantitatively for bank stability than the geographical diversification, in the 1920s and 1930s. Stijn Claessens' (2004) findings confirm that contestability determines effective competition especially by allowing (foreign) bank entry and reducing activity restrictions on banks.

Research methodology

Every scientific approach ought to be implemented through adequate scientific research. Methodology is a complex word made up of two parts *methodos* and *logos* which mean "method" and "science" in Greek and in free translation "the science of the method" meaning the science of conceiving, of choosing and using the method in the process of investigating the economic phenomenon. Similarly, the term *methodos* is formed of two words *meta* and *odos*, which means "following the path", the path or the guideline which insures the success of any scientific endeavor. The methodology of scientific economic research is part of the economic science. Therefore, the research methodology can be defined as *a set of principles, stages and phases, a set of methods, techniques, tools and instruments for scientifically investigating and discovering the economic phenomena* (Răboacă Gh. et al., 2007). The research methodology employed for the purposes of

this article consisted in the analysis and the synthesis of specialized literature, the data concerning Herfindahl index for credit institutions, Share of total assets by five largest credit institutions (%), Number of credit institutions are obtained from The European Central Bank, The National Institute for Statistics and The Romanian National Bank.

In order to achieve our objectives, for the purposes of this article, we used the following main research methods: *qualitative analysis*, with the *comparative method*, which aims at obtaining perceptible differences between the level of the Herfindahl index of EU member states and Romania; *synthesis*: which was used to draft the conclusions that explain the newly found situation, *documentation*, *statistical clustering*, *case study*, *graphical representation* and *data interpretation*.

The paper concludes with an analysis of the correlation between Herfindahl index and the key-indicators: Total assets, Number of credit institutions, Population and Gross domestic product at market price. We want to study the relation between these indicators which define the degree of bank concentration with the help of the correlation coefficient. We will calculate the correlation between Herfindahl index and the key-indicators: Total assets, Number of credit institutions, Population and Gross domestic product at market price for each analyzed year (2005-2011) and we will also analyze the intensity of the relation between the two indicators.

In order to analyze the evolution of the Herfindahl index, we cannot calculate this index for each particular country. For this reason, we count on the data delivered by the European Central Bank. Herfindahl index was collected from the reports and statistics of The European Central Bank (2005-2011).

The evolution of bank concentration indexes

Herfindahl Index (HI) for the total number of assets of credit institutions refers to the concentration of banking activities. HI is computed as the sum of the squares of market shares of all credit institutions in the banking system and is calculated according to this formula:

$$HI = \sum_{i=1}^n (X_i / X)^2 \quad (2),$$

where: n = total number of credit institutions in the country

X_i = total assets of credit institutions

X = $\sum_{i=1}^n X_i$ = total assets of all credit institutions of the country

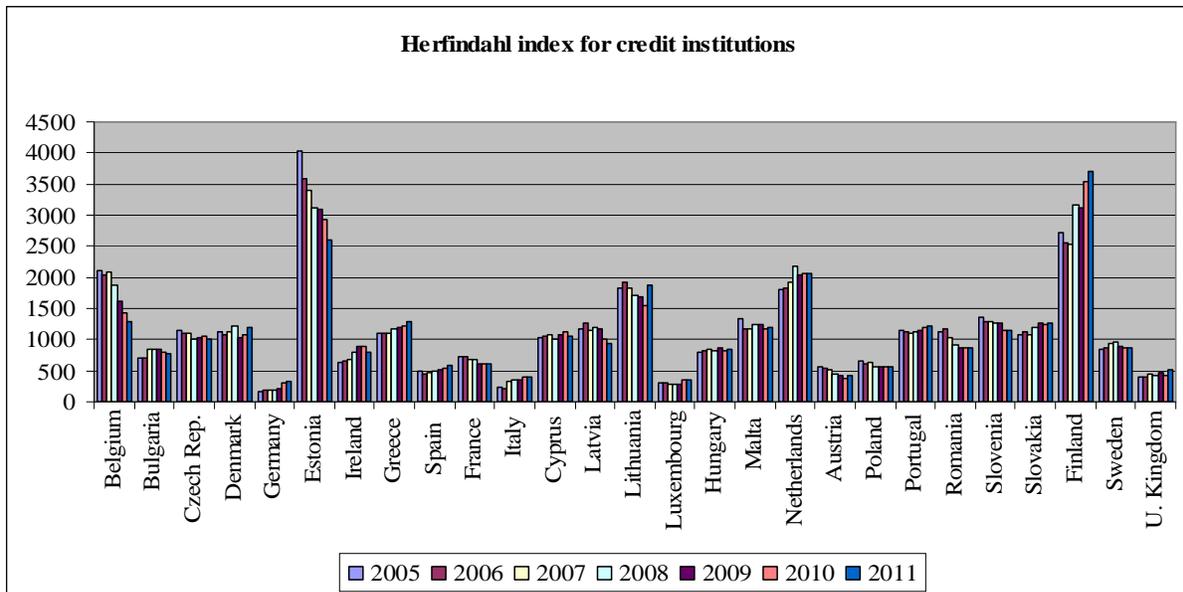


Figure no. 1. - Herfindahl index for credit institutions

Source: personal processing of data collected from the statistical reports of the European Central Bank

As a general rule, if the Herfindahl index is below 1,000 it indicates a low concentration, while a value higher than 1,800 indicates a high concentration. For values that range between 1,000 and 1,800, the banking industry is considered moderately concentrated.

Chart 1 reveals significant concentration differences in the European Union. In Germany, Italy, Luxemburg and The United Kingdom the concentration ratios on banking markets are relatively low (below 500). The highest concentration ratios can be found in: Belgium, Estonia, Finland, Lithuania and The Netherlands which have reported the highest value for Herfindahl index in all EU member states. In 2011 the following countries report a Herfindahl index higher than 2,000: Estonia (2613); The Netherlands (2061) and Finland (3700). These figures measure the concentration on the global banking market of a certain country.

Upon analysis of the evolution of the Herfindahl index in each country, over the period 2005-2011, we have noticed that in some countries this index reported a constant decline: Belgium (from 2112 in 2005, to 1294 in 2011); Estonia (from 4039 in 2005, to 2613 in 2011) and Slovenia (from 1369 in 2005, to 1142 in 2011). Other countries have reported constant growths each year: Germany (from 174 in 2005, to 317 in 2011), Greece (from 1096 in 2005, to 1278 in 2011) and Italy (from 230 in 2005, to 407 in 2011). The rest of the countries had a fluctuating evolution.

Calculated at an asset level, at the end of 2012, in Romania, the Herfindahl index confirms a low concentration level. A value of 878 places the Romanian banking system below the average reported by EU27.

Share of total assets by five largest credit institutions (CR5). This index refers to the concentration of banking activities. It is calculated according to this algorithm:

- (1) we rank all balance sheet totals of all reporting credit institutions;
- (2) we calculate:
 - (a) the sum of the five largest balance sheet totals
 - (b) the sum of all balance sheet totals
- (3) we calculate the share of (a) by (b).

The data is expressed in percentage.

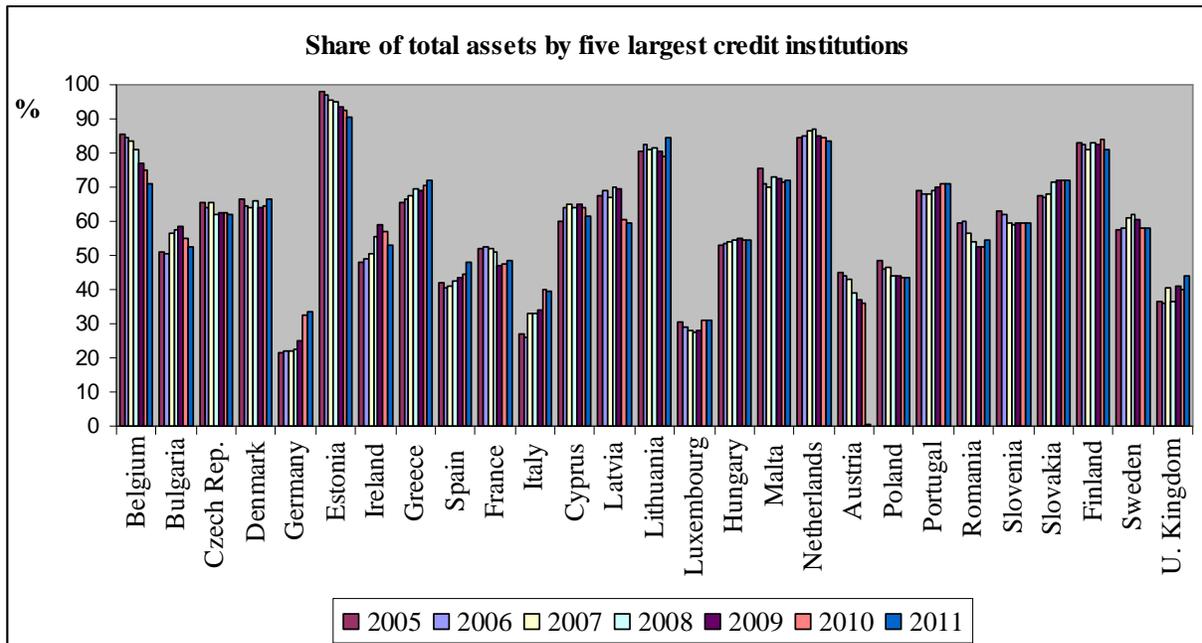


Figure no. 2. - Share of total assets by five largest credit institutions (%)

Source: personal processing of data collected from the statistical reports of the European Central Bank

Market concentration, as measured with the share of total assets held by the five largest institutions, increased in the period 2008-2009 in most countries in line with the increased consolidation in the EU banking sector. The EU banking system became more efficient in the period 2007 – 2009. In general, bank concentration indexes continue to vary in EU countries, as a consequence of the different strategies employed by banks, but also as a consequence of certain factors, such as population density.

Chart 2 shows that there are significant concentration differences in EU countries from the point of view of the Share of total assets by five largest credit institutions. In Germany, Italy, Luxemburg, The United Kingdom, Spain and Austria the value of this index is below 50%. The highest percentages were reported by these countries: Lithuania, Estonia, The Netherlands and Finland. In 2011 the highest value was reported by Lithuania. Most countries have reported fluctuations of this index over the analyzed period (2005-2011).

In Romania the degree of concentration, from an asset and credit perspective, reflected by the share of the first five banks in the system remains at a moderate level, with a slight tendency of increase in the last two years of the analyzed period. The concentration degree in the Romanian banking system, reflected by the share of assets held by five largest banks in aggregate asset, has increased slightly until reaching 54.6 % (Chart 2) thus continuing the tendency started in 2010.

A slight increase in the concentration rate of the banking system reveals a tendency of the economic agents and of the population to orient towards well regarded credit institutions.

Analysis of key-indicators influencing the degree of bank concentration

a) Number of credit institutions: As we can observe in Chart 3, during the analyzed period of time (2005-2011), only Germany has a very high number of credit institutions (over 1800 banks), being followed by France (between 600 and 800 credit institutions), Italy, Austria and Poland. Certain countries had less than 100 credit institutions in 2011: Bulgaria, The Czech Republic, Estonia, Greece, Latvia, Lithuania, Malta, Romania, Slovenia and Slovakia.

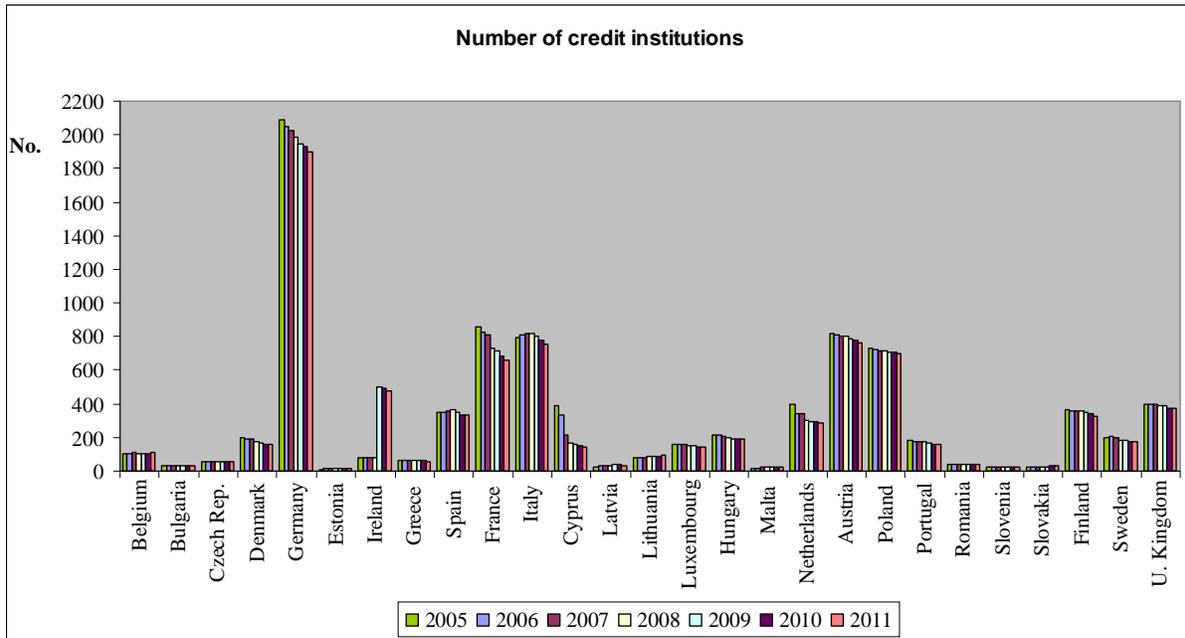


Figure no. 3. - Number of credit institutions

Source: personal processing of data collected from the statistical reports of the European Central Bank

b) Total assets: Chart 4 reveals that only three countries reported an asset value of over 6,000,000 million euro: Germany, Great Britain and France. Holland, Spain and Italy have reported values up to 4,000,000 million euro; Luxemburg, Ireland and Belgium have reported values of up to 1,000,000 million euro while the rest of the countries were below this value.

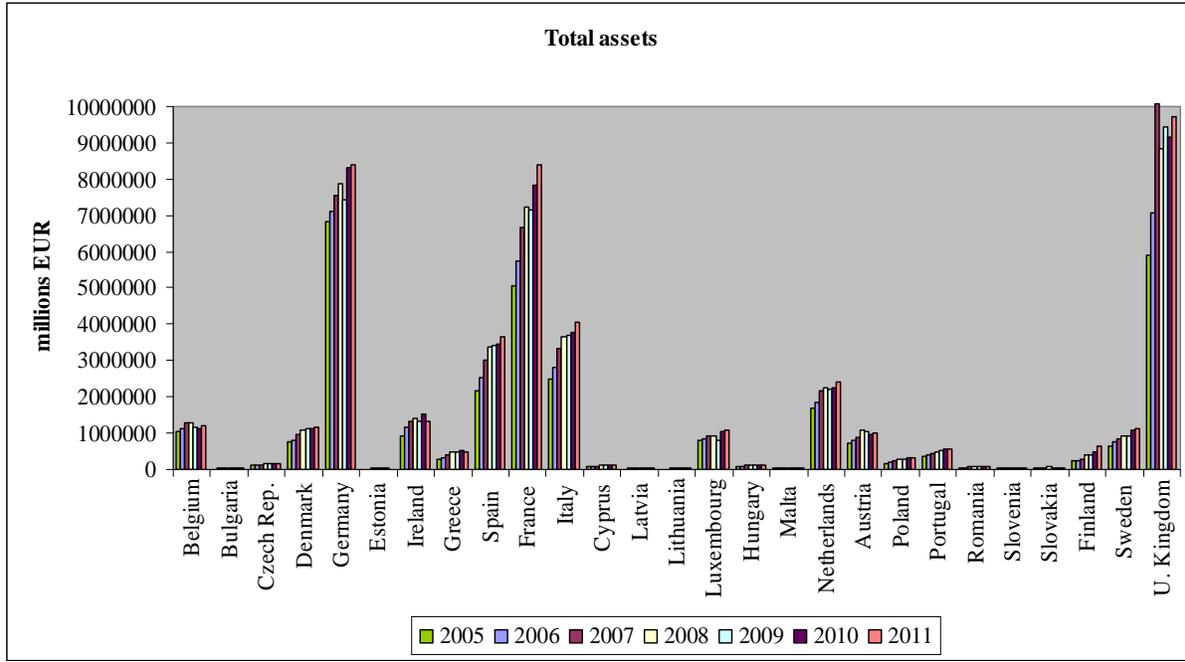


Figure no.4. - Number of total assets

Source: personal processing of data collected from the statistical reports of the European Central Bank

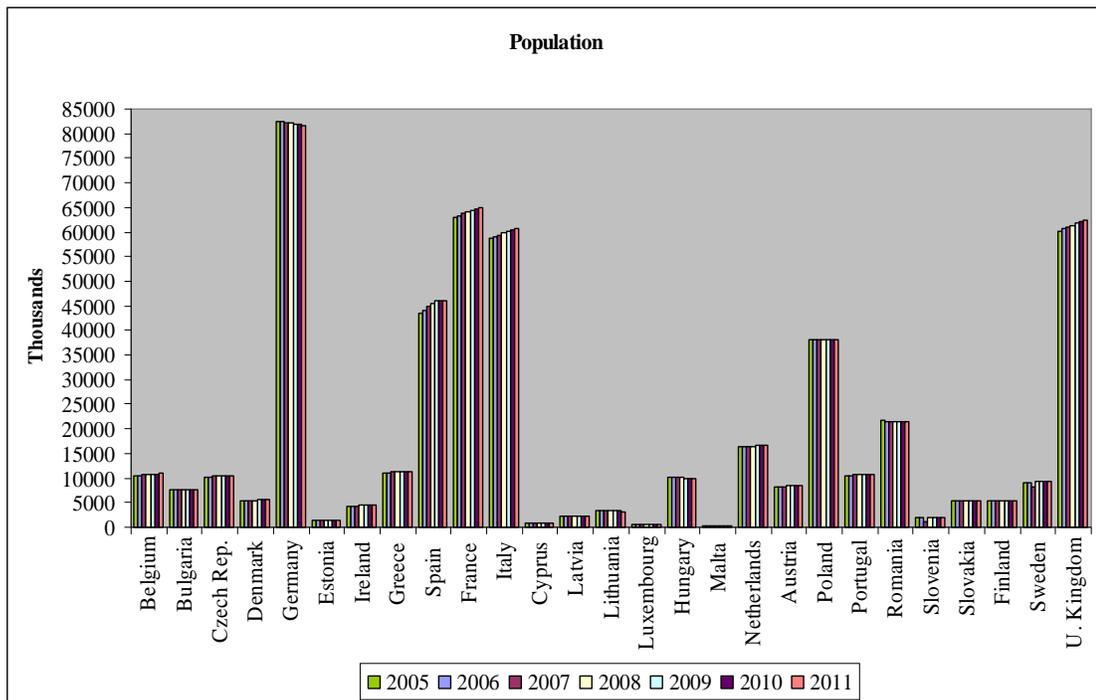


Figure no. 5. - Population

Source: personal processing of data collected from the statistical reports of the European Central Bank

c) **Population:** As we can see in Chart 5 the countries with the largest population are: Germany followed by France, Great Britain, Italy and Spain. The same ranking order can be found for the index: Gross domestic product at market price (See Chart 6)

d) **Gross domestic product at market price**

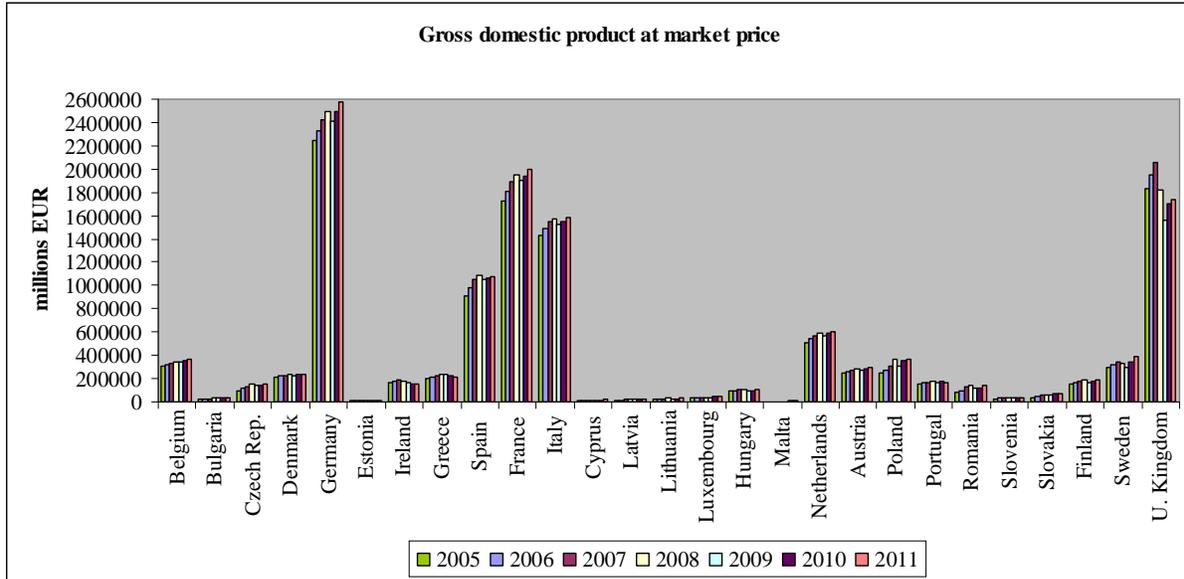


Figure no. 6: Gross domestic product at market price (EUR millions)

Source: personal processing of data collected from the statistical reports of the European Central Bank

Relation between the Herfindahl index and the key-indicators

This last part of our paper establishes the relation between the Herfindahl index and the key-indicators: Total assets, Number of credit institutions, Population and Gross domestic product at market price. We want to study the relation between these indicators which define the degree of bank concentration with the help of the correlation coefficient. We will calculate the correlation between Herfindahl index and the key-indicators mentioned above for each analyzed year (2005-2011) and we will also analyze the intensity of the relation between the two indicators.

The study is based on data from the period 2005 –2011 in all EU member states and we turned to statistics for their interpretation, which allowed calculating the correlation coefficient for the two variables: the independent variable (Number of credit institutions / Total assets / Population / Gross domestic product at market price), and the dependent variable – Herfindahl index. In this respect, to obtain the linear correlation between the two series of data, we used Person’s correlation coefficient. Pearson’s correlation coefficient gives indication about the magnitude of a correlation through a value that lies between -1.00 and 1.00.

In the case of EU countries, during 2005-2011, we would obtain the following Person’s correlation coefficient between Number of credit institutions / Total assets / Population / Gross domestic product at market price, and Herfindahl index:

$$r = \frac{\sum_{i=1}^n (X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum_{i=1}^n (X_i - \bar{X})^2} \sqrt{\sum_{i=1}^n (Y_i - \bar{Y})^2}} \tag{1}$$

If Person's coefficient is negative, then there is an inverse correlation where X increases and Y decreases. If the result is positive, then there is a direct correlation where X increases and Y decreases. If the coefficient is 0, then there is no correlation.

A correlation of one indicates a perfect correlation, so if we know it has the highest score for one variable, we also know it has the same score for the other variable. A negative correlation would engage each other in an inverse proportion. A correlation of less than one, either positive or negative, shows that each result of a pair of scores attracts the other one in a less than perfect correlation, so the highest score of a variable in a positive correlation could be accompanied by an average score of the other variable.

In the table below we will calculate four correlation coefficients as follows:

C1: the correlation coefficient between the Number of credit institutions and Herfindahl index

C2: the correlation coefficient between Total assets and Herfindahl index

C3: the correlation coefficient between Population and Herfindahl index

C4: the correlation coefficient between Gross domestic product at market price and Herfindahl index.

We want to discover which of the four key-indicators has a more aggressive influence on the Herfindahl index. The correlation coefficients were analyzed for the entire analyzed period (2005-2011).

Table no.1

Correlation coefficients			
C1	C2	C3	C4
-0.395	-0.388	-0.472	-0.414

Source: Personal calculations

The correlation coefficient was computed by introducing the data from all EU member states for the period 2005-2011. The analysis of the correlation coefficient **C1** between Number of credit institutions and Herfindahl index in the period 2005-2011, reveals that there is an inverse correlation between the Number of credit institutions and Herfindahl index in the sense that: if the Number of credit institutions increases, Herfindahl index decreases, because the result was negative. The correlation is not very close, as it is around 0.4. We could talk about a close and very close correlation only if the value exceeded 0.5. According to Table 1 all the correlation coefficients (C1, C2, C3, C4) have reported negative values and below 0.5. This means that none of the four key-indicators (Number of credit institutions / Total assets / Population / Gross domestic product at market price) has an aggressive influence on Herfindahl index. Due to the fact that the result of the correlations is negative, it means that there are inverse correlations but not intense correlations.

Conclusions

In contrast to the market share of the five or ten largest banks, the Herfindahl index will reflect changes in the market structure also among smaller banks. An analysis of the changes in the competitive structure reveals a more intense competition in the last few years of this period.

Generally, the European financial system witnessed a remarkable expansion in the banking field alongside a continuous update and review of the legal framework in order to insure solidarity and caution in the banking system.

In 2011, with respect to the degree of bank concentration measured by the **Herfindahl index**, we discovered a high bank concentration determined by the high value of this index, in these countries: Estonia, Lithuania, Netherlands and Finland. An average bank concentration was reported in: Belgium, The Czech Republic, Denmark, Greece, Cyprus, Malta, Portugal, Slovenia and Slovakia. The rest of the EU countries have a low bank concentration (See Chart 1). The evolution of this index, in the given time span (2005-2011) was relatively fluctuating in almost

every country. One could argue that the Herfindahl index varies monotonically by the size of each country. Nevertheless, this is true only for a limited number, as shown in the figures presented in Table 1.

With respect to the next indicator: **Share of total assets by five largest credit institutions**, there are three countries where this percentage has increased significantly (by more than 4% in 2011 as compared to 2010): Spain, Lithuania and Great Britain. In 2011 as compared to 2005, this indicator reported its most prominent decrease in value in Belgium (by more than 14%) and its greatest increase in: Germany (by 11.9%) and Italy (by 12.7%) (See Chart 2).

Chart 4 reveals an increase in the number of **total bank assets** in most European countries in 2011, as compared to 2005. Nonetheless, during the last two analyzed years (2010 and 2011) we found that there is a discrepancy in the evolution of bank assets in EU member states, as follows:

1. in 2011 as compared to 2010, the fastest growth rate of bank assets was reported by Finland (33.7%). Other countries with smaller growth percentages are: Netherlands (7.5%), Italy (7.3%), France (7.2%), Sweden (6.8%), the UK (5.8%), Belgium (5.6%) and Bulgaria (5.2%).
2. in 2011 as compared to 2010, the most accentuated decline of bank assets was reported by Ireland (-14%), and other countries with the same decreasing trend: Hungary, Greece, Estonia, Lithuania, Latvia and Slovenia.

Most of the banks from European countries have restricted the number of their **credit institutions**, reporting a decreasing trend in 2011, as compared to 2005, as it is shown in Chart 3.

With respect to **population**, in Chart 5 it is noticeable that this number has grown in 2011, as compared to 2005 in almost all countries, with the exception of: Bulgaria, Germany, Estonia, Latvia, Lithuania, Hungary and Romania.

The countries with the most important population increase in 2011 as compared to 2010 are: Spain, France, Italy, The United Kingdom and Belgium (See Chart 5). Some countries have reported decreases in population in 2011 as compared to 2011: Bulgaria, Germanu, Latvia, Lithuania, Hungary, Portugal and Romania.

Gross domestic product at market price: the only two countries which reported a decrease in 2011, as compared to 2005, are Ireland and The United Kingdom. All the other countries have reported increases with respect to this indicator in 2011 as compared to 2005 (See Chart 6).

After calculating the **correlation coefficients C1, C2, C3, C4** we found that there is an inverse correlation between the four indicators (Number of credit institutions / Total assets / Population / Gross domestic product at market price) and the Herfindahl index, but the correlation is not very close. Therefore, we are able to conclude that there are other factors as well (besides those mentioned above) which influence the evolution of the Herfindahl index, such as: technological development, the legislation of a particular state, the degree of development, the standard of living.

We found that:

- bank concentration differs substantially among EU member states;
- it could be that the differences of bank concentration between countries exist due to differences in definitions: the definition of the degree of bank concentration in a country might not coincide with the definition given by the European context;
- an increase in concentration may lead to collusion and to higher interest rates (for credits and deposits) charged by banks.

References

1. Al-Muharrami S., 2009. *The competition and market structure in the Saudi Arabia banking*, Journal of Economic Studies, Volume 36, Issue 5, pp.446 - 460
2. Ávila F., Flores E., López-Gallo F., Márquez J., 2012. *Concentration indicators: assessing the gap between aggregate and detailed data*, IFC Bulletin, No 36, Statistical issues and activities in a changing environment, Proceedings of the Sixth IFC Conference, Basel, 28-29 August 2012.
3. Berger Allen N., Demirgüç-Kunt A., Levine R., Haubrich J.G., 2004. *Bank Concentration and Competition: An Evolution in the Making*, Journal of Money, Credit and Banking, Vol. 36, No. 3, Part 2: Bank Concentration and Competition: An Evolution in the Making A Conference Sponsored by the Federal Reserve Bank of Cleveland May 21-23, 2003 (Jun., 2004), pp. 433-451
4. Carlson M., Mitchener K.J., 2006. *Branch Banking, Bank Competition and Financial Stability*, Journal of Money, Credit and Banking, Vol. 38, No. 5 (Aug.), pp. 1293-1328
5. Casu B., Girardone C., 2009. *Competition issues in European banking*, Journal of Financial Regulation and Compliance, Volume 17, Issue 2, pp.119 - 133
6. Cetorelli N., 2004. *Real Effects of Bank Competition*, Journal of Money, Credit and Banking, Vol. 36, No. 3, Part 2, pp.543 - 558
7. Claessens S., Laeven L., 2004. *What Drives Bank Competition? Some International Evidence*, Journal of Money, Credit and Banking, Vol. 36, No. 3, Part 2: Bank Concentration and Competition: An Evolution in the Making A Conference Sponsored by the Federal Reserve Bank of Cleveland May 21-23, 2003 (Jun.), pp. 563-583
8. de Guevara J.F., Maudos J., Perez F., 2005. *Market power in European Banking Sectors*, Journal of Financial Services Research, 27, 2, pp. 109-137
9. Dick A.A., 2007. *Market Size, Service Quality and Competition in Banking*, Journal of Money, Credit and Banking, Vol. 39, No. 1 (Feb.), pp. 49-81
10. European Commission, Enterprise and Industry (SAFE), 2011a. *SMEs' Access to Finance*, Survey 2011. Analytical Report, December.
11. European Commission, 2011b. *Commission Staff Working Paper, Impact Assessment. Accompanying the document Regulation of the European Parliament and the Council on prudential requirements for the credit institutions and investment firms*, COM(2011) 452 final, Brussels, 20.7.2011.
12. OECD, 2010. *Assessment of Government Support Programmes for SMEs' and Entrepreneurs' Access to Finance in the Global Crisis*, OECD Working Party on SMEs and Entrepreneurship' Bologna+10' High-Level Meeting on Lessons from the Global Crisis and the Way Forward to Job Creation and Growth, available online at:
http://www.oecd.org/cfe/smesandentrepreneurship/Assessment_Government_Support_Programmes.pdf.
13. Perera S., Skully M., My Nguyen, 2012. *Market concentration and pricing behaviour of Sri Lankan banks*, South Asian Journal of Global Business Research, Volume 1, Issue 1, pp. 63 - 78
14. Schoenmaker D., 2011. *The European Banking Landscape after the Crisis*, DSF Policy Paper, No. 12, available online at
<http://www.dsf.nl/assets/cms/File/Research/DSF%20policy%20Paper%20No%2012%20The%20European%20Banking%20Landscape%20after%20the%20Crisis%20April%202011.pdf>
15. Weill L., 2004. *On the relationship between competition and efficiency in the EU banking sectors*, Kredit und Kapital 37, 3, pp. 329-352
16. Yildirim H.S., Philippatos G.C., 2007. *Competition and contestability in Central and Eastern European banking markets*, Managerial Finance, Volume 33, Issue 3, pp. 195-209
17. ***, *GUIDELINE OF THE EUROPEAN CENTRAL BANK on monetary, financial institutions and markets statistics (recast) (of 1 August 2007) (ECB/2007/9) (2007/830/EC) (OJ L 341, 27.12.2007, p. 1)*
18. ***, *GLOSSARY OF INDUSTRIAL ORGANISATION ECONOMICS AND COMPETITION LAW, ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT*