MEASURING THE EFFECTS OF THE MOST SIGNIFICANT PROCESSES IN THE EUROPEAN BANKING SYSTEM

Theses of PhD dissertation

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Gödöllő
2016

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CONTENT

1. INTRODUCTION

1.1 The relevance and the actuality of the selected topic

The subprime crisis causing significant changing in the banking system of the European Union could be led back to the deregulation processes of the United States, which is observable from the ’70s of the previous century. Less strict rules and price boom in the real estate market made possible providing such loans where the repayment of the exposure of the banks was strongly questionable. However, price fall in the real estate market bore inherent risk in the system. When this came true, the default credit portfolio of the banks significantly grew, and eventually, launched the crisis. Since securities containing subprime loan claims were traded worldwide in the money markets, the credit crisis spread quickly.
The asset-liability structure of the bank collapsed, the interbank market froze, and therefore, numerous banks had to face with liquidity problems. Governmental bodies had to intervene in this situation in order to avoid collapse of the bank sector and had to refund the banks by using taxpayers’ money. However, this process caused significant indebtedness of the sovereigns, bringing further difficulties.
The symptoms of the crisis appeared in the European Union soon and in the period 2009-2011more member states were close to the insolvency (Grace, Ireland, Italy, Spain, Portugal).

Beside elaborating and providing different aid packages, as a new intension, the revision of the regulations of the banking activity appeared as a new goal in this period in the European Union. This revised integrated financial system is nowadays called simply as Banking Union. Pillars of the Banking Union are defined in more regulations and directives in the European Union.
The European Parliament approved the proposals of the Commission concerning European Single Supervisory Mechanism in 12 September 2013. From November 2014, it brought significant changing in the banking supervisory activity.
After regulating the banking supervision, two new pillars were created in the frame of Banking Union in 2014. The European Parliament and the European Council issued their common directive on the banking deposit scheme in April 2014 and one month later, they issued their directive on recovery and resolution of credit institutions and investment firms. The Parliament and the Council also issued a regulation that defines uniform rules and procedures concerning resolution of credit institutions and certain investment firms registered in territory of the euro zone. Beside the mentioned directives and regulation creating framework for deposit insurance and banking resolution, the rules stipulate the expectations regarding uploading the funds to be used to maintain the systems. According to this regulation, the so-called Single Resolution Fund is to be created by the member states of the euro zone.
By partly implementing and partly supplementing the mentioned directives and regulation, the so-called Single Rulebook makes complete the regulatory background of the Banking Union. Its goal is to define single prudential expectations for banks operating within the European Union and to create framework for application of the Basel III accord within the Union.

1.2 The aim of the analysis

The aims of my analysis were the followings:
C1 Overview of the rules of the single supervisory mechanism and result of research activities in connection with this topic.

C2 Overview of the rules of the single deposit guarantee schemes and result of research activities in connection with this topic.
C3 Testing the operation of the banking deposit insurance systems within such market condition where depositors of a large bank must be compensated by a deposit insurance institution.
C4 Overview of the rules of the single resolution mechanism, overview of the rules of creation of Single Resolution Fund and its uploading as well as overview the result of research activities in connection with this topic.
C5 Forecasting the wealth of the Single Resolution Fund as of 2024.
C6 Overview of the methods used for measuring the market concentration and their results.
C7 Calculation of the concentration of the banking market based on different methods and aspects.
C8 Elaborating such method that ensures estimation of bounds of the Herfindahl-Hirschman index.
C9 Overview of the rules of remuneration of bank managers and material risk takers and overview of the results of research activities in connection with this topic.
C10 Sampling in order to fulfil the aims above and processing the data originated from the sampling.

Based on the aims above, proving of the following allegations was planned:

H1 If the number of market players of the whole banking market and aggregated value of their balance sheet or profit or loss statement are known, lower bound value of Herfindahl-Hirschman index is determinable which is greater than zero in connection with the concentration of the balance sheet or profit or loss statement item in question based on a sample. In addition, upper bound value of Herfindahl-Hirschman index is determinable. This upper bound value is less than Harfindahl-Hirscman index of the market where only one market player operates. By increasing the sample size the interval determined by bounds decreases. In other words, the estimation of the Herfindahl-Hirschman index is more accurate.

H2 The number of population has significant effect on number of branches in the European Union.

H3 The concentration of the European bank market shows duality. The concentration level is at least medium if the subject of the analysis is the distribution of the number of branches, number of credit institutions, balance sheet total, own fund, net interest income, net fee income among member states. However, the concentration level is low if the analysed market is independent of the member states. In other words, if the analysed market is the single European banking market, the concentration level of the items above is low.

H4 The recent banking deposit insurance schemes do not compose appropriate guarantee for savings in the banks in the European Union. There is such insurance institution in the European Union that wound not be able to fulfil its compensation function if a large bank belonging to the institution in question was not able to pay its depositors.

H5 If structural break does not occur in the economic development of the memebr states of euro zone than the target level of Single Resolution fund, which is 55 billion euro, is underestimated.

2. DATA AND METHODS

2.1 Seconder data sources applied

More seconder data sources were available for accomplishing the analyses and for proving the theses.
Different balance sheet and profit or loss statement data are originated from Statistical Data Warehouse (hereinafter SDW) of the European Central Bank that show the balance of the assets and liabilities as well as the annual result of the banks for period 2008-2014.
Beside primer data collection, data of survey of Cannas et al. provided base for proving thesis regarding risk hidden in banking deposit insurance systems. In addition, these data of the survey was used when calculating the wealth of the resolution funds. Furthermore, data of the statistical institute of the European Union (Eurostat) were used when proving the theses regarding banking concentration and banking resolution.

2.2 Primer data sources applied

In order to prove theses of my research, a sample was taken from the financial statements of the banks operating in the European Union where the selection aspects were the followings:

- at least 5 banks were to be selected from each member states;
- the cumulated balance sheet total in the consolidated financial reports of the banks operating in a member state was to be covered at least one to third part by the summarized balance sheet total of the banks operating in a member state and being in the sample in case of financial reports composed as of end of the year 2014;
- the cumulated balance sheet total in the consolidated financial reports of the banks operating in the European Union was to be covered at least one to third part by the summarized balance sheet total of the banks being in the sample in case of financial reports composed as at end of the year 2014;
- data in connection with balance sheet total, own funds, net interest income and net fee income were to be available,
- data were to be available for at least two years (2013,2014).

Based on the aspects 164 banks were selected.

When proving the thesis related to vulnerability of the deposit insurance systems, financial statements of four insurance institutions and four belonging banks were selected and used. Besides, the ensured amount of deposits had to be used but these data were not published in each case for year 2014. Since the values of the aggregated deposit portfolios as per member states are known from SDW and the values of the ensured portfolios are also known from survey of CANNAS et al. for year 2012, their ratio had been used when determining the values of ensured portfolios for year 2014.

The following table summarises data used during the analysis.

Table 1: Data used during the analysis

Thesis or topic	Seconder data	Primer data
Analysis of the concentration	SDW, Eurostat	data of balance sheet and profit or loss statement of 164 banks
Deposit insurance	Cannas et al., SDW	Financial data of deposit insurance institutions and the belonging banks being in the sample
Banking resolution	Cannas et al., Eurostat	-
Remuneration	-	Financial statements of the banks being in the sample

Source: own editing

2.3 Method applied during the research activity

In order to get detailed picture on the concentration of the market of the Union, estimation method has been elaborated. Its essence is that lower and upper bounds of Herfindahl-Hirschman index (HHI) are determinable based on data of a sample from the market. The precondition of method usage is that the analysed aggregated value of the market and the number of the market players must be known. It is the case if the subject of the analysis is the European bank market because the aggregated balance sheet or profit or loss statement data as well as number of banks are disclosed in the SDW.

It was proven that when data of banks are not selected in the sample and are replaced by their average in case of these banks, the Herfindahl-Hirschman index of the population composed on that way is lower than the Herfindahl-Hirschman index of the whole population (bank market). If data of banks are not selected in the sample and are not taken into account but replaced by their sum, the Herfindahl-Hirschman index of the population composed on that way is higher than the Herfindahl-Hirschman index of the whole population (bank market). This method was used when making evidence for thesis H1.
Beside the Herfindah-Hirschman index, further two indexes were calculated, namely the Gini-index and CR_3 index. Therefore, three different indicators were used for determining the concentration level of the banking market of the European Union. This method was used when making evidence for thesis H3.

At first, the concentrations of the credit institutions and their branches were determined. Thereafter, the concentrations of balance sheet total, own fund, net interest income and net fee income of the banks were calculated.

The following table overviews the different methods serving calculation of different balance sheet and profit or loss statement data.

Table 2: Different methods serving calculation of different balance sheet and profit or loss statement data

	Lorenz-curve, Gini-index		Herfindahl-Hirschman index		CR_3 index	
Data type	Primer data	Seconder data	Primer data	Seconder data	Primer data	Seconder data
Scope of the analysis	Based on consolidated data of 164 banks		Based on consolidated data of 164 banks	Cumulated data of banks in 28 countries	Based on consolidated data of 164 banks	Cumulated data of banks in 28 countries
Period	2013-2014		2013-2014	2008-2014	2013-2014	2008-2014

Source: own editing

In order to make evidence in relation with thesis H4, a test has been done. Wealth changing was observed in case of four banking deposit institutions by supposing that a large bank in the member state goes bankruptcy. Data were calculated as for 31 December 2014.
The main steps of the test were the followings:

a. Liability forecasting in connection with deposit payments
    i. Determining the value of saleable assets in case of the bank analysed;
    ii. Determining the liability remained after paying the depositors by fund originated from the income of liquid assets of the bank sold.
b. Comparing the wealth of the deposit insurance institution and the fund to be paid by the deposit guarantor institution.

In order to make evidence for the allegation, Danish, French, Greek and Hungarian deposit guarantee institutions were selected and their financial ability was analysed in such environment where, according to the presumption, a significant bank had gone bankruptcy. In addition, four significant parent banks (Danish, French, Greek and Hungarian) belonging to the deposit guarantee institutions were selected. By selecting parent bank, such situation was excluded where another bank being in the banking group could overtake certain part of the liabilities. On the other hand, the separated financial data of the parent bank were used in the calculation and the consolidated data were not taken into account. Therefore, deposits gathered by the parent bank and ensured by the guarantee institution were solely taken into account.
In all four cases, three scenarios were applied. In the calculation, the whole cash portfolio of a bank being in the sample was treated, as they would be paid back to the depositors. The asset saleability within short period made the difference among scenarios. In the first scenario, 30% of the liquid assets could be sold within short period, in the second scenario, this ratio was 50% and in the third scenario, this ratio was 100%. It means that in the latter case, the entire liquid assets of the bank could be sold and the cash flow of the sales paid back to the depositors. Table 3 shows the liquid assets of the banks taken into account in the test.

Table 3: Liquid assets of the banks taken into account in the test

Asset to be sold	Value taken into account		
	Scenario 1	Scenario 2	Scenario 3
Cash	100 %		
Financial instruments at fair value through profi t or loss	30 %	50 %	100 %
Available for sale financial assets			
Shares			

Source: own editing

In case of theses H2 and H5, regression models as well as method of trend calculation were used.

3. RESULTS

3.1 Bounds of Herfindahl-Hirschman index used for determining the concentration level of balance sheet and profit or loss statement items

During the model compilation, it is supposed that the aggregated value analysed and the number of units of the population were known. Furthermore, it is supposed that result of a random sample from the given population is also available. Generally, the propositions refer to populations but it can be any set of balance sheet or profit or loss statement data. For example, the calculation of the Herfindahl-Hirschman index of total assets is the following:

If a bank market has *n* market players and the total assets of the banks are denoted by $0 < x_i$, where $i \leq n$ and the aggregated total assets of the market is denoted by $T = \sum_{i=1}^{n} x_i$ as well as $i, n \epsilon \mathbb{Z}^+$, than the Herfindahl-Hirschman index is the following:

$$HHI = \sum_{i=1}^{n} \left(\frac{x_i}{T}\right)^2$$

In addition, any balance sheet or profit or loss statement data of the market participants can be the subject of the concentration analysis. The following propositions are determined in general form but the "value" word embodies any of the balance sheet or profit or loss statement data.

Proposition 1

Let $0 < x_i$ denote the value of the units of a population which has $n \in \mathbb{Z}^+$ units where $i \leq n$ and $i \in \mathbb{Z}^+$. Let the sample size originated from the population is $n - k$ $(1 < k < n, k \in \mathbb{Z}^+)$. Let at least one unknown unit value which in not equal to at least one other unknown unit value. In that case, by substituting each unknown unit by their mean, the HHI value of the population composed by $n - k$ known units and k pieces mean value is lower than the HHI of the original population.

If the proposition is true, the lower bound level of the HHI is determinable by sampling in case where the aggregated value and the number of units of the population are known. It means that knowing the aggregated value of a population (for example the aggregated value

of the total assets of banks funded in the area of the European Union) and the number of units of a population (the number of those banks), than a lower bound determinable (by calculating the mean of the total assets of the unknown banks and substituting each unknown total asset value by their mean). In this case, the HHI value of the population is higher than the lower bound.

For example let the *A* the set of the following values: *A*= {5;10;20;25;40;50;60;80;100}. *A* has nine units and sum of the elements is 390. The HHI value of the population is

$$HHI = \left(\frac{5}{390}\cdot 100\right)^2 + \left(\frac{10}{390}\cdot 100\right)^2 + \left(\frac{20}{390}\cdot 100\right)^2 + \left(\frac{25}{390}\cdot 100\right)^2 +$$
$$+\left(\frac{40}{390}\cdot 100\right)^2 + \left(\frac{50}{390}\cdot 100\right)^2 + \left(\frac{60}{390}\cdot 100\right)^2 + \left(\frac{80}{390}\cdot 100\right)^2 + \left(\frac{100}{390}\cdot 100\right)^2 =$$
$$= 1660.09.$$

If the sample has four units, than five units is unknown. For example let the sample is the following: {25;50;80;100}. Therefore, {5;10;20;40;60} are unknown. The essence of the method is that the unknown units are substituted by their mean during the HHI calculation. Though, {5;10;20;40;60} are unknown, their mean is determinable because according to the original assumption, sum of the value of the units and number of the units is known. Since sum of the units is 390, sum of the known elements is 25+50+80+100=255 and the number of the unknown units is 5, therefore, the mean of the unknown units is $\frac{390-255}{5} = 27$. Let *A*' the population of the known values and 5 pieces 27: *A'*= {27;27;27;25;27;50;27;80;100}. In that case the HHI value of the modified population is the following:

$$\underline{HHI} = \left(\frac{27}{390}\cdot 100\right)^2 + \left(\frac{27}{390}\cdot 100\right)^2 + \left(\frac{27}{390}\cdot 100\right)^2 + \left(\frac{25}{390}\cdot 100\right)^2 +$$
$$+\left(\frac{27}{390}\cdot 100\right)^2 + \left(\frac{50}{390}\cdot 100\right)^2 + +\left(\frac{27}{390}\cdot 100\right)^2 + \left(\frac{80}{390}\cdot 100\right)^2 +$$
$$+\left(\frac{100}{390}\cdot 100\right)^2 = 1523.34\ .$$

By substituting the 5 unknown elements by their mean, such value was determinable which is lower than the HHI of the original population. In this case the HHI value is higher than 1523.34.

Proposition 2

Let $0 < x_i$ denote the value of the units of a population which has $n \in \mathbb{Z}^+$ units where $i \leq n$ and $i \in \mathbb{Z}^+$. Let the sample size originated from the population is $n - k$ $(1 < k < n, k \in \mathbb{Z}^+)$ where $T = \sum_{i=1}^{k} x_i$ denotes the sum of the unknown units. By excluding the unknown units from the population and supplementing it by T, the Herfindahl-Hirschman index value of the population created on this way (it has $n - k + 1$ units) is higher than the Herfindahl-Hirschman index value of the original population (which has n units).

Keeping the above example, A= {5;10;20;25;40;50;60;80;100}. It has nine units, the sum of the value of the units is 390, the value of the HHI is 1660.09.

The sample is {25;50;80;100}. The essence of the method is that the unknown units are excluded and the population is supplemented by sum of their values. The HHI of the population created on this way is higher than the HHI value of the original population. Since sum of the units of A is 390 and sum of the value of the units in the sample 25+50+80+100=255, therefore, the aggregated value of the unknown units is $390 - 255 = 135$. According to the proposition, the HHI of the A population is less than the HHI of the population composed by {25;50;80;100;135} units ($\overline{HHI}$). It is less actually, since

$$\overline{HHI} = \left(\frac{25}{390}\cdot 100\right)^2 + \left(\frac{50}{390}\cdot 100\right)^2 + \left(\frac{80}{390}\cdot 100\right)^2 +$$
$$+\left(\frac{100}{390}\cdot 100\right)^2 + \left(\frac{135}{390}\cdot 100\right)^2 = 2481.92.$$

By excluding the 5 unknown elements and supplementing the population by their aggregated value, such value was determinable which is higher than the HHI of the original population. In this case the HHI value is less than 2481.92.

Based on the Proposition 1 and Proposition 2 the allegation of the first part of the thesis H1 is true. In other words, if the number of market players of the whole banking market and aggregated value of their balance sheet or profit or loss statement are known, lower bound value of Herfindahl-Hirschman index is determinable in connection with the concentration of the balance sheet or profit or loss statement item in question based on a sample. Also, such upper bound value of Herfindahl-Hirschman index is determinable. (Proofs of the prepositions are available in the dissertation)

Proposition 3

Supplementing the sample size by an additional data collection, the value of HHI of the modified population determined in Proposition 1 will increase.

In the example at Proposition 1 the sample size was four. Let the sample size now five where the known values are {25;40;50;80;100}. Sum of their values is 25+40+50+80+100= 295. The mean of the unknown values is $\frac{390-295}{4} = 23.75$. Therefore, the value of $\underline{HHI}$:

$$\underline{HHI} = \left(\frac{23{,}75}{390}\cdot 100\right)^2 + \left(\frac{23{,}75}{390}\cdot 100\right)^2 + \left(\frac{23{,}75}{390}\cdot 100\right)^2 + \left(\frac{25}{390}\cdot 100\right)^2 + \left(\frac{40}{390}\cdot 100\right)^2 +$$
$$+\left(\frac{50}{390}\cdot 100\right)^2 + \left(\frac{23{,}75}{390}\cdot 100\right)^2 + \left(\frac{80}{390}\cdot 100\right)^2 + \left(\frac{100}{390}\cdot 100\right)^2 = 1537.23$$

Proposition 4

Supplementing the sample size by an additional data collection, the value of HHI of the modified population determined in Proposition 2 will decrease.

In the example at Proposition 2 the sample size was four. Let the sample size now five where the known values are {25;40;50;80;100}. Sum of their values is 25+40+50+80+100= 295. The sum of the unknown values is $390 - 295 = 95$. Therefore the value of the $\overline{HHI}$:

$$\overline{HHI} = \left(\frac{25}{390}\cdot 100\right)^2 + \left(\frac{40}{390}\cdot 100\right) + \left(\frac{50}{390}\cdot 100\right)^2 + \left(\frac{80}{390}\cdot 100\right)^2 + \left(\frac{100}{390}\cdot 100\right)^2 + \left(\frac{95}{390}\cdot 100\right)^2 =$$
$$= 1982.25.$$

When four units were known 2481.92 was the value of the HHI (which was higher than the HHI of the original population). By adding new data to the sample, the value (which is higher than the original HHI) decreased. Therefore, the accuracy of the forecast is better.
Based on the Proposition 3 and Proposition 4 the allegation of the second part of the thesis H1 is true. In other words, by increasing the sample size the interval determined by bounds decreases. (Proofs of the prepositions are available in the dissertation)

3.2 Concentration in the European banking system

The number of branches might depend on different factors. The greater geographical area needs more branches or the increase in number of citizens also might generate growing in the

number of branches. The higher number of credit institutions within a sovereign could also generate growing. However, selling banking products via internet has invers effect.
In order to get clear picture on factors that have influence on number of branches, a multiple regression model has been employed where the dependent variable was the number of branches of the member states of the European Union and the following predictor variables were included in the model:

- number of credit institutions registered in the authority of the sovereign;
- GDP per capita of the sovereign;
- number of citizens of the sovereign;
- territory of the sovereign;
- the ratio of the citizens having at least minimal digital interest in the sovereign.

In that case, the value of explanatory power (R^2) is quite high (0.88). When analysing the effect of the parameters, some variables are seemed to be that could be excluded from the model while the explanatory power does not decrease significantly. By excluding parameters in more steps, only one predictor remained while the explanatory power remained strong. The population was this variable. **Therefore, the allegation according to which the population has decisive effect on the number of branches is true.**

The concentration of the number of the banks, the balance sheet total, the own fund, the net interest income and the net fee income were also calculated by using Gini-index, CR_3 and Herfindahl-Hirschman index. Based on 34 observations, the result is summarized in the following table.

Table 4: Summary of the result in connection with concentration measurement

Object of the analysis	Index	Among member states	Within member states	Single market of the Union
number of banks	Gini-index	high		
number of branches	Gini-index	high		
number of banks	HHI	high		
number of branches	HHI	medium		
number of banks	CR_3	high		
number of branches	CR_3	high		
balance sheet total	Gini-index	high		
balance sheet total	HHI			low
balance sheet total	HHI		mainly medium or high	
balance sheet total	HHI	medium		
balance sheet total	CR_3	high		
balance sheet total	CR_3			low
balance sheet total	CR_3		high	
own fund	Gini-index	high		
net interest income	Gini-index	high		
net fee income	Gini-index	high		
own fund	HHI			low
net interest income	HHI			low
net fee income	HHI			low
own fund	HHI		mainly medium or high	
net interest income	HHI		mainly medium or high	
net fee income	HHI		mainly medium or high	
own fund	HHI	medium		
net interest income	HHI	medium		

Object of the analysis	Index	Among member states	Within member states	Single market of the Union
net fee income	HHI	medium		
own fund	CR_3	high		
net interest income	CR_3	high		
net fee income	CR_3	high		
own fund	CR_3			low
net interest income	CR_3			low
net fee income	CR_3			low
own fund	CR_3		high	
net interest income	CR_3		high	
net fee income	CR_3		high	

Source: own editing

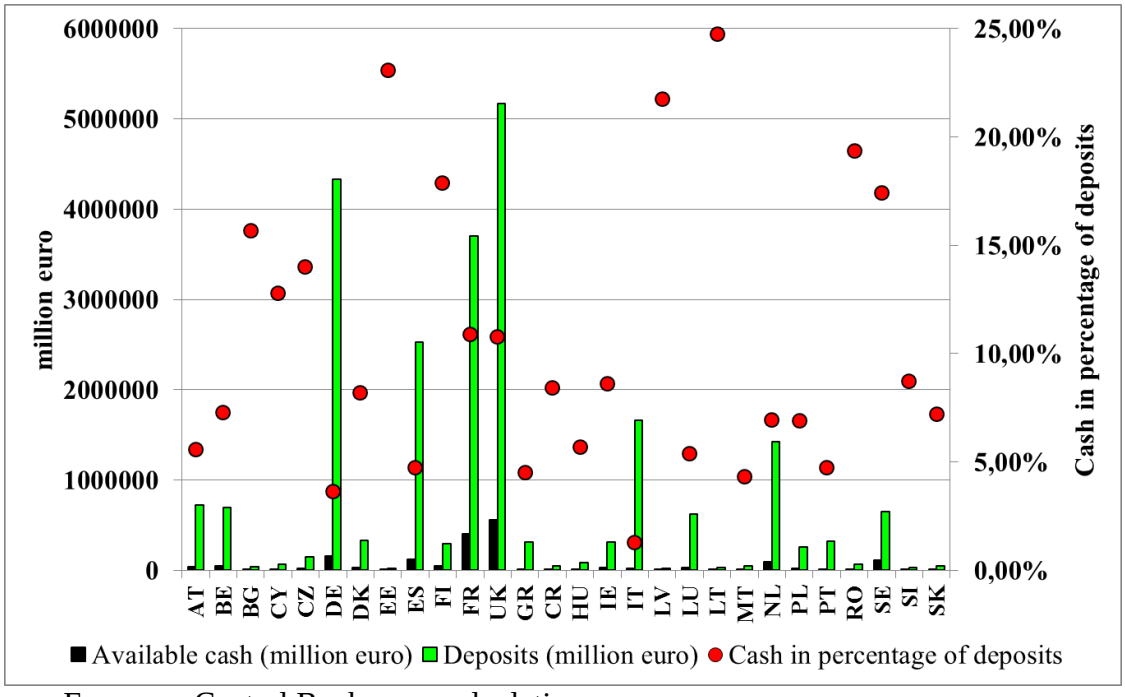
The concentration level calculated among member states and within member states are either high or medium, while this level is low where the banking market was considered as a single market. **Taking this into account the allegation of the related thesis is true.**

3.2 The vulnerability of the deposit guarantee schemes

The main and base activity of the banks is deposit receiving and loan providing. Since banks pass on deposits as loans, credit institutions are not able to pay back all the deposits at a certain moment. However, the actual risk would arise if a bank could not satisfy the increased withdrawal needs independently of the reason of the claims. It generates mistrust, which enhance further cash-back needs.

The following chart shows the significant difference between the received deposits and the available cash as at end of 2014 as per European Union member states.

Chart 1: Cash and deposits in the banking sector of European Union as of 31/12/2014 as per member states



Source: European Central Bank, own calculation

It is well observable that the cash portfolios are significantly lower than the deposit liabilities in each country.

In order to make evidence for the allegation H4, Danish, French, Greek and Hungarian deposit guarantee institutions were selected and their financial ability was analysed in such environment where, according to the presumption, a significant bank gathering deposits under their insurance had gone bankruptcy.
Doing so, four significant parent banks (Danish, French, Greek and Hungarian) belonging to the deposit guarantee institutions were selected.
In all four cases, three scenarios were applied. In the calculation, the whole cash portfolio of a bank being in the sample was treated, as they would be paid back for the depositors by the bank. The asset saleability within short period made the difference among scenarios. In the first scenario, 30% of the liquid assets could be sold within short period, in the second scenario, this ratio was 50% and in the third scenario, this ratio was 100%. It means that the income from selling the liquid assets of the selected financial institution was available for paying back the deposits. In the model, all of the income from sale of the liquidated assets and the cash has been paid back to the depositors of the bank. Certain part of the remaining deposits is ensured depending on the country specific ratio, which is indicated in the tables bellow. In the model, the remaining ensured deposit to be compensated by the deposit insurance institution and the wealth of the insurance institution has been compared.

a. Garantifonden for Indskydere og Investorer

According to the annual report of Garantifonden for Indskydere og Investorer (2014) the value of total assets is amounted to 11114 million Danish kroner as at 31/12/2014. The selected financial institution was the Danske Bank A/S. According to the presumption, this bank had financial difficulties and could not pay back the deposits.

The uncovered part of the deposits and the calculated ensured deposit portfolio was the following as per scenarios as of 31/12/2014:

Table 5: The calculation of uncompensated part of the deposits as per scenarios – Denmark (million Danish kroner)

	Scenario 1	Scenario 2	Scenario 3
Remaining part of the deposits	555810	408192	39145
Calculated guaranteed deposits (63.20%) to be compensated by the deposit guarantee institution	351272	257977	24740

Source: Annual report of Danske Bank and Garantifonden for Indskydere og Investorer as at 12/31/2014

Even in case of the most favourable scenario, the assets of the Garantifonden for Indskydere og Investorer institution does not have enough assets to entirely compensate the depositors.

b. Fonds de Garantie des Dépôts et de Résolution

The assets of the Fonds de Garantie des Dépôts et de Résolution Institution is composed by tangible and intangible assets, short term receivables, convertible securities and cash amounted to 3146 million euro as at 31/12/2014.
The BNP Paribas SA, the parent bank of the BNP Paribas Group was the selected bank for testing. The calculation of the deposits to be compensated by the deposit guarantee institution is the following taking the financial data as of 31/12/2014 into account:

Table 6: The calculation of uncompensated part of the deposits as per scenarios – France (million euros)

	Scenario 1	Scenario 2	Scenario 3
Remaining part of the deposits	216562	162108	25974
Calculated guaranteed deposits (69.96%) to be compensated by the deposit guarantee institution	151506	113411	18171

Source: Annual report of BNP Paribas and Fonds de Garantie des Dépôts et de Résolution as at 12/31/2014

The wealth of the Fonds de Garantie des Dépôts et de Résolution much lower than the uncovered ensured deposit portfolio, even in case of scenario 3.

c. Hellenic Deposit and Investment Guarantee Fund

The value of assets of the Hellenic Deposit and Investment Guarantee Fund is amounted to 4577 million euros as at 31/12/2014. The Pireaus Bank S.A. was the selected bank for testing. The following table shows the uncompensated part of the deposits as per scenarios.

Table 7: The calculation of uncompensated part of the deposits as per scenarios – Greece (million euro)

	Scenario 1	Scenario 2	Scenario 3
Remaining part of the deposits	41681	37884	28391
Calculated guaranteed deposits (59.87%) to be compensated by the deposit guarantee institution	24954	22681	16998

Source: Annual report of Pireaus Bank S.A. and Hellenic Deposit and Investment Guarantee Fund Résolution as at 12/31/2014

As it was well observable in both former cases, the assets of the deposit insurance institution are not enough to compensate entirely the depositors.

d. Országos Betétbiztosítási Alap (OBA)

According to the annual report 2014 of the Országos Betétbiztosítási Alap, the wealth of the fund was significant undergoing a change.
While, the OBA had liquid security portfolio amounted to 91.9 billion forint at the end of 2013, this value fell significantly and amounted to 9.1 billion forint by the end of 2014. Meanwhile, the value of the receivables grew significantly. This process well shows the vulnerability of the system.
In 2014, OBA had to compensate clients of six saving as well as credit cooperative institutions. The value of receivable taken over in relation with compensation was 4.93 billion forint at the beginning of the year. This value grew by gross amount of 102.2 billion forint and fell by 55.79 billion forint based on the impairment calculation. Therefore, the closing data of this item in the balance sheet was 51.34 billion forint.
Consequently, the OBA had to sell its securities in order to compensate clients of the mentioned six institutions and OBA overtook receivable portfolio. However, this portfolio had to be impaired. Eventually, the wealth of the Országos Betétbiztosítási Alap remained 64681 million forint by the end of 2014.

The OTP Bank Nyrt. was the selected parent bank in my calculation.

Based on the different scenarios in my calculation, the compensation to be paid by the OBA is given in the following table.

Table 8: The remaining ensured deposit in case of OTP Bank Nyrt. (million forint)

	Scenario 1	Scenario 2	Scenario 3
Remaining part of the deposits	1685917	1251544	165609
Calculated guaranteed deposits (50.40%) to be compensated by the deposit guarantee institution	849702	630778	83467

Source: Annual report of OTP Bank Nyrt. and Országos Betétbiztosítási Alap, own editing

The wealth of the OBA as of end of 2014 is 64681 million forint but this amount would not be enough to compensate the clients, as it was observed in case of other three deposit guarantee institutions.

Although, such assets were also included in the calculation that could not be easily liquidate in short period, it became obvious that none of the guarantee institution being in the sample could compensate entirely the ensured deposits. As further easing, only one institution was supposed going insolvency procedure in the model. However, if a significant bank has financial difficulties, it would also have effect on solvency of other banks in the practice.

Taking the above into account the thesis H4 has been accepted.

3.4 The wealth of Europena Resolution Fund

In my calculation, I analysed the changing of the ensured deposit portfolios depending on the national GDPs. The following charts depicts the strong correlation between the GDPs of the

sovereigns and the belonging banking ensured deposit portfolios based on data as of end of 2012 (Since Croatia joined in 2014, related data do not indicated) .

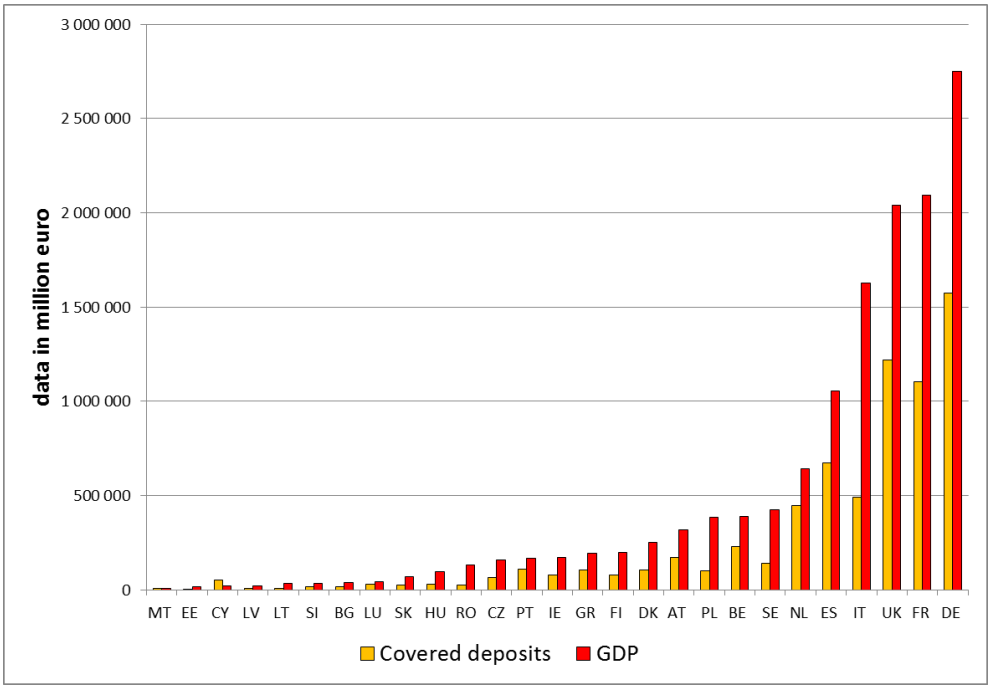


Chart 2: GDP of member states in 2012 and ensured deposits in the member states as of 31/12/2012
Source: based on Eurostat and CANNAS et al., own editing

The strong correlation between the national GDP and the covered deposits of the sovereigns is well observable in the chart.

Taking the continuous changing in ratio of the ensured deposits within the whole deposit portfolio into account, linear regression model was applied where the ensured deposit portfolio was the dependent variable and the national GDP was the predictor variable. The equation of the linear regression model of member states using euro was the following:

$$\hat{y} = 3470{,}7 + 0{,}523299x.$$

If the national GDP grows by one million euros, the ensured deposit in banks registered in the member state in question also grows by 523299 euros. The coefficient of determination (R^2) is especially high (0.95). Since strong correlation has been found between ensured deposits and national GDPs, it can be supposed that the covered deposit portfolio strongly depends on the nation GDP. By using the equation above, the measure of growth in the GDP that generates 55 billion euros wealth of the Single Resolution Fund by 2024 can be determined. The planned wealth of the Fund is one per cent of the ensured deposits. Therefore, the ensured deposit portfolio has to be amounted to 5500 billion euros by 2024 in order to reach the target level of the Fund. Consequently, the following equation is to be true:

$$5500000 = 3470{,}7 + 0{,}523299x.$$

The value of *x* determined on this way is 10503606 (million euros). According to the report of the Eurostat on GDPs disclosed as for 2014, the aggregated GDP value was 10108395 in the euro zone. Based on it, the following interrelation can be specified:

$$10503606 = 10108395 \cdot (1 + r)^{10},$$

where *r* the average growth of the GDPs. Therefore, by using logarithm calculation, *r* is equal to 0.38%. Consequently, only low growth ensures reaching the target level. According to forecast of the European Committee issued in 2015, the determined level specified above will be reached in the euro zone already in 2017. It means, that if there will not be economic growth in the euro zone after 2017, the target level will be reached. However, it is not lifelike. In order to forecast the expected level of the Single Resolution Fund, the expected level of aggregated GDP of in the euro zone has been determined. The following chart shows the quarterly GDP data in the euro zone in the period 2004 and third quarter of 2015.

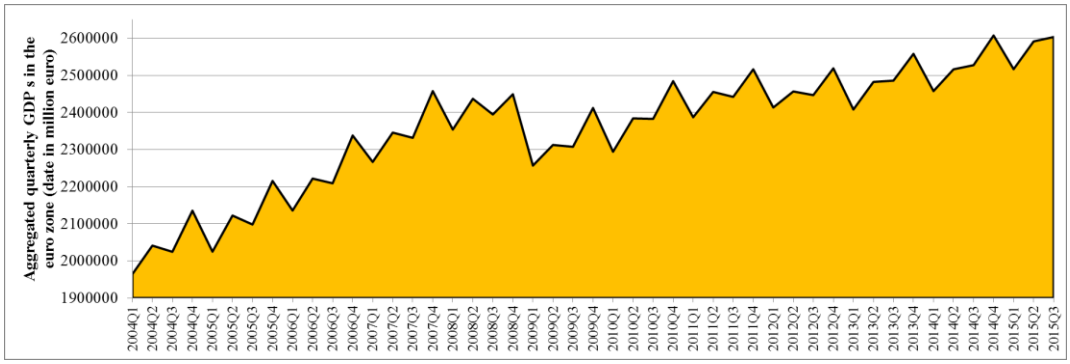


Chart 3: Aggregated quarterly GDP data in the euro zone
Source: based on Eurostat data, own editing

Structural collapse in first quarter of 2009 is well observable in the chart. Similar event cannot be found in the following years. Therefore, in my trend calculation data after first quarter of 2009 were taken into account. Three types of trend was analysed: linear, logarithm and exponential. The following chart shows the different trend lines and the factual.

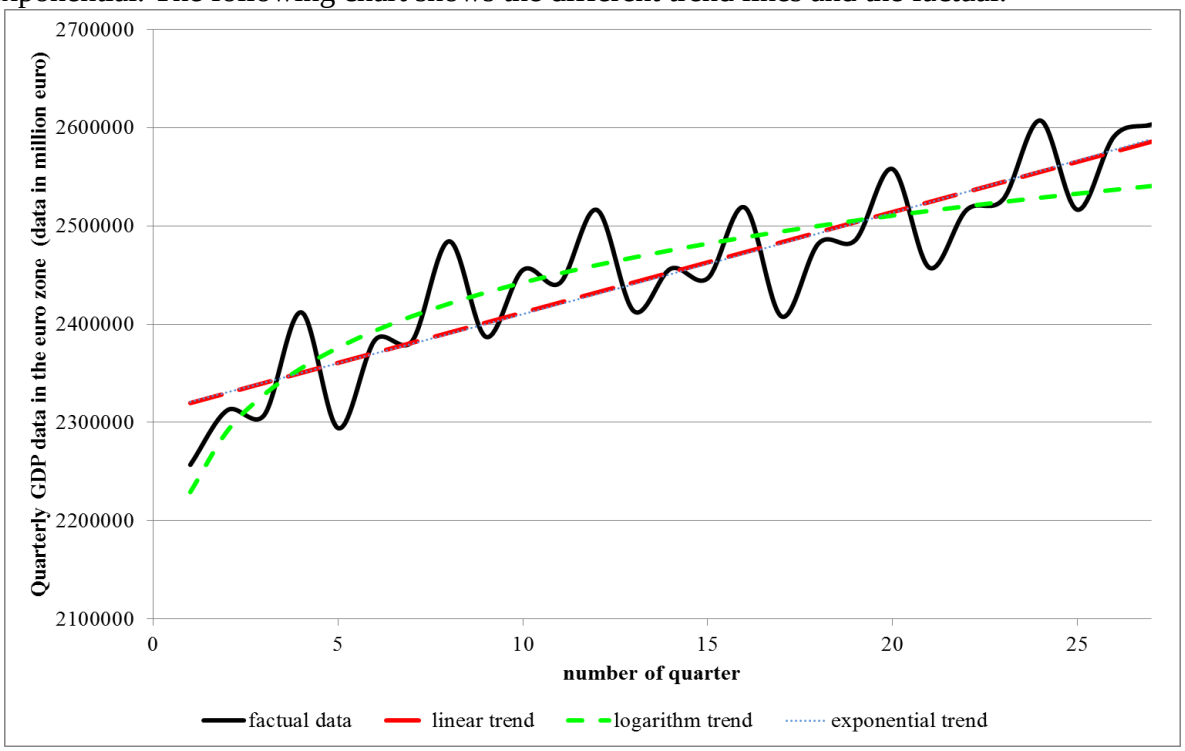


Chart 4: Aggregated quarterly data and the trend lines calculated
Source: Based on data of Eurostat, own editing

Practically, the linear and exponential trends cover each other.

The equations of the trends are the following:
Linear trend:

$$\hat{y} = 2309396{,}37 + 10234{,}10 \cdot t,$$

exponential trend:

$$\hat{y} = 2311172{,}54 \cdot 1{,}0042^{t},$$

logarithm trend:

$$\hat{y} = 2229012{,}17 \cdot t^{0{,}0397}.$$

The equations above are the result of special regression calculation where the predictor value is the number of the quarter within the analysed period. Since, the analysis was made from first quarter of 2009 the value of *t* was 1. In case of second quarter of 2009, the value of the *t* was 2, etc. The last quarter was third quarter of 2015 and the value of *t* was 27.
The least sum of squared errors was in case of linear trend. Using this trend equation, the following values were calculated as for year 2024:

Table 9: Forecasted GDP values based on trend calculation

Quarters	Forecasted GDP value (million euro)
1st quarter 2024	2 933 676
2nd quarter 2024	2 943 910
3rd quarter 2024	2 954 145
4th quarter 2024	2 964 379
Sum	11 796 110

Source: Based on Eurostat, own calculation

Using the $\hat{y} = 3470{,}7 + 0{,}523299x$ equitation, the forecasted wealth of the Single Resolution Fund is 61.764 billion euro. It is higher by more than 12 per cent than the target level declared by European Commission.
Taking this into account, the allegation of the thesis H5 is true.

4. CONCLUSION, RECOMMENDATIONS

Such method was elaborated which makes possible usage of concentration bounds of Herfindahl-Hirschman index based on sampling in relation with a market (e.g. bank market of European Union). When using the model, the accuracy of the estimation is better if the sample is larger.

The estimation method elaborated is applicable in further researches as well as in the practice. For example, if concentration level of balance sheet total of the United States is the subject of the analysis where the Herfindahl-Hirschman is the indicator used, than two conditions must be fulfilled. On the one hand, the aggregated balance sheet total of the banks operating in the United States and number of market players are to be known. There is no other precondition for using this method. By sampling, the value looked for can be estimated.

This method can be used in case of any geographical area. In addition, it can be used (for example) if the subject of the analysis is the retail exposure of a bank. If the aggregated value of the retail exposure and number of retail client is known in that case, the concentration level can be determined by knowing some exposure value belonging to the clients of the bank. Obviously, detailed data are available in the analytical system of the bank analysed but these

date are not known by investors, economic analysts, etc. However, by using this method they have opportunity to estimate the concentration level of retail exposure of the bank analysed.

The mutual feature of former estimations of Herfindahl-Hirschman index is that the value of first k ($k \in \mathbb{Z}^+$) largest market players had to be known. This method does not need this but it must be noted that the measure of the sample has effect on accuracy of the bounds.

This method can be used when analysing the concentration level of bank operating in the European Union because the two preconditions mentioned above can be fulfilled. The Statistical Data Warehouse contains aggregated data on balance sheets and income statements. It is a special case. Generally, the accurate aggregated values of the market and accurate number of market players are not known. However, data on banking market of the Union as well as data on banking market of member states are available.

The concentration level of total balance sheet, own funds, net interest income and net fee income was calculated during my analysis by determining bounds of the Herfindahl-Hirschman index, Gini-index and CR_3.

When the single European Banking market was the subject of the analysis and the concentration level of total assets, own funds, net interest income and net fee income of the 4408 banks or banking group were calculated, the concentration level was quite low. This result is underpinned by Gini-index and CR_3 index calculations.

The internal banking concentration of the sovereigns was also analysed in case of abovementioned balance sheet and income statement data. Bounds of Herfindahl-Hirschman index shows high concentration level in case of nine countries and significant level in case of three further countries. As for own fund, net interest income and net fee income, the concentration level at least medium. Furthermore, in one third of the member states the concentration level is high. The Gini and CR_3 indexes show similar result.

Even if new resolution rules were issued, the strong asset concentration within the internal banking activity of the member states bears risk of usage of taxpayers money for bail out a large bank during critical financial situation. Furthermore, if a significant bank was close to the bankruptcy, the wealth of the related deposit insurance institution would not be enough to entirely compensate the depositors.

There are more opportunities for reducing the risks caused by large banks.
On the one hand, additional capital requirement could be ordered above certain level of total assets. This additional capital requirement could be determined as per measure of exposure of the large banks. Obviously, this solution hurts the competitiveness of the large banks. However, that could cause higher level of security and confidence.
On the other hand, enlarging the level of deposit insurance and resolution funds contribution could be progressively enlarged based on the total assets or based on the exposure of the banks. The reason for this idea is such approach according to which a larger bank in financial difficulties could cause larger problem during the deposit compensation or resolution processes. The recent system of deposit guarantee schemes and single resolution mechanism is the result of long negotiation process. There is no valid regulation for determining and uploading the wealth of the Single Resolution Fund but an intergovernmental agreement regulates its level and its uploading mechanism. In the recent economic environment, lifting the uploading obligation of the banks has low probability. However, raising the wealth of

deposit guarantee funds can be reached on easier way because they are under national management.
There is one more opportunity to reduce the risk origination from banking concentration. It is itself the concentration reduction. If the number of competitors in the market grows or the aggregated market performance decreases, the market concentration also decreases. If the number of market players and the level of market performance remain on the same level but the market performance is smoother distributed, the concentration level also decreases. Naturally, reduction of the market performance is not a good goal. Therefore, the smoother distribution of the market performance or increasing of the number of market players could be the solution. A good example for the latter is the appearance of the telecommunication firms in the financial market by offering services to be provided via mobile tools. Furthermore, spread of the so-called fintech (financial technology) companies also could reduce the banking market concentration.

5. LIST OF PUBLICATIONS

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