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DOCTORAL THESIS

ABSTRACT

RECORDS OF THE INTERFERENCE BETWEEN THE ASSETS AND LIABILITIES OF COMMERCIAL BANKS

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STRUCTURE OF THE DOCTORAL THESIS

KEY WORDS

resource and investment management, ALM models, banking stability, performance, correlation, canonical analysis, dependency, interference.

RECORDS OF THE INTERFERENCES BETWEEN THE RESOURCES AND INVESTMENT OF COMMERCIAL BANKS

"Essentially, all models are wrong, but some are useful."
Box, George E. P.; Norman R. Draper (1987). Empirical Model-Building and Response Surfaces.

“If you put two economists in a room, you get two opinions, unless one of them is Lord Keynes, in which case you get three opinions.”(Winston Churchill)

INTRODUCTION

As a result of the fact that the knowledge process, especially in the economic field, is ongoing we often find ourselves in a situation where the theories used and known so far are challenged, we have paradigm shifts and new theories arise that try to explain the functioning of the economic system. As economists, we feel this much stronger than other professions. The reasons for which economics undergoes changes are due, in particular, to the fact that it is a social science which leads to the impossibility of replication experiments / studies in the same conditions.

The *importance* of the research topic on resource management and investment banking, reflected in the thesis "Records on interference between resources and investment of commercial banks" derives from the central role that banks have in modern economies, the financial intermediary and obviously the contribution of the commercial banks to the economic crisis of 2008-2009. The need to analyze the methods and techniques used in the management of resources and investment is related to the identification of instances where banks are unable to quantify and predict the risks that arise as a result of transactions, this limitation leading to the appearance of the greatest economic crisis since the Great Depression.

The current economic climate, where we have a frail recovery of economies after the economic crisis, has brought to attention of the public and professionals themes related to the role of financial and banking institutions, namely the way of supervision and regulation in financial and banking area. Steps have been taken to increase the resilience of the banking sector to shocks, for example, the Basel Committee has established a timetable for the implementation of new regulations (Basel III), which aim to introduce new surveillance indicators and tighten the existing ones. Regarding the impact of these regulations on the banking system the opinions of the researchers are divided, some perceive the regulation as a necessity in time while other researchers believe that the economic impact of the measures proposed by Basel III will be negative. In this context the role of "risk management" within banking institutions and resource and investment management occupy the

attention of specialists in the field.

The purpose of resource and investment management is related to risk management using methods and techniques that lead to the quantification of the existing and probable risks for a better understanding of the challenges the financial institution is financing. By banking asset-liability management (ALM) is meant the optimization of income, and profitability, given the risks that manifest themselves in the market. In Romania the banking resource and investment management is generally used by big banks and in the case of smaller commercial banks we do not find distinct department of resource and investment management but only risk management department.

Through resource and investment management a liquidity planning is performed according to maturity bands; it is considered the internal transfer of funds; special attention is paid to the level of capital and methods of its use thereof; instruments for measuring profitability and, of course, risks are used.

Resource and investment management models both dynamic and static placements began to be developed since the 80s (van Deventer & Uyemura, 1992), the long period of use and refinement of the models used makes that now bank managers have increasingly more precise tools in risk management or banking resource and investment management. Resource and banking investment management represents a cost / profit analysis of the level of the assumed risk, asset and liquidity (Kusy & Ziemba, 1986), it becomes clear from the definitions given that the cornerstone of resource and investment management is risk management. Regardless of models used, the existing regulations, the risk and uncertainty will always be present in the banking system; the difference between risk and uncertainty according to (Knight, 1921) is given by the fact that the risk is measurable in time whereas the uncertainty cannot be quantified.

The *research* conducted interference of resources and banking investment aims to identify the links that are established between assets and liabilities, given the linear dependencies between asset and liability stations. The research conducted is focused on the structure of banking investment and resources of the European banks.

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The purpose of the research is to identify, analyze and monitor the evolution of resources, investment and capital within banks; particular attention being given to the requirements of banking supervisory and regulatory bodies.

An essential part of this work is the practical study that analyzes the correlation of resources and banking investment using canonical analysis method. In order to achieve this goal the following objectives were set: to present the evolution of the concept of risk and the contemporary approach of the concept of risk; to assess the tools and indicators proposed by Basel III; to analyze the impact of Basel III on banks and economies; to analyze the patterns of resource and investment management; to define and quantify banking stability; to analyze the banking performance indicators in the period 2005-2013; to analyze the bank assets and liabilities structure using the canonical correlation.

The practical part of the thesis is focused on identifying the mutations that occurred in the structure of resources and bank investment, namely the identification of linear interdependencies between resources and investment; the emphasis is on the interference of resources, investment and capital in banks.

In terms of structure and organization, the thesis is divided into four chapters presenting in detail the objectives set, completing the existing research in the field of dependencies of resources and investment within banks. If (Deyoung & Yom, 2008) analyzes the structure of assets / liabilities of the US banking system and (Memmel & Schertler, 2012) of the German banking system, this paper extends the analysis to a sample of European banks.

The first chapter - *The risk and bank resource / investment management*- deals with banking risks and the role of Basel role within risk management, analyzing the impact and the role of Basel III regulations have on the banking system and economies. This chapter also discusses the importance of risk measures used in the financial system, analyzing the compliance with the "consistency" properties by the VaR and CvaR indicators.

The second chapter - *Resource and bank investment management* – examines the models used in ALM, the relationship established between risk management and

ALM or the limits of models used in the event of shocks that lead to structural changes in the connections between economic and financial variables. It is also discussed in detail the static and dynamic models used in resource and bank investment management, highlighting the advantages or limitations of these models.

The third chapter – *The comparative analysis of bank performance in the European banking system* - addresses the concept of financial stability and the link between the banking system on the one hand and the economic growth on the other. The comparative analysis of bank performance is conducted on a representative sample of European banks following the banking performance in terms of indicators related to: *asset quality, capital adequacy, operational results and bank liquidity.* The research strategy aiming to analyze the procyclical/ anticyclical character of the banking system, the impact of the economic crisis on the performance indicators, namely the correlations established between those indicators.

Chapter four – *The quantification of interference of resources, investment and capital* - includes the analysis of the structure of resources and bank investment. Using the canonical analysis on the sample of 228 banks in the period 2005-2013, we studied the correlation established between resources and banking investment and its evolution over time. By the canonical correlation it can be seen the complexity of the linear links between resources and banking investment together with the identification of asset / liability stations that contribute mostly to explaining the variation of the commercial banks' balance sheets.

CHAPTER SUMMARY I
THE RISK AND RESOURCE AND BANK INVESTMENT MANAGEMENT

The first chapter deals with the role of resource management and bank investment (assets-management -ALM Liabilities) and the analysis of the methods and techniques used in commercial banks.

Regardless of the models used, the existing regulations, the risk and uncertainty will always be present in the banking system. The financial system (Levine, 2005) analyzes and generates information on investment projects / capital allocation, monitors the investment, providing risk management arrangements that is why, due to the nature of banking activity, banks can be treated as *risk transformation machines*. By risk management and resource and investment management (ALM) banks act as important gears of economies that internalize risks and attempt to minimize the negative effect on the real economy.

Examining whether the financial system is a shock absorber or on the contrary their amplifier (Allen & Carletti, 2008, p. 3) consider that if there are no market failure the financial system acts as a shock absorber, thereby reducing the overall risk; in the case where there is the effect of market failure it acts as a shock amplifier. In the case of market failures it is desirable a state intervention if the balance the market becomes stable is suboptimal (Goodhart, 1998); the information asymmetry, externalities and the degree of bank concentration are also causes of market failure which amplify the risks within the banking system.

The capital and debts are not interchangeable, especially for banks the cost of capital is much higher than the debt, which is a clear violation of the Miller-Modigliani theorem on capital structure. The role of capital for banks being (Aiyar, Calomiris, & Wieladek, 2015, p. 27): loss absorber and it stimulates an effective risk management; while a high level of capital may adversely affect the level of lending. Thus the level of capital held by banks influences the structure of debts.

The impact of Basel III implementation of the provisions on economic growth ranging between -0.05% and -0.15% per year (Slovik & Cournède, 2011)

factor most important generator is increasing interest due to the increasing cost of capital is estimated rate increase interest rate by 15 basis points (Slovik & Cournède 2011, p. 8) following the transfer of capital costs on bank customers. Basel III implementation costs must be weighed against the costs arising from the banking crisis, banking crisis impact on the economy beyond the Basel III implementation costs. The impact of Basel III provisions implementation on the economic growth ranges between -0,05% and -0,15% per year (Slovik & Cournède, 2011), the most important generating factor being the increasing interest due to the increasing costs of capital, it is estimated an increase in the interest rate by 15 basis points (Slovik & Cournède, 2011, p. 8) following the transfer of capital costs on bank customers. The costs of Basel III implementation must be weighed against the costs arising from the banking crisis, the impact of the banking crisis impact on the economy beyond the Basel III implementation costs.

Another important issue to be examined is the consistency of the risk measures used. Risk measure (Artzner, Delbaen, Eber, & David Heath, 1999, p. 2) means a function that is used to quantify the risk, by using a risk measure determining the level of minimum capital to be set aside to cover the losses that may occur as a result of the risk.

A risk measure $\rho : X \to Y$ is considered coherent if satisfies the following properties (Szego, 2002, p. 1259): is monotonous, positive homogeneous, subadditive, invariant to translation. These properties of risk are not to be found in the case of Value at Risk. None of the risk measures (Yamai & Yoshiba, 2005, p. 1014) is not perfect, VaR is subadditive and does not show the maximum loss, CVaR on the other hand requires observations over longer periods of time and, even in this case, the estimation errors are greater than the VaR. There is no adequate risk measure that can present in a single figure the complexity of the financial markets, (Yamai & Yoshiba, 2005) drawing the attention to the need for complementarity between CVaR and VaR in the risk management process. Thus, together with using VaR and CVaR it is necessary to use other indicators in order to grasp more clearly the risks the financial institutions are facing.

CHAPTER SUMMARY II
RESOURCE AND BANK INVESTMENT MANAGEMENT

The Management of Financial Institutions has two fundamental objectives (Sironi & Resti, 2007, p. 657): to ensure an adequate level of capital relative to the level of risk and to optimize the capital or debt structure. For the financial institutions the role of integrated risk management is particularly important due to the functioning of the financial markets, the structure of assets and liabilities, respectively due to the impact of the regulations of the supervisors.

The asset liabilities management (ALM) is defined by (Rosen & Zenios, 2008) as the strategic balance sheet management, other authors (van Deventer & Uyemura, 1992) define resource and investment management as revenue and expenditure management in view of maximizing the profit, adjusted to the level of risk, and considering the long-term interests of shareholders; also ALM follows the risk management emerged due to the differences in maturity between bank resources and investment. The purpose of ALM is integrated risk management in terms of risk management at the level of financial institutions, having different objectives: profitability, liquidity, solvency or even the risk level may be an objective (Ferstl & Weissensteiner, 2011).

In order to achieve an efficient resource and investment management various models have been developed, (Stavros A Zenios & Ziemba, 2006) classify the models of resource and investment management according to the period of time analyzed and the influence of random variables, thus resulting four categories: static models in a single period (annual), static models over several periods (multi), stochastic models (dynamic) over a single period of time, dynamic models over several periods of time.

One of the limitations of the resource and investment management models derives from the basic models used to explore the relationship between variables; financial markets dynamism, the speed with which information spreads, market fluctuations, external shocks require the existence of models encompassing and rapidly responsive to new information. The resource and investment management

models, dynamic or static, use the information already available at moment t_0 to optimize the function objectively at the times $t_1, \ldots, t_n$, by using simulations and scenarios optimal decisions being made based on information available at the moment t_0. The problem that arises is related to the fast inclusion within the earliest resource and investment management models of all available information / shocks affecting the classes of assets / liabilities held by the financial institutions, especially banks, from the moment $t_0 \rightarrow t_n$.

When researchers use a model they must take into account that the models used are stable, the parameters of the estimated equations are constant over time. The issue of realization of the forecasts in case of structural breaks is brought in by (Pesaran, Pettenuzzo, & Timmermann, 2006, p. 1058) showing that where there were structural breaks in the past then they will certainly manifest in the future, to quantify the risk of structural breaks and their influence on prognosis.

Specifying the model used in the assets-liabilities management should take into account the existence of break points as specifying the wrong model may influence the scenarios used, which can lead to making wrong decisions adversely impacting the financial institution.

It is true, on the other hand, that such modelling becomes more complex and subtle changes can lead to contradictory results, yet any additional information is essential especially in times when markets are volatile; although more complex, by using models that incorporate structural breaks the financial institutions that are the first identifying the regime changes will be in a position to benefit from a competitive advantage compared to the other players in the markets in which they operate.

CHAPTER SUMMARY III
THE PERFORMANCE IN BANKS

The importance of the banking system is given by the influence that the banking system has on the economic growth and development (Barth, Lin, Ma, Seade, & Song, 2013, p. 2; Levine, 2005, p. 869), namely the direct link between a banking system operating at optimum levels and the level of economic growth. The existence of causality between the economic growth and the state of the banking sector emerges from the analyses performed on data for companies. If the studies on the correlation between the degree of development of the financial sector and the economic growth show that there is a direct link between the two so the question whether "what's too much hurts?" can be raised. If the analysis is performed at a granular level, the conclusion is that with the exceeding of a threshold level of the credit / GDP ratio, the influence of the financial sector on the economic growth slows and may even be negative. (Pagano, 2012) raises the question of the effects the financial system has, when overdeveloped, expressing it in a plastic manner (Pagano, 2012): from the "blood" of the financial sector the economy becomes its "poison". According to (Pagano, 2012, p. 4) the relationship established between the financial sector and the economic growth does not have the shape of a monotonically increasing function but rather the banking sector can become hypertrophic to the real sector. (Arcand, Berkes, & Panizza, 2015, p. 8) show that the shape of the link between the economic growth and the degree of growth of the financial sector is of concave type, the positive effect of the financial sector development is found in countries with low and medium financial sector, once the ratio of private credit and GDP exceeds the level of 80-100%, the link becomes negative. (Arcand, Berkes, & Panizza, 2015, p. 20) explains the phenomenon of reverse link between the financial sector and the economic growth due to the increased volatility at the economic level, the high number of economic crises and the inefficient allocation of capital. The main idea when analyzing the influences between the financial sector and the economic growth is actually the link between an optimal banking system and the level of economic growth; where an

optimal banking system has as main features: performance and stability.

Given the impact of financial crisis on the global economy is understandable the concern of researchers in analyzing the types of financial crises, their effects (Claessens & Kose, 2013) the degree of stability of the financial sector, namely the bank. Banking crises have high costs on the economy, for example in the case of Ireland tax costs were up to 40% of GDP (Laeven & Valencia, 2013) and for US the costs for taxpayers were in the sum trillions of dollars (Atkinson, Luttrell, & Rosenblum, 2013), while recessions following banking crises are long-standing and influence the long-term economic growth. Given the impact of financial crisis on the global economy is understandable the concern of researchers in analyzing the types of financial crises, their effects (Claessens & Kose, 2013), the degree of stability of the financial sector, namely the banking sector.

The financial system, naturally, regulates, self-analyzes and monitors through markets, sending signals to participants (e.g. an increase in country risk translates into raising the interests demanded by investors), in addition to self-regulating systems the financial system benefits from, the national and international supervisory authorities having an important role. Yet, as the financial markets fail to function always perfectly may constitute a serious risk to the financial stability, such example is the periods of speculative bubble, during which the asset prices have no real or fundamental basis in fact making the allocation inefficient at the economic level.

In order to grasp the evolution of the banking sector performance and the impact on the economic growth, the analysis performed is based on four major categories of indicators: asset quality indicators, capital adequacy indicators, operating results indicators, indicators regarding bank liquidity.

The high level of NPLs influence bank lending through three channels (profitability, capital requirements, risk level) (Aiyar, Bergthaler, et al., 2015, p. 9)□, reduced profitability due to credit defaults occurring due to the need to implement provisions makes that funds that could have been used for credits (under normal conditions) to fall. Another channel of expression is given by the higher capital requirements, the risk associated with non-performing loans is naturally higher which

may bring banks in the position of having to make additional capital. In the same time, the financing capacity of the banks with a high degree of NPL in the balance influences the perception of the investors about the risks they are exposed to. All these lead to a decrease of the lending level in economy, making banks behave pro-cyclically.

The positive development of capital adequacy indicators indicates a banking sector which is recovering from the shocks of the crisis yet when we look at the evolution of indicators in comparison with the economic growth rates we notice that the periods of growth of capital adequacy indicators correspond to periods of economic downturn.

The main cause of the decrease in profitability of the banks analyzed is given by the economic crisis, the decrease in banking efficiency due to the impact of the economic crisis (Matousek & Rughoo, 2015) being observable across the entire European sector. The impact of the economic crisis on the profitability of banks is lengthy, the first step that banks need to realize is lowering the costs and continue the process of cleaning the balance of bad loans, only then being able to discuss the recurrence of a functional/profitable banking system. It is necessary to develop and implement tools that reduce the procyclical character of the banking system, although Basel III recognizes the limitations of the previous agreements and has in view the use of countercyclical instruments; the effectiveness of these measures remains to be demonstrated, in the same time the banking system is required to achieve a compromise between profitability on the one hand and liquidity, on the other hand and solvency respectively.

Given that the objective of the banks to ensure long-term profitability for shareholders it is necessary to have a balance between the liquidity needs of the banks, solvency and the strategy of lending, with of course an adequate level of profitability, yet achieving this kind of balance is particularly difficult to achieve in practice.

CHAPTER SUMMARY IV
THE QUANTIFICATION OF INTERFERENCES OF RESOURCES, INVESTMENTS AND CAPITAL

Measuring the dependence of resources and bank investments must consider the role that the asset management and banking liabilities have in meeting the profitability targets of the banking institution. Measuring the bank performance (Heffernan & Fu, 2010; Hughes & Mester, 2008; Kosmidou, Pasiouras, & Floropoulos, 2004) is performed using profitability indicators, economic value added, the net interest margin, Sharpe indicator, Robin indicator, cost / income ratio, liquidity indicators, the reserves for loan losses / total loans ratio, capital / total assets ratio or the total assets level of banks.

(Hester & Zoellner, 1966) analyzes the impact of the structure of assets and liabilities on the bank profitability using the linear, (Crum, Lund, & Van Auken, 1987; Stowe, Watson, & Robertson, 1980) on the other hand uses the canonical correlation to study the structure of assets and liabilities and the relationships established between them in non-financial companies, noting the complex relationships established between the various balance sheet items. The same method, the canonical analysis, is applied in the analysis of the assets / liabilities structure of the bank by (Simonson, Stowe, & Watson, 1983) showing that unlike the regression method by canonical analysis it succeeds in capturing the links between two sets of variables, the canonical analysis method being superior in expressing the complexity of the financial institutions.

The structure of bank assets and liabilities plays an important role on bank profitability (Deyoung & Yom, 2008; Memmel & Schertler, 2012) existing clear differences in terms of balance sheet structure according to the size of the assets held by the banks, differences that have an impact on the profitability of the banks. The canonical analysis was used in studies on the structure of companies (Auken & Lema, 2003; Helleloid & Sheikholeslami, 1996; Van Auken, Doran, & Yoon, 1993), in the case of the Spanish firms (Auken & Lema, 2003) being highlighted the use of various

hedging strategies or the use of a mix of cash and long term debts in the process of risk management. (Helleloid & Sheikholeslami, 1996) explores the systemic relationship of the subsidiaries of American multinationals using as a method to capture these relationships the canonical correlation, the results suggesting the existence of links between the income levels in other countries and the investments made abroad, the use of long/short term debts for investments at the expense of using equity. (Van Auken et al., 1993) also uses the canonical correlation to capture the interdependencies in the balance sheet structure of Korean companies, noticing similar interdependencies in the balance sheet structure of Korean companies with the balance sheet structure of American companies.

The canonical correlation analysis is part of the category of multivariate analysis techniques, this method offering the possibility of exploring the relationships between two sets of variables, the objective of the canonical analysis is to reduce the multidimensionality of data in the case of subsets of explanatory variables (Jaiswal, 2010, p. 46), respectively if in the case of multiple regression the relationship between one dependent variable and several independent variables is analyzed, by canonical analysis the relationships between the two sets of variables, without the use of assumptions about the causality between the two sets of variables is analyzed simultaneously.

The canonical correlation analysis method has the following mathematical foundation (Härdle & Simar, 2007, p. 321): be two groups of variables X formed of *p* variables $X = [X_1, X_2, ..., X_p]$ and Y formed of *q* variables $Y = [Y_1, Y_2, ..., Y_q]$, based on which we will build the liniar combinations,

$$U = a'X = \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + ... + \alpha_p X_p \quad (1)$$

$$V = b'Y = \beta_1 Y_1 + \beta_2 Y_2 + \beta_3 Y_3 + ... + \beta_q Y_q \quad (2)$$

where $a' = [\alpha_1, \alpha_2, \ldots, \alpha_p]$

and $b' = [\beta_1, \beta_2, \ldots, \beta_q]$

represent the vectors of canonical coefficients and the linear combinations *U=a'X* and *V=b'Y* are canonical variables. In the case of the second canonical correlation the variables maximize the degree of correlation between all the options that are

uncorrelated with the first pair of canonical variables, thus if p> q then we will have a maximum of q correlations between the two groups of variables. The first canonical function with a certain level of correlation between the two linear combinations uses for the maximum the variance between the two sets, the residual variance unexplained by the first correlation function is then used by the second correlation function (etc.). Each canonical function being orthogonal with the other canonical functions obtained. The canonical loadings or the canonical factors are defined as the correlation between the *U, K* canonical variables and the group of initial variables $X_i,\ Y_j$, respectively:

$$Corr(X_i, U_1) = Corr(X_1, \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + ... + \alpha_p X_p) \quad (3)$$

$$Corr(Y_j, V_1) = Corr(Y_1, \beta_1 Y_1 + \beta_2 Y_2 + \beta_3 Y_3 + ... + \beta_p Y_p) \quad (4)$$

There is a high possibility that the high linear correlation coefficient is due to the existence of a strong correlation between one variable of the group $X = [X_1, X_2, ..., X_p]$ și $Y = [Y_1, Y_2, ..., Y_q]$, therefore the redundancy coefficients are analyzed which provide information on the level of variance explained by the group of variables *X (Y)* within the individual variables $Y_j(X_i)$(Deyoung & Yom, 2008, p. 14)□. The benefits of the canonical analysis are given by the fact that it does not use assumptions about causality (the resources influencing the investments or vice versa), the canonical analysis applied to the banks' balance sheets believes that both pulling resources and allocating investments are interconnected, by the canonical analysis measuring the correlation (covariance) between the asset and liability stations in the balance sheet. The canonical correlation coefficient presenting the correlation at the level of assets and liabilities, the analysis of the redundancy coefficients includes the impact of the assets (liabilities) on the liability (asset) stations, and the canonical factors show the link between the asset (liability) stations and the linear combination of assets (liabilities), thus the canonical analysis can capture both the link between the individual variables and the linear links between the two groups of variables analyzed (assets /liabilities).

The structure of resources and bank investments in the major banks (228 banks) within the European Union and Switzerland was analyzed. The data used (annual) are retrieved from the Bankscope database and include the period 2005-2013.

The classification was performed using the balance sheet stations of asset / liability, respectively the eight groups of assets / liabilities. In terms of the liability evolution it can be noticed the increased level of own funds and short/long term deposits concomitantly with the decline in deposits from other banks. The capital held by banks is increasing, in the period under review, the banks analyzed having the objective to replace volatile funding sources with stable funding sources.

In order to grasp the homogeneous nature of the banking systems in the countries analyzed the hierarchical agglomeration analysis was used on the cross-sectional (transversal) data in the years 2005, 2009 and 2013; the measure used to capture the similarities was the Euclidean distance. In 2005 the clusters had the following composition: Cluster 1 (C1): Luxembourg, Belgium, Germany, Great Britain, Finland, Italy, Denmark, Malta; Cluster 2 (C2): France, Spain, The Netherlands, Sweden, Ireland, Portugal, Austria, Latvia, Switzerland; Cluster 3 (3): Czech Republic, Cyprus, Slovakia, Poland, Romania, Croatia, Slovenia, Hungary, Lithuania, Estonia, Greece, Bulgaria. In 2009 Austria passed from cluster 2 to cluster 3, in 2013 Austria, Estonia, Lithuania, Hungary and Slovenia passed from cluster 3 to cluster 2.

In terms of balance sheet structure European banks are not homogeneous, yet three groups with higher homogeneity can be identified, which geographically are divided on east-west (Western Europe - Eastern Europe) axis; and between the cluster made up primarily of Germany / UK / Finland / Italy / Denmark, on the one hand and France / Spain / Portugal, on the other hand. The banking supervisors at the European and the ECB level should take into account the existing heterogeneity in the European banking system when implementing monetary and supervision policies.

The bidirectional correlation analysis between resources / investment shows that there is a transformation of liquidities into financial investment and that the two are complementary, and also the transformation of long-term deposits into cash can be seen; a positive correlation was observed with the link between equity and cash at hand. Thus the liquidity of banks is directly influenced by the type of funding sources, the banks showing a preference for long-term funding sources. The banks analyzed

actively use derivatives as a method to reduce the risk; the financial assets station, namely the passive station of Derivatives having a high number of significant correlations with other balance sheet items.

When analysing the allocation of assets we observe that the balance sheet items made up of loans (mortgage, consumer, corporate or other types of credit) are generally negatively correlated between them; regarding the correlation with the liabilities there is a differentiation, the short-term investment are financed from short term sources while the long term investments are financed from long term sources.

The economic crisis has caused mutations in the financing of the banks, so they prefer to attract funds from other banks only if they fail to finance from deposits (short / long) or other sources.

The results of canonical analysis on the sample of European commercial banks show that there is a high independence between asset and liabilities of commercial banks, the values of explained variance ranging between 0,65-0,80. For the analyzed banks the first canonical function explains 47% (in average) of the variance of asset/liabilities, the second canonical function explains 30% (in average) of the residual variance, the third canonical function explains 18% in average) of the residual variance. The shocks experienced by banks in 2007-2008 period led to an increase in the dependency of assets and liabilities, for the 2010-2013 period the dependencies have decreased; which shows that in the case of commercial banks there is an active use of risk management tools, they diversify their products in order to reduce the correlation between resource / investment.

FINAL CONCLUSIONS AND PROPOSALS

The bankruptcy of Lehman Brothers in September 2008 has led to a change in the perception regarding the banking system, also the risks levels associated with the banking system increased after the crisis in 2007; therefore, in this context is necessary to understand how banks perform the asset-liability, respectively what is the impact of the changes in the structure of balance on the assets and liabilities.

The importance of banks in modern economies is given by their role in analyzing and generating information on the funded projects, the role of banks being to transform and minimize risks; thus, banks should act as a buffer against shocks but the reality has demonstrated the opposite. Banks have failed in their task of minimizing the risks, on the contrary they acted as an amplifier of risk, generating an economic crisis with the impact and duration comparable to those of the Great Depression.

The supervisory authorities, through their rules and regulations (for e.g. Basel III), seek to increase the resilience of banking sector to the exogenous/ endogenous shocks; the proposed regulations aim is to decrease the effect of shock transmission from the financial system to the real economy, all of these measures will lead to an increase in stability of the financial sector. The positive or negative effect of regulations under Basel III Accord are still debated, with no clear consensus on the impact that this package of measures will have, the studies showing a mixed impact of the new capital requirements.

The purpose of asset-liability management is this: reducing the risk levels while achieving the highest possible profitability. The objective of the research conducted on the interference between assets and liabilities is to identify the links which were established between the assets and liabilities of banks, through the

analysis of linear dependence between assets-liabilities, given the linear dependencies between asset items and liability items. The risks which financial institutions are facing, the risk management, and asset-liability management are directly connected; thus, through a more accurate measurement of banking risks one could make better decisions on how to control and minimize their risk.

The optimization models used in ALM provide optimal solutions based on the type of variables used and based on the way in which we infer from their evolution, the main limit of these models is not given by the mathematical-statistical apparatus but from the assumptions, hypothesis used: the type of function distribution, the links between the analyzed variables, namely how to incorporate shock in these models. The fundamental limitation of the used model is given by their inability to identify relevant information or to incorporate the shocks. The models specification must take into account the dynamics of economies, they must identify the regime changes, because specifying the wrong models can lead us to a situation in which we take decisions based on erroneous information.

The importance of the banking sector is well known, however an oversized banking sector is changing banks from their role as the "blood" of the economy to the "poison" of economies (Pagano, 2012). The main idea being that there is an optimal level of banking sector and also that banks must be profitable and stable.

In the case of the banking sector the 2007-2008 crisis has brought renewed attention to the terms of moral hazard and "too big to fail", due to the fact that supervisory authorities were forced to intervene in order to limit the domino effects that the banking system had on the real economy; because the repercussions generated by the failure of a systemic bank is much higher, in term of cost, than the costs of intervention.

Banks may be an important risk to the financial stability, which depends on the following factors: ownership structure, market share growth, lending levels in previous years, the ability to finance and refinance on the foreign/local markets or

through international institutions, the role of macro-prudential supervision being to keep the banking system healthy, efficient and stable.

The commercial banks from Central and Eastern Europe, the Baltic and Mediterranean regions are face with the highest levels of non-performing loans. The financing capacity of banks with a high degree of NPL on their balance sheets influences the perception of investors about the risks posed by banks, also their ability to lend to the economy is limited, this shows that the banking systems has a high procyclicality.

The evolutions of the capital adequacy indicators indicate a banking sector that is recovering from the shocks of the crisis; but when we compare the indicators of capital adequacy to those of economic growth it can be observed that a rise in capital adequacy indicators correspond to economic downturns; therefore, the capital adequacy indicators are having a procyclical behaviour.

For the analysed period all the profitability indicators are decreasing, the most vulnerable countries are those in SE Europe and the Mediterranean countries. The impact of economic crisis on the profitability of commercial banks is one of longer duration, banks must reduce the expenditure and continue the process of cleaning their balance sheet of bad loans, only then we can discuss about a profitable banking system -> high-achiever -> stable.

It is necessary to develop and implement tools that reduce the procyclicality of the banking system. The Basel Committee, through Basel III Accord, is aware of the limits of previous agreements and provides countercyclical instruments, at the same time the banking system is required to achieve a compromise between profitability and liquidity on the one hand, and solvency on the other hand. Due to the fact that the aim of banks is to ensure long-term profitability for shareholders it is imperative that the liquidity needs of the banks, the capital adequacy and the level of

capital to be in balance.

Regarding the structure of asset-liability of banks, due to the difficult economic climate and high risks of default for corporate and consumer loans their levels remain almost unchanged in the 2005-2013 period, the banks preferring to grant loans with collateral (real estate) and to increase their liquidity (especially cash). The level of cash doubled, also the banks increased mortgage loans, which are considered safer than consumer loans or corporate loans.

The banks adjust the level of the capital which they hold and grow the share of deposits, both short term and long term. Other changes occur in the balance sheet of analyzed commercial banks, banks increased their currency holdings while reducing the exposure to the rest of the banking system; this shows that the banks for the 2008-2013 period have an increased aversion to risk, their balance sheet structure changed from risky/volatile assets/liabilities toward more stable sources of financing and also to investments with a low risk.

Regarding the similarities of European banks systems the cluster analysis, done by country, shows that the European banking system is still one of heterogeneous type. We identify three major clusters in the 28 countries analysed, discussing their homogeneity of asset-liability the clusters formed from the developed countries of Western Europe plus some countries from Central Europe and the Baltic area have the closest structure of asset-liability.

The method used, the canonical correlation analysis, does not make any assumptions about the causal connection between assets-liabilities, there are some limitations of the results. The canonical correlation analysis captures only the linear link; but there are, possibly, nonlinear influences which are not captured by this analysis. Another limitation of the method is given by the fact that we do not use information from the profit and loss account. These limitations of results can be

overcome by extending the canonical analysis to more than two groups of variables in order to capture the relationship between assets, liabilities and performance indicators.

The results of the bidirectional correlation analysis between assets-liabilities indicate an intensive use of financial instruments in order to minimize the liquidity and maturity mismatches between assets and liabilities. The financial assets and the derivatives have the most significant correlation with the other balance sheet items. Another observation is that long-term deposits and own funds have a high correlation with liquidity items. Especially after 2007, the commercial banks have a strong preference for long-term funding sources.

Thus, banks behave, increasingly, in a way that follows the irrelevance financial structure theory (Modigliani & Miller, 1958), respectively there is an increasing independence between assets and liabilities; an important role, in this increase, is being played by the intensive use of financial instruments. The downward trend of the dependence between assets and liabilities was discontinued with the emergence of the financial crisis, which shows that although banks have actively used tools to reduce risk, these tools actually were correlated with the economic cycle.

The final goal of this research is to identify the interference that exists between the assets, liabilities and capital, understanding these correlations provides investors with information on the behaviour of banks and the success or failure of strategies used by managers.

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