BABES-BOLYAI UNIVERSITY OF CLUJ-NAPOCA

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AND BUSINESS ADMINISTRATION

BANKING RISK ANALYSIS METHODS

PH.D. THESIS

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CONTENTS ABSTRACT

THESIS CONTENT

KEY WORDS: banking risk**,** systemic risk, bank management, bank contagion, credit risk, operational risk, market risk, social and environmental risks, global financial crisis, CAAMPL rating system, statistical modeling of CAAMPL downgrade.

Introduction

The complexity and diversity of banking risks were an upward trend in recent years due to increased competition between banks, due to increased international financial markets but also due to the growing number of financial products and services. Changes occurring in the banking market in recent years have led to major changes in terms of risk in banks. Role played by them in the financial sector in economic growth and financial stability is crucial, therefore financial risk management has become more important than ever.

Based on these considerations, the topic addressed in this paper is the risk. Risk is considered one of the basic concepts of finance: "The whole financial research focuses on three fundamental concepts: cost, risk and value" Stancu, I. (2007). The most important aspects of risk, namely risk management and its impact on financial and banking activity will be treated in this thesis. The current context of crisis being given, the topic is very timely and very useful for practice and current research in finance.

In this thesis there are presented the common problems of the most important banking risk management. Bank risk issue is addressed in the context of international and national legislation.

The reason for choosing this research topic lies in the need for careful consideration of risks in the banking sector because they have particular importance in economy. Current economic situation and the global financial crisis highlighted many problems of current practices related to risk and required a review of techniques and methods used in risk management. The paper presents not only the traditional banking risks, but also how, through crisis and recent events, risk management is particularly important in overcoming less predictable situations.

Research goal is to identify, analyze, monitor and control risk while the banks are subject to diversified risks. Particular attention was paid to regulatory requirements and bank supervisors as well as to the methods and tools used in managing banking crises. In identifying, analyzing and managing banking risks, several important pieces of puzzle are the models and techniques that address credit risk, market risk, operational risk and liquidity risk. Particular attention was given to their behavior in times of economic crisis. Another essential

piece of puzzle is econometric study on the most important microeconomic indicators of CAAMPL rating downgrade.

To achieve this goal the following objectives were established:

- analyzing the evolution of the concept of risk and contemporary approach to the concept of risk
- assessment of systemic risk and contagion effects
- analysis prudential regulations on risk
- presentation the development of bank risk management
- research and comparison methods for credit risk, operational risk, market risk and liquidity risk management
- risks in the context of financial sustainable development
- analysis of important aspects of banking risk event in the crisis

Literature published in recent years in the financial field, highlights the main directions of banking risk management, increasing attention being paid to bank risk management in crisis conditions.

Achieving financial stability in the banking system involves the use of established methods in modern management of risk. Elsinger et al. (2003) presents an original approach by creating a network model of inter bank lending, analyzing the risk in the banking system as a whole and not the individual banks. Following the study, Elsinger found a correlation between banks' asset portfolios and concludes that it is the main source of systematic risk.

Because treating each bank separately and not as part of a system led to incorrect predictions of the evolution of risks, in recent years more and more authors have expressed concern about systemic risk. Thus Kaufman (1995), Flannery (1999), Santomero & Eckles (2000), De Bandt & Hartmann (2002) are just a few of the authors who have studied the systemic risk as an event that affects the entire banking system. In his paper Choudhry (2009) studied the issue of banking risks and propose effective measures to remove the banking system weaknesses identified during the financial and economic crisis event.

From the national literature is necessary to recall a number of studies (Nanu et al., 2005; Dedu and Ganea, 2006; Negrila, 2008) which argues the need to adjust banking structures on risk management in order to align the existing requirements in the international banking system. Negrila (2008) points out that the implementation of a risk assessment process and capital adequacy management is an important step for the Romanian banking system stability. He also stresses the need to run the process at a pace as brisk.

Regarding research methodology, this analysis focused on banking risks and potential effects that these risks have on the banking system. Throughout this paper theoretical and practical aspects, quantitative and qualitative analysis are found, all with the aim of identifying, analyzing and controlling bank risk, not least, to manage risk in time of financial crisis. Through this thesis we aimed present a methodological framework for risk management in the Romanian banking sector, the central element is the risk assessment tool based on CAAMPL indicators.

Thesis Structure

The thesis is divided into four chapters provide detailed benchmarks, following risk analysis on the banking market.

Summary of Chapter 1

Current approach to banking risks and their regulation

Assume your risks. If you win, you

will be happy, if you lose you will be wise. (Anonymous)

The first chapter is characterized by a brief presentation of the concept and typology of theoretical approaches on bank risk. Here are some of the best known and recent classification criteria underlying risks. Outlining the importance of bank risk management and the need for its continuous improvement, a synthesis of the literature in risk is presented..

Risk is a reality that has accompanied human society throughout its development, as one of the greatest challenges due to its presence in many fields. Any human activity carries a risk. The fact that we live in an uncertain world is a fact for sure. Removing uncertainty is impossible. Voltaire said, "doubt is uncomfortable, but certainty is absurd!" Nevertheless, , I consider the above to understand that the risk, measurement and management is not an absurdity.

The society we live in has had considerable progress due to risk taking. Growth would not have occurred if certainty would have priority over risk. Prosperous economies use frequently and effectively models under risk and uncertainty.

Definition of economic risk in the sense of Nita Dobrotă is the "event or process uncertain and likely to cause damage, a loss in activity, operation or economic action." Unlike uncertainty, economic risk can be characterized by describing a law of probability to the expected results, as well as through knowledge of the law by those concerned.

Bank risk can be defined as the probability of an event with adverse consequences on banking activity. Bank risk is a phenomenon that has negative effects. It can capture reductions in profit or loss, affecting the full functionality of banks. Banking risk refers to those risks faced

by banks in their current operations and not just traditional banking activities. Banking risk is generated by a large number of operations and procedures. Risk accompanies each activity in the bank it generate or not losses depending on the conditions under which it manifests itself. There is a domino effect in case of risk. It may generate a chain of other risks. Banking risks should be inventoried and defined as well as possible.

In this chapter, special attention is paid to systemic risk and bank contagion effect. The current financial crisis reveals new dimensions of the concept of systemic risk in banking. This crisis has shown how interconnected the financial world has become and has showed how a shock coming from a region can propagate very quickly, with an impact on financial stability around the world. In order to limit bank contagion effects there are identified national and international approaches to regulating bank risk and the need for continuous improvement of banking supervision process. Captured objectives and role of risk management in banks are identified as trends in banking risk management and its relationship to corporate governance.

Changing environment in which banks operate presents major opportunities for them, but also requires complex and variables risks, which are a challenge for bank management. Given these considerations and taking into account the principle of prudence applied to the entire banking system, a method of verifying banking activity namely banking supervision is observed. Bank supervision is the result of experience with the analysis of the evolution of national banking systems. The need for monitoring arises from the need for principles to provide a verified mechanism on bank efficiency activities of each institution, the economy and the whole societies.

The financial crisis has shown the limits to effective risk management. In this respect supervisors have developed a series of methods and techniques to detect, monitor and predict risk. In the current context, in order to improve the stability of the banking system and prevent systemic risk, Basel II has been revised. It required a fundamental review of existing prudential regulations embodied in Basel III. This new agreement brings more clarity on bank finance, addressing a wider range of risks, providing better regulation.

Summary of Chapter 2

Risk management policies and practices regarding banking

"The biggest risk for a banker is not known risk that confronts the bank."

Bank risk is a constant presence in banking. Therefore, the second chapter assumes that bank risk elimination is impossible. The risk management goal is to measure and to limit the negative effects of risks on the banking institution. To achieve these objectives, banks must have policies and procedures to limit and control risks and their measurement system must consider all significant sources of risk, taking into account the interdependencies between different types of risk. So in this chapter the modeling elements for the most important categories of banking risks: credit risk, operational risk, market risk and not the least of liquidity risk are studied. It also analyses the main models used in identification, assessment and management of the banking risks.

Existences of bank risk management techniques have advantages for the bank, and their absence can have serious consequences. Assessment and banking management techniques are growing, they are increasingly used in advanced management of credit institutions to limit as much as possible the negative effects of assuming these risks which are generated and amplified by permanent changes in financially and institutionally.

From the presented in this chapter is a clear need to correlate credit risk management with the market and the operational risk management, in order to balance bank risk management system, resulting in an integrated risk management. In this context, it needs reviewing international regulation for banking risk by continuously adapting risk management methods to economic realities. Also the preparation of a liquidity plan by each banking institution in order to be constantly subject to stress tests, and to identify in advance the existence of disturbance is important.

Banks can successfully manage banking risks only if they recognize the strategic role of risk management, if they use analysis and management to increase efficiency, if they adopt specific measures of performance risk adjustment and reporting mechanisms that create risk-based performance.

We can say that risk is an essential part of financial and banking activity. Banks must acquire a certain level of risk in order to ensure maximize value for shareholders. Such risk management should be the first priority of all those involved in the management of the bank.

Summary of Chapter 3

Risk management for sustainable development

"Without environmental policy development will be compromised.

Without development environment will not be achieved"

Dan Manoleli

Durability or sustainability is an issue of increasing importance today and in the opinion of specialists will become the main issue of the 21st century. Sustainability is more than a necessity, it is an obligation of present generations to ensure future generations, the ecologically and socially and economically.

In recent years the industry has gained an important role in global developments and hence sustainable development, by virtue of which he holds the economic scene. Banks have unsuspected power of influence, they have gained increasingly more rights and governing to some extent the lives of billions of people. Banks are one of the key players in sustainable development. This is because they play a fundamental role in economic performance, and in all forms of commerce and industry.

In this chapter, the urgent need to implement the principles of sustainable bank management and the role that banks play in the sustainable development of society is presented.

Although banks initially responded more slowly to sustainable development issues in the current environment profoundly marked by globalization, deregulation and diversification of the financial industry, banks have become increasingly aware of their role as intermediary, which has become increasingly complex. Lately more and more banking groups started creating sustainable products, adapted internal policies and lending, advisory programs prepared obliging employees partner companies to invest in environmental social responsibility principles.

The sustainable banking plays a increasingly important role worldwide. Compelling evidence in this regard is the growing concern for the development of indicators, evaluation criteria and scoring systems to assess and classify banks while encouraging the adoption and sustainability principles in banking.

The last part of this chapter is dedicated to present a case study on how the sustainable banking management is implementing at Romanian Commercial Bank. Regarding sustainable development, BCR has a privileged position proved to be forefront in our country, sharing, respect and promotion of sustainable development that is why we chose BCR for this case study.

Chapter 4

Risk management in the context of banking crisis

"There is no merit without crisis. It's in the crisis where we can show the very best in us"

Albert Einstein

The financial crises topic is extremely vast, including a significant number of financial, economic, social, ethical, technological and human elements, which by association may influence the financial operations of a country or region of countries. Financial crises, born from the irrational exuberance of one or a certain number of markets, are not a recent fact. They came together with money evolution and with the growth of financial markets, and some of them remained in history. Reviews of the great financial crises through history reveal that these crises are more and more at an international level and wide-spread. Apostolache M. (2012) emphasizes that if we retrospect from the past to the present time we observe that the financial globalization phenomenon is the next step to opening, widening and deepening the frontiers of the financial crises.

Financial crises represent a threat for the entire economy, and finding and implementing the solutions in order to destroy their effects is a must. The impact of banking crisis is spread through the entire economy by affecting the lending mechanism. During a banking crisis, the access to bank loans is frozen, and there is no other immediate way of transition to some other financial sources. This illiquidity determines the annulment of profitable projects, generates blockings of the production, of the labour force and, as a consequence the appearance of bankruptcy in the entire economy. Starting with these premises, we analised the financial bank crises and the modalities to diminish and remove them and also the important role of the risk in the context of the global financial crisis.

This chapter includes the most important opinions from the literature and treatises about Early Warning System. It describes the system methodology to prevent the flow of CAAMPL rating and the posibilities to improve it by making the risk analysis of the BRD CAAMPL rating.

The last section of this chapter is reserved to an econometrics study through which we try to validate the economic theory about the most significant microeconomic indicators with the biggest impact on the CAAMPL rating. Also there the results of the evolution of the banking

rating, determined by the CAAMPL model will be compared, by the binary logit model of improving or getting to a diminishing rating level, or using the ordered logit model on the local banks rating.

The singularity of this practical study emerges from the estimation of two types of econometrics models specific to qualitative variables, a contrastive view of their performances and the emphasize of the common factors whose rating influence the most change of CAAMPL rating, granted to the most important bank institions from Romania, indicators that match with those emphasized in the specialty literature and in the practical approach. The last phase involves testing the models obtained from the series formed by the rating of the 15 local banks on the sampling from 2011, the last year analized.

In order to complete this analysis, there were used 2 databases that contain microeconomics information from the financial and economical situation of the most important banks from Romania. The 15 bank institutions selected have a common market share bigger than 0.75 and they are a representative sample for the entire Romanian banking system.

The Rating given by the National Bank of Romania, and the bank report elements that are used to establish this rating, is studied on a 5 years period (2006-2011). This period of time has been selected in order to observe the rating before and after the global financial and economical crisis.

The database used for the binomial logit model includes binomial variables, and these changes were made on the basis of the rating evolution of all the variables, as it follows:

- Diminishing score=1, Rating $_{t+1}$> Rating $_{t}$
- Improving or stabilizing score=0, Rating $_{t+1}$ <= Rating $_{t}$

The database used for the *proportional odds model consists of a dependent variable rating encrypted ordered from 1-5 and the* independent variables in a percentage form or as a change indicator, without the general indicators.

A comparative analysis on the performance of the two models

- The binary logit model

After the assessment, the contingence table of the binary logit model that includes the performance measures is the following:

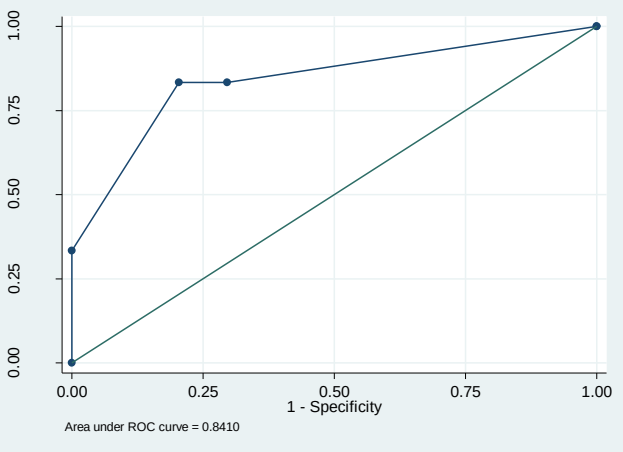
Table 1: Contingence table of the binary logit model

Noticed / Predicted	1	0	total
1	2	0	2
0	4	54	58
total	6	54	
Sensitivity/true positive rate	33.33%		
Distinctiveness	100%		
Precision	100%		
Accuracy	**93.33%**		

Source: Stata 9.0 processed

- Since sensitivity has 0.33 value we can state that the model makes an accurate estimation only in a third of the cases where the CAAMPL damages year over year.
- The 100% distinctiveness value indicates that the factor variables explain very well the situations where the bank ratings are better or stable.
- Precision describes this model's ability to make an accurate estimation on the situations where the dependent variable has value 1; the model has a proportional 100% performance to the rating probability to diminish.
- The rate of accuracy represents the performance of this model as a unit, making an accurate estimation of the dependent variable in 93.33% of the cases.

Figure 1 : ROC curve of the binary logit model



Source: Stata 9.0 processed

Each point on the ROC curve is a pair of sensitivity-specificity for a certain decision. In the binary logit model, the upper left point has a 0.8 sensitivity value and a value of an approximate 0.2 (1- specificity). This gets near to the 1 value, the greatest value of sensitivity.

Another criteria for analyzing this model's performance is the area under the ROC curve, AUROC that has a 0.8410 value which indicates that the binary logit model is highly validated (0.8<=AUROC<0.9).

- The ordered logit model

For the ordered logit model we reappraised in MS Excel the expectations that the estimated bank rating should go in categories 1, 2 or 3 following the values of the assessed factors and β parameters. The results are displayed in the following table.

Table 2: Observed values vs predictive values on the ordered logit model

Bank rating	Observed values	Predictive values	True	False
Y=1	2	0	2	0
Y=2	49	0	49	0
Y=3	24	75	24	51
Accuracy			**32%**	

Source: MS Excel processed

In conclusion, the binary logit model is superior to the ordered logit model from the perspective of the specific measures of the econometrics of qualitative variables, the accuracy of the model being the most comparable. This model has no power of discrimination on the 1 and 2 bank ratings.

Predictions. We will try to validate the binary logit model by it's power to predict the evolution in 2011 of the CAAMPL rating of the top 15 financial institutions from Romania.

Table 3: Predictions from the binary logit model (year 2011)

Estimated equation	Observed dependent variable=0	Observed dependent variable=1	Total predictions
Dependent predictive variable=0	14	0	14
Dependent predictive variable=1	0	1	1
Total	14	1	**15**

Source: MS Excel processed

The ordered logit model aquired from the financial and economical data of the 15 most important local financial institutions, for the period of 2006-2010, will be tested on the sample coresponding to the year 2011. The result is displayed in the following table:

Table 4: Predicted values from the ordered logit model *(year 2011)*

Estimated equation	Observed dependent variable =1	Observed dependent variable =2	Observed dependent variable =3	Total predictions
Dependent predictive variable =1	0	0	0	0
Dependent predictive variable =2	0	0	0	0
Dependent predictive variable =3	1	10	**4**	15
Total	1	10	4	15

Source: MS Excel processed

In the case of the binary logit model the decrease of the liquidity rating and of ROE - return on equity- conducts to the increasing probability that the total bank rating will suffer negative changes.

In the case of the ordered logit model the decrease of the share capital, of the general risk rate, the weight of the custom loans and of the ROE value indicates a strong probability that the CAAMPL rating will pass to a higher class.

From the comparative analysis of the binary logit model and the ordered logit model results that from the classic econometrics measurements, adjusted R2, the ordered model (53%) is superior to the one with dichotomic answer. If we compare the two models performance in terms of accuracy, the proportion of correctly estimated units from the observed values, the binary logit model has a significant value of 93% against the ordered logit model value, near 32%.

We can conclude that by using the binary logit model, better estimation for the bank rating that increases or remains constant (the coding for the CAAMPL change rating is 0) is obtained. The power of binary logit sampling model is highlighted by the ROC curve and the AUROC that is the area under the receiver operating characteristic curve. The evaluation results shows a higher value of this indicator, 0.84, value that is superior to the one of 0.75 considered a baseline in the field. The AUROC validation is confirmed also by the form of the ROC curve. The ordered logit model instead, indicates better results in the case of the banks with 3 rating class, but has significant estimation errors when it comes to the 1 and 2 categories of bank ratings.

The 2011 prediction phase on the evolution of liquidity ratios on the local financial market revealed that the binary logit model has a 100% forecasting and it indicated the only institution whose CAAMPL rating diminished in 2011, compared to 2010, Citibank. In return, through the proportional odds model there were correctly estimated only the probabilities for the financial institutions rated by 3 grades in 2011: Citibank, Procredit, Unicredit, Volksbank. In conclusion, the proportional odds model was confirmed in 2011 only in proportion of 27%. We may also conclude that the binary logit alternative is superior to the ordered logit model if we refer to this financial and economic analysis of the local banks.

Financial institutions should be aware regarding the liquidity ratios, profitability, assets quality and capital in order to be able to estimate, control and improve the BNR rating.

Conclusions

Analysis of economic aspects of risk demonstrated no unique approach to the concept of risk, generally accepted by most economists. Also at present, there is no strict separation of all types of bank risk. The diversity of the risks a bank may face and many situations that generate risks hinders their unique classification. Some of the causes that have generated the variety of banking risk have been identified and the most representative are globalization and innovation process.

The benefits are evident in banking regulation. However Basel II has sparked criticism. One of the issues is related to the costs of implementing an operational risk management system as required by the agreement. These costs were added to a lack of information and data about credit risk, and especially about operational risk. Another drawback is that using similar methods by banks can produce disastrous effects in crisis situations when decisions are consistent. In these circumstances it was necessary to rethink the entire architecture of prudential regulations, embodied in Basel III which represents a fundamental review and consolidation of global capital standards.

Existence and management of banking risks are inherent to the activities of banks and the role of banks as financial intermediaries. Analysis of issues related to the development trends in banking risk management demonstrated the importance of corporate governance must hold, and the need to implement sustainable management principles bank.

From those presented in this thesis, results also the need to correlate credit risk management with the market risk management and the operational risk management, in order to balance bank risk management, resulting in an integrated risk management system. In this context, it is necessary to review the international regulation of banking risk by continuously adapting risk management methods to economic realities and preparation by each banking institution of a liquidity plan that is always subjected to stress tests to could identify in advance the existence of disturbance.

Banks can successfully manage banking risks only if they recognize the strategic role of risk management, if they use analysis and management to increase efficiency, if they adopt specific measures of performance risk adjustment and reporting mechanisms that create risk-based performance to ensure that investors understand the impact of risk management on the value of the banking institution.

Another conclusion of risk management research is that although social and environmental risks have not come to the attention of the Basel Committee in the coming years, there will be regulations that will cover these issues of sustainable bank management, risk measurement and social environment.

Our study on the implementation of sustainable management principles at BCR showed that the bank aims to be a model and an inspiration in this area. Sustainable bank management is a key aspect of corporate governance and one of the Bank's strategic objectives. BCR considers sustainable development an important part of management strategy and its activity is aimed at promoting green credit, energy conservation and emission reduction. BCR demonstrated that the essence of sustainable development is to ensure the planet, people and corporations based on mutual benefit. In this respect, BCR developed risk management principles and social environment where directions, commitments and financial credit policies are defined.

Romanian banking system must follow BCR example and take the whole concept of social responsibility. This concept must become an essential element in the revival and development of Romanian economy and society. Romanian banks must understand that in current situation caused by the economic crisis it is not the time to slow down social responsibility but a time when sustainable banking development and society in general is extremely important and can help to overcome the current crisis.

Analysis of international financial crisis has highlighted the important role of banking institutions in onset, propagation and management of economic crisis. Low quality or inadequate banking supervision and regulation, correlated with macroeconomic imbalances are the main causes of the occurrence of these phenomena. Identified ways are to reduce and eliminate the banking crisis. We watched the manifestation of risk in present financial crisis, which was generated at the micro level by the implications of the securitization process and the macro level by the abundance of financial resources and liquidity, low spreads discriminatory and insufficient understanding of risk and its implications.

Current difficult economic environment and the social and political changes have the potential to enhance the role and impact of non-banking risks on banking activity. We consider as a relevant trend, further improvement of assessment tools and risk analysis bank, the main purpose of reducing banks' exposure to different types of banking risks.

One of the major objectives of a central bank is to prevent systemic risk by promoting effective bank monitoring, which contributes to the stability and viability of the entire financial system. Thus, central banks have developed methods and processes for monitoring and continuous assessment of banks - premises of preventing the occurrence of a wide variety of banking crises or other unpleasant surprises on banking entities. In this category fall the rating models. Banks can successfully manage bank risk models that recognize the strategic role of credit rating if I use assessment, analysis and management to improve the quality of bank examination. Banks can successfully manage bank risk if recognize the strategic role of credit rating models, if they use assessment, analysis and management to improve the quality of bank examination.

By studying the evolution of the local banking market, CAAMPL rating has validated economic theory that microeconomic indicators with the greatest influence are those related to profitability (ROA, ROE) liquidity, capital ratio, but also those related to asset quality. Future research directions are considering developing an econometric model to quantify the probability of CAAMPL rating downgrade. With such an early warning system to provide increased efficiency by completing surveillance act ex post analyses made using CAAMPL rating system, with ex ante information about possible problems that banks might face.

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