Charles University in Prague

Faculty of Social Sciences
Institute of Economic Studies

BACHELOR THESIS

The role of bank management in the European banks' stability during the global financial crisis 2007-2008

Author: **Olena Melnychuk**

Supervisor: **Mgr. Iuliia Brushko M.A.**

Academic Year: **2015/2016**

Declaration of Authorship

The author hereby declares that he compiled this thesis independently, using only the listed resources and literature.

The author grants to Charles University permission to reproduce and to distribute copies of this thesis document in whole or in part.

Prague, July 30, 2016

Signature

Acknowledgments

I would like to express my sincere gratitude to the supervisor of my thesis Mgr. Iuliia Brushko M.A. for her guidance, valuable advice and ideas, and time that she devoted to my thesis.

Abstrakt

During the crisis of 2007-2008, many banks had to improve their management because their previous models could not cope with the increase in the number of defaults on mortgage loans and new risks produced by credit derivatives. The goal of this study is to define what factors were the most significant determinants of the stability of large banks of Europe during the crisis of 2007-2008. This study concentrates mostly on the indicators of the management of loan portfolio in major banks of Europe. For this purpose, the thesis uses a balanced panel data of 69 banks in 18 largest European countries during 2006-2009. Furthermore, from the results of tests on the significance of used variables, the model that evaluates the distance from the insolvency for banks is constructed.

Klíčová slova Crisis, management, banks, loan portfolio, capital, Tier1 ratio, Z-score

E-mail autora lena-melnichuk@list.ru
E-mail vedoucího práce iuliia.brushko@cerge-ei.cz

Contents

List of Tables

List of Figures

Acronyms

AR Accounts receivable

CAE Cash and equivalents

CAR Capital adequacy ratio

CDO Collateralized debt obligations

CDS Credit Default Swap

CL Current liabilities

DEP Depreciation

EBIT Earnings before interest and taxes

GDP Gross domestic product

LCR Liquidity coverage ratio

LM test Breusch-Pagan (Lagrange Multiplier) test

LSDV Least square dummy variable

LTD Total loans to total deposits ratio

MS Marketable securities

NI Net income

NIM Net interest margin

NP Net profit

NPAT Net profit after tax

NS Net sales

NW Net worth

OLS Ordinary least square

ROA Return on assets

ROE Return on equity

RWA Risk weighted assets to total assets ratio

SR Sales or revenues

SWAT Strengths, Weaknesses, Opportunities, Threats

TA Total assets

TE Total equity

TL Total liabilities

Bachelor Thesis Proposal

Author	Olena Melnychuk
Supervisor	Mgr. Iuliia Brushko M.A.
Proposed topic	The role of bank management in the European banks' stability during the global financial crisis 2007-2008

Topic characteristics During the crisis of 2007-2008, many banks had to improve their management because their previous models could not cope with the increase in the number of defaults on mortgage loans and new risks produced by credit derivatives. The goal of this study is to define what factors were the most significant determinants of the stability of large banks of Europe during the crisis of 2007-2008. This study concentrates mostly on the indicators of the management of loan portfolio in major banks of Europe. For this purpose, the thesis uses a balanced panel data of 69 banks in 18 largest European countries during 2006-2009. Furthermore, from the results of tests on the significance of used variables, the model that evaluates the distance from the insolvency for banks is constructed.

Hypotheses Firstly, we want to determine what financial indicators were the most significant for the stability of banks during the crisis. Secondly, we examine if the indicators of the management of loan portfolio affect significantly the stability of banks. Finally, we compare European banks' stability across the EU countries in the sample.

Methodology For our analysis, we take a balanced panel data of 69 large banks in 18 largest European countries during 2006-2009. To narrow our data sample to only large banks, the logarithm of total assets is used as an indicator of the size of the banks. To estimate the stability of these banks, we calculate Z-scores. Then we run several regressions to analyze what factors of banking

stability were significant during the crisis. Finally, the thesis analyses in which country from the sample the banking sector was the most stable and in which one the least.

Outline

1. Introduction
2. Motivation and literature review
3. Methodology and data
4. Empirical results
5. Conclusion

Brown, K., P. Moles (2008): "Credit Risk Management" *Edinburgh Business School*

Kapan, T., C. Minoiu (2013): "Balance Sheet Strength and Bank Lending During the Global Financial Crisis" *IMF Working paper.*

Kohler, M. (2012): "Which banks are more risky? The impact of loan growth an business model on bank risk-taking" *Discussion Paper, Deutsche Bundesbank.*

Lepetit, L., F. Strobel (2014): "Bank income smoothing, ownership concentration and the regulatory environment" *Journal of Banking & Finance* **41**: pp. 253–270.

Wilson, T., (2015): "Value and Capital Management: A Handbook for the Finance and Risk Functions of Financial Institutions" *Wiley finance series.*

Author

Supervisor

Chapter 1

Introduction

In the banking business, one thing that is vital is to find the balance between the risks a bank faces and the profits it seeks to earn. Managing risks for a bank is one of the most important and challenging tasks. Nevertheless, efficient management of the risks does not always guarantee that a bank will be able to avoid losses. Successful operation of banks requires the efficient management of capital as well. After the global financial crisis had occurred, banks needed to improve their systems of management.

This paper aims to determine what were the main factors influencing banks' stability during the global financial crisis. After the world financial crisis, managers in banks realized how important it is to manage the credit risks. Therefore, it might be interesting to see how strongly the relationship between banks' stability and the quality of loan portfolio management was during the crisis. Though apart from credit risks banks needed to manage other banking factors, such as liquidity, capital, operational risks, business risks, systemic risks and a lot more, this paper focuses mainly on loan portfolio management.

The thesis is organised as follows. In the first section, the literature review describes the impact of the global financial crisis on European banks. Additionally, we describe the most important indicators of banking management and the methods to analyze banking stability. Then the literature review explains methods to manage loan portfolio efficiently and impacts of bank specific characteristics. In the second section, methods for creating panel data regression are used and described. Then we describe our data sample and the sources that provided us with the data. Finally, the paper explains and describes the results of the regressions created.

We test the variables that indicate the quality of loan portfolio management.

The primary purpose of these tests is to see whether the hypothesis of their significance holds during the crisis. From the results of the econometric regression, we conclude what factors of loan portfolio management were crucial to managing during the crisis.Additionally, we compare European banks' stability across the EU countries in the sample. In order to do this, we use Z-score, which is negatively related to the probability of bankruptcy. Finally, we create the model that includes all significant variables from the previous regressions. This model evaluates the distance from the insolvency for banks in the sample, controlling only significant factors.

To estimate the model empirically, we take a data set of 76 the largest banks in 18 European countries. The thesis analyzes the stability of these banks from 2006 till 2009, as apart from the beginning of the crisis (2007-2008), we want to take into account pre-crisis period (2006) and first results of the activity of banks after the start of the crisis (2009). The banks are considered largest by analyzing their total assets in the pre-crisis period (2006).

This thesis contributes to the area of studies of key variables that influence the banking stability. The study of the factors that were significant for big European banks to decrease the probability of bankruptcy can help in future to avoid the big number of bankruptcies in the case of new global crisis. Furthermore, the results of the comparison of the stability of banking sector in different European countries can induce researchers to analyze in future how the decisions of the authorities influenced the banking sector in different countries.

The results of this thesis show that loan portfolio management indicators had a significant effect on the banking stability during the crisis. Furthermore, we find that all country variables used are significant for Z-scores of banks. Finally, the model provided us with results that the fact whether a bank is listed or not and the specialization of banks have significant effects on their stability in the conditions of the crisis.

Chapter 2

Motivation and literature review

2.1 The impact of global financial crisis on European banks

The global financial crisis started in 2007 in the United States of America and dramatically influenced the economy of the European Union. Though the crisis originally started in the USA, there are pieces of evidence that it has a longer impact on European banks than on US banks. Schildbach and Wenze (2013) discuss why European banking has never reached the level of the profitability that they had before the crisis. While US banks now have stable and even greater profits than they used to have in the pre-crisis period. The authors say that there are three main reasons for this. Firstly, the fact that US banks possessed larger capital than European banks before the crisis started. A large amount of capital helped US banks to recover quicker. Secondly, the real economy of the USA is considered to be more develeraging and easier adaptable to the market conditions. Last reason described is that the European Union has the problem of the weakness of central institutions. This issue exists because member states have different interests.

Additionally, Weigand (2015) claims that European banking system is much less developed in the post-crisis period than US one. This paper shows that European banks have earned fewer stock returns since the start of the crisis. Moreover, the author claims that European banks still experience negative revenue, an increasing number of impaired loans and negative loan growth. Terazi and Senel (2010) claim that after the start of the crisis many EU countries began to experience high debt ratio. Moreover, Hungary, Romania, and Latvia were affected so strongly by the crisis that they needed external financial help.

In contrast, Delia (2012) asserts that European banks, especially in Western Europe, succeeded in increasing their earnings during the crisis. The author says that this increase was caused by both efficient and fast decisions of the authorities and the volatility of emergent market.
From the literature described above, we can conclude that though the opinions of economists differ about the influence of the crisis on European banks, it is evident that the crisis that had started in the USA had a strong impact on the European economy and banking.
Because of the crisis, the authorities in Europe had to strengthen the regulation of the banking sector in Europe. Black et al. (2016) claim that the crisis during 2007-2009 in Europe led to an increase of regulation of the banking sector in Europe. European banks need to satisfy the norms of these regulations. For instance, one of such regulations was the increase of required minimum Tier 1 ratio for banks from 4% demanded by Basel II to 6%.

2.2 Methods to analyze the stability of banks

Different approaches throughout the literature help to create the analyses of the stability of banks. In the literature, one of the most popular ways to analyze the probability of bankruptcy is using Z-score. (Lepetit and Strobel, 2014). The usage of Z-score is so popular because it is negatively related to the probability of insolvency of banks. Therefore, the higher Z-score is, the stronger the bank is. Usually to estimate Z-score economists use a bank capital asset ratio and its return on assets. Return on assets (ROA) shows the profitability of the firm compared to its total assets, while Capital asset ratio describes if the firm has enough capital to support its assets. Additionally, Altman created his formula, known as Altman Z-score formula, which takes into account five key financial indicators by firms to estimate Z-score. These indicators are reported annually.
Another method to analyze the stability of banks is the accounting approach. If economists want to analyze the stability of banks using this method, they use the data from the balance sheet of banks. As well as, it is common to use econometrics techniques to estimate if a bank operates successfully. (Kumbirai and Webb, 2010). Apart from analyzing balance sheets and income statements, it is crucial to monitor cash-flow statements.
The indicators that are commonly used to analyze banks' stability can be divided into five groups:
- Capital adequacy indicators

- Indicators of liquidity
- Indicators that show the quality of assets
- Indicators of quality of liabilities
- Profitability indicators

There is a big amount of ratios that economists use as those indicators. Firstly, when researchers want to estimate the capital adequacy of a bank, they usually use capital adequacy ratio (CAR). This ratio determines how well a bank can meet its obligations relatively to its exposure to risk. It protects depositors and other lenders. As in the case of insolvency of a bank, a bank's capital is used to return depositors their money. Therefore, the higher this ratio is, the stronger the protection of depositors is.
The formula is

$$CAR = \frac{TIER1 + TIER2}{RWA} \tag{2.1}$$

Where CAR - capital adequacy ratio; TIER1 - Tier 1 capital; TIER2 - Tier 2 capital; RWA - risk weighted assets.

Tier 1 capital represents the capital adequacy of a bank. It is necessary capital that involves equity capital and disclosed reserves. Tier 1 capital is considered to be the best form of capital of a bank. Tier 2 capital includes hybrid capital instruments, loan-loss and revaluation reserves as well undisclosed reserves. Additionally, there exists Tier 1 capital ratio that shows the comparison of risk-weighted assets and equity capital. Well-capitalized firms have this ratio equal or larger than 6%.
As, after the crisis occurred, the minimum Tier 1 ratio increased to 6%, the economists started to use it a lot in the literature while analyzing the banking stability and performance. For instance, Berger and Bouwman (2013) use this ratio to examine the influence of capital on the performance of banks during financial crises. Their results show that Tier 1 ratio has a significant positive effect on survival of small, normal and large banks during financial crises. However, the impact of Tier ratio is stronger for small banks than for large ones. Compared to the conditions of financial crises, during normal times there is no significant effect on the stability of banks.
Secondly, the analysis of liquidity indicators uses the liquidity coverage ratio (LCR). This ratio represents one of stress tests that examines if a bank has enough high-quality assets to survive one month full of stressed liquidity con-

ditions. In Basel III it is written that even though some banks were managing their capital efficiently and had high CAR in 2007-2009, they experienced problems since that they did not pay a lot of attention to their liquidity during the crisis. Angelini et al. (2015) while analyzing Basel III impact on the economy use LCR as liquidity indicator.

Instead of LCR, some papers use the ratio of total loans to total deposits (LTD) as an indicator of liquidity of banks. For example, Shingjergji and Hyseni (2015) use LTD as liquidity indicator for their model that analyzes CAR in Albania. When the ratio is very high, there is a danger that a bank will not be able to meet its obligations and return to depositors their money in the case of crisis. This ratio is very often used by insurance companies to estimate the price for insurance for banks.

Thirdly, one of the indicators of the quality of assets is the number of impaired loans compared to the number of total loans. Samad (2004) uses this ratio as an indicator of asset quality to analyze the performance of Islamic banks in Bahrain. Due to the fact that the more impaired loans a bank has, the more the quality of its assets worsen. The amount of non-performing loans evaluates the quality of loan portfolio. Furthermore, the ratio of loan impairment charges yearly to total assets is often used to analyze the quality of assets. The loan growth is also informative about the assets quality. Ongore and Kusa (2013) use this ratio in their analysis of the performance of Kenyan commercial banks. If the loan growth higher than the market average by 20-25%, it may imply that a bank experiences problems with a quality of its assets. There are some reasons for this. First reason is that if a bank supplies substantially more loans than an average norm, it is very doubtful that it has enough labor force to monitor well its borrowers. The second one is that usually when the growth of loans increases too much, the ratio of impaired loans to total loans increases as well. Last reason is that after a new pool of loans is created, it takes a long time for a portion of this pool to become impaired. Therefore, a bank continues to provide its borrowers with new loans, though it may bring even more problems.

Fourthly, the analysis of liabilities of a bank can be done with a help of debt ratio that is the ratio of total liabilities to total assets. This ratio provides the comprehensive analysis of how much debt a bank has. The higher this ratio is, the more risks a bank is considered to have. Additionally, high debt ratio means that a bank is highly leveraged. When a bank uses borrowed money a lot, its debt increases. And there can come a moment when a bank will have

too much debt compared to its assets. Therefore, a bank will not be able to meet its obligations. Moreover, when debt ratio is very high, depositors and lenders are afraid to give their money to a bank, as there is a chance that they will not get their money back in the case of insolvency. As a result, banks with too high financial leverage loose potential additional capital. Nevertheless, it is important to have a balance in this ratio. As when it is too low, a bank loses an opportunity to earn profits that financial leverage can provide.

Last but not least, there are a lot of profitability indicators that are used to analyze the performance of banks. Two of the most famous are return on assets (ROA) and return on equity (ROE). ROA can be seen as an indicator of the efficiency of management in a bank. It is calculated by dividing net profit (NP) after taxes by an average value of total assets. Sometimes economists use earnings before interest and taxes (EBIT) as nominator instead of NP. ROE is the ratio of net income to total equity. It shows the level of profitability of investments of shareholders. Moreover, it can help to take a decision for investors whether it is a good idea to continue investing their money into this bank. Both ROE and ROA have a strong influence on the prices of shares of banks in the market. Therefore, managers pay a lot of attention to these indicators. In addition to ROE and ROA, some papers use other indicators. For example, Caruntu and Romanescu (2008) use such ratios as the profit rate that net profit divided by total income and the margin of assets utilization that is the ratio of total incomes divided by total assets. But mostly researchers use only these two indicators, as they are considered to be the most accurate ones. Some papers use adjusted versions of ROE and ROA, for instance, PwC International Limited while publishing their yearly financial statement, apart from using ROE and ROA, use these indicators adjusted for risks.

2.3 The influence of country variables on banking stability

When economists want to analyze the stability of banks, they usually take into account macro variables, because the overall economy of a country has a big effect on the probability of insolvency and performances of financial institutions in this country. The opportunities for banks in the market depend on various factors. These factors are – the direction of development of the national economy, the structure of government, the level of strength of regulations of

commercial banks by national banks, the system of law in a country, balance of payments of a country, foreign reserves, rate of inflation, interest rate, household incomes, GDP growth, the level of competition among banks in a country and a lot more.

In the literature, there are a lot of papers that show how strongly macro conditions of countries influence their financial institutions. For example, Pan and Pan (2014) create the analysis of the dependence of profitability of commercial banks on macro factors in China. They estimate the model where ROA is a dependent variable, and macro factors are independent variables. These factors are the rate of inflation, GDP, interest rates, money supply growth and total market capitalization of stock.

Gizycki (2001) takes as explanatory factors GDP growth, the share of interest in household income, real credit growth, inflation rate and share of construction in GDP to analyze banks′ risks and profitability. Liang and Reichert (2006) also focus their study on the impact of economic growth on the banking sector development. To compare, Bucur and Dragomirescu (2014) create a research of influence of macro variables on credit risks of banks specifically.

Gocer (2013) studies the effect of the unemployment rate on bank loans. National Bank of Romania created the analysis in 2008 of the relationship between the unemployment rate and the development of banking sector in Romania. If the unemployment rate is high, people do not have enough money to deposit them in banks, and there is a danger that of a big number of default of loans. Therefore, unemployment is considered to be important to control while studying the factors of banks profitability.

The use of macroeconomic indicators is based on the assumption that the reliability of banks depends on cyclically varying external conditions.The decrease in the stability of European banks during the crisis is strongly determined by the changes in macroeconomic conditions in Europe because of the global financial crisis. Due to this fact, to the factors that identify the characteristics of management and quality of the financial policy of banks are often added the macro indicators. The global financial crisis led to the decrease in GDP growth in Europe. The graph 2.1 shows the average GDP growth percentage change from the previous period in Eurozone and United Kingdom from 2005 till 2012. The countries that are taken into account are – Belgium, Germany, Estonia, Ireland, Greece, Spain, France, Italy, Cyprus, Luxembourg, Malta, Netherlands, Austria, Portugal, Slovenia, Slovakia, Finland, and the United Kingdom. We can see that in 2007 GDP growth started to fall and in 2009 it

reached the lowest point. However, in 2010 it began to increase.

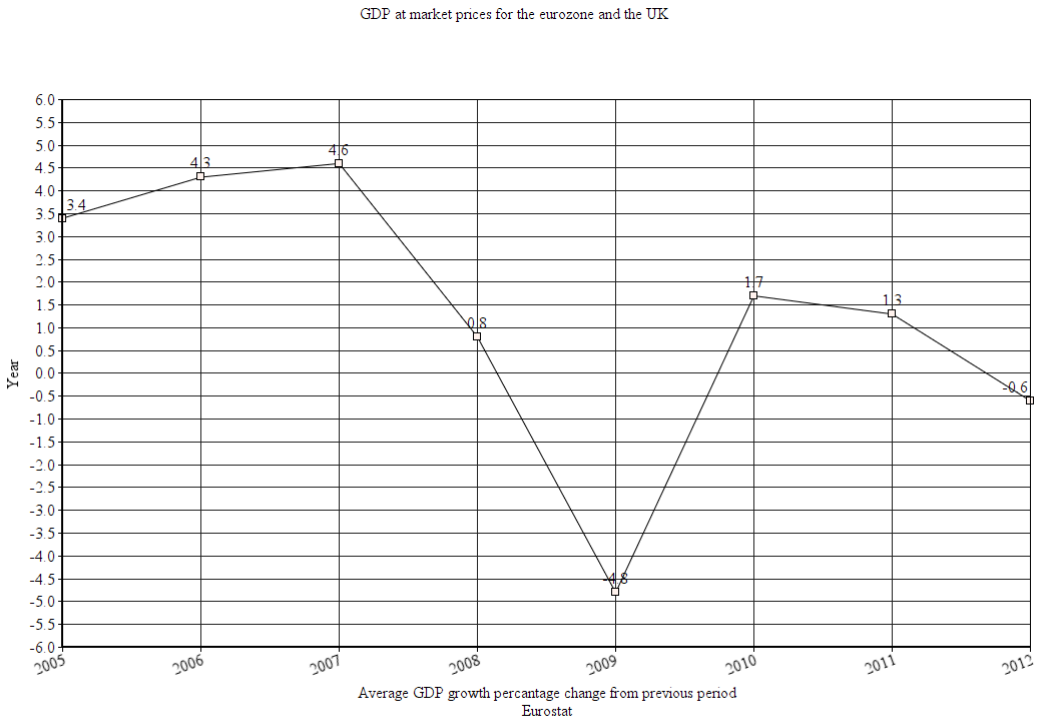

Figure 2.1: GDP growth

Therefore, we can observe that the crisis influenced the economic growth in Europe dramatically . The banks needed to react, as it could lead to their defaults due to the fact that banking risks increase, when the economy worsens.

2.4 Methods to manage loan portfolio

From the methods described above how to analyze the stability of banks, it is clear that loan portfolio management indicators are often used to analyze the banking probability of insolvency. The efficient management of loan portfolio is one if the key conditions of successful operation of a bank. Therefore, we further describe the methods of management of credit risks that enable banks to minimize them.

There are different approaches to the evaluation of credit risks, such as judgmental methods, expert systems, analytical models, statistical models, behavioral models, and market models. The bank faces two choices - to provide the

loan or refuse the loan. Brown (2008) say that there is ex-ante payoff of two options: –Provide credit:

$$PV(Revenue-Costs)*(1-p)-PV(Cost)*TheProbabilityOfDefault \quad (2.2)$$

(Where PV - portfolio value; Revenue - expected revenue from a loan; Cost - expected costs of a loan; The probability of default - the probability that a borrower will fail to meet his/her obligations)
or
– Refuse Credit: 0
The analysis of the creditworthiness of a borrower in banks is very complex. It consists of some basic steps (Lobanova and Chugonova, 2008):
1) Analysis of justifications of a borrower that explain a need for a loan.
2) Analysis of financial reports of an enterprise, where primary attention is paid to development potential and recent changes in activities of a company. It helps to predict future perspectives of a company.
3) Analysis of preliminary financial statements.
4) Analysis of balance of payments and income to predict the ability of a borrower to repay a loan and the probability of occurrence of delay of repayment.
5) Scenario analysis and evaluation of resistance of a borrower in case of extreme unexpected changes in the economy.
6) Evaluation of the position of enterprise compared to its competitors on the market.
7) Evaluation of the top management executives of the enterprise, their strategies and performance, based on the gained results.
8) Drawing up a contract with agreed terms about liabilities and rights of a borrower and a lender.
These steps allow a manager to estimate credit risks by analyzing the financial position of an enterprise. This estimation includes analyzing the structure of assets and liabilities, cash flow, financial stability, effectiveness of the company. The assets are analyzed by considering of their liquidity. The bank also needs to ensure that the liabilities are fully valued and appropriately disclosed. Additionally, to estimate the financial position of the firm, the banks use following rational coefficients (Lobanova and Chugonova, 2008):
1. Current ratio - shows the ability of an enterprise to repay its short-term

liabilities. It is the ratio that indicates the liquidity of a firm.

$$CurrentRatio = \frac{CA}{CL} \tag{2.3}$$

Where CA - current assets; CL – current liabilities.

2. Quick ratio shows the short-term liquidity of a firm. This ratio is the indicator of the ability of an enterprise to meet its short-term obligations by using its most liquid assets.

$$Quickratio = \frac{(CAE + MS + AR)}{CL} \tag{2.4}$$

Where CAE - cash and equivalents; MS - marketable securities; AR - accounts receivable; CL - current liabilities.

3. Debt ratio is an indicator that compares total debt of a firm to it total assets.

$$DebtRatio = \frac{TL}{TA} \tag{2.5}$$

Where TL - total liabilities; TA - total assets.

4. Return on sales evaluates the effectiveness of production of a firm.

$$ReturnOnSales = \frac{NI}{NS}. \tag{2.6}$$

Where NI - net income; NS - net sales.

5. Asset Turnover Ratio compares the revenue of a firm to its total assets.

$$AssetTurnoverRatio = \frac{SR}{TA} \tag{2.7}$$

Where SR - sales or revenues; TA - total assets.

6. Solvency ratio shows the ability of a firm to pay its debt and meet other obligations with its current cash flow.

$$SolvencyRatio = \frac{(NPAT + DEP)}{TL} \tag{2.8}$$

Where NPAT - net profit after tax; DEP - depreciation; TL - total liabilities.

7. Current debts to net worth ratio is the indicator that shows the financial

health of a firm.

$$CurrentDebtsToNetWorth = \frac{CL}{NW} \tag{2.9}$$

Where CL - current liabilities; NW - net worth.

8. Debt to equity ratio makes the comparison of total liabilities to total equity.

$$DebtToEquityRatio = \frac{TL}{TE} \tag{2.10}$$

Where TL - total liabilities; TE - total equity.

Risk managers use these ratios to estimate the probability of a borrower to fail to meet the obligations. They compare the values of the ratios with average ones in the industry or normative ones as one of the tools to get proper results. Then managers analyze the effectiveness of the work and competence of top management of a firm, by considering the strategies they use and results they achieve. The next step is to analyze the stability of the industry where a firm operates. Last but not least is to analyze the country risk.

After conducting the analysis described above, it is possible to give a borrower corresponding credit score by including a borrower to a particular risk group. There are different credit agencies that created rating systems that allow predicting the probability of default. The most leading rating agencies are Standard Poor's (SP), Moody's and Fitch Group. The table (figure 5.1)[1] shows the scales that these agencies use.

[1] https://www.cnb.cz/en/monetary$_p$olicy/inflation$_r$eports/2011/2011$_I$V/boxes$_a$nd$_a$nnexes/zoi$_2$011$_I$V$_b$ox$_2$.ht

Fitch	S&P	Moody's	Rating grade description (Moody's)	
AAA	AAA	Aaa	Investment grade	Minimal credit risk
AA+ AA AA-	AA+ AA AA-	Aa1 Aa2 Aa3		Very low credit risk
A+ A A-	A+ A A-	A1 A2 A3		Low credit risk
BBB+ BBB BBB-	BBB+ BBB BBB-	Baa1 Baa2 Baa3		Moderate credit risk
BB+ BB BB-	BB+ BB BB-	Ba1 Ba2 Ba3	Speculative grade	Substantial credit risk
B+ B B-	B+ B B-	B1 B2 B3		High credit risk
CCC+ CCC CCC-	CCC+ CCC CCC-	Caa1 Caa2 Caa3		Very high credit risk
CC C	CC C	Ca		In or near default, with possibility of recovery
DDD DD D	SD D	C		In default, with little chance of recovery

Figure 2.2: The scales of rating agencies

2.5 The impact of banks specific characteristics on their stability

The specialization of banks tends to have an impact on their stability during the crisis. Therefore, economists often control the specialization in their models, when they analyze the stability and the performance of banks. For instance, Stefancic (2016) create the analysis of Italian banks that showed that the cooperative banks performed better during the crisis than the commercial ones. The reason for this is that cooperative and commercial banks have different business models. Cooperative banks tend to be less exposed to credit

risks than commercial ones. Additionally, the allocation policy of assets is more efficient in cooperative banks than in commercial ones. The lending policies of cooperative banks tend to be more provident. Finally, cooperative banks tend to show lower cost-to-income ratio.

Manghetti (2011) compares in his study saving and commercial banks. It is a common view of economists that saving banks to be less efficient, less stable and less profitable than commercial ones. However, there are studies that refute this view, because they do not find significant difference between the performance of commercial and saving banks. The author claims that during the crisis the profitability of saving banks was less than the profitability of commercial ones. Nevertheless, the declining trend of the profitability is more observable for commercial banks.

Apart from the specialization, there are economists that argue that the fact if a bank was listed or not had an impact on the performance of banks during the crisis. However, this impact is not clear. Dietrich and Wanzenried (2011) create a study of main factors that influence the probability of banks, where they control the effect of listing a bank in a stock exchange market. On the one hand, the profitability of listed banks has to be higher, as there are shareholders that coerce them to be more profitable. On the other hand, unlisted banks do not have the costs of reporting and other requirements that listed banks have.

The effect of the size of a bank is also not clear. Adusei (2015) creates the analysis of banking sector in Ghana, where he claims that the size of a bank is positively related to its stability. The author explains it with the argument that size is positively related to the volatility of returns. In contrast, Kasman and Kasman (2016) argue exactly the opposite point of view. During their analysis of the banking sector of Turkey, they conclude that size is negatively related to the volatility of returns. Furthermore, De Nicolo (2000) claims that larger banks tend to have a higher level of risk-taking. Therefore, they are less stable.

Chapter 3

Methodology

To estimate the stability of the banks during the crisis, we count Z-scores for the banks in our sample for four years: 2006, 2007, 2008 and 2009. Z-score estimates the distance from the insolvency for banks. Z-score is negatively related to the probability that the bank can go broke. Thus, the higher Z-score is, the more stable and resistant the bank is. In order to find z-scores for the banks in our sample, we use a formula from (Laeven and Levine, 2009)

$$z = \frac{(ROA + CAR)}{\sigma(ROA)}. \tag{3.1}$$

Where
ROA – return on assets
CAR – capital adequacy ratio
z – Z-score
$\sigma(ROA)$ – standard deviation of return on assets
Z-score was very often used in the pre-crisis period to analyze the reliability of the bank. However, it is better to use the logarithm of z, as Z-score is highly skewed. For our sample, we calculate Z-scores for all banks for every year from 2006 till 2009. The means of Z-score between years differ a lot. In 2006 the banks in the sample have a mean of 24,94 and in 2009 an average Z-score decreased to 14,05 for the same sample of banks. This decline confirms that the crisis influenced the stability of the banks dramatically. Figure 3.1 illustrates the means of Z-scores during 2006-2009. We can observe that the mean of Z-score started to decrease in 2007. The cause of this might be the occurrence of the crisis. The probability of insolvency for the banks started to increase in 2007. As our primary goal is to analyze the influence of the indicators of loan

portfolio management on banks' stability during the crisis, we take Z-score as the dependent variable in our model.

Figure 3.1: Z-score

The independent variables are divided into three groups: the balance sheet variables, the variables that show the overall state of the economy of the country where the bank is located and banks specific dummies. For all the variables that we have in percentage, we calculate logarithms. Summary statistics for all variables is shown in the table A.1 in the appendix. Table A.2 provides the description of all the variables used.

This study concentrates a lot on analyzing the management of loan portfolio during the crisis. Therefore, from the balance sheet banking variables, the first independent variable taken is the ratio of impaired loans to total loans (IMPTOT) that allows us to estimate the quality of assets in the loan portfolio. The higher this ratio is, the worse the position of the loan portfolio of a bank is. And vice versa, when the ratio is low, it means that there is not a big amount of non-performing loans compared to the total number of bank's loans. Additionally, the growth of loans (GROWLOAN) is taken in order to find out if it was important during the crisis to decrease the growth of loans to have smaller credit risks for banks. Next independent variable examined is the ratio of (LOADEP) customer loans to customer deposits, as Huang and Ratnovski (2010) say that as investors have incentives to monitor banks accurately when

wholesale funding is high, banks cannot afford to take too much risks. Also, we take into account the ratio of total loans to total assets (LOANS). When this ratio is high, the banks are considered to be riskier and more active in lending. Nevertheless, usually these banks have less securitized assets that were highly risky during the crisis, that is why it is hard to say for sure what the effect of this ratio on Z-score is (Köhler, 2012).

To further analyze the risk of a portfolio, we use the ratio of risk-weighted assets to total assets (RWA)(Kapan and Minoiu, 2013). The tier 1 ratio (TIER1) is used to estimate the capital adequacy of the bank. Basel III demands that tier 1 ratio has to be greater than 6 at all times to consider the bank as well-capitalized. This ratio gives the opportunity to see the degree of influence of efficient management of capital on the overall stability of banks (Office of the Comptroller of the Currency, Treasury et al., 2012). In order to control the investment practises as a factor of successful activity of banks, the variable (NIM) which is net interest margin is included. The negative interest margin may imply that the managers were taking inefficient decisions.
To control the effects of overall countries' economies, we use GDP (GDP) (Daly et al., 2003) and average annual inflation (INFL) in the countries (Peng et al., 2005). Moreover, to further analyze the difference in banks' stability because of the location. The unemployment rate is used as an independent variable (UNEMP) in the model. As, for example, in Romania research showed that unemployment rate in the country played a crucial role for the performance of Romanian credit institutions (National Bank of Romania, 2008).
Finally, we also want to see if there is any relationship between banks stability during the crisis and whether the bank was listed, delisted or never listed at all. For this purpose, dummy variable (UNLIST) and (DELIST) is used (Koöhler, 2012). We also include dummy variables (COMM) and (COOP), which control the effects of specialization of the bank in our model (Kapan, 2013). The variable (SIZE) is created by taking the logarithm of the total assets of banks to be able to define the largest banks in the countries in our sample in 2006.

3.1 Empirical model

Firstly, we create a model that includes only bank characteristics variables that depend on the loan portfolio management. Thus, the regression is done on independent variables – IMPTOT, GROWLOAN, LOADEP and LOANS. The dependent variable is Z that is the logarithm of Z-score calculated above.

As it was said above, we take logarithm due to the fact that Z-score is very skewed.

$$Z_{i,t} = \beta_0 + \beta_1(IMPTOT_{i,t}) + \beta_2(GROWLOAN_{i,t}) + \beta_3(LOADEP_{i,t}) + \beta_4(LOANS_{i,t}) + u_{i,t} \quad (3.2)$$

Where $Z_{i,t}$ - the logarithm of Z-score for bank i in a year t; $IMPTOT_{i,t}$ - the logarithm of ratio of impaired loans to total loans; $GROWLOAN_{i,t}$ - the logarithm of growth of loans; $LOADEP_{i,t}$ - the logarithm of the ratio of total loans to total deposits; $LOANS_{i,t}$ - the ratio of total loans to total assets; $u_{i,t}$ - error term.

As the model uses panel data, we have to choose between different models. As when we work with this type of data, we have three types of models: Pooled OLS model, random effects model and fixed effects model. Therefore, first, we test our model with a Breusch-Pagan Lagrange Multiplier test, to choose what is more appropriate to use OLS model or random effects model. If we get results from LM test significant, random effects model is preferred to OLS model. However, we still need to decide if random effects model is better than fixed effects model. Though random effects estimator is considered to be more efficient than fixed effects estimator, sometimes we lose consistency while using random effects model.The Hausman test will indicate which of the models is more appropriate to use. As panel data regression demands estimators be both consistent and efficient, we need to be sure that our estimators satisfy these assumptions. But consistency is even more important than efficiency.

To extend the analysis, other regressors that represent banks characteristics are added to the model. In this model our explained variable is Z-score again. The set of our independent variables is – IMPTOT, GROWLOAN, LOADEP, LOANS, RWA, TIER 1, NIM, and SIZE.

$$Z_{i,t} = \beta_0 + \beta_1(IMPTOT_{i,t}) + \beta_2(GROWLOAN_{i,t}) + \beta_3(LOADEP_{i,t}) + \beta_4(LOANS_{i,t}) + \beta_5(RWA_{i,t}) + \beta_6(TIER1_{i,t}) + \beta_7(NIM_{i,t}) + \beta_8(SIZE) + u_{i,t} \quad (3.3)$$

Where $Z_{i,t}$ - the logarithm of Z-score for bank i in a year t; $IMPTOT_{i,t}$ - the logarithm of ratio of impaired loans to total loans; $GROWLOAN_{i,t}$ - the

logarithm of the growth of loans; $LOADEP_{i,t}$ - the logarithm of the ratio of total loans to total deposits; $LOANS_{i,t}$ - the logarithm of the ratio of total loans to total assets; $RWA_{i,t}$ - the logarithm the ratio of risk-weighted assets to total assets; $TIER1_{i,t}$ - logarithm of tier 1 ratio; $NIM_{i,t}$ -the logarithm of net interest margin; $SIZE$ - logarithm of total assets; $u_{i,t}$ - error term.
It might be also of interest to study the impact of macro variables on the stability of banks. Therefore, GDP, INFL and UNEMP are included to the model.

$$\begin{aligned} Z_{_{i,t}} = \beta_0 + \beta_1(IMPTOT_{i,t}) + \beta_2(GROWLOAN_{i,t}) + \beta_3(LOADEP_{i,t}) \\ +\beta_4(LOANS_{i,t}) + \beta_5(RWA_{i,t}) + \beta_6(TIER1_{i,t}) + \beta_7(NIM_{i,t}) \\ +\beta_8(SIZE) + \beta_9(GDP_{i,t}) + \beta_{10}(INFL_{i,t}) + \beta_{11}(UNEMP_{i,t}) + u_{i,t} \end{aligned} \quad (3.4)$$

Where $Z_{_{i,t}}$ - the logarithm of Z-score for bank i in a year t; $IMPTOT_{i,t}$ - the logarithm of ratio of impaired loans to total loans; $GROWLOAN_{i,t}$ - the logarithm of the growth of loans; $LOADEP_{i,t}$ - the logarithm of the ratio of total loans to total deposits; $LOANS_{i,t}$ - the logarithm of the ratio of total loans to total assets; $RWA_{i,t}$ - the logarithm of the ratio of risk-weighted assets to total assets; $TIER1_{i,t}$ - the logarithm of tier 1 ratio; $NIM_{i,t}$ - the logarithm of net interest margin; $SIZE$ - logarithm of total assets; $GDP_{i,t}$ - the logarithm of GDP growth; $INFL_{i,t}$ - the logarithm of the rate of inflation;$UNEMP_{i,t}$ - the logarithm of unemployment rate; $u_{i,t}$ - error term
Then individual-specific effects are recovered to see how much individual values can be different from the ones predicted by the model. We recover these individual-specific effects using the following formula

$$\widehat{a}_i = \overline{Z}_i - \overline{\mathbf{x}}'_{\mathbf{i}}\widehat{\beta} \quad (3.5)$$

Where a_i - individual specific effects for a bank i; $\overline{Z}_i$ - the mean of logarithm Z-score; $\overline{x}'_i$ - the means of regressors. So we are removing the times effects from both the dependent variable and the independent variables.

After all, the countries are compared by the means of Z-score in order to determine in which countries the banking sectors performed better during the crisis than in other countries in the sample. And vice versa, the paper intends to determine in which countries the banking sectors performed worse during the crisis than in other countries in the sample.

3.2 Data and sample description

This paper uses the data for 69 largest banks during the period of 2006-2009 in 18 European countries: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, United Kingdom, Greece, Hungary, Ireland, Italy, Netherlands, Norway, Poland, Portugal, Sweden and Switzerland. The banks were considered as largest by their total assets as of 2006. Due to the data unavailability, the sample decreased from 100 largest banks to 69. The choice of the number of years from 2006 till 2009 is made because we want to analyze the dependence of banks' stability during the crisis (2008-2009) on their stability in the pre-crisis period (2006-2007). The sources for the data are Bureau Van Dijk's BankScope[1]database and the WorldBank [2]. From the BankScope, the data for bank characteristics is obtained. The WorldBank was used to collect the data about macroeconomic variables for the countries where banks from our dataset are located.

We have a balanced panel data, meaning that all banks have measurements for all independent variables in all time periods. The panel data is considered to be short, as there are a lot of entities (banks), but a few periods (4 years). Additionally, panel data is fixed, as the same banks are observed for each period in the data set.

Additionally, our data set can be divided in two ways. Firstly, there are three different specializations of banks in the sample: commercial (51banks), saving (10 banks) and cooperative (8 banks). Secondly, we can create groups based on whether the banks were listed or not: delisted (10 banks), listed (30 banks) and unlisted (29). Unlisted are those banks that were never listed at all. Table A.3 provides the overview of the banks in the sample in the appendix.

[1]BankScope:https://bankscope.bvdinfo.com/version-2016620/home.serv?product=scope2006
[2]http://www.worldbank.org/ database

Chapter 4

Empirical results

4.1 Results of the regressions

The result of the first test taken – Breusch-Pagan Lagrange Multiplier test is the rejection of H_0. This result means that random effects model is more appropriate for this panel data, as p-value is small enough and we can reject H_0. The results are in the Appendix in Figure A.1. Then, Hausman test resulted in p-value equal to 0.000. As a result, we can reject the null hypothesis again. The results are shown in Figure A.2 in the Appendix. In Hausman test the null hypothesis is that both models - random and fixed are appropriate for the data set. Therefore, we should use fixed effects model. The correlation between the fixed effect a_i and independent variables may cause biased estimators if we do not take a_i from the estimation. Eliminating of these biases is done by fixed effects model and the first differencing. However, the first differencing method works only for two-period panel data. As we have four periods, we use fixed effect model. Fixed effect model allows the intercept to differ across the banks, but to be the same over time. With this model, we can control heterogeneity if it is constant over time, but is correlated with regressors. To estimate fixed effects model, two regressions are run with LSDV estimator and within estimator. They produce identical estimators. However, within model gives us incorrect R^2, therefore, we should use R^2 from LSDV model. To cope with perfect multicollinearity, LSDV1 approach is used. This approach drops one dummy variable from the regression.

Our results show that average value of a is equal to 4.66851. Only GROWLOAN that is the growth of loans is estimated to increase the value of Z. The β is equal to 0.046. The model predicts that when the growth of loans increases by 1%,

Z-score increase by 0.046%. Thus, the growth of loans influenced the stability of big European banks positively during the crisis. The result is significant with a 95% confidence, as p-value is 0.000. Thus, it is small enough to reject the hypothesis that there is no influence of this regressor on the explained variable.

In contrast, IMPTOT, LOADEP and LOANS are considered to have negative effects on the banks profits during the crisis. IMPTOT (impaired loans to total loans) is significant, as p-value is 0.000. A one percent increase in the ratio of impaired loans to total loans is predicted to decrease Z-score by 0.227 percent by the model, holding all other variables constant. This is easily predictable, as the more non-performing loans a bank has, the more losses it experiences. Additionally, the model shows that LOADEP decreases Z-value of banks. However, the result is not significant.The reason for this conclusion is that p-value is greater than 0.05. Thus, we cannot reject the null hypothesis that the estimator is equal to zero at the 0.05 level. Therefore, the ratio between loans and deposits did not play an important role for banks' stability during the crisis. The independent variable LOANS that is the ratio of total loans to total assets is insignificant. Due to the fact that p-value is not small enough to reject the null hypothesis. Therefore, we can conclude that from the independent variables used in the model, only loan growth and the ratio of impaired loans to total loans were important during the crisis. This importance means that it was crucial for managers to analyze the borrowers accurately in order not to let IMPTOT increase. Nevertheless, providing loans produced a profit for banks, so an increase in the rate of growth of loans enabled them to improve their stability. Doubtless, this was possible only with a condition of efficient analysis of borrowers due to the fact that they had to avoid the appearance of impaired loans. Therefore, the banks had to use methods to manage credit risks described above in the literature in order not to let subprime lending happen. Both LSDV1 and within estimator provide identical estimates for regressors. Therefore, it is concluded that data set does not have too many observations for LSDV being not appropriate. In this case, it is better to use LSDV1 approach, as it gives us correct R2, which is equal to 0.588. This means that 59% of the variation in Z-score is explained by this model. And p-value for F test is very small, that is why we can say that we can reject the null hypothesis that all of the coefficients on the regressors in the model are equal to zero. Both tables with LSDV(4.2) and within(4.1) provide the results. t statistics in parentheses* $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table 4.1: Within estimator

Variable	**Coefficient** (Std. Err.)
IMPTOT	-0.227** (0.038)
LOADEP	-0.239 (0.163)
GROWLOAN	0.046** (0.012)
LOANS	-0.703 (0.460)
Intercept	4.669** (0.742)
N	276
R^2	0.374
$F_{(72,203)}$	30.294

Table 4.2: LTDV

Variable	**Coefficient** (Std. Err.)
IMPTOT	-0.227** (0.038)
LOADEP	-0.239 (0.163)
GROWLOAN	0.046** (0.012)
LOANS	-0.703 (0.460)
Intercept	4.832** (0.764)
N	276
R^2	0.588
$F_{(72,203)}$	4.03

To extend the analysis we add RWA, TIER 1, NIM, and SIZE to the model. Then LSDV is run again. The R^2 has increased to 0.785, therefore, adding new variables increases the number of percents in the variation of Z-score that is explained by the

model. The regressor IMPTOT is still significant, as p-value is small enough to reject H_0. Nevertheless, the influence of this independent variable is smaller now, as a one percent increase in the ratio of non-performing loans to total loans is predicted to decrease Z-score by 0.192 percent by the model, holding all other variables constant. GROWLOAN is also significant, due to the fact that p-value is very small. But in contrast to IMPTOT, after we control more variables, the model predicts that the influence of the growth of loans on the stability of a bank becomes greater. Now 1% increase in growth of loans leads to 0.072% increase in Z-score. While controlling new variables, LOANS becomes significant because p-value is small enough to allow us to reject the hypothesis that there is no significant influence of the ratio of total loans to total assets on the stability of banks. The estimator is equal to -1.119, thus, 1% increase in LOANS results in 1,119% decrease in Z-score. Therefore, if there are too many loans compared to bank's total assets, a bank's stability is predicted to worsen. The explanatory variable LOADEP is still not significant, as we cannot reject the null hypothesis at 0.05 level. Because p-value is too large. Additionally, while analyzing newly added to the model variables, we can see that Tier 1 ratio is predicted to increase Z-score. The p-value is very small. This is expected, as the capital adequacy is high, a bank is considered to be more stable. A one percent increase of Tier 1 ratio leads to 0.690 percent increase of Z-score. Also, net interest margin has a positive estimator. However, the result is not significant, as p-value is too big to reject the null hypothesis. Therefore, we can say that investment strategies were not so important as the management of loan portfolio during the crisis in order for a bank to be more stable. Furthermore, the ratio of risk-weighted assets to total assets (RWA) is not significant. The p-value is not small enough to reject the null hypothesis. The estimator is positive. Though the more capital bank holds to reduce the risk of insolvency, the more chances it has to pay the debt. Higher RWA does not cause significantly higher Z-score. In contrast to RWA, SIZE is the significant independent variable, as p-value is small enough to reject H_0. The model predicts that larger size increases the probability of insolvency. This effect may be due to the fact that large banks show higher levels of risk-taking (De Nicolo , 2000). Table 4.3 shows the results.

In order to control country variables, now GDP, UNEMP and INFL are added to the model. The significance of previously described explanatory variables does not change. R^2 becomes slightly bigger (0.822). All country variables are significant, as p-values are small enough to reject the null hypotheses. The rate of unemployment tends to increase the probability of insolvency of a bank, thus, decrease Z-score. This relationship is due to the fact that when the unemployment is high, the demand for new loans is also high, but mostly these loans become non-performing.(National Bank of Romania report, 2008) In addition, GDP growth has a positive income on Z-score.

Table 4.3: Controlling other banking factors

Variable	**Coefficient** (Std. Err.)
LOANS	-1.119** (0.359)
TIER1	0.690** (0.088)
NIM	0.054 (0.052)
GROWLOAN	0.072** (0.010)
LOADEP	-0.108 (0.121)
IMPTOT	-0.192** (0.029)
SIZE	-0.862** (0.107)
RWA	0.239 (0.312)
Intercept	17.723** (2.018)
N	276
R^2	0.785
$F_{(76,199)}$	9.548

As GDP growth increases, when there is economic growth in a country. When the economy prospers, the banking sector becomes more stable (Worldbank). Furthermore, a higher rate of inflation is predicted to increase Z-score. This relationship is due to the fact that banks can make profits on higher inflation. As when prices rise, people need more money, thus they want to borrow from banks. Moreover, there is a view that inflation tends to encourage investment decisions of banks (Chioma et al., 2014). Table 4.4 describes the results.

Table 4.4: Country variables

Variable	**Coefficient** (Std. Err.)
LOANS	-1.381** (0.333)
TIER1	0.687** (0.083)
NIM	0.032 (0.048)
GROWLOAN	0.057** (0.010)
LOADEP	-0.032 (0.113)
IMPTOT	-0.145** (0.028)
SIZE	-0.712** (0.105)
RWA	0.169 (0.291)
GDP	0.00019** (0.000)
INFL	0.057** (0.017)
UNEMP	-0.437** (0.111)
Intercept	16.520** (1.997)
N	276
R^2	0.822
$F_{(79,196)}$	11.434

Now we create the model that includes only significant variables from previous regressions. Additionally, we want to control the specialization of banks, for this purpose dummy variables – COMM and COOP are created. The base group includes saving banks. LTDV regression is run again. The p-values are small enough to consider the specialization of banks to be significant at 0.05 level. Therefore, we can conclude that our model suggests that the specialization of banks had a substantial effect on the probability of bankruptcy of banks in our sample during the crisis. Commercial banks tend to have a higher Z-score than Saving banks, as predicted by the model. The coefficient is positive – 0.461. Cooperative banks are predicted by the model to have higher Z-scores than commercial ones. Furthermore, to control the possible effect of the fact if the bank is listed. We add to dummy variables DELIST and UNLIST to the model. The base group includes listed banks. The p-values are small enough to conclude that the model allows considering these independent variables as significant at 0.05 level. If a bank is unlisted, its Z-score is larger on 1.219% approximately than Z-score of a listed bank. While if a bank is delisted, its Z-score is larger on 3.356% than Z-score of a listed one. This result let us conclude that the model predicts that listed banks tend to have a higher probability of insolvency than those that are unlisted and delisted. The R^2 is 0.821. Therefore, the model explains 82% of the variation of Z-score for banks in our sample. The final model is

$$\begin{aligned} Z_{i,t} = \beta_0 + \beta_1(IMPTOT_{i,t}) + \beta_2(GROWLOAN_{i,t}) \\ +\beta_3(LOANS_{i,t}) + \beta_4(TIER1_{i,t}) \\ +\beta_5(SIZE_i) + \beta_6(GDP_{i,t}) + \beta_7(UNEMP_{i.t}) \\ +\beta_8(INFL_i) + \delta_9(COMM_{i,t}) + \delta_{10}(COOP_{i.t}) \quad +\delta_{11}(DELIST_i) + \delta_{12}(UNLIST_{i,t}) + u_{i,t} \end{aligned}$$

Where $Z_{i,t}$ - the logarithm of Z-score for bank i in a year t; $IMPTOT_{i,t}$ - the logarithm of ratio of impaired loans to total loans; $GROWLOAN_{i,t}$ - the logarithm of the growth of loans; $LOANS_{i,t}$ - the logarithm of the ratio of total loans to total assets; $TIER1_{i,t}$ - the logarithm of tier 1 ratio; $SIZE$ - logarithm of total assets; $GDP_{i,t}$ - the logarithm of GDP growth; $INFL_{i,t}$ - the logarithm of the rate of inflation;$UNEMP_{i,t}$ - the logarithm of unemployment rate; $COMM_{i,t}$ - dummy variable for commercial banks; $COOP_{i.t}$ - dummy variable for cooperative banks; $DELIST_i$ - dummy variable for delisted banks; $UNLIST_{i,t}$ - dummy variable for never listed banks; $u_{i,t}$ - error term.

Table 4.5 shows the results of the final model. This model evaluates the distance from the insolvency for banks (Z-score) in the sample, controlling only significant factors.

Table 4.5: Final model

Variable	**Coefficient** (Std. Err.)
LOANS	-1.354** (0.289)
TIER1	0.654** (0.063)
GROWLOAN	0.054** (0.009)
IMPTOT	-0.150** (0.028)
SIZE	-0.741** (0.094)
GDP	0.00019** (0.000)
INFL	0.057** (0.017)
UNEMP	-0.450** (0.110)
DELIST	3.356** (0.638)
UNLIST	1.219** (0.340)
COMM	0.461** (0.134)
COOP	2.064** (0.303)
Intercept	15.417** (1.384)
N	276
R^2	0.821
$F_{(76,199)}$	11.996

After running all the regressions, we want to recover individual specific effects. For this purpose we use fixed effects estimator for the significant independent variables, we got from previous recessions. However, dummy variables that control the specialization and the fact if a bank is listed are excluded. As fixed effects model

does not allow to analyze dummy variables. Then formula 3.4 is used.
The results show that standard deviation of individual specific effects – alphafehat is 1.167. The minimum of alphafehat is -2.818, the maximum is 2.341. This means that individual specific effects increase Z-score maximally by 2.341 and decrease maximally by 2.818 from predicted by the model. Table 4.6 provides the summary of the results. Table A.4 in the appendix shows the detailed overview of the results.

Table 4.6: Summary individual specific effects

Variable	**Mean**	**Std. Dev.**	**Min.**	**Max.**
alphafehat	0	1.167	-2.818	2.341
N		276		

Finally, we compare the development of banking sector among countries in our sample. To do this, we use Z score means. We intend to find in which countries Z-score decreased the most and in which one the least. To do this, we calculate Z-score means for the banking sector for each country in 2006 and 2009 years. Then we subtract Z-score means 2009 from Z-score means 2006. The table A.5 in the appendix provides the results. It can be observed that Belgium is the only country in the sample in which banks have on average Z-score in 2009 higher than in 2006. In contrast, the banking sectors in Greece and Ireland experienced more problems than the banks in other countries in the sample during the crisis. Because their average Z-scores decreased a lot.

4.2 Further discussion of the results

The model estimates that the explanatory variables, which indicate the quality of loan portfolio management, are significant for the size of Z-score. The ratio of impaired loans to total loans (IMPTOT) is significant for the stability of the banking sector in Europe, managers need to analyze the borrowers accurately. Because subprime lending can lead to high losses for a bank, and, thus, lead to its bankruptcy. The growth of loans is estimated to have a positive effect on Z-score. That is why it is very important not only to use efficient models to evaluate the creditworthiness of borrowers but also try to achieve a positive loan growth. The way to analyze the ability of borrowers to repay loans is done through basic steps described in the literature review.
The ratio of total loans to total assets affects Z-score severely. That is why it is important for banks to find a point where the number of assets that are loans is such that does not let liquidity problems appear. Their assets must be diversified by other types of assets, such as reserves, investment securities, and physical assets. This is

significant for banks in order to have a low probability of insolvency.
The model considers Tier 1 ratio as also the significant variable. Therefore, managers in banks have to keep it high enough in order no to go broke. As managers have to keep the capital high enough to let a bank operate successfully, they should replenish the capital either with the help of external sources or internal sources. The decision what sources to use should be made in response to the size of profit and the conditions on the market. The conditions on the market determine how fast the capital must be replenished.
The listing of banks is predicted to have a bad effect on Z-score. In Europe mostly only very large banks are listed. The majority of European banks are unlisted. The model shows that delisted banks tend to have a lower probability of the bankruptcy. This may be caused by the fact that they have lower costs than the banks that are listed. Despite the fact that they destroyed the value of shares. Additionally, the results show that cooperative banks were the most successful during the crisis. The difference in stability that is related to the difference in the specialization may occur due to the fact that commercial, cooperative and saving banks have completely different business models. This may be due to the fact that cooperative banks are less exposed to credit risks.
All country variables turned out to be significant for the size of Z-score of the banks. Country variables cannot be regulated by banks, as only macro policies can have impacts on them. Therefore, when we create the analysis that shows in which countries the banking sector was the most stable and which one the least during the crisis, we can conclude in which countries macro policies were more successful. Successful macro policies mean that the government provides easy conditions for the banking sector to operate efficiently. From analyzing Z-scores, we concluded that Belgium was the only country in the sample where average Z-score for banks did not become less in 2009 compared to the pre-crisis period. This result of the analysis means that authorities responded well to the crisis. Therefore, it might be interesting to analyze in future what decisions were made and what policies were implemented in Belgium that it performed better than other EU countries. Additionally, it should be interesting to study what were reasons for Greece and Ireland that made them perform worse than all other countries in the sample.

Chapter 5

Conclusion

The global financial crisis that started in 2007-2008 affected the whole world. The number of bankruptcies of banks all over the world was increasing during those years. Though the crisis appeared initially in the USA, there are pieces of evidence that the impact of it on European banks was even larger than on US banks. Because for European banks, it was harder to recover from the crisis. Furthermore, some economists claim that European banks have never recovered fully after the crisis appeared. Because of such a strong effect of the crisis, the managers in banks had to improve their systems of management as fast as they could. The successful management during the crisis depended on the factors that were the most crucial for the stability of the banking sector.

This thesis analyzes the role of bank management in the stability of large banks in 18 European countries during the period of 2006-2009. For the analysis, the sample of 69 banks considered large by their total assets is taken. To estimate the stability of banks, we calculate Z-score, which is the negatively related to the probability of insolvency of banks. From the literature, we determine what factors are the most frequently analyzed to evaluate the stability of banks by the economists. Mostly the paper focuses on the indicators of loan portfolio management. Additionally, the study takes into account country variables such as GDP growth, the rate of inflation and unemployment rate. Furthermore, to control bank specific characteristics – dummy variables that control the specialization of banks and the fact whether a bank is listed or not are included. Then fixed effect model is used to analyze our data.

One goal of this paper is to analyze what factors were significant to manage during the crisis. The second goal is to examine if specifically loan portfolio management indicators were significant for the stability of banks during the crisis. Finally, our intention was to analyze in which country the banking sector had the highest and the lowest stability during the crisis.

In order to analyze what factors were significant for banking stability during the crisis, we reviewed the literature. We included the independent variables that control loan portfolio management, liquidity management, capital management and investment practices. Our first findings are that for the stability of large European banks during the crisis, loan portfolio management indicators are significant. The ratio of impaired loans to total loans is negatively related to Z-score, as the more impaired loans a bank has, the more losses it experiences. However, the growth of loans has a positive effect on Z-score. This is due to the fact that banks earn profits on loans, whenever they perform. Therefore, it is important for managers in banks to have a high growth of loans, but to analyze borrowers accurately to have these loans performing. The ratio of total loans to total assets is estimated to decrease Z-score. Therefore, though it is good to have a high growth of loans for banks, their assets must be diversified by other types of assets, such as reserves, investment securities, and physical assets.

Additionally, apart from loan portfolio management indicators, the size of banks and Tier 1 ratio are significant for Z-score of banks, as estimated by our model. Size has a positive relationship with their probability of insolvency. This may be caused by the fact that large banks tend to show higher levels of risk-taking. In contrast, the increase in Tier 1 ratio is estimated to reduce the probability of insolvency by increasing Z-score. The cause for this relationship is that Tier 1 ratio shows the level of capitalization of a bank. Well-capitalized banks are more stable than other banks. Moreover, the study reveals that all country variables included in the model, such as GDP growth, Unemployment rate and Inflation rate have significance effect on the probability of insolvency of banks. Unemployment rate increases the probability of bankruptcy of banks because of increasing number of non-performing loans. In contrast, GDP growth, and Inflation rate improve the stability of banking sector. Because economic growth creates more opportunities for the banking sector to progress and banks can earn profits on inflation.

Furthermore, the dummy bank specific variables included in the model are also significant. We found that cooperative banks had the least probability of insolvency during the crisis. The reason for this is that cooperative banks are considered less risky than other types of banks. Additionally, unlisted and delisted banks tended to be more stable during the crisis, as estimated by the model. The might be caused by the fact that they have lower costs, as they do not have to pay for reporting and other requirements.

Finally, we created the model that included all significant variables from the previous regressions. This model evaluates the distance from the insolvency for banks (Z-score) by controlling only significant factors. This model explains 82% of the variation of Z-score. Then, we analyzed the stability of banking sectors in different

countries in our sample. Our results are that in Belgium banking sector was the most stable, while in Ireland and Greece the least. This can induce future studies about decisions of the governments that led to these results.

In the end, we would like to conclude that efficient systems of management in banks are essential for their successful operation and stability. The management in banks is a very complex issue that consists of many different factors and depends on the conditions of the economy. The primary intention of this thesis was to analyze loan portfolio management and its influence on the banking stability of European banks during the global financial crisis.

Bibliography

Angelini, P., L. Clerc & L. CĂşrdia & V. Gambacorta& L. Gerali& A. Locarno& A. Motto& R. Roeger& W. Van den Heuvel& S. VlÄŤek (2015): "Basel III: Long-term Impact on Economic Performance and Fluctuations" *The Manchester School* **83**: pp. 217–251.

Adusei, M. (2015): "The impact of bank size and funding risk on bank stability" *Cogent Economics Finance* **3**: pp. 1–19.

Berger, A., C. Bouwman (2013): "How does capital affect bank performance during financial crises?" *Journal of Financial Economics* **109**: pp. 146–176

Black, L., R. Correa & X. Huang & H. Zhou (2016): "The systemic risk of European banks during the financial and sovereign debt crises" *Journal of Banking & Finance* **63**: pp. 107–125.

Brown, K., P. Moles (2008): "Credit Risk Management" *Edinburgh Business School*

Bucur, I., S. Dragomirescu (2014): "THE INFLUENCE OF MACROECONOMIC CONDITIONS ON CREDIT RISK: CASE OF ROMANIAN BANKING SYSTEM" *STUDIES AND SCIENTIFIC RESEARCHES, ECONOMICS EDITION* **19**.

Caruntu, G., M. Romanescu (2008): "The Assessment of Banking Performances-Indicators of Performance in Bank Area" *University of Constantin Brancusi Targu Jiu, Romania.*

Chiorma, D., S. Adanma& N. Clementina (2014): "Empirical Study of the Impact of Inflation on Bank Performance: Implication for Investment Decision Making

in Banking Industry in Nigeria" *Humanity & Social Sciences Journal* **9**: pp. 61–71.

Daly, M., J. Krainer& J. Lopez (2003): "Does Regional Economic Performance Affect Bank Conditions? New Analysis of an Old Question" *Federal Reserve Bank of San Francisco, Economic Research Department.*

Dietrich, A., G. Wanzenried (2011): "Determinants of bank profitability before and during the crisis: Evidence from Switzerland" *Journal of International Financial Markets, Institutions and Money* **21**: pp. 307–327.

Gerlach, S., W. Peng& C. Shu (2005): "Macroeconomic conditions and banking performance in Hong Kong SAR: a panel data study" *Investigating the relationship between the financial and real economy* **22**: pp. 481–497.

Gizycki, M. (2001): "THE EFFECT OF MACROECONOMIC CONDITIONS ON BANKS RISK AND PROFITABILITY" *System Stability Department, Reserve Bank of Australia.*

Gocer, A. (2013): "Relation between Bank Loans and Unemployment in the European Countries" *EUROPEAN ACADEMIC RESEARCH* **1**: pp. 981–995.

Huang, R., L. Ratnovski (2010): "The Dark Side of Bank Wholesale Funding" *International Monetary Fund.*

Kapan, T., C. Minoiu (2013): "Balance Sheet Strength and Bank Lending During the Global Financial Crisis" *IMF Working paper* **43**: pp. 607–631

Kasman, A., S. Kasman (2013): "Bank size, competition and risk in the Turkish banking industry" *Empirica*

Kohler, M. (2012): "Which banks are more risky? The impact of loan growth an business model on bank risk-taking" *Discussion Paper, Deutsche Bundesbank.*

Kumbirai, M., R. Webb (2010): "A financial Ratio Analysis of Commercial Bank Performance in South Africa." *African Centre for Economics and Finance* **2**: pp. 30–53.

Laeven, L., R. Levine (2009): "Bank Governance, Regulation, and Risk Taking" *Journal of Financial Economics* **93**: pp. 259–275.

Lobanova, A., A. Chugunova (2008): "ENCYCLOPEDIA OF FINANCIAL MANAGEMENT OF RISK"

Lepetit, L., F. Strobel (2014): "Bank income smoothing, ownership concentration and the regulatory environment" *Journal of Banking & Finance* **41**: pp. 253–270.

Manghetti, G. (2011): "Do Savings Banks differ from traditional Commercial Banks? " *ESBG Perspective* **63**: pp. 141–156.

Moinescu, B. (2008): "Banking stability and unemployment: an empirical analysis on Romania" *International Monetary Fund, National Bank of Romania Regional Seminar on Financial Stability Issues.*

Nicolo, G. (2000): "Size, Charter Value and Risk in Banking: An International Perspective" *IMF Working Paper.*

Ongore, V., G. Kusa (2013): "Determinants of Financial Performance of Commercial Banks in Kenya" *International Journal of Economics and Financial Issues* **3**: pp. 237–252.

Pan, Q., M. Pan (2014): "The Impact of Macro Factors on the Profitability of Chinaâ€™s Commercial Banks in the Decade after WTO Accession" *Open Journal of Social Sciences* **2**: pp. 64–69.

Poura, E.,M.. Lasfer (2013): "Why do companies delist voluntarily from the stock market?" *Journal of Banking & Finance* **37**: pp. 4850–4860.

Samad, A. (2004): 'PERFORMANCE OF INTEREST-FREE ISLAMIC BANKS VIS-Ă€-VIS INTEREST-BASED CONVENTIONAL BANKS OF BAHRAIN'" *IIUM Journal of Economics and Management* **12**: pp. 1–15.

Schildbach, J., C. Wenze (2016): "Bank performance in the US and Europe" *Deutsche Bank research* : pp. 1–19

Stefancic, M., (2013): "Are Cooperative Banks Better Equipped to Weather Financial Crisis than their Commercial Counterparts? Evidence from the Italian Banking

Sector before and during the Credit Crisis" *Organizacija* **49**: pp. 108–126

Shingjergji, A., M. Hyseni (2015): "The determinants of the capital adequacy ratio in the albanian banking system during 2007-2014" *International Journal of Economics, Commerce and Management* **III**: pp. 1–10.

Terazi, E., S. Senel (2010): "The Effects of the Global Financial Crisis on the Central and Eastern European Union Countries" *International Journal of Business and Social Science* **2**: pp. 186–192

Wilson, T., (2015): "Value and Capital Management: A Handbook for the Finance and Risk Functions of Financial Institutions" *Wiley finance series.*

Weigand A., R. (2015): "A tale of two banking systems: the performance of U.S. and European banks in the 21st century" *Investment Management and Financial Innovations* **12**: pp. 146–162.

Appendix A

Appendix

Table A.1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
A					0
BankName					0
City					0
year	2007.5	1.12	2006	2009	276
TotalCapitalRatio2006	12.409	7.033	7.140	88.900	276
ROA2006	0.618	0.76	-5.449	3.039	276
SDROA06	0.675	0.186	0.503	0.950	276
Z	20.623	12.486	8.302	162.061	276
LIQUI	0.189	0.126	0.003	0.828	276
LEVER	19.524	12.251	9.364	161.519	276
ROADV	1.099	1.22	-5.733	6.038	276
SIZE	17.697	1.661	13.553	21.513	276
NetInterestIncomeAverageEa	1.968	1.072	-0.08	6.97	276
IMPTOT	0.776	1.007	-5.116	3.074	276
LOADEP	4.94	0.392	3.776	5.98	276
NIM	0.53	0.618	-2.12	2.526	276
GROWLOAN	1.805	1.839	-4.163	4.518	276
LIST					0
SPEC					0
tier1	9.587	6.391	5.05	83.100	276
TIER1	2.186	0.321	1.619	4.42	276
LOANS	0.636	0.186	0.038	0.992	276
RWA	0.556	0.182	0.069	0.876	276
GDP	43708.604	18931.381	8999.74	96880.509	276
INFL	0.684	0.854	-2.337	2.347	276
UNEMP	1.783	0.383	0.916	2.625	276
banknum	35	19.953	1	69	276
z	2.944	0.363	2.117	5.088	276
_est_fixed	1	0	1	1	276
_est_random	1	0	1	1	276
res	2.944	0.39	2.057	6.029	276
_est_ols	1	0	1	1	276
_est_ols_dum	1	0	1	1	276
countrynum	11.159	4.364	1	18	69
COMM	0.739	0.44	0	1	276
COOP	0.116	0.321	0	1	276
SAV	0.145	0.353	0	1	276
DELIST	0.145	0.353	0	1	276
LISTED	0.435	0.497	0	1	276
UNLIST	0.42	0.495	0	1	276
alphafehat	0	1.167	-2.818	2.341	276

Table A.2: Description of the variables

Variables	Description
z	logarithm of Z-score
IMPTOT	logarithm of the ratio of impaired loans to total loans
GROWLOAN	logarithm of growth of loans
LOADEP	logarithm of the ratio of total assets to total deposits
LOANS	logarithm of the ratio of total loans to total assets
TIER1	logarithm of Tier 1 ratio
SIZE	logarithm of total assets
NIM	logarithm of net interest margin
RWA	logarithm of the ratio of risk-weighted assets to total assets
GDP	logarithm of GDP growth
INFL	logarithm of inflation rate
UNEMP	logarithm of unemployment rate
COMM	dummy variable if a bans is commercial
COOP	dummy variable if a bank is cooperative
DELIST	dummy variable if a bank is delisted
UNLIST	dummy variable if a bank was never listed

Table A.3: Description of banks in the sample

Countries	all banks in the model	listed	delisted	unlisted	commercial	saving	cooperative
Austria	2	1	0	1	2	0	0
Belgium	3	0	0	3	2	1	0
Czech Republic	3	0	1	0	3	0	0
Denmark	6	5	0	1	6	0	0
Finland	3	0	1	4	2	2	1
France	4	0	2	4	3	0	1
Germany	3	3	0	0	3	0	0
Greece	1	1	0	0	1	0	0
Hungary	3	1	0	2	3	0	0
Ireland	3	1	1	1	3	0	0
Italy	7	4	0	3	2	0	5
Netherlands	4	0	0	4	3	0	1
Norway	7	5	2	1	3	5	0
Poland	2	2	0	0	2	0	0
Portugal	5	3	0	2	4	1	0
Sweden	3	3	0	0	2	1	0
Switherland	1	0	1	0	1	0	0
United Kingdom	9	0	2	7	9	0	0
Total	72	30	10	32	54	10	8

Table A.4: Individual specific effects means for 4 years

banknum	**mean**	**banknum**	**mean**
1	-.0256494	36	-1.061751
2	-.3116042	37	1.758617
3	1.268128	38	.4568818
4	-.4090922	39	1.927687
5	1.199938	40	-.7510849
6	-.3826129	41	-.4960299
7	-1.155776	42	-1.597696
8	-.3661287	43	-1.108759
9	.1438747	44	.7465461
10	-.3397425	45	-1.231604
11	.3520709	46	.3467127
12	.3490492	47	.6463647
13	-.0335703	48	-1.215458
14	-2.747089	49	-.7662646
15	-.3207464	50	.170613
16	-1.515645	51	-.387044
17	.119837	52	.0875859
18	-1.762416	53	.5122387
19	.5448247	54	1.21323
20	-.6670524	55	1.027556
21	.4064626	56	-.6338593
22	-2.817955	57	-.3783688
23	-.4870063	58	-.8733428
24	-1.058979	59	-1.706114
25	-1.080669	60	-.812421
26	2.056297	61	1.024842
27	1.57667	62	.9893865
28	-1.308034	63	-.5725744
29	-.6276267	64	2.111641
30	2.340973	65	.3096476
31	-.0212106	66	.4771047
32	1.43279	67	2.321115
33	1.704335	68	-.5465322
34	2.059698	69	-1.102748
35	.9975372	Total	-5.51e-09

Table A.5: The difference between Z-scores in 2006 and in 2009

Countries	Z-score 2006	Z-score 2009	the difference between 2006 and 2009
Austria	46.9	37.2	-9.76
Belgium	19.0	27.5	8.51
Czech Republic	24.2	16.3	-7.94
Denmark	27.4	16.2	-11.2
Finland	26.1	13.3	-12.8
France	20	12.9	-7.14
Germany	22	13.6	-8.41
Greece	34.1	12.8	-21.25
Hungary	21.3	13.7	-7.58
Ireland	23.2	8.7	-14.5
Italy	21.7	12.3	-9.7
Netherlands	25.5	12.8	-12.7
Norway	21.9	12.2	-9.71
Poland	26.3	12.1	-14.25
Portugal	27.4	14.3	-13.13
Sweden	21.9	14	-7.90
Switherland	30.4	20.7	-9.64
United Kingdom	30	16.3	-13.76

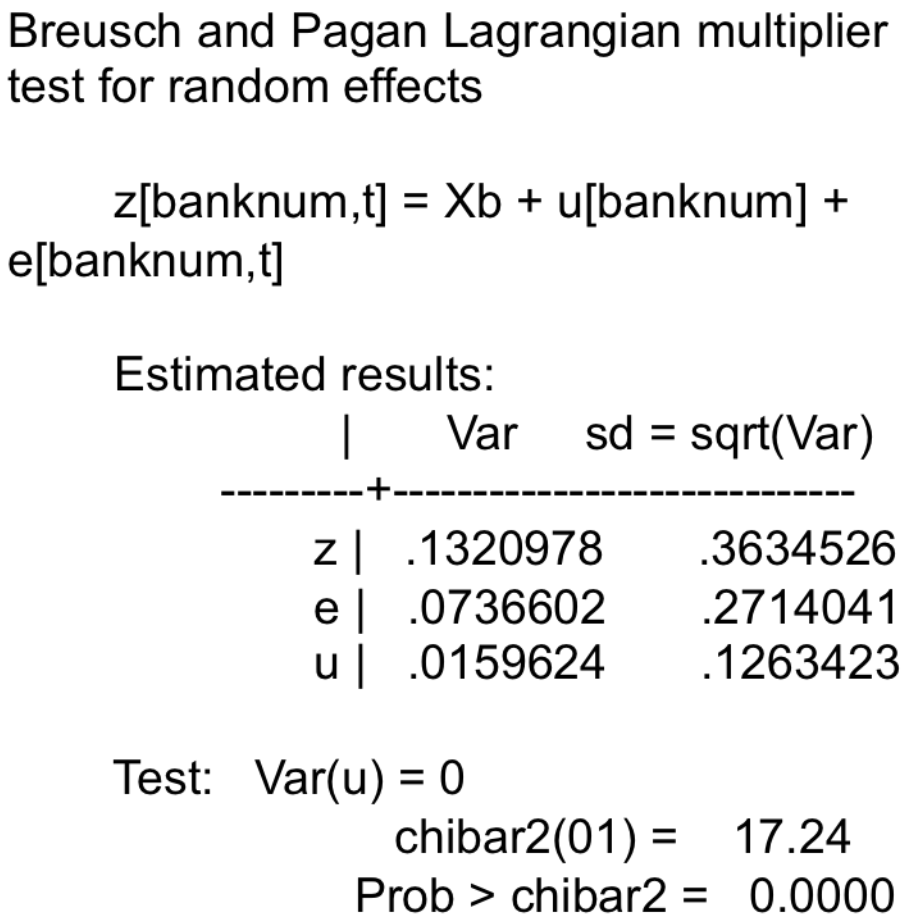

Figure A.1: Breusch and Pagan Lagrangian multiplier test for random effects

	Coefficients (b) fixed	(B) random	(b−B) Difference	sqrt(diag(V_b−V_B)) S.E.
IMPTOT	−.2273742	−.1466804	−.0806938	.0298759
LOADEP	−.2394584	−.2638601	.0244017	.1469366
LOANS	−.7034442	−.2001443	−.5032998	.4332235
GROWLOAN	.0456297	.0492622	−.0036325	.0066345

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(4) = (b−B)'[(V_b−V_B)^(−1)](b−B)
= 89.14
Prob>chi2 = 0.0000

Figure A.2: Hausman test