ISTANBUL BILGI UNIVERSITY

INSTITUTE OF GRADUATE PROGRAMS

FINANCIAL ECONOMICS MASTER'S DEGREE PROGRAM

EVALUATION OF CREDIT RISK IMPACT ON BANK PROFITS IN VOLATILE PERIODS: CASE OF 2008 SUBPRIME MORTGAGE AND 2012 EUROPEAN FINANCIAL CRISES

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ISTANBUL

2021

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2008 MORTGAGE KRİZİ VE 2012 AVRUPA FİNANSAL KRİZİ ÜZERİNDEN KREDİ RİSKİNİN İSTİKRARSIZ DÖNEMLERDE BANKA KÂRLARI ÜZERİNDEKİ ETKİSİNİN DEĞERLENDİRİLMESİ

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Tezin Onaylandığı Tarih: 23.06.2021

Toplam Sayfa Sayısı:

Keywords
1) Credit Risk
2) Financial Crisis
3) Bank Profitability
4) Subprime Mortgage Crisis
5) European Debt Crisis

Anahtar Kelimeler
1) Kredi Riski
2) Finansal Krizler
3) Banka Kârları
4) Mortgage Krizi
5) Avrupa Borç Krizi

PREFACE

I would like to express my deepest gratitude to my advisor, Assoc. Prof. Serda Selin Öztürk for her guidance and patience. I am and will always be deeply indebted to my instructor Alper Kırık for his Computational Finance lectures and his willingness to help me.

I would like to thank my parents, Nejla and Hamdi Özçetin, my sister-in-law Olca Ceren Özçetin and my brother Alper Özçetin for their endless support. I would like to thank my aunt Hülya Kömbe for being an inspirational role model. I would like to thank you, M. Doğa Bilir, for encouraging me to take this master's program in Istanbul Bilgi University and for your life-time support. I would like to thank you, Zeynep Burcu Nemutlu for your motivation and encouragement. I would also like to thank all my classmates, especially Ersan Elmas, for their profound belief in my research.

Last but not least, I dedicate my thesis in memory of my aunt Güler Özçetin who was a dedicated teacher.

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

BCBS	Basel Committee on Banking Supervision
BIS	Bank for International Settlements
CAR	Capital Adequacy Ratio
CRM	Credit Risk Management
GDP	Gross Domestic Product
NPL	Non-performing Loans
ROA	Return on Asset
ROE	Return on Equity

LIST OF TABLES

ABSTRACT

This dissertation is an inquiry into the credit risk impact on bank's profitability ratios, which are Return on Asset (ROA) ratios by paying attention to volatile periods focusing on the time period between 2008 Subprime and 2012 European Financial Crises. The main two questions are how the bank's profitability ratios are affected by the global financial crises and are these ratios of banks in developed countries less affected by global financial crises. The data samples were collected from 40 banks covering the years from 2008 to 2013. Banks included in the analysis are classified as developed and underdeveloped, considering the country classification defined by the World Bank for the year 2008. In this research, the panel data analysis is used since the dataset of randomly selected banks has both time series and cross-section dimensions with the fiction of the time and a variety of banks classified as developed and underdeveloped countries. Return on Asset ratio was used as a dependent variable, and as explanatory variables are defined measurement of risk, Non-performing Loans to Total Loans, Tier 1 Capital Ratio, Total Loans to Total Deposits variables were used. The results indicated that in the examined period with the sample banks, Non-performing Loans to Total Loans variable showed a greater risk for banks located in underdeveloped countries than banks in developed countries. Tier 1 Capital Ratio, a bank's core capital measurement, has much greater significance as a risk reduction in banks in underdeveloped countries. Banks in underdeveloped countries have much greater risk than banks in developed ones for Total Loans to Total Deposits, since an increase in the total loan amount and a decrease in the total deposit amount mean an increase in the risk in the banking system. When the effect of explanatory variables on banks' profitability ratios is examined, the risk of banks in underdeveloped countries is higher than the risk of banks in developed countries in the stated period of time.

Keywords: Credit Risk, Financial Crisis, Bank Profitability, Subprime Mortgage Crisis, European Debt Crisis.

ÖZET

Bu çalışma, 2008 Mortgage ve 2012 Avrupa Borç Krizleri arasındaki istikrarsız dönemlere odaklanarak, banka kârlılık oranı olan Aktif Kârlılığı (ROA) oranları üzerindeki kredi riskinin etkisini araştırmaktadır. Bankaların kârlılık oranlarının küresel finansal krizlerden nasıl etkilendiği ve gelişmiş ülkelerdeki bankaların Aktif Kârlılık oranlarının küresel finansal krizlerden daha az etkilenip etkilenmediği sorgulanmaktadır. 2008-2013 yıllarını kapsayan 40 bankadan veri örnekleri toplanarak Dünya Bankası'nın 2008 yılı için belirlediği ülke sınıflandırması dikkate alınarak gelişmiş ve az gelişmiş olarak sınıflandırılmıştır. Rastlantısal seçilen banka verilerinin hem zaman hem de yatay kesit boyutlarına sahip olması nedeniyle panel veri analizi kullanılmıştır. Analizde Aktif Kârlılık Oranı bağımlı değişken olarak, risk ölçümü açıklayıcı değişkenleri olarak Takipteki Kredilerin Toplam Kredilere, Tier 1 Sermaye Oranı ve Toplam Kredilerin Toplam Mevduatlara Oranı kullanılmıştır. Örneklem bankaları ile incelenen dönemde Takipteki Kredilerin Toplam Kredilere Oranı değişkeninin az gelişmiş ülkelerde yerleşik bankalar için gelişmiş ülkelere göre daha fazla risk teşkil ettiğini göstermektedir. Bankanın çekirdek sermayesinin ölçümü olan Tier 1 Sermaye Oranı, az gelişmiş ülkelerdeki bankalarda risk azaltımı hususunda çok daha büyük bir öneme sahip olduğunu yansıtmaktadır. Toplam Kredilerin Toplam Mevduatlara Oranları incelendiğinde, toplam kredi tutarının artması ile toplam mevduat tutarının azalması bankacılık sistemindeki riskin artması anlamına geldiğinden, az gelişmiş ülkelerdeki bankaların gelişmiş ülkelerdeki bankalara göre daha fazla riske sahiptir. 2008'den 2013'e kadar olan istikrarsız dönemde, çalışmada ele alınan bankalar incelendiğinde, azgelişmiş ülkelerdeki bankaların gelişmiş ülkelerdeki bankalara göre daha yüksek risk taşıdığı görülmektedir.

Anahtar Kelimeler: Kredi Riski, Finansal Krizler, Banka Kârları, Mortgage Krizi, Avrupa Borç Krizi

INTRODUCTION

Banks have played a crucial role as the lenders with financial services in a countries' economies since they provide credits for the borrowers. Bank lending is an important source of financing for both businesses and consumers. The "credit" is a term that has been derived from the Latin word "credere", meaning "to trust" or "to entrust" (Parasız, 2000). Similarly, credit risk is one of the crucial types of risk in the banking sector that directly affects the bank performance, as it shows loss of probability to repay because of the failure of the debtor to fulfill their total debt obligations to the bank. Aligned with its dictionary meaning, banks conduct credit analysis to ensure and maintain this trust-based relation with their borrowers. High level of credit risk may trigger a banking crisis. Therefore, it has gained vital importance to evaluate the credit risk on bank profits in volatile periods. Historically, the credit crisis in the U.S. in 2008 , which later had spread to Europe, caused a synchronized and severe reduction in the global economy. The crisis undoubtedly had global consequences that were more mixed across developed and emerging market economies. Systemic instability happened because of spreading bank runs behaviour. The awareness of the solvency hitches in a bank concludes in runs by other depositors on other banks. The non-intervention of the central banks or any lender of last resort increased the liquidity pressures on the banking system and caused a decrease in bank capitals. Thus, it turned into a systemic banking crisis with its devastating effects (Ergungor & Thomson, 2005).

Problematic public debt levels and a fragile banking system are the common frameworks in both crises. These crises affect banks' balance sheets since they became vulnerable to higher credit default risk and higher mortgage. In these highly volatile periods, the level of non-performing loans (NPLs) gives insights into the crises.

CHAPTER 1

1. Literature Review

Banks are inherently experienced to several risks such as credit risk, operational risk, liquidity risk, reputation risk and market risk. Amongst all, credit risk is one of the most common reasons for bank failures among these risks. In literature, there are lots of studies focusing on credit risk on bank's profitability. Therefore, credit risk management (CRM) has a a crucial effect on the performance of banks (Achou & Tenguh, 2008; Poudel, 2012). The mortgage crisis that started in 2007 at the subprime market is a banking crisis, occurred as a consequence of banks increasing NPL. This situation prevented them from fulfilling their obligations to financial institutions and banks (Ari, 2014).

Castro (2013) employs dynamic panel data approaches to Greece, Ireland, Portugal, Spain and Italy (GIPSI) over the period 1997-2011 and focuses on both economic environment, macroeconomic factors and highlights that the risk of default is highly affected households and companies. Musyoki & Kadubo (2012) analyze the effect of CRM on the banks' financial performance by analyzing 10 banks for the period of 2000-2006. They use profitability ratio as ROA, while the CRM variables are defined as bad debts cost, cost per loan asset and default rate. Results statistically show that; these are significant as well as a negative impact on the bank's performance. Further results showed that the default rate, also known as the non-performing loans to total loans ratio, is the major predictor of a bank's financial performance. Poudel (2012) studies default rate, cost per loan asset and capital adequacy ratio (CAR), related to CRM as it affects the bank profitability by analyzing the financials of 31 banks for the period of 2001-2011. He finds out that all these ratios have inverse effects on banks' financial performance. He concludes default rate as the major predictor of banks

financial performance, on the other hand, cost per loan asset does not predict bank's financial performance significantly.

Achou & Tenguh (2008) conduct a study to find the answer to the question of how credit risk is managed by the banks. They analyze for the period of 2001-2005 focusing on Qatar Central Bank profitability ratios. The results of the regression model reveal that CRM and bank performance have a significant relationship. Moreover, findings revealed that the ratio of NPLs/TL has a significant negative association with profitability which was measured by return on assets (ROA) and return on equity (ROE). The finding of Felix & Claudine (2008) also shows that return on equity (ROE) and return on asset (ROA) all indicating profitability was negatively related to the ratio of non-performing loans to total loan of financial institutions therefore decreasing profitability. Similarly, in all three studies regarding to the effect on CRM on banking profitability, indicate that there is a negative relationship between NPL ratio and ROE or ROA (Zou & Li, 2014; Kargi, 2011; Hosna, Manzura & Juanjuan, 2009; Felix & Claudine, 2008).

Ekinci & Poyraz (2019) study panels' data for Turkish state-owned banks, privately-owned banks and foreign banks focusing on profitability ratios of ROA and ROE on credit risk determinants as NPLs from the period of 2005 to 2017. They find out relationships between credit risk and profitability ratios, ROA and ROE are negative.

On the other hand, some of the studies also focus on volatility in international financial markets. For instance, Laeve & Valencia (2008) focus on systemic banking crises from 1970 to 2011 by analysing policy indices, and policy responses associated with banking crises. They analyze the differences between output losses across different crises and find that sovereign debt crises have a tendency to be more costly than the banking crises.

Some studies consider the effects of global financial crises, taking into account the country classification, whether they are globalized or not. Increases in public debt and output losses tend to be larger in advanced economies with deeper financial systems, thus a banking crisis is much more disruptive (Laeven & Valencia, 2012). Dreher (2006) indicates a direct relationship between the globalization level and economic growth of a country. Per capita GDP (Gross Domestic Product) growth is a useful metric to indicate a country's standard of living. Simply put, more developed countries tend to have higher per capita GDP. Dreher (2006) tests the correlation between KOF Index of Globalization and KOF Economic Index of Globalization for the year 2008 to determine if globalized countries are more vulnerable to crises than less globalized ones by using panel data for 123 countries for 30 years. These indexes measure the economic, social, and political dimensions of globalisation. In result, Dreher (2006) concludes that the correlation between them is not significant. Similarly, the hypothesis was tested based on the Maastricht Globalization Index which measures the economic, social, political, cultural, technological, and ecological dimensions of globalization. It is concluded that more globalized European countries are equally vulnerable to the crisis as less globalized ones. Additionally, as the level of globalization of a country increases, the level of coping with crises increases. (Martens & Amelung, 2010). In this point of view, globalized countries are no need to suffer more in crisis (Marginean & Orastean, 2011).

CHAPTER 2

2. CRISES

Financial crises happen and they are not new. Every economy has experienced financial crises throughout history. In this chapter, you will find the global crises which are Subprime Mortgage and European Debt Crises, and the reasons behind them.

2.1. Subprime Mortgage Crisis

In mid-2007, a global financial crisis that started in the U.S. subprime mortgage market struck at the core of the international financial system. The crisis has two apparent phases. In the first phase which is between August 2007 and October 2008, banks deeply damaged from the collapse of the interpark market, following the large losses arising from the crisis in both asset-backed securities and conventional assets. Developed economies are affected more than emerging economies as a consequence of losses. Developed economies tried to decrease the risk exposure by deleveraging and cutting the level of credit to the real economy. In the second phase, emerging countries are highly affected because of the real economy. In the corporate sector in developed economies, credit became costly, thus, firms reduce their stocks because of the unexpected cut of investment plans. Herewith, all over the world faced a significant fall in world trade. The value of exports diminished by 20% in the U.S. 18% in Germany, 25% in France, and up to %32 in China (Bénassy-Quéré, Decreux, Fontagné & Khoudour-Casteras, 2009).

With the bankruptcy of Lehman Brothers, an investment bank, alongside a debt of 600 billion dollars, this crisis is considered the largest crisis the world has experienced after the Great Depression of 1929. In the early 2000s, the U.S. Federal Reserve (Fed)

decided to lower the interest rates from 6.5% to 1% between May 2000 and June 2003 in order to get the US economy out of the recession. By doing so, the aim was to stimulate the economy by increasing consumption. Interest rate cuts have rapidly increased the use of housing loans. Hereat real estate prices started to increase excessively. Real estate owners, who saw that their houses were appreciated, started to buy more houses and used large amounts of loans from banks. Previously, most of the housing loans were given to high-quality which are also known as "prime mortgages", but in the course of time, loans began to be given to lower-quality customers called "subprime mortgage" (Göçer & Özdemir, 2012). By the middle of 2008, the volume of subprime mortgage loans in the US increased to 1.5 trillion dollars. Low-income people using subprime mortgages mostly opted for floating-rate loans, as interest rates in the U.S. were extremely low in the past. FED started to increase the interest rates again after 2004 caused these people to be unable to repay the loans they took (Eğilmez, 2009).

Banks that provided housing loans in the pre-crisis period, provided new funds for themselves by issuing derivative financial instruments, whose values are derived from one or more underlying financial assets. The reason behind this crisis is that these derivative transactions are based on the overvaluation of real estate prices. It helped to allow the mortgage lenders to transfer the risk of non-repayment of the loan to third parties, such as hedge funds. The continual transactions caused much greater risks and the derivatives market gradually grew. In 2007, the total size of the housing loans in the U.S., thus the derivative products related to these loans reached 10 trillion dollars (Bocutoğlu & Ekinci, 2009). It became the largest loan market in the world. While the banking system in the U.S. has been audited, derivative markets and hedge funds, also known as shadow banking, have not been audited (Özatay, 2009). The value of derivative instruments has overvalued the house they are attached to. This is called the "credit bubble". Derivative products, which initially served to transfer the risk and functioned as insurance in the system, especially in this sense, gradually started to

become risk factors themselves. These derivatives transactions took place at an incredible speed. With the sale of derivative products to European banks, the crisis spread to Europe. According to the Case-Shiller index, which measures the development of house prices in the U.S., after reaching its highest level at the end of 2007, house prices started to decline rapidly (Altuğ, 2009). People who bought a house with a loan also lost the chance to pay their debts to banks by selling their houses. This situation increased the amount of NPLs, and caused banks to experience liquidity and financing problems.

In the pre-crisis period, Lehman Brothers was the bank with the highest volume of the derivative products. Lehman Brothers was in danger of going bankrupt when default risk on mortgage loans increased with house prices falling rapidly. After the government and the FED announced that they could not save the bank, creditors from Lehman Brothers realized the great risk. This time, the creditors of these banks wanted the bank to run as soon as possible. On September 14, 2008, the principals involved, disputed the view, citing a volume of toxic assets, so-called troubled assets, at Lehman Brothers which made a rescue impossible. The Lehman Brothers, 158 years old bank, went bankrupt the next day (Guillén, 2009). Immediately after Lehman Brothers bankruptcy, big companies such as AIG, Merrill Lynch and Morgan Stanley, gave signals of bankruptcy. The Treasury Secretary made a strong case to persuade Congress to provide $700 billion to purchase other toxic mortgage-backed securities. Because these assets were held widely and had lost much of their value, many banks and other institutions actually were bankrupt, rather than merely illiquid (Congleton, 2009).

2.2. European Crisis

Many factors, that are arising from the system and economic imbalances played an important role in the occurrence of the Subprime crisis in 2008. The loose fiscal policies and rapidly increasing interest rates in developed country economies encouraged people to use loans. The “liquidity squeeze” in the financial system of the U.S. had also affected other countries and it turned into a global financial crisis. The current public deficits and debts, which differed especially in the European region, showed the effects of the crisis in the Euro region after 2009, as well as the debts of the private sector. The Eurozone countries, which did not encounter a serious economic crisis until the debt crisis that started with Greece, struggled with the debt crisis. The crisis in the Euro Area is not only a public debt crisis but also a crisis of banking, growth, and competition.

The interdependence of the countries in the crisis in the Euro Area and the Union's economic policies were taken from the member states and managed at the "supra-national" level caused the difficulty on the economic management of countries and worsened macroeconomic imbalances in the countries experiencing the crisis (Çakaş, 2019). Differences in opinions among the countries of the region in the diagnosis and treatment of the crisis worsened the situation and deepened the crisis. It created a failure to comply with the criteria regarding the Economic and Monetary Union and the inadequacy within the models, especially the fiscal policies of the countries included in the region, inability to provide the necessary coordination and discipline in economic policies. In addition to these, the risk premiums of the countries in the region to be evaluated at the same level as Germany and the government bonds occupied an important place in the banks’ balance sheets. These are the systemic reasons for the emergence and deepening of the crisis (Çakaş, 2019).

Among peripheral countries where the debt crisis is experienced also have common points such as macroeconomic imbalances. After the inauguration of the Euro, with the effect of decreasing interest rates and increasing liquidity supply until the global financial crisis, domestic demand increased, resulting in structural current account deficits, and these deficits were financed by borrowing from abroad. At the same time, the increase in domestic demand led to a rapid rise in real estate prices in Spain and Ireland, then the bursting of the housing bubble and the banking crisis. Although some EU members did not fulfill the criteria in transition to the common currency, the Euro, these members switched to the Euro by promising to fulfill these criteria later on. Here, it can be concluded that political concerns and priorities are preferred to economic priorities (Wyplotz, 2006; Marzinotto, Sapir & Wolff, 2011). For instance, the structural deterioration in public finances was at the root of the crisis in Greece, whereas the most important problem in Italy and Portugal was low economic growth and competitiveness. Although aid funds and mechanisms to prevent the crisis have been developed within the Union, delayed measures have made it more difficult for countries to get out of the crisis. It can be argued that one of the most important reasons for the deepening of the global crisis in the European Union and becoming a structural problem is that the member states do not comply with the economic criteria set forth within the framework of the founding treaty of the European Union, called the Maastricht Criteria (Lane & Ferretti, 2011). Since in the Maastricht Criteria, which revealed the formation of economic and monetary union, a number of criteria were determined for states to enter into monetary union. These criteria express the minimum standards that states have to do in order to enter the monetary union, not that they are free to do so. However, the European Central Bank did not impose any sanctions on these countries for their compliance with the Maastricht Criteria after the transition into the common currency. As a result of this, the debt burdens and public deficits of the said countries are out of a sustainable structure, and the crisis originating from the U.S. has turned into the deepening debt crisis of the Euro region. (Lane, 2010).

After the crisis in the EU, Germany, which has a serious geopolitical and economic power, assumed the leadership role. Germany argued that the countries within the Union should adopt the “Austerity” policy instead of the aid funds and mechanisms given to the countries. Although Germany adopted a different view within the union in the Euro crisis; aims to preserve the unity of the union and strengthen it economically. Germany was the country at the center of the Union, as well as its dominance over institutions also drew attention. Although Germany adopted a different view within the union in the Euro crisis; the country still strives to preserve the unity of the union and strengthen it economically to this day.

CHAPTER 3

3. RISKS IN THE BANKING SECTOR

There is no doubt that the economic crises affect the financial sector. A well-defined lending criteria is crucial for banks in order to operate in a reliable environment since it enables creditor and borrower sides to be able to indicate the structure of the loan, the purpose of its acquisition, and the source of repayment. Determining the capital obligations of financial institutions constitutes the basis of modern risk management. The risk taken by financial institutions should be proportional to their capital. Otherwise, the bank is exposed to insufficient capital. If not interfered immediately, this situation can even result in bankruptcy. In order to control these risks, central banks of developed countries have been working in coordination for many years. As a result of these, the capital adequacy framework was developed by the Basel Banking Committee.

As reported by Basel Committee on Banking Supervision (BCBS), thereafter bank failures in both the United States and Germany in 1974, BCBS formulated supervisory standards and guidelines (BCBS, n.d.). Basel I Minimum Capital Standard, the capital adequacy agreement, has helped the balance and soundness of the international banking system and improve competition amoıng the banks (Arslan, 2007). The purpose of Basel I Criteria is to strengthen banks against possible crises. Minimum capital adequacy is the minimum amount of capital that a bank should hold. In other words, by performing a certain risk analysis, it is required that the loans given must have a capital equivalent (Turgut, 2007). First of all, in 1988 Basel I Minimum Capital Standard of 8% was published to provide a standard in capital adequacy calculation. It has been reported that the ratio below the standard may cause difficulties for banks in possible crises. In the following years with the attention to market risk arising from the

bank's trading activities, Basel II Criteria was published, focusing on not only capital adequacy calculation but also operational risk. While Basel II had been implemented by banks, in response to the global crisis of 2008, it was understood that Basel II Criteria were insufficient. Therefore, Basel III focuses on global standards to address both firm-specific and systemic risks such as the regulations regarding increasing the amount and quality of capital, establishing the leverage ratio and raising capital buffers (Basel Committee on Banking Supervision, n.d.).

Basel III Criteria is important both for reducing vulnerability in the banking sector, an international liquidity risk measurement, as well as monitoring the whole banking system. It is aimed to reduce the fragility in the banking sector, to increase the quality and quantity of capital, to establish a leverage ratio and to create a cyclical capital buffer. It will increase capital requirements for banks, thereby strengthening the stability of the global financial system (Temel Nalın & Sezer, 2014).

The banking sector contains various risks due to its structure. The probability of the bank to incur a loss represents the risk in terms of banking (Bolgün & Akçay, 2016). As a general framework, banks are faced with macro and micro risks (Allen & Santomero, 1997). Macro risks are defined as at a level that will affect the entire sector, micro risks defined as competition between banks.

Credit risk is the most fundamental risk that banks are exposed to as a result of the financial intermediation function undertaken between fund suppliers and fund demanders. In fact, it is possible to classify the risks that banks may face in three main groups: market risk, credit risk and operational risks.

3.1. Basic Risks in Banking Sector

There are risk factors that may cause special problems for the banking system. Interest rate, liquidity risk, credit risk, and market risks, are the main components of all banking crises because of the macroeconomic factors (Ergungor & Thompson, 2005).

High real interest rates are associated with systemic banking sector problems and create crises regarding the vulnerability to balance of payments (Demirguc-Kunt & Detragiache, 1998). It is systemic since interest rate risk covers the volatility because of fundamental factors such as changes in monetary policy that a bank cannot interfere in. On the other hand, Ovideo (2003) points out the counter-cyclical behaviour of country-specific interest rate spread since financial crises are less likely during booms. It is highlighted that the probability of a banking crisis is increased during a deep recession. However, not every recession, regardless of depth, causes a crisis; both unexpected and deep down-turn trigger a financial crisis. Additionally, in a high interest rate risk environment, although there is a change in interest rates in the market conditions, there is no change in assets and liabilities of a bank. It makes equity capital fragile against fluctuations in interest rates. In such a case, if the high level of interest rate risk continues, it creates liquidity risk.

Liquidity means the amount of money held in the bank to meet the withdrawals of customers which shows its ability to turn its assets into cash. With that in mind, liquidity risk refers to how an individual bank's inability to meet its obligation threatens the existence or the financial position. This kind of risk arises when the ratio of illiquid assets to liquid assets is too high. Liquidity risk may cause the bank to become unable to fulfill its obligations, especially in unusual circumstances. Liquidity risk management is one of areas focused on Asset and Liability Management. Liquidity risk generally arises due to the customers' desire to make their positions to liquify the investments. If the bank fails to respond to withdrawal requests, that could initiate a

crisis. To eliminate such a situation, banks may choose to borrow at high costs to close the liquidity gap or sell the bank's assets to close this gap. This causes the bank to lose its ability to pay at high costs. If no action is taken, the bank may be merged with another institution or closed. In this case, shareholders, employees, and customers bear the cost (Parasız & Bildirici, 2003).

Liquidity is an indicator of the bank's ability to meet its cash needs in its assets and liabilities, that is, its capacity to meet its liabilities and to provide the resources it needs. Since liquid values have no return, it cannot be said that a bank with high liquidity works efficiently. The purpose of liquidity management is to ensure a sufficient level of liquidity to be able to continue disbursing new loans and fulfil all its payment obligations. In case of unexpected high rate of withdrawals, the continuity of bank activities is an indicator of the strong liquidity of the bank. The liquidity ratio brings the risk to a minimum while keeping the profit at the maximum level. Increasing liquidity reduces the bank's risk and income. When the liquidity is decreased, the income and risk of the bank increases (Parasız & Bildirici, 2003).

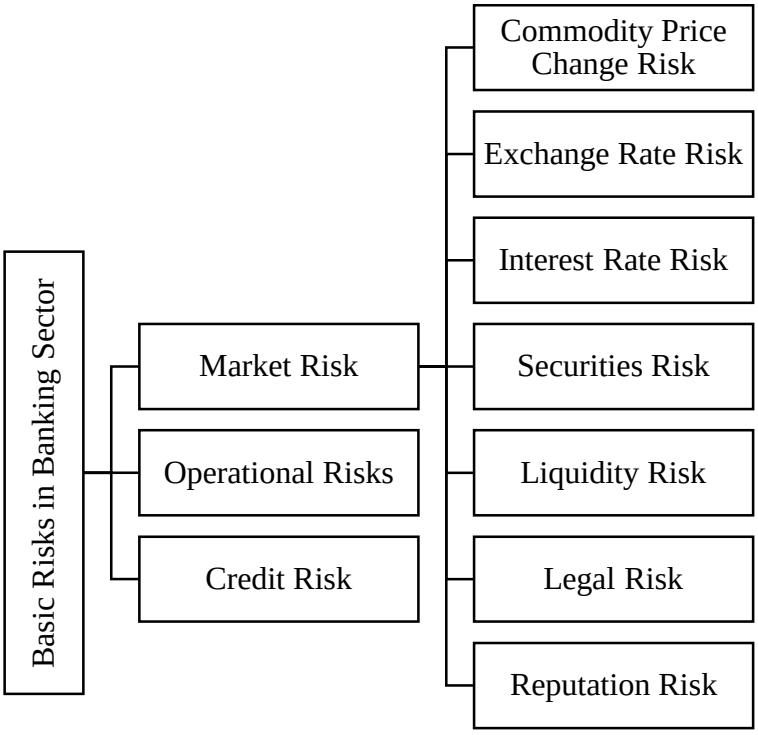
Another cause of the crisis is increased credit risk, in other words, increased probability of borrowers falling into insolvency. Credit risk is built up when borrowers pay their debts whereas banks give loans by applying looser credit standards, however, it occurs during recessions (Gila-Gourgoura & Nikolaidou, 2017). The pro-cyclical movement of loans and other asset prices can be an important reason because asset prices lead to the next stage of the cycle. Hence, the willingness of banks to take risks is increased by good times and banks underestimate their ability to give loans and collect them at maturity (Jiménez & Saurina, 2006). The loan given by the bank will not be returned partially or completely. In addition to this, the loans given by the bank are not paid by the borrower either at all or on time. Delaying the principal and interest payments of the borrowers creates a liquidity problem. If there is no diversified portfolio, the risk of default increases, hence resulting in bankruptcy of the bank. One of the ways to reduce this risk is by eliminating high lending to a small number of customers or credit

concentration to specific industries. Portfolio diversification is a frequently-recommended way. If it has a bad asset structure in terms of quality, it will lose its ability to pay due to the large number of customers who do not pay their debts with external shock (Parasız & Bildirici, 2003).

Generally market risk follows the credit risk. Market risk, which is a type of systematic risk, reflects possibilities for price volatility of certain assets that affect the banks' net worth. It indicates the risks that banks will face in the face of changes in global economic markets (Aydın, 2006). It is systematic since price volatility comes from an unexpected economic contraction and expansion period. The volatility in oil prices due to political reasons can be an example of market risk.

The main risks that may be encountered in the banking sector are given in Figure 1.

Figure 1: Basic Risks in Banking Sector



3.1.1. Market Risk

Market risk emerged mainly as the risk arising from the fluctuations in financial prices and rates. The Basel Committee has defined market risk as "the risk of loss due to changes in market prices in positions held in on-balance sheet and off-balance sheet accounts" (BIS, 2006). In other words, it is defined as the risks "caused by fluctuations in bond, commodity or stock prices in financial markets, or changes in interest rates or exchange rates" as market risk, emphasizing that banks are prone to market risk due to both their balance sheet management and their trading activities. From this point of view, it can be said that market risk is the most comprehensive of the risks faced by the banking sector (Tapiero, 2004). Market risks can be handled under two headings as dependent and independent risks. Dependent risks are the risks arising from changes in stock prices, interest rates, exchange rates and other financial instruments. Independent risks include other risk groups other than these (Bolgün and Akçay, 2016).

3.1.2. Operational Risk

Developments in financial markets, the use of more complex systems due to technological advances, and the diversification of products and services provided by banks have significantly changed the operational activities of banks today. Operational risk can generally be expressed as all risks other than credit and market risk.

The first step in identifying operational risks is to identify these risks by the bank's management. Inadequate internal controls, corruption and fraud, weak credit controls, faulty accounting records, errors and malfunctions in information technology systems,

information loss that may occur after natural disasters are various risk groups under the definition of operational risk.

Although financial institutions have experience and expertise in managing credit and market risks, only a few institutions have systematically addressed the concept of operational risk. Operational risk should be integrated with credit and market risk approaches. Operational risks, which can be characterized by features such as application errors, management errors, computer and network failures, service or product quality differences, counterfeiting, non-compliance with relevant legislation or company policies, are not always adequately defined or at least clearly defined by financial services institutions. not expressed. Operational risk is much more comprehensive than credit and market risks, which can be made more clearly and precisely with process definitions and the database can be supported by necessary and compatible information systems (Bolgün & Akçay, 2016).

3.1.3. Credit Risk

Giving credit is one of the risky activities of the bank. Credit risk is the risk of loss that may occur due to the failure of the borrower to fulfill the agreed terms for financial or other reasons (Donaldson, 1989).

One of the most important areas of expertise of banks is taking credit risk and managing these risks effectively. Credit risk is the possibility that a bank borrower will not be able to fully or partially fulfill its obligations on time. In other words, credit risk is the risk of not repaying all debts, delaying the credit service or not returning the loan (Parasız, 2007).

In the distribution of losses due to credit risks, banks will cover the expected loss with their reserves, and unexpected losses with their provision and equity capital (Altıntaş, 2011).

Credit risk can be diversified, although credit risk consists of the counterparty's failure or unwillingness to fulfill its obligations. However, since most of the default risk arises from systematic risk, it is difficult to hedge (risk aversion) (Oldfield and Santomero, 1997).

Credit risk is the most important banking risk undertaken by commercial banks in developed countries. However, in developing countries, as seen in our country, the small loan portfolios of banks and the fact that they work with very few known customers are among the reasons that reduce this risk.

The risk of a loan portfolio is affected by the inherent risks and concentration risk it contains. The credit risk of the portfolio consisting of funds offered by banks depends on internal and external factors. Internal factors can be expressed as deficiencies in the credit policies of banks, deficits, lack of realistically established credit concentration limits, insufficiently defined credit limits by the credit committee, failure to fully evaluate the borrower, not pricing the risk correctly, and lack of a review system in the loans extended. As external factors, it can be said as various factors such as fluctuations in prices, interest rate, exchange rate, trade restrictions, general economic situation and government policies (Hatiboğlu, 1996).

3.1.3.1. The Factors Causing Credit Risk

The factors causing credit risk can be examined in two groups as internal and external factors, listed in the table below. Internal factors are dependent on the bank’s

capabilities such as credit analysis, CRM and customer, whereas external factors are risk factors that are beyond a bank's authority.

Table 2: Internal and External Factors of Credit Risk

INTERNAL FACTORS	**EXTERNAL FACTORS**
Factors Specific to Credit Customers	***Political, economic, social factors***
• Supply, Production and Marketing Structure • Competition Power • Management Skill • Product life cycle	• Regulatory changes, • Changes in the political structure, • Changes in economic policies, • Volatility, shock and crises
	Natural Factors
	• Natural disasters, drought etc.
Bank-Specific Factors Natural Factors	
• Financial Analysis-Intelligence structure • Risk assessment capability • Decision criteria • Risk-Collateral Balance	***Other*** • Technological developments, • Customer preferences • Product life cycle

Source: Iskender (2014).

Additionally, other types of risk that can be evaluated within the credit risk. One of such is the risk of failure of the process which is especially significant in futures markets. It is expressed as the possibility that the bank will not be able to receive the funds, foreign currency or similar financial assets subject to the contract on time as a result of the failure of the counterparty at the end of the specified period.

3.2. Financial Performance Indicators

The determinants of credit risk have been an active research field of some empirical studies, as ratios are also affected by both internal and external factors as the risk factors change. Users regardless of internal or external, find financial ratios useful, since they give signals for areas that may cause problems in the future (Simga-Mugan & Akman, 2012).

To illustrate, profitability can be defined as the ultimate indicator of economic achievement achieved by a bank regarding the capital invested in it. This is indicated by the magnitude of the net profit accounting (Pimentel, Braga & Casa Nova, 2005).

The main objective of banks is this achievement with a good return over the amount of risk. After all, profit is the propulsive element of any investments in different projects. Profitability ratios indicate how well a bank utilized its assets to generate revenues in a given period, regardless of its cash transactions or the way its assets were financed (Simga-Mugan & Akman, 2012). ROE, ROA, and income before taxes to total assets are considered as the profitability ratios. The assessment of profitability is usually done through the ROA and ROE, which is the ultimate measure of economic success.

On the other hand, liquidity ratios indicate the riskiness of changing in terms of cash. These ratios indicate how well the cash inflows and outflows managed (Simga-Mugan & Akman, 2012). Liquid assets to total assets, liquid assets to short-term liabilities, liquid assets to total assets are used as liquidity ratios.

Meanwhile, capital structure ratios indicate how the assets of a bank are financed, and give insights about the long-run liquidity of a bank (Simga-Mugan & Akman, 2012). Capital adequacy ratio, shareholders' equity to total assets and shareholders' equity minus permanent assets to total assets are used as capital structure ratios.

Profitability, liquidity, and capital structure ratios are used as proxies for financial performance indicators. When ratios for the bank are compared over a period of time, the changes in operating conditions such as economic condition, changes in prices, levels of inflation must be analyzed (Simga-Mugan & Akman, 2012).

Since the financial statements alone do not make it possible to reveal the financial performance of the company with all clarity, ratio analysis is used to examine the activities of the borrower more deeply. Ratio analysis enables the financial performance of the firm to be evaluated over different periods by bringing the financial information to a common format.

Table 1: Financial Ratios Category

Category	**Ratio**
Activity Performance	Interest, taxes, impairment and depreciation Earnings before / Total Sales Net Profit / Sales Effective Tax Rate Net Profit / Total Assets Sales / Fixed Assets
Debt Service Capacity	Interest, taxes, impairment and depreciation earnings before / Interest Free Cash Flow- Capital Expenses / Interest Free Cash Flow- Capital Expenses
Financial Leverage	Long term Debt / Capital Long term Debt / Tangible assets Total liabilities / Tangible assets

	Short Term Liabilities / Tangible Net Assets
Liquidity	Current rate Quick Rate Stocks / Net Sales Stocks / Net Working Capital Short Term Debts / Inventories Raw materials, Intermediates and finished goods / total stocks
Receivables	Aging of receivables Average collection period

Source: Iskender (2014).

Ratios are used to analyze operating performance, profitability, cash flow, as well as leverage and liquidity status for each firm. Each ratio gives information on a comparative and absolute basis. To illustrate, the profitability of a firm's sales and return on equity reveal different dimensions of profitability. Debt service capacity measures the ability of borrowed loans to meet the interest cost. The current ratio measures liquidity. Firms can be compared among themselves or with industry averages.

Apart from the ratios produced from the financial statements, very useful information can be generated from the stock prices of public companies or the prices of debt securities and bills. This market data is more precise and more up-to-date than accounting data.

CHAPTER 4

4. THE EMPIRICAL ANALYSIS

4.1. Methodology

In order to further understand how the objectives will be achieved the following questions are constructed:

1. How are the bank's profitability ratios affected by global financial crises?

2. Are these ratios of banks in developed countries less affected by global financial crises?

In this analysis, R-studio, an open-source programming language, is used since it enables customizable programs regarding statistical analysis. (Ozgur, Colliau & Hughes, 2017).

4.2. Data

In this study, randomly selected banking data from 2008 to 2013 sourced by Bloomberg Terminal were used as annual data. 40 banks belonging to various countries are included. In order to determine the difference between the countries where the banks included in the analysis are located, the countries are divided into two as developed countries and underdeveloped countries by taking into consideration country classification in 2008 defined by the World Bank. Underdeveloped countries are determined as China, Hungary, Mexico, Poland, Russia, Romania and the developed countries are listed as Austria, Canada, Denmark, Germany, Greece, Italy, Spain, Singapore and Sweden. In the study, the variable of Return On Assets (ROA) was used

as the dependent variable in order to measure the effect of risk on profitability. Non-Performing Loans to Total Loans Ratio (NPL), Tier1 Capital Ratio (TCR) and Total Loans to Total Deposits (TLTD) variables were used as explanatory variables in the measurement of risk.

4.3. Method

Panel data analysis method was used in the study. However, before explaining the panel data analysis method, it is essential to understand the time series analysis, cross-sectional data and why this method was decided in the first place.

4.3.1. Time Series Analysis

Time series data consists of a time-varying collected variables or observations on several variables. One of the important dimensions in a time series data is the time dimension. When economic time series are examined, it is known that most of them are time series variables. A common probability density function is used when generating time series. This process is stochastic and is created by being characterized by this function. Analysts must be aware of the fact that this process is stochastic because stochastic time series follow a different pattern. The collection method of time series data differs according to cross-sectional data as they are often not derived from survey data. Much of this data is based on econometric models and predictions as these predictive values are used, time series data is probabilistic. In time series data, there are continuously variable time labels on one side and observation values on the other side. These values change over time. The most important feature of time series data is that it is frequently related to the previous period. Since these variables are usually

dependent on their past values, there is often a high correlation between them and the previous period. The existence of this feature brings along many econometric problems. Since the errors obtained from the model will also be related to each other, it is necessary to systematically examine the analyzes and eliminate econometric problems (Das, 2019).

For these reasons, it is necessary to consider many details and avoid econometric problems when performing a standard time series analysis. In addition to this, it is necessary to increase the application steps in econometric time series analysis and to know the basic assumptions about the error term that causes this problem. Time series data can belong to a country, a city, a state, or a group, a class, or a family, as explained earlier.

4.3.2. Cross Sectional Data

Different types of data are used in economic research. In applied research, the characteristics of individuals and units are generally examined with a series of cross-sections at a certain point in time. It is possible to combine data using some methods when observations of many individual units, such as households, firms, and cities, are available over a period of time (usually annual). For example, for modeling firm profits in any industry, simple cross-section data may have some explanatory independent variables such as firm manager's characteristics, physical capital type, and financial leverage. If data is available for each firm over time, it can be examined whether the cross-section estimators remain constant over time. If the estimators remain constant over time, more efficient parameter estimators can be obtained by combining the data set. The combined data set is obtained by bringing together the cross-section and time series (Pindyck and Rubinfeld, 1991). Independently combined cross-section data differs from simple random sampling. In simple sampling, it is seen that the sample

observations from the main mass at any point in time are not identically distributed (Wooldridge, 2002).

4.3.3. Panel Data Analysis

The main purpose of panel data analysis is to make simultaneous predictions about time series models based on units by considering cross section data and time series as a single data set. Briefly, panel data analysis is expressed as a method that allows the investigation and estimation of cross-sectional data with each other within a certain time period. Time series and regression analyzes are known as two important methods that are often used in predicting the future and analyzing data. In the time series analysis, data belonging to one or more variables analyzed with simultaneous intervals are handled, while in regression analysis, data obtained from traditional cross-section units are considered (Frees, 2004). As stated before, panel data consists of the combination of the two types of data mentioned, and the model is generally expressed with the equation shown below (Gujarati, 2003):

$$Y_{\mathrm{it}} = \beta_{1\mathrm{it}} + \beta_{2\mathrm{it}} X_{2\mathrm{it}} + \cdots + \beta_{\mathrm{kit}} X_{\mathrm{kit}} + e_{\mathrm{it}} \quad i = 1, \ldots, N t = 1, \ldots, T \tag{1}$$

t represents time, and N represents units, as shown in equation 1. The Y variable also refers to the dependent variable, which has different values depending on time and unit.

Panel data are named in two different types by examining the lengths of time and section dimensions. The first of these; N appears as panel data sets in which the cross-section size is smaller than the T time dimension. This type of panel data is called micro panel or short panel. Secondly, it is panel datasets where the time dimension of (T) is smaller. This kind of panel data is named as long panel or macro panel. It is possible to express the panel linear regression model with the following formula:

$$y_{\mathrm{it}} = \alpha + \beta X_{\mathrm{it}} + e_{\mathrm{it}};\ i = 1, \dots, N;\ t = 1, \dots, T_{\mathrm{i}} \quad (2)$$

Shown above are the regression coefficients named as β slope and α constant term. i denotes cross-sectional units such as households, individuals, countries, and t denotes the time point at which the observations of the mentioned cross-sectional units are made. X_{it} is the independent explanatory variable, it of the section unit represents the X value at the time point. The e_{it} expressed as the error term, is a random variable that has an effect on the dependent variable, but includes the effects of variables that are not in the model.

In the panel linear regression model shown in the above equation, variables showing the special effects of time series or sections are not included in the model, since the time data and section units are assumed to be homogeneous. If unique features are not taken into account, these features are indicated in the error term. The fact that the mentioned features are not included in the model causes problems such as autocorrelation and the explained part is less (Isbilen, 2005).

In this study, there are variables along the cross sections and there are different banks along the time series. Therefore, variables should be analyzed with panel data analysis, which are a mixture of these explained above.

Panel data or aggregated data sets are beneficial when data is compared to cross section or time series. The benefits of using a combined dataset as numbered (Baltagi, 2005; Hsiao, 2003):

i. Control of individual differences: Panel data states that individuals, firms, cities or countries may have different structures. In time series and cross section series studies, there is a risk of obtaining biased results if the differences are run without checking.

ii. Panel data contains more information. This means more variability, less multicollinearity between variables, more degrees of freedom, and more efficient econometric estimators. However, time series studies encounter more multicollinearity

problems. In combined data models, the number of observations will be higher than cross-section and time series. In this case, the parameter estimates to be obtained will be more reliable and the estimated models will be based on less restrictive assumptions. However, in studies conducted only with time series or cross-section data, the differences in units cannot be controlled in detail since there will be a risk of obtaining deviated results. Panel data allows for better examination of dynamic adaptations. Unemployment, job turnover, settlement or income mobility are better analyzed by panel studies. In studies on the duration of economic situations such as unemployment and poverty, if the panels are long enough, panel data studies can shed light on the speed of adaptation of economic policy changes. For example, a cross-sectional study to measure unemployment can calculate the unemployment rate of the population at a certain point in time. Repetitive cross-sectional studies can show how the unemployment rate has changed over time. Only panel data can predict whether and the rate of those who were unemployed in one period were also unemployed in other periods. However, panel data may be required to determine whether families' poverty, unemployment, and wealth dependency status are temporary or chronic. Panel data should be used in the estimation of inter-period relations, life cycle and intergenerational models.

iii. Panel data also identifies effects that cannot be detected by cross section series or time series alone. For example, let's work with a cross-section series and assume the average annual female labor force participation rate is 50%. This situation can be expressed in two different ways: (a) each woman has a 50% chance of joining the workforce in any given year, or (b) it always means that 50% of women are working while the rest are not. In case (a) the employment rate is higher than in case (b). Only panel data can distinguish between these two cases. Another example can be examined whether being a union member increases or decreases wages. It is possible to answer this issue by examining the mobility of employees from unionized jobs to non-union

jobs or vice versa. By keeping individual characteristics constant, it can be determined whether and how much union membership affects wages.

iv. Panel data models allow to construct and test more complex behavior models than only cross-sectional series or time series only. For example, technical efficiency is better analyzed and modeled with panel data models. Panel data in distributed lag models impose less constraints than pure time series studies. In addition, the use of panel data provides a convenient method for reducing or solving an important econometric problem. The presence of variables that are neglected (incorrectly measured or not observed) in empirical studies may be related to independent variables. The effects of missing or unobservable variables can be controlled by investigating intertemporal dynamics and individuality. (Baltagi, 2005; Hsiao, 2003). While excluded variables cause deviations in the estimation results in studies using time or cross-section data; In case the excluded variable or variables are variables that do not change according to units or time, the use of panel data ensures that the deviation is under control. (Baltagi, 2005; Hsiao, 2003).

v. Panel data collects information about micro-units such as individuals, firms, and households. Many variables can be measured more accurately at the micro level and the deviation caused by aggregation on individuals or firms can be eliminated.

4.4. Descriptive Statistics

In this part of the study, descriptive statistics will be included. Descriptive statistics for underdeveloped countries are given below.

According to the dependent variable, ROA, the lowest observation value observed in 2011. Accordingly, the lowest observation bank belongs to MIL PW Equity in Poland. The second smallest variable value was observed in 2008. This observation value

belongs to bank “c* mm Equity” located in Mexico. The third lowest country was Mexico again, and the value was observed in 2008.

The highest value of variable return of assets was observed in 2008 by bank otp hb Equity operating in Hungary. The second highest variable value was observed in 2011 by SBER RM Equity bank operating in Russia. The third highest variable value was observed in 2011 by SBERP RM Equity bank operating in Russia again.

The three smallest observation values of the independent variable, NPLS to Total Loans, were observed by 601998 CG Equity bank operating in China in 2008, 2011 and 2012.

The three highest observation values of the independent variable NPLS to Total Loans were observed by otp hb Equity bank operating in Hungary in 2013, 2012 and 2011.

The lowest observation value of the other independent variable, Tier1 Capital Ratio, was observed in 2008 by UCG PW Equity bank operating in Poland. The second and third lowest observation values for this variable were obtained by Romania in 2008 and 2009 by EBS RO Equity bank.

The highest observation values for this variable were observed in 2013 for all three countries. Two of the banks with the three highest observation values are in Hungary, and the bank with the third observation value is in Romania. And the banks are otp hb Equity, deutsche hb Equity and DBK RO Equity.

According to the last variable, Total Loans to Total Deposits, the lowest observation value belongs to deutsche hb Equity bank operating in Hungary in 2008. The second lowest value was observed in Romania in 2008 again. The third lowest value was observed deutsche hb Equity bank in Hungary in 2011.

The highest observation values for this variable were observed by UCG PW Equity in Poland in 2011, 2012 and 2013, respectively.

The first of the descriptive statistics for developed countries belongs to the return of assets variable. The lowest values for this variable were obtained in 2012. Two of the highest values belong to ETE GA Equity and Alpha Ga Equity bank operating in Greece and CBK GY Equity bank operating in Germany.

The highest observations of the Return of assets variable were obtained in 2013, 2008 and 2012. The countries of these banks were in Italy, Germany and Greece. The banks are CBK GY Equity , ETE GA Equity and UBI IM Equity.

The two lowest values for the NPLS to Total Loans variable, the first of the independent variables, were observed in 2008 and 2013 by the Spanish bank BBVA SM Equity. The third lowest observation was observed by the NA CT Equity bank in Canada in 2013.

The highest observation value in the data of developed countries regarding the Total Loans to Total Deposits variable was obtained in 2013. The highest observation value was observed by CBK GY Equity operating in Germany, the second and third highest observation value by ETE GA Equity and Alpha Ga Equity banks operating in Greece.

The two lowest observation values for the NPLS to Total Loans variable belong to BBVA SM Equity bank in Spain in 2008 and 2013. The third lowest observation value belongs to NA CT Equity bank operating in Canada in 2013.

The highest observation values for this variable belong to Germany and two for Greece in 2013. The banks are CBK GY Equity, ETE GA Equity and Alpha Ga Equity.

The lowest observation value for the Tier1 Capita Ratio variable was in Austria, and the second and third lowest observation values were in Italy in 2008, 2008 and 2011. The tickers of the banks are ISP IM Equity, UCG IM Equity and EBS AV Equity.

The two highest values of Tier1 Capital Ratio were observed by SAB SM Equity in Spain in 2012 and 2013. And the third highest value occurred in the same country by BBVA SM Equity in 2012.

The lowest observation values of the Total Loans to Total Deposits variable occurred in 2008, 2009 and 2010, respectively. The lowest observation value was occurred by dc Equity bank in Denmark. The second and third lowest observations are from TD CT Equity bank in Canada.

The highest observation values belong to SEBa ss Equity bank in Sweden in 2008, 2010 and 2009, respectively.

4.5. Cross Sectional Dependence and Unit Root Tests

Within the framework of panel unit root testing, there are two generations of unit root testing. First generation unit root tests assume cross-section units are cross-sectionally independent; whereas second-generation panel unit root tests stretch this assumption and allow for cross-sectional dependence. In this context, it is possible to summarize the first and second generation panel unit root tests, which are frequently used in panel data studies. Among the first generation panel unit root tests, all tests except Hadri (2000) test the null hypothesis of the unit root. In addition, Levin, Lin & Chu (2002), Breitung (2000) and Hadri (2000) tests assume a common unit root process (eg, homogeneous cross-sections) among cross-section units. Im, Pesaran & Shin (2003), Choi (2001) and Maddala et al. (1999) tests are based on heterogeneous section formation. Finally, it is possible to use all first generation tests except the Hadri (2000) test for unbalanced panels.

Second-generation panel unit root tests aim to overcome the lack of cross-sectional dependence in first-generation tests. Regarding this, all tests except Bai & Ng (2002) assume a unit root in the data. Second-generation tests are based on the assumption of heterogeneity. Accordingly, there is no common autoregressive (AR) structure in the series and the panels are heterogeneous (Tugcu, 2018).

For this reason, the study will continue by examining the cross-sectional independence of the variables first.

4.6. Cross Sectional Independence

The key issue inherent in any panel data study, with potential implications for parameter estimation and predictions, is the possibility of correlated individual units. This concept of "within" dependency has been known in the social sciences since the 1930s, even long before the advent of panel data econometrics. Specifically, Stephan (1934) states that "when dealing with social data, we know that individuals, groups, and traits are dependent and not independent because of their very social character." (Stephan, 1934; 165)

By nature, the matter of how to characterize cross-sectional dependence has been of great interest among researchers over the years. The oldest method put forward to carry out this is the spatial approach. Spatial models were developed primarily for cross-sectional data using the concept of a distance measure that allows for formulating models with a similar structure to those provided by the time index in time series. The concept of "economic distance" ultimately also allows the use of spatial models in certain economic applications, mainly drawn from regional science and urban economics. The increased availability of panel data over the last decade has opened up new possibilities for characterizing error cross-sectional dependence (Sarafidis & Wansbeek, 2010). An important alternative to the spatial approach is the factor structure approach, which assumes that the error term contains a limited number of unobserved factors that affect each individual individually. Initially, inferential theory for factor models was developed for situations where one dimension is constant and the other goes to infinity. Recently, this theory has been extended for large panels where both dimensions can go to infinity (Bai & Ng, 2013).

4.7. Pesaran 2004 Cross Section Independence Test

In general, it is assumed that the distortions in panel data models are independent between cross-sections. This is especially true for panels with a large cross section size (N). In the event of panels where N is small (for example, 10 or less) and the time dimension of the panel (T) is large enough, cross-correlation of errors can be modeled (and statistically tested) using an seemingly unrelated regression equation (SURE). The SURE framework was originally developed by Zellner (1962). Since N is fixed as T $\rightarrow \infty$, conventional time series techniques including log-likelihood ratio tests can be applied. A simple example of such a test is Breusch and Pagan's (1980) Lagrange multiplier (LM) test; this test is based on the mean of the squared pairwise correlation of the residuals. However, in cases where N is large, standard techniques cannot be applied, so other approaches should be considered. When we consider the standard panel data model:

$$y_{it} = \alpha_i + \beta' x_{it} + u_{it} \quad i = 1, \dots, N \quad and \quad t = 1, \dots, T \tag{3}$$

x_{it} is a K x 1 dimensional vector of regressors, β is a K x 1 dimensional vector of parameters to be estimated, and α_i represents individual constant parameters that do not change over time. Under the null hypothesis, u_{it} is assumed to be independent and identical distributed (i.i.d.) over time periods and across cross-sectional units. According to the alternative, u_{it} can be correlated between cross sections, but no assumption of serial serial correlation remains.

So the null hypothesis is

$$H_0: \rho_{ij} = \rho_{ji} = \text{cor}(u_{it}, u_{jt}) = 0 \text{ and } i \neq j \tag{4}$$

and hypothesis against null hypothesis is

$$H_1: \rho_{ij} = \rho_{ji} \neq 0 \text{ and } i \neq j \tag{5}$$

Note that the number of possible matches (u_{it}, u_{jt}) increases with N. In the context of seemingly unrelated regression estimation (SURE), Breusch and Pagan (1980) proposed a Lagrangian Multiplier (LM) statistic, which is valid for constant N as T → ∞, and

(6)

$$LM = T \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij}^2$$

$\hat{\rho}_{ij}$, is an exemplary estimate of the binary correlation of residues.

(7)

$$\hat{\rho}_{ij} = \hat{\rho}_{ji} = \frac{\sum_{t=1}^{T} \hat{u}_{it}\hat{u}_{jt}}{(\sum_{t=1}^{T} \hat{u}_{it}^2)^{\frac{1}{2}}(\sum_{t=1}^{T} \hat{u}_{jt}^2)^{\frac{1}{2}}}$$

and $\hat{u}_{it}$ is the estimation of u_{it} in equation (3). The LM is distributed asymptotically as a chi-square with N(N - 1)/2 degrees of freedom under the null hypothesis of interest. However, this test is likely to show significant size disturbances where N is large and T is finite, and if this is common in empirical applications, first of all, the LM statistic has a finite T and bias, likely to worsen as N gets larger.

Pesaran (2004) suggested that

(8)

$$CD = \sqrt{\frac{2T}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij} \right)$$

alternatives. Unlike the $CD \xrightarrow{d} N$ statistic under the null hypothesis of no cross-sectional dependence, the CD statistic has exactly zero mean for constant T and N values under a wide variety of panel data models, including heterogeneous models, non-stationary

models, and dynamic panels. In the case of unbalanced panels, Pesaran (2004) proposes a slightly modified version of equation 10.

(9)

$$CD = \sqrt{\frac{2}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\sqrt{T_{ij}}\hat{\rho}_{ij}\right)$$

$T_{ij} = \#\,(T_i \cap T_j)$ and

(10)

$$\hat{\rho}_{ij} = \hat{\rho}_{ji} = \frac{\sum_{t\in T_i\cap T_j}\left(\hat{u}_{it} - \bar{\hat{u}}_i\right)\left(\hat{u}_{jt} - \bar{\hat{u}}_j\right)}{\left[\sum_{t\in T_i\cap T_j}\left(\hat{u}_{it} - \bar{\hat{u}}_i\right)^2\right]^{\frac{1}{2}}\left[\sum_{t\in T_i\cap T_j}\left(\hat{u}_{jt} - \bar{\hat{u}}_j\right)^2\right]^{\frac{1}{2}}}$$

(11)

$$\bar{\hat{u}}_i = \frac{\sum_{t\in T_i\cap T_j}\hat{u}_{it}}{\#\left(T_i \cap T_j\right)}$$

The modified statistic explains the fact that residuals for subsets of t do not necessarily mean zero.

Pesaran 2004 CD test was used to investigate cross-sectional dependence in the study.

Hypotheses here are identified as;

$$H_0: No\ Cross\ Section\ Dependence$$
$$H_1: Cross\ Section\ Dependence$$

Test results are given in Table 3 and Table 4 for underdeveloped and developed countries.

Table 3: Pesaran CD Test Results For Underdeveloped Countries

Variables	Test Statistics	p_values
ROA	4.0632	0.0000 ***
NPL	10.8614	0.0000 ***
TCL	3.3326	0.0009 ***
TLTD	6.8659	0.0000 ***

***, ** and * indicate significance at 1%, 5% and 10%, respectively.

According to the test statistics given in Table 3, it was decided that there was a cross-sectional dependence in all variables. The null hypothesis is rejected and the alternative hypothesis is accepted because they are less than 10%, which is the significance level, according to the p values next to the test statistics given in the table for underdeveloped countries.

Table 4: Pesaran CD Test Results For Developed Countries

Variables	Test Statistics	p_values
ROA	6.3472	0.0000 ***
NPL	18.4010	0.0000 ***
TCL	25.9242	0.0000 ***
TLTD	7.3788	0.0000 ***

***, ** and * indicate significance at 1%, 5% and 10%, respectively.

Similar results were obtained in Table 4 with the results from Table 3. The null hypothesis is rejected and the alternative hypothesis is accepted because they are less than 10%, which is the significance level, according to the p values next to the test

statistics given in the table for underdeveloped countries. In this case, according to the results obtained above, it was decided to continue the study with second generation unit root tests.

4.8. Second Generation CIPS Unit Root Test

In recent years, unit root testing in panel data has become a frequently debated topic. The literature on the development of such tests was initially based on the assumption of cross-sectional independence between units, and "first generation panel unit root tests" were being produced. However, in many empirical applications, this assumption is likely to deviate, and O'Connell (1998) has shown that ignoring the possible dependence between units can cause severe bias in first-generation panel unit root tests. Therefore, researchers have been interested in developing variable tests for cross-section dependence, called "second generation unit root tests". Among them, Pesaran (2006) proposed the CIPS test based on a single common factor specification for the cross-correlation structure. The simulation results, the assumption of a single common factor, and the known autocorrelation order of residuals show that the CIPS test performs very well. Considering the dynamic linear heterogeneous panel data model

$$z_{it} = (1 - \phi_i)\mu_i + \phi_i z_{i,t-1} + u_{it} \quad (12)$$

u_{it} has one common factor structure.

$$u_{it} = \gamma_i f_t + e_{it} \quad (13)$$

f_{it} (0, σ^2) whereas is the unobserved common effect, f_t~i.i.d. (0, σ^2) individual factor loadings and statistically identically and independent distributed (0, σ^2) or, more generally, the idiosyncratic component that is a stationary autoregressive process.

$$\Delta z_{it} = \alpha_i + \beta_i z_{i,t-1} + e_{it} \quad (14)$$

Pesaran (2006), suggests that cross sectional mean of z_i, should be represented by $\bar{z}_t = N^{-1}\sum_{i=1}^{N} z_{it}$ and common factor with lags i $\bar{z}_{t-1}, \bar{z}_{t-2}$, The unit root zero point test is now based on the ratio of the OLS estimate of β_i in a cross-sectionally enhanced Dickey-Fuller (CADF) regression.

$$\Delta z_{it} = a_i + b_i z_{i,t-1} + c_i \bar{z}_{t-1} + d_i \Delta \bar{z}_t + e_{it} \quad (15)$$

a natural test of heterogeneous alternative H_1: $\beta_i = 0, \ldots, \beta_{N0} < 0$, $N_0 \leq N$ versus all i in the entire panel dataset H_0: $\beta_i = 0$ is given by the average of individual CADF statistics

$$CIPS(N,T) = N^{-1}\sum_{i=1}^{N} t_i(N,T) \quad (16)$$

The distribution of this test is non-standard, even asymptotic; Critical values of 1%, 5% and 10% for different N and T combinations are tabulated by the author. In the case of serial correlation of individual error terms, the CADF regression without any change in the statistical distribution, the test procedure can be easily extended by adding the appropriate number of $\bar{z}t$ and Δzit lagged values (Cerasa, 2008.)

Although it is not recommended to test stationarity in small time periods, non-stationary time series and panel data analysis results may contain the problem of spurious regression. The unit root test results represented in Table 5.

Table 5: Unit Root Test Results For Underdeveloped Countries

Variable	**Test Statistics**	**p_value**
ROA	2.688469	0.0372 **
NPL	2.417225	0.0389 **
TCL	1.545251	0.0666 *
TLTD	-1.83471	0.0636 *

***, ** and * indicate significance at 1%, 5% and 10%, respectively.

Hypotheses regarding the tests performed are

$$H_0: Serie\ has\ a\ unit\ root.$$
$$H_1: Serie\ has\ no\ unit\ root.$$

As mentioned, if unit root test analysis cannot be performed on the variables, it cannot be determined whether the variables are stationary or not. In this case, in the analyzes made with non-stationary variables, the results of the analysis may lead to the problem of spurious regression, since the series have both characteristic roots greater than one and have a trend variable. For this reason, unit root tests were carried out for all variables and the results are given in Table 5. When Table 5 is analyzed, it is decided that the variables for underdeveloped countries are stable at the 10% significance level.

Table 6: Unit Root Test Results For Developed Countries

Variable	Test Statistics	p_value
ROA	2.233398	0.0429 **
NPL	1.721104	0.0689 *
TCL	3.001731	0.0046 ***
TLTD	-1.11545	0.0936 *

***, ** and * indicate significance at 1%, 5% and 10%, respectively.

Since the p values obtained in this country group were less than 10%, which is the significance level, all variables were observed to be stationary.

4.9. Fixed Effects Model

Models that estimate unobservable units or time effects by taking into account the assumption of fixed effects are called fixed effects panel data models. Fixed effects refer to the treatment of unobservable effects as parameters to be estimated in the panel

data model. Two separate situations arise in this method. One of them is one-way unit effect models, which expresses the constant time effect or unit effect, and the other is two-way fixed effect panel data methods that consider both time and unit effects.

(17)

$$Y_{it} = \alpha_i + \sum_{k=1}^{K} \beta_k X_{kit} + \varepsilon_{it}; i = 1, \dots, N; t = 1, \dots, T; k = 1, \dots, K$$

Here, it is stated that the error term ε expressed in equation 17 (Güriş & Bölükbaşı, 2018) has an independent and identical distribution with zero mean, constant variance. Parameters, and parameters in equation 17 represent the intersection and slope parameters, respectively. Y dependent variable, Xk represents as many explanatory variables as k, and i units represent time, and t represents time. While the parameters expressed in the regression model given in equation 17 vary throughout the units, they remain constant throughout time (Stock & Watson, 2011). As the i index under the constant term indicates, the constant term changes from unit to unit.

(18)

$$Y_{it} = \alpha + \sum_{k=1}^{K} \beta_k X_{kit} + \mu_i + \varepsilon_{it}; i = 1, \dots, N; t = 1, \dots, T; k = 1, \dots, K$$

The parameter in Equation 18 expresses a fixed value, that is, it does not change between units. If the constant parameter is re-expressed to $\alpha_i = \alpha + \mu_i$ represent the unit effect, it is written as however, unobservable unit effects are allowed to be correlated with the explanatory variable

$$\begin{aligned} E(\varepsilon_{it} \mid X_{i1}, X_{i2}, \dots, X_{iT}) = 0 t = 1,2, \dots, T \\ E(\mu_i \mid X_{i1}, X_{i2}, \dots, X_{iT}) \neq 0 t = 1,2, \dots, T \end{aligned} \quad (19)$$

is expressed as.

One-way fixed effects panel data models can be built in a structure that includes not only unit effects, but also only time effects. Although it is not used much, the model in which only time effects are included is given in equation 20. According to this;

(20)

$$Y_{it} = \alpha + \sum_{k=1}^{K} \beta_k X_{kit} + \lambda_t + \varepsilon_{it}; i = 1, \dots, N; t = 1, \dots, T; k = 1, \dots, K$$

The λ_t parameter in equation 20 includes the time effect in the model. Fixed effects are included in the model over the fixed parameter, as in unobserved time effects, which cannot be observed in panel data models. Such models are assumed to contain one constant parameter for each period included. The time parameter, which is also expressed as the trend parameter added to the model here, although it changes according to the units between the periods, does not change but changes according to time. Here it is assumed that each time period has its own constant parameter. Since the time effect is an unobservable effect that does not change according to the units that differ from period to period, that is to say, while the fixed parameter changes according to time, it is constant according to the unit. α; The constant parameter (common parameter), which has a constant value for all units, is defined as $\alpha t=\alpha+\lambda t$, where λt is the parameter that includes the time effect. The fixed parameter is also called temporal fixed effects and the change in the fixed parameter is due to the excluded variables that change according to time but remain constant according to the units (Stock & Watson, 2011).

In the method discussed so far, one-way change is taken into account. It has been taken into account that only one of the parameters in the model, in addition to the constant one, changes throughout the units. However, sometimes there are situations where two parameters change together in the model.

(21)

$$Y_{it} = \alpha + \sum_{k=1}^{K} \beta_k X_{kit} + \mu_i + \lambda_t + \varepsilon_{it}; i = 1, \dots, N; t = 1, \dots, T; k = 1, \dots, K$$

Features in Equation 21 are called two factor model. Two-factor models will solve individual and time effects more effectively with separate parameters. Within the fixed effects approach, these two factors are specific individual and time-dependent terms. Again, the estimation procedure is based on the least squares method (Merz, 2002). The result of underdeveloped countries' fixed effects model estimation is given in table 7. Estimated regressions for countries given below,

$$Y_i = \beta_{i0} + \beta_1 NPL_i + \beta_2 TIER_{i2} + \beta_3 TLTD_{i4} + v_i \quad (22)$$

Table 7: Fixed Effects Model Estimation Results For Underdeveloped Countries

Variable	Estimate	t -value	p-value
NPL	-0.1429879	-4.0500	0.0001712 ***
TCL	0.0771470	1.5917	0.1175203
TLTD	-0.1231080	-1.4182	0.1620998

***, ** and * indicate significance at 1%, 5% and 10%, respectively.

At this stage, the same tests will be estimated for developed countries.

Table 8: Fixed Effects Model Estimation Results For Developed Countries

Variable	Estimate	t -value	p-value
NPL	-0.0995733	-3.1829	0.0001712 ***
TCL	0.0771470	1.5917	0.1175203
TLTD	-0.1231080	-1.4182	0.1620998

***, ** and * indicate significance at 1%, 5% and 10%, respectively.

And the results are similar for developing countries and random effects models.

4.10. Random Effects Model

Panel data models in which unobservable unit and/or time effects are handled under the assumption of random effects are called panel data models with random effects. Random effects are obtained by adding a random variable to the model, as in the error term, of the effects that cannot be observed in panel data models (Hsiao, 2003). As in the fixed effects model, a one-factor and two-factor model can be established in the random effects panel data model. The general structure of the unit effect random effects model is given in equation 23.

(23)

$$Y_{it} = \alpha_i + \sum_{k=1}^{K} \beta_k X_{kit} + u_{it}; i = 1, \dots, N; t = 1, \dots, T; k = 1, \dots, K$$

$$u_{it} = \mu_i + \epsilon_{it}$$

In Equation 23, the error term, which consists of two separate components, expresses the unitary effect component where the time is constant and the remaining component. It is assumed that these two components are independent of each other.

In random effects panel data models, unit effects should not be correlated with explanatory variables. Accordingly, in order to get rid of the internality problem, the unit effect should be unrelated to the explanatory variables, as is the case with the error term. Thus, strict externality, which is the most basic assumption of the error components model, is provided (Baltagi, Matyas, & Sevestre, 2008). The assumption that the independent variables and the unit effects and the error term are uncorrelated is given in equation 24.

$$E(\varepsilon_{it} \mid X_{i1}, X_{i2}, \ldots, X_{iT}) = 0 \quad t = 1,2, \ldots, T$$
$$E(\mu_i \mid X_{i1}, X_{i2}, \ldots, X_{iT}) \neq 0 \quad t = 1,2, \ldots, T \tag{24}$$

The one-way random effects panel data model, which includes unobservable time effects, is given in equation 25 when the random effects panel data model only includes the time effect.

(25)

$$Y_{it} = \alpha_i + \sum_{k=1}^{K} \beta_k X_{kit} + u_{it}; i = 1, \ldots, N; t = 1, \ldots, T; k = 1, \ldots, K$$
$$u_{it} = \lambda_t + \epsilon_{it}$$

The unobservable time effect λ_t is added to the model as a random variable as if it were a component of the error term. The composite error term consists of two components: the unobservable time effect component λ_t and the remaining component, the error term εit, and these two components are assumed to be independent from each other. The λ_t unit is constant, representing the unobservable time effect.

The general structure of the two-way random effects panel data model is given in equation 26:

(26)

$$Y_{it} = \alpha_i + \sum_{k=1}^{K} \beta_k X_{kit} + u_{it}; i = 1, \ldots, N; t = 1, \ldots, T; k = 1, \ldots, K$$
$$u_{it} = \lambda_t + \mu_i + \epsilon_{it}$$

Here, expressed as a compound error term, consists of three separate components. λ_t is the time effect component with a unit constant, μ_i; time constant unit effect component, ε_{it}; represents the remaining error term component (Baltagi, Matyas, & Sevestre, 2008).

Estimated regression for random effects model is given below,

$$Y_i = \gamma_{i0} + \gamma_1 NPL_{1i} + \gamma_2 xTIER_{i2} + \gamma_3 TLTD_{i3} + \gamma_k + \phi_i \qquad (27)$$

In the next step random effects estimation performed and results are given in Table 9.

Table 9: Random Effects Model Estimation Results For Underdeveloped Countries

Variable	**Estimate**	**z -value**	**p-value**
Intercept	0.5058600	0.5050	0.6136
NPL	-0.1088911	-11.72115	0.0000 ***
TCL	0.551080	2.402808	0.0172 **
TLTD	-0.1231080	-1.886454	0.0606 *

***, ** and * indicate significance at 1%, 5% and 10%, respectively.

Table 10: Random Effects Model Estimation Results For Developed Countries

Variable	**Estimate**	**z -value**	**p-value**
Intercept	1.0079121	1.773001	0.0779 *
NPL	-0.0932527	-2.031934	0.0436 **
TCL	0.0128957	1.765737	0.0791 *
TLTD	-0.0028403	-6.326355	0.0000 ***

***, ** and * indicate significance at 1%, 5% and 10%, respectively.

No test should be used to decide which is the valid model. However, for this, information about its methodology will be given first.

4.11. Hausman Test

According to the estimation results obtained here, the Hausman test was used to decide whether the effects observed here are fixed or random. As stated earlier, model selection in panel data should be based on information about individual specific components and the externality of independent variables. The hypotheses for choosing the right model are given in equation 28. According to the result of the test, the appropriate model gives the best linear unbiased estimates. Consistent, efficient and unbiased estimators are obtained. However, there is a correlation between the error term of the random effects model and the independent variables). If there are any, their estimates will be inconsistent and therefore the fixed effects model will be preferred over the random effects model. Individual components may be related to the independent variables in the random effects model, if there are neglected variables for which the fixed effects model is strong. Fixed effects model estimates are always consistent, but it is inefficient compared to random effects model predictions (Karlsson, 2014).

H_0: The appropriate model is the random effects model. There is no relationship between the error term and the independent variables in the panel data model.

$$Cov(\alpha i\ ,\ \boldsymbol{x_{it}}) = 0 \tag{28}$$

H_1: The appropriate model is the fixed effects model. In the panel data model, the relationship between the error term and the independent variables is statistically significant.

$$Cov(\alpha i\ ,\ \boldsymbol{x_{it}}) \neq 0$$

Hausman test results for Developed and Underdeveloped Countries are given the Table 11.

Table 11: Hausman Test Results For Developed and Underdeveloped Countries

Hausman Test Results		
	Test Statistics	P Value
Underdeveloped Countries	6.945	0.1067
Developed Countries	5.6656	0.1291

The p values in Table 11 cannot be interpreted because the appropriate model is decided according to the test statistic included here.

Table 11 indicates that random effects estimations for both country groups are valid. And the random effects estimations will be discussed in the results section.

4.12. Results

The Non-Performing Loans to Total Loans variable represents the receivables that are not repaid and turned into risks in total bank loans. The increase in this variable also increases the risk in the banking sector. Therefore, the economic expectation is that the coefficient of this variable is negative. When this variable is analyzed for both underdeveloped and developed countries, it is observed that the coefficient is obtained as negative for both. However, while this coefficient was -0.1088911 for underdeveloped countries, it was calculated as -0.0932527 for developed countries. In this case, it was observed that this variable showed a greater risk for underdeveloped countries than developed countries.

Tier 1 capital is a key measure of a bank's financial strength from a regulatory perspective. It consists primarily of common stock and disclosed reserves, but also includes non-cumulative preference stock that cannot be recovered. The fact that this variable is large indicates that the risk in the banking sector decreases and the bank

becomes stronger. This variable value was estimated to be positively related to the economic expectation in the same direction for both country groups. This coefficient is much higher for banks operating in developing countries than banks operating in developing countries. In this case, this variable has a much greater importance as a risk reduction factor in underdeveloped countries.

Total loans to total deposits variable indicates the share of loans in total bank deposits. In order to increase the use of credit in the banking system, the total deposits in the bank should increase at the same rate. However, in the banking system, if the total loans grow and the deposits begin to decrease, then the risk increases and the loans run out due to the decrease in the total cash in the banking system.

In other words, an increase in the total loan amount and a decrease in the total deposit amount mean an increase in the risk in the banking system. In such case, when the coefficients related to these variables are examined, it is estimated that the coefficient in underdeveloped countries is -0.1231080 and for developed countries it is estimated as -0.0028403. In this case, it is very clear that the risks of underdeveloped countries are higher than the risks of developed countries in the examined period.

As a result, in the study, a comparison between developed and underdeveloped countries was made. There is an expectation that the risk in underdeveloped countries will be much greater than the risk in developed countries. As a result of the analysis, the coefficients of all the variables were estimated to be significant at 10% significance level, according to the estimation of random effects. All the coefficients obtained show that the parameters obtained in the developing countries are much higher than the parameters in the developed countries. In all coefficients obtained, it has been determined that the parameters obtained in underdeveloped countries are much higher than the parameters in developed countries and the risk in underdeveloped countries is much higher in the banking sector.

CHAPTER 5

5. CONCLUSION

The banking sector has recently started to discuss about the concept of risk with the globalizing world more. The studies carried out by the Basel Committee on Banking Supervision (BCBS) provide insights to identify and evaluate the risks of the sector and to determine the ratios such as the capital adequacy ratio (CAR) that banks should hold against them. BCBS derives from the learnings of the U.S. and German counterparts in 1974, as previously stated. It is inevitable in today's world for banks to perceive and manage risks correctly. It is especially important to evaluate the credit risk on banks profits in volatile periods.

In history, the credit crisis in the U.S. in 2008, which later had spread to Europe, caused a systemic global economy. Both developed and underdeveloped countries' economies were affected from the crises and suffered problematic public debt levels and a fragile banking system. These are the common framework in both crises. These crises affect banks' balance sheets since they became vulnerable to higher credit default risk and higher mortgage. In these highly volatile periods, the level of non-performing loans (NPLs) gives insights into the crises.

This study focuses on the credit risk impact on Return on Asset (ROA), bank's profitability ratio, considering volatile periods focusing on the time period between 2008 Subprime and 2012 European Financial Crises. The main two queries are how the bank's profitability ratios are affected by the global financial crises and if these ratios of banks in developed countries are less affected by global financial crises. The data samples were collected from 40 banks covering the years from 2008 to 2013.

Countries classified where they are located as developed and underdeveloped, considering the country classification defined by the World Bank in 2008. Return on

Asset (ROA) ratios of these banks was used as a dependent variable, and explanatory variables are defined as measurement of risk, Non-performing Loans to Total Loans, Tier 1 Capital, Total Loans to Total Deposits ratios were used.

In this research, the panel data analysis is used since the dataset of randomly selected banks has both time series and cross-section dimensions with the volatile period spanning from 2008 to 2013 and a variety of banks classified as developed and underdeveloped countries. In order to analyze the panel data analysis, second-generation Pesaran's CD tests, Paseran's CIPS unit root test, fixed-effects model, and Hausman test model are used respectively. First of all, the cross-sectional dependence of the variables was checked to decide whether to use first-generation or second-generation unit root testing. In this study, the Paseran CD test was applied to decide the appropriate one. Afterward, stationary tests of the variables were performed to detect the spurious regression relationship. Then, it was deemed appropriate to perform one of the unit root tests, called the CIPS test. The variables were found to be stationary. There are two types of panel data models which are fixed-effects model and random-effects model. After estimating both models, it is necessary to determine which model is appropriate and interprete the parameters of the model. Later on, the Hausman test was performed to decide which of these models should be used to estimate one of the fixed-effects or random-effects models and interpret the parameters. Since the Hausman test is based on errors, the regressions were estimated first, and the errors were obtained from the model to eliminate econometric problems. Finally, the Hausman test was used to decide whether the effects observed here are fixed or random effects. Random effects parameters were interpreted accordingly. The coefficients of all the variables were estimated to be significant, according to the estimation of random effects. All the coefficients obtained show that the parameters obtained in the developing countries are much higher than the parameters in the developed countries. In all coefficients obtained, it has been determined that the parameters obtained in underdeveloped countries are much higher. The results show that in the examined

period with the sample banks, Non-performing Loans to Total Loans variable showed a greater risk for banks located in underdeveloped countries than banks in developed countries. Tier 1 Capital Ratio has much greater significance as a risk reduction in banks in underdeveloped countries. Banks in underdeveloped countries have much greater risk than banks in developed ones for Total Loans to Total Deposits, since an increase in the total loan amount and a decrease in the total deposit amount mean an increase in the risk in the banking system. All in all, in the examined period of 2008 to 2013, the credit risk of banks in underdeveloped countries will be much greater than the risk of ones in developed countries.

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