THE EFFECTS OF POSSIBLE DEFAULT RISK OF RETAIL MORTGAGE LOANS ON THE CAPITAL ADEQUACY RATIO OF TURKISH DEPOSITORY BANKS

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The Effects of Possible Default Risk of
Retail Mortgage Loans on the Capital Adequacy Ratio of Turkish
Depository Banks
Konut Kredilerinde Olası Temerrüt Riskinin Türk Mevduat Bankalarının
Sermaye Yeterlilik Rasyolarına Etkisi

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1) Capital Adequacy Ratio
2) Turkish Depository Banks
3) Mortgage
4) Default Risk
5) Stress Testing

ABSTRACT

The purpose of this study is to analyze the effects of possible default risk of mortgage loans on the capital adequacy ratio of Turkish depository banks to assess the ability of Turkish banking sector to withstand adverse conditions by running a simple stress exercise. For this purpose, 3 different scenarios have been analyzed by using the formula which has been implemented in Basel accord for calculation of capital adequacy. Capital adequacy ratio is calculated in different scenarios by assuming the entire, existing mortgage loans are default at certain rates; by increasing the risk weights of mortgage loans by decision of regulatory authority and finally, the size of mortgage loan portfolio in Turkey is assumed that there is a considerable amount of bank assets such in USA. The results of the scenarios support that Turkish banking sector has a strong and stable capital position to withstand against possible future shocks arising from mortgage loans. The sector's capital adequacy ratio tends to decrease where possible default situation but it does not decrease to critical ratios. And also, even without any default, the change of the risk weight within the framework of measures is taken by the regulatory authority, sector CAR's is not being heavily affected. Finally, when the ratio of mortgage loans portfolio in banks' balance sheets increase; any negative situation in the housing market, mortgage loans, may impact the capital adequacy ratio of banks' more destructively.

ÖZET

Bu çalışmada, Türk Bankacılık Sektörünün olası şoklara karşı ne kadar dayanıklı olduğunu gözlemlemek amacı ile basit stres testi uygulamasına yer verilmiş ve mortgage kredilerinde yaşanacak olası temerrüt riskinin Türk Mevduat Bankaları'nın sermaye yeterlilik rasyolarına etkisi incelenmiştir. Bu amaçla, Basel düzenlemelerinde uygulanan sermaye yeterliliği formülü kullanılarak 3 farklı senaryo analiz edilmiştir. Sermaye yeterliliği rasyosu, mevcuttaki mortgage kredilerinin belirli oranlarda temerrüde düştüğü; düzenleyici otorite tarafından mortgage kredilerine ilişkin risk ağırlığının arttırıldığı; Türkiye'deki mortgage kredi portföyünün banka aktifleri içerisindeki payının Amerika'daki gibi büyük ölçüde bir paya sahip olduğu, varsayımları ile yeniden hesaplanmıştır. Senaryo sonuçları, Türk Bankacılık Sektörü'nün gelecekte mortgage kredilerinden kaynaklı yaşanabilecek olası şoklara karşı güçlü ve istikrarlı bir sermaye yapısına sahip olduğunu göstermektedir. Senaryo sonuçlarına göre , olası bir temerrüt durumunda sermaye yeterliliğinde düşüş meydana gelmekte ancak kritik oranlara ulaşmamaktadır. Diğer yandan, herhangi bir temerrüt durumu olmaksızın, düzenleyici otorite tarafından risk ağırlıklarının değiştirilmesi durumunda, sektörün sermaye yeterliliği aşırı bir şekilde etkilenmemektedir. Son olarak, mortgage kredilerinin bankaların aktifleri içerisindeki paylarının artması sonrası oluşacak bir temerrüt durumu, sermaye yeterliliğini daha olumsuz etkileyebilmektedir.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

BRSA	**:** Banking Regulatory and Supervision Agency
CAR	**:** Capital Adequacy Ratio
CBRT	: Central Bank of the Republic of Turkey
CDO	**:** Collateralized Debt Obligations
CMB	**:** Capital Markets Board
CRA	**:** Credit Rating Agencies
FHLMC	**:** The Federal Home Loan Mortgage Corporation
FNMA	**:** Federal National Mortgage Association
FSAP	**:** Financial Sector Assessment Program
GDP	**:** Gross Domestic Product
GNMA	**:** Government National Mortgage Association
IMF	**:** The International Monetary Fund
MBS	**:** Mortgage-backed Security
NPL	**:** Non-performing Loan
RWA	**:** Risk Weighted Assets
SDIF	**:** The Savings Deposit Insurance Fund
US	**:** United States

1. INTRODUCTION

Recent global financial crisis is commonly believed to have been caused by the rise in the sub-prime mortgage delinquencies and foreclosures and by real estate bubbles in the US. This US sub-prime mortgage crisis has not only affected financial institutions but also created serious consequences for the whole US economy and has had an enormous impact on the world economy.

Turkey is also one of the affected countries by the crisis; however Turkish Banking Sector has been affected relatively in a limited way by the global crisis compared to other developing countries. This was due to strengthened banking regulation and supervision, and conservative approach for banking practices. Consequently, sector entered into the crisis with a strong capital position which was above regulatory minimums.

There have been a lot of case studies and academic researches presented in order to understand the causes and consequences of the crisis and moreover so as to strength the international financial regulations as a response to the global financial crisis for both Turkey and other countries. Also, the effects of the recent financial crisis on Turkish economy, Turkish Banking Sector, and especially small medium enterprises' financial decisions in Turkey have been examined. While there have been a lot of studies to measure the vulnerability of the banking sector against adverse conditions in other countries, there have been very few studies about resilience and strength of Turkish banking sector against possible future crisis.

Over the past decades, analysis is related to financial stability in banking sector has been played an important role to study how vulnerable the banking system to shocks. And this can be measured by conducting stress test.

Stress testing exercise is a kind of early warning exercise and one of the main tool for examining the resilience of the banking system against possible future shocks. It tries to reexamine a portfolio by using a different set of assumptions and it aims to understand how vulnerable the portfolio against to changes in various risk factors.

This study tries to figure out that how Turkish banking sector's capital adequacy strong enough the weather possible future shocks and it tries to calculate credit risk as part of stress test by using shock scenarios and it measures the impact of future credit losses on capital adequacy ratio. In other words, it contributes to this growing literature by analyzing the effects of retail mortgage loan defaults on the capital adequacy ratios of Turkish depository banks. The analysis is important to figure out the results of the possible mortgage crisis in the future, and also it is important to make sure that Turkish banking sector capital positions how strong enough to weather possible further shocks.

Capital adequacy ratios (CARs) has been used in analysis because it is a measure of the amount of a bank's core capital expressed as a percentage of its risk-weighted asset and it is one of the main tools to measure bank's balance sheets wealth. Besides, it has been designed to ensure that banks hold enough to absorb shocks to their balance sheets. Low capital adequacy might imply the higher probability for the bank's bankruptcy and might influence banking sector adversely and therefore whole economy. So, the importance of the capital adequacy ratios (CARs) which are measures of the health of the banking sector has increased after the global financial crisis.

The study provides a contribution and great overview to the all parties which are related to the balance sheet of banks, financial institutions, consumers, investors, regulatory authority, public institutions etc. This study aims to help to avoid future crisis while showing the results of the effects of the default risk and consequences of mortgage loans to the CARs.

In the first part of the study, there is a literature review of the studies conducted on various stress testing to simulate the shocks of banks in various countries.

In the second part, a general overview is given about capital regulation and Basel I - Basel II and Basel III Accord including the rules, regulating operations of banks and financial institutions.

In the third part, the origin and the evaluation of the recent US Sub-prime Mortgage crisis is examined especially along with the critical role of regulations. Also, the financial situation of Turkey is compared to US after the global crisis and then, the applicability of mortgage system in Turkey is examined.

In the fourth section of the study, adaptation of mortgage system in Turkey is examined in the context of the new Mortgage Law passed through the Parliament and BRSA regulations. After that, upward trend of housing loans made by Turkish Banking Sector is analyzed along with the development of consumer loans. Within this framework, housing loans is examined in comparison with other consumer loans and the proportion of housing loans in consumer loans, total loans and total assets is examined as well. And then, in the fifth part of the study, stress testing methodologies are examined briefly.

In the final part of the study, the stress testing is conducted for the analysis of the effects of possible default risk of mortgage loans on the capital adequacy ratio of Turkish depository banks with 3 different scenarios and the results are evaluated.

2. LITERATURE REVIEW

Over the past decades, analysis is related to financial stability in banking sector has been played an important role to study how vulnerable the banking system to shocks. Especially, after recent financial crisis, it has given much more importance to financial stability and a significant number of researches have been done in the literature about stress testing for measuring the ability of the banking system to withstand some unexpected events. Jones et al. (2004) presented a general introduction some of concepts and basic methods of the process of stress testing and also provide a basic framework for conducting a stress test such as identifying vulnerabilities, to constructing scenarios, to interpreting the results. Also, Cihak (2007) aims to clarify stress testing methodology by pointing out their strength and weaknesses in their paper. He also describes links between stress testing and analyzes the other analytical tools for financial stability such as financial soundness indicators in his paper.

Firstly, examining the stress testing methodologies which are conducted for Turkish banking sector and evaluating their results will be useful to make comparison with our study. Secondly, presenting other countries' analyses provide a broad perspective for stress testing practices by way of trying to understand their technics and approaches to analysis.

International Monetary Fund has been using stress tests to describe vulnerabilities across institutions and stress tests are generally performed within the Financial Sector Assessment Program (FSAP). FSAP is a joint program which has been established in 1999 by IMF and World Bank for comprehensive and in-depth analysis of the member country's financial sector.

The first study for Turkey was prepared by FSAP in 2007 and the report has been published by the IMF in November 2007. The latest report has been published in 2012. The report was based on end-2010 data and analysis was conducted for the nine large banks which hold 80 percent of banking system assets. The report included sensitivity analysis and scenario stress tests. Sensitivity analysis for credit risk stress test with the participation of only some selected banks based on ; (i) 200 percent increase in PD of all exposures-at-default combined with 30 percent increase in LGD (ii) 400 percent increase in PD of all exposures-at-default combined with 100 percent increase in LGD. Report also included scenario stress tests were based on the two macroeconomic scenario (sharp contraction in economic activity, a two-year boom in robust economic growth,) and the effect of shocks on the capital adequacy has been measured. Stress tests results show that, while the banking system seems to have adequate buffers to withstand a deep, but brief shock, the system could come under stress if a shock was long duration or buffers were eroded through further credit growth and reliance on short-term external funding.

Also, CBRT Financial Stability Reports includes the scenario analysis which test the resilience of the Turkish Banking Sector to shocks coming from credit and market movements. With this purpose, analysis tries to estimate capital adequacy ratios of the system by applying maximum shocks to NPLs, exchange rates, Eurobond returns and interest rates. In the study which is conducted as of September 2012, capital adequacy ratio is calculated as 7.9 percent under all of these assumptions and the ratio occurs under the regulatory minimum ratio.

The report also includes macro-scenario analysis which is observed that a similar adverse situation to the 2008 global financial crisis . Within the context of macro scenario analysis, while under the adverse scenario the NPL ratio of the sector are assumed to increase to 4.2 percent, on the other hand, under the baseline scenario, the ratio is estimated to decrease to 2.4 percent. While sector CAR is increasing to 16.4 percent by the third quarter of 2014 under the baseline scenario, the sector CAR decreases to 14 percent under the adverse scenario. According to scenario analysis, adverse conditions does not lead to a remarkable deterioration in the capital adequacy of the Turkish banking sector.

Moreover, BRSA Financial Market Reports which are published quarterly include stress testing analysis beside financial sector overview and macro financial framework. This stress test analysis depend on macroeconomic scenarios and estimate the effect of the change of risk factors such as consumer prices, default loans, interest rates etc. on banking sector. Stress testing analysis which are conducted in June 2012 report, conclude 4 different macro- economic scenario and autoregressive econometric models and their result are implemented to the banks' balance sheet dated December 2011. These 4 different scenario includes 5% and 10 % shrinking in the economy and increase 3 and 7 points in TL interests in one quarter. Within the scope of analysis, sector CAR is estimated 13,4% in the scenario of shrinkage by 10% which is the most loss causing scenario. According to analysis, Turkish banking sector's capital adequacy remain resilient even in the most adverse shock conditions and realize above the target ratio.

The Federal Reserve and other US supervisors released a stress test results for 19 large US bank holding companies (BHCs) in May 2009 under the Supervisory Capital Assessment Program with the aim of reducing uncertainty about the soundness of financial system and allowing to measure how much additional capital buffer, if any, each firm would need to have to withstand the potential losses in more adverse conditions.

The publication have included two-year-ahead exercise conducted under two macro scenarios which are 'baseline' and 'more adverse'. And it has tried to find out an answer the following two questions:

- If the economy have more adverse scenario, an institution need how much additional Tier 1 capital to be able to have a Tier 1 capital risk-based ratio in excess of 6 percent at the end of 2010.
- If the economy have more adverse scenario, an institution need how much additional common Tier 1 capital to be able to have a Tier 1 Common capital risk-based ratio in excess of 4 percent at the end of 2010.

According to results of the more adverse scenario, $600 billion losses occur at the 19 firms during 2009-2010 and particularly come from residential mortgages and results shows that these 19 firms need $ 185 billion to capital buffers to reach target capital buffer by the end of 2010 under the more adverse scenario. This $185 billion capital buffer comes from 10 of the 19 institutions and other 9 firms already have capital buffers get through the adverse scenario in excess of 6 percent Tier 1 capital and 4 percent Tier 1 Common capital. And also this $185 billion capital shortfall in Tier 1 common capital so there is no any short fall overall Tier 1 capital.

The prediction of loan losses are based on variety methods including analysis of historical loss experience of BCHs and quantitative model relating the performance of loans. For instance, they have used statistical model to estimate residential mortgages losses at firms based on including breakdowns by type of product, loan-to-value ratio, FICO score, year of origination, and so on for each institution.

In the calculations, losses on residential mortgages have a substantial share because of the sharp drop in residential house prices in the past two years and their projected continued to decrease in the more adverse scenario. Results of the calculation shows that residential mortgages and consumer loans account for $322 billion, or %70 percent of the loan losses projected under more adverse scenario. In brief, the two year cumulative loss rates have 9.1 percent share in total loans in the more adverse scenario and this rate occurs higher than two-year loss rates observed for U.S. commercial banks from 1920 to 2007/2008.

Jang and Sheridon (2012) have tried to find out sensitivity of Australian Banks to shocks to residential mortgages. For this purpose, they have considered in the paper apply Irish banks' residential mortgage developments during the global financial crisis to four major Australian banks' balance sheet. Irish banks' residential mortgage quality has gotten worse by reason of large increase in unemployment rate, decrease in house prices and high loan-to-value ratios during the global financial crisis. This experience has been used to calibrate tail risk scenarios for analyzing to see resilience of Australian banks' to several stress scenarios by calculating capital ratios included in the capital adequacy calculation. And their study have suggested that major Australian banks' could stand out against shocks to residential mortgages.

They have supposed that the ratio of four Australian banks' residential mortgage three riskiest categories would increase to those of Irish banks' in 2010 and ratio of other low risk category would decrease correspondingly. Probability of default of four Australian banks have recalculated and there has been an increase to 11 percent from 2 percent and estimated losses would be higher than the banks' total provisions due to the decrease in the bank's capital. While the Tier 1 capital ratio four banks' decrease 1 ½ percentage points, the ratio would remain over the regulatory minimum capital ratio of 4 percent (Banks would be required to hold tier 1 capital of at least 4% of risk weighted assets (RWA) and total capital of at least 8%)

Then, they have increased the loss given default and risk weights by 1 ½ times according to first scenario and they have found that one banks' total capital ratio decrease to 6 percent while other banks' total capital ratios remain above 8 percent.

Furthermore, they have taken into account losses corporate property lending. When they have added to calculation 6 percent of corporate losses which was estimated for corporate sector during the financial crisis, the four banks' capital ratio about 7 percent under the above scenario 1 and 5 ¼ percent under scenario 2 which are under the regulatory minimum ratio.

Also, another paper which is conducted by Jang and Kataoka (2013) have tried to estimate that sensitivity of four large New Zealand banks to sizable stand-alone shocks based upon residential mortgages and corporate lending. They have used the September 2011 data published by banks for assessing the risks of residential mortgage lending. Then they have applied the residential mortgage movements of Irish banks during the global financial crisis to New Zealand banks' balance sheets. Irish banks' experience has been used for calibration because of their deteriorating residential mortgage quality during the financial crisis. Under the scenario, probability of default is estimated to increase from 2 ¾ percent to 10 ½ percent and estimated losses are calculated

They have supposed that the ratio of four New Zealand banks' residential mortgage three riskiest categories would increase to those of Irish banks' in 2010 and ratio of other low risk category would decrease correspondingly. Probability of default of four New Zealand banks have recalculated and there has been an increase to 2 2/3 percent from 10 ½ percent and estimated losses would be higher than the banks' total provisions due to the decrease in the banks' capital. Tier 1 capital ratio four banks' decrease about 1 percentage point. Also, they have increased the loss given default and risk weights by 1 ½ times according to first scenario and they have found that banks' Tier 1 capital ratio decrease to 7 percent, also all four banks' Tier 1 ratio remain above regulatory minimum ratio 4 percent.

Andersen and Berge (2008) have tried to examined financial stability of Norwegian banks by using stress-testing in their paper. And they presented a bank model which have been used to investigate developments in banks' profit and capital adequacy for the five largest Norwegian banks in two different scenarios. One of them is baseline scenario for the Norwegian economy presented in Monetary Policy Report and alternative stress scenario where houses prices fall, the interest rate rises and banks' risk willingness decline. Their stress scenarios have shown that capital adequacy have decreased if house prices were sharply decreased and interest rates increased. However, average of the capital adequacy for five banks were above the regulatory minimum of 8 percent. In conclusion, their analysis have showed that these five banks financially well-conditioned and they were able to weather such macroeconomics development.

In the study, the purpose of the bank model is to examine how vulnerable banks are to risk factors which banks face and the model have been used how change in credit risk affect banks' profit and financial strength. A bank model have been three main components; profit and loss account, balance sheet and capital adequacy. The bank model's projections make use of the output from macro model on lending households, lending rates, loan losses and labor costs. They have used banks' loan losses which were a key variable to estimate banks' profit and capital adequacy. For estimating loan losses, they have used macro model which includes house prices, household debt, housing investment and banks' problem loans in the household and corporate sector. The macro model have included relationships for banks' problem loans to the household sector and the corporate sector severally. In the study, problem loans were determined by macroeconomic variables and have been used to assess banks' vulnerability.

3. EVALUATION OF CAPITAL REGULATION FROM THE 1988 BASEL ACCORD

Capital adequacy ratio is one of the main indicator of financial soundness which is used to express the impacts of a stress testing results. And also it is important tool for measuring how much capital buffer are needed in stress conditions. Moreover, impacts on capital adequacy ratio is important for institutions with supervisory responsibilities. It is used by financial institutions for their risk management activities through the capital adequacy framework of Basel Committee. Also, in our analysis, capital adequacy ratio which is implemented in Basel are used for interpreting the result of scenarios. Therefore, it is substantial to understand the evaluation of capital regulations which are implemented under the Basel accords.

Hence, in this section is included the development of capital regulations as from the 1988 Basel Accord.

How to calculate the required level of the adequate capital is mostly discussed in the literature and regulators and banks have been developing models of measurement of capital adequacy for the last two decades.

One of those works has been carried out by Maisel (1981). He has stated that determining the adequate level of capital, measuring the risk of insolvency is very important for bank managers, shareholders, regulators, insuring agencies and uninsured creditors.

According to Crouhy and Galai (1986), the risk of solvency is related to the risk of capital loss on bank’s assets, risk of uncollected loans, and risk of incurring a rate. On the other hand, this risk is less related to the current yield on bank’s assets, and initial amount of capital, which might cover the adverse effect of this risk

In the study of Hellwig (2008) it is stated that while banking regulation depends on the combination of asset allocation rules and deposit rate regulation. On the other hand, the capital requirements have not been at the center of the scope of banking regulations in the past as his work also has emphasized. Also, these rules are developed after the Great Depreciation and have been practiced until 1970s. But, in the 1970s and 1980s, the financial sector had met with the structural changes and the most of these rules had been abandoned. Since, they had been seen as dysfunctional and weakening the position of banks in competition with other banks and other non-bank intermediaries . He also states that the banks could not deal with the increased risk in the period of large fluctuations in interest and exchange rates.

In the following period of the mid-1980s, capital regulation had started to take the center stage, where bank regulators of the G-10 countries had come together to propose a framework for the prudential regulation (macroeconomics affect the financial system and vice versa) against increasing globalization of financial activities (Basel, 1988).

Santos (2000) has stated that The Basel Committee on Banking Supervision has started to evaluate the proposals to set capital standards. Because there have been some concerns about the health of the international banks and complaints about the unfair competition in the early 1980s.

The Basel Committee from the Bank for International Settlements proposed Basel I Accord of 1988 which includes the measurement of capital and the declaration of capital standards for credit risk. This accord has been signed by the G-10 countries by many other countries in the following years. The accord has been proposed with the aim of achieving the international convergence of capital standards and to improve these standards in many countries (Basel, 1988)

Although the content of application of the Accord has been limited to the internationally active banks; more than 100 countries have adopted the Accord as a risk-based supervisory approach for the concept of capital adequacy (Basel, 2001)

The framework of the 1988 Accord just considered the issues about the credit risk. The minimum total capital equals to 8.0% of risk adjusted assets has been required for banks. The Committee has also defined capital elements as Tier 1 and Tier 2 in its accord. Tier 1 includes common stock and disclosed reserves and Tier 2 capital includes other instruments and hybrid debt capital instruments. Also, according to accord, at least half of the minimum capital ratio should be met by Tier 1 capital. Moreover, the weighting structure of on-balance-sheet assets have been grouped under five categories as 0%, 10 %, 20%, 50%, 100%. The assets have grouped into one of these category-based parameters of counter-party: collateral and maturity. Off-balance-sheet engagements such as letter of credit first has been converted to the credit risk equivalence and then multiplied by the appropriate risk weight (Basel, 1988)

According to James (1996), the interest in measuring risk that has come with the implementation of the Basel Accord of 1988 has been a partial response to the greater regulatory emphasis on capital adequacy.

However, Basel Accord of 1988 has been relied on a relatively simple method of assigning the risk weights to asset categories. Therefore, it has very little risk sensitivity for measuring credit risk. For example, all corporations carry the same risk weight of 100 %. This standardized approach of the accord criticized for its ‘one size fits all’ command.

In 1996, amendment of the capital accord was published in order to incorporate market risks. This amendment also has defined a third tier of capital ‘Tier 3’. This amendment consists of short term subordinated debt. This amendment has allowed banks to use, as an alternative to standard approach, their internal models. Those internal models take the real degree of risk associated to the composition of the bank's portfolio into account. And the internal model approach, in contrast to the standard approach, has allowed banks to use this model to estimate the value-at-risk (VaR) in its trading account (Basel, 1996)

After that, in June 1999, the Basel Committee has released a proposal (Consultative Paper 1) to replace the 1988 Accord with a more risk sensitive framework (1999 Basel Committee). Later, the Committee presented a more general proposal (Consultative Paper 2) in 31 May 2001. They presented third proposal (Consultative Paper 2) in April 2003. As a result of these efforts, many valuable improvements have been made to the original proposals and final text has been prepared.

In June 2004, the Basel Committee has introduced a New Accord called ‘Basel II’ with the name of A Revised Framework International Convergence of Capital Measurement and Capital Standards.

While 1988 Accord has focused on the total amount of banking capital, the new framework has aimed to improve the safety and soundness in the financial system. They have tried to realize this aim by placing more emphasis on banks’ own internal control and management, the supervisory review process, and market discipline. Committee has also proposed to establish a 150% risk weighting category to include instruments rated below B- and securitization tranches that are rated between BB+ and BB-. The new accord has included three pillars that contributed to safety and soundness of the whole financial system.

- In the first pillar, minimum capital requirements were defined. The operational risk measurement was proposed in the new framework. And also two principal options which have been the standardized approach, and the internal rating based (IRB) approach have been proposed for the measurement of credit risk.

Banks have received supervisory approval to use the IRB approach. Then this approach is used for their internal estimates of risk components in specifying the capital requirement for a given exposure.

- The second pillar, the supervisory review process, has aimed to develop the requirements of supervisors to ensure that banks have accurate internal processes. As a result, the assessment of the adequacy of their capital based on a complete evaluation of their risks could be done.

- The third pillar has aimed to encourage market discipline through enhanced disclosure by banks. Therefore, the new framework sets out the disclosure requirements including how a bank calculates its capital adequacy and its risk assessment methods.

Saidenberg and Schuerman (2003) have stated that new accord has been better designed in order to direct the regulatory capital to the important risks by encouraging better and more systematic risk management practices.

In contrast, Atkinson (2008) blames the Basel framework for its insensitivity for portfolio diversification, favoring high leverage, supporting heavy concentrations on favored asset classes, notably residential real estate lending. According to him, the well-designed capital adequacy framework should provide more restrictions against this. As a result, he emphasizes that there should be more capital to absorb losses when they occur.

Goodhart (2008) states that Basel II gives each bank a much clearer and better defined picture of its own individual risk position. However, he concludes that Basel II should be blamed for the crisis because of not properly foreseeing the risk of liquidity, and also because of the exclusion of the systemic risk and the possibility of contagion.

Another approach to Basel Accords is carried out by Morrison and White (2005). They have specified that the international capital regulations has been created for a ‘‘level playing field’’. Also, the accord should guarantee the fair competition among financial institutions. According to them, policies should be different with respect to the country’s regulations, transparency, and agent’s beliefs about the quality of banking system. Furthermore, they have also indicated that the financial system should not try to impose uniform standards for all countries as the Basel Accord does. Therefore, they have declared that a better policy is needed to measure the reputation of the economy’s banking regulator.

The Basel Committee on Banking Supervision had released a final version of its new bank capital and liquidity standards, referred to as “Basel III”, in December 2010. This new version has had the aim of improving the banking sector’s ability to absorb shocks arising from financial and economic stress and reducing the risk of spillover from the financial sector to the real economy (Basel, 2010).

Various activities have been carried out for realization of the above-mentioned objective in Basel III accord (Basel 2011).

- Level of minimum common equity requirement has been increased at least 2 to 4.5% of risk-weighted assets

- Basel III has introduced two new capital buffers: a capital conservation buffer of 2.5% which has been designed to ensure that banks hold capital buffers outside periods of stress and a countercyclical buffer within a range of zero and 2.5% of risk weighted assets.

- Total common equity requirement has been determined 7% (4.5% common equity requirement and the 2.5% capital conservation buffer)

- Tier 1 capital ratio has been increased from 4 to 6% (The ratio will be set at 4.5% from 1 January 2013, 5.5% from 1 January 2014 and 6% from 1 January 2015)

- The Committe developed Liquidity Coverage Ratio to ensure that banks have sufficient high quality liquid resources to withstand to a stress condition lasting for one month

- The Committe developed a supplemental 3% non-risk based leverage ratio which constrains the build-up of leverage in the banking sector

4. THE US SUB-PRIME MORTGAGE CRISIS

4.1. OVERVIEW US SUBPRIME MORTGAGE CRISIS

According to Vinal et al (2009), the financial system is disrupted as a result of several dimensions as described below:

- The financial system developed mostly complex and not transparent.
- The financial system became overly leveraged and highly interconnected.
- Liquidity risk is high.
- Large complex institutions have used the benefits of being "too big to fail''.
- Financial intermediation has growingly turned out to be the ''shadow banking'' sector.

Hellwig (2010) have stated that global financial crisis of 2000s has been serious enough and it ended up bringing down the global financial system. Losses have not been larger than losses in the Japanese banking crisis of the nineties. However, he has specified that the difference between those crises is that in US mortgage crisis, institutions have been more fragile and more interconnected than they were in the previous crisis.

Many other economists and researchers like Hellwing (2010) believe that the U.S. housing bubble has been caused partly by the low interest rates. In another study, Taylor (2007) claims that the Fed set the interest rates far below the correct rate. And many have argued that these low interest rates encouraged the extraordinary increase in housing demand. By this way, Taylor (2007) argues that the volatility in the demand of housing has resulted in the volatility in housing price inflation as well. Also, he has reconciled that this jump in the inflation accelerated the demand for housing in an upward spiral. He explains the process such that:

At first, while the housing prices were increasing rapidly, delinquency and foreclosure rates on sub-prime mortgages also fell. On the other hand, the short-term interest rates came back to the normal levels. Then, as a result, housing demand rapidly decreased and delinquency and foreclosure rates, then increased sharply. After all, this leaded to the meltdown in sub-prime market.

The homeownership rate was raised to 69.2 percent in 2004 before declining to 68.2 percent at the end of the third quarter in 2007. During these periods, there have been several periods of disruption in the market. However, the most recent episode, which is widely referred to as the “sub-prime mortgage market meltdown’’, happened in the summer of 2007. At the same period, the home prices fell and foreclosures rose (Barth et al., 2008).

The term sub-prime is generally used to define certain characteristics of the borrower. For instance, a FICO score (The well-known and most extensively used credit score model is to evaluate creditworthiness of a borrower in the United States) of less than 620 is a common definition of a sub-prime borrower.

According to, Gerardi et al. (2008) there are, effectively, four basic ways to classify a credit as sub-prime. They explain those ways such that:

Firstly, mortgage servicers charge higher fees to service since they accept that borrowers need to be contacted frequently. Secondly, some lenders specialize in the borrowers who have financial difficulties. Thirdly, high cost loans are charged to the ordinary borrowers. And finally, loan can be sold in the asset-backed security market by including the sub-prime mortgages.

Nevertheless, According to Demyanyk and Hemert (2008), a broad definition of a sub-prime loan is a high default risk.

Bernanke (2007) have stated that Subprime mortgage lending started to expand seriously since the mid-1990s. Bernanke (2007) summarizes that its expansion has been encouraged by innovations that decreased the costs for lenders of assessing and pricing risks. And especially, technological advances have enabled the lenders to combine and disseminate information on the creditworthiness of potential borrowers. Additionally, the lenders have developed the new techniques to define underwriting standards, to set the interest rates, and to manage their risks by using this information (Bernanke, 2008).

And then, Bernanke (2008) emphasizes that the secondary mortgage market developments strengthen the effects of these innovations. Besides this, the growth of the secondary market has enabled the mortgage lenders to access to the capital markets by degrading transaction costs and spread risk more broadly. Therefore, this has resulted in the rising in the supply of mortgage credit to all types of householders. Homeownership has been made possible with the expansion of subprime mortgage lending for households that may not have qualified for a mortgage. Therefore, this has made a contribution to the increase in the homeownership rates since the mid-1990s.

Another discussion about the reasons of market failure has been made by Allen and Carletti (2010). Their discussion is about the persistence in the mispricing of assets due to limits of arbitrage. They explain the problem such that: Mortgage backed securities and securitized assets have not been priced correctly for a long time. Investors would buy the underpriced security and make a profit. This incentive arbitrage mechanism has been provided to make sure that prices rose to the correct level. But, during the crisis, prices kept going down and caused difficulties for many investors.

Bart et al. (2008) mention that before 1980, the most part of the residential home mortgages loans were made by savings and loans. These loans were created, serviced and held by the institutions in the portfolios of those institutions. Barth et al. (2008) have compared the periods such that in the 1970s, the combination of these functions by a single institution started to change, as residential home mortgage loans were progressively securitized. The Government National Mortgage Association (GNMA, Ginnie Mae), The Federal National Mortgage Association (FNMA, Fannie Mea), and Federal Home Loan Mortgage Corporation (FHLMC, or Freddie Mac) have become the major securitizes of home mortgages (quoted in Barth, et al., 2008).

In the study of Mishkin and Eakins (2012) have stated that share of the mortgage market has been held by the main mortgage-lending institutions in the United States. The largest investors in the market have been mortgage pools and trusts with the 53 % proportion.

According to Brueggeman and Fisher (2011) the secondary mortgage market is evolved as a consequence of the market affected by a combination of the following influences:

- In the market there are specialized mortgage originators such as mortgage banking companies. Those originators can sell mortgages and replace funds. As a result, the new loans could be originated.

- Funds can flow more easily between geographic areas by the help of the market mechanism. For instance, market allows lenders located in the different areas, where there is a housing demand and mortgage financing needs are more than availability of deposits, to sell mortgages in other geographic areas. In those areas, the surplus of saving is used to finance the debts in other areas.

- In the late 1960s, because of the innovations in the securitization, savers were no longer limited to the conventional approaches of saving. Moreover, investable funds became much broader because of the raise in the floating of the funds to the pension accounts of the aging population of US

According to Crouhy et al. (2008) there are four reasons about raise of delinquency after mid-2005: Firstly, sub-prime borrowers are not very credible, leveraged high debt to income ratios and extended loans with high loan-to-value ratios are persistent. Secondly, sub-prime loans were of the short-reset type which the interest rates firstly lower than the standard rates but after a few years, they reset at a much higher rate. Thirdly, refinancing or repaying mortgages early through home sales caused equity cushion in the market. And finally, investors' demand for higher yielding assets increased the availability of sub-prime mortgages.

According to Demyank and Hemert (2008), poor performance of the mortgages was not confined to the specific part of the sub-prime mortgage market. For instance, fixed-rate, adjustable rate, purchase money, low documentation loans in 2006, and all of them had a high delinquency and foreclosure rate. However, the mortgage crisis was especially confined to adjustable-rate or low-documentation mortgages.

Brueggeman and Fisher (2011) explain that this type of mortgage instrument is different from FRMs (fixed rate mortgages): in FRMs, it is designed to adjust the economic situations with respect to the changes in the overall situation. It is an alternative way of financing that provides sharing the risk of interest rate changes between lenders and borrowers. Addition to this, it gives an opportunity to the lenders to match changes in interest costs with changes in interest revenue more effectively and borrowers can have lower financing costs within possible range.

Mishkin and Eakins (2012) have stated that lenders prefer ARMs (adjustable rate mortgages) because ARMs decrease the interest-rate risk. Mortgages' value is very sensitive to interest rates and they have usually long-term maturity. So ARMs give an opportunity to reduce the sensitivity of the lender institutions to the interest rate changes.

On the other hand, Bart et al. (2008) criticize that increased use of adjustable-rate of mortgage has made it possible to share the interest rate risk by both lenders and borrowers. Initial interest rate is lower than the fixed-rate mortgage. However, then the individuals that choose the adjustable-rate mortgage face the likelihood of higher interest rate when interest rate rise in the market (Barth et. al, 2008).

According to Allen and Carletti (2010) inefficient liquidity provision is one of the main causes of the crisis. The basic problem has been that holding liquidity is costly. The significant level of price volatility is the only way for getting people to hold liquidity in a financial system without government intervention. However, the price volatility causes crisis when prices fall to levels of low enough.

Hellwig (2010) states that excessive indebtedness and maturity transformation have increased by the shadow banking system since this system has financed itself by issuing short-term debt in wholesale market. Then, it has invested in marketable assets with longer maturities.
Also, Hellwig (2010) has stated that the exploitation of the model-based approach to capital regulation by banks has been one of the reasons of excessive indebtedness and maturity transformation. Banks can invest in asset-backed securities through the conduits and structured-investment vehicles (SIVs) without putting up the equity from their own books. As a result, they have been boasting for having more core capital.

Moreover, Gorton (2008) argues that the lack of information arising from the securitization process was another major factor behind the crisis. He argues that the sell side of the market such as dealer banks, CDO and SIV managers has understood the complexity of the subprime chain. On the other hand, buying-side such as institutional investors has not.

Another paper of Hellwig (2008) has stated that performance level of the regulators and supervisors have been low. He has explained that they have less information about the institutions which have been exposed to the systemic risk. The reason of this lack of information has been that the important players, such as conduits, SIVs and hedge funds, have been unregulated. Besides, they have not had to provide any information about their positions.

Mishkin (1996) has defined the financial crisis within the frame of the asymmetric information regarded as ‘‘a nonlinear disruption to financial markets’’ in which adverse selection and moral hazard problems become much worse. Therefore, the financial markets are unable effectively channel funds to those who have the most productive investment opportunities.

According to Vinals et al (2010) a key concern relating to financial stability in this area is that when downgrades happen, securities below a given threshold force investors to sell. At the same time, this is causing “cliff effects,” in particular if the threshold is between investment and non-investment grade.

Also, there has been much argument about the behavior of credit rating agencies (CRAs) and their ratings in the aftermath of the crisis (Mishkin, 1996).

In the research of Crouhy et al. (2008), it is stated that credit rating agencies are the hearts of the crisis. Since many investors have invested in both complex and risky assets. Then they substantially have had less information about credit quality of the assets they have been holding in their portfolios than the originators. Therefore, they have mostly relied on rating agencies' risk evaluation. In the risk evaluation process, originators provide information from the borrowers, and issuers of mortgage-backed securities that perform the due diligence. Moreover, rating agencies obtain the data from the issuers. Also, they do not cross-check the information about borrowers provided by the originators. The failure of check data have caused underestimated data about the probability of default of the assets in the collateral pool.

The Table 4.1 shows that details of the risk-based weights applied to home mortgages and mortgage-related securities. Securitizations are based on residential mortgages, commercial mortgages, other asset backed securities and CDOs. It could be seen from the table: agency securities and AAA/AA securitization tranche enable the banks to decrease their capital requirements by securitizing pools of whole mortgages into agency or AAA/AA rated securitizations MBS or CDOs.

Table 4.1: Risk-Based Weights Applied To Home Mortgages And Mortgage-Related Securities

Asset Class	Risk Weight
Whole Residential Home	0.50
Agency Debt and Agency MBS	0.20
AAA /AA Securitization Tranche	0.20
A Securitization Tranche	0.50
BBB Securitization Tranche	1.00
BB Securitization Tranche	2.00

Source: Federal Register, 2011

Gourinchas and Obstfeld(2011) defines that the rapid buildup of the leverage has been the signal of the crisis. He has used discrete-choice panel analysis using 1973-2010 data in his analysis. The findings suggest that domestic credit expansion and real currency appreciation have been the most reliable and considerable predictors of financial crises. For emerging economies, however, higher foreign exchange reserves predict a sharply decreased probability of a crisis.

In the study conducted by Helwig (2010) he has stated that The Basel Committee did not submit any systematic analysis of:

- Why the proposed measures should have the useful effects that are expected from them,
- And why the current system of capital regulation has failed badly in the crisis.

According to him, regulatory institutions stick to a tradition of discussing the rules of capital regulation among bureaucratic experts without showing any theoretical or empirical analysis of the effects.

In the discussion which has been conducted by Allen and Carletti (2010) it is emphasized the importance of having a clear idea about what are the benefits and the costs of the banking regulation for designing it effectively. And, within this context, Basel Agreements is given as example of being not clear. Because, there is no other explanation for why the capital requirements ratios are set at the level they are. Moreover, it has been spent billions of dollars for designing these agreements, however, these agreements has not prohibited the crisis and have had very little effect on decrease in severances.

Viñals et al. (2010) has expressed, in their IMF Staff Position Note, the recent proposals of the Basel Committee have exhibited significant improvement in the quality and quantity of bank capital. However, these implements have been only subjected to a subset of the financial system. They have argued that policies need to deal with not only the risks posed by individual banks but also, importantly, risks posed by non-banking institutions and the all financial system.

The crisis has brought into question once prevailing views that capital in the financial sector has been both adequate and adequately regulated. Table 4.2 shows that capital to assets ratios of US Banks decreased during the crisis in 2007 and 2008.

Table 4.2: Capital to Assets Ratio of US Banks (%)

YEAR	2006	2007	2008	2009	2010	2011
US Capital to Assets Ratio	10,5	10,3	9,3	10,9	11,1	11,3

Source: WorldBank

When we look at the Table 4.3, total risk weighted assets has increased much since 2006. While RWA increased 10.1 % in first quarter of 2007, it increased by 11.8 % in the first period of 2008.

Table 4.3: Equity Capital and Total Risk-Weighted Assets of US Banks

	Billion $						Percentage Change	
	2004	**2005**	**2006**	**2007**	**1Q/2007**	**1Q/2008**	**1Q/2007**	**1Q/2008**
Equity Capital	850	912	1.030	1.144	1.041	1.158	9	11,2
Tier 1 Capital	631	690	759	812	762	823	7,6	8
Total Risk Weighted Assets	6.292	7.002	7.764	8.607	7.828	8.752	10,1	11,8

Source: FDIC

Demir et al. (2008) has stated, in their research, the cancellation of loans from the assets has been mostly occurred with a rate of 122% in the first period of 2008. Themortgage loans has been the largest share of this increase with a rate of 532 %. While the cancelled net asset value was $ 38.122 million in 2007, this value was $ 15.722 million in the first quarter of 2008. The net asset value of the cancelled due to mortgage loans was $ 8.004 million in 2007 and it was 5.985 million in the first quarter of 2008. Net cancelled asset value of the first quarter of 2008 was equivalent to 75% of the value comes from the year 2007. These results imply that the effects of the crisis on the balance sheet occurred more clearly in the first quarter of

2008 due to the reflection of the effects of the mortgage crisis to the market after the third quarter of 2007.

CAR of US Banks started to increase after 2009. We can explain this increase such there have been several capital injections. According to Federal Reserve information:

- On October 14, 2008, the U.S. government announced a series of initiatives to strengthen market stability, improve the strength of financial institutions, and enhance market liquidity. Treasury announced a voluntary Capital Purchase Program to encourage U.S. financial institutions to build capital to increase the flow of financing to U.S. businesses and consumers and to support the U.S. economy. Under the program, Treasury will purchase up to $250 billion of senior preferred shares on standardized terms. Treasury's Capital Purchase Program and the FDIC's Temporary Liquidity Guarantee Program complement one another. Through these programs, fresh capital and liquidity are available to foster new lending in nation's communities.

Federal Deposit Insurance Corporation (2009) has reported that there are 552 problem banks on their list of the most recent quarterly survey. US Treasury Department have stated that total capital injection to problem banks has amounted to USD 204.71 billion as of November 27, 2009.

Table 4.4: Expropriated and Purchased or Recovered Institutions in US

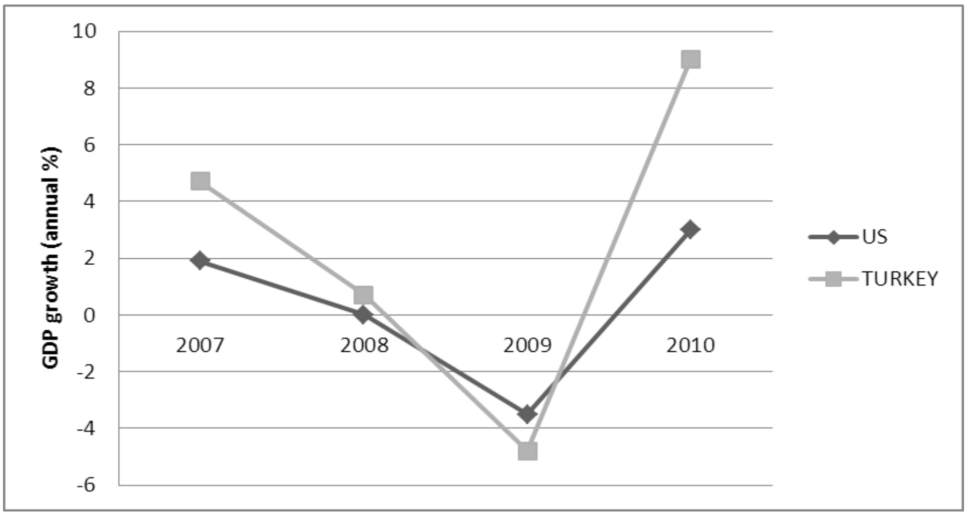
Bear Stearns has been bought by a commercial bank	$ 29 Billion
Freddie Mac and Fannie Mae have been nationalized.	$ 200 Billion
Lehman Brothers went bankrupt.	
AIG has been nationalized.	$ 87 Billion
Wachovia Bank bought by Citibank	$ 12 Billion
It has been supported capital to City Group	$ 40 Billion

Table 4.4 shows that expropriation of purchased or recovered institutions which has been provided by funds (Erdönmez, 2009):

4.2. COMPARISON OF TURKEY'S FINANCIAL SITUATION DURING THE US FINANCIAL CRISIS

After the 1990s and early 2000s, The Turkish economy recorded high and significant growth and structural change between 2002 and mid-2007. When we compared Turkish GDP to US GDP (Figure 4.1), Real GDP Growth in Turkey was higher than the one in US, where the recession began in 2007. However GDP growth started to decline in Turkey in mid-2007. GDP growth sharply was down to 4.7 % during 2007. And in the first quarter 2009, the Turkish economy experienced the sharpest quarterly GDP decline of the last three decades, at -14.3 %.

Figure 4.1: GDP Growth in Turkey and US 2007-2010

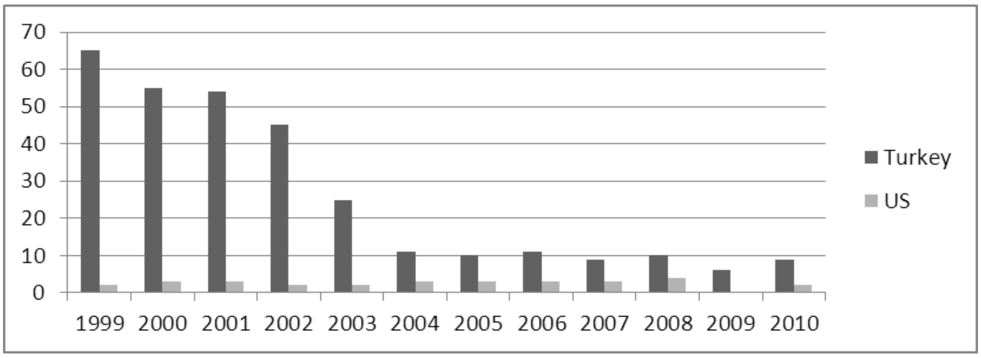


Source: World Bank

Turkey has been a high inflation country since mid-1970s and it had significantly dropped from 1999 and 2000 (Figure 4.2). Then, inflation declined in a period when the Turkish Lira has appreciated starting from

2002. This high inflation was brought under control by 2005 and dropped single digit levels. In the crisis 2008-2009 inflation declined.

Figure 4.2: CPI Inflation in Turkey and US 1999-2010



Source: World Bank

When we look at the total assets in banking sector in Turkey, we can say that the size of the banking sector recorded a substantial growth in late 2008 and in early 2009 with the help of the restructuring and proper regulation. On the other hand, heavy increase on the number of foreign banks, shown below in Table 4.5, is telling in this respect:

Table 4.5: Ratio of Turkish Bank Assets to GDP (1999-2Q/2009)

	1999	2002	2008	1Q/2009	2Q/2009
Total Bank Assets, Billion $	133,5	129,7	482,2	452,7	503,5
Total Bank Assets, GDP	67,1	58,6	78,1	79,8	79,1
Total Banks (I + II, % Share)	100	100	100	100	100
I: Commercial (Deposit)Banks	95,2	95,6	96,9	96,7	96,7
(1) State	34,9	31,9	28,5	29	30,2
(2)Private	49,5	56,2	41	40,7	40,2
(3)SDIF	5,6	4,4	0	0	0
(4) Foreign	5,2	3,1	27,4	27	26,3
II: Development and Investment Banks	4,8	4,4	3,1	3,3	3,3
(1) State	3,4	3,2	2,8	3	3
(2)Private	0,9	0,8	0,2	0,2	0,2
(4) Foreign	0,5	0,4	0,1	0,1	0,1

Source: BRSA

Also, Turkish banks entered into the crisis with a stronger capital position with comparison to US. According to BRSA From Crisis to Financial Stability Report; the capital structure of the Turkish banking sector has strengthened; and the capital adequacy ratio which was 9.3 percent in 2000 rose to 18 percent as of end-2008.

According to Bakir (2009), it is stated that Turkish government showed overconfidence in the economy, so there was no bank in bankruptcy to rescue. Turkish Banks did not have any exposure in the home-grown crisis emerging from mortgage-backed securities.

Also, Bennett and Erdoğan (2011) have explained the major reason of this better performance is due to the fact that Turkey have implemented reforms in order to strengthen the banking system and government finances after the progressions undertaken after its 2000-2002 banking and currency crisis. Also they have added that Turkish banks were well capitalized and tightly regulated, and inflation was under-control during the 2007-2010 global crises.

Bennet and Erdoğan (2011) explains this profitability is due to the fact that rigid BRSA regulations, limited entrance into the banking sector, attractive interest rates for foreign investors and no exchange trading options. Also they have added to the list the Turkish banks investment preferences such as they prefer to invest in treasury papers instead of giving more credits.

These outcomes could be explained briefly such that: banking sector have been restructured and well regulated, and there have been no complex instruments in banks’ portfolios such as toxic instrument as in the USA, and provided only a limited housing loan in comparison to the USA.

Bakir (2009) briefly focuses on four main sectors of the Turkish economy such as public, financial, non-financial and household in his article. He shows that Turkish economy is in relatively good shape with regard to the public finance/debt ratio and banking sector robustness. On the other hand, there are substantial weaknesses in non-financial and household sector.

While mentioning the applicability of the mortgage system in Turkey, it would be appropriate to compare the Turkish Banking and US Banking System

While US Banking system liabilities heavily depend on short-term funding in the money and capital markets, in Turkey they do depend on traditional deposit liabilities (Bennett and Erdoğan, 2011).

Consumer Loans are founded through their saving deposits by the Lenders in Turkey and the average term of these deposits is still less than 6 months. The funding loans which have 20-25 year terms through deposits with less than 6 months cause large maturity mismatch in the banks' balance sheet. Banks have to increase the maturities in the liabilities side of the balance sheet or to decrease the maturity in the assets side in order that minimize the maturity mismatch. Proper secondary market practices such as on-balance sheet or off-balance sheet securitizations are other solutions to minimize this mismatch (Karakaş and Özsan, 2005)

The total liabilities of the Turkish Banking Sector balance sheet is 1.073.049 TL million by the end of 2011. When we look at the Table 4.6 , we can see that total deposits to liabilities ratio is 64 %. On the other hand, while the share of deposits up to 3 months in total deposits is 85.5 %, the share of 1 year and more deposits in total deposits is only 4.6 %.

The continuous funding of the long term housing loans is not an easy task with this mismatch between assets and liabilities.

Table 4.6: Deposit Maturity Structure (TL Million)

December 2011	Demand Deposit	Total-Up to 1 Month	1-3 Months	3-6 Months	6-12 Months	1 Year and More	Total
TL Million	121.168	102.700	370.139	52.416	16.825	32.249	695.496
(%)	17,4	14,9	53,2	7,5	2,4	4,6	100

Source: BRSA

On the other hand, it is not possible to carry burden of funding of housing loans with up to 1 year syndication loans or up to 3-6 months deposits. In addition to this handicap, financing of TL based housing loans with Euro or USD based long term funds create a currency risk.

According to Erol and Patel (2005), it is necessary to establish a secondary mortgage market in order to increase funds for housing finance. While the US Banks are issuing the loans in the form of mortgage securities, Turkish banks originate the housing loans by keeping their own portfolios. Because, there is no secondary market in Turkey yet.

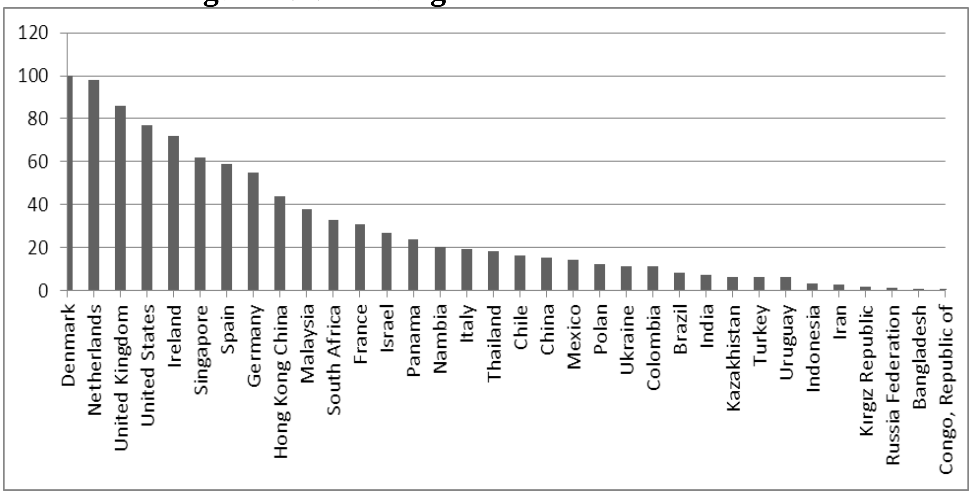
According to Erbaş and Nothaft (2005), well-functioning mortgage market plays a significant role in the success of growth-enhancing policy targets. Widespread existence of affordable mortgages can increase the wealth accumulation, support savings and financial market improvement, and invigorate the investment and job creation in the housing sector. Widespread existence of affordable mortgages has a positive effect on the housing quality, urbanization and infrastructure.

Also, Turkey has lack of government supported housing finance institutions in contrast to US. In US, federal government found several agencies such as GNMA, FNMA etc to buy mortgages and to help support the nation's economic activity.

While we are mentioning about the applicability of the mortgage system in Turkey, it is useful to look at some other indicators as it stated below:

According to Figure 4.3, emerging market economies usually have smaller housing finance system than developed countries. The ratio of outstanding housing loans to GDP is around 6-17 percent in Turkey, Kazakhstan, Brazil etc., whereas the range is between 50 and 100 percent in developed countries such as United States, EU Countries, Australia and Japan, 20-35 percent in a few middle income countries such as the Republic of Korea, South Africa, Malaysia, Chile, Baltic countries.

Figure 4.3: Housing Loans to GDP Ratios 2007



Source: World Bank

According to Alptürk (2007), illegal urbanization has created the most important and unsolvable problem in the Turkish housing market.

Besides, income distribution is relatively unequal in Turkey. Table 4.7 below shows the income distribution of households in Turkey. Considering the quintiles constituted by the equivalent household disposable income, the share of the fifth quintile which has the highest income is 46.4 % whereas the share of the first quintile which has the lowest income is 5.8 %. Therefore, the share of the fifth quintile of the total income is 8 times more than the first quintile.

Gini coefficient, which is one of the income inequality criteria, is estimated at 0.402 with a decrease 0.013 point by the previous year. The coefficient is estimated at 0,389 for urban settlements and 0.379 for rural settlements.

Table 4.7: Household Incomes by Quintiles in Turkey, 2009-2010

Quintiles	Turkey		Urban		Rural	
	2009	2010	2009	2010	2009	2010
Total	100	100	100	100	100	100
First 20%(*)	5,6	5,8	6	6,3	6,1	6,2
Second 20%	10,3	10,6	10,7	11	10,9	11
Third 20%	15,1	15,3	15	15,3	15,9	15,7
Fourth 20%	21,5	21,9	21,1	21,6	23,1	22,8
Fifth 20%(*)	47,6	46,4	47,3	45,7	44	44,3
Gini coefficient	0,415	0,402	0,405	0,389	0,38	0,379
Share ratio(S80/S20)	8,5	8	7,9	7,3	7,2	7,1

Source: Republic of Turkey Turkish Statistical Institute

(*) The bottom income group is defined as 'the first quintiles', and the top income group is defined 'the last quintiles'.

Moreover, Table 2.6 above shows that the target market for mortgage lending activities are mainly for the upper income level families and mortgage finance is neither accessible for the low nor middle income households in Turkey. According to Alptürk, (2007) creating a longer repayment periods for the lower income families is important to make a mortgage affordable. In order to have a developed mortgage market, fixed rate instrument is not adequate, especially adjustable and indexed mortgages are the main products to increase the market size by penetrating lower income segments.

Turhan (2008) has stated that macroeconomic instability has been one of the main inhibiting factors for the development of the mortgage system in Turkey. Also, the housing sector had experienced several recession in parallel to macroeconomic problems in the late 90s. Development of the housing sector declined substantially because of the Russian Crisis in 1998, of the earthquake in 1999 and of the economic and political instability. Housing sector was the least significant point in the economic crisis of Turkey in 2001.

As also Turhan (2008) has specified that the macroeconomic environment has started to change after the 2001 crisis. Then, economic activity has increased, and inflation and interest rates had declined in Turkey. This situation shows that macroeconomic stability is continued and inflation is kept under control, there can be successful future for the housing finance in Turkey.

When housing prices are analyzed, housing prices throughout Turkey and in three major cities continue to increase beginning from the first half of 2009 (see figure 4.4). According to Financial Sector Report of BRSA, deflation tendency observed in asset prices during global crisis period is predicted to end and there is moderate inflation risk in housing prices. On the other side, at the end of 2011, supply of housing decreased 268.700 item according to previous year (see table 4.8), however, on the contrary of supply, according to building construction cost index, housing costs has increased due to the increase of material and labor costs.

Table 4.8: Dwelling Units in Turkey

Periods	Number of apartments with construction licences	Number of apartments with occupancy permits
2010 Q1	125,512	87,654
2010 Q2	173,948	94,221
2010 Q3	165,279	101,573
2010 Q4	446,933	144,43
2011 Q1	91,911	94,167
2011 Q2	161,507	130,171
2011 Q3	174,116	148,436
2011 Q4	215,438	174,861

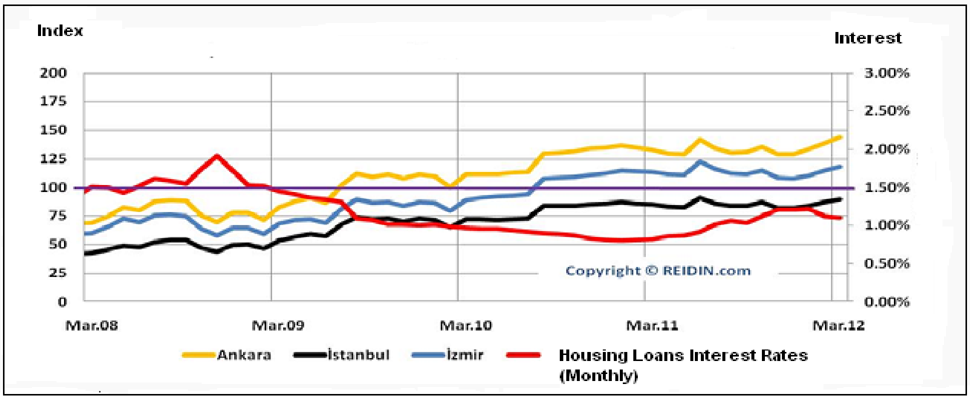
Source: GYODER

When we have analyzed the housing purchase power index (Figure 4.4) , according to results of REIDIN.com:

- while index value is 100, the above shows becoming a homeowner with 10 year maturity housing loan is possible in the current interest rate environment,
- index value of below 100 shows that it is not possible to become a homeowner by using housing loan which has 10 year maturity.

So, this situation shows that housing sale transactions, which are under the index value 100, may cause a problem in the installment payments of the customers. While index values are above 100 in Ankara and İzmir, are below 100 in İstanbul as of March 2012.

Figure 4.4: Housing Purchase Power Index



Source: Reidin

The government’s borrowing instruments have dominated the secondary markets for fixed products in Turkey, crowding out others from the market. Asset backed securities have been issued in domestic capital markets by Turkish banks in the previous years. In recent years, securitization of non-housing consumer loan receivables by Turkish Banks through off-shore vehicles, has been increasing. But, Turkey still lacks a mortgage portfolio securitization practices (Karakaş and Özsan 2005)

Another set of impediments is the significance costs associated with a typical housing transaction. Stamp duties, resource utilization fund, banking and insurance transactions tax, title fee, and notary expenses are some of these costs. These costs certainly do not help the banks in creating affordable housing loan products (Karakaş and Özsan, 2005).

5. MORTGAGE SYSTEM IN TURKEY

5.1. NEW MORTGAGE LAW

Amending the Laws Related to Housing Finance System

The Housing Finance System in Turkey is related to several laws, including consumer protection, foreclosure and bankruptcy, tax, capital market and financial leasing law. These laws have been redesigned by the new mortgage law. The Law has been prepared under the leadership of the Capital Markets Board called ‘‘Law Amending the Laws Related to Housing Finance System ’’ and enacted by accepting the 21.02.2007 meeting of the Parliament.

Mortgage has been included in the legal system as a result of enacting ‘‘Law Amending the Laws Related to Housing Finance System ’’ numbered 5582 published in the official gazette dated March 6, 2007 and numbered 26454.

According to Preamble of the Law, it is aimed to establish a corporate housing finance system by providing a common and appropriate borrowing way to buyers, by developing the financial market and boosting the construction sector.

Mortgage, in USA, is used to define a credit system which is providing for a person to obtain a real property by granting the realty. But in Turkey, the scope of the system is limited as compared to USA by the ‘‘Law Amending the Laws Related to Housing Finance System ’’. In Turkey, mortgage system is used for dwellings, not for whole real properties (Koçak, 2007)

During the preparation of the Law No. 5582, it is consulted with the department related to housing finance in World Bank, benefited from the views of EU Consumer Rights Council and European Mortgage Federation. They have also examined the laws of Germany and Ireland. System in

Turkey mostly resembles the system which is performed in the USA, Germany and Denmark. And mortgage procedures which have more powerful finance (securities) side has been taken as a basis by Law No. 5582. The term ‘housing finance system’ has been preferred instead of the term ‘mortgage’(Aydoğdu, 2007).

Amendments and additions in Laws related to Housing Finance System are defined as follows:

Capital Markets Law

Definition of Housing Finance and Housing Finance Institutions has been added to Capital Markets Law. According to Article 38/A of the law numbered 2499;

> ‘‘Housing finance is extension of loans to consumers to acquire houses; leasing of houses to the consumers through financial leasing; and extension of loans to consumers where such loans are secured by the houses that the consumer owns. Loans extended to refinance the loans explained in this context are also included in the housing finance.’’
>
> “Housing finance institutions” are banks that lend or lease directly to the consumer for the purposes of housing finance and leasing companies and consumer finance companies which are found eligible to operate in housing finance by the Banking Regulation and Supervision Agency.’’

According to new added Articles, consumers can purchase housing loans as securing the houses that they own. Also, financial leasing transactions are added to the definition of housing finance as an alternative method of financing, and leasing companies and consumer finance companies are defined to be mortgage lenders in addition to banks.

According to Koçak (2007), financial leasing and consumer loans which are related to housing finance are taken as the basis in this article. In this case, only receivables arising from these transactions are considered as housing finance receivables. However, a law that is made for the purpose of consumers to acquire houses must involve all the loan transactions to acquire a house. On the other hand, definition of housing finance institutions is limited under the purpose of the new law. As it is also understood from the article, it is undertaken two missions. It is stated in the article, both components which are related to how the housing finance are assigned and housing finance institutions are defined.

Also, housing finance receivables have not been defined, instead of this, certain legal entities have been counted as housing finance institutions. However, long term housing finance system is generated by all the legal institutions which including securitization. Institutions which are able to issue the capital market instruments have been restricted in the article. This situation is the key concern about an effective housing system.

According to Alptürk (2007), when using mortgage loans from banks, banks put in pledge on housing and ownership of the house which is belong to borrower. Also, in the financial leasing system, ownership of the house cannot be transferred to the borrower. Besides, valuable papers such as promissory notes are taken from the customer and negotiation risk occurs in this way.

Article 13/A of Law No: 2499 has been amended as follows:

> ‘‘Mortgage covered bonds are debt securities which are general obligations of the issuer and secured by assets in the cover pools.

> Mortgage covered bonds can be issued by banks and mortgage finance corporations defined in Article 39/A of this law.''

> ‘‘The cover pool may consist of receivables secured by mortgages on authorized houses and authorized other real estate properties, substitute assets and contracts protecting against the risks associated with these. No assets other than these may be included in the cover pool.''

While mortgage covered bonds has been enacted by the new Law, regulations have been made through the authorized houses and authorized other real estate properties. Existence of this element in a country where more than half of the constructions is unlicensed stonewalls the system. New Law should not support only authorized houses also it must support social houses of urban transformation projects (Koçak, 2007).

The following paragraph has been added to the article 3 of Capital Markets Law numbered 2499;

> ‘‘Mortgage Capital Market Instrument: Mortgage Capital Market Instruments are, mortgage covered bonds, mortgage-backed securities, capital market instruments other than stocks that are issued by mortgage finance corporations and other capital market instruments collateralized by the receivables arising from housing finance.”

With this article, legislator have created three types as ‘‘mortgage covered bonds'', ‘‘mortgage backed securities'' and ‘‘capital market instruments that are issued by mortgage finance corporations''. Article 13/A of Law No: 2499 which has regulated asset backed securities has been amended with its title. Asset backed securities have been divided two categories as mortgage backed and asset backed (Koçak, 2007).

Özince (2005) specifies that these capital market instruments increase the access to the housing finance funds in Turkey and increase the ability to pay of consumers, also increase the liquidity of housing finance institutions and contribute to their risk management. Also it is important that capital markets funding must have the necessary demand by both investors and market participants (Özince, 2005).

Article 39/A given below has been added to be placed just after Article 39 of Capital Market Law No. 2499:

> ‘‘Mortgage finance corporations are joint stock corporations, classified as capital market institutions and established solely for the purpose of taking over, managing and transferring the receivables arising from housing finance and providing financial resource by means of taking receivables arising from housing finance as collateral. Mortgage finance corporations may conduct risk management operations as required by their business transactions.’’

Consumer Protection Law

Housing loans, due to the type of consumer loan, depend on Article 10 is titled ‘‘Consumer Credit ’’ of Law No.4077. In the new mortgage law, The Article 10/B has been added to Law No.4077. According to Article 10/B;

> ‘‘The interest rates of the credits issued for housing finance or financial leasing agreements can be fixed or variable with the condition that it is stated in the contract. In case the interest rates are decided to be fixed, the interest rate which is stated in the contract cannot be changed without the consent of both parties. In case the interest rate is decided to be variable, the interest rate

> determined by the contract can be changed according to an index stated in the contract which must be a generally accepted and widely used index in national or international level, however maximum amount of periodic repayment amount stated in the contract cannot be exceeded by periodic repayment amount. In case the interest rate is decided to be variable, then it is necessary that the consumer be informed about the possible effects of this method. Central Bank of Republic of Turkey shall determine the reference interest rates and indexes to be used, whereas Ministry of Industry and Trade shall determine the principles and guidelines to inform the consumers.''

Before the Law, while variable rate housing loans are not provided by the financial institutions, it enables customers to purchase a housing loan which has a variable interest rate with this new addition to the Article:

> ''In case the interest rate is determined to be fixed, on condition that it is stated in the contract, for one or more payments made before due, the creditor may demand a prepayment fee from the consumer. The prepayment fee cannot exceed 2% of the prepaid sum, calculated by making the necessary deductions of interest and fees. A prepayment fee cannot be demanded from the consumer, in case the interest rate or lease payments are determined to be variable.''

The Law implies that on the condition that it is stated in the contract, for one or more payments made before due, prepayment fee is only be demanded for fixed rate loans. On the other hand, law has protected the consumer which has a fixed rate loan and limited the prepayment fee as 2%.

5.2. BRSA REGULATIONS

“Regulation on Measurement and Assessment of Capital Adequacy of Banks”, was published in the Official Gazette in 2006 dated November 1, 2006, No: 26333.

The purpose of regulation, the procedures and principles has been to ensure that banks maintain adequate capital on a consolidated and non-consolidated basis as hedging against potential losses that may be incurred as a result of risks experienced.

Operational risk component was incorporated to the capital adequacy calculations as from June 2007. Basel II implementations were projected to start by January 2008 in Turkey, in June 2008 BRSA of Turkey postponed the implementation of capital requirements measurement and delayed to January 2009.

In BRSA Progress Report, March 2012, it was stated that while many countries around the world implementing Basel II currently, process of compliance to Basel II continue in many countries. One-year period which is called parallel implementation was started as of July 2011. By the end of parallel implementation period, all sectors were implemented by the standard method for the measurement of credit risk and Basel II were implemented in Turkey completely.

According to BRSA Progress Report related to Basel, in the calculation of credit risk, a great majority of banks are planning to switch to advanced techniques on the basis of the different portfolios. It is aimed that within two years following the start of the application, by collecting data within the scope of works, performing stress tests, almost all of the banks use the results of credit risk analysis in decision making processes. Also, most of the banks are targeting advanced measurement approach for operational risk and collecting data within this context. Almost all of the banks use internal models to measure market risks, performing stress tests. 83% of the sector is planning to use an internal model regulatory capital calculation.

Also BRSA reported that parallel implementation process was completed and definite implementation process was started as of the date of July 1, 2012 and Basel-II regulations has been published in the Official Gazette in 2012 dated June 28, 2012, No: 28337.

Also, According to Regulation on Measurement and Evaluation of Capital Adequacy of Banks (Published in Official Journal No 26333 of November 1, 2006), real estate loans are included in the following category:

> On-balance sheet asset, non-cash loans, commitments and derivative financial instruments with a risk weight of 50 %

By the Board Resolution dated December 16, 2010 number 3980, published in the Official Gazette dated December 18, 2010 number 27789, as of the date of January 1st,2011, it was decided that:

> In credits to be extended by banks to customers for housing and in consumer credits to be extended under housing collaterals, the amount of the credit shall be limited to 75% of the value of the real estate subject to collateral.

And it was also decided:

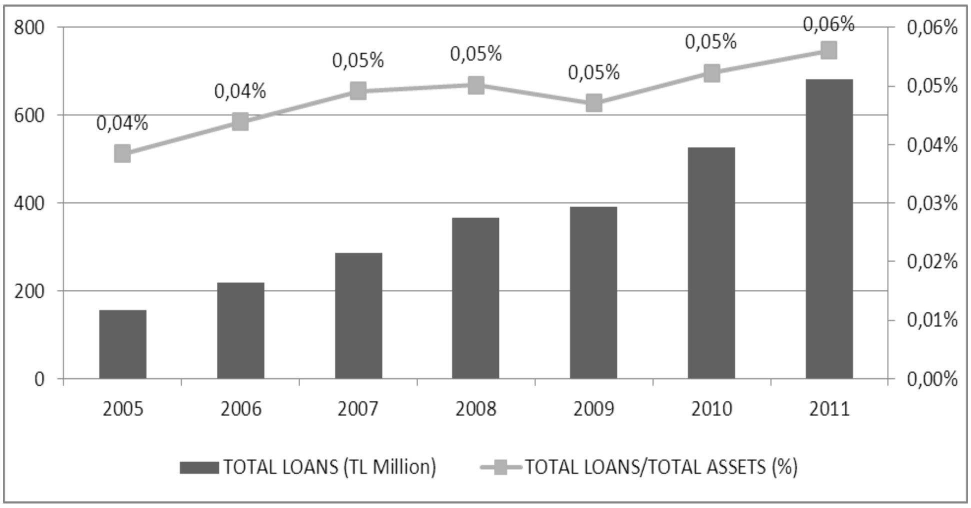
> The value of these real-estates subject to collaterals shall be determined by valuation companies authorized by the Banking Regulation and Supervision Agency or the Capital Markets Board (CMB) and these values shall be used during the determination of the limits.

5.3. DEVELOPMENTS OF HOUSING FINANCE LOANS IN TURKEY

While loan volume of the Turkish Banking Sector was TL 156,4 billion and share was 38,44 % in total assets by the end of 2005, this volume increased to TL 682,8 TL billion and share increased to 56,08 % in total assets by the end of 2011 (Figure 5.1). In 2010, while annual growth rate was 33,9 % compared to previous year, at the end of 2011, an annual growth rate of 29,9% was lower than in 2010.

According to BRSA General View of Turkish Banking Sector Report, the effects of the legislative amendment, made by the Authority which set the increase in the general loan provisions in June 2011, slowed down the rate of growth of loans in the 3th and last quarter.

Figure 5.1: Total Loans to Total Assets

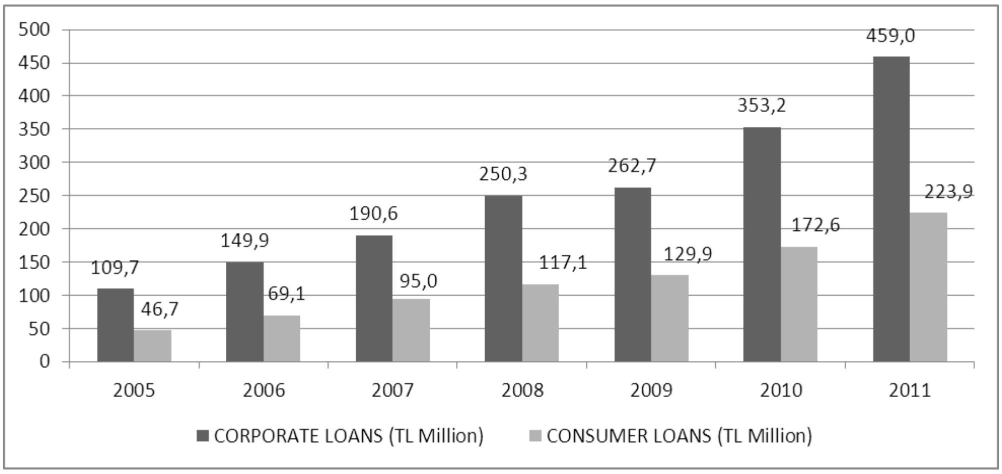


Source: BRSA

While the total loan volume increased, volume of the consumer loans raised likewise at the end of 2011. While consumer loan volume was TL 46,7 billion by the end of 2005, it increased to 223,8 TL billion at the end of 2011 (Figure 5.2).

Percentage distribution of the total loans of Turkish Banking Sector was 32,8 % consumer Loans and 67,2 % commercial loans. There is no significant change in the distribution of loan types compared with the end of 2010 (Figure 5.2).

Figure 5.2: Developments of Loans as of Types



Source: BRSA

The volume of consumer loans reached amounted to 233.8 TL billion by the end of 2011.

In 2011, while the increase in credit cards (27,3 %) and in housing loans (22,6 %) was below the average of consumer loans (29,7 %), increases in the other segments were above the average (Table 3.1).

According to BRSA General View of Turkish Banking Sector Report, it is observed that annual increases in consumer loans have slowed down in the second half of 2011. The annual rate has risen to the level of 50,6 % for personnel finance and other consumer loans in June 2011. These loans started to decrease after this date and realized as 38.6% at the end of the year. The Board Decision dated June 2011 set the increase in the general loan provisions.

In 2011, while the increase in total consumer loans 29.7 % according to previous year, housing loans increased by 22,6 % (see table 5.1).

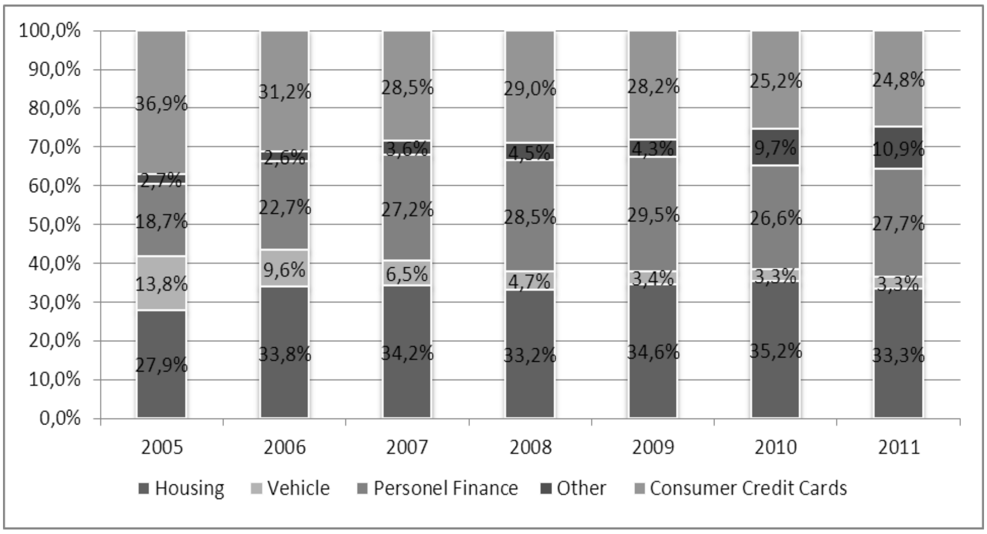
Table 5.1: Consumer Loans (2005-2011)

(TL Million)	2005	2006	2007	2008	2009	2010	2011	2011/2010 % Change
Consumer Loans (Total)	46.720	69.101	94.994	117.132	129.916	172.625	223.893	29,7
- Housing	13.037	23.378	32.460	38.900	44.888	60.801	74.591	22,6
- Vehicle	6.445	6.660	6.155	5.498	4.423	5.666	7.366	30
- Personal Finance	8.715	15.719	25.861	33.415	38.390	45.844	62.076	35,4
- Other	1.264	1.818	3.415	5.329	5.639	16.732	24.371	45,6
- Credit Cards	17.259	21.526	27.103	33.990	36.576	43.582	55.489	27,3

Source: BRSA

Percentage distribution of the consumer loans was 33,3 % housing loans, 27,7 % personal finance, 24,7 % credit cards by the end of 2011 (see figure 5.3).

Figure 5.3: Distribution of Consumer Loans



Source: BRSA

Decreasing tendency in the ratio of non-performing loans which is the most significant indicator concerning banking sector credit risk continues in 2011. When we look at the Table 5.2, we can see that non-performing loans decreased in comparison to the previous year in all segments of consumer loans. NPL in housing which was 860 TL million in 2010 decreased to 659 TL million in 2011. There is a 23,3 % decrease in NPL ratio of housing loans according to previous year by the end of 2011. We can say that banking sector has a growth potential with respect to the housing loans, when NPL ratio of housing loans is considered as being lower in comparison to others.

Table 5.2: Non Performing Consumer Loans

TL Million	2005	2006	2007	2008	2009	2010	2011	2011/2010 % Change
Consumer Loans	205	407	988	2.074	4.040	3.637	3.205	-11,8
Housing	19	56	217	522	962	860	659	-23,3
Vehicle	79	138	248	352	508	360	253	-29,7
Personnel Finance	76	140	408	937	1.797	1.504	1.457	-3,1
Other	31	73	115	263	773	913	836	-8,4
Consumer Credit Cards	1.350	1.717	1.834	2.372	4.252	3.792	3.450	-9
TOTAL	1.555	2.124	2.822	4.446	8.292	7.429	6.655	-10,4

Source: BRSA

While total housing loans was 13,3 TL Billion by the end of 2005, it increased to 74,6 TL billion at the end of 2011. In other words, while the share of housing loans in total loans was 8,34 %, this ratio increased to 10,92 % by the end of 2011. On the other hand, while the share of housing loans in total assets was 3,20 %, this ratio increased to 6,13 % by the end of 2011. While the total housing loans are increasing in Turkish Banking Sector, non-performing housing loans are 659 TL million. In this sense, rate of turnover of non-performing loans is quite low (Table 5.3).

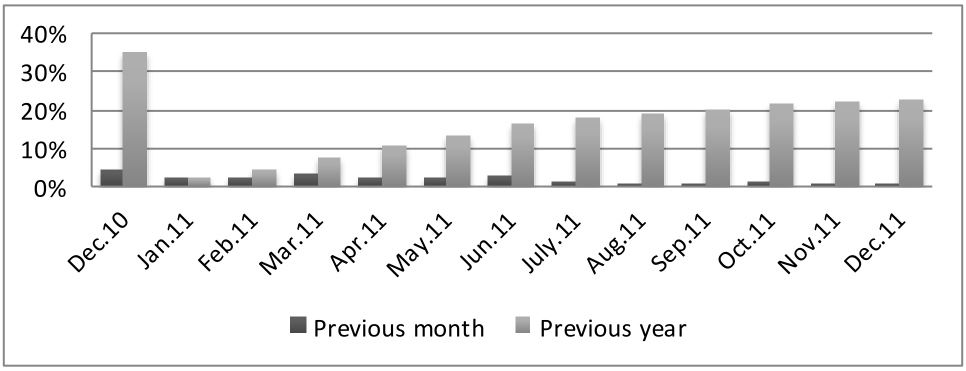
Table 5.3: Development of Housing Loans (2005-2011)

Period	Housing	Increase to Previous Month	Increase to Previous Year	Housing Loans/ Total Assets	Housing Loans/ Total Loans	Non Performing Housing Loans	Rate of Turnover
	TL Million	%	%	%	%	TL Million	%
Dec.05	13.037	13,07	395,33	3,2	8,34	19	0,15
Dec.06	23.378	2,31	79,32	4,68	10,68	56	0,24
Dec.07	32.460	2,52	38,85	5,58	11,36	217	0,67
Dec.08	38.900	-1,31	19,84	5,31	10,59	522	1,34
Dec.09	44.888	2,28	15,39	5,38	11,43	962	2,14
Dec.10	60.801	4,55	35,45	6,04	11,56	860	1,41
Jan.11	62.092	2,12	2,12	6,08	11,57	858	1,38
Feb.11	63.487	2,25	4,42	6,05	11,5	812	1,28
Mar.11	65.510	3,19	7,74	6,26	11,61	796	1,22
April11	67.180	2,55	10,49	6,28	11,71	780	1,16
May.11	68.917	2,59	13,35	6,18	11,52	695	1,01
Jun.11	70.931	2,92	16,66	6,19	11,43	718	1,01
Jul.11	71.824	1,26	18,13	6,2	11,44	718	1
Aug.11	72.366	0,75	19,02	6,06	11,2	711	0,98
Sep.11	72.885	0,72	19,87	6,01	11,02	708	0,97
Oct.11	74.006	1,54	21,72	6,08	11,15	688	0,93
Nov.11	74.168	0,22	21,98	6,12	10,98	679	0,92
Dec.11	74.591	0,57	22,68	6,13	10,92	659	0,88

Source: BRSA

Increased in housing loans according to previous month and previous year can be seen from the Figure 5.4 clearly.

Figure 5.4: Changes Housing Loans According to Previous Year and Previous Month



Source: BRSA

6. STRESS TESTING

Cihak (2007) define stress testing as a process of examining the resilience of financial systems to adverse conditions. In financial literature, stress testing has traditionally implemented to asset portfolios, however it has been applied to whole banks, banking and financial systems.

In the simplest term, a stress test tries to reexamine a portfolio by using a various set of assumptions and it aims to understand how vulnerable the portfolio against to changes in various risk factors. Stress tests can be applied to both the asset and liability sides of a portfolio. And it can be used to examined different kind of risks such as market risk, credit risk and liquidity risk (Jones et al. 2004).

Stress testing is one of the most substantial risk management tool which is conducted by banks of their internal risk management by way of Basel II capital adequacy framework. It is a early warning method which alerts banks to adverse unexpected shocks relevant to different kind of risk factors and it also provides a finding of how much capital can be needed absorb shocks. It has a role in;

- providing farseeing estimation of risks
- overcoming limitations of models and historical data
- reinforcing internal and external communications
- making a contribution capital and liquidity planning techniques
- giving an information setting of a banks' risk tolerance
- simplifying the improvement of risk mitigation or contingency plans against stressed circumstances

A "stress test" can be either a sensitivity stress test or a stress test scenario , by methodologically :

Complexity of stress tests methodologies can diversify, ranging from simple sensitivity tests to complex stress tests and the range of techniques have been used to create scenarios.

Sensitivity tests are the most basic level test which only shock one single parameter while all other factors are constant. The advantage of this technique is that can provide a rapid assessment of portfolio sensitivity to a given risk factor and define certain risk concentrations.

Stress test scenarios are more complicated approaches apply shocks to a number of parameters simultaneously. A stress test scenario can be historically based or hypothetical. While historical scenarios are based on a specific event experienced in the past, hypothetical scenarios are based on capture events that had not yet been experienced (Principles for Sound Stress Testing Practices and Supervision , Basel Committee on Banking Supervision Consultative Document, January 2009)

A. Coverage of Stress Testing

According to Jones et al. (2004), stress test practices requires to ask question ‘ which institutions should be included in the exercise?’ The coverage of the stress testing must be both extensive to show a meaningful critical mass of financial system, and it must be keep the number of institutions covered applicable level.

Another important question to consider is ‘what are the data constraints?’. The feasibility and range of data impose major constraints on the nature of stress tests that can be performed. Data limitations can come in four forms as noted in IMF and World Bank (2003);

- Accessibility to balance sheet data
- Difficulty separating specific exposure data

- The absence of risk data, e.g. in countries where risk management systems are less advanced
- Data privacy

B. What Type of Risk Will Be Analyzed

Next step in the stress test exercise is determination of major risks and vulnerabilities of the system. Stress tests represent the reality only in a facilitated form and can not therefore cover every possible risk factor for the portfolio or system, the researcher usually narrows down the focus on the main risk factors and weakest points in the financial system, he is interested in understanding. Focusing on the country-specific significant exposures makes the process of stress test more effective and prevents waste of time and resources (Jones et al., 2004).

Type of risks which are the most widely used ones are;

- Market Risk which is the risk of losses on a portfolio appearing from the changes in market prices of the risk factors such as interest rate risk, exchange rate risk, equity and commodity risk
- Credit risk which is the risk of losses arising from debtor's default
- Other risk forms such as liquidity risk and operational risk

Especially, credit risk is one of the most important risk factor which is faced by the banking sector. The Basel Committee on Banking Supervision (2001) described credit risk as the possibility of losing the outstanding loan partially or completely, due to lending events the higher exposure of a bank to credit risk, the higher the tendency of the banks to experience financial crisis.

Cihak (2007), have presented three basic approaches to modeling credit risk as a part of stress test. First one is mechanical approach which is used if there are no available data or if shocks are different from past shocks, second one is based on loan performance data such as non-performing loans and based on regression. And the last one is based on corporate sector data and household sector data.

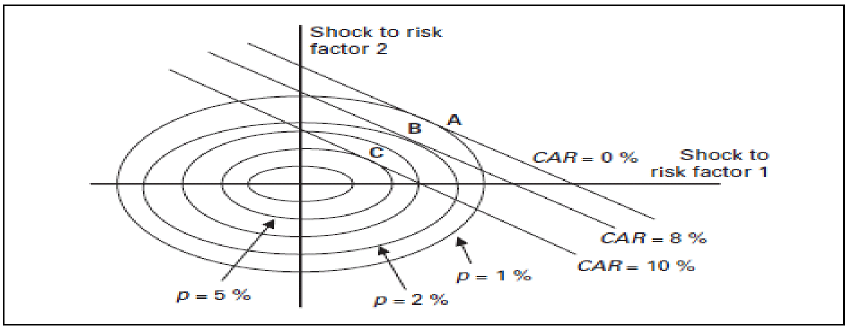
C. Calibrating Shocks

In the shock calibration process, one of the key question should be taken into account is that how shocks are big. According to Jones et al. (2004) scenarios considered should be beyond the normal range of experience. While scenarios can be based on historical data, on the other hand they can be hypothetical and include large movements thought to be reasonable. Also, hypothetical scenarios can be more realistic than historical ones. In addition, the experiences in countries can be useful guide. For example, a simple sensitivity analysis of interest in the highest risk factor changes that occurred in the past ten years "shock" can be calibrated.

According to Cihak (2005), there are two approaches for determining the exposure in the financial system. One of them is ‘worst case approach’ is interested in what scenario has the worst impact on the system, and another one ‘threshold approach’ is interested in what is the most reasonable combination of shocks that would need to happen to have that impact.

Figure 6.1 shows that worst case and threshold approach in the scenario selection by the combination of two risk factors which are the probability of occurrence. The correlation between the risk factors is depicted with the shape of the ellipse and the size of the ellipse represents the plausibility (p). The impact of the shocks is measured by the change in capital adequacy ratio (CAR), represented by the diagonal lines in the picture.

Figure 6.1: Approaches For Determining The Size Of Shocks



Source: Cihak(2005)

D. Selecting And Implementing Methodology

This step includes the translation of different kind of outputs into the financial statement of the financial institutions. ‘Top-down’ and ‘bottom-up’ approaches are two main approaches for translating scenarios to the balance sheet of the financial institution.

In the bottom-up approach, authorities determine the macroeconomic shocks themselves and then intermediaries evaluate the effects of these outcomes to their balance sheets, in the up-down approach, authorities apply the shock themselves and evaluate its impact on the banking system as a whole.

Blaschke et al. (2001) define that the bottom-up approach can provide more informational picture about the sensibility of the financial system as whole, because the individual institutions have the best knowledge about their own risk exposure and the strongest encouragement to conduct an correct stress test. On the other side, top-down approach can be resource-intensive and requires the central bankers to have more detail information about data of the individual banks.

E. How Are The Result Presenting

The final step in stress testing process is interpreting the effect on the banks’ loan portfolio and determining whether banks can withstand the shock presumed. Typically, impact of the stress event is expressed in terms of some indicator of financial soundness such as capital adequacy in order to assess the ability of the banks to withstand the shock assumed.

The impacts on capital adequacy ratios are especially important for institutions with supervisory responsibilities. Most particularly, supervisors should investigate the outcomes of stress testing for determining the adequacy of capital buffers and they should protect capital adequacy under shock situations. (Principles for Sound Stress Testing Practices and Supervision , Basel Committee on Banking Supervision Consultative Document, January 2009)

7. SCENARIO : THE EFFECTS OF POSSIBLE DEFAULT RISK OF MORTGAGE LOANS ON THE CAPITAL ADEQUACY RATIO

7.1. PURPOSE

This study tries to figure out that how Turkish banking sector's capital adequacy strong enough the weather possible future shocks and it tries to calculate credit risk as part of stress test by using shock scenarios and it measures the impact of future credit losses on capital adequacy ratio of Turkish depository banks.

Stress testing has been used in the finance literature highly since the financial analysis needs to see the future and what future might bring to the investor. Therefore, the stress testing methodology is highly used and a useful tool for the researchers as well.

Also, credit risk is one of the most important and highly used factor in stress testing. Especially mortgage credit risk in the example of recent financial crisis has gained increasing consideration both by policy makers and academicians.

Moreover, presenting the effects of stress test event in terms of bank's portfolio and capital adequacy is the most commonly used methods as well. Capital adequacy ratios (CAR) are a measure of the amount of a bank's core capital expressed as a percentage of its risk-weighted asset and it is one of the main tools to measure bank's balance sheets wealth.

In this work, the stress testing is used for the analysis of the effects of possible default risk of mortgage loans on the capital adequacy ratio of Turkish depository banks and following scenarios is used for this purpose:

Scenario1: The entire existing mortgage loan portfolio in Turkey defaults on and losses in a market.

Scenario 2: Mortgage Loans are removed by % 50 risk weighted assets and assumed that have been included among the 60%, 70%, 80%, 90%, 100% risk-weighted assets by regulatory authority.

Scenario 3: The size of mortgage loans in Turkey is assumed that it is a considerable amount of bank assets such in United States. After that, mortgage loan portfolio defaults on and losses in a market is assumed.

7.2. DATA AND METHODOLOGY

Stress testing methodology can be either sensitivity stress test or a stress test scenario. While sensitivity analysis is based on one single risk factor, stress scenarios is based on a number of risk factors which are determined according to complicated parameters.

Our methodology in the scenarios can be defined a kind of sensitivity analysis which applies a one single shock while all other factors are constant. On the other hand, it is possible to define the analysis as a scenario analysis which has a one factor shock which is based on very basic hypothetical estimation methods.

Identifying the necessary data and appropriate financial institutions to be included in the analysis is a key element of a stress testing coverage. Selected data and institutions in the stress testing exercise must be broad enough to show a significant critical mass of the financial sector.

In this study, banks which are operating in Turkey and their balance sheet data are used in the analysis. The data published by the BRSA is used and it includes the data of only deposit banks operating in Turkey. Data does not include ‘‘Participation and Development & Investment Banks’’ due to the reason of that they have different weights and balance sheet data.

Size of mortgage loans, total assets and total equity, and also capital adequacy ratios are identified with the reference to consolidated balance sheet data as at 31 December 2011 of banks in operating in Turkey. The certain balance sheet items as of the end of 2011 and the capital adequacy calculation of Depository Banks operating in the Turkish banking sector are given below:

Table 7.1: Selected Balance Sheet Items of Deposit Banks in Turkey (TL Million)

	31 December 2011
Total Mortgage Loans	73.272
Total Shareholder's Equity	123.007
Total Assets	1.119.911
Provision for non-performing loans/ Non performing loans	80,44%

Source: BRSA

Table 7.2: Capital Adequacy Calculation of Deposit Banks in Turkey (TL Million)

		31 December 2011
1	Total Core Capital	121.150
2	Total Supplementary Capital	14.646
3	Third-Generation Capital	-
4	Total Capital Base to Ratio	135.796
5	Total Assets Deducted from Capital	893
6	Regulatory Capital	134.903
7	Total Risk Weighted Items	875.303
7.1	Value at Credit Risk	753.215
	Total 0% Risk Weighted Items	303.415
	Total 10% Risk Weighted Items	-
	Total 20% Risk Weighted Items	50.373
	Total 50% Risk Weighted Items	147.947
	Total 100% Risk Weighted Items	607.992
	Total 150% Risk Weighted Items	11.504
	Total 200% Risk Weighted Items	21.959
7.2	Value at Market Risk	35.770
7.3	Value at Operational Risk	86.318
8	**Capital Adequacy Standard Ratio (6/7)(Percentage)**	**15,41**

Source: BRSA

US Subprime mortgage crisis is the latest example for a default risk in mortgage industry and the effect of the crisis has started to have an impact on the balance sheets of the banking system at the first quarter of 2008. So, 2008/1Q US Banking System data is taken as a reference in the third scenario.

Table 7.3: U.S. Banking System Data – (Billions of Dollars)

	2008/1Q
Real Estate Loans	3.681
Total Assets	11.495
Real Estate Loans/Total Assets	%32

Source: FDIC

In the shock calibration process, what will be the size of the shocks is one of the key question. In this study, two approaches are used for determining the exposure in the financial system. One of them is ‘worst case approach’ is interested in what scenario has the worst impact on the system. By this way, the existing mortgage loan portfolio of Turkish depository banks defaults on and losses at the level of 100%.

The second approach is ‘threshold approach’ which is interested in what is the most reasonable combination of shocks that would need to happen. By this way, the existing mortgage loan portfolio of Turkish depository banks defaults on and losses at a certain levels which provide to lead us to the obligatory capital adequacy ratios determined by the regulatory.

In the ‘Regulation on Measurement and Evaluation of Capital Adequacy of Banks’ which was prepared under the leadership of BRSA, assets in assets side of banks’ balance sheet is subject to a specific risk weight. Besides, it is obligatory to affix and sustain the capital adequacy standard ratio to minimum of 8 %. Moreover, BRSA is mandating that banks should sustain minimum 12 % target capital adequacy ratio in order to open new branches.

One of the steps of stress testing is identifying the potential vulnerable risk factor. Credit risk is one of the most important factor which is faced by banking sector and it should be importantly taken into account after the experience of the recent financial crisis.

In this study, analysis focus on credit risk using non-performing loans as a proxy for credit risk. A single shock is utilized to non-performing residential mortgage loans and it is supposed to existing mortgage loan portfolio of Turkish depository banks defaults on hypothetically.

Also, provision non-performing loans/non-performing loans ratio is taken into account while measuring the default risk of mortgage loans. Provision of non-performing loans is deducted from core capital and remainder amount is added to the 100% risk-weighted assets. (Receivables to be liquidated are risk-weighted in the 100% by the regulation)

Finally, impact of non performing mortgage loan portfolio which are calculated hypothetically is interpreted on capital adequacy ratio of Turkish depository banks in order to determine whether banks can withstand the shocks assumed.

In our analysis, stress test event is presented on the capital adequacy ratio formulas which are implemented in Basel as follow:

$$\text{CAR} = \frac{\text{Regulatory Capital (Core Capital + Supplementary Capital) - Total Assets Deducted from Capital}}{\text{Total Risk Weighted Items (Credit Risk + Market Risk + Operational Risk)}}$$

Also, during the measurement of CAR, for real estate loans, the following risk weights which are implemented in ‘Regulation On Measurement And Evaluation Of Capital Adequacy Of Banks’(Published in Official Journal

No 26333 of November, 2006 and Published in Official Journal No 26369 of October, 2007) are taken into account as it is stated below: On-balance sheet asset, non-cash loans, commitments and derivative financial instruments with a risk weight of 50 % :

- Those extended against mortgage of first degree on real estate used for residential purposes
- Cash loans extended against mortgage of first degree on developed land and undeveloped land with title deeds in the municipal territories
- 2/3 of cash loans extended against mortgages of degree 2 or 3 on such real estate

7.3. FINDINGS

Scenario 1

In this scenario, it is assumed that the existing residential mortgage loan portfolio of Turkish depository banks defaults on and losses at certain rates between 20% and 100 % in the banking sector.

The entire residential mortgage loan portfolio, which equals to 73.272 TL million in the balance sheet of depository banks by the end of 2011, is supposed to become overdue at certain rates and pursue by legal proceedings. Especially, the portfolio defaults on at a certain levels which provide to lead us to the obligatory capital adequacy ratios 8% and 12% determined by the regulatory. Therefore, the portfolio defaults on 100% in order to see the sector's vulnerability to such a worst case scenario.

Under these scenarios, 50% risk weighted assets, core capital and capital adequacy ratio are recalculated. Also, provision non-performing loans to total non-performing loans ratio (80,44 %) is taken into account while calculating the amount which is deducted from the core capital. Provision of non-performing loans is deducted from core capital and remainder amount is added to the 100% risk-weighted assets. (Receivables to be liquidated are risk-weighted in the 100% by the regulation)

Table 9: Capital Adequacy Ratio Calculation of Deposit Banks – Scenario 1 (TL Million)

		31 Dec 2011	20% Default	40% Default	55% Default	60% Default	80% Default	100% Default
1	Total Core Capital	121.150	109.362	97.574	88.733	85.786	73.998	62.210
2	Total Supplementary Capital	14.646	14.646	14.646	14.646	14.646	14.646	14.646
3	Third-Generation Capital	-	-	-	-	-	-	-
4	Total Capital Base to Ratio	135.796	124.008	112.220	103.379	100.432	88.644	76.856
5	Total Assets Deducted from Capital	893	893	893	893	893	893	893
6	**Regulatory Capital**	**134.903**	**123.115**	**111.327**	**102.486**	**99.539**	**87.751**	**75.963**
7	**Total Risk Weighted Items**	**875.302**	**870.841**	**866.380**	**863.034**	**861.920**	**857.459**	**852.998**
7,1	**Value at Credit Risk**	**753.214**	**748.753**	**744.292**	**740.946**	**739.832**	**735.371**	**730.910**
	Total 0% Risk Weighted Items	303.415	303.415	303.415	303.415	303.415	303.415	303.415
	Total 10% Risk Weighted Items	-	-	-	-	-	-	-
	Total 20% Risk Weighted Items	50.373	50.373	50.373	50.373	50.373	50.373	50.373
	Total 50% Risk Weighted Items	147.947	133.293	118.639	107.647	103.984	89.330	74.675
	Total 100% Risk Weighted Items	607.992	610.858	613.724	615.874	616.591	619.457	622.324
	Total 150% Risk Weighted Items	11.504	11.504	11.504	11.504	11.504	11.504	11.504
	Total 200% Risk Weighted Items	21.959	21.959	21.959	21.959	21.959	21.959	21.959
7,2	**Value at Market Risk**	**35.770**	**35.770**	**35.770**	**35.770**	**35.770**	**35.770**	**35.770**
7,3	**Value at Operational Risk**	**86.318**	**86.318**	**86.318**	**86.318**	**86.318**	**86.318**	**86.318**
8	**Capital Adequacy Standard Ratio (6/7)(Percentage)**	**15,41%**	**14,14%**	**12,85%**	**11,88%**	**11,55%**	**10,23%**	**8,91%**

Source: BRSA

When we analyzed the current data, the sector's CAR is high above the minimum capital requirement 8% and target capital adequacy ratio which is determined as 12% by BRSA.

After measuring the new CAR of the deposit banks for the default case of 100% the new ratio is calculated 8,91 %. This scenario shows that when there is 100% default in 50% risk weighted assets, it causes 6,50 % decrease in the capital adequacy ratio. As it is mentioned at the beginning of the section, it is obligatory to generate and sustain the capital adequacy standard ratio to a minimum of 8 percent. In this scenario we have calculated the CAR as 8,91 and it is above the minimum risk weight.

On the other hand, the target for the capital adequacy ratio of banks is determined as 12 % by BRSA in the press release in 2006. After measuring the new CAR of the deposit banks for the default case of 55%, it is calculated that the new ratio 11,88 % and it is below this target ratio.

Also, in the Article 67, Banking Law Numbered 5411, it is mentioned that the cases, where measures are required to be taken, (and if a bank's own funds is inadequate to pursue the provisions pertaining to capital adequacy,) or such cases are likely to occur; then corrective, rehabilitating, and restrictive measures included in the Article 68-69-70 must be taken immediately.

In this scenario, although there has been downward tendency in banking sector's capital adequacy, but it was still realized high above the minimum capital requirement which is 8% even in the case of 100% default. However, the ratio has been decreased below the capital adequacy target ratio of 12% which is determined by the BRSA when 55% default loss occurred. And, this structure shows the strong and stable capital structure of the Turkish banking sector in the event of default. When we consider the large share of depository banks in Turkish banking sector, they are playing a significant role in the market and their strong and stable capital structure is the most important indicator maintaining the financial stability.

Scenario 2

BASEL sets standardized risk weightings for mortgages of 35%. On the other hand, it is given to use local initiative to the Regulatory Authority. In this framework, BRSA has identified 50 % risk weight for mortgage loans.

In this scenario, mortgage loans are removed by % 50 risk weighted assets and it is assumed that they have been included among the certain rates between 60% and 100% risk-weighted assets by regulatory authority.

Table 7.5: Capital Adequacy Calculation of Deposit Banks – Scenario 2 (TL Million)

		31 Dec 2011	Risk Weight %60	Risk Weight %70	Risk Weight %80	Risk Weight %90	Risk Weight %100
1	Total Core Capital	121.150	121.150	121.150	121.150	121.150	121.150
2	Total Supplementary Capital	14.646	14.646	14.646	14.646	14.646	14.646
3	Third-Generation Capital	-	-	-	-	-	-
4	Total Capital Base to Ratio	135.796	135.796	135.796	135.796	135.796	135.796
5	Total Assets Deducted from Capital	893	893	893	893	893	893
6	**Regulatory Capital**	**134.903**	**134.903**	**134.903**	**134.903**	**134.903**	**134.903**
7	**Total Risk Weighted Items**	**875.302**	**882.674**	**890.002**	**897.329**	**904.656**	**913.438**
7,1	**Value at Credit Risk**	**753.214**	**760.586**	**767.914**	**775.241**	**782.568**	**791.350**
	Total 0% Risk Weighted Items	303.415	303.415	303.415	303.415	303.415	303.415
	Total 10% Risk Weighted Items	-	-	-	-	-	-
	Total 20% Risk Weighted Items	50.373	50.373	50.373	50.373	50.373	50.373
	Total 50% Risk Weighted Items	147.947	74.765	74.765	74.765	74.765	74.765
	Total 60% Risk Weighted Items	-	73.272	-	-	-	-
	Total 70% Risk Weighted Items	-	-	73.272	-	-	-
	Total 80% Risk Weighted Items	-	-	-	73.272	-	-
	Total 90% Risk Weighted Items	-	-	-	-	73.272	-
	Total 100% Risk Weighted Items	607.992	607.992	607.992	607.992	607.992	682.764
	Total 150% Risk Weighted Items	11.504	11.504	11.504	11.504	11.504	11.504
	Total 200% Risk Weighted Items	21.959	21.959	21.959	21.959	21.959	21.959
7,2	**Value at Market Risk**	**35.770**	**35.770**	**35.770**	**35.770**	**35.770**	**35.770**
7,3	**Value at Operational Risk**	**86.318**	**86.318**	**86.318**	**86.318**	**86.318**	**86.318**
8	**Capital Adequacy Standard Ratio(6/7)(Percentage)**	**15,41%**	**15,28%**	**15,16%**	**15,03%**	**14,91%**	**14,77%**

Source: BRSA

After the new arrangement in the scenario, while the core capital of deposit banks have not changed, CAR has decreased by 0,64 % and calculated as 14,77 % when mortgage loans is assumed that they have been included among 100% risk weighted assets.

If there is a possible crisis in the housing sector, even without any default, the change of the risk weights by the decision of regulatory authority does not affect sector's CAR dramatically.

<u>Scenario 3</u>

In this scenario, the size of retail mortgage loan portfolio in Turkey is assumed that there is a considerable amount of bank assets such in USA. It is considered to apply the share of retail mortgage loans in US banking sector during the global financial crisis to Turkish depository banks' balance sheets. After that, retail mortgage loan portfolio defaults on and losses at certain rates in a market is assumed.

Moreover, before applying the share of US banking sector's retail mortgage loans to Turkish banking sector, change in total assets and core capital as of the years in banking sector in Turkey is examined. Table 7.6 shows that there is an increase at a similar rate between two items. From this point of view, core capital is increased at the level of growth rate of total assets and core capital ratio which is needed in the calculation of CAR is re-calculated.

Table 7.6: Change in Total Assets and Total Core Capital Between 2006-2011

Year	Total Assets (TL Million)	Total Core Capital(TL Million)	Change in Total Assets (%)	Change in Core Capital (%)
	470.635	49.426	0,5798	0,592
2011	1.119.911	121.145		

Source: BRSA

While the share of housing loans in total assets of depository banks is 6,5 % by the end of 2011, the share of housing loans in total bank assets is 32% in the US Banking system.

Table 7.7: U.S. Banking System Data – (Billions of Dollars)

	2008/1Q
Real Estate Loans	3.681
Total Assets	11.495
Real Estate Loans/Total Assets	%32

Source: FDIC

With reference to US data, some of the balance sheet data of the deposit banks in Turkey are re-calculated in the case of the assumption of the similar ratios. The total asset size of the deposit banks in Turkey is 1.119.911 TL million by the end of 2011. When we calculate the 32 % of this amount and , the amount of retail mortgage loans is calculated as 358.371 TL million and Total 50% risk weighted items have increased to 433.046 TL million after the calculation. And core capital is increased at the level of growth rate of total assets as 159.918 TL Million.

Under these scenarios, 50% risk weighted assets, core capital and capital adequacy ratio are recalculated. Also, provision non-performing loans to total non-performing loans ratio (80,44 %) is taken into account while calculating the amount which is deducted from the core capital. Provision of non-performing loans is deducted from core capital and remainder amount is added to the 100% risk-weighted assets. (Receivables to be liquidated are risk-weighted in the 100% by the regulation)

CAR of deposit banks operating in Turkey are re-calculated as follows:

Table 7.8: Capital Adequacy Calculation of Deposit Banks – Scenario 3 (TL Million)

		31 December 2011	Scenario 3
1	Total Core Capital	121.150	159.918
2	Total Supplementary Capital	14.646	14.646
3	Third-Generation Capital	-	-
4	Total Capital Base to Ratio	135.796	174.564
5	Total Assets Deducted from Capital	893	893
6	**Regulatory Capital**	**134.903**	**173.671**
7	**Total Risk Weighted Items**	**875.302**	**1.017.852**
7,1	**Value at Credit Risk**	**753.214**	**895.764**
	Total 0% Risk Weighted Items	303.415	303.415
	Total 20% Risk Weighted Items	50.373	50.373
	Total 50% Risk Weighted Items	147.947	433.046
	Total 100% Risk Weighted Items	607.992	607.992
	Total 150% Risk Weighted Items	11.504	11.504
	Total 200% Risk Weighted Items	21.959	21.959
7,2	**Value at Market Risk**	**35.770**	**35.770**
7,3	**Value at Operational Risk**	**86.318**	**86.318**
8	**Capital Adequacy Standard Ratio (6/7)(Percentage)**	**15,41%**	**17,06%**

Source: BRSA

In consideration of the assumed data, when the 50% Risk Weighted Items increases to 433.046 TL million, and Total Core Capital increases to 159.918 TL million, CAR increases by 1,65 % and calculated 17,06 %.

After that, we have assumed that the retail mortgage loans default on and loss at certain rates in a market.

Also, non-performing loans to total consumer loans average ratio is examined and Table 7.9 shows that 8,73 % in the year 2009 is the highest average rate of the ratio. From this point of view, mortgage loans portfolio defaults on % 10. On the other hand, which default case will reach to minimum capital adequacy ratio of 8% and target capital adequacy ratio of 12% is examined.

Table 7.9: Ratio of Non-performing Loans to Total Consumer Loans (%)

	2005 (%)	2006 (%)	2007 (%)	2008 (%)	2009 (%)	2010 (%)	2011 (%)
Housing	0,15	0,24	0,67	1,34	2,14	1,41	0,88
Vehicle	1,23	2,07	4,03	6,40	11,49	6,35	3,43
Personal Finance	0,87	0,89	1,58	2,80	4,68	3,28	2,35
Other	2,45	4,02	3,37	4,94	13,71	5,46	3,43
Credit Cards	7,82	7,98	6,77	6,98	11,63	8,70	6,22
Average	2,50	3,04	3,28	4,49	8,73	5,04	3,26

Source: BRSA

Capital Adequacy Ratios of deposit banks, which are operating in Turkey, are re-calculated with the presumptive data in the table below.

Table 7.10: Capital Adequacy Calculation of Deposit Banks – Scenario 3 (TL Million)

		Scenario 3	Default %10	Default %19	Default %34
1	Total Core Capital	159.918	131.091	105.147	61.905
2	Total Supplementary Capital	14.646	14.646	14.646	14.646
3	Third-Generation Capital	-	-		-
4	Total Capital Base to Ratio	174.564	145.737	119.793	76.551
5	Total Assets Deducted from Capital	893	893	893	893
6	**Regulatory Capital**	**173.671**	**144.844**	**118.900**	**75.658**
7	**Total Risk Weighted Items**	**1.017.852**	**1.006.942**	**997.125**	**980.762**
7,1	**Value at Credit Risk**	**895.764**	**884.854**	**875.037**	**858.674**
	Total 0% Risk Weighted Items	303.415	303.415	303.415	303.415
	Total 20% Risk Weighted Items	50.373	50.373	50.373	50.373
	Total 50% Risk Weighted Items	433.046	397.209	364.956	311.200
	Total 100% Risk Weighted Items	607.992	615.001	621.310	631.825
	Total 150% Risk Weighted Items	11.504	11.504	11.504	11.504
	Total 200% Risk Weighted Items	21.959	21.959	21.959	21.959
7,2	**Value at Market Risk**	**35.770**	**35.770**	**35.770**	**35.770**
7,3	**Value at Operational Risk**	**86.318**	**86.318**	**86.318**	**86.318**
8	**Capital Adequacy Standard Ratio (6/7)(Percentage)**	**17,06%**	**14,38%**	**11,92%**	**7,71%**

This scenario shows that when it occurs, 10% default loss in 50% risk weight housing loan portfolio and in 10% risk weight mortgage backed securities portfolio causes 3,37 % decrease in the capital adequacy ratio and it is calculated as 13,66 %.

There has been downward tendency in banking sector's capital adequacy, but it was still realized high above the minimum capital requirement which is 8% and the capital adequacy target ratio of 12% which is determined by the BRSA when 10% default loss occurs.

However, the ratio has been decreased below the capital adequacy target ratio of 12% which is determined by the BRSA when 16% default loss occurred and it has been decreased below the minimum capital requirement which is 8% when 26% default loss occurred.
As it can be seen from the calculations made under the specified assumptions, when the ratio of housing loans portfolio in banks' balance sheets increase, any negative situation in the housing market, retail mortgage loans, may impact the CAR of banks' more destructively. When we compare the results of scenarios, even if the case of 100% default in Scenario 1, CAR is still above the minimum risk weight 8%, on the other hand, in the case of increased the share of retail mortgage loans in Scenario 3, hereby, when there is a 34% default occurs, CAR falls below the minimum capital adequacy.

In the current situation, sector's CAR is high above the minimum and target capital requirement, which shows the strong and stable capital structure of the Turkish banking sector. This situation is a result of the strengthened banking regulation and supervision of Turkish regulatory, and its conservative approach for banking practices of Turkish.

And also, all of the analysis above suggest that Turkish Banking Sector has a strong and stable capital position to withstand against possible future shocks. When we consider case by case, the sector's capital adequacy ratio tends to decrease where possible default situation but it does not decrease to critical ratios and banks could withstand sizable shocks to their exposure to residential mortgages. And also, even without any default, the change of the risk weight within the framework of measures is taken by the regulatory authority, sector CAR's is not being heavily affected. On the other hand, when the ratio of mortgage loan portfolio in banks' balance sheets increase; any negative situation in the housing market, retail mortgage loans, may impact the capital adequacy ratio of banks' more destructively.

The analysis conducted above are based on a very basic hypothetical estimation methods which utilize a single shock to non-performing residential mortgage loan portfolio while all other factors are constant. Also, level of shock applied to the portfolio is based on a very simple hypothetical methods without considering macro level variables such as house prices or household debt. Despite their simplicity, all of the analysis can provide an advantage for a rapid assessment to potential vulnerabilities of the financial system to possible future shocks and they are useful the demonstrate strength of Turkish Banking sector.

On the other side, when we consider the other researches about stress testing in the literature, they have more complicated approaches to apply shocks and contain simultaneous moves in a number of risk factors. Moreover, in some of the researches, analysis are conducted for more than one year time period. Although, taking into account correlations among number of risk factors and analyzing their movements under a scenario analysis in a long time period is more realistic approach to measure potential vulnerabilities in an adverse event. On the other side, basic stress testing methodologies are simple and easy to implementation and they can provide rapid assessment to potential vulnerabilities of the financial system.

Both the IMF financial stability assessment program, CBRT financial stability reports and BRSA financial market reports which conduct a stress testing to analyze the resilience of Turkish Banking sector, include sensitivity analysis and macro scenario analysis. In both of these analysis, it is generally emphasized that the Turkish banking sector are resilient against adverse shocks and has adequate capital buffers because of its strong structure and macro prudential measures implemented by the authorities. When these studies are compared with our analysis, we can say that the findings of the analysis show similar results about resilience of Turkish banking sector. All of these studies shows that a strong and stable structure for Turkish Banking sector as well as our study. In addition to these results, there is a similar but a little bit different approach which is stated in IMF's FSAP analysis It is specified in the report that while the Turkish banking system seems to have adequate buffers to withstand possible shocks, but a brief shock, the system could under stress if a shock has a long duration.

When we consider other stress testing analysis which have been publish in US, Australia, New Zealand and Europe , they includes both basic sensitivity analysis and macro stress scenarios as well. And also, the point which is placed a particular emphasis in the analysis, they generally take into account Tier 1 capital risk-based ratio as an indicator for financial soundness. We can explain this situation, while Turkish banking system just finalized its adaption Basel II in 2012, these countries has already started to studies to adapt implementation of Basel III. And Basel III will require banks to hold more and higher-quality capital than under Basel II rules and as a consequence, analysis also tries to find out that banks are well-positioned or not to meet the higher capital requirements under Basel III.

For instance, in the study of Jang and Sheridon (2012), they tries to find out Australian banks' sensitivity under the shock scenarios and they first divide residential mortgage loan portfolios into risk categories, then they calibrate Irish banks' residential mortgage experience to three riskiest one. Also after calculation of probability of default and estimated losses, they take into account the Tier 1 capital ratio as an indicator of financial stability.

Moreover, study of Federal Reserve Supervisory Capital Assessment Program tries to measure the effects of stress scenarios by using Tier 1 capital risk-based ratio as well. Furthermore, unlike our analysis, the publication reveals how much additional Tier 1 capital to be able to have a Tier 1 capital risk based ratio in excess of regulatory minimum.

All of the studies and methodologies are considered above, they meet in a common point. First, they aim to figure out the resilience of a financial systems to adverse conditions. Second, impact of the stress test event is expressed on the capital adequacy indicators which are implemented Basel Committee.

8. CONCLUSION

The contemporary world of finance has experienced a significant global financial crisis. Through the domino effect, the financial crisis created serious consequences for US economy and also had an enormous impact on the world economy. It showed that non of the countries remain unconcerned about finacial stability. Especially, it has brought into question once prevailing views that capital in the financial sector has been both adequate and adequately regulated. As a consequence of this situation, stress testing analysis is related to financial stability in the banking sector has started to play an important role.

This study focusing on the credit risk, which is the most important risk factor in banking system and it tries to calculate non performing mortgage loan portfolio as a proxy of credit risk inferentially by conducting a simple stress testing exercise. Then it measures the impact of possible credit losses on capital adequacy ratio and in this way, it tries to figure out how Turkish banking sector's capital adequacy strong enough the weather possible future shocks. And following scenarios is used for this purpose:

Scenario1: The entire existing mortgage loan portfolio in Turkey defaults on and losses in a market.

Scenario 2: Mortgage Loans are removed by % 50 risk weighted assets and assumed that have been included among the 60%, 70%, 80%, 90%, 100% risk-weighted assets by regulatory authority.

Scenario 3: The size of mortgage loans in Turkey is assumed that it is a considerable amount of bank assets such in United States. After that, mortgage loan portfolio defaults on and losses in a market is assumed.

The results of the scenario could be summed up such that:

- In the current situation, sector's CAR is high above the minimum capital requirement and target capital requirement , which shows the strong and stable capital structure of the Turkish banking sector.

- According to the results of scenario analyses in which the effect of default risk on mortgage loan portfolio shows that it is seen that the sector's capital adequacy ratio tends to decrease where possible default situation but it does not decrease to critical ratios which are minimum capital requirement 8%. And the ratio has been decreased below the capital adequacy target ratio of 12% when 55% default loss occurred. And, this structure shows the strong and stable capital structure of the Turkish banking sector against the adverse events as well.

- If there is a possible crisis in the housing sector, even without any default, the change of the risk weight within the framework of measures is taken by the regulatory authority. Then it does not affect sector's CAR dramatically.

- And finally, when the ratio of retail mortgage loan portfolio in banks' balance sheets increase, even if the core capital is increased; any negative situation in the housing market, retail mortgage loans, may impact the capital adequacy ratio of banks' more destructively and sector can be more vulnerable to the risks than current situation.

And for protecting against the possible default condition, banks must be taken into consideration all of the factors listed below:

- The amount of the credit shall be limited to 75% of the value of the real estate subject to collateral. Banks must be taken into consideration this limitation in their lending procedures.
- Value and type of collateral have a significant impact on the risk involved in lending. Collateral value of real estates must be evaluate by the authorized corporations which are determined by BRSA.
- Banks shall be reviewed property value at a minimum once every three years for residential real estate.
- Evaluation of the risk profile of customers that could potentially impact the bank's financial position. So creditworthiness of the customers and customer evaluation criteria must be taken into consideration in lending process.
- Banks must establish their credit monitoring systems well for the purpose of monitoring concentrations of credit and providing sufficient diversification of risk in the loan portfolio.

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