MORTGAGE CREDITS DEFAULT RISK
IN RESPECT OF MACROECONOMIC INDICATORS

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SOSYAL BİLİMLER ENSTİTÜSÜ
BANKACILIK VE FİNANS YÜKSEK LİSANS PROGRAMI

DANIŞMAN: ORAL ERDOĞAN
2013

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Makroekonomik Veriler Işığında Konut Kredilerinin
Takibe Dönüşme Riski

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Tezin Onaylandığı Tarih   :

Toplam Sayfa Sayısı: 52

Anahtar Kelimeler (Türkçe)	Anahtar Kelimeler (İngilizce)
1) Konut Kredileri	1) Mortgage
2) Konut Fiyatları	2) House Prices
3) Makroekonomik	3) Macroeconomic
4) Takibe Dönüşme	4) Default
5) Tüketici Kredileri	5) Consumer Credits

ÖZET

Bu çalışma, Türkiye'de makroekonomik faktörlerin, konut kredilerinin takibe dönüşme riski üzerindeki muhtemel etkilerini incelemiştir. Yaptığımız literatür taramasında, temel makroekonomik faktörler olarak ev fiyatları, işsizlik, faiz oranları ve enflasyon tespit edilmiştir. Takibe dönüşme ve bir çok makroekonomik faktör arasında ilişki olmasına karşın, konut kredilerinin geri ödenme performansının diğer tüketici kredilerine kıyasla daha güçlü olduğunu düşünüyoruz. Makroekonomik şartlardaki iyileşme, konut kredilerinin geri ödenmelerini olumlu etkilerken, kötüleşme ise aynı oranda olumsuz yansımamaktadır.

Literatürle uyumlu olarak, makroekonomik verilerin hem konut kredilerinin hem de tüketici kredilerinin takibe dönüşme oranları üzerindeki etkilerini değerlendirmek için regresyon analizi kullandık. Geçmiş dönem takibe dönüşme oranları, ev fiyatları, konut kredisi faiz oranları ve hisse senedi borsasındaki hareketlerin takibe dönüşme oranları üzerinde belirgin etkileri olduğunu tespit ettik. Ev fiyatlarındaki getiri en etkili değişken çıkarken, geçmiş dönem takibe dönüşme oranlarını ve faiz oranlarının değişimini de konut kredilerinin takibe dönüşme analizinde kullandık. Tüketici kredilerinin takibe dönüşme analizinde ise hisse senedi borsasının getirisi, geçmiş dönem takibe dönüşme oranlarının farkları ve devlet tahvili faiz oranları analizde yer almıştır.

ABSTRACT

This study investigates the possible effects of macroeconomic factors on mortgage credit default risk in Turkey. In our literature review, the main macroeconomic factors are to be found as house prices, unemployment, interest rates and inflation. Although default and many macroeconomic factros are found to be related, we believe that the pay off performance of mortgage credits is strong among other consumer credits. A positive performance in macroeconomic conditions affect mortgage pay offs positively, whereas worsening macroeconomic conditions do not affect mortgage pay offs that negatively.

We employed regression analysis to evaluate the effects of various macroeconomic factors on both mortgage default rates and total consumer default rates in Turkey in line with the literature. We found that previous defaults, house prices, interest rates and stock market movements have significant effect on defaults. The house prices return found to be the most effective while we used difference of previous defaults and difference of interest rates on mortgage credits defaults analysis. For consumer credits defaults analysis, the return of stock market index, difference of previous defaults and government interest rates are considered in the analysis.

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1. INTRODUCTION

In this study we seek the macroeconomic determinants of credit defaults. The last global financial crisis showed us the importance of financial markets in modeling macroeconomic environment. This issue can be found as a part of studies about default risk. The default risk has largely been the focus of many studies in the literature. Many studies focused on determinants of default and tried to understand default probabilities. In the literature, house prices, interest rates, unemployment and inflation are mentioned to be important determinants of mortgage defaults. Most of the studies are based on U.S. market and naturally reflect this market's structure. With this study we're concentrated on Turkey mortgage market. Accordingly, we have findings showing similarities and differences between two markets. Ahead, we mentioned about some major differences which should be considered in this study.

Our experiences show us characteristics of Turkish mortgage market needs researches. Firstly we see a strong housing motivation all along our customers. Among the understanding in U.S. accepting house an asset or an investment, in Turkey house is somehow the fortress to be defended at all costs. Regardless house price is reasonable or not customers are very keen on their mortgage loans. This cultural structure leads to a weak connection between macroeconomic changes and defaults in mortgage credits. In economic turmoil terms we see a common solidarity among relatives. This provides a significantly low rate of defaults in Turkey mostly.

We are questioning the definition of default at some parts of this study. Because definition and the base we are moving from are important to reach a conclusion. In Turkey default data are available in BDDK site. We used the data. Data show us delinquencies exceeding 90 days from the maturity. Also the other macroeconomic factors does not affect at the beginning because of the solidarity of relatives. These are likely to give us

two facts. Firstly macroeconomic factors and defaults do not have a strong connection. Secondly we expect the macroeconomic factors to show lagging effects.

If we discuss house prices; which is surely so important in U.S. just because whenever paying the mortgage loan is senseless regarding the declining prices, a customer is supposed to leave it. Another important variable interest rate is not that strongly connected with defaults. Almost each mortgage credit in Turkey is based on a fixed interest rate. Compared to adjustable rate mortgages in U.S. we don't expect to see interest rate as a major determinant. Also unemployment effects do not show up quickly in Turkey. In many examples family members and relatives pay the loan cooperatively, so this reduces the unemployment effect.

Considering the default probability we think that mortgage credits are the most reliable among both consumer credits. This is related to behavioral and economic fundamentals. Also mortgage credits - naturally collateral inside – have the smallest negative effect on capital adequacy ratio (CAR). According to CAR measurements, mortgages provide banks to give twice credit relative to normal credits. So this is just one of the examples once again explains why banks are ambitious about mortgage credits. With the lowest rates and the longest maturities, mortgage credits have become one of the most competitive areas for Turkish banks in the last decade.

Credit risk is the default risk due to delays of payments on the side of the borrower, as stated by Jaffee and Renaud (1997). Default risk is always seen as a major risk of all credit types. Case and Shiller (1996) when grouping risks for mortgage lenders; indicate interest rate risk and prepayment risk to be easily hedged in futures and options market but for foreclosures hedging is impossible yet. Mortgage default is important, because sustainable mortgage is important in order to answer increasing

housing requirements. Sinai and Souleles (2005) state that everyone is born short on housing services, since everyone needs housing to live somewhere.

At first, default risk needs to be clarified. Definition of default is important at this point. While there are several definitions, basically failure of performing the terms of a loan agreement or in other words the loan that is not paid back by borrower at the agreed time. With starting from this point, in a mortgage termination by default we can list steps as first step is delinquency, second step is default and third step is foreclosure. As the steps indicate, each step takes a time to happen. We learn an example of Veteran Agency (VA) action from Furstenberg (1970) that it takes 105 days until foreclosure in VA terminology. Delinquency is delayed payments while default and foreclosure can be considered as results of continuous delays. Gardner & Mills (1989) in their study on transition of delinquent loans to default status, state that delinquency and default are strongly related and they are similar circumstances. The delinquency leads the default and the decision of this transition is connected to degree of the delinquency. This approach is mainly the same as our study's default content. Campbell & Dietrich (1983) also indicate similarly that all delinquencies mean delayed payments and they do not necessarily end in default.

Barth & Yezer (1983) state a complexity of definitions. They think that with the delinquency a mortgagee can be considered in default but this does not necessarily to push a foreclosure action. The difference between these definitions is actually determined by the policy, applied by the mortgagor.

Default risk for mortgage credits stands as a major risk ahead of increasing banking credits. Smith (1964) stated the lack of perfect evaluation process for consumer credit institutions while they lend billions of dollars each year, much of it to people they have never seen before. By the way we should accept that their losses often seem surprisingly low. It is

not possible to understand the exact background of this success whether it reflects the efficiency of their credit evaluating systems or the honesty and dependability of the public. After almost a half century time has passed, still the need of understanding default determinants is on the table.

Jackson & Kaserman (1980) mentioned about two different theories of default. They state the first one is "*equity theory*", according to this a rational borrower would choose to default if home price falls below a certain level. Because a default would be profitable once equity is under what it was supposed to be. This view leads to see home as a "*financial asset*" by Yao & Zhang (2005) and after it, to see default as a put option, we can see in Kau, Keenan, Muller & Epperson (1992) and Kau, Keenan, Muller, (1993) to be chosen by the borrower. This approach can be called "*optimal choice*" by Kau & Keenan (1996) or even "*ruthless choice*" by Ambrose and Capone (1997). We should note that Ambrose and Capone also calculated the advantage of the ability to live rent free during the default period which shows the ruthlessness of default choice. Another similar approach comes from Davis (2010) he describes buying a second house is like buying a stock option. If the house's value went up, the buyer profited; if it went down, then the buyer could walk away with a minimal loss, while the mortgage issuer and the house's neighborhood suffered from this result.

Jackson & Kaserman (1980) state the second one is "*ability to pay theory*", according to this, a borrower would try as far as he/she is able to fulfill the requirements in order to maintain the most valuable asset of households' which is stated by Campbell (2006) and Poterba (1991) as home.

Some studies on default draw attention to volatilities such as house price and income. Titman & Torous (1989) and Kau, Keenan, Muller & Epperson (1993) saw the volatility issue important for defaults. Various

other determinants can be found in literature such as Furstenberg (1970) stating that the age of origination of mortgage is important and most dangerous period for becoming default is addressed as first four years.

At this point we should indicate the differences between the US and Turkey terminologies, including default definition, insurance and actors of the market.

Mortgage market in the US is separated two parts; commercial and residential. In US both companies and individuals are possible mortgage borrowers. In Turkey mortgage law and mortgage credits is only for residential and individual credits. The legal infrastructure is based on consumer (no. 4077) and mortgage (no. 5582) laws.

Default is regarded as an option type, "*a put option for mortgagor to default on the loan*", see Kau, Keenan & Muller, (1993) for mortgage borrowers in US. Also in that study prepayment is considered as an alternative to the decision of default. Prepayment definition is similar to examples in Turkey. Because mostly prepayment decisions are made by mortgagors who consider profit maximizing also in Turkey. Just like US market, interest rate declines play the main role, while house price increases drive prepayments. But unlike the defining default with option in US, in Turkey default is not an option but a result that no one wants to face. The difference comes from laws; in the US (for mortgage foreclosures' infrastructure, laws, diversity, depth of this issue and further discussions about laws and mortgages in the US, see R.J.B. (1930) and Bridewell (1938)), residential mortgage credits are mostly only related with the house itself, on the other side, in Turkey mortgage borrower is responsible with all his/her assets. Jackson & Kaserman (1980) also indicated two views of default as the "*equity theory*" of default which is related to house price primarily and the "*ability to pay theory*" which is related to cash flows primarily. In Turkey definitely we see the impact of "ability to pay".

Insurance is a very common and main issue in the US mortgage market. FHA and VA insurance models are frequently used. While in Turkey the mortgage insurance mechanism is not used. Mortgage default insurance products are not commonly used in Turkey. Çetinkaya (2009) states the existing studies, for mortgage sector suggest that there is no urgent need for mortgage insurance as this will increase the cost of funds for borrowers. The nearest vehicle for this need is life insurance which is guaranteeing   mortgage credit debt in case of mortgagor's death.

Secondary mortgage market is essential in the US mortgage market. This market providing enough liquidity with Fannie Mae and Freddie Mae as main actors, made it possible for mortgage creditors to grow their portfolios enormously. Green & Wachter (2005) explain this enormous growth of American home mortgages as a percentage of GDP, with a transformation in their form such that American mortgages are now distinctively different from mortgages in the rest of the world. Also, Cho (2007) indicates that the growth in mortgage credits debt outstanding in US is strongly related with the mortgage market's increased reliance on securitization. Despite the appropriate regulations still there is no secondary market in Turkey. The closest vehicle can be considered as securitization credits by Turkish banks which are based on various baskets of products.

Diversity of actors in the US market is another difference from Turkey mortgage market. In Turkey commercial banks are main actors of mortgage market. Both state owned and private banks offer their funds for mortgage credits up to 30 years maturity. In the US, commercial banks, mortgage companies and other various institutions play role in the primary market. Of course secondary market actors, GSE companies Fannie Mae and Freddie Mac primarily play important role in liquidity supply for primary markets. Also Federal housing Agency (FHA) insurance on mortgage credits is very important. Borrowers use FHA insurance for fulfilling the down payment. Lastly insurance companies like AIG support

to mortgage backed securities by insuring them with Credit Default Swaps (CDS), is another role in the US mortgage market.

Kavrakoğlu (1987) states that starting from 1950s Turkey always had a deficit of housing and this deficit became more serious and almost permanent after 1980. According to Kavrakoğlu, even official numbers indicated a total deficit of 1,292,000 homes between 1955 and 1983, illegal housing supply took place and ''gecekondu'' or shanty housing units surrounded major cities. As a contribution to this issue, Buğra (2002) states that this illegal supply method not only used by low income individuals but also used by some high income groups for land speculation. This issue has many aspects such as behavioral and political, so solution must contain more than just regulations. Again if we turn back to 1955 – 1983 period and official deficit, thanks to this illegal supply, despite official numbers, only a few people were homeless in Turkey.

Population growth is seen as the main determinant of the deficit by Kavrakoğlu (1987). Between 1950s and 1983 annual population growth was around 2.5 and 3 percentages in country. In major cities this rate was twice and around 5 and 6 percentages. That was of course related to industrialization and a result of fast urbanization. This extremely high rate of growth especially in urban populations lead us to high housing need but, addition to this housing is also important for its integration with the rest of the economy.

Kavrakoğlu (1987) states that housing sector is one of the key sectors, and its strength would lead to higher production in general. On the other side a slowing in the housing sector would affect whole economy. According to his calculation one unit increase in demand of building causes 2.18 units increase in total production. In the same study construction sector's positive effects to employment and also positive effects to detailed sectoral productions are also stated. A recent research report revealed by

Gayrımenkul Yatırım Ortaklıkları Derneği (GYODER) also indicates housing need of Turkey. According to this report between 2010 and 2015 housing need would be 3,400,000 units.

As the first attempt of mortgage credits in Turkey, "Emlak ve Eytam Bankası" was founded in 1926. This bank was a state owned bank aiming mortgage credits. This bank's operations lasted until 1946. Within 20 years of operations, overall performance was pretty weak. The most important work during the banks' operations is known to be 434 homes site construction. At year 1946, with the same purpose and again with a state owned structure, but this time more strongly "Turkiye Emlak Kredi Bankası" was founded. This bank's operations lasted 45 years until 1988. During this period the bank's own constructions were significant all in mostly metropolitans. We see bank choosing to give mortgage credits in its own constructions generally. Istanbul Ataköy was an exceptional and impressive example of this bank's operations. Ataköy area was called Baruthane (Gunpowderhouse) which belonged to military at the late Ottoman and early Republic periods. Since this "*satellite city*" project took place starting from 1950, area name also naturally converted to Ataköy. Between 1950 and 1990s thousands of homes constructed in an exceptional (for Turkey standards at that time) satellite city form. Mango (1989) in his article about liberalization process of Turkey, describes the airplane's landing to Istanbul and indicates that Istanbul skylines is not dominated by minarets but by towers of residential suburb of Ataköy which attracted many rich Turks.

Also as other actors of mortgage credits until 1980' we see SSK, Bağkur and Oyak in a study by Ercan (2009). These institutions gave mortgage credits to their members at some levels. Even after 1980s Oyak's efficiency as a special purpose institution lasted, and after that a commercial bank was founded in its structure. An economic crisis which caused triple digit inflation and brought the end of closed economy in 1980, according to

Kavrakoglu (1987) was important for the change of some behaviors in Turkish economy. In 1980, developments in social, political and economic sides drew government to take some serious measures to control high inflation and high current account deficit primarily. One of the important vehicles was high interest rates which made banking system to attract more funds from households since then. This new situation caused even housing demand of individuals to fall significantly.

We can see the period from 1926 to 1980s with the government support but without enough privatization and regulations, so mortgage market remained weaker than its potential. We see the first serious steps of liberalization process starting from 1980s with regulations and a single party government ruling in 1980s. With government policies and efforts, state owned land development examples were seen across the country. In 1984 a new Housing Law accepted. A Mass Housing Fund was developed tied to the new regulation. Buğra (2002) states that a significant portion of this fund, was used to provide subsidized credit to middle income housing projects. At the year 1988 with the merger of other two state owned banks "Turkiye Emlak Bankası" (Emlakbank) was founded. First noteworthy movements in Turkey mortgage market was started by this bank since then. First steps of modern residential mortgage can be seen starting from 1980s with state owned banks' originations. Jaffee & Renaud (1997) see government policies extremely important for development of mortgage markets in transition economies. They see impossible for a mortgage market to go further without the government support. They state three steps towards development. First step is economic stabilization and liberalization, second is privatization, and third is financial sector development. The development of a housing finance system should reflect this order, since a mortgage market can be included as a core component in last step only after a serious progress occurred in first two steps.

In 1990s despite the improvements from 1980s general view was similar. Whole decade was dominated by mortgage credits originated by state owned banks, primarily Emlakbank and secondly Vakıfbank. At the beginning foreign currency loans were intensive. With the economic crisis in 1994 and devaluation resulted from it, changed the situation. This time index linked rate mortgages (ILM) came out. Two types of ILMs were used. First one was inflation indexed mortgages and second one was wage indexed mortgages, we learn from Erol and Patel (2004). Probably those years' high inflationary and high interest rate structure encouraged borrowers through ILMs. While ILMs were widely originated by state owned banks, adjustable rate mortgages (ARM) were not popular. Berument & Malatyalı (1999) connect this unpopularity to the difference of the interest rate on expected and unexpected inflation. Mostly inflation was below what it was expected, but interest rates reflected expected inflation. So we understand that ILM choice was rational. Today ILMs are still widely used for TOKI based mortgages. Wage indexed pricing is used for low income and social homes, also inflation indexed pricing is seen in some low and middle income home projects. In a country report by IMF (2007) the ongoing preparation of the mortgage regulation at that year which allowing ARMs is described as the optimal way to control economic behavior by using interest rates attached in ARMs. Besides IMF's expectation, so far ARMs has been almost never used in Turkey.

The shocking effect of 1999 earthquake - which caused physically and mentally severe damage, also caused a common fear about real estate ownership – almost stopped the mortgage market. Addition to this November 2000 and February 2001 financial crisis were the last nails in the coffin. Mortgage demand was very low and banks were struggling with probably the most serious crises in Turkish banking history. We should note that during 1999 – 2001 period management of 17 banks were took over by TMSF. At that year the leader lender of mortgage market was still Emlakbank even it became out of order same year, we learn from Erol &

Patel (2004). Total amount of mortgage credits were 356 mio TL and mortgage follow ups were 4.4 mio TL. During this year, Kemal Derviş was assigned as economic minister and with his sponsorship Government expressed a program in May 2001, named "Transition Program for Strengthening the Economy" aiming the way out of the crisis. Somewhat Derviş (1981) article on foreign exchange shortages and the suggestions on that article had a chance to be put in practice. Many regulatory policies were developed and the legal infrastructure, for a healthier financial sector, was prepared at that time.

The first signs of economic recovery became visible in 2002. GDP data turned to positive. Economic data showed -some of them even slightly-but positive growth in every aspect. While things started to get normal, also credit markets showed signals of normalization slowly. Banks were recovering from the 2001 trauma, but still they were too cautious than they were supposed to and still interest rates were too high (the year began with 66% mortgage rate and ended with 43%), mortgage demand was still low, total mortgage credits were even lower than previous year with 307 mln TL and besides positive macroeconomic figures mortgage follow ups increased to 8.4 mln TL. So, house prices remained at low levels. General election held and after a period which lasted more than a decade with coalitions and minority governments, surprisingly a single party government, with enough majority, took the power. After all, this gave a chance to the administration for putting the regulations in practice held by previous government. Implied inflation targeting was being started also during this year.

With discussions about almost inevitable Iraq invasion and Turkey's support to this operation, year 2003 started. In March 1 permit for the military support was rejected by TBMM. Two days after the rejection government expressed a new package of economic measures. Later this year a lighter version of permit was accepted by TBMM, so US assigned a 8.5 bio USD credit line for Turkey. This line was never used by Turkey but the

psychological effect was positive on the markets at that fragile times. By the end of this year mortgage credits reached 786 mio TL and mortgage follow ups was 10 mio TL. Besides 156% increase in credits, the follow ups increased only 19%. A clear picture of healing was seen on the market. Still housing prices didn't increase too much. But the mortgage demand was strengthening and banks were lowering mortgage interest rates to reasonable levels. The year began with 44% average mortgage interest rate and ended with 29%. 2004 started with the positive momentum from previous year, economy continued growing and CPI decreased to single digit with 8.8% after 32 years in 2004. Although good performance of CPI, average mortgage interest rates moved in a band between 25 – 30 %. As another sign of global growth, oil price exceeded $50 first time in the history. Recessions all over the world seemed to come to an end. Turkey remembered the comfort of having both economic growth and declining inflation after a long while. This was a surprising and difficultly understandable situation for our generation regarding all we heard a lot about "For economic growth we need for sure, a considerable inflation even two digits is a must. Once the economy grow enough, we promise inflation will be reduced" in 1980s and 1990s from prime minister's own words, and as a common belief. Also in 2003 and 2004 "Toplu Konut Idaresi" (TOKI) put first examples of its innovative real estate evaluation method "*income sharing model*". With this model contractor firms was not just promises lands' price, also they promises a certain share of each square of the sales in project in a given period. This challenging tender method was full of dangers for contractor firms. But thanks to positive economic environment, offered lands' attraction at the beginning and commercial banks' increasing desire, the model reached a high success in the beginning.

Next couple years 2005 and 2006 mortgage market cheered officially. The longest maturities extended to 15 years and in monthly basis mortgage interest rates saw below 1% at the first time in history. The lowest recorded mortgage default rate ever was in April 2006 with 0.011%. At the

same month average mortgage interest rate saw a historic low with 13.28%. During this period home prices rose significantly, land prices started to rise because of the land demand for new constructions. Later on, year 2006 would be seen as a top year from constructors for, high demand from customers, high home prices, low construction costs and low land costs. This perfect mix could never be caught later. Just after the best numbers in Turkey were watched, in Middle 2006 the world first time felt something is going wrong with the mortgage system and this reflected to our markets a little bit. US also reached a peak level of housing prices and had a comfortable low interest rate period through 2006. Also Roubini's famous warning to IMF about upcoming burst of housing bubble, was in September 2006. As the end of the year with a slight increase in interest rates and slowing house prices, first signs of future problems started to become visible.

2007 would be the year which, the subprime mortgage crisis makes its public appearance. Discomfort feeling was spreading among investment banks in the US primarily. Mostly waited and desired "mortgage law 5582" was accepted by TBMM in February 2007. With this law a structure for ARMs, secondary market and mortgage firms is settled. Turkey's economic indicators showed increasingly good performance through 2007. As a main indicator industrial production index reached a peak of 128 points as of November 2007. Also unemployment rate saw the lowest of 8.8% five times during 2006 – 2007 period. TCMB at those years was not brave like nowadays yet and chose to determine policy rate above 20% during the same period. Of course affected form policy rate, average mortgage interest rates were moving between 15 – 20% levels despite good signals from the economy. Istanbul Stock Exchange index reached peak levels by the Fall 2007. We have a house price data for Turkey since June 2007, which showed slow but steady increase since April 2008. In fact 2007 had been a year everyone realized things were going to worsen. But interestingly things got ugly by the middle 2008, approximately a year later from this common

realization. Already increasing commodity prices were disturbing Turkey a little bit and after 2007 we saw some difficulties for economic indicators in Turkey.

After middle of 2008 parallel to global crisis, a wave of negativity also hit our shores. Bond rates jumped above 20% while average mortgage interest rates also jumped above 20 %. GDP turned to negative in the last quarter. Mortgage credits got affected from these developments, mortgage default rate increased above 1% in October 2008 for the first time after January 2004. Mortgage credits amount didn't significantly decrease, but 35 bln TL of mortgage credits were first seen in June 2008 and since middle 2009 the amount nearly didn't change. At that period banks had difficulties to see where things were going. Thanks to our much simpler banking system our banks almost never carried sophisticated assets such as MBSs, so it didn't take too much time to understand that our banking system wouldn't get hurt from storms outside. State authorities took some measures right after Lehman collapse in September 2008. While FED realized that letting a bank to sink is not such a good thing and it's worth doing anything to save another possible bank collapse, almost every central bank all over the world started to take easing measures especially including liquidity to financial sector. TCMB started easing measures - later these measures would be called by them "*Full Liquidity Support*"-. Through middle 2009 banks were even more courageous from the before of 2008 turmoil. With a strong decline in average mortgage rates December 2009 rate of 22% declined to 12% as of December 2009. Reidin housing price index saw its bottom in March 2009 with 85 points, also increased to 91 points by the end of 2009. After four quarters of negative territory, GDP turned to positive in fourth quarter of 2009. Unemployment was struggling during this healing, maybe because of its nature but despite other indicators' positive performance unemployment stuck around 13% levels.

Turkey tried to deal with the global crisis with different measures taken from different authorities. With the start of the crisis, as a result of global risk aversion, Yen currency hiked against other currencies. This situation caused a serious problem for mortgages in Yen basis. Those credits surely were taken because of Yen's enormously low interest rate advantages, but with the crisis Yen jumped so much that they turned to be a disaster. In June 2008 FX consumer credits are banned in order to prevent further problems. Again, at the first stages of the crisis some fiscal easing measures taken by authorities were seen, TCMB started liquidity easing operations with decreasing interest rates about lending for financial institutions in October and November 2008, also at the same time easing in reserve requirements, sharp decline in policy rate from 16.75% to 6.5% during November 2008 – April 2010 period, tax for stock market profits is set to 0% for domestic investors by the government in November 2008, also later in March 2009 a small reduction of tax for consumer credits was applied.

A significant healing was seen beginning from middle 2009. We mentioned mortgage amount was around 35 bln TL for almost a year between 2008 and 2009. Then it started to increase, with the decline in average mortgage interest rates. We started year 2010 with 12% average mortgage interest rates and 43 bln TL mortgage amount. Mortgage default rate topped at 2% at that time. Afterwards average mortgage interest rates decreased below 10% by the end of the year, mortgage amount reached an impressive 59 bln TL and mortgage default rate decreased to 1.4%.

State authorities started to put some measures, seeing this healing has a potential to go too far that can turn into a heating, beginning from 2010. In April 2010 TCMB explained its "*monetary exit strategy*" including monetary tightening in O/N markets and declared 1 week repo interest rate as policy rate. As of November 2010 this time TCMB declared its new policy mix. Afterwards, Başçı's presentation, putting intention of cooling

was in December 2010. Same month BDDK revealed new measures about down payments in real estate credits. Beginning from January 2011 mortgage down payments are to be at least 25% of the home's value. This has been the first rule directed by authorities related to loan to value ratio. This rule caused certain difficulties for banks connected to the fact that most times expertise values are much lower than the actual values of homes. Even later, Tevfik Bilgin -president of BDDK- needed to make another announcement in May 2011 that some banks by pass this rule by giving consumer credit for the 25% supposed down payment proportion of the home's value.

In Turkish Banking Sector Mortgage Credits Report which released by BDDK in 2006, it is stated that increase in real interest rates causes decrease in mortgage volume, increase in inflation causes one term delayed decrease in new mortgage demands and at last as a main indicator of growth every 1% increase in industrial production index causes 4.7% increase in mortgage credits.

Also in a very recent 11/12/2010 dated presentation -we mentioned before- of Erdem Başçı (currently president, at that time vice president of TCMB) stated that current deficit has a strong relation with the credit amount. After this, in order to reduce the current deficit TCMB forced banks to reduce their credit volume by increasing reserve requirements. Later, in April 2011, Erdem Başçı at another presentation revealed TCMB quantitative tightening policy with a lower policy rate, a wider interest rate corridor and higher reserve requirements and put a strong will to continue this innovative approach further.

We mentioned before about Jackson and Kaserman's (1980) "*equity theory*" and "*ability to pay theory*" on defaults. In that study equity theory had been found to be stronger than ability to pay theory. Barth and Yezer (1983) discussed the same issue. They found evidence of borrowers try to

maintain payments even negative equity. So this study indicated "ability to pay theory" stronger.

Many things can cause a default. In academic researches primarily loan-to-value ratio stands in the forefront. This is related to home equity which is an important determinant in defaults. According to Jaffee and Renaud (1997) default risk is measured by two ratios; the loan-to-value ratio and the payment-to-income ratio. They were not the first to say these. Campbell & Dietrich (1983) in their study on determinants of defaults, they state that there are two main determinants of the default decision: the borrower's current equity regarding to the mortgaged property, measured by the loan-to-value ratio and the size of the borrower's mortgage payment obligation regarding to his income, measured by the payment-to-income ratio. More borrowers are forced to choose to default on their home mortgages as their incomes worsen or their payment obligations increase beyond their capacity. At this point we remember Jackson and Kaserman's "*ability to pay theory*". Campbell & Dietrich (1983) continued, they stated that rational borrowers who become unable to meet payment obligations should default only when equity values would decrease to the point that default is the borrower's optimal action. This time we remember Jackson and Kaserman's "*equity theory*". The cost of default, seriously affecting borrowers' decision is also considered in this study.

Campbell & Dietrich (1983) found that the cost incurred in default would include any direct loss on the property plus the increased cost of future credit due to a reduction in credit rating. Hence, the probability of default should be positively related to both the payment-to-income ratio and the loan-to-value ratio. As we see, with the light of this study, the payment-to-income ratio is equivalent to "*ability to pay theory*" and the loan-to-value ratio is equivalent to "*equity theory*". Another discuss related to default decision issue was done by Deng, Quigley, & Van Order (2000). In their study on mortgage terminations, once again, house prices and thus equity

issue is on the table. They found that even in the event of a housing market downturn, the investor can carry a mortgage larger than the market value of his house. In this case, the investor theoretically would be better off defaulting on his mortgage obligation. However, in reality, residential mortgage defaults are rare and less than 2%. This statement also once again brings us to the "*ability to pay theory*".

In a very recent study by La Cour-Little and Young (2010) they state two reasons for a default; first if future income is not sufficient to service the debt, a "payment-driven default" will occur. Second, if the price of the house at the end of the second period is too low, the borrower may elect to default and an "equity-driven default" will occur.

Economic factors are considered as one of the important determinants of defaults in credits. Both firms and individuals face difficulties in the times of financial crisis. Campbell & Dietrich (1983) studied a regional economic data developed by a US institution covering 1960s and 1970s. They reached a result that there is a statistically significant relationship between default incidence and most of the economic variables such as unemployment and inflation primarily.

In a paper written by Jappelli, Pagano & di Maggio (2008) household indebtedness and financial fragility as a result of it, is discussed. Macroeconomic factors of unemployment, interest rates and GDP growth are used to understand how households are affected from economic shocks. As the result of this study, it is stated that macroeconomic factors significantly affect borrowers, as indebtedness increases.

House prices are seen important in default decisions. Chen, Chang, Lin & Shyu (2010) saw a significant influence between house prices and defaults while they consider interest rates is strongly related to prepayment decisions. A different approach to interest rates came from Furstenberg

(1969), he saw interest rates and related borrower costs as important factors of defaults. According to his study, conditions of financing are strong determinants of defaults. This also brings us to micro data like income, age and employment. Of course these are out of our interest at this moment. As another macroeconomic figure, house prices also are affected by interest rates. As a result, the interest rate can be accepted as a benchmark for understanding defaults.

Page (1964) looked inside the interest rates and tried to understand if all costs are included or not. According to him, interest rates cover three separate costs. Opportunity cost, originating and servicing cost and finally the cost of default probability. A contract's interest rate depends on three variables, loan amounts, monthly payments, and contract maturities. So Page (1964) states that **"The greater the value of the loan, given the value of the property and maturity, the greater the monthly payment and the lower the borrower's equity at any given point in time. Presumably, the lower the borrower's equity, all else equal, the more likely a default will occur."**. This study connects interest rates to loan-to-value ratio and of course loan-to-value ratio is naturally connected to default probability. Jung (1962) reaches similar results, finds interest rates and loan-to-value ratio strongly connected. We see Sandor & Sosin (1975) study as further discussions connecting interest rates and default risk in respect of risk premium. Another related study for this issue by Muth (1962) considering default probability, states the inverse proportion between down payment ratio and default probability, affects interest rates.

The interaction of house prices, interest rates and loan-to-value ratio is significant. Lamont & Stein (1999) state that higher loan-to-value ratios, cause sensitivity in house prices. This means borrowers with high loan-to-value ratios are vulnerable to economic shocks and in tough situations they are forced to sell their homes at low levels. At this point Chen, Chang, Lin & Shyu (2010) also state these relations. With respect to mortgage terminations, they find that the present value of amortizing mortgage

payments and the ability of the borrower to release from the payments through either prepayment or default must be considered. Although the prepayment decision is significantly affected by the interest rate, the house price influences significantly the decision to default. Although studying foreclosure decisions and timing after default, Lambrecht, Perraudin, & Satchell, (2003) found interest rates and home equity important for such decisions.

In another study on macroeconomic factors and mortgage defaults was done by Campbell & Cocco (2010) recently. For understanding the main actor of default, dependents of negative home equity are studied. According to this study, labor income, house prices, inflation and interest rate risks are collectively and interactively affect home equity decreases and so defaults. As a study looking macroeconomic factors in different aspects and try to determine default relation, Hong Kong Monetary Authority report revealed in 2004, uses three main macroeconomic factors, interest rates, unemployment and Hang Seng Index (HSI). This study reaches that interest rates primarily and also unemployment and HSI have a significant impact on default probability.

İşcan (2003) in her study on the economic effects of narrowing banking credits, finds that by looking credit cards and consumer credits at follow up, it can be possible to understand the effect of crises on household budgets. Especially during the term of November 2000 and February 2001 crisis, a rise was observed both in credit cards and consumer credits follow ups as a result of the worsening household budgets. She also adds, falling real wages, narrowing employment and rising interest rates caused the increment in consumer credits follow ups.

Overall economy and credits are strongly tied, according to Iacoviello (2008). With a macro view he sees at the aggregate level, macroeconomic developments should affect both the trend and the cyclical

behavior of debt over long horizons, as countries become richer, their financial systems better allocate the resources between those who have funds and those who need them. Another macro view this time for housing loans from Jaffe & Renaud (1997) indicates in all economies, long-term housing loans create significant credit, interest rate, and liquidity risks for bank management. In the transition economies, volatile inflation and the political pressures to control interest rates have expanded these risks even further. They see mortgage market as the mother of all financial markets for a country. In their study they state the need of regulations to improve the efficiency of mortgage markets in transition economies.

As an example of economic shocks and mortgage defaults, it is stated in a study by Duebel (2006), major devaluation in Mexico in the late 1994 caused interest rates to jump and fall in house prices, all these developments drove mortgage defaults. Not in every study macroeconomics and defaults are found to be strongly related. Gross and Souleles (2002) state that default costs are stronger determinants than the economic fundamentals are.

Yao & Zhang (2005) state that **"housing differs from other financial assets in that, housing serves a dual purpose. It is both a durable consumption good from which the owner derives utility and also an investment vehicle that allows the investor to hold home equity"**. Only this clear perspective seeing housing as an asset is enough to understand the importance of house prices in discussing defaults. House prices definitely affect defaults. Decreases in house prices trigger defaults, while increases strengthen borrowers' hands. Many studies and articles considered house prices in the center of mortgage defaults. That's because home equity, loan-to-value ratio and interest rates issues are very closely related and at the time of house prices move each borrower is affected in one way.

If house prices are so important, is it possible to predict the direction house prices? Gerardi, Lehnert, Sherlund & Willen (2008) ask the question

if the foreclosures of 2007 and 2008 could be anticipated by the market actors. They do not go too far to find the answer. Subprime credits, that caused the crisis, were intensively originated in years 2005 and 2006. Why all the bright guys in finance sector couldn't see what's coming, that's interesting. Was it possible to see what would happen two years later? In order to understand this they make a time-travel to 2005. They look forward from 2005, to understand if house prices indicated some signals, because just the house prices estimation would be enough to see upcoming defaults. In this study they find really interesting results such as the belief that home prices could not decline that much persisted even long after prices began to fall. Market analysts predicted it was a stabilization that would eventually move upwards for a while. So as a result most of the analysts saw the fall but didn't understand that it was real. At this point, we should also note that as the name fathers of the most famous house price index "S&P Case and Shiller Index", Case & Shiller (1989) state that individual changes in house prices are not very forecastable at all. Poterba (1991) also indicates house prices determinants. He sees house prices to predict the future to some degree. Prediction of upcoming crisis issue attracted some studies. Demyanyk & Van Hemert (2009) use a database containing between 2001 and 2007 years. They reach evidence that the rise and fall of the subprime mortgage market follows a classic lending boom-bust scenario, in which unsustainable growth leads to the collapse of the market. Problems could have been detected long before the crisis, but they were masked by high house price appreciation between 2003 and 2005. Once again house prices come out with its enormous effect on defaults.

Another study on the relation between house prices and defaults by LaCour-Little & Young (2010) indicates declining house prices in the central role of surging defaults and foreclosure rates. As a result with the decline in house prices, default and foreclosure rates rose to record levels. Case & Shiller (1996) study on relation of default rates of home mortgages and real estate prices containing data from 1975 – 1993 puts a strong

relation between defaults and declining housing prices. Davis (2010) describes what the US mortgagors felt when the crisis hit; in the US rates of foreclosure reached unthinkable levels, as millions of homeowners found that they owed more on their mortgage than their house was worth.

Before, we mentioned, default is considered as an option in US. Çetinkaya (2009) states that if the house price is less than the value of the remaining payments, a rational borrower will prefer to default since the amount obtained by selling the house will not cover all remaining payments. It can be said that house prices have a direct impact on the default option value.

What if we look this matter in a new light? We saw house prices declines to cause defaults. We saw housing prices increases to solve many problems. In some studies housing prices increases are tied to asset bubble risk. Although, Büyükkarabacak & Valev (2006) find in their study on credit expansions and results related to banking and currency crises that, increasing asset prices – primarily house prices for household – are eventually found to be one of the important reasons of especially banking crises. Another paper on this asset bubble issue is written by Bernanke, Gertler & Gilchrist (1996). That's interesting to hear this from Bernanke, when we consider today's money flood created by FED. Another connected study is made by Espinoza (2008) just before the crash all over the markets. The study is on money supply and its effects on primarily asset prices, interest rates and defaults. The study focuses on states but the results are commonly known facts that money supply increases asset prices, decreases interest rates and thus default becomes costly and the need for default declines.

A further study by Abolafia (2010) asks if speculative bubbles (example: the burst of housing bubble in 2008) can be managed or not. His answer is both yes and no. He says "yes" because enough knowledge is

available and it is possible to prevent new bubbles. But at the end he states that real answer is "no" because he called "*market fundamentalism*" above many things and new bubbles will occur again.

House price dynamics are in a wide range. Kapur (2006) puts four mainly determinants of housing price as the housing services effect, the interest discounting effect, the consumption smoothing effect, and the rate of price increase effect. So far we saw the connection between house prices and defaults by looking into falls of house prices. Actually this connection is also meaningful when we look to the other side. Ortalo-Magne & Rady (2006) stated a strong positive relation between housing prices and income. Also they indicated "*starter home*" and "*trade up home*" concepts to understand income and house prices. Lauria & Baxter (1999) studied New Orleans example to understand economic shocks in 1980s, results of these shocks, decreasing house prices and declining income for already low income and also black people.

As another approach to house prices, two different influences of house price effect that causes mortgage terminations idea is introduced by Downing, Jaffee & Wallace (2009). This finding is interesting because we heard decreasing house prices and defaults, but here house price increases is said. First of all in general, increases in house prices tend to accelerate terminations. These terminations are in two ways. On the one hand, increases in house prices depress defaults (and the opposite is also possible). On the other hand, increases in house prices generate home equity that homeowners can use by refinancing to a higher loan-to-value ratio, or that can help to minimize the costs of moving and make it possible for a down payment on a larger home. So the perspective of house prices' effects is widening with this study. Many studies are mentioning house prices and defaults, while this study adds prepayment probability with increasing house prices.

We just mentioned about foreseeing the upcoming crisis. A study by Case, Glaeser & Parker (2000) tries to draw attention to steadily rising house prices all across the country. Widely increasing house prices are normally a good thing for each market actor. Everyone benefits from this, defaults and foreclosures are very low, but they remind the savings and loan crisis of the late 1980s and the banking problems in New England and California. At that time damage was limited, because the losses were concentrated in specific regions of the country. After that he asks the question; how would the mortgage market react to major nationwide recession? Now we all know, this question waited approximately 8 years to find its answer.

After the mortgage crisis in 2008 many studies looked back and tried to understand why this happened. Palmer & Maher (2010) find complexity of transactions and indicate interactive determinants mentioned by Davis (2009) states that there is an equilibrium which starts with the thought of considering homes as investment and therefore continuously purchase of new and additional homes which would increase home prices and usage of more adjustable rate mortgages. Afterwards construction firms respond by building more buildings which cause home prices to drop and eventually mortgagors to default.

We mentioned before, insurance is an essential part of the mortgage market in US. Insurance can cover all risks a mortgage has question can't be easily answered. Clickner (1967) in his article about insurance techniques covering risks of mortgage lenders' sees especially market risks are unmanageable. Falling real estate values as a result of market forces, which out of borrower's control, are representing one of the biggest problems for risk management. He states that market risks those resulting in either losses or gains, can only be countered by careful forecasting. Although, Clickner stated a forecasting need to control market risks, after more than 40 years passed, we still lack in forecasting market moves.

Unemployment and income are important for defaults. With the simplest thinking none of the banks would give credit to unemployed applicants. That's because regular income is wanted to ensure credit's health. In a study about mortgage terminations Deng, Quigley & Van Order (2000) stated that unemployment and divorce rates have significant effects on default. Without needing any further research it is obvious that unemployment and divorces are strongly related. Although we think unemployment is important, Malik & Thomas (2010) couldn't able to add unemployment in their model of understanding macroeconomic factors affecting defaults. In their study four determinants found to be related, CPI, interest rates, stock market index and GDP. Also in literature unemployment is a rarely mentioned issue. It is understood that unemployment's nature of delayed effects and difficulty of finding direct relation to defaults caused this. As one of the rare studies stating unemployment strongly, Adibi (1993) focused on Los Angeles, finds results indicating foreclosures, housing prices and unemployment rate connections.

Since we accept home equity at the top of the determinants of defaults, inflation needs to be understood with the role in asset values. If we accept interest rates effective in both defaults and prepayments once again inflation comes up with the role in interest rates. The intersection between inflation and interest rates are seen in some studies.

Çobandağ (2010) studied the relation between inflation, interest rates and mortgage credits. Çobandağ states that the relation is found obvious between mentioned macroeconomic variables. Banks are eager to give more credit in low inflationary and low interest rates periods due to narrowing profits from government borrowing. Also mortgagors tend to use mortgage credits with low interest rates due to cost advantage.

Inflation's effect on interest rates and so on defaults is a clear issue. In high inflationary environment, solutions to deal with it came out. Sanders

(2005) gives example from US market. In US, 1970s and 1980s passed with high inflation. At that period price level adjusted mortgages (PLAM) were used to deal with inflation. In Turkey wage indexed mortgages (WIPM) during 1990s are similar to US experience. Erol & Patel (2004) study focused on WIPMs. They found that WIPMs' linked structure to civil service employee's wage provided protection at the high inflationary period. The choice was rational, thus less than expected defaults were seen considering the possible results of ARMs and DIMs. Although ARMs can be seen as "*optimal mortgage design*" by Piskorski & Tchistyi (2010), and believed to prevent borrower from making wrong choices, we still think Turkey's infrastructure is not ready yet for such vehicles to be used. Of course determinants of this situation can be widely discussed, Erdoğan (2011) in a very recent article, connects this to wrong reference point according to mortgage law. The law gives TCMB to set reference rate. TCMB's decision mainly affected by the inflation belongs to two months before, so it is obvious that moving point is wrong and far from market facts.

Adjusted rate mortgages are likely to be more discussed in the future; Miles & Pillonca (2008) article on financial innovation including ILMs and ARMs is useful. Brueckner & Follain (1988) study on "*Rise and Fall of ARMs*" is also important to understand this vehicle completely. And finally Campbell & Cocco (2003) on optimal mortgage choice for households issue can be seen for further discussions.

The inflation issue is important for its multi sided effects. A general equilibrium is explained by Kearl (1979), according to him, in the times of wrong valuation because of inflation effects, the wealth effect of housing also can mistake individuals. As a result, inflation causes a lower demand for housing and lower asset prices in general. This decreasing demand and lower house prices eventually lead a new equilibrium that, actors take action again. Thus we see house prices increase issue once again.

Inflation, interest rates and default interaction is a very clear issue. Martin & Smyth (1992) in their model of default pricing, they use T-bill rate as the cost of short term loanable funds and they use inflation to see opportunity cost due to reducing purchasing power of the lenders.

Interest rates issue is significantly a main determinant on mortgage defaults. This issue is studied in many academic studies. Once we accept this importance of interest rates we need to understand what affects interest rates. Vidger (1968) puts a very basic explaining for interest rates below, **"Interest rates inserted in various real estate contracts are determined after considering the availability of capital, credit worthiness of the borrower, local legal pro-visions, marketability of the loan, servicing facilities, and the nature of the property pledged as collateral. At the time conventional (those not backed by a governmental agency) mortgage loans are negotiated the stipulated interest rate reflects the lender's overall appraisal of the above factors. It follows that when mortgage credit is plentiful and the risk element is minimized, the borrower can usually obtain a lower interest rate."**

In a study by Yılmaz (2009) it is found to be a direct relation between interest rates and mortgage defaults. Interest rate's inseparable effect on costs and equity and thus both prepayments and defaults is accepted widely. Klaman (1961) examines determinants of the interest rates in respect of banks' decisions. He states that interest rates have a behavior that affected from many variables but always primarily from cost affected.

In many studies we see housing prices and interest rates to be related. Çetinkaya (2009) states the mortgage crisis in US began in an economic environment in which low house prices and high interest rates existed. Therefore, the claim mentioned above can be seen to contradict with the main reason of the subprime mortgage crisis in the US. However, there is a distinction between two events. In the US, the most important reason for the crisis is that higher interest rates cause low house prices. So, the borrowers had some difficulties to refinance their credit. We should note

that in US refinancing is vital for borrowers. Because refinancing is widely used by borrowers and refinancing is inseparable in US households' wealth. Housing market wealth affecting consumption is studied by Case, Quigley & Shiller (2005).

Interest rate declines benefit mortgagors; Muth (1962) sees a fall in the pure rate of interest and, consequently, the marginal cost of capital for all borrowers means that the cost of some low down-payment and long maturity loans considered too expensive at the higher rate falls enough to push borrowers to demand loans of this kind. This decreases the average down-payment and increases the average maturity and spread (between contract rate and government bond yield) on loans actually made.

Karacula (2009) tries to understand default probability by studying the data from a commercial bank including loan parameters. With some data related to customer, for us especially interest rates were found to be significantly related to defaults. Once we discuss credibility issues, Stanton (1995) states that if a mortgagor is not sufficiently credit worthy (or if the underlying house is not sufficiently valuable), he or she will be unable to refinance, regardless of how interest rates become.

2. DATA AND METHODOLOGY

This study aimed to find facts about macroeconomic factors and mortgage defaults relation. Mortgage defaults data is extracted from the data which taken from BDDK site in monthly basis. This data is extracted from consumer credits report which has been released since December 2003 every month. We are interested in mortgage amount and mortgage follow ups data for calculating mortgage default. As far as we are interested in the data starting from June 2007, we had the mortgage credits default rate in monthly basis up to June 2011.

This study claims that mortgage credits are the most sustainable in whole consumer credits in respect of macroeconomic factors. Even things start to worsen mortgage credits would be the last to go down. We have to put this claim by comparing consumer credits and mortgage credits. So we extracted consumer credits data from BDDK site. The consumer credits report is also used for calculating consumer credits default rate. We are interested in consumer credits amount and consumer credits follow ups data for calculating the default rate. Just like mortgage credits default rate we calculated consumer credits default rate in the same timeline. This data include mostly 90 days and more matured follow ups and some less than 90 days follow ups those are determined by banks to be default. Let's say a company and this company's owner are a risk group and both company and owner used credits separately. While company credit defaulted consumer credit of owner still could be less than 90 days. At this case bank can report both credits in follow ups.

In our models, previous default data are found to be important for defaults. So we used previous mortgage credits default rate and previous consumer credits default rate in our study.

Our data set includes some macroeconomic factors as well as stock market index which are expected to be related with defaults. We started with most common data set and tried to find if each of them appropriate or not. We attempted to use current account balance which is said to be related with crises, also there seems to be no relation. Dollarization process has been an important issue for Turkey; so we checked real foreign exchange rates to understand if there is a relation. The result was not meaningful. Industrial production and gross domestic product are also tested in our model; even these are important indicators for macroeconomics, showed no relation with defaults.

At last we had data with meaning. In literature housing prices definitely dominate and we see housing prices a must to implement in these data. Unfortunately after starting to seek for housing data availability for Turkey, we realized that there is a serious lack of data problem. Most common historic data near to house prices are construction permits and construction costs. These two data are put out by TUIK in quarterly basis. First problem appeared to be the time gap, because our study is planned to analyze monthly data. Construction permits show the incentive on construction but we should consider that the time between permit and start of the construction is mostly too long that sometimes take years. So permits indicate something but we can't accept this data as a significant factor. Construction costs also give a clue about demand of housing but mostly it is related to inflation and we can't accept this as a significant factor. House price index is the real need of this study for sure. The famous S&P Case and Shiller index includes data starting from 1987 up today. This index is used in many academic studies in the US. In Turkey we could find the closest to our purpose, REIDIN house price index which is prepared by REIDIN in coordination with Garanti Bank and GYODER. This index is based on the data from 7 metropolitans in Turkey. Index starts from June 2007 and continues in monthly basis. We used house prices data in our study's mortgage credits default and consumer credits default sections. We should

especially say that this data is so important that although other data in our study were available from older dates, in order to use house prices we had to use all data starting from June 2007. The return of a stock market index is included in our consumer credits default rate analysis and no significant relation is observed.

For consumer credits default we searched for a reflecting interest rate and TCMB policy rate mostly does not reflect the market so we chose government bonds average rate which is available in Hazine Müsteşarlığı (Treasury) site in monthly basis. We used this government bonds average rate in our analysis with consumer credits default.

Banks' credit evaluation process can differ from bank to bank, but there is a certain thing that each credit granting decision stands on a borrower's cash flow expectation. Since unemployment definitely ceases cash flow, we expect a problem in borrower's ability to pay credits. In literature we see unemployment important but difficulty of stating the direct relation is obvious. This is more related to unemployment's delayed effect on defaults. Probably individuals expect to find a new job just after they become unemployed and with this incentive in the first few months of unemployment period, they tend to act like everything is normal and they continue payments orderly.

As a result we have constants of the difference of mortgage credits default rate and the difference of consumer credits default rate consisting of data starting from June 2007 ending in June 2011.

We have variables, previous mortgage credits default rate, previous consumer credits default rate, the return of house prices, the return of stock market index, the difference of average government bonds rate and the difference of mortgage interest rates consisting of data starting from June 2007 ending in June 2011.

We need a methodology to explore the relationship between defaults and macroeconomic factors. Multiple linear regression analysis provides solution in cases with more than one variable. So, to give one illustration, defaults might be purported to depend on their sensitivity to unexpected changes in several macroeconomic variables. Therefore we construct the following model following Brooks (2008)

$$y_t = \beta_1 + \beta_2 x_{2t} + \beta_3 x_{3t} + \cdots + \beta_k x_{kt} + u_t , \quad t = 1, 2, \ldots, T. \quad \text{(Eq. 1)}$$

So the variables $x_{2t}, \ldots, x_{kt}$ are a set of k explanatory variables which are thought to influence y (defaults) , and the coefficient estimates $\beta_1, \ldots, \beta_k$ are the parameters which quantify the effect of each of these explanatory variables on y . The coefficient interpretations are slightly altered in the multiple regression context. Each coefficient is now known as a partial regression coefficient, interpreted as representing the partial effect of the given explanatory variable on the explained variable, after holding constant, or eliminating the effect of, all other explanatory variables. Stating this in other words, each coefficient measures the average change in the dependent variable per unit change in a given independent variable, holding all other independent variables constant at their average values.

Equation 1 can be expressed even more compactly by writing it in matrix form

$$y = X \beta + u \quad \text{where:}$$

$$y \text{ is of dimension } T \times 1$$
$$X \text{ is of dimension } T \times k$$
$$\beta \text{ is of dimension } k \times 1$$
$$u \text{ is of dimension } T \times 1$$

The difference between previous and last equations is that all of the time observations have been stacked up in a vector, and also that all of the different explanatory variables have been squashed together so

that there is a column for each in the X matrix. Such a notation may seem unnecessarily complex, but in fact, the matrix notation is usually more compact and convenient. So, for example, if k is 2, i.e. there are two regressors, one of which is the constant term (equivalent to a simple bivariate regression $y = \alpha + \beta\, x_t + u$), it is possible to write,

$$
\begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_T \end{bmatrix} = \begin{bmatrix} 1 & x_{21} \\ 1 & x_{22} \\ \vdots & \vdots \\ 1 & x_{2T} \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \end{bmatrix} + \begin{bmatrix} u_1 \\ u_2 \\ \vdots \\ u_T \end{bmatrix}
$$
$$
T \times 1 \qquad T \times 2 \quad 2 \times 1 \quad T \times 1
$$

so that the x_{ij} element of the matrix X represents the *j*th time observation on the *i*th variable. Notice that the matrices written in this way are conformable – in other words, there is a valid matrix multiplication and addition on the RHS.

The above presentation is the standard way to express matrices in the time series econometrics literature, although the ordering of the indices is different to that used in the mathematics of matrix algebra (as presented in the mathematical appendix at the end of this book). In the latter case, x_{ij} would represent the element in row i and column j, although in the notation used in the body of this book it is the other way around.

With this we have a result explaining how the dependent variable depends on independent variables. In our study two different regression analyses are made. We used two different dependent variables: Difference of mortgage credits default rate and the difference of consumer credits default rate for each regression; as independent variables, lagged mortgage credits default rate, lagged consumer credits default rate, the difference of government bonds average interest rate, the difference of mortgage interest rate, the return of house prices and the return of stock market index are used as independent variables..

We used unit root test (Augmented Dickey Fuller Test) in order to see the right usage of data.

The early and pioneering work on testing for a unit root in time series was done by Dickey & Fuller (Fuller, 1976; Dickey & Fuller, 1979). The basic objective of the test is to examine the null hypothesis that,

$\varphi = 1$ in

$$y_t = \phi y_{t-1} + u_t$$

(Eq. 2)

against the one-sided alternative $\varphi < 1$. Thus the hypotheses of interest are H_0: series contains a unit root versus H_1: series is stationary.

In practice, the following regression is employed, rather than (Eq. 2), for ease of computation and interpretation

$$\Delta y_t = \psi y_{t-1} + u_t$$

(Eq. 3)

so that a test of $\varphi = 1$ is equivalent to a test of $\psi = 0$ (since $\varphi - 1 = \psi$).

Dickey--Fuller (DF) tests are also known as τ-tests, and can be conducted allowing for an intercept, or an intercept and deterministic trend, or neither, in the test regression.

Table 1: Critical values for DF tests

Significance level	10%	5%	1%
CV for constant but no trend	−2.57	−2.86	−3.43
CV for constant and trend	−3.12	−3.41	−3.96

Source: Fuller, 1976, p.373.

The model for the unit root test in each case is

$$y_t = \phi y_{t-1} + \mu + \lambda_t + u_t$$

(Eq 3)

The tests can also be written, by subtracting y_{t-1} from each side of the equation, as

$$\Delta y_t = \psi y_{t-1} + \mu + \lambda_t + u_t \qquad \text{(Eq 4)}$$

In another paper, Dickey & Fuller (1981) provide a set of additional test statistics and their critical values for joint tests of the significance of the lagged y , and the constant and trend terms. These are not examined further here. The test statistics for the original DF tests are defined as

$$Test\ statistic = \frac{\hat{\Psi}}{SE(\hat{\Psi})} \qquad \text{(Eq 5)}$$

The test statistics do not follow the usual t-distribution under the null hypothesis, since the null is one of non-stationarity, but rather they follow a non-standard distribution. Critical values are derived from simulations experiments in, for example, Fuller (1976).

Comparing these with the standard normal critical values, it can be seen that the DF critical values are much bigger in absolute terms (i.e. more negative). Thus more evidence against the null hypothesis is required in the context of unit root tests than under standard t-tests. This arises partly from the inherent instability of the unit root process, the fatter distribution of the t-ratios in the context of non-stationary data, and the resulting uncertainty in inference. The null hypothesis of a unit root is rejected in favour of the stationary alternative in each case if the test statistic is more negative than the critical value.

The tests above are valid only if u_t is white noise. In particular, u_t is assumed not to be autocorrelated, but would be so if there was

autocorrelation in the dependent variable of the regression (Δy_t) which has not been modelled. If this is the case, the test would be 'oversized', meaning that the true size of the test (the proportion of times a correct null hypothesis is incorrectly rejected) would be higher than the nominal size used (e.g. 5%). The solution is to 'augment' the test using p lags of the dependent variable. The alternative model in case (i) is now written

$$\Delta y_t = \psi\, y_{t-1} + \sum_{i=1}^{p} \alpha i \Delta y_{t-i} + u_t \qquad \text{(Eq 6)}$$

The lags of Δy_t now 'soak up' any dynamic structure present in the dependent variable, to ensure that u_t is not autocorrelated. The test is known as an augmented Dickey-Fuller (ADF) test and is still conducted on ψ, and the same critical values from the DF tables are used as before.

Table 2: Unit Root Test Results (Augmented Dickey Fuller Test)

	Probability	
Data	Level	First Difference
Mortgage Credit Default Rates	0.55	0.02
Consumer Credit Default Rates	0.49	0.04
House Price Index	0.60	0.02
Government Interest Rate	0.68	0.07
IMKB100	0.85	0.00
Mortgage Interest Rate	0.78	0.00

As we can see from the table, we will use first and second difference forms of MCDR and CCDR. Also we will use first difference form of DGIR. Results of this table and our analyses show that it is accurate to use first differences for rate variables and in-returns for price index variables. It is essential that these series provide weak stationary conditions. When we use difference or return the conditions are provided enough. So this kind of transformation will do it.

We reconstructed our models (by using model selection criteria like AIC and SC, and also by controlling the steps in a usual Box-Jenkins time series procedures like ACF/PACF values for no serial correlation in the residuals):

$$MCDR_t = \beta1 + \beta2\ DMCDR(-1)t + \beta3\ DMCDR(-2)t + \beta4\ RHPI(-5)t + \beta5\ DMIR(-5)t + ut, \quad t = 1, 2, \ldots, T. \quad \text{(Eq. 3)}$$

$$CCDR_t = \beta1 + \beta2\ DCCDR(-1)t- + \beta3\ DCCDR(-2)t + \beta4\ DGIR(-1) + \beta5\ RXU100(-5) + ut, \quad t = 1, 2, \ldots, T. \quad \text{(Eq. 4)}$$

whereas DMCDR, RHPI, DMIR represents difference of mortgage credit default rates, house price index return, and difference of mortgage interest rates respectively. DCCDR, DGIR, RXU100 stands for difference of consumer credit default rates, difference of average government bond interest rate and stock market index return.

3. RESULTS

The following Table 3, illustrates the factors affecting the changes in mortgage credits default rate. The regression has a 73.5% of explanatory power. Observing the effects of one and two lagged changes in mortgage credit default rates DMCDR, one can safely see that the mortgage credit default rates are very persistent. Also the return of house prices RHPI has a significant and negative effect on the changes in mortgage credit default rates. This is somewhat expected concerning the previous studies (e.g. Jackson & Kaserman (1980), Campbell &Dietrich (1983), Poterba (1991), Case and Shiller (1996), Deng, Quigley & Van Order (2000), Yao & Zhang (2005), Campbell (2006), Chen, Chang, Lin & Shyu (2010)) The difference of mortgage interest rates DMIR has a slight effect on the difference of mortgage credit default rates DMCDR. This is another consistency with the literature (e.g. Jung (1962), Muth (1962), Page (1964), Furstenberg (1969), Sandor and Sosin (1975), Lambrecht, Perraudin & Satchell (2003), Yao and Zhang (2005), Espinoza (2008), Malik & Thomas (2010)) stated before.

Table 3: Multiple Least Squares Regression of Mortgage Credit Default Rates

Dependent Variable: DMCDR
Method: Least Squares
Date: 12/04/12   Time: 11:15
Sample (adjusted): 2007M12 2011M06
Included observations: 43 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-8.66E-06	6.95E-05	-0.124568	0.9015
DMCDR(-1)	0.314898	0.157193	2.003253	0.0523
DMCDR(-2)	0.366032	0.153769	2.380398	0.0224
RHPI(-5)	-0.021410	0.007491	-2.858241	0.0069
DMIR(-5)	0.010854	0.006607	1.642804	0.1087

R-squared	0.735352	Mean dependent var	8.46E-05
Adjusted R-squared	0.707494	S.D. dependent var	0.000807
S.E. of regression	0.000437	Akaike info criterion	-12.52633
Sum squared resid	7.24E-06	Schwarz criterion	-12.32154
Log likelihood	274.3161	Hannan-Quinn criter.	-12.45081
F-statistic	26.39670	Durbin-Watson stat	1.948634
Prob(F-statistic)	0.000000		

$D(MCDR)=0.000008+0.31DMCDR(-1)+0.37DMCDR(-2)-0.02RHPI(-5)+0.01DMIR(-5)$

In our model, difference of default rates, return of house prices and difference of mortgage interest rates are used. All variables except mortgage interest rate are significant at 10% significance level. This is consistent with the literature we mentioned before. However, interest rates seem to have a slight effect. This may be due to the structure of interest rates. That is, almost all of the mortgages in Turkey are given with fixed rates. This must be reducing the interest rates effect.

The following Table 4; illustrates the factors affecting the changes in consumer credits default rate. This table shows that at the one side lagged consumer credit defaults have effects on the difference of consumer credits default DCCDR, while the most important factor in explaining the change in consumer credits default rates DCCDR is the changes in government interest rates, DGIR. An increase in interest rates is associated with decreases the level of consumer default rates. Stock market index XU100 return also found to have a negative significant effect on DCCDR.

Table 4: Multiple Least Squares Regression of Consumer Credits Default Rates

Dependent Variable: DCCDR
Method: Least Squares
Date: 12/04/12   Time: 11:12
Sample (adjusted): 2007M12 2011M05
Included observations: 42 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.02E-08	0.000116	0.000606	0.9995
DCCDR(-1)	0.685284	0.147860	4.634692	0.0000
DCCDR(-2)	0.288926	0.151232	1.910480	0.0638
DGIR(-1)	0.025947	0.012224	2.122612	0.0405
RXU100(-5)	-0.001941	0.001099	-1.765616	0.0857

R-squared	0.787206	Mean dependent var	0.000170
Adjusted R-squared	0.764201	S.D. dependent var	0.001508
S.E. of regression	0.000732	Akaike info criterion	-11.48938
Sum squared resid	1.98E-05	Schwarz criterion	-11.28251
Log likelihood	246.2769	Hannan-Quinn criter.	-11.41355
F-statistic	34.21923	Durbin-Watson stat	1.964659
Prob(F-statistic)	0.000000		

D(CCDR)=0.00000007+0.69DCCDR(-1)+0.29DCCDR(-2)+0.03DGIR(-1)-0.002RXU100(-5)

R^2, for this regression, is 79% which means that independent variables have enough power to explain dependent variable. Neither of the models exhibits significant autocorrelation, since this was controlled in the estimation procedure.

Consumer credit defaults model has a slightly higher explanatory result. All variables are significant with 10% significance level. Compared to mortgage credit defaults, we think that shorter maturities and the weakness of other types of consumer credits yield this result. As an asset we show that stock market index has a significant and negative effect on the defaults. However we should accept that stock market is still not that strong to determine defaults.

4. CONCLUSION

Mortgage credits have been increasing since 1990s in Turkey. With the mortgage law in 2007 mortgage market has a legal infrastructure to catch developed mortgage markets. So far we mostly have seen conventional mortgages with commercial banks dominating the market. The market's expand is strongly tied to the economic perception in Turkey. After the big financial crisis in 2001 we observe a drastic change in our financial markets. Since then banking system has been sterilized and many legal changes related to banking infrastructure, credit issues have been accepted. Moreover, serious transformations in politics have occurred. The relationship between Turkey – EU – IMF – etc. have been stormy, waving between hopeless and positive modes. Interest rates have been declining orderly to one digit levels. Banking behavior has changed seriously from funding government with enormous interest rates to funding for corporate and consumer credits. Thus, 1990s' mortgage credits structure consisting of state owned banks turned to private banks rapidly. Nowadays, banks are in a race to canalize their funds into right addresses, which means higher profits and lower percentage of default credits. Therefore, we think that development in the mortgage credits is one of the most reasonable answers to this question.

We ran a regression to understand the determinants of mortgage defaults and consumer defaults. We reached that mortgage credits are presenting a sustainable and strong growth area for banks. Households' efforts to pay their mortgage payments regularly deserve further investigations for its behavioral aspects. While mortgage credits defaults are considerably lower than other consumer credits defaults, we reached some similar results about character of defaults in Turkey. Interest rates is stated as one of the most important determinants for mortgage defaults in literature, it is found to be average mortgage interest rates for mortgage

defaults and government interest rates for consumer defaults have significant effects on defaults which is consistent with the literature.

Changes in stock market index as well as return of house prices for mortgage defaults and return of XU100 for consumer defaults, both price indexes showed us the same 5 terms lagged effects on defaults, which is consistent with the literature.

Additionally, we researched some key factors that TCMB pays attention to. Foreign exchange levels play a major role in decisions of households in Turkey. This is related to intensive choice of savings in foreign currency, which leads to wealth effects in times of significant increases and decreases. Also economic model of Turkey depending on high imports, leads to high inflation in times of increasing foreign currency. We included real foreign exchange index in our model and we concluded that foreign exchange levels do not affect the defaults in Turkey. Regarding this issue, we should note that current account balance is found to be ineffective on defaults.

In the future, banks seem to try harder on increasing average liability more and more. Today, banks' average deposit maturities are quite short that 89% of the maturity is less than 3 months according to BDDK in March 2011. This is the main barrier on improving mortgages, while average maturity demand of mortgage is 75 months as of March 2011 according to an index. Even we calculate average maturity from the demand of 75 months and reach a 38 months average, there is still a serious gap regarding the deposits below 3 months. After TCMB measures on reserve requirements, considering different maturities aiming to extend banking system's average deposit maturity, we have been seeing banks' commence efforts to find syndication credits in order to reach long maturity funds. We think that if Turkish banks can find a solution for the mismatch of maturities, mortgage credits can go much further in the future.

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