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The Role of Mortgage Backed Securities in Capital Markets  
İpoteğe Dayalı Menkul Kıymetlerin Sermaye Piyasasındaki  
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## **Abstract**

The aim of this paper is to analyze the effects of mortgage backed securities in capital markets. It consists of primary and secondary markets with subprime mortgage crisis. The analysis is carried out against the role of mortgage backed securities in the US subprime mortgage crisis as a structure product.

## **Özet**

Bu çalışmanın amacı ipoteğe dayalı menkul kıymetlerin sermaye piyasalarındaki etkisini incelemektir. Birincil ve ikincil mortgage piyasaları ile mortgage krizi üzerine yoğunlaşmıştır. Çalışma yapılandırılmış ürün olarak ipoteğe dayalı menkul kıymetlerin Amerika'daki mortgage krizindeki rolü ile tamamlanmıştır.

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## **LIST OF ABBREVIATIONS**

ARM:	Adjustable Rate Mortgage
CDO:	Collateralized Debt Obligations
CDS:	Credit Default Swap
CMO:	Collateralized Mortgage Obligations
FCC:	Collective Investment Vehicles
FHA:	Federal Housing Administration
FHLB:	Federal Home Loan Bank System
FRM:	Fixed Rate Mortgage
GSE:	Government Sponsored Enterprises
HOLC:	Home Owners Loan Corporation
HUD:	Housing and Urban Development
MBS:	Mortgage Backed Securities
NYSE:	New York Stock Exchange
OAS:	Option Adjusted Spread
PAC:	Planned Amortization Class
RBC:	Risk-Based Capital
REMIC:	Real Estate Mortgage Investment Conduit
ROA:	Return on Asset
SML:	Specialized Mortgage Lenders
SPE:	Special Purpose Entities
SPV:	Special Purpose Vehicles
TAC:	Targeted Amortization Class
VA:	Veterans Administration

# 1. INTRODUCTION

Mortgage system refers to a mechanism including self-financing, in other words, with its primary and secondary market processes provides house ownership to low and middle income individuals as well as ensuring long term financing for new mortgage loans through its derivative products.

Although mortgage system has different structures and institutions in the world due to differentiation in economic, social and demographic structures the basic purpose is to bring a solution to housing problems and housing deficit. The way of resources and solutions mainly depend on financing of housing sector. Secondary market functions gain importance regarding to financing of existing loans and meeting demand in new loans.

The way of creating liquidity in the secondary market is securitization of mortgage loans which is called “Mortgage Back Securities”. As a derivative product of mortgage loans MBS represents a new investment tool for the investors in the capital markets as well as it represents the way of financing of mortgage market.

On the other hand, securitization gains prevalence in countries having developed and deep financial markets because an investors intend to buy derivative products only if they can sell it to other investors with any price. In other words deep financial markets include many buyers and sellers for any product which can be traded in the capital markets.

This study aims to explain the role of mortgage backed securities as a structure product in capital markets and US subprime mortgage crisis. It focuses on the mortgage back securities as a liquidation tool and being obtained by securitization of mortgage loans and the effects of these securities on the capital markets.

In the first part of study, definition and scope of mortgage system are placed with functions of and actors in primary and secondary markets are

emphasized. In addition, fixed rate and adjustable rate mortgages have been mentioned as types of mortgages. Mortgage system is encountered as a whole in terms of economic benefits and risks of the counterparties in the process.

The second section includes information about scope of mortgage back securities, functions, pricing of MBS and advantages and disadvantages of this derivative product. Also, mortgage systems in the world especially focusing on ABD and Europe tried to be summarized.

The final section focuses on 2007 subprime mortgage crisis experienced in recent history and influence the whole world in order to show the reasons and effects of mortgage back securities on the capital markets with the measurements to mitigate subprime mortgage crisis effects.

In conclusion, general assessment and comments are placed related with the crisis and its consequences.

## **2. LITERATURE REVIEW**

Mortgage backed securities were almost seen as the reason due to backed by subprime mortgages and deterioration in their issuance process.

Weaver (2008) stated that depending on lower interest rates mortgage lending became profitable, market participants did not expected fall in house prices. On the other hand, Weaver concluded subprime crisis to unregulated originators which aimed to sell subprime mortgages and lack of involvement of the Federal National Mortgage Origination (FNMA) and Federal Home Loan Mortgage Corporation (FHLMC).

According to Hampel, Schenk & Rick (2008), subprime crisis depended on usage of new credit scoring techniques which included creditworthiness degrees and interest rates with risk premium. Many of these loans were bought by Wall Street Investment Banks.

The subprime loans sold to Wall Street investment banks were converted into mortgage backed securities in secondary markets to fund the market transactions.

Guseva (2011) specialized securitization as a profitable financing, its consequences on related parties and effects on other countries. The article states that mortgage backed securitization were the basic of US mortgage market in terms of financing from 1960-70s to present.

McDonald (2008) focused on securitization process and government sponsored enterprises following up regulatory changes after subprime crisis and highlighted the subprime mortgage secondary markets as the cause of subprime crisis. McDonald (2008) argued that defaults in primary subprime market deteriorated secondary market for subprime MBS which led to huge losses for Wall Street Banks. Due to tend to conforming loan market, subprime mortgage market faced with illiquidity problems.

Contact with the role of MBS in subprime crisis, Bianco (2008) states that subprime MBS share was 54 percent in 2001 which ramp up 75 percent in 2006. Also, the article took place Alan Greenspan speech in London in October 2007. In the speech Alan Greenspan defending the U.S. subprime mortgage market and showed the securitization as the main reason for mortgage meltdown rather than mortgage loans.

In order to show MBS effect in crisis, Weaver (2008) expressed the subprime MBS. In other words, the subprime MBSs as wrong products were marketed to wrong borrowers at wrong time.

MBS process criticized in different dimensions such as lack of performance data, off-balance sheet activities, credit rating process, asymmetric information between insiders (namely originators) and outsiders (investors) and the valuation model of MBS.

Although Guseva (2011) highlighted benefit of MBS and defended that MBS provides easier access to secondary mortgage and capital markets in exchange for creating more effective mortgages, MBS was criticized due to a new product, MBS has no long term performance records in the article.

In line with Guseva (2011), Garfinkel (2009) observed that new innovations in the mortgage markets such as securitization and originate-to-distribute model resulted as decline in underwriting standards, greater underpricing of credit risk, a huge infusion of easy credit and serious adverse selection concerns as well as their benefits. Therefore, mortgage defaults were seen as the Achilles heel of MBSs, leading to deterioration of this asset class.

As well as lack of long term track records in subprime MBS, Guseva (2011) pointed out reliance on rating process tied to complex instruments and ineligible of analytical data which led to overinvestments in subprime MBS.

Weaver (2008) emphasized wrong ratings due to lack of effective evaluation of mortgages to evaluate risk factors. The rating agencies expected soft landing in home prices, therefore made optimistic assumptions for ratings.

Kroon (2008) aimed to test stock returns for financial and non-financial firms during crisis period by using a regression analysis which depended on different variables. According to Kroon (2008) these defaults led to downgrade in MBS and CDO relied on subprime and Alt-A mortgages. The downgrade created uncertainty in the market. Together with increasing uncertainty and losses investors tend to invest safer products such as government securities.

Bianco (2008) stated that rating agencies were criticized as a result of their investment grade ratings in mortgage backed securities because of conflicts of interest. The critics directly related with payments to rating agencies by investment banks selling MBS to investors.

As another factor MBS provides transfer of risk to counterparties. This creates conflicts of interests such as adverse selection and moral hazard in the securitization process. According to Guseva (2011) low quality mortgage loans and underwriting standards originated from information asymmetries among originators and investors which affected pricing of assets.

Weaver (2008) defended that securitization played a role in the subprime mortgage crisis in terms of conflicts of interest and development of synthetic market in the subprime MBS included default effect.

In terms of problems in valuation, Kroon (2008) stated that the increasing uncertainty in the financial markets led to wrong valuation of securitized products and increased the need for re-evaluation of price assumptions. Investors and lenders became reluctant for investments due to uncertainty, therefore funding and liquidity problems occurred. Besides, the

actual default rate exceeded the forecasted rate in the valuation models and rating process. Investors exposed to price volatility depending on liquidity and valuation problems.

Moreover, Kroon (2008) supported the idea about uncertainty and lack of transparency with Crouhy and Turnbull (2008), the IIF (2008) and the Financial Stability Forum. Increased uncertainty resulted as damaged confidence in the market. Unexpected level of write-downs and commitments of financial institutions shook the confidence of investors.

Rankov emphasized the effect of US mortgage crisis on Europe by summarizing the reasons and giving examples on British and German economies and the bailout programs. Regarding to highlight risk reducing, securitization is an off balance sheet activity which allows to risk transfer. Rankov expressed that By MBS process originators remove substantial assets and associated liabilities from their balance sheets which resulted as distribution of risk among larger list of investors.

Also, Rankov stated that risk transfer became a tool for reducing risk for banks which tend to transfer their junk assets. This action formed a base for MBS backed by subprime mortgage loans.

Garfinkel and Sa-Aadu compared the subprime mortgage crisis with the previous U.S. housing crisis of the early 1990s in terms of default effect and lending attitudes with focus on housing sector, banking sector and stock market. Garfinkel and Sa-Aadu (2009) emphasized prime loan default sensitivities which were changed in the recent period. In the article subprime mortgages were seen as candidates for loss. Due to defaults in both prime and subprime loans, negative wealth effect expanded even among traditional banks.

Garfinkel and Sa-Aadu (2009) worked on a study to associate the hypothesis with the mortgage market. The study focus on banks that have publicly traded equity and bank holding company data available via the

Federal Reserve's Y-9 forms. It included the changes in the third quarter of 2007 when the AAA tranche of the ABX index (which measures the performance of MBS) dropped by at least 1%. As a result, the study showed the truth of hypothesis and the banks which were active lenders in the mortgage market exposes to larger than expected losses due to surprising declines in the AAA tranche of the ABX index.

Shortly; Hampel, Schenk & Rick (2008) attracted attention to primary mortgage market while Guseva (2011), McDonald (2008), Weaver (2008) and Bianco (2008) pointed out securitization as blame of subprime crisis.

### 3. THE PRIMARY MORTGAGE MARKET

#### 3.1. Definition

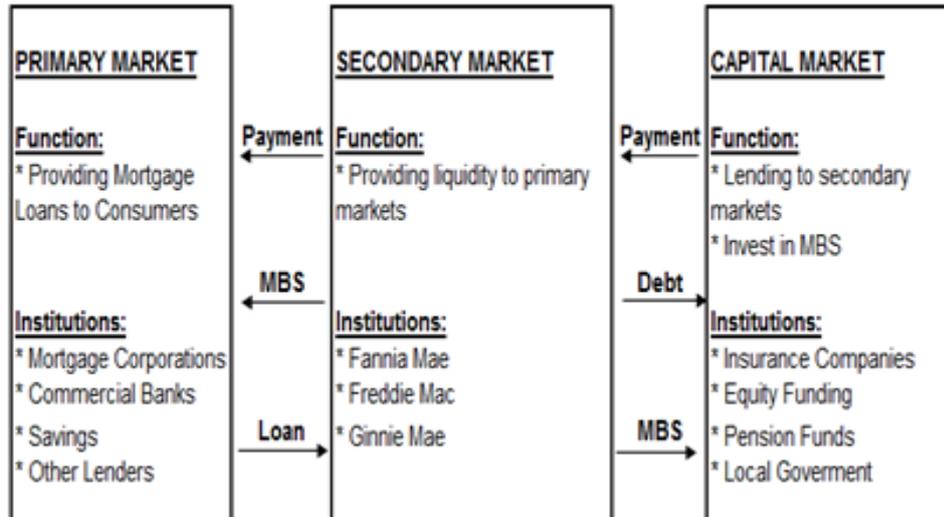
Fabozzi (2001) illustrates mortgage as following:

*“A mortgage is a loan secured by the collateral of some specified real estate property and is a contractual agreement between the lender and borrower that pledges the property to a lender as a security for the repayment of the loan through a series of payments.”*

In other words, Berberoğlu (2009) defines a mortgage as a debt which provides purchase a home, land or other real property.

Oksay (2006) states that in this type of loan, while financing institutions give mortgage loans, they place a mortgage on the property subject to guarantee their selves. With this feature, the concerned loans give collection right to credit vendor through converting of hypothec into cash as limp of promised payments by borrower.

**Table 1: Function and Institutions in U.S. Mortgage System**



Source: Kömürlü, R., & Önel H. 2007, 'Türkiye'de Konut Üretimine Yönelik Kaynak Oluşturma Model Yaklaşımlar', YTÜ Mimarlık Fakültesi E-Dergisi, vol:2, p: 95.

As shown in Table 1, Aydođdu (2007) shows that mortgage is processed in two markets: primary and secondary markets. Primary markets mainly depends on mortgage of real estate property in favor of lender or in the future residential estate rental by consumers through financial leasing in order to obtain property in return the loans consumers obtain for residential purpose; secondary markets also relies on the claims or the value of real estate that is an asset in financial leasing by funds (housing finance or asset finance fund) via securitization (mortgage back or asset back securitization) and usage of gains from these securitized mortgage or assets in terms of refinancing of primary markets.

Mortgage is a kind of consumer loan but the most important features distinguish from other consumer loans are; having long term, being a system based on the mortgage and usage of derivatives in order to refinance of portfolios and liquidity for the system.

### **3.2. Participants in the Primary Mortgage Market**

The actors in the primary markets, which include the relationship between the borrowers who intend to buy a real estate and lenders who are credit provider, are as following:

1. Mortgagors
2. Mortgage Originators
3. Insurance companies
4. Investors
5. Other actors in the market.

#### **3.2.1. Mortgagers in the Mortgage Market**

The origin of the mortgage system is application to creditor aiming to obtain credit for home ownership. The individuals who want to buy a real state but do not have enough money can apply for mortgage loans if they

meet the requirements which are put by financial institutions. Following application process, creditor focus on lenders' ability to pay and the value of appraisal value of real estates which are mortgaged in return mortgage loans. The evaluations in this step become important for the purposes of healthy system.

The clarifications of income properties assist to determine customers' profiles and payment system with optimum principle amounts and monthly payments. On the other hand these evaluations are not only belonging to creditors, customers should make objective assessments about their possible loans. Consumers should gather detailed information related with payment procedure in terms of advantages and disadvantages or future value and risks of their real estate because creditors utilize in all chooses to be preferred by the customers.

Time value is another factor that should be evaluated by the customers. The important thing is the aim of real estate according to customers. Long term mortgage loans are logical if customers plan a long home stay in the real estate but it should be opposite in loans for investment purposes or resources and income owned by customers are determinant for long or short term mortgage loans. For instance, a customer who has enough saving to pay higher principle amount can shorten instilment period. Higher principle amounts help to eliminate risk therefore he pays lower interest rates and lowers monthly payments.

### **3.2.2. Originators in the Mortgage Market**

The creditor institutions are commercial banks, constructions institutions, pension funds, insurance companies, leasing companies...etc.

Oksay (2006) highlights the basic functions of credit institutions in primary mortgage market as following:

- *'Give credit,*
- *Issue mortgage back securities based on these loans,*
- *Manage repayment process and translate these payments to MBS investors.'*

These companies generate income through application and origination fees, selling them in secondary markets or hold them in their portfolio.

Oksay (2006) denotes that origination fee is expressed in terms of points, where each point represents 1% of the borrowed funds. For example, an origination fee of 2 points on a \$100,000 mortgage is equal to \$2,000.

These institutions rate borrowers on qualitative assessments such as consumer characteristics, guarantee, life standards and quantitative assessments such as income level and continuity of this. This is called as "Scoring Method". The real value of this method reflects quality of mortgage loans. The financial institutions can organize scoring method or apply for consultancy to another firm.

In the scoring method, a limit is established to determine the level of clients' qualifies for acceptance. If results exceed the fixed upper limit, this indicates that the risk is too high and the applicant will be rejected or if score is lower than the fixed lower limit, applicant will be accepted. The real value of this method reflects quality of mortgage loans. The financial institutions can organize scoring method or apply for consultancy to another firm. Besides, credit scoring facilitates risk-based pricing. In other words, financial institutions charge higher interest rates for borrower with low scores and charge lower interest rates for borrower with high scores. Therefore, depending on customers' score level cost of funding varies.

During evaluations by financial institutions, consumers' ability to pay of monthly payments and other significant features of collaterals are pointed out. The standards for determination of "Payment to Income" and "Loan to Value" ratios have significant role in measuring capacities of

collaterals and consumers which are the basic of mortgage loan. The acceptable levels for these ratios differentiated from country to country due to economic and financial structures in these places. For example in U.S. “payment to income” ratio should be 35% maximum while in Turkey this ratio is acceptable up to 60%. In other words, if consumers realize their loan payments with at most 35% of income in United States and 60% of income in Turkey, this kind of loan can find acceptance. If these ratios come closer to optimum level, the value and quality of loans will increase.

### **3.2.3. Insurance Companies in the Mortgage Market**

According to Oksay (2006), insurance companies locate as a an important actor in the mortgage system due to contribute to sustainability by securing risks by mortgage, in interest paid loans guarantee principle amounts with saving products and undertake investor role in secondary markets to buy and sell funds.

The saving products offered by insurance companies are endowment policies and private pension plans. By this way, they ensure repayments of mortgage loans by tending consumers to save.

In addition, insurance companies undertake a guarantor role against defaults in repayment process in terms of consumers and lenders.

Güzey (2009) states that long term mortgage loans depend on the availability of long term investors in the capital markets. These long term investors are predominantly corporate investors such as private pension funds, insurance companies, etc. In short, these companies are effective for the purposes of primary market’s funding.

#### **3.2.4. Investors in the Mortgage Market**

Investors are the key factors that provide translation of funds to primary markets. Actually, they have important role in mortgage system through source of fund via buying securitized mortgage loans.

The mortgage backed securities are marketed to investors to raise funds in the market. The originators deduct servicing or guarantee fees from mortgage loans. By investors' activities in the mortgage market, products become more liquid.

Investing in mortgage market includes risks such as prepayment risk. When the interest rates fall, borrowers tend to make prepayments to benefit from lower rates which force investors to reinvest with lower returns.

#### **3.2.5. Other Actors in the Mortgage Market**

The other actors in the mortgage system are real estate valuation experts, brokers and capital markets institutions.

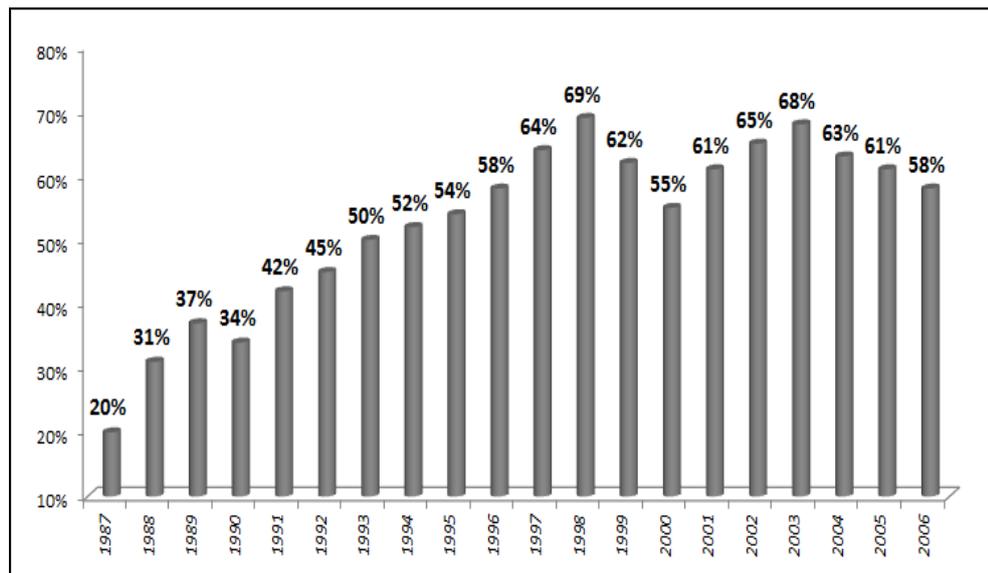
Demir (2005) explains that in the long term mortgage system, valuation is analysis of real estate sale and all conditions related with these process for financial decisions. As a result of valuation process financial institutions can make right decisions about amount of credit, interest rate, time interval for repayment and guarantee conditions.

In addition, financial institutions work with brokers that undertake intermediary role behalf of them in mortgage system to assist in customer assessment. Brokers are responsible for credit consultant rather than creditor. Banks offer only existing credit packages they own to customers but brokers take offers from various local banks or banks around the country in order to create more attractive alternatives. In the face of limited financial strength of local banks, national banks' in the brokers' national networks present advantages.

In Figure 1 the share of mortgages that originated by brokers is showed year by year. In 2003 the share of brokers among real state credits climbed to 68% because individuals that are eligible to receive credits in case of apply directly to a bank, can obtain credits through brokers easily.

As shown in Figure 1 above, the share of mortgage origination ramped up as of 1991 with increase demand in mortgage loans especially through loosing standards in mortgage originations. The pick point in originations by brokers was experienced in 1998 as 69% of total originations and this share decreased beginning from 2004.

**Figure 1: Mortgage Brokers Accounts in Recent Mortgage Originations**



Source: Barth J. R. & Triphon, T.L. & Phumiwasana, G. Y., 2008, 'A Short History of the Subprime Mortgage Market Meltdown, Milken Institute, p.:6.

On the other hand, capital market institutions ensure selling of securities gathering in the pool.

### **3.3. Types of Mortgage**

Mortgages can mainly be classified into two groups according to repayment amounts (Fix Rate Mortgage vs. Adjustable Rate Mortgage) and quality (Prime vs. Subprime Mortgages).

#### **3.3.1. Fixed Rate Mortgage**

Fixed rate mortgage is a mortgage loan in which preconcert interest rates are performed throughout the life of the loan.

McDonald states that the most common mortgage type is fixed rate mortgage, which is about 70 percent of the total mortgage market.

In FRM interest rates are relatively higher than market interest rate but homeowners make constant payment regardless the market conditions. On the other hand, interest rates produce a dominant conundrum for most homeowners have to procure their home with FRM in volatile markets. For example, as interest rates increase in the country, people tend to lend cheaply from a financial institution to close the loan but this prepayment risk has some penalties such 2% of remaining loan. Therefore, FRM can create prepayment risk for financial institutions and interest rate risk originated from market volatility for counterparties.

#### **3.3.2. Adjustable Rate Mortgage**

Adjustable rate mortgages are the mortgage loans in which interest rates are adjusted periodically generally every six months throughout the life of loan in order to bear interest rate risk for borrowers and financial institutions. These loans index mainly the Eleventh Federal Home Loan Bank Board District Cost of Funds Index (COFI) and the National Cost of Funds Index.

Table 2 refers ARM has lower interest rates mainly in line with market rates comparing with FRM interest rates due to level of protection

against interest rate risk that fluctuated by several factors in the market such as economic, political, etc.

**Table 2: Comparison of Fixed and Adjustable Rate Mortgages**

<b>Comparing Effective Interest Rates on Fixed- and Adjustable-Rate Mortgages (assuming an LTV ratio between 0.8 and 0.9)</b>			
	<u>Fixed Rate</u>	<u>ARM</u>	<u>Difference</u>
1997	7,91	6,95	0,96
1998	7,21	6,69	0,52
1999	7,47	6,93	0,54
2000	8,3	7,5	0,8
2001	7,19	6,72	0,47
2002	6,84	6,13	0,71
2003	6,05	5,2	0,85

*Source: Mc Donald, D. J. & Thonton, D.L. 2008, 'A Primer on The Mortgage Market and Mortgage Finance', Federal Reserve Bank of St. Louis Review, p:34.*

According to Federal Reserve Board article (2003) in addition to these advantages, the consumers protect themselves regarding an increase in interest rates in the future. On the other hand, the consumer can use ARM to get a lower initial rate in exchange for assuming more risk over the long run. To avoid risk in the long run, upper and lower bounds are determined.

Besides, in contrast with FRM, in ARM, interest rates and principle amount per month vary from month to month that is the main reason for uncertainty. To clarify ambiguity, counterparties determine beginning interest rate, time intervals at which interest rates adjusted and the basic index used for adjustments.

In ARMs financial institution arrange monthly payments and the term of loan according to borrowers' monthly income, ability to pay, etc.

### **3.4. Effects of Mortgage System on Economy**

Eriş (2008) specifies that unlike other consumer loans mortgage loans do not fall within import so it has higher usage rate in domestic spending that contributes to economic growth.

Mortgage system provides real estate ownership in suitable conditions to middle income consumers, who have not enough saving, through the availability of credit resources. As a result of increasing demand in mortgage loans, the expansion of credit volume occurs as well as increase in buy-sell facilities and product range in the secondary market so financial sectors deepens. Also, economic growth will be achieved by transferring these funds to economy.

Oksay (2006) denotes that one of the basic indicators of financial deepening is the transferring rate of financial sector funds to real sector. Depending on this rate level, financial deepening will increase, and therefore economic growth increases. In the event of low rate, due to lack of resources in real sector through weak financial deepening, economic growth will not be at a desired level.

The funds transferring to real sector ensure particularly development of housing sector and the sectors in connection with this sector. Thus, in parallel with growth in housing sector labor requirements will increase and this positively influence employment in the country. Increase in unskilled labor, needs of this sector, can decrease unemployment and ensures emergence of new expertise fields with the need such as real estate valuation expertise, mortgage brokerage...etc.

However, Eriş (2008) also indicates that transfer of funds just limited with housing sector lead to contraction of others sectors in the country and production, trade and employment in these sectors will cause the fall. With the growth in housing sector increase in demand for unskilled workforce and decline demand in qualified workforce in narrowing sectors cause to

decrease in qualified labor in the country. In order to create resource in narrowing sectors, hot money, syndicated loans, private sector foreign credits and securitization are mainly requested.

Mortgage system can be a solution for housing problem, a construction with infrastructure, buildings not generate health risk, healthy living conditions and quality of life will be provided.

## **4. THE SECONDARY MORTGAGE MARKET**

Early housing finance system depended on a simple basis, called as originate-to-distribute model. According to this model, borrowers lenders mainly banks and saving and loan associations and depositor took place in the mortgage market. Funding of mortgage loans were almost provided from depository institutions and were held in lenders' balance sheets until they were repaid.

In 1970s primary mortgage market funding shifted to capital markets rather than depository institutions, represented as originate-to-distribute model. Mortgage loans gave in primary markets have started to be pooled and bundled in the secondary markets in order to be sold to investors as mortgage backed securities in the capital markets. Holders of an MBS have the right to receive the principal and interest payments made by mortgage borrowers in the underlying pool, which is held by a trust on behalf of MBS investors.

Yücel (2007) points out that secondary markets increase liquidity and marketing of mortgages thanks to its link to capital markets. Mortgage backed securities are offered these markets; by this way a mechanisms that provide funds and liquidity to secondary markets and new investments instruments are created in order to be useful for investors.

Due to new way, illiquid mortgage loans have converted into liquid instruments as well as primary market funding. Also, originate-to-distribute model has allowed cost reduction, therefore lower cost of borrowing which has given a chance to be a homeowner to middle and low income borrowers.

### **4.1. Scope of Mortgage Backed Securities**

Mortgage backed securities represent an investment tool which represent creation of liquid assets and are served as an underlying asset and

refer to source of cash flow for the security. “MBSs are known as “fixed income” investments and represent an ownership interest in mortgage loans.”

In the Educated Investor Article (2009) mortgage backed securities is defined as;

*“Mortgage backed securities are also sometimes referred to as “mortgage pass-through certificates,” because the security passes through to its investors (at a specific coupon) the monthly principal and interest due on the outstanding balance of the loans backing the security, as well as any unscheduled prepayments.”*

Originators pool mortgage loans and sell them to a special purpose vehicle or an investment bank in return for MBSs formed by the proceeds of mortgages. By this way, originators isolate the pools from their risks as well as their balance sheets. These mortgage pools include the combination of mortgage loans and the certificate holder of pass through securities receives monthly scheduled payments depending on the principle and interest from the mortgages in the pool. Investment banks divide principle and interest payments into tranches. Each tranche includes different credit risk levels, therefore has different ratings. Junior tranches of MBSs absorb all the losses firstly, due to them senior tranches are protected from these losses. Due to their riskiest structure junior tranches have higher returns and longer lives. Until senior tranches are retired or paid off, they do not receive principle payments. This tranche system in MBSs called as senior-subordinate structure. Through this system investors are able to determine risk levels for their investments in exchange for returns which they are willing to gain.

MBS is issued by commercial banks, saving and loan associations, mortgage bankers and other lending institutions as well as government sponsored or quasi-government agencies such as Ginnie Mae or Freddie Mac, Fannie Mae which are the key to shift to capital markets-based funding of mortgage lending and publicly issued certificates by private

financial institutions. The originator must agree to abide by the GSEs' underwriting guidelines, which specify types of loans each GSE will buy as well as processes for verifying the creditworthiness of borrowers. Mostly investors tend to invest in agency mortgage backed securities due to their guarantees in timely and full amount payment, liquidity and its capital treatment. In exchange for providing guarantee against defaults in payments, Fannie Mae and Freddie Mac deduct guarantee fee from MBS annual interest rate.

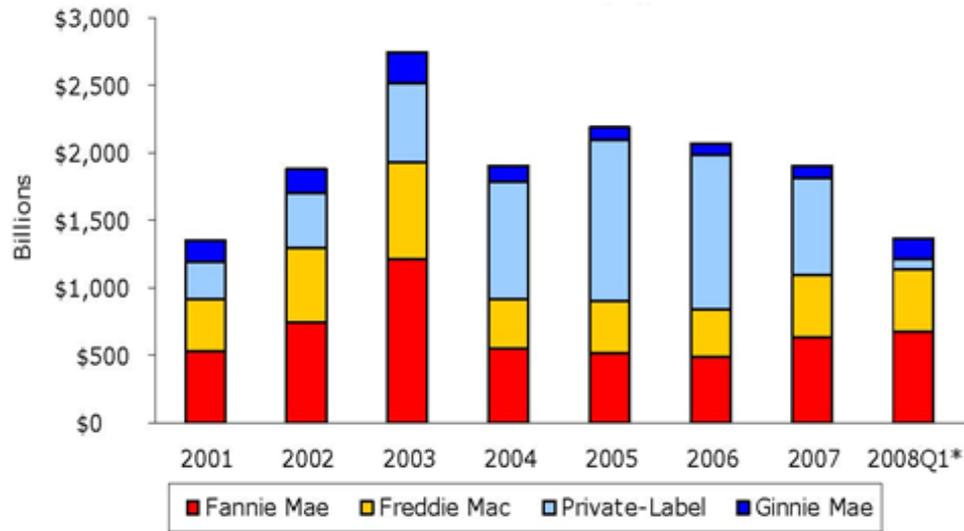
The Professional Risk Managers' Internal Association's article states that Fannie Mae and Freddie Mac undertake an important role in mortgage market. They purchase the mortgage loans and by this way, these institutions provide fresh money to banks and other financial institutions in order to make even more new loans.

While Ginnie Mae issues FHA and VA mortgages guaranteed by government, Fannie Mae and Freddie Mac that private corporations chartered by Federal Government are major issuers of conventional loans in the mortgage market. MBSs backed by government sponsored agencies carry a guarantee by government.

As shown in Figure 2 government sponsored enterprises heavily operated until 2004. Due to lower interest rates, therefore increase in subprime mortgage shares (with no documentation) non-agency mortgage originations showed a dramatic increase. In 2008, tighten standards in mortgage market led to decrease in non-agency mortgages.

According to the Office of Federal Housing Enterprise Oversight's article (2008), at the end of 2007, outstanding MBS backed by single-family mortgages totaled \$6.6 trillion. Securities guaranteed by Fannie Mae and Freddie Mac accounted for \$4.1 trillion, MBS guaranteed by Ginnie Mae accounted for \$0.4 trillion, and PLS accounted for \$2.1 trillion of that total.

**Figure 2: Distribution of MBS Issuance, by Issuer**



Source: 'A Primer on the Secondary Mortgage Market' 2008, Federal Housing Finance Agency. Available: [www.fhfa.gov](http://www.fhfa.gov).

Following up GSEs other financial institutions would securitize mortgage loans in the market. In private label, namely non-agency securitization process there is an MBS sponsor such as investment banks, commercial banks, mortgage banks...etc. They retain mortgages by originating or buying from an originator. On order to issue MBSs they transfer mortgages to special purpose vehicles (SPV).

In contrast, private label MBSs provide only cash advance provision in case of delinquencies in monthly scheduled payments and principle payments rather than government guarantee due to their non-conforming standards such as little documentation, borrower who have credit problems... etc. of quasi government agencies. Therefore, they played significant role in subprime, jumbo and Alt-A markets especially in 2000. To receive higher investment grades from rating agencies for their MBSs they use a set of credit enhancements.

In comparison with agency MBSs, private labels are smaller source of mortgage pass through securities.

**Table 3: Distribution of Mortgage Loans in Percentage**

Type of purchases	2006		2007		2008	
	By number of loans	By amount of loans	By number of loans	By amount of loans	By number of loans	By amount of loans
Fannie Mae	17,2	14,3	23,4	21,2	25,8	27,1
Ginnie Mae	2,2	1,4	3,5	2,4	11,4	9,5
Freddie Mac	10,7	8,9	15,3	13,4	16,2	16,2
Farmer Mac	0	0	0	0	0	0
Private Securitization	9	11	3,6	5	0,5	0,6
Commercial Bank or Saving Institution	6,9	7,6	6,8	7,6	8,8	8,8
Insurance Company	15,7	15,5	10,5	10,3	9,7	9,4
Affiliate of Institution	14,5	16,2	21,4	23,4	12,3	13,5
Other	23,8	25	15,6	16,7	15,4	14,8
Total	100	99,9	100,1	100	100,1	99,9
MEMO						
Share of All Originations Sold	72,2	71,9	69,5	67	73,2	72

Source: Avey, R. B. & Bhutta N. & Brevoort, K.P. & Glenn, B. C. & Gibbs, C.N. 'The Mortgage During The Turbulent Year', Federal Reserve Bulletin, p: 44.

Table 3 represents distribution of loans sold during the year of origination, by type of purchasers, number of loans, and amount of loans in 2006-2008 periods. As shown in the table, in 2006 Fannie Mae bought 17.2% of number of loans which equal to 14.3% of amount of loans originated. The share of government sponsored agencies' shares in terms of number of loans realized as 30.1%, 42.2% and 53.4% in 2006, 2007 and 2008 respectively while share of all originations sold realized as 72.2%, 69.5% and 73.2% consecutively in 2006-2008. The share of insurance companies decreased year by year as well as other institutions.

MBS shows a dramatic growth since 1970 in the secondary mortgage market. Before the innovation of this financial instrument, mortgage loans are relatively illiquid. Illiquid mortgage market refers to a risk for mortgage lenders who are not able to find buyers when they want to sell their portfolio at an acceptable price. Besides, mortgage lenders expose to interest rate risk which arose from rising interest rates that triggered the gap between their interest income and costs. MBS are beneficial to alter

these risks in order to create more attractive mortgage markets for investors and lenders. In MBS process similar loans are combined into pools and agencies are able to pass the mortgage payments through investors.

Prerequisites for Secondary Mortgage Market Development's article explains that;

*“A sustainable secondary market involves generating an on-going flow of transactions that will develop liquidity in the market, enhance investor and regulatory understanding and comfort and achieve the desired increase in availability of funds and decreased relative cost of mortgage credit.”*

By means of MBS, mortgage lenders are able to minimize their interest rate risk by moving mortgages off their balance sheets.

MSB is used as financial tool in order to use mortgage market funding. With the help of these financial instruments excess demand relative to supply can be met and this led to creation a competitive mortgage market due to existence of new financial institutions and organizations in mortgage market. Competition triggers decrease in interest rates and thrift institutions profits. By a sizeable and affordable secondary market, integration with capital markets realizes.

Banks has converted their originate-hold credit mechanism into originate and distribution model. By this way, mortgage credits in primary markets could be exported to international markets via securitization. Due to to securitization US expanded mortgage credits into financial markets in order to meet housing demand in the primary markets with funds coming from secondary markets. Liquidity from secondary markets increased especially 2000-2006 periods depending on securitization promotions.

In addition, MBS has a crucial role in US mortgage market in order to provide housing finance at lower costs to home owners. Investors such as corporations, banks & thrift institutions, insurance companies and pension funds prefer to invest in MBS due to its liquidity, yield and capital management flexibility.

Yield is the return of an investment in terms of annual percentage rate. For MBS payments are done monthly and payments differentiate according to prepayments. The price of MBS affected from interest rate change. When interest rates fall, MBS prices fall too. People tend to refinance their mortgages cause prepayment risk. The earlier than expected return of principle led to reduce in yield. By the way, average life of investment, which affects potential MBS investment return, decreases due to prepayment represented as call risk. Due to lower interest rate investors forced to make investments at lower interest rate. On the other hand, along with rising interest rates, average life of investment increases and investors are not able to anticipate reinvestment at higher interest rate what is called an extension risk in parlance of mortgage finance.

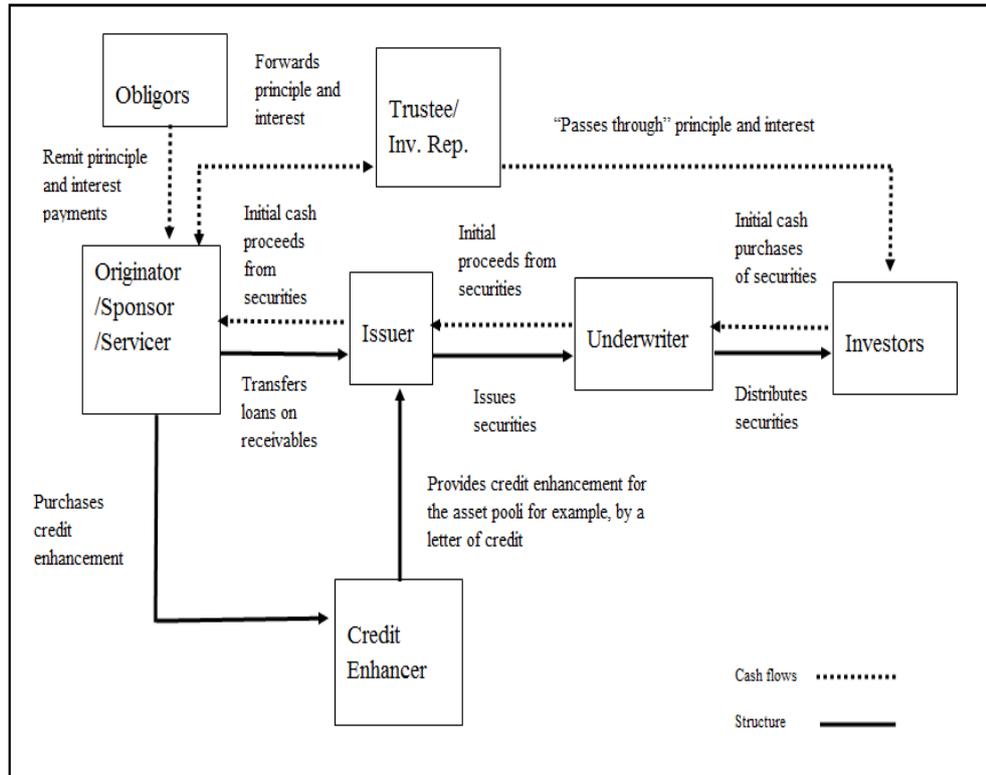
MBS prices fluctuate due to interest rate changes. MBS is sold at or close to its face value. The prices above or below face value called as premium or discount respectively. The factors such as interest rates, coupon rate, type of mortgage backing the security, prepayment rates and supply & demand.

Some investors intended to hold bonds until they mature put MBS in held to maturity accounts while some of them use available for sale accounts in order to sell them prior to maturity.

#### **4.2. Parties in a Securitization Transaction**

Securitization process includes several participants in order to provide sufficient control and necessary infrastructure. All participants in securitization process undertake specific role or roles such as originator, servicer, credit enhancer, underwriter, trustee and investor in terms of creating and analyzing the asset pools, accounting and legal terms, credit rating, administration, ... etc.

**Table 4: Parties in Securitization Transaction**



Source: Shiva, G. 1997, 'Securitization of Debt', *Head-Fixed Income & Money Markets*, Citibank, India, p:205.

As Table 4 “Parties in Securitization Transaction below”; originators pool mortgage loans and sell them to a special purpose vehicles or an issuer in return for MBSs formed by the proceeds of mortgages. SPEs are owned by originators but legally separated entities. In effort to guarantee losses the loan pools which the securitization character is added to, go through credit enhancement or rating agencies to be rated. After rating process, SPEs/issuers combine loans into an asset pool which are structured as a set of tranches or bonds. They sell these securities to investors. Underwriters are responsible for grasping the collateral in terms of the value of properties underlying the pool. Trustee is usually a bank which undertakes intermediary responsibilities between originators and investors and work as on behalf of investors in securitization process. Underwriters pay issuers with a part of proceeds they collect from the investors. As obligors make

principle and interest payments, trustees pass through principle and interest payments to investors.

#### 4.2.1. The Obligor

The Obligor is an individual who remit principle and interest payments to mortgage originator (for MBS process) in return for his payable. In securitization process the obligors, interchangeably refer as borrowers, are grouped into categories according to their mortgage credit, regency of bankruptcy, debt to income ratio, loan to value ratio, etc. which is shown in “Borrower Credit Quality Categories” below. “A: Standard Agency Quality” represents the borrowers who have the capacity to meet standards insofar as good for instance 36% debt to income ratio and 97% loan-to-value ratio with an extension credit history together with no derogatoriness.

**Table 5: Borrower Credit Quality Categories**

Generic Borrower Credit Quality Description	Mortgage Credit	Other Credit	Recency of Bankruptcy	Debt to Income Ratio	Loan-to-Value Guideline
A: Standard Agency Quality	1x30 last 12 months	No derogatories	5 yrs.	36%	97%
A-: Very Minor Credit Problems	1x30 last 12 months 2x30 last 24 months	Minor derogatories explained	5 yrs.	42%	90%
B: Minor to Moderate Credit Problems	4x30 last 12 months 1x60 last 24 months	Some prior defaults	3 yrs.	50%	75%
C: Moderate to Serious Credit Problems	6x30 last 12 months 1x60 & 1x90 last 12 months	Significant credit problems	18 months	55%	70%
D: Demonstrated Unwillingness or Inability to	30-60 constant delinquent 1x90 last 12 months	Severe credit problems	12 months	60%	65%

Source: ‘Liquidity and Funds Management’ 1997, Asset Securitization, p:9. Available: <http://www.occ.treas.gov/publications/publications-by-type/comptrollers-handbook/assetsec.pdf>

#### **4.2.2. The Originator**

The Originator is a financial institution that acts as a seller in terms of its receivable portfolios in securitization process. They create and sometimes service their receivables as well as securitize or sell them to a Special Purpose Entities (SPE) and act as last users of funds providing from securitization process in order to meet new credit demands in the market.

According to Gorton and Nicholas (2005) special purpose entity (SPE) is a legal entity created by the sponsor or originator. It undertakes some specific purpose or activities, or a series of such transactions.

SPEs have symbolic capitals because the crucial point in securitization process is quality of securitized receivable instead of financial structure of originator or SPE.

Moreover, SPEs book securities originated from receivables assigned from originator as debit while interests and principle amounts are booked as credit.

The originator assigns its receivables to SPE in return for discount. Following assignment, rights for usage of receivables pass through to SPE completely or except in the frame of agreement. By this way securitized papers isolates from originator risk. In case of agreement, should default in monthly payments rise, the originator have to dedicate new receivables or pay interest and principle payments.

Bank for International Settlements' article (2009) states that SPEs are isolated from originators risk, therefore they have bankruptcy remoteness in case of originator's bankruptcy.

In addition, if SPE has some difficulties related with source and liquidity, originator can mediate to provide liquidity to SPE.

### **4.2.3. The Underwriter**

Underwriter is an entity which is responsible for providing consultancy to seller subject to security structure, pricing and its marketing. It is also beneficial in terms of its relationships within the market, legal and structural advices.

Underwriters take on the risk of having to sell securities; therefore if they are not able to find investors for all securities, they hold some securities. Underwriters pay issuers with a part of proceeds they collect from the investors.

Lea (2000) highlighted the objectives of home mortgage underwriting as follows;

1. To control the probability and cost of default losses,
2. Satisfaction of all legal and financial requirements,
3. To meet requirements in terms of safety, secondary markets organizations and security rating services.

### **4.2.4. The Trustee / Investor Representatives**

Trustee / the Investor Representative act as a fiduciary capacity to guarantee interest and principle payments in order to preserve the rights of investors and act as on behalf of investors.

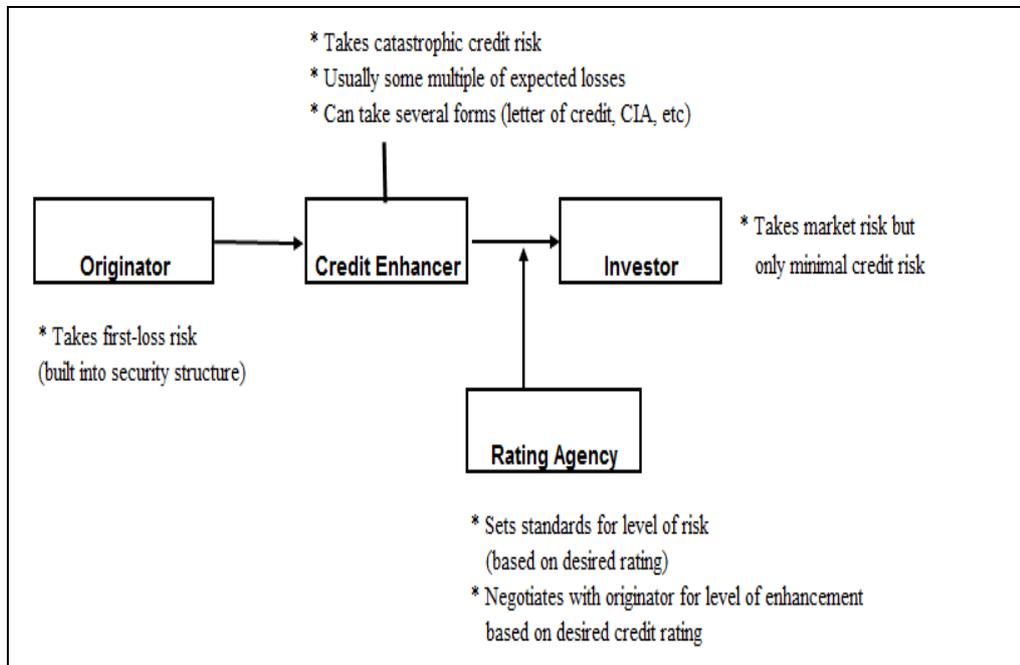
Festante (2008) defined the trustee's responsibilities as holding the receivables and maintaining the mortgage files, collecting payments on receivables from the borrowers on behalf of investors. It reviews the securitization process to ensure adequate cash flow production. Also, it requests financial information from originator and servicer throughout securitization.

#### 4.2.5. Credit Enhancement

Credit Enhancement is used for decreasing risks in securitization followed up providing improvement in credit rating. Credit enhancement is possible with a letter of credit or a surety bond from highly rated financial institutions such as banks, insurance companies or other institutions. In case of defaults in monthly payments investors have rights to apply these institutions to dedicate their interest and principle amounts.

In order to classifying credit risk, securitization creates several tranches. As “Credit Risk Diversification table” shown below, normal or expected risk refers as first loss which is able to absorb by originator. Second tranche represents higher risks that exceed originator capacity and absorb by credit enhancer. Third tranche is directly related with investors.

**Table 6: Credit Risk Diversification**



Source: 'Liquidity and Funds Management' 1997, Asset Securitization, p:20.

Credit enhancement can be separated into two groups; credit enhancement provided by external parties or internal parties. External credit enhancement includes third-party or seller's guarantee and provided by letter of credit, recourse to seller and surety bonds. Surety bonds guarantee 100% of interest and principle payments while letter of credit and resource to seller methods give limited guarantees.

Statement of Cameron L. Cowan Partner Orrick, Herrington, and Sutcliffe (2003) explained that;

*“Internal enhancements include subordinating one or more tranche, or portion, of the securities issued. This practice places the claims of one tranche over another. Any defaults affecting the securities must be absorbed by a subordinate tranche before the senior tranche is affected.”*

The credit enhancement techniques provided by internal structure are;

- 1) Overcollateralization: Overcollateralization is used when the principle amount of asset becomes greater than principle amount of security. By the way of senior/subordinate structure, overcollateralization can be used to protect senior tranche from an expected loss. Because investors who willing to buy senior tranches accept lower yield in return of lower risk. Conversely, subordinate tranches are bought by risk lover investors who willing to accept higher risk in exchange for the possibility of higher yields or losses.
- 2) Excess Spread: Excess spread is the remaining financial charges after securitization costs such as coupon, servicing costs and unexpected losses. The excess spread mainly used for unexpected losses arising from delinquencies and credit losses rather than additional profit.
- 3) Spread Account: Excess amount within a given month normally used for cover unexpected losses. In case of no need to cover these losses, excess amount reverts to originator as additional profit. On the other hand,

many trusts put this profit as reserve to protect investors against losses higher than expected in order to provide future credit enhancement.

- 4) Cash Collateral Loans: According to Hahn in many securitizations, excess spread is deposited into a reserve account. This reserve account refers as cash collateral accounts. The lender makes a loan to cash collateral account. Telpner (2003) denoted that the loan proceeds are pledged as collateral for the covered tranche and losses are funded from this account.

#### **4.2.6. The Rating Agencies**

A credit rating agency evaluates the credit risk in securitization process and undertakes a crucial role in determination of credit quality of securitized paper. The ratings by credit rating agencies are basis of product pricing as well as accepted as a reference point for investors to determine risk-income ratio.

Katz, Salinas and Stephanou state that credit ratings help to mitigate principle-agent problems through information asymmetries. The rating agencies are the main tools used during investment decisions and the guides for investors because search the credit-worthiness of a security or issuer.

Rating agencies hired by the underwriters to assess and assign credit ratings to the credit quality of pools of mortgages before the issuers and underwriters can sell them.

Ratings are investment guidelines for investors. As shown in below table ratings range from triple-A to triple-B (higher to lower) and they have a major influence on structure and pricing. Triple-A represents highest quality and lowest risk rating which provide lowest return to investor in line with its risk level. Triple-B represents minimum grade for investments which contains higher risk and return compare with triple-A.

**Table 7: Investment Grade Ratings**

<b>Moody's</b>	<b>Standard &amp; Poor's; Fitch</b>	<b>Description</b>
Aaa	AAA	Highest Rating-interest payments protected and principle is secure. Expectation of payments is extremely strong.
Aa	AA	Highly quality-expectation of payment is strong.
A	A	Somewhat more susceptible to adverse change in circumstances, but expectation of
Baa	BBB	Medium grade-investment protected, but adverse change

*Source: Forti, D. D. & Dechert, M. W. & Cleary, G. & Steen & Hamilton, 2002, 'Underwriter and Rating Agency Issues in Securitized Loan Transactions.'*

However, the unique role belongs to investors due to their investment attitudes which mainly effects value of securitized paper. Their decisions in securitization process led to an effective securitization process and benefits for counterparties.

According to Comptroller's Handbook (1997);

*"A participant can assume particular role or roles depending on their organization structure to take advantage of expertise or economies of scales like banks. Also, each role exposes to a risk varying from responsibilities in securitization process."*

### **4.3. Risks of Mortgage Backed Securities**

#### **4.3.1. Credit Risk**

One of the most important risk faced in the mortgage system fail to pay the monthly payments of not paid on time.

Credit institutions calculate default risks on loans. However, if the risk level they face occurs higher than their forecasts, credit institutions fall in difficulties about financing of new mortgage credits as well as difficulties in interest and principle payments to investors that invest in derivative products via securitization in the secondary markets.

Against default risk, the assessment of customers' profile by these institutions is important in order to minimize default risk in the credit assessment process. Customers income level and sustainability of these income, "Monthly Income/ Monthly Payment" rate, should be more as possible as the specified rate in the country. Besides, the value of real property based on mortgage loan should be determines fairly by real estate experts because the value of real property is only source of collection by the sale in case of defaults in mortgage loans in the future. Present and possible future value with liquidity rate of real estate is one of factor to decrease credit risk. In addition, default risk increases when amount of loans include 100% of real estate value. Therefore, 75% of generally accepted value of real estate should be gave for loan and remain 25% should be maintained by financial institution ensure guarantee in case of possible depreciation. In other words, "Value of Real Estate/Credit Amount" rate should be 75% at most provide minimum default amount at least.

Requested insurances in the mortgage loan approval process are of use to eliminate default risk arising from unexpected situations. For example, in the case a person's long term injury, illness or unemployment, mortgage payment protection insurance protects creditors and borrowers against credit risk by ensuring on time and on a regular basis loan payments throughout time period the person have not ability to pay.

#### **4.3.2. Liquidity Risk**

Liquidity risk represents losses of financial institutions due to fail to meet demand for new credits or obligations when they due because of

irregular monthly payments, at the time of real estate sale through defaults and lack of maturity concentrations and long term funding requirements. Also, liquidity risk depends on inability to address changes that affect liquidity of assets in the market.

Perry, Robinson and Rowland (2011) showed that the lender can be exposed to interest rate and liquidity risk when they borrow at a fixed rate.

Securitization provides to financial institutions liquidity for their balance sheets in terms of source of liquidity management, easy access to and presence in capital markets. The main problem is lack of contingency planning reflecting potential problems such as security amortization period and maturity mismatching in cash flow provided by securitization. The financial institution should find alternative funding tools for funding difficulties in case of problems in securitization amortization phase to provide its presence in the market and reputation against investors. For instance, irregularity in mortgage payments causes to delay in payments to investors investing in derivative products in the secondary market. In other words, collection and payment imbalances are embarrassing for investors in capital markets as well as financial institutions.

In addition, the risk the financial institution faced during sale of real estate is difference between buying and selling price.

Kabataş (2007) states that various kind of factors affecting liquidity transformation rate of real estate occur in cases where loan payments cannot be made and decide for sale. Physical condition of property, demanded amount and demand and supply factors in the market has effects on liquidity.

The financial institution should prepare a contingency planning that reflects possible returns and losses in various conditions. To achieve an effective liquidity management, financial institutions may arrange schedules for securities which have different amortization characteristics and include

early amortization possibilities as well as long and short term funding tools with replacement alternatives to obtain necessary amounts of liquidity quickly.

### **4.3.3. Market Risk**

Türker (2009) defined market risk as market risk, also known as price risk or systematic risk, defined as risk of asset prices affecting from opposite movements in macro-economic factors on financial status of institutions. These macroeconomic factors are mainly interest rates, stock prices, exchange rates and commodity prices.

Interest rates are consistently effective in credits. Interest rate changes for any reason can create problems for customer and financial institutions. For example, in a period interest rates increase, if the customer has a fixed interest loan, creditor will incur losses, or on the contrary interest rates have fallen, consumer will pass through hard times due to higher interest rates than market rates. Therefore, differentiation of market and loan interest rate can be prevented by adjustable rate mortgages against interest rate risk should be used.

However, Türker (2009) states that belief in adjustable rate mortgages include more default risk than fixed rate mortgages dominated. The reason for this belief is at a time increase in inflation as a result of customers' income cannot capture inflation rate customers have difficulties about fulfillment of obligations.

Exchange rates are another effective factor in the mortgage market. The important thing here is primary market loans and secondary market securitized loans are in the same currency. Because, primary market loans refers to collections and securities in secondary market represents payments for financial institutions. Therefore, collections and payments in different currencies will create a mismatch between two parts due to depreciation in

one of these currencies. For example, if loans given in TL are securitized in USD, depreciation in TL against USD causes depreciation in collections against payments and therefore losses of financial institutions.

According to Dođru (2007) if receivables and security currencies cannot be harmonized, elimination or reduction of risk is possible with “swap” or another derivative contract. However, such a derivative contract contains a certain amount in order to minimization risk.

#### **4.3.4. Prepayment Risk**

Risk of early payment or premature payment refers to full or partial payments by consumers more than expected amounts or real estate sale before maturity in default.

Yalçiner (2006) mentions about downward trend of interest rates in the market increases risk of early payment. In such cases, the person using mortgage loan can able to decide to refinance and close by early payment through provide savings in interest payments.

This situation creates risk for mortgage backed security investors because they will sell the funds as a result of early payment to other consumers with lower interest rate or the investor will be forced prematurely to reinvest at a lower interest rate than was embodied in the MBS that is being prepaid although the value of securitized mortgage loans decrease from these investments in low-interest loans.

Early payment risk is almost more common in fixed rate mortgages. Due to fix rate characteristics of mortgages mainly lower interest rates below borrowers’ contractual rate direct borrowers to refinance their mortgage loans at a lower interest rate or completely paid off. Consequently, the holders of these mortgages or MBSs exposed to prepayments.

Besides, sale of real estate before maturity prior to default triggers early payments to investors investing in securities.

Due to effect of prepayment MBS pricing models must take into account prepayment risk. Mortgage Bankers Association article (2009) explains the reason as;

*“Because investors demand different yields to lend money for different periods of time, a mortgage that is likely to pay off in two years has a very different value (and therefore interest rate) than one that is likely to pay off in seven years.”*

In order to cope with this issue, security industry practices substantial amount of analytical effort to measure and model prepayment experiences. These predictions depending on specific conditions help to determine prepayment proclivities of specific MBS pools. Also, these probabilities reflected to MBS prices in terms of investors' protection against situations led to prepayments.

Besides, one of the ways used to minimize prepayment risk is collateralized mortgage obligations (CMOs) which represent multi-tranche securities. By help of these tranches, prepayment risk distributed over three or more bond classes.

Finally, contract clauses, which include time restrictions or punitive substances for early payment in order to assist reducing payment risk, can be placed in loan agreements by financial institutions. For example, in our country early payment penalty amounting 2% of remain debt is important to be deterrent power for closing credits because this penalty creates extra cost for customer decreasing benefits of early payment.

#### **4.3.5. Performance Risk**

Performance risk is a risk encountered in secondary markets. In securitization process financial institutions securitize their possible gains in

the future. For example, if a financial institution securitizing mortgage loans sell future income rather than existing in the secondary markets, it should continue its facility until securitization process completed. If it encounters any difficulties in sustaining its facilities, performance risk will occur.

Performance risk deeply interacts with reputation and strategic decision making process. Non-performed securitization experience results as negative public opinion that may affect ability to establish new relationships or continue servicing existing relationships. Negative public opinion also represents the organization value and perception by market participants. In securitization process, reputation of originator and underwriter is important in order to achieve regular securitization and therefore trust and prices of newly issued securities. Companies must manage their internal risks as well as market risk to damp with exposure of reputation risk.

Besides, companies' strategic decisions, which represent ability to achieve strategic goals, dedicated resources for these goals and their implementation are essentially a function of reputation risk. The strategic risk exposed by securitization is the long term impacts of securitization on operations, profitability, and asset and liability management. The long term resources must be well defined in terms of sustainability of securitization facilities. Also, strategic decisions extend beyond technical, legal or contractual responsibilities in terms of credit quality and origination may increase exposure to reputation risk.

#### **4.4. Pricing of Mortgage Backed Securities**

Pricing of Mortgage-Backed Securities has been an issue in both pre-crisis and post-crisis times. The homeowners' ability to prepay mortgages makes the pricing of MBSs more complicated than simple non-callable bonds. Pricing of MBS is also more complicated than those of callable bonds due to the inexistence of one-to-one correspondence between interest

rate levels and prepayment speeds. In spite of such problems, several techniques have been developed to price MBS. These techniques can be grouped as:

**a) Static Valuation:** In order to price MBS, how interest rate might move in the future must be taken into consideration. Static valuation method analyzes only a single interest rate scenario, keeping yield curve as it is. Another shortcoming of this method is making an assumption of prepayment rate for the loan pool<sup>1</sup>.

**b) Dynamic Valuation:** Dynamic valuation methods involve running simulations for several variables such as interest rates and prepayment speed. The motive behind using simulations is path dependency of cash flows. As the current and future interest rate levels determine the possible cash flows, future behavior (or path) of interest rates primarily affect the current level of MBS price.

According to Heidari and Wu (2004) in order to expressing relative value in the MBS market financial institutions used a standard known as Option Adjusted Spread (OAS).

Not only interest rates, but also prepayment speed of borrowers is simulated when dynamic valuation techniques are in use. Prepayment speed depends on multiple factors such as actual path of interest rates, home price appreciation and slope of the yield curve, which means that prepayment option on mortgages is path dependent. In order to value an MBS properly, this path must be modeled. By doing so, possible paths that interest rate and/or other path-dependent variables can take in the future can be taken into account while pricing MBSs so that corresponding cash flows and discount rates can be calculated. The OAS, the constant spread over all these paths, includes all these information so that it equates average price of

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<sup>1</sup> Although prepayment models can be implemented to this method, such models are more effectively used in dynamic valuation techniques (Fabozzi, 2005).

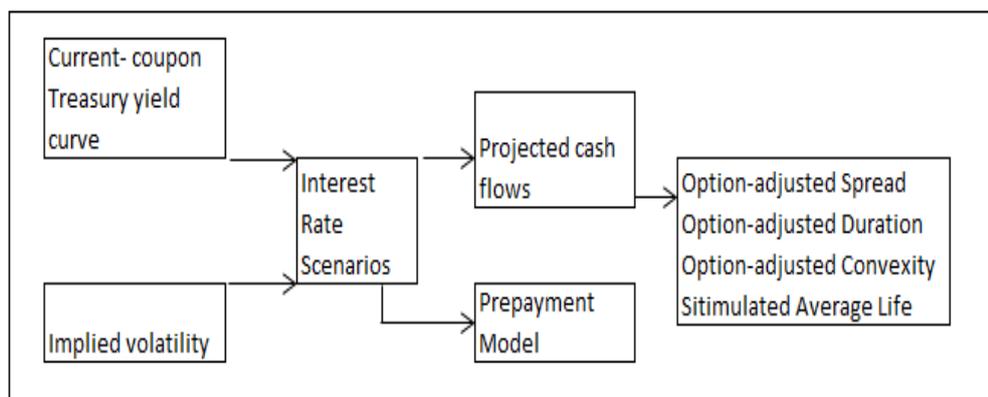
MBS to market price. Due to this fact, it is crucial to model OAS properly to avoid any market imbalances.

Bandic denotes that OAS calculations are usually done using Monte-Carlo simulations to value a security. These simulations generate thousands of interest rate scenarios, calculates mortgage securities prices along these paths and averages of these prices. The value of the security is found for each scenario by discounting the cash flows at the projected risk-free rates plus a spread. The spread that equates these averages to the market price is the Option Adjusted Spread (OAS) Model.

As shown in Table 8 the important components of a typical OAS model consist of three branches:

- Simulating Future Interest Rates by take into consideration the yield curve and volatility
- Simulating Prepayment Incentives and Calculating Prepayments
- Calculating Cash Flows and Average Present Value (of different scenarios)

**Table 8: Simulation Analysis: OAS Model Functions**



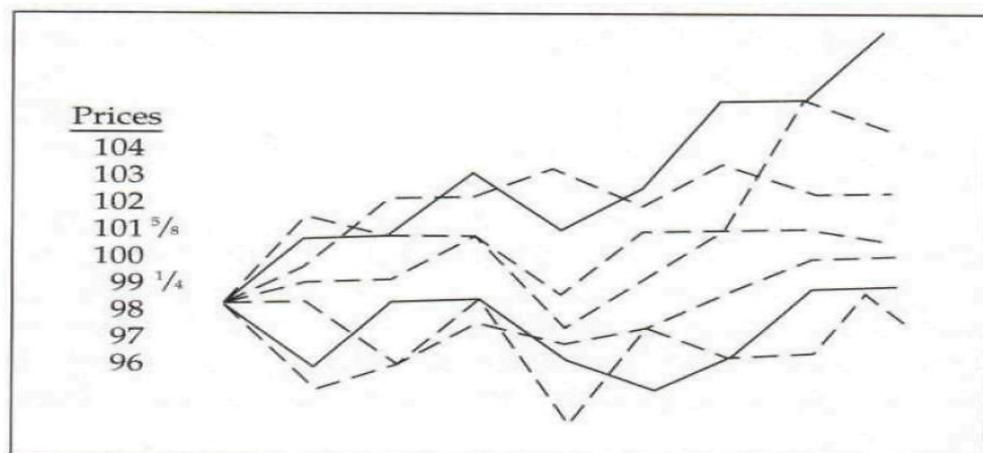
Source: Bandic, I. 'Pricing Mortgage-Backed Securities and Collateralized Mortgage Obligations', University of British Columbia, p: 21

#### 4.4.1. Interest Rate Model and Future Interest Rate Scenarios

Future interest rate<sup>2</sup> is a vital component of MBS pricing. This stems from the fact that borrowers tend to use their early repayment option or restructure their debt when interest rate goes down. In order to account for such a possibility, first how interest rates move and what they depend on must be taken into consideration. This can be achieved by simulating possible interest rate paths using mathematical models together with Monte-Carlo simulation. Once the interest rates are simulated, they will be used to determine the discount rates for cash flow projections as well.

Various models are being used in today's market. Most common ones can be named as (modified versions of) Vasicek Model in Herrala's article, Brace-Gatarek-Musiela (BGM) in Kajsajunttil's article (2004) and Hull-White Model<sup>3</sup>.

Figure 3: Simulation of Interest Rate Path



Source: Koprash, R. W., 1994, 'Option-Adjusted Spread Analysis: Going Down the Wrong Path?', *Financial Analysts Journal*, p: 43.

<sup>2</sup> The yield curve to simulate is also called the benchmark curve, which already exists in the spot market. This curve is used not only to calculate discount factors but also to assess return performance of the product it is used as the benchmark of.

<sup>3</sup> These models also connect interest rate sensitivity of mortgages to other assets in the market, such as swaps, treasuries and swaptions. By doing so, it becomes possible to do hedging of mortgages (up to a limited level) by these securities.

A good model takes into account the current term structure of yields as well as correlations between forward rates of different tenors, in addition to dependence of interest rate (of different tenors) volatility on various expiries<sup>4</sup>. Once these main features are provided, it becomes possible for structures to simulate interest rate paths. Figure X shows a set of such paths that is generated by using BGM model.

#### **4.4.2. Calculation of Prepayments**

Stein, Belikoff, Levin and Tian (2010) state that calculation of prepayment is more complicated than a simple option. Errors in deducing homeowner behavior can cause pricing errors. In the interest rate model a set of interest rate paths is provided. However, in order to price MBS properly, mortgage rate (i.e. current coupon) model is needed to obtain mortgage rates along the simulated interest rate paths. In theoretical and practical context, the rates obtained by such models are considered as rates in the secondary market. Thus, these rates must be converted into the primary mortgage rates that are aimed directly for borrowers. Generally, this is achieved by adding a constant spread<sup>5</sup> to these model-generated secondary market mortgage rates.

Once mortgage rates are simulated, it becomes possible to calculate refinancing incentives in the coming months and these incentives are then used to project prepayment speeds along simulated interest rate paths. Various models are being used to achieve this task of quantifying the behavioral fact in the market. An important point is to include non-quantitative factors, such as seasonality effect, age of the borrower, into the model used.

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<sup>4</sup> Volatility enables the model to estimate the deviation of an estimated rate from the general trend and possible direction -up or down-.

<sup>5</sup> This spread changes with time, depending on borrowers' tendencies and market conditions. When refinancing volumes spike or hedging becomes expensive, MBS originators keep this spread high in order to make refinancing less attractive or to compensate for high hedging costs.

#### 4.4.3. Calculating Cash Flows and Average Present Value

Once the possible interest rate paths and prepayment incentives are known cash flows can be calculated easily. The monthly interest rates are used to discount the projected cash flows, which are adjusted by the projected prepayments.

In the below MBS cash flow calculation model, fixed interest rate and equal monthly payment was used.  $R_n$  is annual borrower's mortgage rate at  $n$ ,  $C$  is the annual coupon,  $S$  is the annual servicing rate,  $N$  is maturity month,  $m$  is the MBS valuing month and  $MB_n$  is remaining balance at  $n$  without prepayment.

In Pricing Mortgage Backed Securities (MBS)-A Model Describing the Burnout Effect (Takeaki & Kobayashi, 2000) the remaining balance at  $n$  without prepayment and monthly payment were formulized as below;

$$MP = MB_0 \times \frac{R_0/12 \times (1+R_0/12)^n}{(1+R_0/12)^N} \quad (4.4.3.1)$$

$$MB_n = MB_0 \times \frac{(1+R/12_0)^N - (1+R_0/12)^N}{(1+R_0/12)^N - 1} \quad (n=1, \dots, N)$$

The principle payment was denoted as the difference of remaining balances at  $n-1$  and  $n$ . Also, it was formulized as a ratio over the remaining balance at time 0 multiplied by the interest rates that were paid until valuing date ( $n$ ) over total paid interest.

$$P_n = MB_{n-1} - MB_n \quad (4.4.3.2)$$

$$= MB_0 \times \frac{R_0/12 \times (1+R_0/12)^{n-1}}{(1+R_0/12)^N - 1} \quad (n=1, \dots, N)$$

$I_n$  represents initially scheduled interest and represents as a part of remaining balance at  $n-1$  which was equal to monthly borrower's mortgage rate over the balance.

$$\begin{aligned}
I_n &= MB_{n-1} - R_0 / 12 & (4.4.3.3) \\
&= MB_0 \times \frac{R_0 / 12 \times \left[ (1 + R_0 / 12)^N - (1 + R_0 / 12)^{n-1} \right]}{(1 + R_0 / 12)^N - 1} \quad (n = 1, \dots, N)
\end{aligned}$$

$MB_n$  is the actual balance at  $n$  with prepayment and the remaining rate of total balance ( $Q_n$ ) formulized as single monthly mortalities from 1 to  $n$  or the ratio of remaining balance after prepayment and initial balance. Besides, single monthly mortality rate was the ratio of  $\Delta Q$  at  $n$  and  $Q$  at  $n-1$ .

$$SMM_n = \frac{Q_{n-1} - Q_n}{Q_{n-1}} \quad (4.4.3.4)$$

$$\begin{aligned}
Q_n &= (1 - SMM_n) \times (1 - SMM_{n-1}) \times \dots \times (1 - SMM_1) \\
&= \overline{MB}_n / MB_0 \quad (\overline{MB}_0 = MB_0) & (4.4.3.5)
\end{aligned}$$

In the below formula the unscheduled interest rate with prepayment is calculated. It is equal to monthly mortgage borrower's rate multiplied by actual remaining balance at  $n-1$ .

$$\overline{I}_n = \overline{MB}_{n-1} \times R_0 / 12 = I_1 \times Q_{n-1} \quad (4.4.3.6)$$

The total cash flow is equal to the total of  $\Delta MB$  from  $n-1$  to  $n$  and interest rate less servicing fee.

$$\overline{CF}_n = \overline{MB}_{n-1} - \overline{MB}_n + \left( \frac{C}{C + S} \right) \times \overline{I}_n \quad (4.4.3.7)$$

The average present values from many simulations give the theoretical value of MBS, which might deviate from market price of MBS. The spread that is added to the interest rates that are used for discounting the cash flows is OAS.

In order to formulate present value of an MBS cash flows and discount factors are used. The spot interest rate at the maturity date determines the discount factor. As shown in above formula delivered from OAS Analysis for CMOs (Cheyette) present value of an MBS is the total of cash flows and their discount factors for n periods.

$$PV = \sum_{(\text{periods } n)} \frac{CF_n}{(1 + r(n))^n} \quad (4.4.3.8)$$

Under uncertain conditions risk neutral probability measure is taken into consideration for MBS price calculations. In the below formula from ‘Pricing Mortgage-Backed Securities and Collateralized Mortgage Obligations’ (Bandvic) Q represents risk neutral probability measure, M is the maturity, PV(t) is the present value at time t, df(t) is discounting factor at time t and cf(t) is cash flow at time t. Price of MBS is equal to sum of discounted cash flows from time 0 to M with risk neutral probability measure.

$$P = E^Q \left[ \sum_{t=0}^M PV(t) \right] = E^Q \left[ \sum_{t=0}^M df(t) cf(t) \right] \quad (4.4.3.9)$$

Given that the simulated interest rates are expectations for the discounting/benchmark curve, OAS over this curve is also considered as the spread the investor can earn versus the benchmark curve after hedging the prepayment risk. However, it must be stressed that OAS is highly model dependent and shouldn’t lead to any implications of an MBS’s being cheap or expensive.

**A numerical example:**

Cash flow calculation for an MBS as a 5 year with 6% annual interest rate, 5% coupon rate and 1% servicing fee is as following;

R <sub>0</sub>	6%
N	60 month
MB <sub>0</sub>	\$500.000
n	18 month

$$MP = 500.000 \times ((6\%/12) \times (1+6\%/12)^{60}) / (((1+6\%/12)^{60})-1)$$

$$= 9.666.40\$$$

$$MB_n = 500.000\$ \times ((1+6\%/12)^{60} - (1+6\%/12)^{18}) / (((1+6\%/12)^{60})-1)$$

$$= 365.374\$$$

$$MB_{n-1} = 500.000\$ \times ((1+6\%/12)^{60} - (1+6\%/12)^{17}) / (((1+6\%/12)^{60})-1)$$

$$= 373.174\$$$

$$P_n = 373.174\$ - 365.374\$$$

$$= 500.000\$ \times ((6\%/12) \times (1+6\%/12)^{17}) / (((1+6\%/12)^{60})-1)$$

$$= 7.801\$$$

$$I_n = 373.174\$ \times 6\%/12$$

$$= 500.000\$ \times (6\%/12) \times ((1+6\%/12)^{60} - (1+6\%/12)^{17}) / (((1+6\%/12)^{60})-1)$$

$$= 1.866\$$$

Month	As of 16th month	17. month	18 .month
Scheduled Balance	380.936	373.174	365.374
Actual Balance	380.936	370.174	360.374
SMM	0,00%	0,80%	1,37%

$$Q_n = (1-0\%)^{16} \times (1-0.80\%) \times (1-1.37\%)$$

$$= 97.84\%$$

$$Q_{n-1} = (1-0\%)^{16} \times (1-0.80\%)$$

$$= 99.20\%$$

$$SMM = (99.20\% - 97.84\%) / 99.20\%$$

$$= 1.3683\%$$

$$I_n (\text{actual}) = 370.174\$ \times 6\%/12$$

$$= 1.850,87\$$$

$$CF_n (\text{actual}) = 370.174\$ - 360.374\$ + (5\% / (5\% + 1\%)) \times 1.850,87\$$$

$$= 11.342,44\$$$

Referring to Pricing Mortgage Backed Securities (MBS)-A Model Describing the Burnout Effect (Takeaki & Kobayashi, 2000), the total cash flow for 18 months are calculated as 172.421\$ and discounting factor is assumed as 7%.

$$PV = 172.421\$ / (1 + 0.07/12)^{18}$$

$$= 155.282,22\$$$

Depending on risk neutral probability measure the price of an MBS calculated as;

$$P = E^Q \times 476.628\$$$

where 476.628\$ represents total present values of an MBS for 60 months.

#### **4.5. Evaluation of Mortgage Backed Securities**

The originator can transfer default risk to third parties. Also, companies can convert their long term receivables in their balance sheets into cash in the short term by securitization instead of waiting for a long time to provide cash. In other words, MBS process provides liquidity to lenders to meet extra demand, moderates cyclical flow of mortgage capital and assists the flow of capital from surplus areas to deficit areas for financialization of mortgage market

Refer to managements of financial statements in Table 9 securitization also led to increase capital return by converting an on balance

sheet activity to off balance sheet. Originators benefit from risk transfer in securitization process. Statement of Cameron L. Cowan Partner Orrick (2003) argues that risk transfer allows the originator improve certain measures of financial performance.

Gashler expresses that liquid secondary market increases the availability of capital to meet the demand for new loans. This way is an efficient way in order to raise new funds in the capital markets and reduce the cost of borrowing.

The company, not able to receive investment grade note, may evaluates as investment grade company for the securitization process as long as it has strong receivables or it can provide funds, that cannot be accessed by another means of funding method, through mortgage securitization.

Besides, securitization is essential to eliminate intermediary costs in the market. The fund suppliers and fund claimants are able to contact directly in financial systems depending on securitization, therefore they have no need to intermediaries.

MBS also helps to decrease the costs of credit by lowering originator's financial costs by offering lenders a way to raise funds in the capital market with lower interest rates. Besides, it improve asset/liability together with create additional capital for expansion or reinvestment purposes.

Uğur and Erkuş (2007) specify that due to risk transfer in securitization the credibility of securities and originator are separate. In a securitization, investors do not focus on the risk of originator; instead they evaluate the creditworthiness of assets backed securities.

MBS provide higher yields compared to other instruments with same quality; followed up more protection arising from collateral overages and guarantees by entities with high and stable credit ratings.

**Table 9: Benefits of MBS**

Benefit	Description
Operating Efficiencies	<ul style="list-style-type: none"> <li>* Facilitates assets and capital management- the issuer would be positioned to either sell or retain assets</li> <li>* Allows for expansion of servicing volume at the margin thereby reducing per cost of servicing</li> <li>* Provides increased control over asset pricing as a result of the market discipline provided by</li> </ul>
Rating Agencies	<ul style="list-style-type: none"> <li>* Demonstrates ability to access alternative liquidity</li> <li>* May provide for capital preservation</li> <li>* Initiates rating agency discussions beyond the corporate ratings group</li> </ul>
Management of Financial Statements	<ul style="list-style-type: none"> <li>* May constitute a sale of assets for financial reporting purposes</li> <li>* Facilitates acceleration of income, if strategically desired</li> <li>* May improve net interest margin of on-balance sheet assets</li> <li>* Improves financial ratios (i.e. ROA, ROE) related to the balance sheets assets</li> <li>* May constitute debt treatment of receivables financing for tax purposes</li> </ul>
Efficient Means of Funding	<ul style="list-style-type: none"> <li>* Provides access to triple-A funding regardless of the credit rating of the seller/servicer</li> <li>* Offers a cost of competitive source of funds relative to many traditional debt alternatives</li> <li>* Demonstrates an alternative source of funding assets to the rating agencies and the equity market</li> <li>* Provides perfect match funding for the assets</li> <li>* Values asset portfolios at the market value as opposed to book value</li> </ul>
Re-capitalization Purposes	<ul style="list-style-type: none"> <li>* Often reduces capital requirements, enabling capital to be redeployed to fuel growth</li> <li>* Achieves greater borrowing capacity through the higher leverage obtained in selling assets through debt financing</li> <li>* Off-balance sheet financing may provide borrowing flexibility</li> <li>* Increases balance sheet liquidity, facilitating future originations</li> </ul>
Risk Management	<ul style="list-style-type: none"> <li>* Generates risk-free fee income from continued servicing of assets</li> <li>* Allows for the transfer of credit risk in the portfolio</li> <li>* Provides match funding for amortizing assets as principle payments on the assets amortize the outstanding securities</li> <li>* Diversifies funding sources</li> </ul>

Source: Russian Securitization Forum, 2007, 'The Role of Investment Banks in the Securitization Process', New York, pp: 18-19. Available: [www.rusipoteka.ru/konf/dbank-2.ppt](http://www.rusipoteka.ru/konf/dbank-2.ppt)

Allianz Global Investors article argues that offered higher yields compared to Treasuries. The main reason is to compensate investors' risk for the uncertainty due mortgage refinancing. Because mortgage prepayments, trigger when interest rates fall, MBS investors may need to reinvest their money in a lower interest rate environment, or vice versa. Therefore, uncertainty affects the price and yield of any MBS.

White (2004) expresses that;

*“The creation of securities based on the mortgage cash flows permits a “slicing and dicing” of those flows into more finely structured securities that can appeal more closely to the preferences to tolerances of investors with respect to credit risk, maturity and prepayment risk.”*

Securitization reallocates risk at many levels. By transferring much of the credit risk in the portfolio to the MBS investors, originators can reduce their own risk. This is very useful, as the originator can then take larger exposure to individual obligors as well as provides a higher degree of comfort to his creditors.

Some critics against securitization come as well as its advantages above. One of them is asymmetric information arising from nature of securitization. Asymmetric information represents full and true information that belongs to only one side among counterparties in a specific process and the other side must decide by using this information. In securitization process, servicers take action through information kept by originators. If these information about security performance does not represents correct ones, mortgage backed security system disintegrates and investors expose to losses.

There are opposite opinions about how advantages of securitization can be harmful although it is accepted as cheap funding method for companies. The most important sides are creditors and employers of companies because in securitization the receivables booked in balance sheets assigned completely or partially in return for cash. The receivables

that are fully assigned are not transferred into bankruptcy; therefore other creditors expose to default risk in terms of collect their receivables. On the other hand, companies balance can become more liquid in exchange for these receivables and keep cash instead of non-cash receivables. Despite receivables are not transferred into bankruptcy, cash from them can be used as substitution.

In addition, companies must invest these cash in useful investments because they will not able to provide cash from the receivables in their balance sheets. Therefore, they may expose to liquidity risk. Also, in case of securitization of future receivables, again there will be short of cash due to wrong investments. On the other hand, if funds from another funding method are not invest correctly, the company again expose to risk. Namely, at this point the main risk element is inefficient investments rather than securitization.

Yakışır (2008) states that there will be prepayment risk for investors. If there is an out balance sheet securitization, securities bought by investors will be paid before their due date in case of prepayment by borrowers. At this time, if interest rate in the market falls, investors must receive lower than expected return.

## **4.6. The Types of Mortgage Backed Securities**

### **4.6.1. Pass Through Securities**

The traditional mortgage backed securities are called “Mortgage Pass Through Securities”. In this type of securities, the mortgage lender pools the mortgage loans, collects the monthly interest and principle payments from borrowers and cash flows from underlying mortgage payments are passes to security investors by deducting servicing fee and other fees. Namely, mortgage pass through securities represent a direct ownership interest in a pool of mortgage loans.

Most of mortgage loans and mortgage backed securities issued or guaranteed by government and quasi-government agencies (Ginnie Mae, Fannie Mae or Freddie Mac). The credit on these securities consider as triple-A or better because they carry guarantees for timely payment of interest and principle whether or not the payments have been collected from the borrowers. Pass-through securities as reliable investment tool have higher marketability feature and this led to easier selling than individual loans.

On the other hand, mortgage pass-through securities exposed to interest rate risk and therefore, prepayment risk in mortgage market. If the interest rates decline in the market, the homeowners will tend to refinance their mortgage to take advantage of the lower cost of financing or make paying of the loan in a part or in a whole. Therefore, the security holders may get their principle back sooner than expected and have to reinvest them at a lower interest rate.

#### **4.6.2. Collateralized Mortgage Obligations (CMOs)**

The Collateralized Mortgage Obligation is a multiclass bond backed by a pool of mortgage pass-through, stripped mortgage backed securities and other whole loans. CMOs are also known as Real Estate Mortgage Investment Conduits (REMICs).

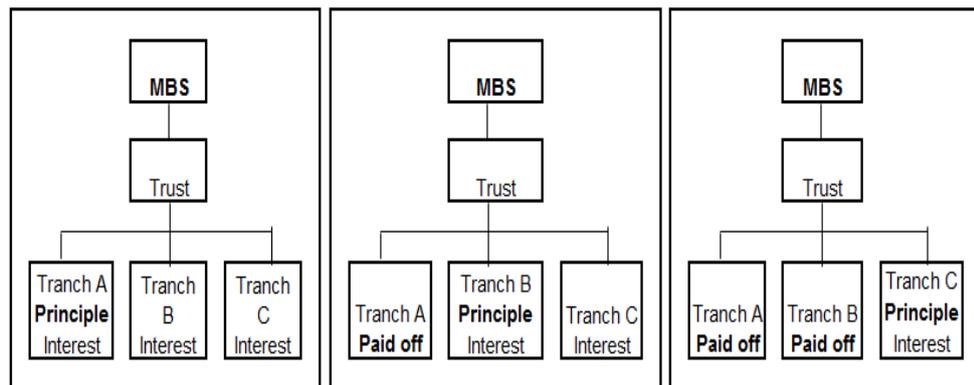
Kelman (2002) indicates that collateralized mortgage obligations are developed to reduce the prepayment risk. This instrument helps to distribute prepayment risk and meets investment time frames and cash flow needs.

According to Jaffee and Kenneth the main difference between a CMO and a mortgage pass through security is in terms of payments of interest and principle. The pass through depends on interest and principle to the holder while substitutes a sequential retirement of bonds in CMOs.

Pass-through securities exposed to prepayment risk and prepayment risk creates uncertainty in principle and interest payments. To cope with prepayment risk, CMOs are created.

In a CMO process, MBSs are pooled and scheduled and unscheduled cash flows generated by underlying collateral distributed over three or more bond classes, generally called tranches from the French word “slice”. Each tranche has effective maturity, different coupon rate and cash flow pattern in order to meet specific expectations of investors. Also, prepayment risk is redistributed among these tranches in a deliberate and sometimes uneven manner.

**Table 10: Sequential CMO**



*Source: Phifer, E. & Keegan, M. 2008, 'CMOs, GNMMAs and Other Complex Securities: What Are They and Do They Have a Place in Your Portfolio?', pp: 18-20.*

CMO issuer pays interest to the bondholders in each tranche as payments from underlying collateral are collected. As shown in Table 10 principle pay down and prepayments go first to first tranche investors (Tranche A). Other consecutive tranches (Tranche B and C) cannot receive principle payments until prior tranches are paid off. In other words, the tranches are repaid according to their subordination. The cash flow is distributed like a waterfall, the full repayment of the most senior notes

followed by the mezzanine notes and the equity tranche at least. This type of CMO is known as a “sequential pay” or “plain vanilla” CMO.

Canadian Institute of Actuaries article (1996) points out that CMOs may include 50 or more tranches. Prepayment and interest rate risk can transfer between tranches in order to reduce prepayment risk. Therefore, some tranches have abilities to absorb most of risk; and other tranches exposed lower prepayment risk. The most common tranches are Planned Amortization Class (PAC) tranches and Targeted Amortization Class (TAC) tranches. These tranches aim to reduce prepayment risk for investors and similar to “sinking fund” structure.

For PAC and TAC tranches the yields, average life and cash flow pattern are predetermined by estimating in the time of investment to provide stability over the life of the security.

Besides, PAC tranches get principle payments generating from underlying mortgage loans firstly. PAC tranches supported by non-PAC tranches that are generally known as “companion tranches”. In case of principle amounts which excess scheduled payments, excess amount are directed to these tranches. On the other hand, if payments are minimal, companion tranches have to wait retirement of PAC tranches.

Although PAC and TAC tranches have similar features, PAC tranches offer higher degree of certainty. The main reason is the prepayment scenarios. PAC bonds include a greater number of prepayment scenarios compared to TAC bonds. TAC bonds have a determined prepayment rate. Actual prepayment rate below or above this rate led to more or less principle payments to investors. On the other hand, in terms of yield, PAC bonds have lower yields than TACs due to containing lower risk, but companion tranches have higher yields compared to TAC bonds.

Demir, Karabıyık, Ermişođlu and Kűçük (2008) state that investors tend to CMOs in order to distribute their risks especially in 2007. In the

third and fourth quarter of 2007, share of CMOs increased 6% compared with prior year. In the first quarter of 2008 total value of MBS market realized as \$1.020 billion. 38.1% of this total belongs to CMOs.

### **4.6.3. Stripped Mortgage Backed Securities**

‘An Investor Guide to Pass-Through and Collateralized Mortgage Securities’ article defines stripped mortgage backed securities as;

*“Stripped mortgage backed securities, first introduced in 1986, are created by segregating the cash flows from the underlying mortgage loans or mortgage securities to create two or more new securities, each with a specifies percentage of the underlying security’s principle payments, interest payments or a combination of two.”*

In some cases, financial assets are divided into sections partially. In this case, each section can receive principle and interest payments. If financial asset is completely allocated into sections, interest rate will be transferred to one section and principle will be transferred to one section.

The section that only interest rate is transferred is called as “interest only” strip while the section including only principle is known as “principle only” strip.

## **4.7. Mortgage Systems in the World**

Housing finance in the world differentiate in terms of process even if they have the same purpose basically depending on different political, legal and economic structure among the countries. For example, whilst in U.S. mortgage back securities ensure primary market financing, Germany, Switzerland and Denmark perform mortgage bonds as well as both two systems seen in France in line with same purpose.

#### **4.7.1. Mortgage Backed Securities in USA**

US mortgage market experienced a rapid growth in 1920s due to entrance of commercial banks into mortgage market with government support and economic optimism among investors. Aalbers (2008) points out that mortgage market growth was deteriorated by Wall Street Crash in 1930 crisis that created chaos in terms of unemployment and refinancing loans. After the 1930 Great Depression, approximately 50% decline in house prices created difficulties for creditors and borrowers in terms of wealth and payment problems. Delays in payments, defaults and then foreclosures began to put pressure on the housing sector.

In order to cope with this episode, US government created “Home Owners Loan Corporation (HOLC)” to provide emergency relief to homeowners in case of foreclosures.

To assure standardization, Federal Housing Administration (FHA) and the Veterans Administration (VA) established. Due to these new institutions’ standards, interest rates were lowered depending on decreasing risks for lenders and loan maturities were extended to 25 or 30 years.

In 1932, Federal Home Loan Bank System (FHLB) was established in order to regulate and provide funds to creditors as a government sponsored enterprise..

Besides, federal government created three financial institutions to support mortgage markets:

- The Home Owners’ Loan Corporation
- The Federal Housing Administration
- The Federal National Mortgage Association

The Home Owners’ Loan Corporation was created by federal government aiming to provide funds to primary markets by government back bonds. This corporation bought the loans in default from financial

institutions and reinstates them. By this way, government became a business in the mortgage market.

Green and Wachter (2005) state that investors requested an assurance regarding receive principal balance and interest payments. The government established the FHA to meet these requests necessary for provide confidence.

In 1934, Federal National Mortgage Association, which is one of the oldest agencies, was established as a GSE in order to provide money to lenders in the mortgage market.

In 1968 Fannie Mae was moved of Federal budget and set up as a private GSE, which in 1970s switched its focus toward conventional loans to finance the mortgage market by purchasing FHA insured loans and VA mortgages during lack of funds and selling them to the market during excess funds to provide continuity of mortgage loans and after 1981 the agency has started to issue mortgage back securities. The agency can hold mortgages purchasing from originators in their portfolio or sell securitized mortgages to the investors in the market. Pools include the mortgages valued at more than \$1 million and different originators can participated in these pools. Also, Fannie Mae collects mortgages delivered from its purchase programs and sells them to investors by issuing MBS in exchange mortgages. It has guaranteed timely full amount principle and interest payments.

Due to unsatisfactory of banking system in mortgage finance after Second World War, Government National Mortgage Association (Ginnie Mae) was established in 1968 subject to be an actor in the secondary market by buying, packaging and securitizing of mortgage loans as a representative of innovation in secondary markets, called “Mortgage Back Securities (MBS)”. These securities are fully modified. This means that even if payment problems occur in mortgages, security holders take their payments on time in fully amounts. However, through this new way, funds for market markets have been provided from capital markets.

Ginnie Mae has issued two MBS programs, called GNMA1 and GNMA2. In these programs pools are formed depending on mortgage maturities, kinds and characters. The significant difference between two programs is in term of homogeneity of the pools. GNMA1 has more homogeneous pools than GNMA2 because in GNMA2 pools include different issuers, differentiated mortgages in geographical terms and mortgage size while GNMA1 pools contain same mortgages which have similar kind and issuer.

As stated by Order, In 1970, Federal Home Loan Mortgage Corporation has started to act as a private GSE secondary market and focused on MBS program for conventional loans in 1970, while Fannie Mae began its conventional MBS program in 1981. In the beginning Freddie Mac was an entity in the Federal Home Loan Bank System, and then it has transformed a market corporate oriented structure as Fannie Mae. The agency has regulated by Department Of Housing and Urban Development.

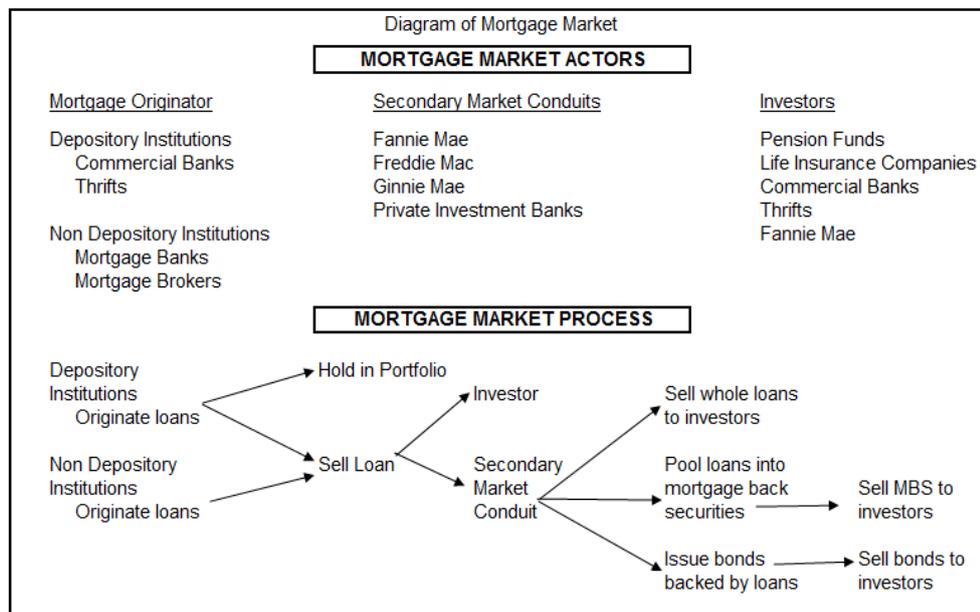
In addition, Freddie Mac can pool fixed and adjustable rate mortgages collecting by Gold Certificate program (PC) as well as FHA and VA mortgages.

Harria (2005) indicates that Fannie Mae and Freddie Mac worked on development of secondary market to meet the lenders with surplus deposits and the lenders with declining deposits. This tends to balance supply and demand for mortgage debt geographically.

In U.S. mortgage funds are provided from capital markets under free market conditions. Banks and other saving institutions transfer mortgage loans to mortgage centers with cutting service fees. Mortgage loans transfers are done in form of “true sale” referring to credit issuer does not have control over mortgage loan after transfer. In this way, creditors remove these loans from their balance sheets.

Mortgage centers may be keep mortgage loans in their portfolio or collect them in a pool in order to issue securities. The securities are completely independent from originator companies' risks. Transfer of loans through true sale cause transfer of risks to mortgage centers but mortgage centers do not reflect to securities issued by them.

**Table 11: Function and Institutions in U.S. Mortgage System**



Source: Cummings J. & DiPasquale, D. 1997, 'A Primer on the Residential Mortgage Market', National Community Development Initiative Meetings, New York, p:1.

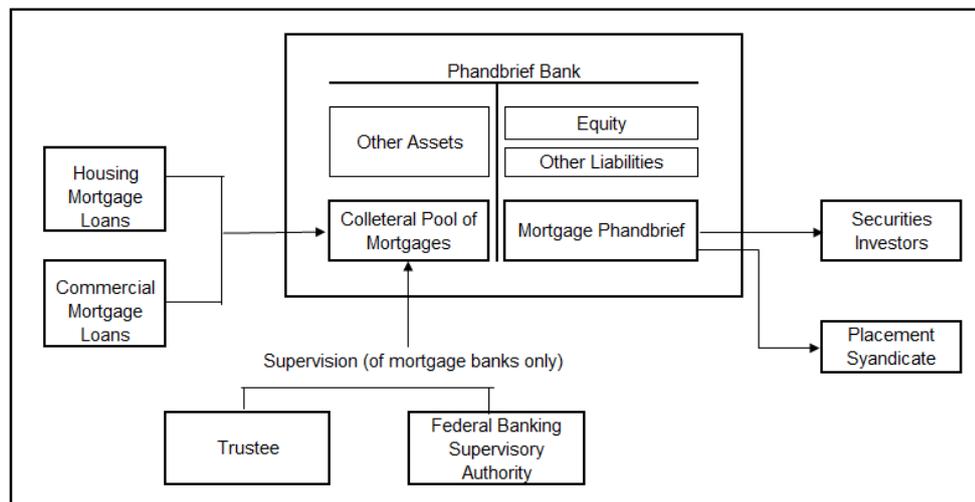
#### 4.7.2. Mortgage Backed Securities in Germany

Germany is one of the countries that have Europe's largest mortgage market. The most important factor is its well-established legal framework and domestic mortgage finance system.

In spite of these factors, mortgage backed securitization in Germany has not developed yet. The main reasons are as following:

1. The existence of Pfandbrief system which is the local mortgage system to provide effective funding for mortgage system and no need to raise funds for mortgage backed securitization due to this system,
2. Due to strict regulations and supervision in banking, sector tight control of customer data security and not keeping the securitization process warm.

**Table 12: The Pfandbrief Bank's Financial Techniques**



*Source: Verband Deutscher Hypothekenbanken Association of German Mortgage Banks, 1997, 'The German Pfandbrief Facts and Figures'. Available:., [www.pfandbrief.de](http://www.pfandbrief.de).*

In the Pfandbriefe model shown in Table 12 housing and commercial mortgage loans are collected in only one mortgage pool and the Pfandbriefe bank issues new mortgage bonds to fund new loans and the whole mortgage system by selling them to investors. Despite mortgage bonds are similar with mortgage backed securities in terms of having mortgage pools; there are significant differences between them.

Kofner (2009) remarks that the most important difference is that; in mortgage securitization process receivables are fully or partially transferred

to special purpose entities, In other words, mortgage backed securitization is a kind of off- balance sheet financing. The main risk depends on the general performance of the asset. In mortgage bonds originator issues mortgage bonds and these are put in their balance sheet. Namely, Pfhandbriefe model is an on-balance sheet model and results as excess of liabilities in originator balance sheet compared to mortgage backed securitization.

The second issue is bankruptcy whether or not to include receivables. In securitization, special purpose entities take over all the rights over assigned receivables from originator and hold them on behalf of investors. Conversely, in mortgage bonds investors have lien rights on receivables. In other words, in securitization investors have full rights on receivables whilst they are limited rights on receivables in mortgage bonds. In case of originator's bankruptcy, this is not led to be effective in securitization due to transfer of all receivable rights to special purpose vehicle and investors collect their fees regularly. However, in mortgage bonds through securities in originator balance sheet, these securities go into bankruptcy in case of originator's bankruptcy.

Another difference arises from issuance method. Special purpose entities undertake issuance process in mortgage backed securitization. These entities are symbolic and their purpose is to protect investors' rights. For this reason, the important thing is quality of securitized receivables rather than structure of originator. Therefore, MBSs are rated according to quality of receivables instead of financial structure and risk of originator. Dissimilar to MBSs, mortgage bonds are issued by strong mortgage banks or other financial institutions in terms of capital, but these securities are placed into originator balance sheet so financial structure of originator gain importance in this model. Also, ratings are mainly based on quality of originator.

### **4.7.3. Mortgage Backed Securities in Europe**

In Europe, first securitization process began in United Kingdom with mortgage backed securitization. The main reason for the emergence of this process began in the 1980s in United Kingdom is need for a source of mortgage market financing, a greater role of capital markets and favorable regulatory framework.

United Kingdom has second largest market in Europe in respect of mortgage loans and mortgage backed issuance predominantly provided by savings from specialized mortgage lenders (SMLs). MBS issuance process starting in 1980s ramped up in 1988 due to strong MBS issuance; but it experienced a stagnant period in early 1990s through housing market collapse.

Following United Kingdom, especially France and Spain involved in securitization process in 1990s. Dissimilar with United Kingdom, tight regulations and supervision have been made in both two countries.

According to Doğru (2007) the main purpose of securitization regulations in France is taking their receivables in their balance sheet out of balance sheet in order to achieve capital adequacy optimization. In France collective investment vehicles (FCCs), which are similar with special purpose entities and undertake to buy securitized receivables and issue mortgage backed securities, are available.

In accordance with regulatory legal framework, Spain has given permission to securitization by the law in 1991 and this law led to creation of new unique securitization vehicles.

Floating-interest rates are predominantly used in Europe mortgage markets. In this way, market is able to eliminate prepayment risk factors. Moreover, due to concentration of prime borrowers in the mortgage market European MBSs are mainly rated as AAA-rated MBSs.

In spite of all the positive developments, MBS issuance in Europe was not able to develop until United States. The main reasons are as follows:

1. Lack of government and quasi-government agencies that support mortgage financing effectively in secondary markets,
2. The lack of specialized housing finance companies that undertake active roles in mortgage market in Europe.

On the other hand, Pfhandbriefe model, therefore mortgage bonds take place in Europe that has a huge mortgage market rather than securitization and its product; mortgage backed securities.

Michael and Chiquierment mention that mortgage bond markets are common in a number of European countries including Denmark, France, Germany, Greece and Sweden. In Europe, mortgage banks are portfolio lenders that raise funds through the issuance of bonds. Bond investors are secured against the issuer's bankruptcy Mortgage bonds can also be issued by banks and other depository institutions that use their loans as collateral for the securities.

#### **4.7.4. Mortgage Backed Securities in Turkey**

Mortgage finance regulations in Turkey came into force as of 2007. Housing finance has been defined in law. Together with law, new models for application of mortgage system in Turkey in terms of primary and secondary markets have been developed. On the other hand, primary mortgage markets in Turkey has still in progress while secondary mortgage markets, therefore securitization have not been established due to lack of capital market depth.

Lack of secondary mortgage markets in Turkey led to expose lower risks than developed countries subject to capital markets during mortgage crisis period.

Bora and Yılmaz defends that Turkey has affected in terms of decline in funds from international markets therefore increase in funding costs and crisis effects on some European countries that export domestic goods.

Alptekin (2009) explains that in Turkey asset backed securitization replaces mortgage backed securitization. Asset backed securitization has continued as of 1992. The main financial institutions that are authorized for asset securitization are banks, financial leasing companies and general finance partnerships. Besides, the possible assets that can be securitized are consumer loans, mortgage loans, receivables of financial leasing companies, receivables from foreign trade and other receivables.

In Turkey, as long as legal requirements have been completed, banks tend to use asset securitization to provide funds. Except banks the first company that made asset securitization was Koçfinans.

## **5. SUBPRIME MORTGAGE CRISIS**

The problems originated in USA in 2007 have affected whole world due to liberalization, delinquencies in credit process, short term debt by investment banks, maturity mismatching in interest rates, balloon increases in mortgage market and deterioration in mortgage structure and over securitization. Therefore, it had bankruptcies, financial consolidations and nationalization its train.

Barth, Li, Phuniwasana and Yago (2008) state that in effort to understand current problems led to the subprime mortgage market, the changes have taken place in the US market and their contributions to crisis should be highlighted.

### **5.1. The Reasons of Subprime Mortgage Crisis**

#### **5.1.1. Liberalization**

The significant legislations separated investment banking and commercial banking was Glass-Steagal Act that was accepted as one of the most important legislations after Great Depression in 1929. With this legislation investment bank and commercial banks were separated, investment banks' authorities in collecting deposits were removed and strict applications were brought in money markets. Through liberalization in financial markets and pressure of financial innovations, liberalization stream appeared and limitations with Regulation Q and Glass Steagal Act were revoked in 1980 and 1990 respectively.

Increased competition due to liberalization commercial banks has interfered investment banks' area in effort to expand their customer portfolio. On the other hand, investment banks had to find new field of facilities and products to sustain their facilities.

In terms of new product categories, the most famous ones are collateralized debt obligations (CDOs) and mortgage backed securities that have been demanded especially after 1990s. However, liberalization that has given opportunities to new products and investment tools but they were out of regulations.

### **5.1.2. Deterioration in Mortgage Credit Structure**

Birdal (2009) denotes that developing computer market starting from 1990s became a focal point of investors in 1996-2000 with improvements in software and internet industry. Within this period Nasdaq (American Stock Exchange Technology Centre) increased from 600 to 5000. However, the index decreased to 2.000 in 2000 and then to 800. In order to pep up the economy interest rates were eased down from 6.5% to 1.5% and to 1% in 2003. Fall in interest rates led to increase in expectations related with housing price appreciation and regardless of borrowers' income level and credit history investors were moved toward to mortgage market.

Aalbers (2008) points out that one of the factors that affected subprime mortgage crisis was the expansion monetary policy of government by lowering interest rates and subsidization of abnormal borrowing among middle and low income class. Strong development was experienced especially in 1990s due to government support such as tax incentives for buyers and landlords, flexibility of credit acceptance policies, credit limits and lower interest rates depending on competition in the mortgage market.

By this way, government tried to stimulating demand for homeownership for well-being of individuals and families especially among middle and low income class.

In 1988 Basel I was published in order to bring a standard for capital adequacy in the banking sector. In the ongoing process until 2004 Basel I has been criticized.

Aykut notes that the first criticism was its insufficiency to evaluate the degree of credit risk, in other words differences among borrowers' default risk. Secondly, banks benefited from difference between measured risk and actual risk. Thus, banks' portfolios moved to lower quality assets such as subprime mortgages.

On the other hand, Aslan (2010) emphasizes that Basel II published in 2004 has emphasized risk management particularly. However, in frame of risk management buying and selling of derivative products' risks have been ignored in Basel II. In addition, Basel II has mainly highlighted capital risk and has been inadequate to evaluate liquidity risk. Hedge funds and mortgage institutions, which have not been controlled out of banking sector, have been passed over.

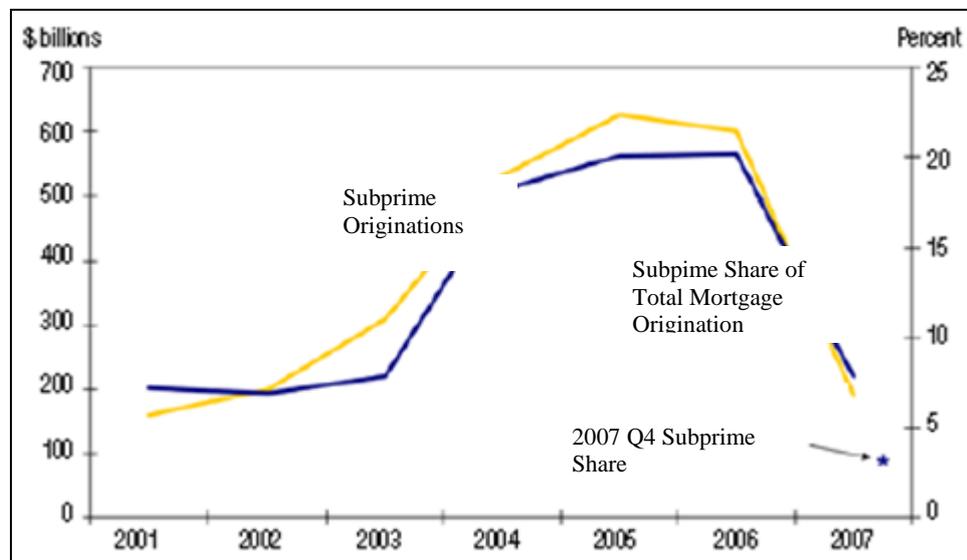
However, according to income level and credit history, borrowers are separated into three groups; prime, Alt-A and subprime. Prime borrowers represent customers with clean credit records, high income level; Alt-A borrowers represent customers with clean credit records and medium income level; subprime borrowers represent customers with less than perfect credit records and low income level.

Atay expresses that people with poor or limited credit records or high debt burdens can take on only subprime mortgages and typically pay rates at least two or three percentage points above prime loans. Also, borrowers' performance the subprime borrowers exposed to higher costs in terms of upfront costs such as application fees, appraisal fees and other fees associated with mortgage origination and continuing costs such as mortgage insurance payments, principle and interest payments. For instance due to higher probability of foreclosure and mortgage payment delinquencies, lenders apply approximately 2% higher interest rates which is called subprime premium to subprime borrowers in order to mitigate defaults effects. Also, depending on credit scores and loan-to-value ratios, interest rates varies. As Chomsisenghet and Pennington (2006) states, according to Country Wide California B&C Rate Sheet Premier Plus borrowers who

have 680 and above credit scores with 40% down payment, pay 5.65% interest rate while the same consumers with same credit scores pay 7.5% interest rate due to missing down payment.

Subprime credits which increased due to government policies allowed to easy access to people with less than perfect credit histories to mortgage markets in spite of higher interest rates. So people are able to acquire expensive properties which led to ramp up in house prices.

**Figure 4: Subprime Mortgage Originations**



Source: Federal Reserve Bank of San Francisco, 2007, 'The Subprime Mortgage Market National and Twelfth Districts Developments Annual Report', p.:8.

Above Figure 4 shows subprime mortgage originations on year basis as amount and percentage. Subprime loan origination accelerated from 2001 and picked up in 2005 depending on lower interest rates and loose credits standards. Also, after 2007 tight credit standards have been requested by financial institutions which led to decrease in amount of subprime mortgage market.

Also, this case maintained higher returns and new market opportunities to mortgage investors who earned higher interest rates than market level in the short term; however, it revealed a financial structure with higher default risk in the long term.

Subprime lending has complicated nature compared to primary market mainly due to the factors drive the subprime lending; credit history and down payment requirements. The borrowers who would fail credit history requirements in the primary mortgage market gain easy access to credit in the subprime market. This led to increase in homeownership and wealth in low and middle income classes, conversely with high cost lending.

In addition, in line with loose standards, the ratios which are used to calculate the size of a mortgage loan became flexible, too. For instance, “the second income” concept started to take into consideration for accepting applications. Due to rapid increase in home prices and real wages keeping up with inflation, people had no ability to pay the whole mortgage loans and monthly payments. By second income within a household, credit limits’ margins were able to be widened. Also “loan to value” ratio was raised to above 75% of the assessed value. Assessed value refers to selling price of a property, which is lower than the market value, in case of defaults.

Increase in the supply of mortgage credit resulted as easy access to credit markets due to looser standards such as higher loan-to value and debt-to-income ratios, limited or no documentation for borrowers’ income; together with growth in housing demand. Also, developments in the secondary mortgage market made subprime mortgage market growth easier.

Aalbers (2008) expresses that;

*“The number of new mortgages that exceed 75 per cent of the assessed value tripled between 1995 and 1999, which has increased the amount of risk faced by banks.”*

The subprime lending has increased until 1998 due to minimum lending standards based on borrowers’ income, payment history, down

payment and the local underwriters' knowledge of the borrowers. With the help of this growth, subprime market has introduced different product types and pricing tiers, therefore price rationing or risk based pricing have gained importance.

However, subprime originations declined 1998-2000; it has resumed its momentum. With decrease in interest rates and increased in house prices, borrowers gained low cost access to credit markets. More than one-half of subprime originations were for cash-out financing while more than one-third were for a home purchase.

Together with easy access to mortgage loans resulted from increasing competition in mortgage markets and loosening of mortgage application requirements, mortgage markets have developed.

### **5.1.3. Maturity Mismatching in Interest Rates**

Low interest rates coupled with loose credit standards gathered momentum in mortgage credits. Borrowers with low credit scores and income level invested in adjustable rate mortgages due to lower interest rate and expectations for permanent market growth.

Lower interest rates between 2001-2006 periods led to borrowers, who intended to buy houses, to adjustable rate mortgages in US mortgage market.

On the other hand, especially these adjustable rate mortgages' repayments reached higher levels depending on ramp up in interest rates. In the first few years borrowers paid interest rates below fixed rate mortgage rates, even if interest rates rise in the future, they could close their credits due to increase in their house values or refinance their credits by benefiting from other alternatives offered by banks.

Birdal (2009) explains that increasing house supply and demand due to interest rate reduction from 6% to 0.98% in 2001-2004 created difficulties for borrowers in case of increase in interest rates to 5.25% in 2007. Within this period, increasing interest rates resulted as decrease in house prices, foreclosure and defaults in mortgage payments.

Houses belong to subprime borrowers facing with unaffordable monthly payments and falling defaults were confiscated and they were sold to other financial institutions by banks. The supply of houses to market by banks resulted as housing price depreciation and fall in capital market instruments' prices underlying on these houses lost their value.

Greenspan (2007) notes that expectations for price increases triggered demand and create asset price bubbles. If low adjustable-rate financing had not been available, most of the demand would have been financed with fixed rate mortgages.

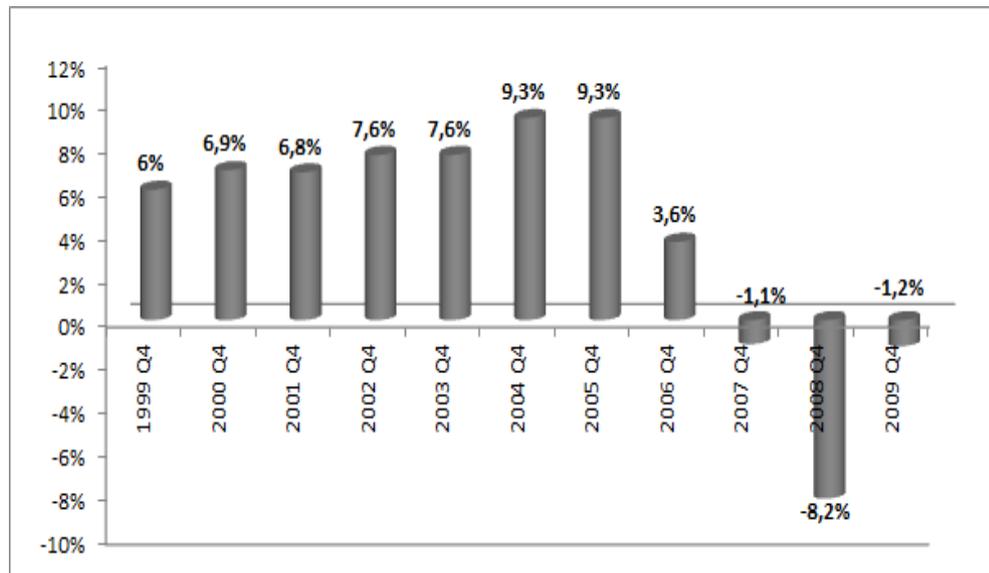
#### **5.1.4. Balloon Increases in House Prices**

Especially due to sudden increase in housing prices due to cheap borrowing opportunities housing market gained momentum and the demand for housing has increased. The lenders, who got the shaft rise in housing prices and minimum risk levels, gave credits regardless of ability to pay. Therefore, credits became available for everyone and environment that consisted on investments financed by borrowing appeared and subprime credits started to increase. With loose standards in credit process, various kind of mortgages such as lower fixed rate mortgages, mortgages without down payment...etc. have been began to use.

Crawford and Young (2009) states that the housing market developed until 2006 due to housing prices slowed and housing inventory increased.

Figure 5 shows house price appreciation over previous four quarters. According to table housing prices increased until 2005 and realized as 9.3% due to subprime loans, whilst it experienced sharp falls after 2006. Housing stocks and depreciation were the main reasons for these shortfalls.

**Figure 5: House Price Appreciation over Previous Four Quarters**



*Source: Federal Housing Finance Agency, 2010, '4Q 2009 (and December 2009 U. S Monthly) House Price Index'.*

Borrowers that preferred to obtain adjustable rate mortgages paid lower interest rates initially compared to fixed rate mortgages, but after interest rate increases their debts became a snowball and got larger and larger due to adding lower payments to capital. Also, increases in interest rates depending on a specific index caused to cut out payments.

Boom in credits and housing prices also led to boom in construction sector. However, depending on this housing stocks increased day by day.

In addition, cost of borrowing led to fall in housing prices after 2006 due to increasing interest rates. Housing price depreciation meant lower housing values compared to mortgage payments. Therefore, borrowers

undertook large amount of monthly payments. It was impossible to pay credit payments for middle or low income borrowers who used credit amounts above their ability to pay.

Borrowers did not afford to pay their debts although they sold their assets. The houses have foreclosure by these institutions which led to increase the effect of house price depreciation.

According to Greenspan (2007) with decrease in inventories of newly built homes will mitigate the effects of crisis. Very large losses will, be taken as a consequence of the crisis.

In addition, due to increasing supply depending on low interest rates and demand houses could not be sold, therefore house stocks increased. Investors were not able to sell their securities in capital markets through house stocks and value loses.

#### **5.1.5. Over-Securitization**

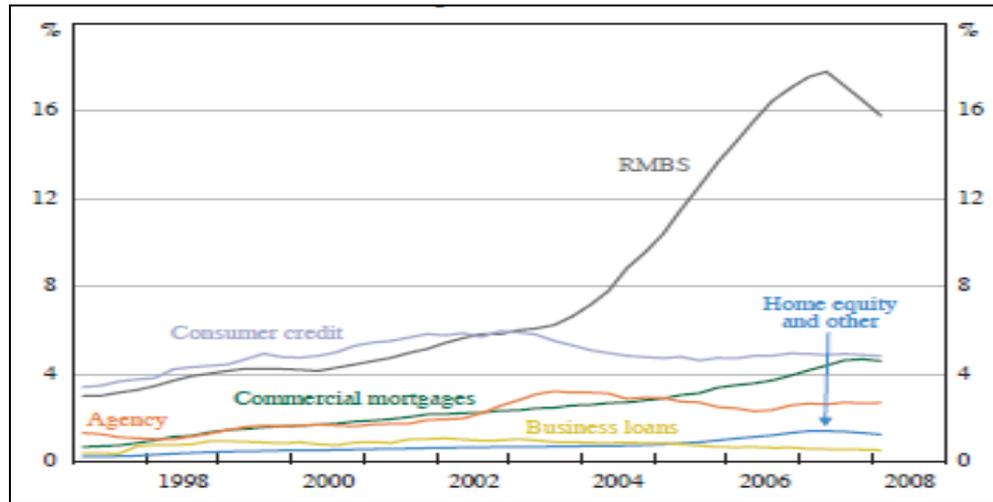
Securitization has been seen as a new funding method by originators. Securitized mortgage loans have found buyers in secondary markets; namely became liquid instruments to be traded. Easy funding by this way has reduced borrowing costs, therefore expansion in credit supply. Also, lower borrowing costs have caused more borrowing that exceeded ability to pay and increase in subprime loans.

The International Labour Office's article (2009) specifies that as the industry expanded rapidly, the quality of the mortgages issued started to deteriorate. All actors in the mortgage market tended to get high profits from selling these securities.

Figure 6 shows breakdown of securitized assets in 1998-2008. Depending on increase in subprime loans as a result of loose standards, residential mortgage backed securitization sharply ramp up in 2004-2005. After 2006 increasing interest rates and falling in house prices have resulted

as higher defaults and foreclosures in mainly subprime loans that have contributed mortgage market meltdown. Therefore, value of RMBS deteriorated and tends to decrease.

**Figure 6: RMBS versus Other Securitized Assets as a per cent of GDP**



Source: Blundell-Wignal, A. & Atkinson, P. 'The Subprime Crisis: Causal Distortions and Regulatory Reform', p:6. Available: [www.oecd.org](http://www.oecd.org)

However, with the increase in subprime lending subprime securitization increased depending on many factors. Most fundamentally, it became legal. The ability to charge high rates and fees to borrowers was not possible until the Depository Institutions Deregulation and Monetary Control acts were adopted in 1980. Also, as of 1982 variable rates and balloon payments have been permitted. Especially through Tax Reform Act in 1986, the demand for mortgage debt increased due to interest deductions on mortgages. So mortgage loans became cheaper than consumer loans. This led to increase in cash out financing which refer to higher new loans than previous loans and the borrower receives difference in cash. In 1994, interest rates started to increase and lenders could not reach higher volumes in prime markets. They tend to use subprime markets to maintain volume. This volume increase could be funded by MBS issuance.

Chomsisengphet and Pennington (2006) defends that with more than expected increase in defaults also affected secondary markets in term of MBS prices and MBS investors. MBS prices dropped and lenders had difficulties to find investors for these risky instruments. Consequently, subprime loans securitization rate dropped from 55.1% in 1998 to 37.4% in 1999 and many firms failed or purchased by larger institutions.

Securitization could reflect as increase in foreclosures in the market. In originate-to hold model originators try to find modifications for borrowers' payments because foreclosure is costly and depress the value of collateral. On the other hand, servicer act as behalf of investors may be not on the same page with lender and went foreclosure even if the efficient method has been modification.

Investors in different MBS tranches may have not shared same interests. For instance, senior tranches have preferred foreclosure due to efficient proceeds while junior tranches may have not access to proceeds from foreclosures and choose modification to get some payment.

Deterioration in mortgage credits and interest rate structures, problems in rating process have given rise to cut off in mortgage payments and naturally payments to MBS investors. However, based on fall in housing prices, MBS values have also fallen. This situation has resulted as losses of investors who had high profiles and dispositions for these instruments in the capital markets. Banks have not able to sold assets in their balance sheets due to decrease in their value and became helpless in terms of meeting credit requirements. Depending on sales pressure in secondary markets, these investment tools' prices have fallen, hedge funds have lost their value and these negative effects led to deepen crisis in capital markets. Owing to toxic assets financial system has exposed to huge losses and financial assets have been writing downed. These huge losses have increased capital requirements for institutions and constricted credits and capital export opportunities. These instruments, that have able to found purchasers in all over the world, have triggered off global effects of crisis.

Above Figure 4 shows subprime mortgage originations on year basis as amount and percentage. Subprime loan origination accelerated from 2001 and picked up in 2005 depending on lower interest rates and loose credits standards. Also, after 2007 tight credit standards have been requested by financial institutions which led to decrease in amount of subprime mortgage market.

**Table 13: Subprime Securitization of Home Mortgage Originations**

Year	Total Originations (US\$ Billions)	Prime Market Share of Total (Percent)	Subprime Market Share of Total (Percent)	Subprime MBS Market Share of Total (Percent)	Share of Subprime MBS of Subprime Originations (Percent)
1994	773	94,0	4,5	1,4	31,6
1995	639	86,9	10,2	2,9	28,4
1996	785	83,2	12,3	4,5	36,4
1997	859	78,3	14,5	7,3	50,0
1998	1.450	84,0	10,3	5,7	55,1
1999	1.310	83,2	12,2	4,6	37,9
2000	1.048	81,5	13,2	5,3	40,5
2001	2.215	87,9	7,8	4,3	55,2
2002	2.885	88,4	7,4	4,2	57,1
2003	3.945	86,5	8,4	5,1	61,0
2004	2.920	68,1	18,2	13,7	75,7
2005	3.120	62,4	21,3	16,3	76,3
2006	2.980	63,7	20,1	16,2	80,5

*Source: Barth, J. R. & Li, T. & Phumiwasana, T. & Yago G. , ibid, page:6.*

The crisis has affected the whole world, not only US due to balloon increases in housing demands and prices. Liquidity shortages have resulted as sudden purchases and sales in the markets; investors' decisions have created panic in commodity markets. Liquidity crisis have come with financing requirements, therefore banks have started to keep cash resources.

Shortly, securitization also have made financial system fragile and sensitive mainly due to mortgage defaults through lack of due diligence.

## **5.1.6. Problems in Securitization Process**

### **5.1.6.1. Deterioration in Mortgage Quality**

Credit scoring affects secondary markets as well as risk based pricing in the primary markets. In securitization process, mortgage backed securities are packaged and sold to investors. MBS packaging are almost done on the basis of these scores. MBS that have low risk credit scores priced differently compared to MBS with high risk credit scores. MBS representing high risk credit scores are traded in subprime mortgage market. The problems in this market lead to illiquid and less easy to trade MBS due to investors' doubts. Secondary market provides funds to primary market in order to finance mortgage markets. Therefore, secondary markets instruments must be liquid and easy to trade. To compensate added risk, financial institutions charge higher risk to subprime loans than prime loans. However, the main reason for crisis is selling of these risky loans to risky borrowers.

According to Crawford and Young (2009) in the second quarter of 2007, many subprime mortgage lenders had to shut down or went bankruptcy based on defaults in subprime mortgages. The meltdown of primary markets deeply affects secondary mortgage markets because the purchasers of mortgage loans pooled them and sold bonds backed by the pool (securitization) to hedge funds, insurance companies and other investors. Deterioration in mortgage loans' values meant deterioration in their values which lead to losses for investors including investment banks, commercial banks, pension funds, mutual funds, insurance companies and hedge funds.

Besides, predatory loans are the loans to specific same targets and accepted as a subset of subprime loans. In predatory lending the main aim is to take ownership from borrower instead of increase home ownership. These loans are given to high risk customers who can applied for cheaper loans

and have not enough ability to pay. Many financial institutions use lower teaser rates to sell these loans. For instance after 3 year teaser rate, they apply high interest rates until the end of mortgage loan. So in case of repeated defaults, financial institutions possess homes and acquire equity.

Funds provided from secondary market facilities reduced costs in mortgage market but due to increasing supply credit standards became loose. Together with low interest rates this led to increase in number of subprime customers and homeownership, therefore house prices. In addition, mortgage originators transferred risk to capital markets with help of securitization, so banks and other financial institutions started to applied loose standards and increased risk factors on the whole financial system. Consequently, financial institutions removed assets from their balance sheets through defaults due to deterioration in credit quality.

Missing points in securitization has expanded crisis and US crisis has become a global crisis. Deterioration in mortgage credit quality in other words increased in subprime credits, increasing credit stocks in the economy and delinquencies in regulation and supervision are the examples of these missing points.

Birdal (2009) states that government regulation and supervision remained passive especially in sales of mortgage debts and acted in accordance with big banks' requests. Delinquencies in regulations and supervisions have expressed importance of Basel II and capital adequacy.

#### **5.1.6.2. Premature Innovations in Mortgage Market**

Other factors influenced the emergence of credit crisis is premature adoptions of innovations in investments tools that were flawed and made unwisely. Primary mortgage market depends on originate to hold mortgage model whilst in secondary markets originate to distribute securities model exercised. New investment instruments such as mortgage backed securities originated with lack of awareness related with their designs.

Brenth (2007) states that mortgage backed securities are complex investment instruments in terms of valuation. Financial institutions and investors only relied on rating agencies to determine their risk level. On the other hand, most of the mortgage backed securities' tranches were highly rated, and the risk level of securities could not be determined clearly.

The other crucial problem is pricing of these MBSs and determining risks that buyers and owners of these securities. Mortgages that had different quality and risks pooled in the same pool and assumed that the pool would give the securities value. The designers of these securities thought that rating agencies determined the prices because they have no guidance for pricing methods. On the other hand, rating agencies only undertook role in rating process of these securities which overstate the value of securities. Therefore, credit markets were not able to operate effectively due to lack of accurate price and thoroughly untested innovations.

Shortly, in secondary markets which help to provide funds to primary markets and deepen capital markets, value, counterparties and risks of mortgages issued by financial institutions were not determined clearly, therefore risk assessments and analysis of securities relied on these products became harder and investors exposed to losses.

### **5.1.6.3. Non-Agency Securitization**

Savings and loan associations composed the majority of residential mortgage market and undertook the main three functions; originating, servicing and held these loans in their portfolios in the early 1980s. Thereafter, a single institution model tradition began to change since residential home mortgage loan securitization process has been carried on by primary securitizes of home mortgages such as Fannie Mae, Freddie Mac and Ginnie Mae. As well as securitization process, servicing and origination functions have started to keep up separately by other institutions which meant separate sources of revenue to be earned.

In the early 1980s savings and loan associations were heavily involved in mortgage market. The mortgage loans held in these institutions portfolios were fixed rate and thirty year mortgages. Shrinkage in long term interest rates and prohibition for adjustable rate mortgages to hedging risk led to insolvency of saving and loan associations because interest rates on their outstanding mortgage loans were below the rates on Treasury securities of same maturity. Commercial banks have been played increasing role in lieu of saving and loan associations over the same period.

Besides, three separate functions serviced by different institutions led to heavily dependence on credit scores which provide information for both lenders and borrowers in terms of assessment and price risk.

**Table 14: US Mortgage Related Security Issuance (USD Billions)**

	Agency (FNMA, FHLMC, GNMA) <sup>4</sup>		NonAgency		Mortgage-Related Issuance
	MBS	CMO	CMBS	RMBS	Total
1996	368	76	13	40	497
1997	364	180	14	55	613
1998	722	233	66	128	1.149
1999	679	208	48	91	1.027
2000	474	109	44	58	685
2001	1.086	394	64	149	1.693
2002	1.447	598	50	248	2.342
2003	2.131	626	72	350	3.180
2004	1.015	378	94	438	1.925
2005	983	364	157	740	2.245
2006	923	316	184	726	2.149
2007	1.189	277	229	537	2.231
2008	1.170	197	4	32	1.404
2009	1.734	289	9	9	2.041
2010	1.420	500	23	12	1.976
2011	1.239	377	34	3	1.660
2012	241	48	1	0	290

Source: 'Mortgage Related Issuance', Sifma Research. Available: [www.sifma.org.tr](http://www.sifma.org.tr)

Table 14 shows changes in agency and non-agency mortgage related securities in 1996-2012. According to table, the crucial increase in non-

agency mortgage realized between 2002-2007 due to lower interest rates and increase in housing demand. In the peak year of non-agency securitization was seen in 2005. On the other hand following deteriorations in mortgage quality experienced, non agency mortgage-related securities declined sharply. Also, in the first two months in 2012 their amounts equals to 1 billion USD.

Securitization process was predominantly driven by government sponsored entities until the past decade. Beginning in the second half of the 1990s, reliance on credit scoring and risk based pricing together with lower interest rates carried with increase in subprime mortgage loans and their issuance in non-agency securitization process.

Barth, Li, Phumiwasana and Yago (2008) notes that the non-agency loan origination increased rapidly depending on wide range of investors all over the world especially between 2000-2005 periods and grew from \$386 billion to \$2.2 trillion throughout this period and to 76% in 2006.

Deliban and Brian point out that while different non-agency securities may bear the same credit ratings, the rating techniques in terms of different scenarios played a critical role. The growth in non-agency MBS market has highlighted the increase in MBS credit risk, a risk that has been largely underestimated by mortgage underwriters and MBS market participants based on the assumption of continued robust housing price appreciation.

#### **5.1.6.4.Collateralized Debt Obligations**

Advisen Productivity & Insight for Insurance Professionals (2008) atticle explains that credit default swaps (CDS) are the insurance against guarantee the performance of another security and they led to losses during subprime crisis.

As of 2004 MBS investors have bundled MBSs they purchased with other asset backed securities and marketed them. In this way, Wall Street has transferred their risks from their balance sheets by transferring high risk MBSs to international capital markets. In 2005-2006 period CDOs have mainly formed from high risk mortgage credits and separated into 3 parts. First part have been belong to first title investors and been the less risky part. For instance, assumed that first part share has been 70%. This has been seen as secure part due to risk exposure only if default rate have exceeded 30% and rated as AAA. Remain 20% has contained more risk compared to first part; therefore return has been also high depending on risk level. It has been carried risk in case of above 10% default rate. Last part has been 10% share and the riskiest part, naturally highest return. This part has offered to risk lover investors.

Erdönmez (2009) denotes that at the time of increasing housing prices, CDOs included high risk credits have offered with high ratings to investors, this led to be questioned their ratings during crisis period.

Structured Investment Vehicles have been established in order to fund CDOs. Financial institutions that issued CDOs and funded them with short term, low interest debts in exchange for long term, high return expectations, have to transfer their CDOs to these institutions due to capital adequacy. The main problem has been maturity mismatching between funding and returns. During increasing interest rates, there have been problems due to liquidity shortage. In 2007 crisis, losses of upper class of CDOs and financing difficulties led to close of play for SIVs.

Sumerlin and Katzovitz (2007) note that due to link between CDO market and the U.S. housing market; CDO market was sensitive to deterioration in mortgage credit quality. Through housing inventory, prices could fall more rapidly. A fall in prices triggered delinquencies and foreclosures and created negative consequences in the CDO market.

Rating agencies have assigned high notes to CDOs due to lower default rates in most part of CDOs. In other words, rating agencies could not anticipate decreased in Alt-A and high risk mortgage credit quality and housing prices.

In the beginning of crisis, the riskiest lower parts that have protected upper classes, have rated as AAA and AA, but with crisis these upper classes have been unprotected, exposed to losses and the banks' equity have macerated through 24% delinquency rates in CDOs heavily relied on high risk mortgage credits.

Distribution of securitized mortgage credits without supervision to capital markets, securitization of these mortgage credits collected from primary markets by Wall Street and encouraged banks for issuing more bonds have triggered the effects of crisis. The banks' equity to liability ratios have increased due to losses in CDOs relied on MBSs and high risk bonds, so bankruptcies have been inevitable.

#### **5.1.6.5. Role of Investment Banks in Securitization Process**

Due to housing price expectations investment banks and other financial institutions invested in mortgage backed securities. They realized huge amount of investments by relying excessively on leverage and short term funding with taking higher risks.

Investment banks undertake various activities in securitization process. They may have subprime mortgage lenders and supported other parties with the help of repurchase agreements as well as pooling mortgages and structuring and selling securities based on pooled mortgage performance. Also, they can be buyers for these securities in order to provide liquidity to specific segments to sustain their profitability by using more leverage and funding themselves through capital markets.

Carwford and Young (2009) express that lenders often focused on sub-prime mortgages and sold to Wall Street banks and other investors, Investment banks recorded the securities with their high values. On the other hand, decreasing interest rates followed by defaults and foreclosures resulted as fall in mortgage backed securities' values; overvalued securities suddenly exposed to decrease in values.

In 2004 Securities and Exchange Commission enacted a legislation to allow higher leverage of investment banks. Due to this legislation investment banks began to use high leverage in order to benefit from fall in interest rates and acted as most of borrowers; thought that housing price appreciation would be permanent and borrowers would made their monthly payments regularly; and have invested in mortgage backed securities. Although this financial leverage method was seen as profitable in case of lower interest rates, with decrease in housing prices and delinquencies in mortgage payments led to huge losses for them.

In addition, investment bank that had no authority for collecting deposits, use short term borrowing to sustain their profitability. They benefited from more leverage, borrowed from other banks, created resources by issuing bonds and equities, and used these amounts with their capital to lend other institutions and bought bonds and equities from other institutions. On the other hand, the crucial problem is that in financial crisis periods their capital becomes fragile due to lack of authority in terms of collecting deposits. They mostly borrow from investments fund and investors. Following up the expectations with financial crisis, their borrowing resources shrunk. Due to lack of liquidity, deterioration in their funds and shrink in their borrowing resources investment banks, that financed their selves in short term, have not afford to pay their liabilities and their assets lost their value. Shortly, investment banks' resourced became unstable in financial crisis period.

Regarding to their diverse roles in securitization process investment banks have been seen as victims of the global crisis.

#### **5.1.6.6. Incentive Problems in Securitization Process**

Financial Crisis Inquiry Commission article (2010) states that securitization process system includes asymmetric information owing to lack of information for one of the counterparties. This problem causes moral hazard and adverse selection problems during securitization operations.

Festante (2008) explains that in originate-to-hold model originator undertakes all risks related with mortgage loans. Due to its risk level originator become more sensitive for approval process in terms of evaluating the borrower's creditworthiness and the value of the home. On the other hand, originate-to-distribute model allows originator to transfers risks to other actors in the market. Due to risk transfer originator has little incentive regarding to borrower's solvency. This led to moral hazard problem. Originators can sell their riskiest loans to investor's against default risk. Namely, due to risk transfer originator can hold prime mortgage loans in its balance sheet while sells more risky mortgages for securitization. Through better information kept by originator, adverse selection problem can occur. These two problems cause lower quality assets and lower prices depending on quality deterioration.

MBS investors have not been informed about these incentives and default risk originated from these problems has not been priced by issuers. Also, rating agencies have not fully understood and took into account moral hazard and adverse selection which led to deterioration in underwriting operations and high risk mortgage originations.

Post funding review refers to audit of loans that are randomly selected to verify loan quality. Moreover, some originators were able to hold MBSs in their balance sheet in order to follow up incentives and controls on

loan performance. In effort to provide secondary market transparency investors could benefit from credit scores in underwriting.

Consequently, MBS issuance resulted as fragile and sensitive financial system due to riskier mortgages through incentive problems caused when originators sell loans. Less sophisticated investors in MBs have not fully understood these incentive problems. Also, rating agencies' models have failed in taking into considerations these problems.

### **5.1.7. Problems in the Rating Process**

According to United Nations Conference on Trade and Development article (2008) a credit rating offers information about the quality of the issuer and financial instruments.

Basel II has included new view regarding to risk sensitivity and revisions with standards for securitization process. In frame of risk evaluation Basel II has offered two different approaches for determination and calculation of credit risk:

- 1) Standardized Approach
- 2) Internal Ratings Based Approach

Van (2005) defines these two approaches as; the standardized approach depends on external ratings which are provided by “external credit assessment institutions” to determine risk levels while internal ratings based approach allows banks to develop their own internal ratings for determination of risk levels subject to the meeting of specific criteria and supervisory approval.

With standardized approach rating agencies has gained importance in evaluation of risks. On the other hand during subprime crisis period problems in credit rating process led to criticisms against Basel II.

Besides, according to Katz, Salinas and Stephanou (2009) states that lack of transparency and higher complexity in mortgage market increased the role of rating agencies.

Rating agencies that evaluate securities in terms of risk and returns made significant mistakes. They could not give accurate ratings due to be financed by banks and financial problems could not be analyzed just in time. Additionally, rating agencies rated just financial institutions in terms of default risk and ignored liquidity risk and rating risk. Most of investors made decisions on the basis of ratings related with these complex products. On the other hand, high rating notes given by rating agencies decreased in 2007. While rating agencies lower mortgage backed securities' ratings, investors intended to withdraw their money form funds so it was difficult to convert these securities into cash. Inconsistency ratings shake the confidence to these agencies. Together with sales pressure in secondary markets price of these investment tools lowered significantly and this led to deepen liquidity crisis.

Rating agencies have used audited and publicly available financial statements to rate corporate debt instruments while structured debt ratings based on information supplied by originator or issuer. Also, rating agencies do not have nor able to assess historical data for innovative structured debt instruments and use computer driven stimulation models that based on market assumptions to determine default risks. These stimulation models were different and sometimes appropriate compared with traditional models and were dependent on low volatility and short term periods.

## **5.2. Effects of the Subprime Mortgage Crisis**

### **5.2.1. Effects on Financial Markets**

Mortgage backed securities and collateralized debt obligations were the main starting points for subprime mortgage crisis

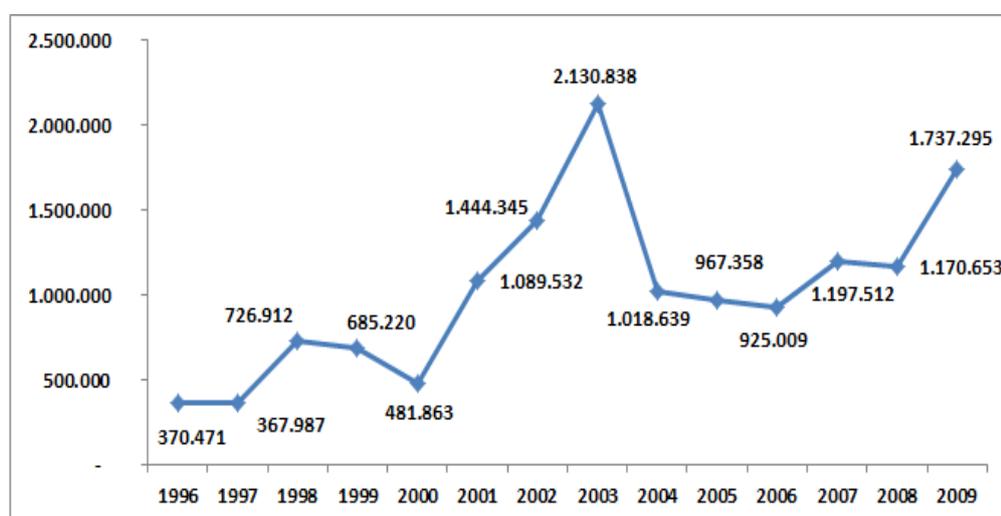
**Table 15 : US Mortgage-Related Security Issuance ( billions)**

Year	Mortgage-Related Security Issuance	Change	Total Security Issuance	Total Mortgage-Related Share in Total Issuance
2006	\$ 1.987,9	0,00%	\$ 6.130,0	32,43%
2007	\$ 2.050,3	3,14%	\$ 6.460,0	31,74%
2008	\$ 1.344,2	-34,44%	\$ 5.000,0	26,88%
2009	\$ 1.949,2	45,01%	\$ 6.900,0	28,25%
2010	\$ 1.741,8	-10,64%	\$ 6.900,0	25,24%
Total	\$ 9.073,4		\$ 31.390,0	28,91%

Source: Research Reports 2006-2007-2008-2009-2010. Available: <http://www.sifma.org/research/item>

Refer to Table 15 total US mortgage-related security issuance in the last five years (2006-2010) realized as \$31.390 billion. Total mortgage related issuance was \$9.073,4 billion. Total share of mortgage related securities in total security issuance were higher in 2006 and 2007 by 32.43% and 31.74% respectively. Mortgage-related securities experienced a shortfall as of 2008 due to housing market weaknesses.

**Figure 7: US Agency Mortgage Securities Issuance (USD)**



Source: [www.sifma.org/uploadedFiles/.../SF-US-Agency-MBS-Issuance-SIFMA.xls](http://www.sifma.org/uploadedFiles/.../SF-US-Agency-MBS-Issuance-SIFMA.xls).

As given in SIFMA Research Report (2010) issuance of mortgage-related securities were \$560.6 billion in 4Q'10, a 27.4% and 44.4% increase respectively from 3Q'10 and 4Q'09. Agency mortgage-related issuance, which was 98.4% of the total, increased to \$551.6 billion in 4Q'10, a 25.7% increase from 3Q'10 and a 39.7% increase year on year.

Figure 7 shows total MBS issuance by Fannie Mae, Freddie Mac and Ginnie Mae in 1996-2009 periods. Agency MBS ramp up until 2003 and reached its maximum level, \$2.130.838. On the other hand due to lower interest rates as of 2004, therefore housing sector weaknesses mortgage quality deterioration their agency MBS issuance decreased year by year. On the other hand, with tight standards in mortgage applications and mortgage quality increase in 2008 their issuance has increased.

According to Middle Market Report (2008) financial markets affected with foreclosures and delinquencies in mortgage markets. Following up tightened underwriting standards non-agency mortgage-backed securitization volume was affected. According to Alptekin (2009), investors with higher profile exposed to losses and avoid from risks. Credit risks were reprised and investors sold their liquid assets. Investors also avoid buying mortgage backed securities.

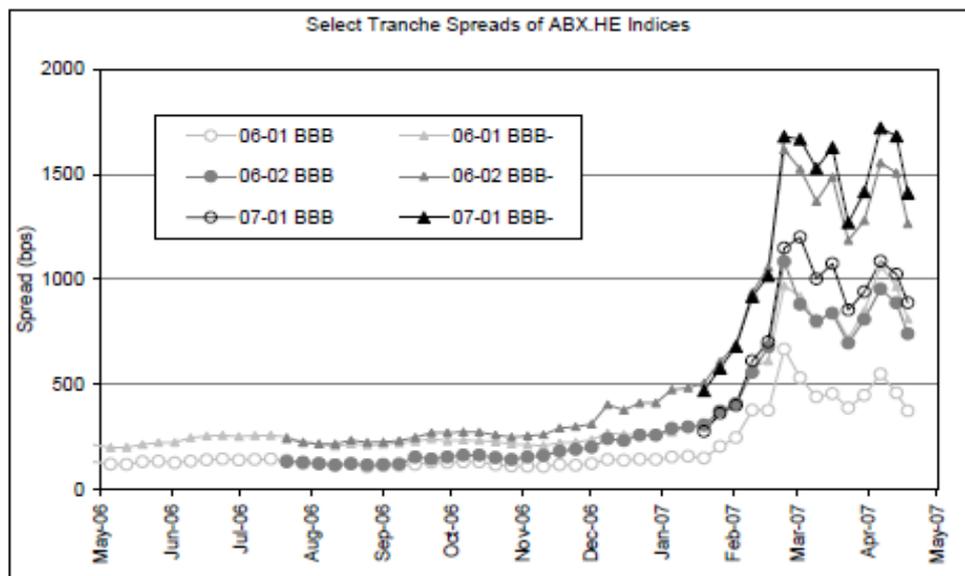
**Table 16: Fannie Mae MBS Issuance and Total Unpaid Balance**

MBS Issuance Year	Number of Loans Placed in MBS that Year	Number of Loans Currently Outstanding	Total UPB of Loans at MBS Issuance	Total Current Outstanding UPB
2002	697	393	\$ 4.657.701.035	\$ 2.217.385.997
2003	582	392	\$ 3.950.436.934	\$ 2.432.369.834
2004	217	163	\$ 1.228.175.667	\$ 870.316.223
2005	281	249	\$ 1.575.380.197	\$ 1.263.930.623
2006	259	235	\$ 984.087.658	\$ 879.619.540
2007	235	217	\$ 981.370.401	\$ 904.966.496
2008	127	123	\$ 678.908.922	\$ 631.413.126
2009	1298	1286	\$ 9.844.444.210	\$ 9.655.245.310
2010	1597	1597	\$ 10.732.112.085	\$ 10.692.500.654

Source: <http://www.fanniemae.com/mbs/mbsmultifamily/index.jhtml>.

Table 16 contains MBSs issued under Delegated Underwriting and Servicing (DUS) program and the loans with a 10 year loan term and a 9.5 year prepayment premium term). The table mainly focuses on unpaid loans at MBS issuance and its balance as of 31 December 2010.

**Figure 8: ABX Index Changes**



Source: Numura Fixed Income Strategy, 2007, 'ABX Index-The Constituent Breakdown.'  
Available: [www.securitization.net](http://www.securitization.net)

In line with defaults in mortgage payments, cost of insurance tends to increase. ABX index represents change in cost of insurance which ramped up in February 2007 due to deterioration in mortgage quality, therefore mortgage risk structure as shown in Figure 7.

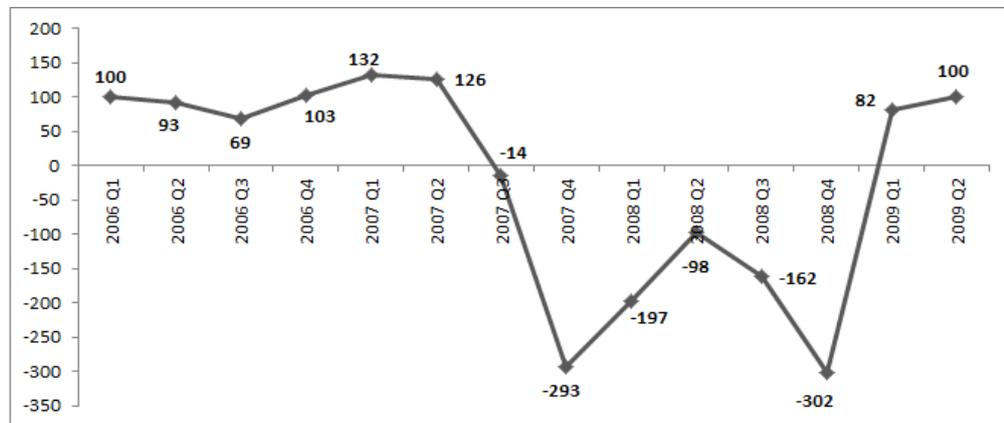
### 5.2.1.1. The Effects on Banking Sector

The credit crunch in 2007 deeply affected financial institutions, such as banks in terms of delinquencies and defaults in their loan portfolio, and write-down the value of these loans. Several banks either failed or were

merged with stronger firms, sparking public concerns for their assets and for their own financial institutions.

Bianco (2008) express that by mid-2007, earnings reductions for large Wall Street investment banks especially Bear Stearns, Lehman Brothers, Goldman Sachs, Merrill Lynch and Morgan Stanley trading in mortgage-backed securities were predicted.

**Figure 9: Investment Banking Performance Index**



Source: *The Investment Banking and Capital Markets Market Report, 2009, p:4.* Available: [www.bcg.com](http://www.bcg.com)

Below Figure 9 shows performance of investment banking that includes the period from starting point of subprime crisis 2006 to 2009. The performance index was 100 in the first quarter of 2006 and performed better till first quarter of 2007. Due to subprime market meltdown and deterioration in MBS values led to sharp declines during 2007 Q2 and 2008 Q4. On the other hand, in 2009 Q2 the index was in the same level with 2006 Q1.

Mejer and Brunner (2009) shows that Bear Stearns firstly declared its problems originated from subprime credit crisis in June 2007. In June 2007 two hedge funds run by Bear Stearns had trouble meeting margin calls. In July 2007, Bear Stearns declared depreciation in its second hedge fund

and each \$100 investment decreased to 9 cent. Consequently, Bear Stearns have acquired by JP Morgan.

Acquirement of Bear Stearns with JP Morgan was the first serious damage for financial markets.

In 2008 Lehman Brothers have faced with a unique loss following up subprime mortgage crisis. The main reason was its huge positions in subprime and lower rated mortgages. It was suspicious that whether Lehman Brothers were not able to sell these mortgages or held in their portfolio consciously. As a result in both cases, the bank experienced huge losses in 2008. In the second half of 2008, Lehman declared \$2.8 billion loss and had to sell its \$6 billion asset and its stock values fell by 73% in the first half of 2008.

Mody (2009) expresses that;

*'While Lehman was allowed to fail the message immediately was that the risk of doing so was great and subsequent public commitment to shore up the financial sector has been clear.'*

In December 2007 Merrill Lynch sold its most of the shares to General Electric and Temasek Holding. In 2008 June Merrill Lynch declared huge loss due to delinquencies and foreclosures in mortgage payments and ineffective investments. The bank decided to sell some of its hedge funds and securities; finally Temasek Company has bought these shares in order to increase its share to \$3.4 billion.

Fall in bank's hedge funds value also led to fall in value of mortgage portfolios included CDOs. Merrill Lynch that was could not pay its short term liabilities acquired by Bank of America in exchange for \$38.25 billion.

Festante (2008) notes that Goldman Sachs securitized \$2.86 billion of residential mortgages during the period of June to August of 2007. In this same period in 2006 they securitized \$18.63 billion.

From the beginning of crisis, Morgan Stanley exposed to \$15.7 billion loss while Goldman Sachs booked \$4.9 billion loss. Despite these losses, each bank declared their balance sheets in order to prove their profitable and strong structure. Through loose regulation and supervision against investment banking and lack of authorization in collecting deposits investment banks included higher risks and deteriorated structure; therefore these banks could not survive as independent banks.

FED has decided to convert Morgan Stanley and Goldman Sachs into government regulated banks. Both of them have been regulated tightly by government. This transformation means the collapse of investment banking in Wall Street. In exchange for FED's regulation, Goldman Sachs and Morgan Stanley have been allowed to access FED funds. They have been out of investment banking and acted as commercial banks in terms of collecting deposits, so they have been authorized in giving credits in effort to raise their capital.

This regulation can limit private transitions by these banks by using leverage. This means that profitable structure of these banks would be decreased. In line with new regulation the main authority that regulated and supervised Morgan Stanley's and Goldman Sachs facilities have become FED instead of SEC. On the other hand only capital issues have been regulated by SEC. These nationalized banks have been allowed to benefit from long term and lower interest rate FED funds and deposits that have been guaranteed by FED.

Table 17 represents write downs of investment banks on the value of loans due to the subprime mortgage crisis. Merrill Lynch booked highest amount of loss among investment banks by 29.1 billion.

**Table 17 : Write-downs of Investment Banks**

<b>Company</b>	<b>Business Type</b>	<b>Loss (Billion USD)</b>
Merrill Lynch	investment bank	\$29.1 bln
Morgan Stanley	investment bank	\$11.5 bln
Barclays Capital	investment bank	\$3.1 bln
Bear Stearns	investment bank	\$2.6 bln
Lehman Brothers	investment bank	\$3.93 bln
Goldman Sachs	investment bank	\$1.5 bln

Source: [http://en.wikipedia.org/wiki/List\\_of\\_writedowns\\_due\\_to\\_subprime\\_crisis](http://en.wikipedia.org/wiki/List_of_writedowns_due_to_subprime_crisis).

Erdönmez (2009) points out that financial markets experienced difficulties after the bankruptcy of Lehman Brothers in September 2008. Depending on withdrawal of \$150 billion by investors from financial markets, liquidity problems occurred, in September 2008 FED and other central banks injected \$2.5 trillion to financial markets and guaranteed direct investments in banks' bonds.

In the 'Journal of Business & Economics Research' article (2009) the effect of crisis on other countries emphasized. The crisis did not affect only the US banks. U.S. UBS, the Swiss banking giant, announced in May 2008 it would issue \$15 billion worth of shares. Additionally, it announced it would lay off 5,500 employees mainly in the U.S. and Britain..

Following up Lehman Brother's bankruptcy, in England Lloyds Bank Group which has had \$620.8 billion assets, have been nationalized.

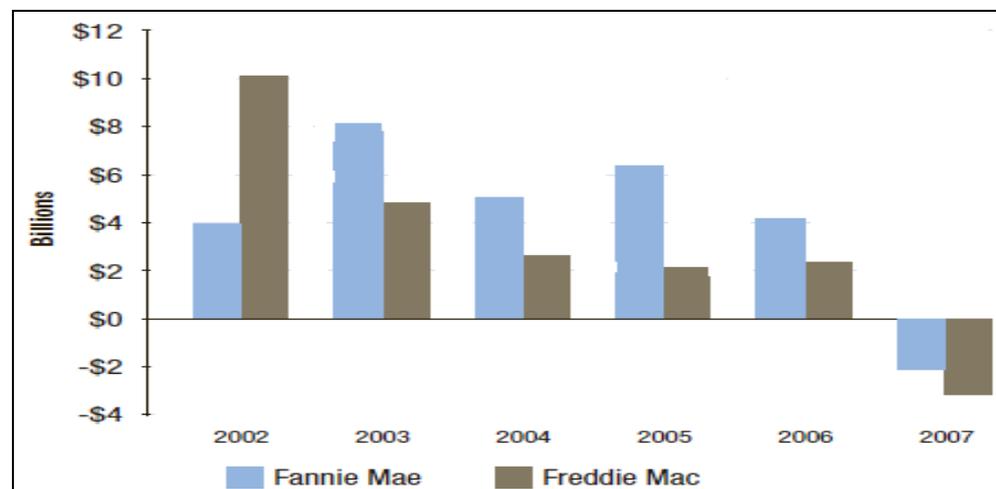
Consequently, central banks injected liquidity to financial markets and decreased interest rates in order to solve financial institutions' liquidity and payment problems while governments arranged precautionary packages. With these measures central banks and government aimed to provide reliability and economic development. As of September 2008, total loss belong to financial institutions in US was \$8 trillion. These huge losses led to shrink in banks' capitals and deteriorated credit transactions.

Demir, Karabiyik, Ermişoğlu and Küçük (2008) note that during subprime crisis banks funded themselves by corporate bonds and interbank markets together with FED fund market in effort to damp with liquidity problems. LIBOR, that is the mirror of interbank markets, tend to increase in 2007 due to higher risk of defaults and liquidity faced by banks. For instance, just as BNP Paribas, French Bank, finalized its three hedge funds' facilities due to fail in valuing of its structure products, LIBOR rates ramped up as a result of lack of trust in the market.

### 5.2.1.2. The Effects on Government Sponsored Enterprises

According to Office of Federal Housing Enterprise Oversight (2008) deterioration in mortgage loans with flexible underwriting standards impacted financial results, flexibility and the overall strength of the Enterprise.

**Figure 10: Fannie Mae and Freddie Mac's Net Income**



Source: Office of Federal Housing Enterprise Oversight, 2008, 'Report to Congress', p:5.

In Figure 10 which shows Fannie Mae and Freddie Mac's net income by years, the enterprises' net income slowed down after 2006 due to deterioration in their asset values that mainly relied on mortgages. In 2007

both company declared losses. Fannie Mae and Freddie Mac declared a net loss of \$2.1 billion and \$3.1 billion respectively resulted from market valuation losses on MBS.

Table 18 shows Fannie Mae and Freddie Mac net worth together with capital draws tied to accumulating losses, In the second quarter of 2008, the FED provided a short-term solution to liquidity worries by allowing the two institutions to borrow at the discount window. Freddie Mac experienced a negative net worth by the end of 2008 Q3, it has required capital draws of \$50.7 billion from the U.S. Treasury in order to maintain a positive net worth position. Similarly, Fannie Mae has required Treasury capital draws of almost \$60 billion to compensate its negative worth and to maintain a positive net worth position.

**Table 18: Quarterly Draws to Fannie Mae and Freddie Mac**

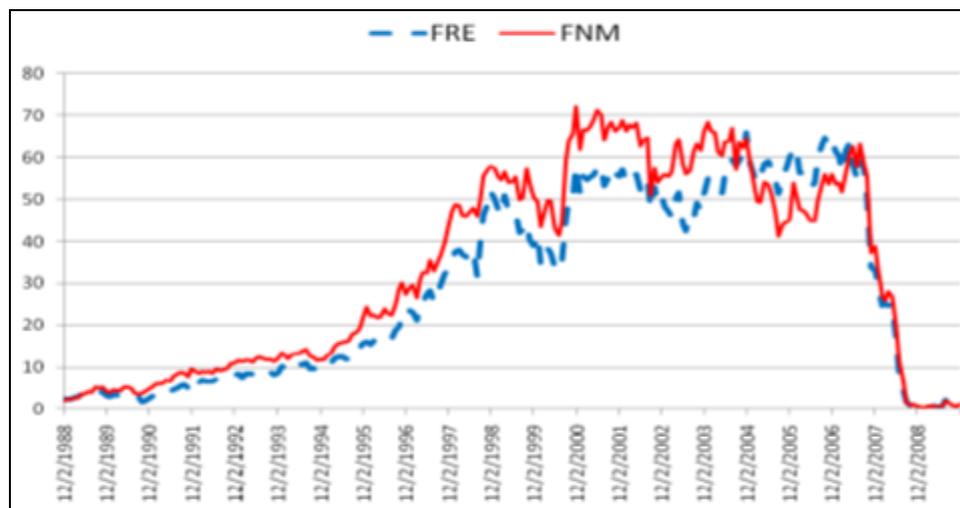
Quarter	Freddie Mae				Fannie Mae			
	Reported GAAP Net worth	Requested Draw	Draw Date	Cumulative Enterprise Draws	Reported GAAP Net worth	Requested Draw	Draw Date	Cumulative Enterprise Draws
2008 Q3	(\$13.7)	\$13.8	11/24/2008	\$13.8	\$9.4	N/A	N/A	\$0
2008 Q4	(\$30.6)	\$30.8	03/31/2009	\$44.6	(\$15.2)	\$15.2	03/31/2009	\$15.2
2009 Q1	(\$6.0)	\$6.1	06/30/2009	\$50.7	(\$18.9)	\$19	06/30/2009	\$34.2
2009 Q2	\$8.2	\$0	N/A	\$50.7	(\$10.6)	\$10.7	09/30/2009	\$44.9
2009 Q3	\$10.4	\$0	N/A	\$50.7	(\$15.0)	\$15	12/31/2009	\$59.9
2009 Q4	\$4.4	\$0	N/A	\$50.7	(\$15.3)	\$15.3	03/31/2010	\$75.2
2010 Q1	(\$10.5)	\$10.6	06/30/2010	\$61.3	(\$8.4)	\$8.4	06/30/2010	\$83.6
2010 Q2	(\$1.7)	\$1.8	09/30/2010	\$63.1	(\$1.4)	\$1.5	09/30/2010	\$85.1
2010 Q3	(\$0.1)	\$0.1	TBD	\$63.2	(\$2.4)	\$2.5	TBD	\$87.6

*Source: The Department of Treasury and The Federal Reserve System, 2010, 'Data as of November 9, 2010 on Treasury and Federal Reserve Purchase Programs for GSE and Mortgage-Related Securities', p:2.*

Figure 10 represents stock prices of two government sponsored institutions, Freddie Mac and Fannie Mae's stock prices in 1988-2008 periods. In 1988 each firm were firstly traded in New York Stock Exchange

(NYSE), therefore their stock prices increased from \$2 per share following up a peak in 2004 by reaching 65\$ per share. Due to subprime meltdown in 2007, stock prices showed sharp declines which continued fast and furiously in 2008 originated from downgrading by Moody's Investors Service for their security.

**Figure 11: Freddie Mac and Fannie Mae Stock Prices**



Source: Jaffee, M.D. 2009, 'The Future Role of Fannie Mae and Freddie Mac in the US Mortgage Market', University of California. Available: [citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.153.6001](http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.153.6001).

### 5.2.1.3. The Effects on Other Markets

The financial crisis has changed the landscape of American financial markets.

Advisen Productivity and Insight for Insurance Professionals (2008) states that AIG which is the world's largest insurance company bailed out with investments banks. The main reason for AIG bailout in September 2008 was CDSs tied to subprime mortgage backed.

Bianco (2008) states that, the subprime crisis also affected other sectors. On July 19, 2007, the Dow Jones Industrial Average hit a record high, and the S&P had crossed into negative territory year-to-date. 2007's largest daily drop by the Standard & Poor's 500 in the United States was in February 2007.

### **5.2.2. Measurements against Subprime Crisis**

During crisis period, England government interfered to financial markets with strategies in effort to provide reliability. Firstly, government exchanged 25 billion GBP for preferred stocks or interest bearing stocks. With preferred stocks government would outmatched against common stock owners in cease of bankruptcy. Secondly, in exchange for stocks government provide 25 billion GBP extra resources in order to provide sustainability of mortgage credits and financial support given by banks to small and medium enterprises. Finally, government guaranteed small and medium term debts between banks that tried to reinforce their financial structures. Also, to interrupt deposit withdrawal government increased deposit guarantee from 35 billion GBP to 50 billion GBP.

Treasury aimed to remove uncertainty in financial markets by buy financial assets which led to crisis. Us government prepared a bailout package, called Troubled Asset Relief Program amount \$700 billion to relief financial structures of institutions that were invested in securities relied on mortgages. On the other hand, together with \$700 billion extra \$150 billion that was reflected as tax credit to low and middle income classes were accepted as Emergency Economic Stabilization Act of 2008.

Selçuk and Yılmaz (2011) states that US government used \$250 billion of \$700 billion to buy preferred stocks from bank. \$125 billion was distributed among Bank of America, Citigroup, Goldman Sachs, Morgan Stanley and JP Morgan; \$125 billion was distributed among small banks. In addition, Federal Deposit Insurance has increased deposit guarantee from

\$100.000 to \$250.000 and have provide 3 year guarantee for credit transaction between banks. Also, government bought commercial papers from financial institutions that had liquidity and borrowing problems.

Alantar defends that after subprime mortgage crisis fall in interest rates, bank acquisitions and nationalizations were the signal of stabilization in financial markets. These developments led to restructuring of US and other developed countries' financial markets, review of capital transfer policies and redesign of financial markets with new ideas and realities.

Although developing countries have limited access to subprime mortgages and securities relied on these mortgages, they have been affected from subprime crisis. Deepening problems between reel and financial sectors have increased effect of crisis. Risk averse investors led to shrink in financing. Withdrawal of funds by big banks from developing countries' financial markets has created negative effects on these countries' financial markets.

After crisis period, missing points and delinquencies in regulation and supervision have occurred. International workings in terms of determination of new regulations have been continued as well as measurements by countries.

New architectural designs of Europe's financial arrangements are still continuing for precautionary measures of global scale arrangements and audits. There are 4 main initiative policies which currently run in European countries. The first one is prepared as "Financial Fluctuations Road Map" by ECOFIN in October 2007 for precautionary action plans against the global market developments. Then in December 2007 Lamfussy Spec has been developed by ECOFIN which is also considered as a road map which is broadening Audit Authorities Committee's functions. Finally, another has been exercised as called "Larosiére Group" which targeted to strengthen European financial auditing systems has completed its investigations for macro level conservative monitoring.

Turkey also have been affected from subprime crisis in terms of decrease in funds from international markets and increase in borrowing costs together with decrease in exports to European countries that have been affected from the crisis.

1929 Great Depression started after globalization in US such as subprime mortgage crisis. Therefore, these similarities led to comparison between two crises.

The main reasons for Great Depression were fixed exchange rate system based on gold, protective policies regarding to financing and foreign trade and risky operations by banks.

In addition, Sumru (2009) notes that protective policies after 1929 crisis led to shrink in foreign trade, therefore increased the effects of crisis. On the other hand, in April 2008 in G20 meetings countries did not approve protective policies as measures.

Following up Great Depression, 11.000 banks among 25.000 bankrupted while only Lehman Brother collapsed in 2007 subprime mortgage crisis. These bankruptcies after 1929 crisis caused global crisis.

## 6. CONCLUSION

Developments in financial engineering together with government policies in financial markets in the past decade led to change in mortgage market players' shares in the secondary mortgage market. Mortgage securitization process has been dominated by government sponsored enterprises until the last decade. However, with innovations in financial engineering and loose standards in credit process; following up US. Government economic policies have resulted as increase in private label securitization share and it has become a significant presence in mortgage securitization.

Private label mortgage backed securities heavily relied on non-conforming loans. Securitization of these loans caused to fall in credit quality and underwriting standards. Therefore, it was equal to higher risk in terms of principle and interest rate payments by borrowers.

Mortgage securitization has established a bridge between mortgage borrowers and capital markets in order to fund primary markets to meet extra demand for housing with decrease cost of borrowing and deepen secondary markets in effort to convert illiquid instruments into tradable investment tools to increase liquidity in the capital markets. Subprime mortgage crisis started in US has deteriorated the linkage between mortgage borrowers and capital markets and has been criticized regarding to weakness in the structure of mortgage finance and originate-to-distribute model process. The criticized points were deficiencies in underwriting standards and rating process, underpricing of risk for MBSs due to their complex nature and usage of excessive leverage to invest these financial instruments.

An effective MBS securitization should firstly provide reliance in terms of credit quality of the underlying mortgage together with management of originate-to-distribute model. Credit quality can be achieved by effective application process with fully documentation of borrowers' ability to repay the home loan such as borrowers' credit quality, income

level, etc. Scoring process to evaluate these factors has a crucial role. By this way, the share of subprime mortgages will decrease and mortgage market will mainly depend on conforming loans. Besides, for the management of securitization process tight regulation and supervision should be come into force at every step in the process from loan origination through the sale of securities backed by those mortgages.

Also, securitization process opens to asymmetric information due to underlying mortgage' originator or issuer. This asymmetric information between key players led to under or over pricing of MBSs regarding to undetermined risk (prepayment risk, credit risk, interest rate risk ...) and credit quality factors. Asymmetric information reflects counterparties as adverse selection and moral hazard problems. These problems also create defects in valuation of mortgage backs securities. If the risks of mortgage loans cannot be measured efficiently, the prices of securities are over or underestimated. The way of reducing information asymmetry problems and measuring risk accurately is effective rating process. Rating process is the determination to value securities. Investors rely on these rating when they invest.

Also, prior to an effective securitization process safety, reliability and soundness of counterparties in the market should be provided by application of tight policies. By this way, asymmetric information that led to moral hazard and adverse selection problems is able to be mitigated and the share of non-conforming loans in securitization process can be shrunk.

In order to reduce risk factors for a mortgage pool, different type of mortgage loans that have various locations, different range of time zones and customer properties in terms of income and credit history. Diversification of risks is a crucial point to bundle these mortgage loans and securitize them to form efficient MBS structures.

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