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Role of Financial Derivatives and Structured Products in the 2007 Subprime Crisis

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Čestné prohlášení:

Prohlašuji, že bakalářskou práci na téma „Role of Financial Derivatives and Structured Products in the 2007 Subprime Crisis“ jsem vypracovala samostatně a veškerou použitou literaturu a další prameny jsem řádně označila a uvedla v přiloženém seznamu.

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ANNOTATION

This paper is addressing the topic of financial crises and focuses mainly on the US 2007 subprime mortgage crisis. It examines the causes of the current meltdown and provides an introduction to relevant financial derivatives and structured products in the roots of the crisis (CDS, CDO, MBS, RMBS). The paper describes the period before and during the meltdown, focusing on the instruments' and securitization weaknesses, including their rating assessment and inadequate regulation and impact on reducing the capital cushion in the economy. It also suggests possible solutions to the current financial system shortcomings with the main focus on proper regulation.

ANOTACE

Práce adresuje tematiku finančních krizí a zaměřuje se hlavně na aktuální krizi amerického hypotečního trhu. Zkoumá její příčiny a poskytuje čtenářům úvod do problematiky relevantních finančních derivátů a strukturovaných produktů, které byly jednou z příčin vzniku a rozšíření krize (CDS, CDO, MBS, RMBS). Práce popisuje období před a počas krize, a koncentruje se na nedostatky těchto instrumentů a sekuritizace, včetně jejich ratingů, neadekvátní regulace, a vlyvu na snížení kapitálových rezerv v ekonomice. Rovněž navrhuje řešení nedostatků současného finančního systému, přičem hlavní pozornost je věnována správné regulaci.

LIST OF ABBREVATIONS

ABS	Asset-Backed Security
AIGFP	American Insurance Group Financial Products
CBO	Collaterized Bond Obligation
CDO	Collaterized Debt Obligation
CDS	Credit Default Swap
CFTC	Commodity Futures Trading Commission
CLO	Collaterized Loan Obligation
CMBS	Commercial Mortgage-Backed Security
CMO	Colaterized Mortgage Obligation
DTI	Debt-To-Income
ERM	European Exchange Rate Mechanism
FICO	Fair Isaac Corporation score
GAO	Government Accountability Office
GDP	Gross Domestic Product
IMF	International Monetary Fund
LIBOR	London InterBank Offered Rate
LTV	Loan-To-Value
MBS	Mortgage-Backed Security
OECD	Organisation for Economic Co-operation and Development
OTC	Over-The-Counter
OTS	Office of Thrift Supervision
PSA	Public Security Association
PV	Present Value
RMBS	Residential Mortgage-Backed Security
SEC	Securities Exchange Commission
SIV	Structured Investment Vehicle
SPV	Special Purpose Vehicle
TARP	Troubled Asset Relief Program

Introduction

Year 2007 is for most of us symbolic as the year when one the most severe financial crises in the history started. And, it is not over yet and the consequences will be felt for a long time to come. Many questions are being asked, mainly what and who caused the financial meltdown. Although the answer is not simple, one thing can be concluded. We can not blame one thing or one person for breaking down the financial system. It was the interaction and interface of many factors, institutions and individuals who did not recognize the coming crisis, did not care or simply did not do enough to prevent it.

Although the topic of the current crisis is broad, this thesis will approach it from a specific point of view of the role of financial derivatives and structured products in the current recession. Not all of these instruments played a role in worsening the situation and I will concentrate only on the most relevant ones- Collaterized Debt Obligations, Credit Default Swaps, and Mortgage-Backed Securities (mainly Residential Mortgage-Backed Securities). These products are relatively new and their understanding had lagged behind their boom. Being opaque and complex, they should have raised flags, pointing at a need for paying closer attention for a quite a long time. One of the many mistakes made was ignoring these flags and letting the credit and structured markets grow exponentially without any controls and breaks. As the means of off-loading risk from specific companies and spreading it throughout the system, the products played a crucial part in causing and magnifying the effects of the crisis.

The thesis is organized as follows: Chapter I briefly describes typical types of crises that occurred in the past and their classification and provides some insights into some of them. Chapter 2 looks into the causes of the current subprime crisis in general, and introduces the role of financial derivatives in causing and spreading the crisis. Chapter 3 is theoretical and highlights the complex structures and pricing of credit derivatives and structured products. The next chapter describes how these derivatives played an active part in what happened before and during the recession, highlighting their weaknesses, contribution to the capital cushion relief in the economy and imperfect ratings used to express their quality. The chapter discusses the

consequences that included misjudgment by many investors and eventually resulted in an illiquid financial sector. Chapter 5 discusses regulation of the credit derivatives and structured products, pointing out its inadequacy and lack of understanding. It also points to the need to increase the oversight and regulation of such markets. Finally, I offer my analysis of possible solutions and lessons learned from this meltdown from my own perspective and compare them with some theories of other economists. I hope to propose successful improvements in the system that will for resolve and prevent such future crises. The main focus is on regulation since I believe it to be one of the main culprits of the current situation.

This thesis is generally addressing the subject of financial derivatives and structured products in theory, practice, with a focus on their place in the current situation and for the future. It aims to provide the reader with a deeper insight into their complexity and how this, along with their ratings, regulation, misuse and misjudgement, helped this financial world become what it nowadays is.

1 Financial crises

Financial crisis is a disturbance to financial markets, associated typically with falling asset prices and insolvency among debtors and intermediaries, which ramifies through the financial system, disrupting the market's capacity to allocate capital within the economy. In an international financial crisis, disturbances spill over national borders, disrupting the market's capacity to allocate capital internationally.[1]

Financial crises can have a serious impact not only on the financial market, but on the whole economy if not treated appropriately and may result in failure of both financial and non-financial institutions, and sharp decline in asset prices. Historical financial crises resulted in deep recessions and had impact on many countries, spreading to the financial system globally. Origins differ and arise from the financial system. Although there are several types of crises, all of them arise from the presence of economic imbalances, mainly misalignment in exchange rates or asset prices. Crisis can also originate from credit flow or external financning problems. For example, very common causes of couple of crises in the past were macroeconomic policies, such as unstability of balance of payments (mainly current account deficit), large public debt, credit booms, etc. Traditional approach towards financial crises points out three main crisis types- currency crisis or exchange-market disturbances, banking crisis and debt crisis.

1.1 Currency crisis

Currency crisis is a sharp and unexpected nominal depreciation of a domestic currency of 30% or more and at the same time at least a 10% rise in the rate of depreciation compared to the previous year. In the system of floating exchange rates, it shows itself in the form of rapid depreciation of the rate, whereas in the system of fixed exchange rates, it enforces the domestic currency depreciation or forces the central bank to intervene in a large scale to protect or devaluate the rate. This may result in increase of interest rates and significant reduction of international reserves. Existence of purely

[1] EICHENGREEN, B., PORTES, R. The Anatomy of Financial Crises. *NBER Working Paper,* 1987, no. 2126

this type of crisis is very rare and does not possess as serious danger as if it was present in a combination with debt and banking problems. It results mostly from a speculative attack on the exchange value of the currency. According to the definition I used to describe a currency crisis, there had been 208 currency crises throughout the period 1970-2007.[2] A typical currency currency crisis can be referred to a brake-up of the European Monetary System ERM in 1992-1993.[3]

1.2 Banking crisis

Banking crisis can be described as a situation, in which some, or most of the commercial banks fail to dispose of sufficient liquidity and are becoming insolvent. It is a state in which multiple banks fail at the same time, reducing the capital in such a manner, that it may have a serious impact on the national economy and may trigger serious and costly government interventions. Thus, it can be referred to a banking crisis not only if banks fail, but also if they are "saved" by the government. This can be accompanied by e.g. reduce of capital inflows, sharp decline in asset prices (such as real estate and equity), increase in interest rates, and so on. Causes can be found in either the bank run, or a rational response to the information shock, which is typical for developing countries, characterized by a sudden loss of confidence in the bank of its customers (depositors). The classic view holds, that banks should have a large number of small, rationally ignorant depositors, who do not detect any bank's solvency problems. The bank should on the other hand have a good lender of last resort to avoid decapitalization and consequently a collapse of the whole system, or maintain a very good liquidity and capital cushion to signal its solvency to the public. Banking crisis can also result from either the currency crisis, if the banks have a large foreign debt, or a debt crisis, when lenders fail to meet their obligations and the number of non-performing loans rapidly grows. This is typical for more developed nations. Banking crisis is often classified as systemic, which depends on how central bankers see it. They evaluate central bank's actions and interventions and if they simply think

[2] LAEVEN, L., VALENCIA, F. Systemic Banking Crises: A New Database. *IMF Working Paper,* November 2008, no. 224

[3] DVOŘÁK, P. Veřejné finance, fiskální nerovnováha a finanční krize. 1. Vydání. Praha: C.H. Beck, 2008

that the specific problem may spread systemwide, or the capital disappears completely by all the loan defaults, they consider it systemic. In short, it must be apparent that most of the banking system's capital has been exhausted and there is a large presence of non-performing loans. For example, the savings and loan crisis and regional banking crises in 1980s in the US are not systemic due to their nature of affecting national banks, but without the government being required to intervene and pump in such a large sum compared to the US GDP. Over the period 1970-2007, however, there had been 124 systemic banking crises including crises in Japan, Latin America, Russia, Scandinavia or Southeast Asia.[4] Banking crises usually have a much worse impact when it comes to fiscal costs, it can therefore severly increase the fiscal debt.

1.3 Debt crisis

This expression usually refers to a foreign debt crisis, which means the country is unable to pay off its foreign sovereign or private debt. Suvereign default means the government can not service its foreign debt. Typical sovereign debt crises occurred e.g. in Mexico in 1982, or Argentina in 2001.[5] 15 countries (mainly developing ones) experienced more than one sovereign debt crises in the last 30 years and there have been 63 cases of sovereign debt defaults since 1970.[6] The external debt crisis can also be caused by private companies and banks, which are unable to meet their foreign obligations. Another very important type of debt crisis is the internal debt crisis which expresses itself as chronic internal heavy indebtedness, growth in outstanding loans and companies insolvency. As a result, credit market can freeze and have a negative impact on the whole economy- credit crunch. Internal debt crises are often very severe, since any government cash injections to help the economy may even worsen the situation and make it become chronic. An example of a chronic internal debt crisis was the situation in Japan in 90s.

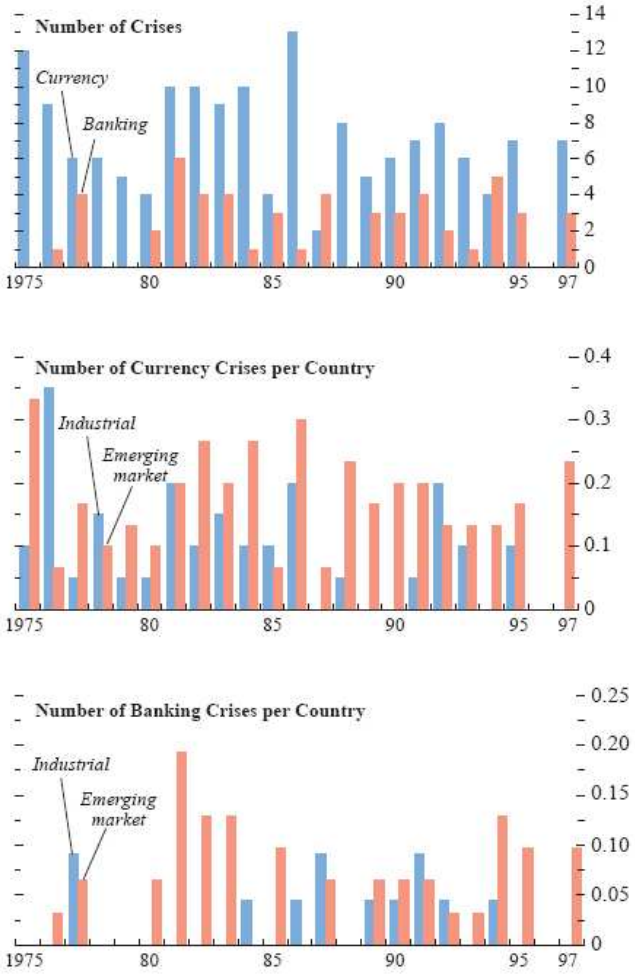
[4] LAEVEN, L., VALENCIA, F. Systemic Banking Crises: A New Database. *IMF Working Paper,* November 2008, no. 224
[5] DVOŘÁK, P. Veřejné finance, fiskální nerovnováha a finanční krize. 1. Vydání. Praha: C.H. Beck, 2008
[6] LAEVEN, L., VALENCIA, F. Systemic Banking Crises: A New Database. *IMF Working Paper,* November 2008, no. 224

It is necessary to mention, that presence of just one type of a crisis in the economy is very rare, and doesn't signify such a serious danger as a systemic crisis. For example, in case of sovereign bond defaults, it can restrain the ability of the bond market to allocate capital effectively across the ecomies, but if this does not include bank failures, bank lending practices can easily compensate for this and create a balance, avoiding any potential crisis. If this, however, indicated depositors to be suspicious and withdraw their savings from the bank, it may imply a problem. Or take another example, if people expected a depreciation of the value of the domestic currency, they will probably withdraw much of their cash or liquidate their accounts in effort to diminish capital losses on their overseas assets. If they held government securities instead, the problem would be pretty much solved.

It is also empirically proven, that there is a connection between the banking and currency crisis. Problems in the banking sector may worsen the domestic market's credibilty, and efflux the capital out of the country, which would have a negative impact on the currency. On the other hand, depreciation of the currency increases the real value of the foreign debt when compared to the value of their assets. It again complicates the bank's position and the government by worsening their real indebtedness. The IMF empirical analysis from 1998 indicates that over the period 1975-1997 currency crises preceded banking crises in exactly 11 cases and banking crises preceded currency crises in 23 cases. After 1989 these two cases have occured simoutaneously more and more frequently.[7] Based on these observations it can be concluded, that banking and currency crises can have a hidden common cause of origin and together form a twin crisis which is referred to this phenomenon.

[7] DVOŘÁK, P. Veřejné finance, fiskální nerovnováha a finanční krize. 1. Vydání. Praha: C.H. Beck, 2008

Figure 1: Incidence of Currency and Banking Crises *(Number of crises)*



SOURCE: IMF (http://www.imf.org/)

Based on the analysis, it can also be implied, that currency crises were more frequent during the first half of the observed period (1975 – 1986), peaking in 1975 during a period of great external shocks, and 1987 during the Latin American financial crisis. On the other hand, banking crises were more frequent in the second half of the time period (1987 – 1997) in context of liberalization of the financial sector in many economies. Also, both types occurred almost twice more frequently on emerging markets.

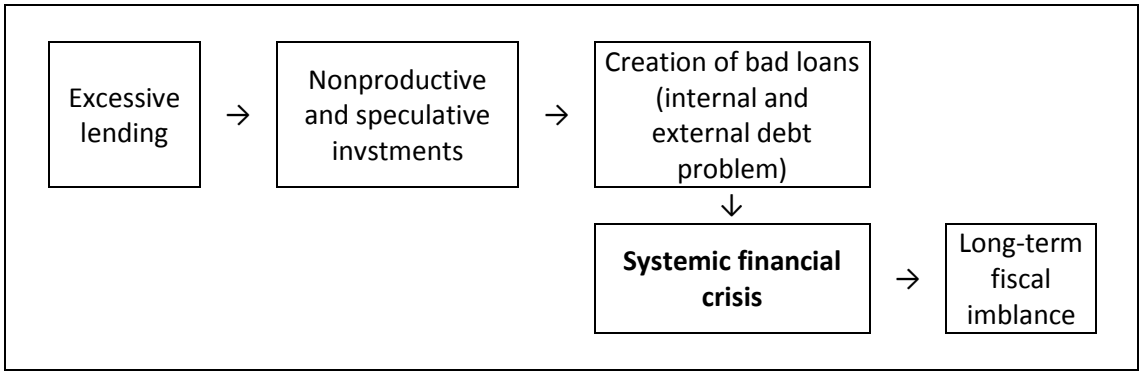
1.4 Systemic financial crisis

The latest concept of the financial crisis understands crisis as all the former types being in relation to each other and is called systemic crisis.

Systemic financial crises are potentially severe disruptions of financial markets that, by impairing markets' ability to function effectively, can have large adverse effects on the real economy. A systemic financial crisis may involve a currency crisis, but a currency crisis does not necessarily involve serious disruption of the domestic payments system and thus may not amount to a systemic financial crisis.[8]

Understanding this concept involves analysis of the individual crises not independently, but together within their conjunction. It can be understood as a chain of currency, banking and debt factors with variable causation. It also analyzes the credit boom and resulting debt problem in more detail as a possible primary cause of the crisis, which was not given a proper attention in previous concepts of the crises. It is indicated, that operations on the international credit market often coexist and contribute to interaction of banking, currency and debt crises even more. This argument of excessive lending being the most likely cause of the systemic crisis is relatively new, but due to empirical observations, it is growing in popularity. A simple diagram can picture a possible course of a crisis.

Figure 2: Exemplary course of a crisis



SOURCE: DVOŘÁK, P. Veřejné finance, fiskální nerovnováha a finanční krize. 1. Vydání. Praha: C.H. Beck, 2008

In the current severe systemic financial crisis which started on American mortgage market, the key role is lying undoubtedly in the debt problem of excessive lending,

[8] IMF. Financial Crises: Characteristics and Indicators of Vulnerability. *International Monetary Fund*, 1998, Chapter 4.

whose latitude and severity was for a long time hidden behind securitization. This problem is described in following parts of my thesis.

Table 1: Cases of significant financial crises since the 80s:

1. Foreign debt crises resulting in banking, or currency crisis
Latin American debt crisis 1982 - 1989
Russian financial crisis 1998
Brazil's financial crisis 1998 - 1999
2. Speculative currency crisis resulting in banking crisis
EMS currency crisis 1992 - 1993
3. Banking crisis resulting from external shock
USA savings and loan crisis 1980 - 1995
4. Banking crisis resulting from currency crisis
Scandinavian banking crisis: Norway 1988 - 1993, Sweden 1990 - 1995, Finland 1991 - 1994
5. Banking crisis resulting in debt and currency crisis
Financial crisis in Chile 1981 - 1985
Financial crisis in Turkey 2000
6. Debt (systemic) financial crises
Tequilla crisis 1994 - 1995 (foreign debt crisis, consequently currency crisis)
Asian financial crisis 1997 - 1998: Thailand, Philippines, Indonesia, South Korea (internal debt, banking and currency crisis
Argentina's financial crisis 2001 - 2002 (foreign debt, banking and currency crisis)
US subprime crisis 2007 - ? (global debt crisis transforming to banking and currency crisis, and recession)
7. Chronic internal debt and banking crisis
Financial crisis in Japan 1989 - 2004 (debt deflation and recession)

SOURCE: DVOŘÁK, P. Veřejné finance, fiskální nerovnováha a finanční krize. 1. Vydání. Praha: C.H. Beck, 2008

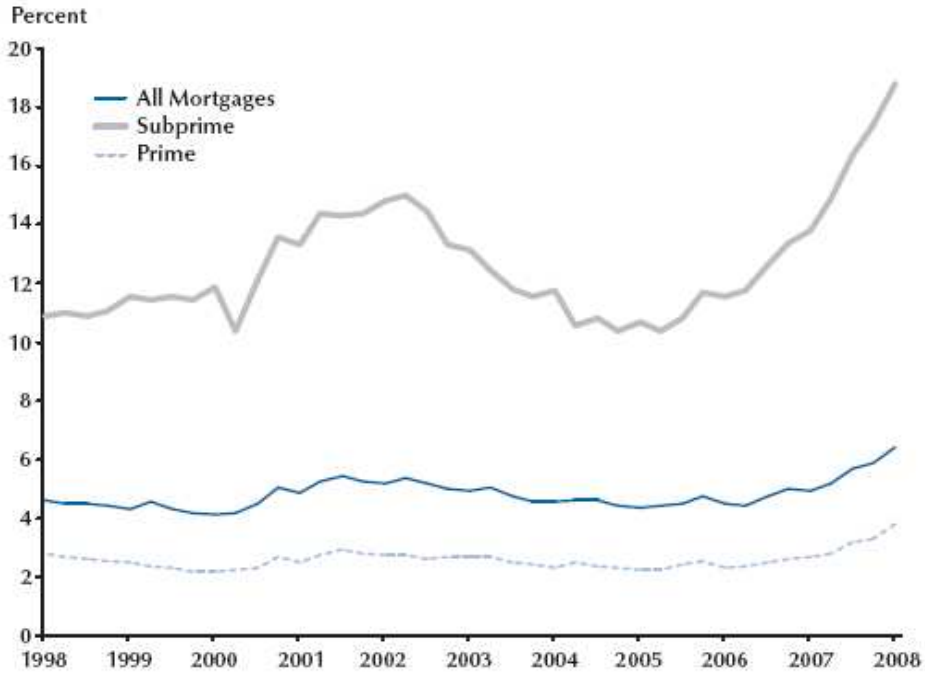
2 Causes of the current subprime crisis of 2007

The current financial crisis, whose roots can be traced to the American subprime mortgage market came to public notice in 2007 when the number of mortgage defaults and home foreclosures started to rise at an alarming rate. The reversal in the trend in the house prices launched a domino effect, resulting in a national financial crisis and subsequently a global financial crisis affecting investors and financial institutions in North America, Europe, Australia and Asia. The financial crisis then led

to a severe global economic crisis, affecting people on the 'Main Street' all around the world.

The US residential mortgage delinquency rates started to rise sharply in 2005, when borrowers found they were unable to refinance their mortgages. Numerous financial institutions had to be bailed out, bought out or close their doors. The housing market declined and consumer spending decreased rapidly. The number of foreclosures is still climbing up. Uncertainty and dispute spread among consumers, investors, lenders and legislators.

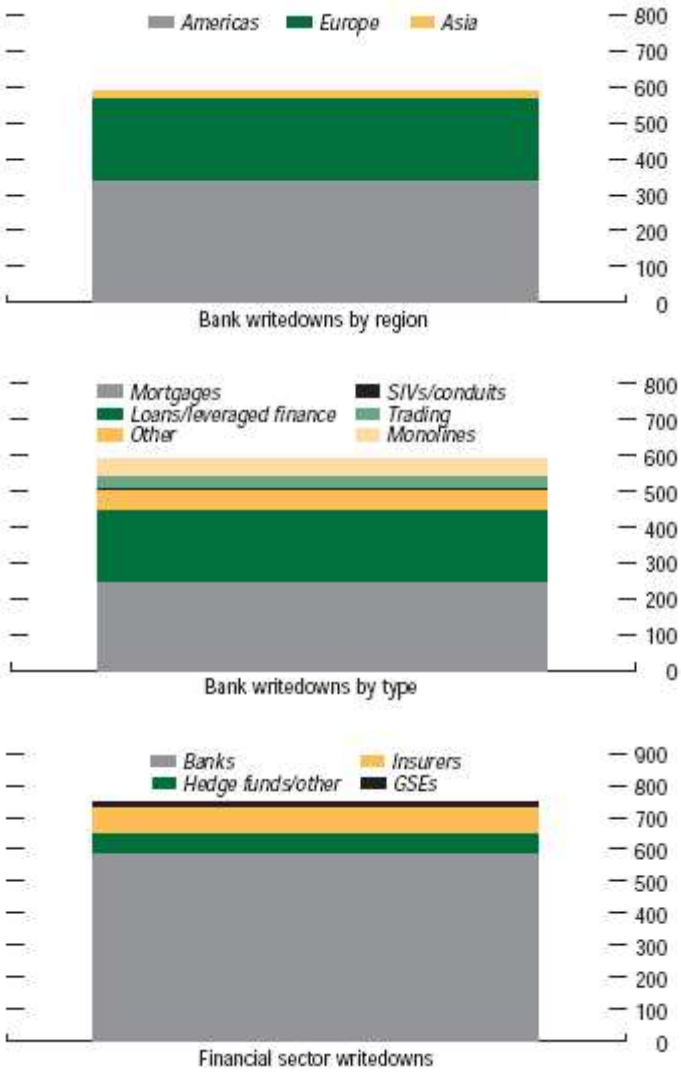
Figure 3: US Residential Mortgage Delinquency Rates:



SOURCE: Mortgage Bankers Association/Haver Analytics

The following figure shows the financial sector losses from the second quarter of 2007 through August 2008.

Figure 4: Financial sector losses 2007 - 2008



SOURCE: IMF (http://www.imf.org/)

In October 2008, International Monetary Fund estimated in its semiannual Global Financial Stability Report that the US mark-to-market losses for loans and securities would reach US$1.4 trillion. This compares to an earlier estimate of US$945 billion in April 2008.[9] IMF ranks this financial shock as the biggest since 1930s.[10] The crisis is not over yet and questions about the roots of this mayhem are continuously asked.

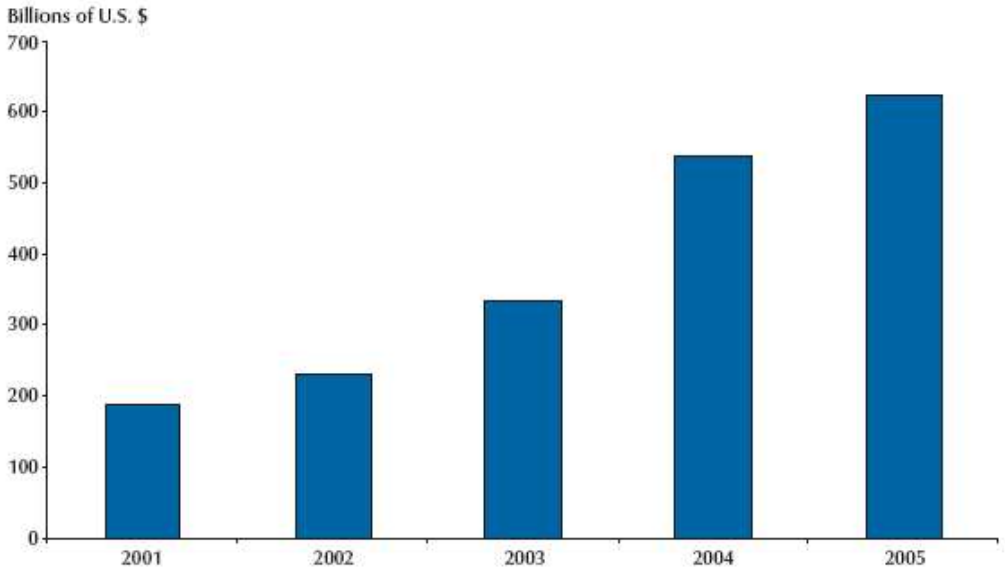
[9] IMF: Financial Stress and Deleveraging, Macrofinancial Implications and Policy. *Global Financial Stability Report*, October 2008.
[10] BEATTIE, A., IMF sees greatest shock since 1930s. Washington: Finantial Times, October 8, 2008

There are multiple theories explaining the causes of the 2007 crisis, however, they have some common denominators, which experts and sophisticated investors agree upon.

First, the 2000 crash of the dot-com bubble resulted in a crisis in 2001, which led the Federal Reserve bank to cut the short-term interest rates to 1% (Sep 2003). The interest rates then increased but subsequently decreased to 4.75% (Sep 2007).[11] This ***low interest rate environment*** triggered an increase in the demand for mortgages accompanied by a rise in housing prices. Investors started to seek yield enhancement instruments and ***subprime mortgages*** were an ideal candidate, since they were more lucrative than regular mortgages. The US ownership rate reached its all-time high of 69.2% in 2004 and the home prices climbed by 124% from 1997 to 2006. The market for subprime mortgages grew really fast. The exceptional subprime mortgage growth was recorded during two periods. The first one was in the late 90s, when mortgages grew to $150 billion in their value, representing about 13% of all annual mortgage originations. The second mortgage boom was documented over the period 2002 – 2006, when their value rose from $160 billion to $600 billion, comprising 20% of the value of all annual mortgage originations.[12] The following figure shows the second phase:

[11] BIANCO, K.M., J.D. The Subprime Lending Crisis: Causes and Effects of the Mortgage Meltdown. CCH *Maftgage Compliance Guide and Bank Digest*, 2008.
[12] CROUHY, M.G., JARROW, R.A., TURNBULL, S.M. The Subrpime Credit Crisis of 2007. *The Journal of Derivates*, Fall 2008, pp. 81-110.

Figure 5: Subprime mortgage originations- annual volume



SOURCE: Data are from Inside Mortgage Finance, as published in the 2006 Mortgage Market Statistical Annual, Vol. 1

Securitization enabled lending banks to take on such mortgages without exercising business prudence in excluding clients with high credit risk. Lenders could sell the mortgages off to intermediaries, who packaged them into structured securities, which through the alchemy of financial innovation transformed below-investment-grade assets into investment-grade or triple-A assets. The structured products could then be sliced up into tranches and sold off to investors. The inherent systemic risks brought on by these complex structured products were overlooked and ignored as the ***credit ratings*** of these products were high and the housing prices continued to rise. So who is responsible for the current situation? There are multiple players that contributed to the development.

The Fed because they kept the interest rates very low for a prolonged time period.

Regulators for overlooking the systemic risks that the complex derivative products posed. I will be describing their role in more detail later in the thesis.

Lenders and mortgage brokers did not have to practice prudence in generating mortgages. They could take on risky mortgages, then turn around and offload the

credit risk for potentially non-performing loans by selling them to intermediaries for securitization. The newly created structured securities were then divided into tranches and sold off to investors. Thus, the credit risk of the assets underlying the products was transferred onto unsuspecting investors. As the lenders and mortgage brokers received commissions on every mortgage origination, they showed no restraint and scrutiny of their clients.

After the Federal Reserve Board increased interest rates in 2006, many borrowers with floating-interest rates on their loans could no longer meet their obligations and started defaulting. The chain reaction was started. As a result, many issuers of subprime mortgages went bankrupt or left the business (Ownit Mortgage Solutions, Inc.; New Century), further spreading the uncertainty and affecting performance and share prices of the whole mortgage market and beyond (Thornburg Mortgage, Inc.; National City Home Equity Corporation; Aegis Mortgage Corporation).[13]

Rating agencies- Some institutional investors, such as money market funds, pension funds and municipalities are only allowed to invest in assets with certain ratings, namely, investment-grade credit rating, AAA. These investors strongly rely on the expertise of the rating agencies such as Moody's or Fitch, who specialize in assessing the credit quality and riskiness of securities and assign them credit ratings. So, how did securities with subprime mortgages underlying them end up with AAA ratings? At higher yields than the traditional investment-grade assets, they were an attractive addition to the portfolios of these investors.

When rating structured products such as collateralized debt obligations, the rating agencies' models utilized historical data (prepayment rates, recovery rates) that did not incorporate the current ones (large loan-to-value ratios, undocumented subprime mortgages). Additionally, there exists an inherent conflict of interest for credit rating agencies when assigning ratings. For example, in order for a CDO trust to remain profitable, they must hold many triple-A rated CDOs. These trusts need to be regularly

[13] CROUHY, M.G., JARROW, R.A., TURNBULL, S.M. The Subrpime Credit Crisis of 2007. *The Journal of Derivates*, Fall 2008, pp. 81-110.

monitored and rated, giving business to the rating agencies. Agencies, such as S&P and Moody's accept raw data from the issuers of the securities, who packaged the underlying assets and who are expected to do their due dilligence. Borrower's information provided by mortgage originators is not rechecked by the rating agencies. Thus, estimates of losses due to default, probabilities of default and the calculation of default dependence in a collateral pool did not reflect reality.

However, rating agencies started to reevaluate the ratings of many securities as the default rate on subprime mortgages started to accelerate. They downgraded many structured products which were backed by such mortgages. Throughout the year 2007, S&P, Moody's and Fitch downgraded securities originally worth US$48.7 billion and SIVs with US$47 billion in debt.[14]

Monolines got in trouble, when they started to insure structured products, e.g. CDOs, or asset-backed bonds. Monolines are very conservative insurers, carrying a large amount of capital, insuring only safe bonds and performing secure transactions. In order for them to stay profitable they must maintain their triple-A rating. The problems appeared, when they started to be downgraded in 2007 and consequently downgrading the securities they had insured. Fair value of their assets dropped precipitously and they were required to come up with more capital due to capital requirements. For that they had to sell their assets in a very non-liquid market, thus pushing the prices even further down. Also, investors who are only allowed to hold highest-grade investments (e.g. pension funds) were prompted to forced sales, which pushed the market down even more. In June 2008, both Moody's and S&P reduced AAA ratings of two major US national monoline insurers: Ambac Financial Group and MBIA.[15]

Asset Backed Securities (ABSs), Collaterilized Debt Obligations (CDOs) held a great deal of information asymmetry. Asset backed securities,. ABSs (which in this definition include Mortgage Backed Securities, MBSs, and Residential Mortgage Backed

[14] CROUHY, M.G., JARROW, R.A., TURNBULL, S.M. The Subrpime Credit Crisis of 2007. *The Journal of Derivates*, Fall 2008, pp. 81-110.

[15] Moody's Cuts MBIA, Ambac Top Insurance Ratings. *Thomson Reuters*, Jun 19, 2008.

Securities, RMBSs) repackage cash flows of underlying assets into structured products. These ABS cash flows were overvalued in the market (otherwise the repackaging would not be profitable) as unsophisticated investors were unable to model the cash flows correctly. Correct valuation was difficult due to complexity of the products, unavailability of current data on the collateral pool and the lack of information on new trends of risk (like teaser rates).

Credit Default Swaps (CDSs) are basically insurance policies written on the probability of default of some reference entity but without posting collateral. They were originally designed to serve to offload credit risk from e.g. banks. However, they became profitable investment opportunities for insurance companies like AIG, investment banks like Lehman Brothers or Bear Sterns and others. CDSs are over-the-counter derivatives and as such, they were neither regulated nor monitored. As they were sold and resold over and over again, they were spreading unmonitored systemic risk by compounding counterparty risk of swap holders. At the end of the day, nobody knew where the risk was lying.

Financial Institutions, Banks who took on too many CDOs, SIVs and did not create an adequate capital cushion against potential losses resulting from these structured products and vehicles.

New capital requirement embodied in Basel II prompted banks and other institutions to hold AAA rated assets. Thus, they bought CDOs that had triple-A ratings yet comparatively higher yields. The institutions driven by the short-term bonus incentives of the managers did not do their due diligence and instead relied on the assigned triple-A ratings. Banks lacked transparency about their complex assets, as well as their liabilities with structured investment vehicles (SIVs) and money market funds. As the ratings of their holdings were marked down, the banks were faced with forced sales to keep the capital at adequate levels. This caused further decrease in prices of these assets and similar products, and the domino effect was spreading.

Investment banks used very high leverage (sometimes as high as 1:50) to make bets on the price of derivatives and complex securities. The highly leveraged bets give them high returns in good times but also very large losses in bad times. In a normal

situation, the losses can be limited if the market downturn is not wide-spread. However, in a situation of a systemic market collapse, the banks were forced to deleverage at fire-sale prices, causing a precipitous drop in their asset values and their valuations. This was caused by approving a new law in 2004, which enabled their brokerage units to be an exception from the old regulation that limited the amount of loan they could take on. The new Gramm-Bleach-Bliley Act from 1999 restricted SEC's authority to oversee investment banks' holding companies and caused massive step towards their deregulation, enabling them to hazardously create and sell infecting structured products, without being properly supervised.[16] The biggest players advocating deregulation were the top 5 investment banks (as they are often called)- Bear Stearns, Lehman Brothers, Meryll Lynch, Morgan Stanley and Goldman Sachs. Investment and commercial banks were undertaking securitization through Structured Investment Vehicles (SIVs), entities established by banks for special purposes, usually investment activities using assets that its parent bank had conferred on them. Before the crisis, they concentrated mainly on creating ABS from complex mixtures of RMBS, and other debt receivables and selling their tranches to investors. Banks, however, did not document these risky transactions on their balance sheets and did not even have a direct control over the SIVs.

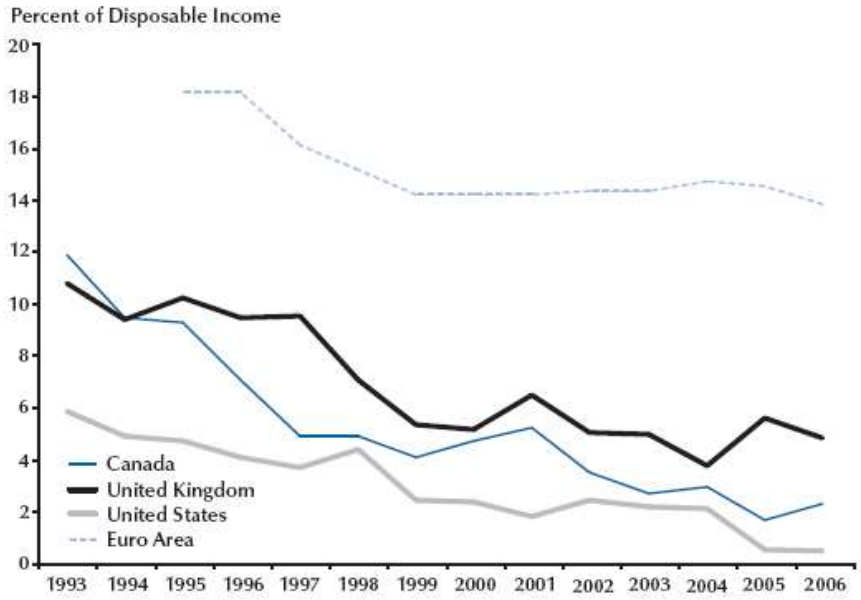
Valuation and Transparency of the structured credit products was in the center of the problem. It was very difficult to assess the probabilities and cash flows of the products as their structures were complicated and hard to measure. Take a subprime ABS trust: it contains hundreds of subprime mortgages, each unique with its characteristics. Also, future values of the collateral as well as anticipated ratings need to be reflected in the valuation but are hard to estimate. Also, many of the securities were created by repackaging of cash flows from one product into another product, which created a need for 'stacked' valuation; i.e., valuation of one product, in order to value another one (CDOs-squared → CDOs → ABS bonds). This adds another layer of complexity to valuation. Unsophisticated investors did not understand the nature and behavior of

[16] FAIOLA, A., NAKASHIMA, E., DREW,J. What Went Wrong - How Lobbyists and Special Interests Won.Washington Post Staff Writers, October 15, 2008, A01.

these structured products under different circumstances and their true risk and relied entirely on the rating agencies However, even the sophisticated investors were unable to verify the credit ratings because there was not enough information on the collateral pool.

Moral hazard, since everyone, including ordinary people, who were eventually buying houses not for their own living but because of speculation, was seeing profit in mortgages, rather than looking at their real purpose. The credit boom and rise in housing prices reinforced each other. Saving ratios declined, as the figure below shows (for industrialized countries). Over a decade, saving ratios in the US dropped to less than 1% of disposal income from previous 6%, and debt-to-income ratios increased from 75% to 120%. Other developed countries were following approximately the same pattern.[17]

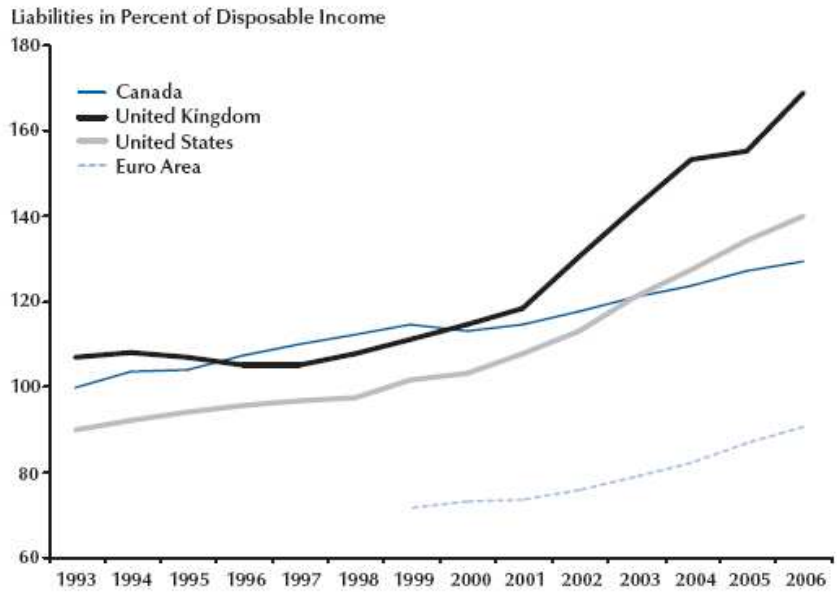
Figure 6: Saving ratios



SOURCE: OECD Economic Outlook and ECB Monthly Bulletin

[17] MIZEN, P. The Credit Crunch of 2007-2008:A Discussion of the Background, Market Reactions, and Policy Responses. *Federal Reserve Bank of St. Louis Review*, September/October 2008, 90(5), pp. 531-67.

Figure 7: Debt to income ratios



SOURCE: OECD Economic Outlook and ECB/Haver Analytics

Financial derivatives didn't cause this greatest economic crisis since the Great Depression, but their increased popularity, expansion and uncertainty about their real values speeded up the collapses of financial and investment institutions and intensified the panic among the world's economies. For this reason I will be concerned with them and their role in the current meltdown in the rest of the thesis.

3 Credit derivatives and other structured products

3.1 Credit Default Swaps (CDS)[18]

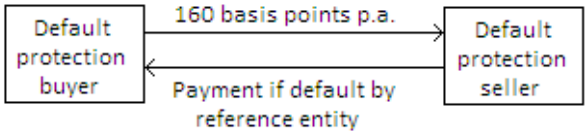
A *credit default swap* (CDS) is essentially an insurance contract and is among the most popular OTC credit derivatives (they make up about 70% of all credit derivatives). Like many other financial swaps, the buyer of the CDS pays the sellers a premium which is

[18] HULL, J. Options, Futures and Other Derivatives. 6th Edition. New Jersey, 2006.

said to be “buying default protection” from the seller. The buyer is required to make payments to the seller until the end of the life of CDS. Once the credit event occurs (the *reference entity* defaults), the CDS is terminated automatically. The *reference obligation* is the fixed income security on which the swap is written on, usually a bond or sometimes a loan. If default event occurs against the reference obligation, the credit protection sellers will assume the credit risk.

The premium paid to the CDS seller, as a percent of the notional principal, is also referred to be *CDS spread*. Buyers are making payments in terms of basis points. 160 basis points would be 1.6% of the principal p.a. For example, a CDS is written on a bond with a $10 million par value and a 3-year maturity. The CDS spread is 160bps per annum. The buyer of the swap will pay the seller $10,000,000 x 1.6% = $160,000 per year, which is usually paid quarterly (or annually, semiannually).

Figure 8: CDS buyer/seller payments



SOURCE: HULL, J. Options, Futures and Other Derivatives. 6th Edition. New Jersey, 2006.

The CDS spread widen when the credit risk of the reference obligation increase, and thus the value of CDS increase and vice versa.

Note that a CDS provides only a protection against the credit risk, not a market-wide interest rate risk, which is usually defined in CDS agreement as bankruptcy, entity default, and restructuring. For example, if a company is worried about the interest rate risk that Federal Reserve may raise interest rates, a CDS would only provide a hedge against Fed action to the extent that the Fed action increases the credit risk of the issue.

3.1.1 Mechanics of a CDS

CDS creates a short position on the reference obligation for the buyer of the swap, because the value of CDS increases as the credit quality or market price of the

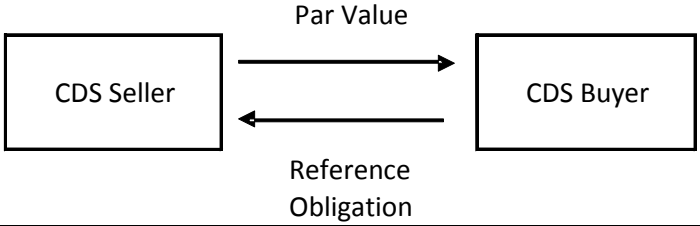
reference obligation decline. If the CDS become more valuable to the buyer when the reference obligation decreases in credit quality, the CDS can then be sold for a profit. There are also institutions, which serve as market makers on the CDS markets. They make profits by buying a protection on a bond, bidding e.g. 100 basis points, consequently selling a CDS, offering 120 basis points, earning 0.2% of the principal.

A CDS can also be used to hedge a position in a corporate bond. If the corporate bond's yield is higher than a benchmark rate, this reflects the credit risk of the corporate bond is higher than it should be. An investor can buy the bond and buy the CDS, that is, buy protection against the corporate bond long position. For instance, if an investor buys a corporate bond maturing in 10 years, returning 8% p.a. of its par value but bears a risk, the investor can buy a CDS with a 2% spread p.a., therefore yielding 6% per year and at the same time turning this bond into a risk-free asset. If the credit event occurs, the investor will earn 6% up to the time of default, exchange the bond for its face value and invest the returned cash at a risk-free rate.

CDS spreads can be sometimes used to indicate a risk-free rate on the market (which is roughly equal to the swap rate (LIBOR) minus 10 basis points). The CDS spread should be approximately the same, or less than a difference between a par yield of a corporate bond and a par yield of a risk-free bond. Otherwise it is not efficient to buy a corporate bond plus this protection.

When there is a credit event, the swap will be settle in cash or physical delivery, with the latter being the usual case. With physical delivery, the seller of the swap receives the reference obligation (i.e., the bond or loan) and pays the buyer of the swap the notional amount. The physical settlement is presented diagrammatically in Figure 9.

Figure 9: Physical Settlement on Credit Default Swap after a Credit Event



SOURCE: HULL, J. Options, Futures and Other Derivatives. 6th Edition. New Jersey, 2006.

The cash settlement specifies a mid-market value, which is an average of the face value, and the current market value of the asset. E.g. if the principal of a bond is US$200 and its price drops to US$100 on a bond market, the CDS buyer can sell it for US$150. The cash settlement is presented diagrammatically in Figure 10.

Figure 10: Cash settlement on CDS after a credit event

SOURCE: HULL, J. Options, Futures and Other Derivatives. 6th Edition. New Jersey, 2006.

3.1.2 CDS Valuation

Valuation of CDS is quite complex and we should obtain the optimal mid-market CDS spread. In this paragraph, I will use an example to illustrate how the valuation is exercised. However, I will assume payments on a 5-year CDS to be made only once a year (at the end of the year) and defaults occurring also once, halfway through the year. Let's suppose that the risk-free interest rate is 4% (LIBOR) and the probability of the default of the reference entity is 2%. The probability of the survival of the entity is quite logically 98%. Each of the following years' default probabilities is then seen as unconditional, counted from the year zero. We also assume, that the recovery rate of the reference entity is 30% and the notional principal of the underlying asset is worth $1 the payments made on CDS are made at the rate of p per year.

First, we calculate the total present value of the expected payments- premiums made on the CDS throughout the hold of the CDS. We calculate the premium as the probability of survival x p (the rate of payment). Therefore, the first premium is worth 0.9800p, the second 0.9604p and so on. To get the present value of these values, we need to discount them and since the assumed LIBOR is 4%, the first discount factor is

$e^{(-0.04x1)}$, the second $e^{(-0.04x2)}$, the third $e^{(-0.04x3)}$,… After multiplying these two outcomes, we get the present value (PV) of the CDS premiums.

In the next step, we count the total present value of expected payoff in case of the company's default. We accomplish this again by, discounting the expected payoffs, which we get by multiplying the probability of default by (1- recovery rate= 0.7). Since we expect the default payment to be made in the middle of the year, the discount factor will only be worth half the one previously calculated ($e^{(-0.04x0.5)}$ for the first year, $e^{(-0.04x1.5)}$ for the second, etc.). For example the PV of the 4th expected payoff will equal 0.0188 x 0.7 x $e^{(-0.04x3.5)}$ = 0.0115.

Finally, we calculate a present value of the accrual payments, the last payments on CDS in case of credit event (thus, the value is the same as the regular payment divided by 2). The discount factor stays the same as in the payoff calculation, e.g. the third accrual payment is (0.0192p/2) x $e^{(-0.04x2.5)}$ = 0.0087p.

The results of these calculations are shown in the following table:

Table 2: Calculation results

Year	Probability of default	Probability of survival	PV of expected payment	PV of expected payoff	PV of expected accrual payment
1 (0.5)	0.0200	0.9800	0. 9416p	0.0137	0.0098p
2 (1.5)	0.0196	0.9604	0.8865p	0.0129	0.0092p
3 (2.5)	0.0192	0.9412	0.8348p	0.0121	0.0087p
4 (3.5)	0.0188	0.9224	0.7860p	0.0115	0.0082p
5 (4.5)	0.0184	0.9039	0.7400p	0.0108	0.0077p
∑			4.1889p	0.0610	0.0436p

The final step is to sum up all the payments and calculate p- the rate of CDS payments:

∑ PV of expected payment + ∑ PV of expected accrual payment = ∑ PV of expected payoff

4.1889p + 0.0436p = 0.0610

4.2325p = 0.0610

p = 0.0144

The mid-market CDS spread should be therefore 144 basis points.

We can similarly use these calculations in a reverse order to calculate the implied default/survival probabilities (if the mid-marked spread is known).

3.1.3 Mark to Market a CDS

Like interest rate swaps, a CDS is worth close to zero at initiation. However, as real market conditions change, a CDS may have a positive or negative value. Take the above CDS for example, if the CDS spread had been negotiated some time ago for 150 basis points, for a CDS protection buyer.

The remaining 5-year of the life of the CDS

Present value of total expected payment = 4.2325 x 0.0150 = 0.0635

Present value of total expected payoff = 0.0610

Mark to market the 5-year CDS value = (0.0610 – 0.0635) x principal

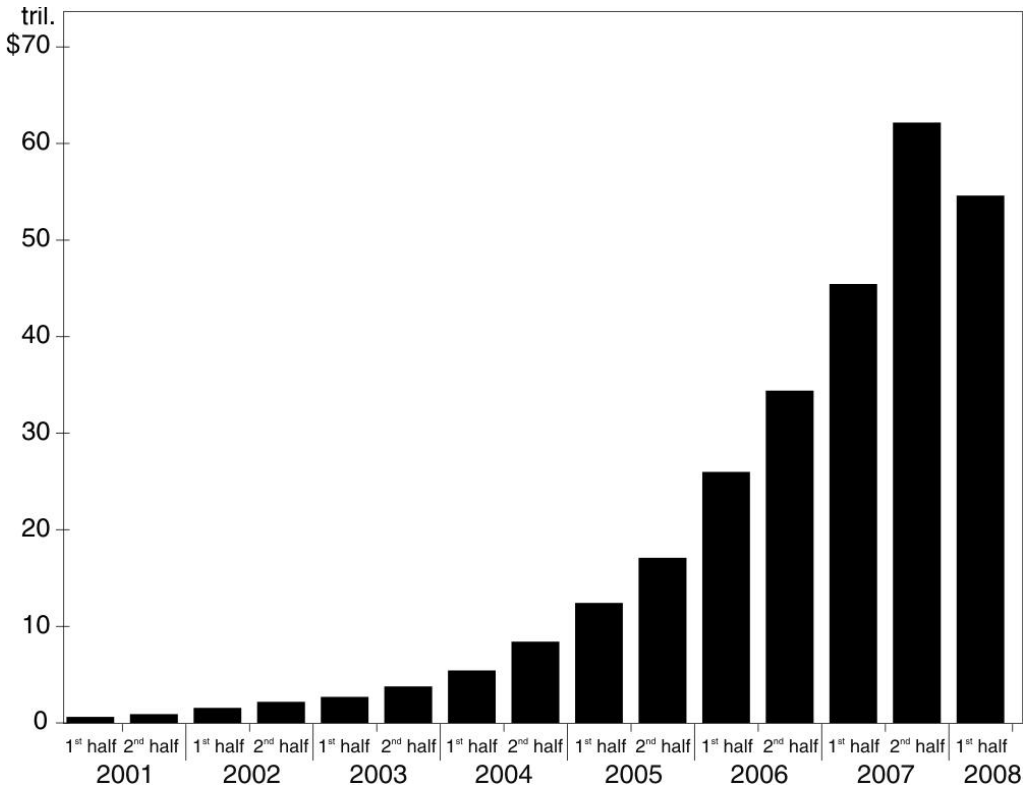
= -0.0025 x principal

Therefore, if the negotiated CDS spread is higher than the “fair” CDS spread, the CDS protection buyer suffers from the decrease of CDS market value.

3.1.4 Future of CDS

CDSs are quite unique, because unlike other OTC derivatives, which reflect interest rates, commodity prices, exchange rates,.., CDS reflect a company’s default probabilty, which is more likely to be know by some invesors more that the others. This information asymmetry also casts doubt on the future disperse of these products. However, other people, who are more optimistic suppose the CDS market will further expand, reaching size of the interest rate swap market by 2010. The following figure shows the exponential growth of the CDS market, that has taken place since 2001.

Figure 11: Credit Default Swaps (Notional Amounts Outstanding)



SOURCE: Bloomberg, International Swaps and Derivatives Association

3.2 Mortgage-Backed Securities (MBS)

A mortgage is a loan that is collateralized with a specific piece of real property, either residential or commercial. If the borrow fails to make the contractual series of payments (i.e., the borrower defaults), the mortgage gives the lender the right to *foreclosure* on the loan or lay claim against the piece of real property. The interest rate on the mortgage is called *mortgage rate*. Mortgages have been the main subject to securitization lately.

Securitization is a structured finance process in which assets, receivables or financial instruments are acquired, classified into pools, and transformed into securities backed by the cash flow or value of the underlying assets.[19] In short, it is a trading a cash flow

[19] Presentation- structured finance training

stream for an upfront payment. Reasons to securitize include fee generation, risk reduction, capital cushion relief, recording gains and losses or accelerating funding.

Structured products, resulting from the process of securitization can be backed by either assets- such as leases, securities backed by loans, credit card receivables, accounts receivables, auto loans, etc. (ABS), or mortgages (MBS)- these mortgages can be prime, Alt-A, or subprime, with prime having the highest quality and subprime the lowest. They represent the largest class of structured assets and their underlying mortgages are commercial mortgages (CMBS), or residential mortgages (RMBS).

3.2.1 Mechanics of MBS

The following figure briefly explains how a MBS works.

Figure 12: How the prime MBS market works

SOURCE: PCAOB Internal sources, 2007

Let me explain how simply a prime MBS works. Mortgage originator, like Countrywide Financial makes a loan to a person who wants to buy a house, earning a servicing fee which is 0.43% in our case. It then sells it to a securitizer, such as Freddie Mac, which charges a guarantee fee to the mortgage lender for bundling, servicing and selling MBS to investors, and managing the securitized mortgage pool. The MBS provider (Freddie) bundles a group of mortgages together, and sells a guaranteed cash flow stream to investors- the Treasury agreed to provide up to $100 billion for Fannie Mae and

Freddie Mac to prevent their net worth from falling below zero.[20] I will explain how a subprime mortgage becomes a MBS in the following part, using RMBS as an example.

3.2.2 Residential Mortgage Backed Securities (RMBS)

As I already explained, RMBS are securities backed by residential mortgages, in other words using a residential mortgage loan as a collateral. They are currently mentioned very often, since their participation in the current crisis is considered higher than CMBS.

The main difference between the prime and subprime MBS is that unlike the prime MBS, these securitizations are arranged not by the GSEs (Freddie, or Fannie), but Wall Street. Also, because of the quality of the collateral, each mortgage in the prime origination can have a AAA rating, whereas subprime RMBS must be structured to originate a AAA piece- RMBS originators are selling different parts of the cash flow (tranches) to investors, but since the mortgages are pooled, this cash flow is not separated, just prioritized to different investors.

3.2.2.1 Mechanics of RMBS

The following steps describe the process of how MBS work:

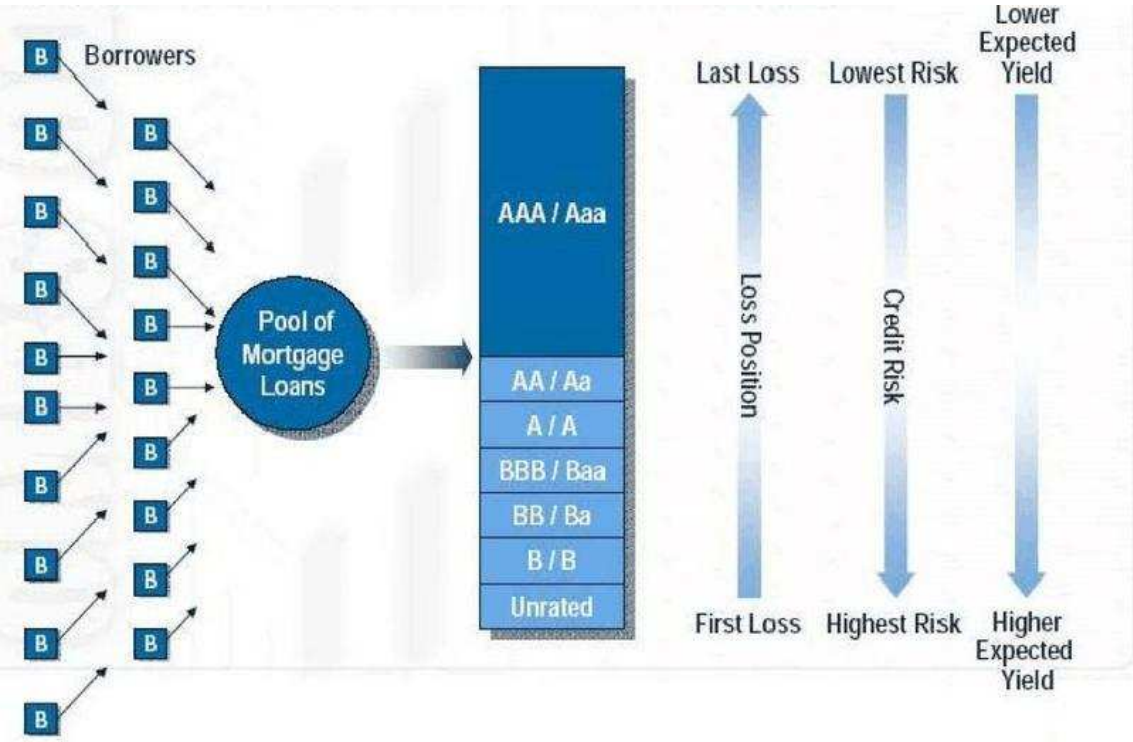
1) A pool of mortgages is created from mortgages, which are grouped according to their risk category- prime (very safe), Alt-A (somewhere between prime and subprime), and subprime (very risky).
2) This pool is packaged into a MBS.
3) The MBS is consequently sliced and diced into different classes with varying maturity- tranches. Each tranche represents a different risk category. The first loan to default will be placed into the most junior tranche, but having the highest rate of return, while the safest loan is rated AAA and placed into the most senior tranche, but having a lower yield.

[20] STEINBERG, M. Treasury's guarantee of Fannie/Freddie Debt Leaves Foreigners Confused. *Seekingalpha.com,* 2008. *http://seekingalpha.com/article/95161-treasury-s-guarantee-of-fannie-freddie-debt-leaves-foreigners-confused*

4) The tranches are resold to individual investors with different risk appetites.

The whole process is shown in the following figure.

Figure 13: Sample subprime RMBS structure



SOURCE: PCAOB Internal sources, 2007

For example, one may agree to take the first 4% of the losses, but demands higher interest payments, as a compensation for holding a low quality, or risky tranche. Lower tranches protect the higher ones by accumulating losses, but on the other hand, earn more (this is a form of natural leverage.

3.2.2.2 Valuation of a RMBS

We can use two approaches when analyzing RMBS:

- Static cash flow yield methodology
- Monte Carlo simulation methodology

The Monte Carlo simulation methodology is a valuation model and specifies a theoretical value of a RMBS. A product resulting from this model is an option-adjusted spread (OAS). First, the simulation is used to generate interest rate paths and cash

flows. Then, we calculate the present value for every scenario interest-rate path. The discount rate used for calculating the present value is the monthly simulated spot rate plus an adequate spread. Next we determine the theoretical value, which is the average of the path values. We also simulate the average life of a RMBS which is the average life of the average lives along the interest-rata paths. Finally, we calculate the OAS which is in the Monte Carlo model a spread added to all the spot rates on all interest-rate paths, equaling the observed market price and the average present value of the paths. Mathematically, OAS is the spread satisfying the following definition:

$$\text{Market price} = (1/N)\{PV[path(1)] + PV[path(2) + \ldots + PV[path(N)]\}$$

where N is the number of interest-rate paths

Ultimately, we count the option cost, which is the difference between the static spread (static interest-rate environment) and OAS at the assumed volatility of interest rates.
The Monte Carlo method can also be used to calculate some important measures, such as effective duration and effective convexity.
The total return on the RMBS is the measure assessing the security's performance over an investment horizon and neither Monte Carlo model nor the static cash flow yield methodology evaluates this performance of an individual RMBS- it does not tell the money manager if the investment aims can be reached. Before applying the Monte Carlo model, we first need to specify the investment horizon. Then we must assume a prepayment rate over the horizon, and a reinvestment rate respectively. Finally we can use the Monte Carlo model to assess the price at the end of the horizon under a specific set of assumptions.

3.3 Collaterized Debt Obligations (CDOs)

3.3.1 Traditional CDOs

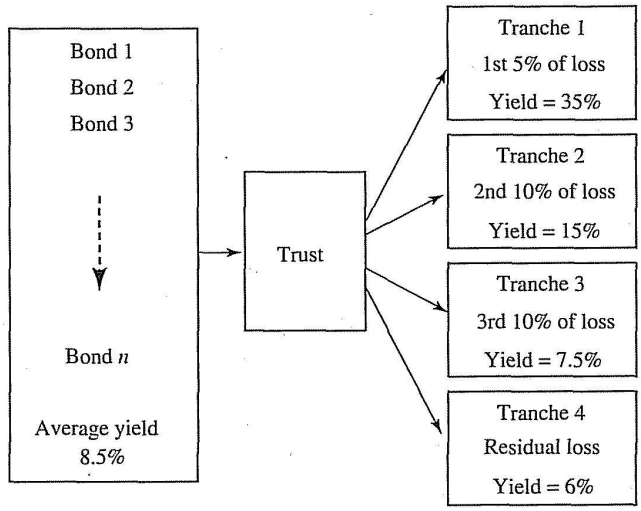
CDOs are structured Asset-Backed Securities, with different levels of seniority (tranches), risk and debt subordination, representing principal and interest payments backed by the cash flows of an underlying portfolio of debt instruments (such as bonds, default swaps, loans, credits). If the debt instruments are bonds, we call it

Collaterized Bonds Obligations (CBO), and if they are loans, CDO becomes Collaterized Loan Obligations (CLO).

3.3.1.1 Mechanics of a CDO

We can simply explain the mechanics of CDO by imagining a couple of water reservoirs on a slope of a mountain. These reservoirs are being filled with water starting with the ones having the highest elevation. I the highest one gets filled to its capacity, the water further flows underneath to the very next one and so on. These reservoirs represent different tranches in a CDO and the water stream can be replaced by the cash flows generated by the underlying assets.

Figure 14: Collateral Debt Obligation



SOURCE: HULL, J. Options, Futures and Other Derivatives. 6th Edition. New Jersey, 2006.

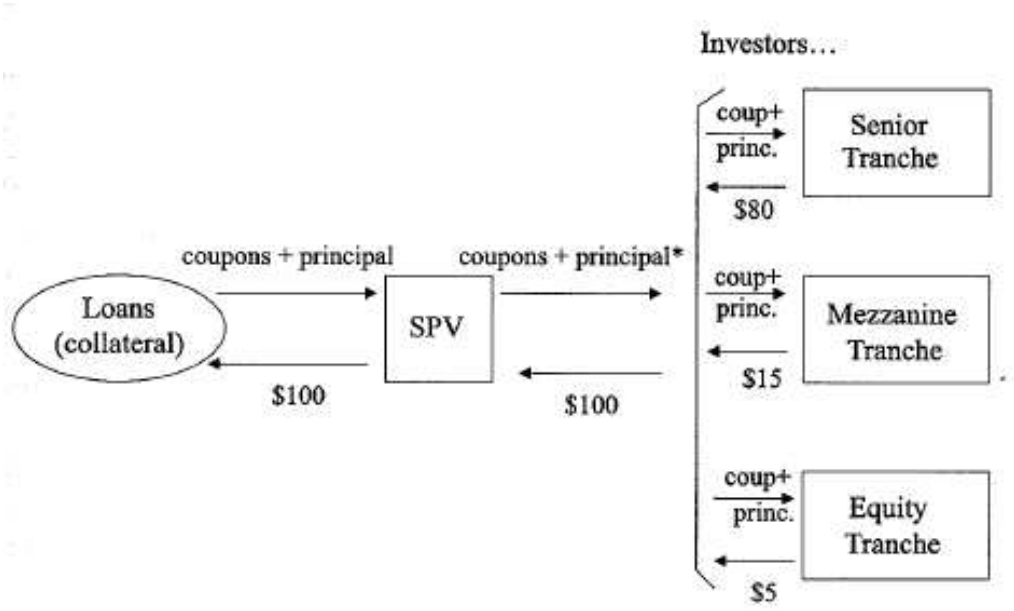
Tranches at the very top (reservoirs having the highest elevation) are considered to be the safest ones, but have the lowest yield and represent the most senior claims on the cash flows. The most profitable junior ones, on the other hand, bear the most risk. For example, the most junior, first tranche (equity tranche) represents 5% of a bond, yielding e.g. 35%. This means this security will absorb all the losses until they reach 5% of the bond's notional principal, but the tranche holder will get 35% of the principal as an interest rate payment (This tranche is usually kept by a CDO issuer). The second tranche may represent 10% of the par value, meaning if the losses exceed 5%, this tranche will absorb them until 15% of the principal is reached. This tranche would have

a lower interest rate, e.g. 15%. The following tranches work the same way, their riskiness as well as rate of profit decreases as the seniority increases. The last tranche absorbs the residual loss and is the least profitable. Investors, who buy these tranches bear the losses, but in return receive a periodic fee from the CDO issuer.

Tranches of a CDO are rated by major credit rating agencies, such as Standard and Poor's, Moody's or FitchRatings.

The following figure, including a SPV also explains how a CDO works.

Figure 15: CDO



SOURCE: BOMFIM, A.N. Understanding Credit Derivatives and Related Instruments. Elsevier Inc., 2005

Let's assume that a CDO issuer has a portfolio of loans with a total notional principal of e.g. $100 million. In our case, we can assume that the issuer is a Special Purpose Vehicle (SPV), designed specifically to create this instrument. To finance this pool of loans, the SPV sells different debt obligations to investors. The cash flow promised by these notes (tranches) is backed by the stream of payments generated by the loans.

Every month, the CDO issuer receives payments from borrowers in form of principal and coupon payments and passes them through to the holders of the tranches. Any cash received from the underlying loans is first used to meet cash flow owed to the most senior holders, as already explained. After they are paid up, holder of the second

most senior tranche receives a payment and so on, until the most junior investor is paid up. The CDO mechanics is built so that when in case of no default, the cash flow generated by the loan portfolio equals the cash flow needed to meet payments of all holders of the notes, from the most senior ones to the most junior ones. In our example of a CDO with 4 levels of seniority, the first-loss tranche is referred to as equity tranche, the second-loss is subordinated mezzanine tranche, the next one is senior mezzanine tranche and the safest note is called simply senior tranche.

3.3.1.2 Moral Hazard and CDO

Institution that accumulates the underlying loans (SPV) often retains the equity tranche, or at least part of it. This is done mainly because of two reasons. First, because there is so much risk associated with it, this tranche may be very hard to sell on the market. Second, the bank that created the SPV may want to avoid investors potential concerns about the moral hazard of the bank. Investors may think, that the fact that banks can sell off their loans and transfer the credit risk to investors may make them want to make even more risky loans than otherwise. Banks can also have an informational advantage when it comes to assessing the credibility of the underlying reference entities, so it can hide potential danger coming from the loans by selling it to entities unaware of this negative fact. By buying back the first-loss tranche, the bank hopes to diminish this kind of worries.

These CDOs are referred to as cash CDOs, whereas synthetic have been the ones getting much of the popularity recently.

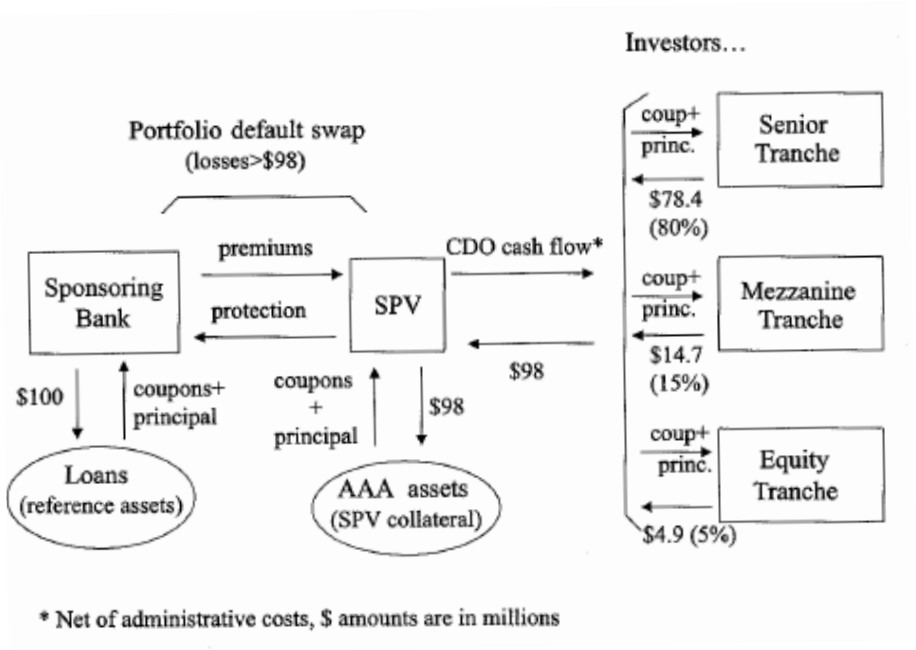
3.3.2 Synthetic CDOs

Synthetic CDOs enable the sponsoring entity (bank) to sell only a credit risk associated with the portfolio, keeping the loans on its balance sheet, rather than selling the loans. This is done through the CDS, which is issued by the SPV in our case, sold to the bank. In this case, the bank usually keeps the small first-loss piece, due to problems already discussed. It can buy a protection against for example losses exceeding 2% of the portfolio.

3.3.2.1 Mechanics of a synthetic CDO

This type of a CDO works quite similarly to the traditional one, as the following figure illustrates.

Figure 16: Synthetic CDO



SOURCE: BOMFIM, A.N. Understanding Credit Derivatives and Related Instruments. Elsevier Inc., 2005

The bank, which buys the protection from the SPV makes periodic payments to the SPV which in return, promises to cover any default losses of the portfolio that exceed e.g. those 2% (as in a CDS agreement). Next, the SPV issues different tranches of securities and sells them off to investors, just as in the traditional CDO. However, the credit default swap agreement is not funded, meaning that the premiums received from the sponsoring bank cannot possibly fully compensate for the funding from investors and credit risk associated with the portfolio of reference loans. The income received by the SPV from the sale of the notes is therefore used to buy a high-grade, usually AAA-rated assets. It then uses these instruments as a collateral towards the sponsoring bank's and investors' obligations and to meet all the payments promised by

the tranches. If there are no defaults in the pool of underlying loans, the CDO cash flow to investors is generated by the income from the sponsoring entity's protection premiums and the triple-A assets collateral cash flow. At the maturity of CDO tranches, the collateral is liquidated to pay off the investors' principal and the CDS agreement is terminated. In case of default, the SPV commonly liquidates just part of the collateral to cover the bank's losses and reduces the nominal value of the tranches held by the junior investors accordingly.

3.3.2.2 Why synthetic CDOs?

Going synthetic has been growing in popularity lately, because of several reasons. Bank does not have to sell any loans to reduce its credit risk exposure. Selling loans can often be expensive in terms of the borrower's approval and notification process. It can also be problematic for relationships the bank maintains. By using a synthetic CDO, the bank effectively securitizes the credit risk without the loan (whereas in a traditional CDO both have to be securitized) and do this process completely anonymously.

3.3.3 CDO Valuation

Valuation of CDO tranches strongly depends on the default correlation among the debt instruments in the collateral pool. If the correlation is low, there is a big difference among riskiness of the tranches, the most senior one is very safe and the most junior is very risky. If we consider a synthetic CDO, and the correlation increases, the default probability of more underlying companies defaulting at the same time increases and reaches its peak in case of perfect correlation. This correlation can also be implied from the spreads on tranches. For this valuation, one-factor Gaussian Copula Model of Time to Default or Black-Scholes Model can be used.[21]

Besides the degree of default correlations, two other factors enter into the CDO pricing: the debt instruments' credit quality and the details of the tranching structure of the CDO. In addition to the synthetic CDO, the legal structure of the SPV and a credit

[21] HULL, J. Options, Futures and Other Derivatives. 6th Edition. New Jersey, 2006.

quality of the sponsoring bank and the SPV's collateral are also very important when assessing the price.

4 Role of financial derivatives and other structured products in the 2007 financial crisis

4.1 Structured products and their shortcomings

Although credit derivatives cannot be solely blamed for this financial wreckage, they contributed to it significantly by making the financial system more opaque and complex, binding the global financial world more closely and facilitating the spreading of the risk systemically. They were created and gained popularity in such a short time that no regulatory and rating agencies could keep up with this rapid development. According to Securities Industry and Financial Markets Association, CDOs worth $272 billion were issued in 2005, out of which about 65% were structured products (RMBS, CMBS, CMOs, ABS, CDOs, CDS and other structured products), $521 billion in CDOs were issued in 2006 with 59% in structured products, and CDOs worth $482 billion in 2007 with 54% of structured products as underlying collateral (with all-time peak of $102 billion in structured products during the second quarter with a rapid decrease to $40 billion in the third quarter). After the bubble burst only 30% of total CDO issuance worth only $61 billion was represented by these derivatives. According to J.P. Morgan, there were about $1.5 trillion in global collateralized debt obligations and about $500 billion to $600 billion in structured-finance CDOs (as of August 2007), referring to those made up of bonds backed up by subprime mortgages, slightly safer mortgages and commercial mortgage backed securities.[22]

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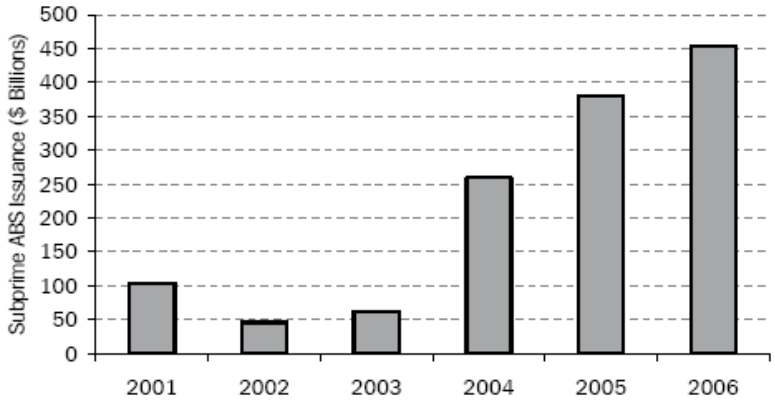
[22] ANDERSON, J., TIMMONS, H. Why a U.S. Subprime Mortgage Crisis Is Felt Around the World. *The New York Times*, August 2007.

Structured products are rather complex products as they are structured into specialized slices out of a pool of underlying assets. Banks increased the complexity even further pooling the tranches again and creating CDOs out of CDOs (CDOs-squared, even CDOs-cubed). Low interests triggered a subprime lending boom and banks sought an instrument that would enable them to take those subprime loans off their books and enable them to lend more. The solutions were Asset Backed Securities (ABS) backed by subprime mortgages - RMBS. Issuance of RMBS increased significantly, mainly during 2004-2006 (CDO issuers made much of the demand).

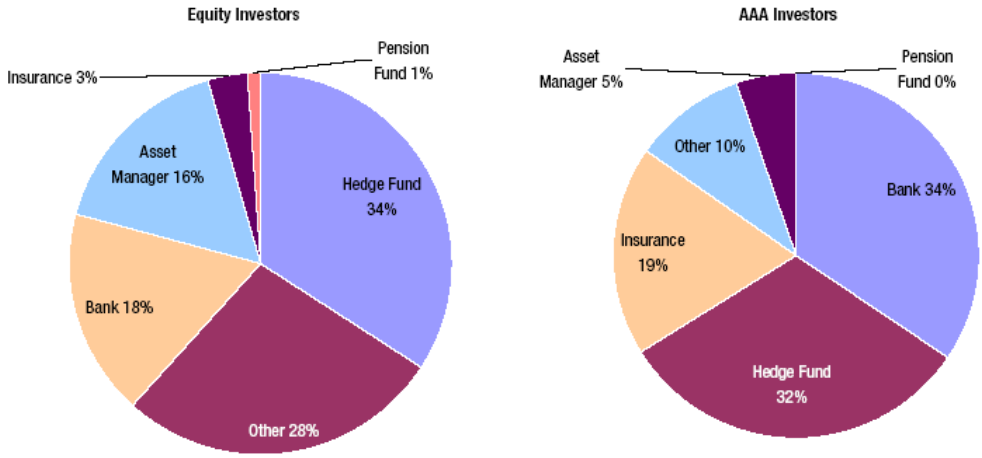
Figure 17: ABS backed by subprime mortgages:



SOURCE: Citigroup (www.citigroup.com)

Tranches of RMBS and CDOs were sold to individual investors, with exposure to CDO tranches as shown in the figure.

Figure 18: Investor Profile of Equity and Senior (Triple-A) Mezzanine CDO Tranches



SOURCE: Citigroup (www.citigroup.com)

As the junk borrowers started to default, it revealed systemically dispersed losses across the global financial system as well as inaccurate ratings and dangerous leverage banks had been undertaking.

The beginnings of the structured products can be traced to a small management team of bankers at J.P. Morgan in New York and their leader Bill Demchak (now a PNC Financial vice chairman in Pittsburgh since 2002). It is necessary to mention that it all started in 1997 when the Asian financial crisis triggered Demchak to create a financial instrument that would protect him from bad loans. He lost money he had lent to Asian blue-chip companies and found out his lending practices were inadequate because he made too many of them and they were quite simply not profitable enough. Demchak needed to somehow reduce his exposure to these loans, in other words free up some capital for something more profitable but without alienating his blue-chip customers. Demchak had a vision of a credit derivatives market and as a result he initiated a project called Credit Transformation within the bank. Along with Blythe Masters, who was a "poster child" of this project, they created an innovation by basically combining securitization and credit derivatives.

Financial innovation, known as securitization, involves creating an Asset Backed Security (ABS) through pooling cash flow assets e.g. mortgages, credit card loans, or corporate loans, then slicing them up into layers called tranches, which can be sold to individual investors. It has been a successful part of corporate risk management since 1970s. Demchak modified this standard securitization by using CDS on a large scale. They pooled J.P. Morgan's exposure to many (around 300) corporations, took it off their balance sheet by creating a special investment vehicle (SIV) and sold tranches of that to investors and paying them for an insurance, which protected him from later defaults. AIG was one of many who misused CDS as I will describe later.

In 1997, Demchak and his team finished the first credit-derivative deal called Bistro (Broad Indexed Secured Trust Offering) with similar structure as a CDO, which worked for J.P. Morgan perfectly, eliminating their exposure of more than $9.7 billion. They industrialized the product and dominated the derivatives market (with $90

trillion underlying assets tied to derivatives, $10.2 trillion out of that to credit derivatives). These products did not perform well later on even with blue-chip loans, with investors loosing money at equity, mezzanine and even AAA layers.

Rating agencies became an integral part of the creation process but this close relationship with the originators of the structured deals may have been in the center of the subsequent problems. Rating products that they had a stake in poses conflicts of interest.

Bistro looked so appealing though, as a way to free up capital and off-load credit risks that many institutions started to copy it. However, Bistro was not as solid as the Demchak team intended, spreading and causing the problems to magnify as the products became widespread. Problem was that within the structure, banks could substitute underlying loans as long as they maintained the same rating. This allowed them to exchange a healthy loan for a seemingly shakier one, but still with the same rating (another mistake by rating agencies). Ultimately, the game became less about reducing risk and more about fooling regulators and the rating agencies.[23]

In 2000, after the burst of the tech bubble constructs similar to Bistro performed terribly and turned out not to be profitable as defaults became more frequent. Although these structures obviously failed, the game was back on in 2003, this time with mortgages to subprime borrowers with shaky credit and loans to junk-rated companies.

It failed again, with financial firms and investors losing billions of dollars. Bistro was the first deal to introduce this model of "originate-to-distribute", taking the risk from the bank and selling it to anyone willing to bear it, immediately dispersing risk throughout the whole market. Thus, when the defaults on subprime mortgages commenced, it sent ripples through the whole financial system domestically and abroad.

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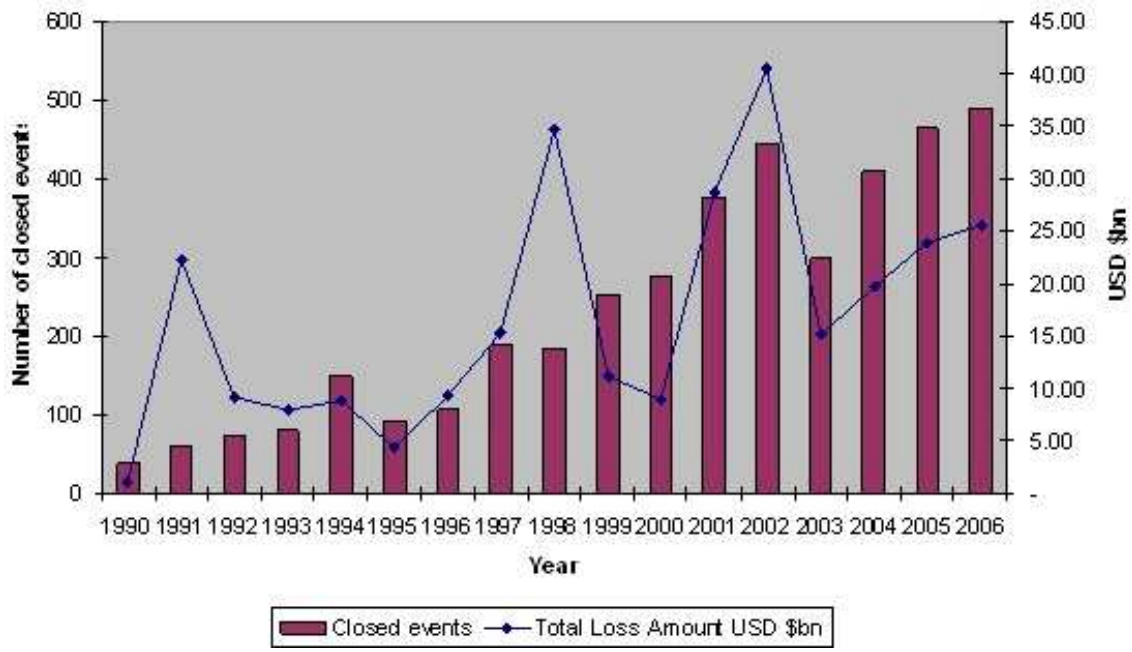
[23] ANDERSON, J., TIMMONS, H. Why a U.S. Subprime Mortgage Crisis Is Felt Around the World. *The New York Times*, August 2007.

Figure 19: Annual Losses on Subprime Mortgages by Settlement/End Date, 1990-2006- Financial Industry



SOURCE: Algorithmics (www.algorithmics.com)

Celebrated as a way for banks to diffuse their risks, the credit derivatives invented by Demchak's team have instead multiplied the risks. The new credit vehicles encouraged banks and other financial firms to take on riskier loans than they should have; helped increase leverage in the global financial system; and exposed a much wider array of financial firms to the risk of default.[24]

Another trend J.P. Morgan pioneered was holding the super senior layer alongside the first-loss tranche. Other investors copied the holdings but unlike J.P. Morgan, they were not aware of risks due to junky underlying assets and did not set aside enough capital for back up. When defaults started, banks could not come up with sufficient capital, resulting in huge losses. The leverage and securitization magnified the losses.

[24] ANDERSON, J., TIMMONS, H. Why a U.S. Subprime Mortgage Crisis Is Felt Around the World. *The New York Times*, August 2007.

4.2 Securitization as a solution to relieving cash reserves[25]

Today, securitization is one of the main factors contributing to the mortgage crisis because of several mistakes overseen by the bankers, investors and regulators. One of the problems was pooling sub-prime and low quality underlying assets together with investment-grade assets and dividing them into tranches, which were then rated inadequately by rating agencies. This combination did not reduce the risk, as it should have. Instead, it enabled multiple institutions to reduce their capital cushion, actually taking on even more risk, which was then offloaded into the system. Securitization also caused the housing bubble to spread globally as it enabled banks to take the loans off their books, and sell them to other companies. Thus, defaults on such a large scale as was the case in the US sub-prime market caused all the involved institutions to be ”infected” because the risk was not localized as it was before the use of securitization. Additionally, low-quality underlying assets increased the probability of occurrence of a large shock, in which all the risks, which should have been uncorrelated, are now dependent and form a systemic risk. Investment banks in case of such a shock find themselves with inadequate capital. In short, the securitization was supposed to be used to offload risk at a specific company but all it did in reality was to reduce the capital requirement, maintaining the risk within the ABS.

The following example illustrates how the securitization reduced the capital cushion.

Let’s assume a subprime-loan with a par value of $100. The bank is obliged to hold a capital cushion as stated by Basel I (banks in the US currently use Basel I requirements, but banks elsewhere in the world are starting to use Basel II), which requires 1% of the face value minimum liquidity reserves, and a minimum capital requirement of 6% in the US, 8% in Europe (I will, however, assume 8% because banks generally held 7%-10% in their reserves anyways) of the FV, adjusted for the risk weighting of an asset (in our case 50%). The total capital cushion would be 1 + (0.5 x 8) = 5%. This situation was typical for banks before the securitization became popular.

[25] STRONGIN, S., O‘NEILL, J., HIMMELBERG, CH., HINDLIAN, A., LAWSON, S. Effective Regulation: Part 1, Avoiding Another Meltdown. *Goldman Sachs Working Paper,* March 2009.

If the bank, which made a subprime loan packaged it with other similar subprime and poor quality assets into an RMBS, it could reduce the capital required. This is because regulators could assign different capital requirement to different tranches due to different risk weighting and rating. RMBS could for example consist of AAA-rated tranche holding 75% of the aggregate loan, AA tranche holding 10%, A tranche 8%, BBB tranche 5% and the first-loss, or equity, most junior tranche having e.g. 2% of the loan. Risk weighting varied according to their assumed riskiness. Securitization concentrated the risk into one single tranche, which was expected to absorb all aggregate losses and was charged a 100% capital requirement. The effect was as the table shows:

Figure 20: Basel I: Securitization reduces the capital cushion required

Whole loans	(A) Reserve requirement	(B) Risk weighting	(C) Minimum tier 1	(D) Tier 1 allocation (B * C)	(E) Total capital held (A + D)
Pool of mortgage loans	1.00%	50%	8.0%	4.0%	5.0%
Total					5.0%

RMBS	(A) Split	(B) Risk weighting	(C) Minimum tier 1	(D) Tier 1 allocation (of loans) (B * C)	(E) Tier 1 capital held (A * D)
AAA	75%	20%	8.0%	1.6%	1.2%
AA	10%	20%	8.0%	1.6%	0.2%
A	8%	50%	8.0%	4.0%	0.3%
BBB	5%	100%	8.0%	8.0%	0.4%
Equity	2%	1250%	8.0%	100.0%	2.0%
Total	100%				4.1%

SOURCE: STRONGIN, S., O'NEILL, J., HIMMELBERG, CH., HINDLIAN, A., LAWSON, S. Effective Regulation: Part 1, Avoiding Another Meltdown. Goldman Sachs Working Paper, March 2009

What was the problem in this case? First, the bank was not obliged to hold 1% minimum reserves on RMBS as before. Furthermore, risk weighting of 98% of the loan equaled 25% on weighted-average basis (vs. 50% of 100% of the loan without securitization). This was an opportunity for the bank, since it could reduce a capital requirement by half when it sold the equity tranche. Hedge funds and insurance companies were the most common customers, which sought high profits through high leverage and were not subject to Basel I requirements.

The bank could further generate a capital relief by repackaging tranches of an RMBS into a CDO. If a CDO was created by pooling and slicing multiple BBB-rated tranches of many similar RMBSs, it creates another group of differently rated tranches. CDO also contained a "super-senior" AAA tranche, which held about 60% of the total and was considered super safe, plus another AAA tranche with 20% of the loan (these high ratings could be assigned due to a relatively large equity tranches (5%) that were supposed to absorb all aggregate losses and assumed CDO diversification). By forming a CDO, 80% of the total loan could be assigned AAA rating. As the table shows, separately held BBB tranches required more capital than those forming a CDO (exactly the same ones)- 8.0% vs. 7.1%.

Figure 21: Transforming RMBS into CDOs also reduces the capital required

RMBS (BBB tranches)	(A) Split	(B) Risk weighting	(C) Minimum tier 1	(D) Tier 1 allocation (of loans) (B * C)	(E) Tier 1 capital held (A * D)
BBB	100%	100%	8.0%	8.0%	8.0%
Total	100%				8.0%

CDO	(A) Split	(B) Risk weighting	(C) Minimum tier 1	(D) Tier 1 allocation (of loans) (B * C)	(E) Tier 1 capital held (A * D)
AAA (super senior)	60%	20%	8.0%	1.6%	1.0%
AAA	20%	20%	8.0%	1.6%	0.3%
AA	6%	20%	8.0%	1.6%	0.1%
A	5%	50%	8.0%	4.0%	0.2%
BBB	2%	100%	8.0%	8.0%	0.2%
BB	2%	200%	8.0%	16.0%	0.3%
Equity	5%	1250%	8.0%	100.0%	5.0%
Total	100%				7.1%

SOURCE: STRONGIN, S., O'NEILL, J., HIMMELBERG, CH., HINDLIAN, A., LAWSON, S. Effective Regulation: Part 1, Avoiding Another Meltdown. Goldman Sachs Working Paper, March 2009

Hedge funds usually held the equity tranches and banks retained the rest of them. This distribution would not be problematic if the underlying loans were of high-quality (e.g. student loans, prime jumbo mortgages,…). However, since the tranches contained subprime assets the probability of a bank getting into trouble while holding inadequate capital rose sharply and eventually caused many of them to go bankrupt or be acquired by other institutions.

4.3 Rise and fall of the Credit Default Swaps[26]

CDO and RMBS were not the only structured products that contributed to the crisis. “The best way to understand the financial crisis is to understand the meltdown at AIG”. AIG was a perfect example of how many companies misused structured products. It was bailed out after posting the largest quarterly loss in the US corporate history, amounting to $61.7 billion ($465,000 per hour during the last 3 months before posting it). The company was seen as a poor victim of bad luck and “infected” by poor health of the economy. The truth was that AIG was systematically avoiding regulation and achieving weaker oversight over their activities in a toxic, complex and completely unregulated derivatives market. People, who are truly mad about the current situation, summarized the political trend as: “the gradual takeover of the government by a small class of connected insiders, who used money to control elections, buy influence and systematically weaken financial regulations. Given virtually free reign over the economy, these same insiders first wrecked the financial world then cunningly granted themselves nearly unlimited emergency powers to clean up their own mess.” There is some truth to this conclusion.

Joseph Cassano, who took over as the chief of AIGFP (AIG Financial Products- a London-based subsidiary of an American insurance company) in 2001, was in the center of this as he was making huge bets with taxpayers’ money, money that he actually did not have. He started to work for Mike Milken in the 80’s, an expert on use of junk bonds on Wall Street, who also actively sought ways to evade detection. Cassano used the investment boom created by a then new product CDO to establish a profit making machine at AIG. The workings of this product was explained previously but it is necessary to repeat that by using this product, banks could turn their worst mortgages into investment-grade assets by purely “convincing” rating agencies to granting AAA ratings. Reality was however different. “The banks knew they were selling bad loans”, as one London-based trader from one of the bailed-out firms said. To get the triple A rating, banks made up mathematical formulas to ‘show’ CDO’s reliability, instead of showing the true nature of the underlying assets. Rating agencies

[26] TAIBBI, T. The Big Takeover. *RollingStone.com,* March 2009.

did not do their due diligence. As conservative investors, who were also buying these subpar mortgages took on more and more CDOs, they needed to somehow hedge, or insure their investments. That's when Cassano came in, settling in London to sell a "lucrative form of insurance" in a form of a CDS.

CDS was presented and popularized by J.P. Morgan (currently known as the "Morgan Mafia"), which sought ways to lend more and at the same time accepting regulations of the minimum cash reserves. They were successful in 90's by arguing, that by buying this protection, they moved the default risk off their balance sheets and therefore should be allowed to lend more. Regulators accepted this argument.

Cassano's insurance differed from the regular insurance in several ways though. First, he did not have to have a single penny to back the deal when making the contract. He could sell as many guarantees as he wanted to without putting up a single dollar. Furthermore, he was selling "naked CDS" instruments, which meant that no one in the contract was obliged to hold the underlying loan. It was basically about betting on someone else defaulting and Cassano made this a huge new market but without having cash to pay it off in case of defaults happening at the same time.

Cassano indeed made this a highly profitable business, AIGFP's profits rose from $737 million to $3.2 billion through period 1999-2005 by selling about $500 billion of CDS insurance with more than $64 billion related to the subprime mortgages. Prior to 2005, AIGFP's debt was rated AAA, so it did not have to maintain much collateral to back its deals (AIG had a very good reputation anyways). In 2007 however, their own accounting practices caused their portfolio to be downgraded. In the fall 2007, losses of the AIG's CDS portfolio climbed up to $352 million, hidden from the pubic eyes. In February 2008, AIG posted $11.5 billion of losses in last year. Cassano resigned. 7 months later, AIG was facing another downgrade, from AA to A forcing it to show much more cash backing up the CDS contracts than they actually had (even if the company sold every single asset it had on its balance sheet, it would not be able to post as much collateral as their rating required). This was what sank this insurance giant, which was bailed-out September 16, 2008.

Cassano's business would not have been possible without the necessary space from regulators. I will explain their role and their "support" for AIG in the next chapter.

Supervision was indeed insufficient, but their internal controls were notably lacking too (considering that half a year before their official bankruptcy they did not have a chief financial officer and risk-assessment officer and never hired one since then).

4.4 Misapplied and static ratings[27]

Rating agencies have played a vital role in assessing companies' creditworthiness since 1909, when a modern credit rating industry was created by John Moody. Rating agencies´ revenues were secured by subscription fees, which were paid by subscribers, who in exchange received the rating of a specific company's debt. Since the 1970s, rating agencies have instead been making profits from payments from issuers of securities. In recent years, relatively new structured products were a great opportunity for rating agencies to increase their profits. They were also motivated to create new approaches and models to rate these products, since many investors were only allowed to purchase investment grade assets and demand for these products with relatively higher yields was very high. Next figure shows how rapidly the global structured finance issuance was growing.

Figure 22: Global structured finance issuance is growing rapidly

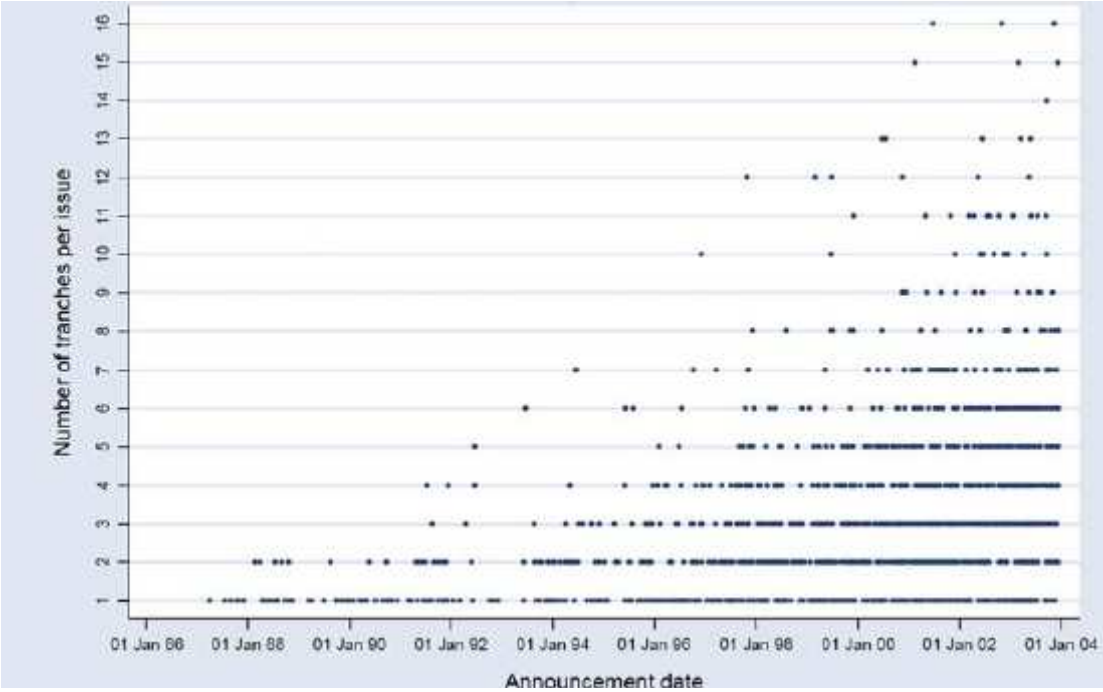
SOURCE: Moody's Corporation, Investor Presentation (March 2007)

Rating agencies applied bond ratings on RMBS and CDOs, however, there are differences in the underlying data. The main difference between traditional corporate

[27] MASON, J.R.,ROSNER, J. Mortgage-Backed Security Ratings. May 14, 2007

bonds and structured products is that bonds have been empirically used and tested, therefore risks associated with any economic condition have been well observed over time. On the contrary, since the market with structured products is relatively new and has been growing in complexity over time, risks coming from structured securities were relatively unknown.

Figure 23: Tranches issued in European securitizations 1987-2003



SOURCE: FIRLA-CUCHRA, M., JENKINSON, T. Why are Securitization Issues Tranched? Oxford University Working Paper, 2005.

RMBS is one of the most complex structured products, since structures with other types of collateral (equipment assets, credit-card receivables, auto-loans, and others) have much simpler tranching structures.

Rating agencies played their role in individual structuring of the deals: „The need for rating agencies to objectively assess and verify information rises in structured finance transactions since, unlike the traditional ratings, process in which an enterprise can do a little to change its risk characteristics, in anticipation of an issuance, in structured finance, the rating agency is an active part of the structuring of the deal." There have been many claims that rating agencies were biased and not objective, because their main source of income was from agents who structured the deals, rather than investors who were buying them. There have been examples of a seeming conflict

of interest on behalf of the issuers (clients) and rating agencies' being involved in a legislation process (GSE legislation in 2005, when S&P clearly stated that it would reconsider GSE's unsecured debt rating if the legislation passed). Such an involvement had never happened before.

Rating of tranches of either RMBS or CDO are crucial for their sales. In order to attain a specific, desired rating, the arrangers „pre-rated" these securities using publicly available models of rating agencies and informed the issuers about the requirements necessary to obtain these ratings. It is claimed, that it was investors who wanted rating agencies to use the same methods and practices as they used on bonds (which they were already familiar with), when evaluating structured products, in order to be able to change and adapt profiles of the tranches to eventually receive the desired rating from the agency. Also, most investors rely on these official ratings when assessing structured deals, which are very difficult to analyze due to complexity, short history, lack of transparency and available data, and diversity of underlying assets.

Rating agencies claimed that methodologies they used were subject to a common rating process and scales remained the same but there has been increasing evidence, that frequent changes have been made to methods and applications used for structured products. Although scales, used to compare different asset classes equal to those before, default risks in each of them differ significantly, which makes it harder for investors to compare risks of different securities. Presence of these frequent adjustments is evidence that they were not able to set stable measures of several factors (e.g. risk correlation), because they were in need of constantly enhancing their techniques in response to the pressure of high demand for structured products and complex deals in a relatively short time. Such rush resulted in potential mistakes in assessment of present risks. For example in Europe during 2007, 2 rating agencies (out of 3 major ones) posted 57 changes in their methodologies- 12 were related to CDOs and 45 to ABS. These regular adjustments became a problem, because agencies usually did not re-rate existing securities after changing their methods, applying changes only to future transactions, therefore similarly rated assets of different issuance dates could have significantly different risk profiles.

Another issue that rating agencies were blamed for what was a lack of details from mortgage securitizers, since they sought no additional information about the borrower's credibility from the issuers, nor did they verify data provided to them (financial and non-financial). For instance, Moody's introduced a new model in 2002, requesting 3 categories of data: primary, highly desirable and desirable. Before 2002, they did not even request the primary data, crucial for the ratings' efficiency. The proposed model was supposed to be created as a reaction to changing and evolving mortgage market, growing in complexity and attached to more risks. Also, this new model did not incorporate important information like DTI (debt-to-income), even though it is along with LTV (loan to value) and FICO score the most significant measure of mortgage credit risk.

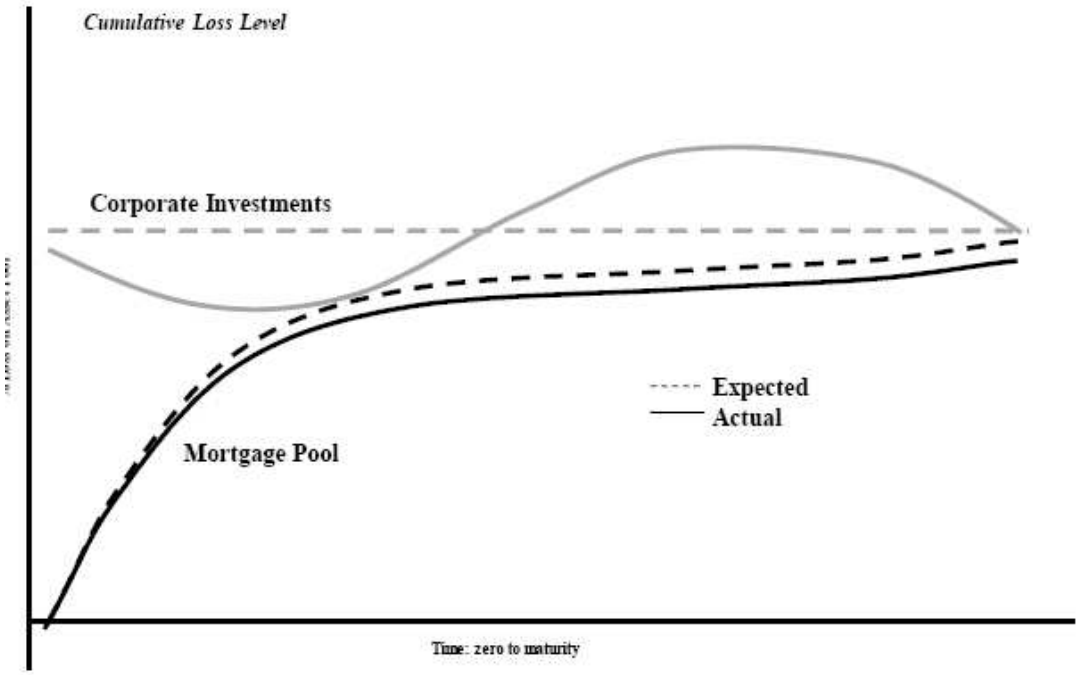
Moreover, rating agencies used automated appraisal techniques (as AVMs-Automated Valuation Models), which use lagged housing price data (several months old), thus overestimating property values during market decline.

There are multiple facts showing RMBS and CDOs should not have been rated using traditional corporate debt methods. Agencies argued that they intended to use the same rating processes for RMBS because of diversification it carried. However, diversification is not created by purely pooling investments and this can be proven by showing that although the overall risk of the portfolio decreased, its dollar amount increased, leaving the risk/return tradeoff same as before, not improving by accumulating more mortgages.

Furthermore, nature of corporate debt and mortgage pool is completely different, e.g. static vs. dynamic investment strategy. In other words, a corporation can easily change their investment strategy by investing in more profitable projects generating bigger profits as a compensation for earlier losses, whereas in a mortgage pool, assets are pre-specified, leaving the trustee with no authority over any change of the strategy due to underlying assets' underperformance. Firms invest in real assets, which can either overperform or underperform expectations, but if fixed-come assets in mortgage pool overperformed, they would earn only as much as originally contracted, or less. The trustee of the mortgage pool is also unable to change the capital structure by selling new equity, as companies can. They can obtain new equity

only by accumulating current-period excess savings, which are highly limited due to mostly downside potential of a fixed-income asset. These differences mean that statistical distributions used in bond ratings should not be used on RMBS because of their performance risk.

Figure 24: Actual and expected losses on corporate investments and mortgage pools



SOURCE: R&R Consulting (2004)

Actual corporate losses fluctuate around the expected ones due to company's ability to recover from losses by either overperformance of underlying investments or by changing the investment strategy, whereas mortgage pools show rising cumulative loss dynamics because of their inability to recover from downturns with the curve of actual losses differing from the expected losses curve only by its steepness.

There are, however, more statistical differences that should be taken into account (given that corporate debt's performance of investments are centered and distributed with a constant variance around a constant mean, whereas RMBS have skewed cumulative loss distributions narrowing over time), but their explanation is beyond the scope of this thesis.

Due to the companies having dynamic portfolios and investment strategies their debt ratings can remain fixed (compensation of losses). But when it comes to

static portfolio and no option of changing a strategy as in the case of mortgage pools, it is necessary to adjust ratings of RMBS regularly to reflect new risk.

Both RMBS and corporate debt are subject to default risk, but RMBS bears also prepayment risk (risk, that borrower will pay off his debt early), therefore expected cash flows of the mortgage pool are even harder to estimate. Prepayment risk is, unlike the risk of default, affected by multiple market factors like interest rates, market competition, seasonality, etc., which adds even more complexity to the whole process of valuation. The risk further differs from the default risk in that if e.g. interest rates either rise or fall, the value of the mortgage pool either declines, or the borrowers prepay, so if interest rates move (no matter which way), the mortgage investor always loses. These 2 risks are completely different and dependent on different factors but unlike the default risk, which is measured by very well developed models like FairIsaac's FICO scores, there is no standard to measure the risk directly. Although Public Security Association (PSA) uses models that are correct for this risk, it does not estimate it.

CDOs, also made up of RMBS tranches, themselves very complex, and other tranched securities that are even more complicated also have been rated according to agencies' traditional methods. However, CDO pools are managed dynamically, migration of underlying assets means migration of ratings as well. This creates even stronger need for frequent rating adjustments for CDOs. Also, CDOs have a large exposure to market risk, which rating agencies were not able to rate properly.

The argument that rating agencies should have applied dynamic rating methods instead of the static ones used on corporate bonds is supported by the fact that some investors are only allowed to hold investment/grade assets in their portfolios and can keep them until the securities are downgraded. Investors may consequently find themselves being forced to bear huge mark-to-market losses after not being able to value these assets correctly themselves.

Former Fed Chairman Alan Greenspan warned that "the credit risk profile of CDO tranches poses challenges to even the most sophisticated market participants" and warned investors "not to rely solely on rating-agency assessments of credit risk".

5 Insufficient regulation before and during the meltdown

Regulation of the financial industry was relatively tough in the 90s, when Glass Steagall Act was implemented in 1933. The Act banned commercial banks from trading in securities using depositors' money, i.e.; investment banking was not allowed for commercial banks. But then the 90s came and the government became more business-friendly. The Glass-Steagall Act was repealed and other enforcement of other regulations was relaxed. Most of this happened during the 8 years of the Bush Administration. Over the 10 years beginning with 1998, financial institutions spent $3.4 billion on lobbyists and $1.7 billion on federal campaign contributions.[28]

In 1999, senator Phil Gramm (along with Alan Greenspan) supported a bill called Gramm-Leach-Bliley Act, that was basically revising the Glass Steagall Act, blurring the border between commercial and investment banking and making creation of megafirms like Citigroup, Bank of America or AIG a lot easier. The following year, the Community Futures Modernization Act was passed, relaxing the regulation of gambling and securities. Even here, CDS did not fall under the jurisdiction of any regulatory government agency as CDS qualified neither as gambling, nor as a security. As a result, the CDS market, at one point worth $60 trillion was going unregulated by any federal agency, with absolutely no restrictions and safeguards.[29]

It was one of the main regulatory issues that should have been solved in the new $700 billion bill. In September 2008, Chairman of the Securities Exchange Commission (SEC) Christopher Cox testified at a Senate hearing, that the CDS market is completely unregulated, lacking in transparency, ripe for fraud and needs serious oversight.[30] The bill, according to Senator Carl Levin, should have given the SEC an authority to regulate CDS or swaps market in general. Instead, these markets remained out of any federal regulatory framework. Growth of the CDS market was further enhanced by a need for higher yields of commercial banks, which started to compete directly with investment banks for customers. Another strict proponent of financial deregulation was a former Federal Reserve Chairman, Alan Greenspan, who

[28] TAIBBI, T. The Big Takeover. *RollingStone.com,* March 2009
[29] TAIBBI, T. The Big Takeover. *RollingStone.com,* March 2009
[30] TAIBBI, T. The Big Takeover. *RollingStone.com,* March 2009

opposed any restrictions on trading in derivatives and has argued for long that Wall Street should self-regulate and deeper regulation of the contracts would be a mistake. He was often referred to as the greatest proponent of the derivatives deregulation. When the housing bubble burst and weaknesses in the system became evident, he still argued that the problem was not in the failure of the contracts, rather in people who use them as well as the Wall Street not acting honorably. He pointed to the lack of evidence that federal regulation is superior to market regulation. His beliefs and actions have been scrutinized since the market collapse and he was often criticized by economists for keeping the interest rates low for an extended time, thus letting the housing market borrow cheap and not stopping the lax lending practices at banks.[31]

There had been multiple warnings to enhance derivatives regulation. For example, in 1997, the Commodity Futures Trading Commission (CFTC) lead by Brooksley E. Born started an inquiry into the regulation of derivatives because they were concerned that this opaque market poses a serious threat to the economy.[32] Ms. Born asked for greater transparency of trades and larger reserves for losses but her opinion was ignored. CFTC regulated commodity futures but many of the new derivatives were not tradable on an exchange market, therefore under jurisdiction of no regulatory agency. There was also no clearing house that would hold reserves in case of default and the trading market was quite opaque. Ms. Born also pointed out that the new structured products were linked to interest rates and currency fluctuations and were at that time linked to inflated prices of millions of American homes that eventually ended up foreclosed. Instead of providing safety, derivatives triggered more risk-taking. Investors invested in MBS and instead of setting aside some cash reserves in case the borrower defaulted, they bought a CDS and thus were protected. On the other hand, the CDS issuers were just making bets that the mortgages would survive. Robert E. Rubin, a Treasury Secretary at that time, privately advocated higher regulation and an increase of potential loss reserves but didn't take any actions publicly as the whole market was against regulation. Mr. Greenspan along with other senior regulators, including Mr. Rubin and SEC Chairman Arthur Levitt Jr.,

[31] GOODMAN, P.S. Taking Hard New Look at a Greenspan Legacy. The New York Times, October 8, 2008. *http://www.nytimes.com/2008/10/09/business/economy/09greenspan.html?_r=1*

[32] EISIGNER, J. The $58 Trillion Elephant in the Room. *Portfolio.com,* November 2008.

argued against Ms. Born that higher regulation would cast doubt on legality of trillions of dollars, create a huge uncertainty over market operations and drive the market overseas. They first managed to convince Congress to pass a law that prohibited CFTC from any action regarding the swaps market and then a bill completely removing the regulatory authority of CFTC over derivatives, later passed by the House. They also managed to repeal already mentioned laws from Depression-era that isolated commercial and investment banking, aiming to reduce the overall risk in financial markets.[33]

After the fact, Mr. Greenspan still advocates his position that central banks and governments could not have changed the direction of the boom. However, many economists agree that had Mr. Greenspan acted differently during his tenure 1987 to 2006 as Federal Reserve Chairman, the current crisis might have been adverted or muted.[34]

In addition to the above described deregulatory changes, there was a new law initiated in 1999, which enabled firms, which owned one or more thrifts (savings–and–loans), to choose Office of Thrift Supervision (OTS) as their regulator. And since OTS was more conforming for businesses, many companies reclassified themselves as thrifts to avoid more stringent supervisors such as the Fed or the Securities and Exchange Commission. For example, by 2007, OTS was approved to regulate GE, Ameriprise Financial and AIG, three gigantic firms, that should have been regulated by more strict and larger EU regulators, e.g. Britain's Financial Services Authority. Moreover, OTS had only one insurance specialist on their staff and yet regulated the largest insurer of the world.[35]

The greatest move towards deregulation came in 2004. For many years there had been an oversight gap on Wall Street, with SEC being allowed to regulate brokerage units of investment banks (as Lehman Brothers, or Bear Stearns), but not their holding companies and other affiliates. In April that year, a meeting of 5

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[33] FAIOLA, A., NAKASHIMA, E., DREW,J. What Went Wrong - How Lobbyists and Special Interests Won.Washington Post Staff Writers, October 15, 2008, A01. *http://www.washingtonpost.com/wp-dyn/content/article/2008/10/14/AR2008101403343.html?nav=rss_email/components*

[34] LEVITT, A. Testimony of Arthur Levitt, Jr. *Senate Banking Committee,* Washington DC, October 2008

[35] TAIBBI, T. The Big Takeover. *RollingStone.com,* March 2009

members of SEC resulted in approval of so called net capital rule, which defined that brokerage units of large investment firms (with assets greater than $5 billion) were an exemption from the old regulation that required them to hold a relatively high and safe cushion against losses on investments, in short, capital rules were loosened. These banks would then be able to use the extra money to invest in credit derivatives, mortgage-backed securities and other exotic financial products. This let the mega-firms grow into too-big-to-fail proportions, where if they got into trouble, they would pose an economy wide risk. All of those firms took advantage of the weakened rules. For example, Bear Stearns leverage ratio significantly increased to 33:1.[36] During this time, EU demanded transparency and threatened it would supervise foreign transactions of the America's top five investment banks if they did not increase their own oversight of the parent companies (brokerage units were already regulated). As a result, George Bush's SEC chief William Donaldson and a Goldman Sachs chief Hank Paulson (future Treasury Secretary) named a commission of 7 people to run a supervisory program under Mr. Cox, which would examine these firms (with combined assets of $4 trillion). However, this group did not even have a director and did not complete a single inspection for a year and a half since its formation. Prior to Bear Stearns collapse, the group pointed out potential risks coming from high leverage, poor risk management, dangerous concentration of MBS, but no actions were taken to overcome these risks. "Great deal for the banks, which originally complained about being regulated by both Europe and the SEC, and ended up being regulated by no one."[37]

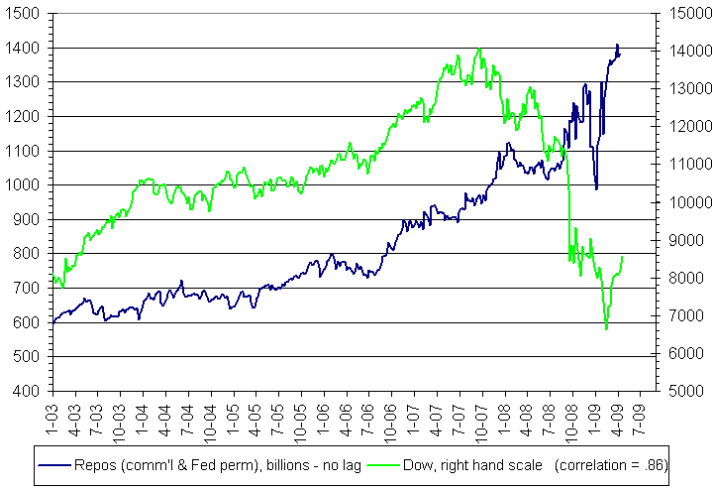
The commission also decided to propose a voluntary system, enabling banks to internally monitor their level of investment risk. The computer models they relied on were by the way similar to those that failed to protect the hedge fund Long-Term Capital Management from collapse in 1998 and even before this date performed badly. The banks ended up with stratospheric debt-to-asset ratios, with off-balance leverage of 100 to 1 or 200 to 1. The system of voluntary regulation, with the commission offering only suggestions, proved to be inadequate as the market failed to impose

[36] TAIBBI, T. The Big Takeover. *RollingStone.com,* March 2009
[37] TAIBBI, T. The Big Takeover. *RollingStone.com,* March 2009

sufficient self-discipline and responsibility, since the banks were able to withdraw from the voluntary supervision anytime they wanted to. In September 2008, the commission officially ended the program stating it overlooked coming problems at Bear Sterns and other 4 major investment banks, which ended up merging, filed for bankruptcy, or converted into commercial banks. There have been many proposals on new electronic systems that would track all the trades and collect cash to back it up in case of need, but there is still no system set up.[38]

What mistakes did Federal Reserve make? Consider the bailouts. Before the crisis, the Fed used so called Repurchase Agreements (Repos), to control the money supply in the economy. If they wanted to lower interest rates, they would pump cash regularly into the economy by buying Treasury Bills and other securities (even mortgage-backed securities) from large and reliable banks like J.P. Morgan, Goldman Sachs and then repurchase them in a couple of days (7 or so). By selling the securities, they increased the interest rates. Looking at the use of Repos throughout the period 2007-2009 in Figure 25, we see an increasing number of Repos, peaking at the beginning of 2009 and then a sudden drop in using these money supply management tools.

Figure 25: Number of Repos



SOURCE: (buttonwood1792.blogspot.com)

[38] FAIOLA, A., NAKASHIMA, E., DREW,J. What Went Wrong - How Lobbyists and Special Interests Won.Washington Post Staff Writers, October 15, 2008, A01. *http://www.washingtonpost.com/wp-dyn/content/article/2008/10/14/AR2008101403343.html?nav=rss_email/components*

The reason for this was the new bailout program called TARP, which included $700 billion bailout package for the financial system. All of a sudden, the Fed invented a whole bunch of new systems and government operations that enabled the government to pump much more cash in the market than the public and Congress was aware of. The systems included the Term Auction Facility, the Term Securities Lending Facility, the Primary Dealer Credit Facility, the Commercial Paper Funding Facility and the Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (in short ABCPMMMFLF).[39] By using these facilities, they injected trillions of dollars into the private sector, without anyone noticing it.

The Accounting and Auditing Act of 1950 specifies the regulation of the Fed, and specifies that audit of the Fed cannot include "deliberations, decisions, and actions on monetary policy matters"[40], which basically includes everything, meaning that the Fed may not be audited by the Congress, or anyone else.

The Government Accountability Office (GAO), one of the 3 watchdog agencies assigned by the Congress to monitor the usage of the $700 billion rescue package of the Troubled Asset Relief Program (TARP), filed a report in December 2008 pointing out weaknesses in monitoring in cases where the institutions that received the rescue money are meeting the limits on dividends and executive compensation and other requirements, like stock repurchases. GAO pointed out that the Treasury Department has no mechanism to track the usage of the bailout money injected into the banking system, neither to monitor the compliance with limits and other requirements and this issue seriously needed to be taken into account. Furthermore, the Fed bailed out the large banks right away (Citi, Goldman and Bank of America) and ignored applications of the smaller community lenders although those are far less guilty for the sub-prime lending. This is suspicious but again there was no one who could examine this.

SEC played a vital role in restoring investors' confidence for about 75 years, assuring functioning of the markets, being the only agency with an adequate mission, experience and history. But many weaknesses were revealed in the recent past. First, as I already mentioned, SEC voluntarily weakened the net capital rule in 2004, which

[39] TAIBBI, T. The Big Takeover. *RollingStone.com,* March 2009
[40] TAIBBI, T. The Big Takeover. *RollingStone.com,* March 2009

resulted in excessive lending and high leverage, decreasing the capital cushion against potential losses. Transparency was lacking everywhere. SEC was expected to resolve the problem of opacity, for example in the case of Special Investment Vehicles (SIVs) and failed to do so.[41]

On the accounting side, incorrect accounting rules were used to inflate the value of assets in companies by using, for example, historical values. For instance, Fannie Mae when bailed out reported $11.2 billion of losses from mortgage-related securities that did not count towards the capital requirements calculations thus keeping it away from the regulator's sight. Freddie Mac kept $34.3 of such losses at the time of the government takeover.[42] Although the SEC did not regulate these firms, they got away with many creative accounting methods that could and should have been revealed if their supervision had been proper.

As another example of accounting discrepancies, Wachovia reported its book value (assets minus liabilities) at $75 billion at the time it was bought by Wells Fargo. Wells Fargo, however, bought it for $15.4 billion, creating a highly suspicious gap. Also, IMF and Bridgewater Associates estimate that only less than half of the losses from the subprime meltdown, estimated at approximately $1.4 - $1.6 trillion (as of Oct 2008), were actually reported to investors.[43]

Another huge and important part of the market that remains unregulated are hedge funds. They are not even obliged to register with the SEC, report their strategies, leverage or information on their holdings. The number of hedge funds is estimated at around 8000, although regulators are not sure about the exact number, or how much money the hedge funds control.[44] Holdings of the hedge funds have increased rapidly mainly over the last decade and number of their assets under investment has also been rising.

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[41] LEVITT, A. Testimony of Arthur Levitt, Jr. *Senate Banking Committee,* Washington DC, October 2008
[42] LEVITT, A. Testimony of Arthur Levitt, Jr. *Senate Banking Committee,* Washington DC, October 2008
[43] LEVITT, A. Testimony of Arthur Levitt, Jr. *Senate Banking Committee,* Washington DC, October 2008
[44] HENRY, A. Rep. Henry A. Waxman holds a hearing on the regulation of hedge funds. *Committee hearing, Congressional Quarterly Transcriptions,* November 2008.

Figure 26: Global hedge fund assets under investments ($ billion)

SOURCE: Reuters EcoWin

Hedge funds are also highly leveraged; they control about $1.5 trillion worth of assets and $3 trillion with leverage (as of Oct 2008) and often invest in illiquid assets. [45] Nowadays, they do all kinds of economic activities - they invest in any asset they want to, make loans (including mortgages), engage in market-making activity and even provide insurance. This "being everywhere" along with its size, uncontrolled leverage, transparency and complexity creates a systemic risk for financial markets. Hedge funds basically provide many of the banks' services, but unlike banks, they are not regulated at all (they are outside the Federal Reserve System).

Rating agencies, described in previous chapters, also need regulation, since their conflict of interest between them and their clients and inadequacy of ratings are still issues to resolve. Huge regulatory framework should also be assigned to the already discussed CDS and other derivatives markets because of extreme opacity and no current oversight.

[45] HENRY, A. Rep. Henry A. Waxman holds a hearing on the regulation of hedge funds. *Committee hearing, Congressional Quarterly Transcriptions,* November 2008.

Problems with regulation were evident well before the crisis though. Unlike Bank Regulators, which are allowed to oversee banks, as well as their holding companies, dealers and other affiliates, SEC and CFTC, are only properly regulating securities and futures (not OTC derivatives) and only companies that trade these products, meaning not dealers or holding companies, or other affiliates.

6 What steps should be taken

In my opinion, the whole today's crisis is a result of weaknesses in multiple factors affecting the economy- weak underwriting standards, moral hazard, regulation, investors and unchecked expansion of structured products and derivatives. The rapid rise of a new structured products marketplace did not give enough time for the other "players" like regulators to understand the products properly, due to their extreme opacity and complexity. Such a situation, created a great opportunity for arbitrage in every aspect. Persuading regulators to let the Wall Street regulate itself was eventually successful, but caused much more harm than good. As mentioned before, the problem lied in many individuals and institutions, but in my view the largest blame lies on the deregulation.

About a decade ago, when the underwriting standards for sub-prime, Alt-A and other mortgage products started to weaken, it triggered a whole chain of subprime lending. Fisher (1932) already claimed that excessive lending is the main cause of any financial crisis, resulting from a new event (invention, or high demand for certain assets).[46] According to this theory, number of loans keeps rising until it reaches the phase of overindebtedness, which is the situation of great sensitivity to a financial crisis. I agree with the opinion of Petr Musílek (2008) that Fisher's theory can be also applied to the current mortgage market situation.[47] There had been high demand for real estate before 2007 due to low interest rates in the US.

[46] Fisher, I. (1932): *Booms and Depressions*. New York, Adelphi, 1932.
[47] MUSÍLEK, P. Příčiny globální finanční krize a selhání regulace. *Český finanční a účetní časopis*, 2008, roč. 3, č. 4, s. 6-20.

Lending standards were lowered nationally. Mortgage brokers, although licensed, were not properly regulated and pushed loans on people who obviously could not afford them. But the fact that the originators did not have to hold on to the loan, selling it to intermediaries (Fannie and Freddie) and thus getting rid of the risk, caused the mortgage market to detach from its real purpose - providing housing to regular people who can afford it. Intermediaries eventually packaged these loans with hundreds of other loans into a complex product, which only a few properly understood, and sold of slices of it to investors all over the world. Traditional requirements sharply weakened and a proper verification of loan documentation no longer mattered. For example, borrowers were eventually able to get a mortgage without showing any proof of income, cash flow verification, or collateral. Everyone was making quick money as long as the housing bubble was on the rise, while the risk was being spread through the economies. According to Blanchard and Watson (1982), price bubbles arise when assets are being bought for a higher price than their value, with investors expecting to make a quick capital gains in the future.[48] The bubble either keeps rising, or it suddenly bursts, not unexpectedly though. Therefore, I think shareholders should put pressure on managers and regulators on bankers and other people working in the financial sector to achieve primarily positive long-term goals, instead of chasing quick profit. The short-term rewards did not account for the long-term risk it carried with it and went unnoticed by analysts. Mortgage bankers, rating agencies and other responsible parties should perform due diligence and mortgage brokers should shove on mortgages fulfilling their use intended, and not seeing people simply as trade. Although borrowers themselves were also taking risks and speculating, each seeing a profit in their house investment, rather than a house for their living, it was the standards and weak oversight that enabled them to take those positions. So, I do not think it is fair to blame mortgage lenders solely, they do carry a large part of the blame.

Central banks and regulators should learn from their mistakes. Central banks could have intervened by e.g. increasing the interest rates sooner to make mortgage

[48] BLANCHARD, O., WATSON, M. Bubbles, Rational Expectations, and Financial Markets. Wachtel, P. (ed.): *Crises in the Economic and Financial Structure.* Lanham, Lexington Books, 1982.

loans more expensive, not allowing the housing bubble to grow so much. Regulators could have imposed new laws on new structured products and certain entities like mortgage brokers, or hedge funds, as well as restrict the use of SIVs or take many other actions to prevent such excessive behavior in the economy. For example, if there are any suspicious trends, such as excessive lending or credit burst, regulators should immediately take action to moderate such an excessive swing. Or if a company, mainly a "too big to fail one" such as AIG has a large concentration of certain product (like CDS in case of AIG), regulators should react, measuring the risk and guiding the firm to mitigate the risk of failure of such a firm.

Especially challenging will be measuring aggregate risk. The current structured products divide risk among numerous tranches and subsequently sell them to investors all over the world. There should be some regulator or a clearing house, that would monitor such transactions. Data then can be used as inputs into an aggregate risk model that would measure the overall national and global risks. Derivatives like CDSs, that so far have gone unchecked, should become regulated, perhaps through establishing a clearing house that would track the trades, parties trading, as well as the value of such transactions. Such a clearing house could also mitigate credit risk of parties in the trades.

It was also thought that the securitization process enables the risk to be transferred to those investors, who are willing to bear it (this was also an argument towards the derivatives deregulation), but this risk relief was misleading as the risk still remained in the system and was spread to other sectors and countries. Thus, I think it is necessary to monitor this process in the context of systemic risk it poses. Also, if everyone in the securitization chain retained some risk, maybe it would enhance due diligence and decrease the leverage, but it would certainly make the participants act more responsibly.

Penetration of the commercial bank industry into the investment bank industry also comes from deregulation, which was explained in detail earlier in the chapter (Gramm-Leach-Bliley Act). This also caused the regulated and unregulated/under-regulated sector to mix, bringing the opacity into the previously "uninfected" part of the system. I must agree with the theory of proper financial regulation of Revenda

(1999)[49] and Dvořák (1999)[50] that regulators should prevent negative externalities from entering the "healthy" part of the system. The unregulated institutions had various advantages, e.g. capital requirements and so forth, which made their position being somehow advantageous, causing the regulated market (competing with the unregulated one due to many legislature weaknesses) to take on more risk they traditionally used to, in seek of higher yields. I think such a penetration and mixing should not have been allowed to happen. The opacity versus the safety should have stayed at opposite sites of the river forever, or at least until the structured products they traded became more explored and understood. Also, the unregulated sector should undertake more oversight or should not be allowed to act in such a large scale. When it comes to "mixing" risks

As I mentioned at the beginning of the chapter, I think effective supervision would help avoid next financial crisis by addressing the problem the known problems. I am not sure how exactly should the regulatory framework look like, but I think the following notes should be taken into account:

There had been many gaps in the regulatory system and many investors were able to use them to their greatest advantage. If several entities are running the same business or they simply perform the same activities within a market, they should be treated equivalently, no matter what name they have. They should not be able to avoid oversight if they are called hedge funds or thrifts, or simply "dealers", while banks are subject to relatively proper regulation. Or they should not be less regulated just because they are based in a different country. Since the investors and entities are so connected to each other through for example structured products, the systemic risks originated in the unregulated part of the marketplace flow to the formerly healthy part, infecting the whole system. I think there should be a proper regulatory framework for a specific market that everyone entering the market would have to be subject to. One of the essential steps towards a healthier system should be global coordination and unification of rules, consolidation of supervision and international harmonization. These are difficult goals to achieve but very important.

[49] REVENDA, Z. Centrální bankovnictví. Praha, Management Press, 1999.
[50] DVOŘÁK, P. Komerční bankovnictví pro bankéře a klienty. Praha, Linde, 1999.

One of the goals should be enhancing transparency and diminishing information asymmetry. The theory of Akerlof and Romer (1993)[51] states that market mechanism does not function optimally (according to Neoclassicism) in the presence of information asymmetry and is likely to result in the market failure, due to investors having different sets of information, or unequal ability to assess them, which evokes investment mistakes. I again share the same opinion with Petr Musílek (2008)[52], that securitization significantly contributed to the global information assymmetry. Regulators should implement some mechanisms, which would improve information collection from all the entities operating in the market that fall under its jurisdiction. The regulator has to monitor the systemic risk and its concentration in the whole market segment but with certain institutions being allowed to be exceptions, the whole process in aggregate is useless. Not only should there be supervisors monitoring each marketplace but also ones that oversee all the marketplaces combined. I envision a supranational regulator overseeing the financial system as a whole and specific regulators with jurisdiction over specific markets. This way the systemic risk would be tracked too and each entity and each product would be monitored. Companies should post complete information necessary for regulators to detect systemic risk. This information should include mainly volume data and prices.
Also, maybe consolidating regulators could help (as it is currently in the UK and Japan), also minimizing the opportunity for arbitrage through let's say reclassification in order to be supervised by a more "friendly" regulator (such as OTC). This would also force the system to treat everyone relatively equivalently.

Fewer, but more effective rules can also be a plus. Again, this may make a sense of "convenience" since business often welcome less regulations and restrictions. When implementing new rules, I think it is necessary to revise the related old ones to find out, if they were truly effective and if it is favorable to leave them where they are or just remove it. It can prevent enterprises from their effort to avoid the regulations overload. New regulations should also be implemented not during a crisis, but well

[51] AKERLOF, P., ROMER, P. Looting: The Economic Underworld of Bankruruptcy for Profit. *Brookings Papers on Economic Activity,* 1993.
[52] MUSÍLEK, P. Příčiny globální finanční krize a selhání regulace. *Český finanční a účetní časopis*, 2008, roč. 3, č. 4, s. 6-20.

before it to prevent recession, or at least mitigate it. Mainly, more regulations of CDS should be implemented, since it is a contract enabling investors to bet on someone else going defaulting. It is a good idea for a risk management tool but without requiring collateral, it was a cheap insurance tool until the default actually happened.

Investors trading in derivatives should put up sufficient capital and meet the margin requirements properly. One of the biggest mistakes was in my opinion the weakening of the net capital rule in 2004, which should be definitely restored and prevent future over-borrowing. Rules limiting leverage and maintaining sufficient liquidity should be reintroduced. Not only should regulators refine the laws but firms should enhance their due diligence and risk management for counterparty risk as well. Many of them failed to determine how big their capital cushion actually has to be. They have to be able to manage their own liquidity, with supervisors creating only a framework for their actions. SIVs are another issue. I think all the bank transactions should be kept on their balance sheet, not hiding from the view of investors and unobserved weakening the capital cushion.

Conclusion

The final outcomes of today's crisis are not clear yet. It left the world uncertain and shaken and correct steps are crucial for fixing what should have been some time ago. The crisis started with the US subprime mortgage market and spread to many other sectors nationally and globally, affecting the whole world. Credit derivatives and structured products are just a part of the story, but a very important one. I believe discussing their role in the crisis, the reasons for their misuse and lack of understanding and lessons learned for the future is extremely timely and relevant. This thesis covers the topic thoroughly with a good understanding and exposition of the different parts of the puzzle and the place of the financial products in it. It is in this sense that I believe the reader will find the thesis very informative and educational, thus fulfilling the main goals that I set for myself in writing it.

I started the thesis with an overview of different categories of crises and what caused the current one, which were necessary as an introduction to what I described later in the paper. Then, I described the most relevant of the financial products with the goal to highlight– their complexity and lack of understanding of their users it resulted in. I then pointed out mistakes made in rating and using these products, as well as in regulating these markets.

I believe the thesis fulfills its goal in showing how the interaction of many parts of the system (originators, buyers, rating agencies, regulators, etc.) resulted in the current crisis, with a particular focus on credit derivatives and structured products. A reader can get a good understanding of the derivatives and structured products themselves and how their opacity, misuse and lack of oversight as well as rating agencies and other players in the financial sector contributed to the meltdown. The analytical part expresses my own opinion and conclusions on possible solutions for the future that are based on my analysis of the causes of the crisis and its moving parts, as well as considering analyses of other experts. I examined the problems and recognized the crucial ones that should be corrected in order to prevent a similar situation in the future. The goal of the last chapter was achieved by addressing the mistakes that should be fixed and proposing solutions that could have prevented or at least mitigated the current crisis and should do so in the future.

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