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UBS Investment Bank

The subprime crisis from the inside

by

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THESIS

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to my wife

ELISA

with love

The Master Thesis of Stefan Olofsson is APPROVED:

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"Information's pretty thin stuff unless mixed with experience"
– Clarence Day, The Crow's Nest

The above quotation reflects the reason behind my choice to undertake a practical thesis. However, given my lack of experience, this task proved to be more difficult than I thought. In consequence, the goal of this thesis is to transform my experience into something that a person, typically another student, can learn from. The following pages are an attempt to make a profound review of the subprime crisis and its effects from a fixed income perspective. There are no proofs or theorems but some interesting results. It is merely the effects that I observed as an intern within the department of Fixed Income at UBS Investment bank, Geneva. This is a summary of most of what I've done and seen, with some suggestions of what I would do if I had more time.

In this context, I would like to express my deep-felt gratitude to my advisor, Dr. Prof. Didier Sornette, of the Management, Technology and Economics Department at the Swiss Federal Institute of Technology in Zürich, for his advice, encouragement, enduring patience and constant support. My seemingly absence of engagement in the thesis was well understood given the context of what UBS was going through. Moreover, his incredible degree of understanding allowed me to change the topic as well as the approach of this thesis while almost half-way through my internship. Simply put, I would not have been able to do this Thesis without him.

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Additionally, I want to express my warmest thanks to those who encouraged me during my studies and during this internship.

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NOTE: This thesis was submitted to my Supervising Committee on July 18th, 2008

Abstract

This paper was submitted as a Master thesis to the Swiss Institute of technology, Zurich (ETH Zürich) in July 2008. Its goal is to give a profound insight to the subprime crisis from a fixed income perspective while working in that department at UBS Investment Bank, Geneva. Following essential definitions and economic context setting, a deep look into the roots of the subprime crisis will be taken, with the U.S. as a reference. Then, the yield curve is analyzed as a prediction tool for past crisis, the current one, and future ones. It is concluded that the crisis could have been foreseen, eventually dampened, but not avoided. This is due to the complexity of the financial system. The TED spread will also be analyzed in the same way and gives an insight to the severity of the crisis – probably the largest one since the great depression! Finally, an insight to what has been happening at UBS and what it is like to work for such a hard-hit bank during times of crisis will be given. The goal is to provide other Master students with a deeper understanding of the subprime crisis, of fixed income tools and of an internship at an investment bank in such times.

(21'153 words)

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Chapter 1

Introduction

1.1 Framework

The goal of this thesis is to provide a better understanding of the subprime crisis. This will be achieved from a fixed income point of view, as this is the department from which the crisis originates. There are no particularly revolutionary findings within the following lines, but there is a true explanation and linkage making between the various factors, causes and consequences. Moreover, this thesis is written while working for the UBS Investment Bank of Geneva, department of Fixed Income, and therefore provides a unique insight into the crisis.

In this chapter, the economic context in which this thesis is written will be described. This is an important aspect in order to understand the rest. Then the fixed income department will be described, as well as its tools. Finally, the internship and my personal role in this department will also be unveiled in order to truly give a unique insight and understanding of what is happening both within a hardly-hit bank and the financial world. This may also inspire other students to join such a team, or perhaps it will have the complete adverse effect!

In chapter 2, a deep economic and financial explanation of the subprime crisis will be provided. First, the necessary definitions will be provided in order to ensure a smooth reading. Second, the true explanation will unravel, as long as the key players in this crisis. Third will come its consequences and then finally I shall suggest some solutions/improvement/steps in order for this not to happen again (the true question being whether it can it ever be prevented!)

The third chapter will be dedicated to the yield curve and its applications. Definitions, examples, theory and history will be provided before moving on to its predicting power. This chapter is closely linked to the next one, where the same steps will be taken regarding what is called the TED-spread, which can be viewed as a measure of the amplitude of a crisis. These two chapters together constitute the bulk of this thesis, and will allow us to realize the depth and importance of this crisis, and that it may have been avoided.

In chapter 5, an insight to what happened within UBS will be given. However, due to confidentiality reasons, this section proved more difficult to develop than originally planned. Yet, some decisions and experiences I lived are depicted and will hopefully provide a new point of view than the general public opinion.

The conclusion will summarize the various aspects developed in this thesis, but more importantly it shall suggest future work that could be done which could lead to very interesting results that would not only be applicable to this crisis, but to the coming one too.

1.2 Economic context

The credit crisis of 2007 started in the subprime mortgage market in the U.S. It has affected investors in North America, Europe, Australia and Asia and it is feared that write-offs of losses on securities linked to U.S. subprime mortgages and, by contagion, other segments of the credit markets, could reach a trillion US dollars [23]. It has brought the asset backed commercial paper market to a halt, hedge funds have halted redemptions, or have failed, and special investment vehicles have been wound-down. Banks have suffered liquidity problems, with losses since the start of 2007 at leading banks and brokerage houses topping US$250 billion, as of April 2008 (Bloomberg). Financial institutions are expected to write off an additional US$80 billion in the first quarter of 2008 [18]. Credit related problems have forced some banks in Germany to fail or to be taken over and Britain had its first bank run in 140 years, resulting in the nationalizing of the troubled mortgage lender. The U.S. Treasury and Federal Reserve helped to broker the rescue of Bear Stearns, the fifth Wall Street investment bank, by JP Morgan Chase during the week-end of March 17, 2008. Banks, concerned about the magnitude of future write downs and counterparty risk, have been trying to keep as much cash as possible as a cushion against potential losses. They have been wary of lending to one another and consequently, have been charging each other much higher interest rates than normal in the inter bank loan markets.

The severity of the crisis on bank capital has been such that U.S. banks have had to cut dividends and call global investors, such as sovereign funds, for capital infusions of more than US$230 billion, as of May 2008, based on data compiled by Bloomberg. The credit crisis has caused the risk premium for some financial institutions to increase eightfold since last summer and is higher than the cost of raising cash for non-financial firms with the same credit rating. The effects of the crisis have affected the general economy. For example, credit conditions have tightened for all types of loans since the subprime crisis started nearly a year ago.

The biggest danger to the economy is that, to preserve their regulatory capital ratios, banks will cut off the flow of credit, causing a decline in lending to companies and consumers. According to some economists, tighter credit conditions could directly subtract 1.25 percentage point from first quarter growth in the U.S. and 2.5 points from the second-quarter growth [4]. The Fed lowered its benchmark interest rate 3.25 percentage points to 2

percent between August 2007 and June 2008 in order to address the risk of a deep recession (Bloomberg). This alone represents one of the largest cuts in interest rates in U.S. history. The Fed has also been offering ready sources of liquidity for financial institutions, including investment banks and primary dealers, that are finding it progressively harder to obtain funding, and has taken on mortgage debt as collateral for cash loans.

The deepening crisis in the subprime mortgage market has affected investor confidence in multiple segments of the credit market, with problems for commercial mortgages unrelated to subprime, corporate credit markets, leverage buy-out loans (LBOs), auction-rate securities, and parts of consumer credit, such as credit cards and car loans. In January 2008, the cost of insuring against default by European speculative bonds had risen by almost one-and-a-half percentage point over the previous month, from 340 basis points (bps; 100bps = 1%) to 490 bps, while the U.S. high-yield bond spread has reached 700 bps over Treasuries, from 600 bps at the start of the year. [8]

1.3 Fixed income toolbox

Fixed income refers to any type of investment that yields a regular return. The most basic tool in fixed income is the bond, or corporate bank debt. At UBS Investment bank, preferred stock is also considered to be fixed income. Such securities can be contrasted with variable return securities, such as stocks. People who invest in fixed income securities are typically looking for constant and secure return on their investment.

Interest rates change over time, base on a variety of factors, particularly the rates set by the Federal Reserve (regarding U.S. bonds). When a company is issuing a bond, it will have to pay the investor a premium in order for them to buy their bonds in order to attract them to their security. Otherwise investors would buy government bonds which are considered to be 100% secure. To complicate matters a bit, fixed income securities are traded on the open market, just like stocks.

Based on the above, it is obvious the most important aspects within fixed income are the interest rates. The interest rate will directly affect the yield of a bond. The term yield refers to the percentage that measures the cash returns to the owners of a security. The yield of a bond is inversely related to its price today: if the price of a bond falls, its yield goes up, and vice-versa.

From this, we derive the yield curve, which is the relation between the interest rate and the time to maturity of the debt for a given borrower in a given currency. This tool will be one of the foci of this thesis, along with the TED-spread. The TED-spread is also a fixed income tool that is directly linked to interest rates on bonds. It is the difference between the yield of inter-bank loans (rates at which the banks loan to each other) and government loans (which are directly derived from the rates set by the Fed).

These two tools will be at the heart of this thesis, and more substantive background information will be given about them in the further sections. It should also be noted that most, if not all, figures, numbers, tables and charts listed below are derived from the US market. However, the same reasoning applies of other economies as well, typically those of the Euro-zone.

1.4 The internship

From January to July 2008, I was staffed in the Fixed Income department of UBS Investment Bank in Geneva, on the sales side. The sales side means that I was the intermediary between the clients and the traders. I was closely monitoring the markets and government actions, in order to advise the customers in the best way possible. Being in the Investment Bank implies that all our customers were institutional, meaning banks and companies. Our customer base in Geneva was composed of virtually all other banks with offices in Geneva, and some other internationally. The department is present on all main markets: Asia, Europe, and the US. My responsibilities were to provide clients with advice and prices on bonds, preferred stock and some structured products. I performed and confirmed the trades with the clients and the concerned trader. I was also included in the marketing of new issues, meaning I had to sell the new issues to interested clients. This is as much front office work as it can get, although we obviously sometimes needed to handle back office problems such as trade settlements or confirmations if something went wrong regarding the client.

These are quite unique and highly interesting responsibilities to have for an internee, which I benefited from due to the bank's difficult position in consequence of the subprime crisis. The advantages are obvious, such as a very steep learning curve and a unique opportunity to show my capabilities. However, as in any such situation, there are drawbacks. The working hours were quite heavy, starting before 8 a.m. finishing no earlier than 7 p.m., without lunch breaks. Given the economic situation, calls and business flow was extremely intensive and left little time for reflection. Moreover, our team, composed initially of up to 6 people, among which were at least two seniors, was understaffed and was down-sized to one senior (my boss), one junior (who joined at the same time as me) and an internee (myself). It can therefore easily be imagined that we lived some rough times. The consequences this had on clients is a very interesting aspect, which will be further developed within this thesis.

Nonetheless, I am more than delighted to have undertaken this professional experience, for as I have already mentioned: knowledge is pretty thin unless mixed with experience. It enabled me to gain a tremendous amount of knowledge while applying it directly to into my daily tasks. The most difficult part was by far to write a Master thesis at the same time. For those wishing to undertake such an approach, be warned, it is probably the heaviest task you'll ever have undertaken as a student, but by far the most enriching one.

Chapter 2

The subprime crisis

2.1 Definitions

The term “subprime” refers to mortgagees who are unable to qualify for prime mortgage rates. Reasons for this include poor credit rating, which includes payment delinquencies, charge offs, bankruptcies, low credit scores, large exiting liabilities and high loan value ratios. In other words, subprime mortgages simply mean lending to house borrowers with weak credit. Lenders did so by providing teasers like minimal or zero down payment, and low introductory adjustable rate mortgages, as well as lax documentation and credit checks. Total subprime loans form 25% of the housing mortgage market [16]. These subprime loans were fine as long as the housing market continued to boom and interest rates did not rise. When these conditions disappeared, the first to default were subprime borrowers. These defaults caused an implosion of the mortgage-backed securities (MBS) and the collateralized debt obligations (CDOs) industry. The blow out surfaced in June 2007 with the collapse of two subprime mortgage hedge funds managed by Bear Stearns, quickly followed by the suspension of three other funds managed by BNP Paribas [18]. Interestingly, there were some forerunners to this spectacular blow out, and these could be observed already as of march 2007. However, as in any given environment of economic growth and prosperity, these were ignored.

Mortgage-Backed Securities (MBS) are the securitization of housing mortgages. They have enabled banks and mortgage companies to increase the velocity and turnover of loans as banks and mortgage companies securitized and sold off these loans. This is known as the “origination-distribution” model. The volume of MBS originated and traded reached $3 trillion in 2005 in a U.S. housing mortgage industry of $10 trillion [16]. Securitization enabled banks and mortgage companies, the originators of these loans, to take on more loans as they moved the securitized loans off their books.

In the early nineties, financial innovation took these MBS to a higher level in terms of complication and leverage with the introduction of collateralized debt obligations (CDOs). CDOs are simply the bundling of a class of asset-backed securities into a special purpose vehicle and then rearranging these assets into different tranches with different credit ratings, interest rate payments, and priority of repayment. For example, a CDO could consist of 100 subprime MBS. Using historical rates of default and recovery, it can be assumed that in an extreme case of default, the loss ratio is no more than 10% [18]. These subprime MBS are then divided into AAA tranche (70%), mezzanine tranche (20%), and subordinated tranche (10%). An investor, depending on risk propensity, can choose which tranche to invest in. The AAA tranche pays lowest interest rate, but provides highest priority in terms of debt repayment. To further complicate matters, these CDOs were used as underlying assets and repackaged to the next level of CDOs. This is referred to as CDO squared and after another round, it becomes CDO cubed. Layered on top of these are CDOs of credit default swaps (CDS) that multiplied the risks further. However, these were marketed as spreading the risks! They were seen as a revolutionary tool to combine all different asset classes covering a wide range of investment possibilities into one product, thus theoretically spreading the risks as much as possible. This was ignoring the underlying assumptions. The defaults are confined not only to the underlying securities, but also the contracts written (CDS) on the traded securities. The higher the level of CDO, the more removed it is from the actual underlying security, complicating the pricing of these CDOs. The volume of CDOs issued tripled between 2004 and 2006 from $125 billion to $350 billion per year (Bloomberg). These CDOs were distributed far and wide. It was not only banks throughout the world that bought these CDOs, but also establishments such as town councils in far flung places like Australia that were chasing for higher yields. Bank of China alone is exposed to $9 billion of subprime CDOs [16]. In this day, it is considered trivial that the CDOs were a complete disaster, but it should be pointed out that not more than a year ago, this was totally ignored!

A special, or structured, investment vehicle (SIV) is a limited purpose, bankrupt remote, company that purchases mainly highly rated medium and long term assets. The SIV funds these purchases with short-term asset backed commercial paper (ABCP), and medium term notes (MTNs) and capital. Capital is usually in the form of subordinated debt, sometimes tranched and often rated. Some SIVs are sponsored by financial institutions that have an incentive to create off balance sheet structures that facilitate the transfer of assets off their balance sheet and generate products that can be sold to investors. The aim is to generate a

spread between the yield on the asset portfolio and the cost of funding by managing the credit, market and liquidity risks. General descriptions of the methodologies employed for SIVs by the agencies are publicly available on their web sites. The basic approach is to determine whether the senior debt of the vehicle will retain the highest level of credit worthiness, (for example, AAA/A- rating) until the vehicle is wind-down for any reason. The level of capital is set to achieve this AAA type of rating, with capital being used to make up possible short falls. The vehicle is designed with the intent to repay senior liabilities, or at least with an AAA level of certainty, before the vehicle ceases to exist. If a trigger event occurs and the SIV is wind-down by its manger (defeasance) or the trustee (enforcement), the portfolio is gradually liquidated. Wind-down occurs if the resources are becoming insufficient to repay senior debt. No debt will be further rolled over or issued and the cash generated by the sale of assets is used to payoff senior liabilities.

Monoline insurers provide insurance to investors that they will receive payment when investing in different types of assets. Given the low risk of the bonds and the perceived low risk of the structured transactions insured by monolines, they have a very high leverage, with outstanding guarantees amounting to close to 150 times capital. Monolines carry enough capital to earn a triple-A rating and this prevents them from posting collateral. The two largest monolines, MBIA and AMBAC, both started out in the 1970s as insurers of municipal bonds and debt issued by hospitals and nonprofits groups. The size of the market is approximately US$2.6 trillion, with more than half of municipal bonds being insured by monolines (Bloomberg). This insurance wrap guarantees a triple-A rating to the bonds issued by U.S. municipalities. In recent years, much of their growth has come in structured products such as asset backed bonds and CDOs. The total outstanding amount of bonds and structured financing insured by monolines is around US$2.5 trillion (Bloomberg). According to S&P, monolines insured US$127 billion of CDOs that relied, at least partly, on repayments on subprime home loans and face potential losses of US$19 billion [18]. Since the end of 2007 monolines have been struggling to keep their triple-A rating. Only the two major ones, MBIA and AMBAC, and a few others less exposed to subprime mortgages such as Financial Security Assurance (FSA) and Assured Guaranty, have been able to inject enough new capital to keep their sterling credit rating.

2.2 The problem

2.2.1 How it all started

Following the tech bubble and the events of September 11, the Federal Reserve stimulated a struggling economy by cutting interest rates to historically low levels. In less than two years, from December 2000 until November 2002, the Fed cut the rates from 6.5% to 1% and (Bloomberg). This means that for two years, interest rates were kept at 1%! Comparing this to the inflation rate, it is arguable that not taking on debt would imply losing money. As a result, a housing bull market was created. People with poor credit got in on the action when mortgage lenders created non-traditional mortgages: interest-only loans, payment-options and mortgages with extended amortization periods. Eventually, interest rates climbed back up and many subprime borrowers defaulted when their mortgages were revised into much higher monthly payments. This left mortgage lenders with property that was worth less than the loan value due to a weakening housing market. Defaults increased; the problem snowballed, and several lenders went bankrupt.

With the description given in the above section, it is quite obvious that if a small problem appeared within the subprime mortgages sector, it would quickly spread to the other sectors. CDOs resemble a house built on a deck of cards: when the cards slip, the house falls apart. As subprime borrowers began to default, investors in the subordinate tranche of the subprime CDOs took the first hit. This led to a loss of confidence even among investors in the safer tranches who had not suffered any losses. Panic ensues as they head for the exit door together. The fire sale of assets led to a downward spiral of prices and a freeze in funding for these CDOs.

Interest rates were relatively low during the first part of the decade. This low interest rate environment spurred increases in mortgage financing and substantial increases in house prices. It encouraged investors to seek instruments that offer yield enhancement. Subprime mortgages offer higher yields than standard mortgages and consequently have been in demand for securitization. The demand for increasingly complex structured products such as collateralized debt obligations (CDOs) which embed leverage within their structure exposed investors to greater risk of default, though with relatively low interest rates and rising house prices, this risk was not viewed as excessive.

Prior to 2005, subprime mortgage loans accounted for approximately 10% of outstanding mortgage loans. By 2006, subprime mortgages represented 13% of all outstanding mortgage loans with origination of subprime mortgages representing 20% of new residential mortgages compared to the historical average of approximately 8% [4]. Subprime borrowers typically pay 200 to 300 basis points above prevailing prime mortgage rates. Borrowers who have better credit scores than subprime borrowers but fail to provide sufficient documentation with respect to all sources of income and/or assets are eligible for Alt-A loans [8]. In terms of credit risk, Alt-A borrowers fall between prime and subprime borrowers.

During the same period, financial markets have been exceptionally liquid, which has fostered higher leverage and greater risk-taking. Spurred by improved risk management techniques and a shift by global banks towards the so-called "originate-to-distribute" business model, where banks extend loans but then distribute much of the underlying credit risk to end-investors, financial innovation has led to a dramatic growth in the market for credit risk transfer (CRT) instruments. Over the past four years the global amount outstanding of credit default swaps has multiplied more than tenfold [8], and investors now have a much wider range of instruments at their disposal to price, repackage, and disperse credit risk throughout the financial system.

CDOs of subprime mortgages are the CRT instruments at the heart of the current credit crisis, as a massive amount of senior tranches of these securitization products have been downgraded from triple-A rating to non-investment grade. The reason for such an unprecedented drop in the rating of investment grade structured products is the significant increase in delinquency rates on subprime mortgages after mid-2005, especially on loans that were originated in 2005-2006 [8].

The delinquency rate for conventional prime adjustable rate mortgages (ARMs) peaked in 2001 to about 4% and then slowly decreased until the end of 2004, when it started to increase again. It was still below 4% at the end of 2006 [4]. For conventional subprime ARMs, the peak occurred during the middle of 2002, reaching about 15%. It decreased until the middle of 2004 and then started to increase again to approximately 14% by the end of 2006, according to the Mortgage Bankers Association. During 2006, 4.9% of current home owners (2.45 million) had subprime adjustable rate mortgages. For this group, 10.13% were classified

as delinquent, which translates to a quarter of a million home owners. At the end of 2006, the delinquency rate for prime fixed rate mortgages was 2.27% and 10.09% for subprime [17].

There are four reasons why delinquencies on these loans rose significantly after mid-2005. First, subprime borrowers are typically not very creditworthy, often highly levered with high debt-to-income ratios, and the mortgages extended to them have relatively large loan-to-value ratios. Until recently, most borrowers were expected to make at least 20% down payment on the purchase price of their home. During 2005 and 2006 subprime borrowers were offered "80/20" mortgage products to finance 100% of their homes. This option allowed borrowers to take out two mortgages on their homes. In addition to a first mortgage for 80% of the total purchase price, a simultaneous second mortgage, or "piggyback" loan for the remaining 20% would be made to the borrower [16].

Second, in 2005 and 2006 the most common subprime loans were of the so called "short-reset" type [17]. They were the "2/28"or "3/27" hybrid ARMs subprime for which the interest rate initially charged is much lower than standard mortgage rates, but after a two to three year period, it is typically reset to a much higher rate. These loans had a relatively low fixed teaser rate for the first two or three years, and then reset semi-annually to an index plus a margin for the remaining period. A typical margin was 400 to 600 bps [4]. Short-term interest rates began to increase in the U.S. from mid-2004 onwards. However, resets did not begin to translate into higher mortgage rates until sometime later. Debt service burdens for loans eventually increased, which led to financial distress for some of this group of borrowers. To make matters worse, US$500 billion in mortgages will reset in 2008 [18].

Third, many subprime borrower had counted on being able to refinance or repay mortgages early through home sales and at the same time produce some equity cushion in a market where home prices kept rising. As the rate of U.S. house price appreciation began to decline after April 2005 the possibility to refinance early was pushed further into the future and many subprime borrowers ended up incurring higher mortgage costs than they might have expected to bear at the time of taking their mortgage.

Fourth, the availability of subprime mortgages was amplified by investor demand for higher yielding assets. A major contributor to the crisis was the huge demand by CDOs for BBB mortgage bonds which allowed substantial growth in home equity loans – otherwise,

there would have been no “arbitrage” in structuring CDOs and therefore less issuance of mortgages. This boosted the demand for residential mortgage-backed securities (RMBS) and CDOs containing mortgage-backed securities (MBS) and CDO tranches, which offer higher returns compared to those available from corporate or sovereign credit. The supply of subprime assets adjusted to this higher demand aided by the application of excessive loose credit standards by mortgage originators. Some mortgage borrowers have ended up with subprime mortgages, even though their credit worthiness qualifies them for lower risk types of mortgages, others ended with mortgages that they were not qualified to have. The accuracy of information in mortgage applications slipped. It has also spurred an increase in illegal lending practices and massive fraud. The results of these declining standards and dubious practices in underwriting over the last three years have manifested themselves in greatly increased delinquency rates for mortgages originated during 2005 and 2006 [15].

2.2.2 Players at the heart of the crisis

Rating agencies are at the centre of the current crisis as many investors relied on their ratings for many diverse products: mortgage bonds, asset back commercial paper (ABCP) issued by the structured investment vehicles (SIVs), and monolines which insure municipal bonds and structured credit products such as tranches of CDOs. Investors in complex credit products had considerably less information at their disposal to assess the underlying credit quality of the assets they held in their portfolios than the originators. As a result, end-investors often came to rely heavily on the risk assessments of rating agencies. Many investors, such as money market funds and pension funds, are restricted to investing only in triple-A assets and base their investment decision on the rating attributed by the rating agencies. Implicitly in the investment decision is that ratings are timely and relatively stable. No one was expecting, until recently, a triple-A asset to be downgraded to junk status within a few weeks or even a few days. The rating agencies started warning about the state of the residential housing market before the beginning of 2006. In the summer of 2006, warnings were issued about the deteriorating state of the subprime market. Moody’s first took rating action on 2006 vintage subprime loans in November 2006. In February 2007, S&P took the unprecedented step of placing on “credit watch” transactions that had been closed as recently as the last year [15]. Subsequent months saw all the agencies downgrade many securities and in many cases, the changes were large, from AAA to CCC, rising questions about the veracity of the rating

methodologies employed by the different agencies. The rating agencies have come under criticism from media and with both the European Commission and Barney Frank, chair of the House Financial Services Committee, holding separate hearings on the agencies response to the subprime mortgage crisis, and possible conflicts of interest arising from, on the one hand, rating agencies being paid by issuers and, on the other hand, rating agencies offering advisory services to issuers.

Originating brokers had little incentive to perform their due diligence and monitor borrowers' credit worthiness, as most of the subprime loans originated by brokers were subsequently securitized. This phenomenon was aggravated by the incentive compensation system for brokers, based on the volume of loans originated, with no negative consequences for the brokers if the loan defaulted within a short period of time. Distress among subprime mortgage lenders was visible during 2006. The problem appeared when the Fed started to raise interest rates and less people could afford to borrow and pay interest on their loans. At the end of the year, Ownit Mortgage Solutions Inc. ranked as the largest issuer of subprime mortgages closed its doors (Bloomberg). This was perhaps surprising, given that Merrill Lynch & Co had purchased a minority stake in Ownit the previous year. In the first quarter of 2007, New Century, ranked as the number two lender in the subprime market, also closed its doors [16].

Others also failed or left the business. Problems with mortgage lenders spread from the subprime to other parts of the mortgage market, as concerns about collateral values increased. The share price of Thornburg Mortgage Inc., which specializes in large (jumbo) prime home loans, dropped 47% after it stated that it was delaying its second quarter dividend and was receiving margin calls from creditors, due to the declining value of mortgages used as collateral. National City Home Equity Corp., the wholesale broker equity lending unit of National City Corp. announced that in response to market conditions, it has suspended approvals of new home equity loans and lines of credit. Aegis Mortgage Corp. (Houston) announced it is unable to meet current loan commitments and stopped taking mortgage applications [15]. Other institutions also withdrew from the subprime and Alt-A markets. Alt-A originators, such as American Home Mortgage, filed for bankruptcy. Small mortgage brokers were being hurt in a number of different ways. GMAC LLC announced that it was tightening its lending terms (Bloomberg). It would not provide warehouse funding for subprime loans and mortgages for borrowers who did not verify their income or assets. Many

small lenders use short term warehouse loans that allow them to fund mortgages until they can be sold to investors. Originators also spent funds persuading legislators to reduce tough new laws restricting lending to borrowers with spotty credits. UBS reports that Ameriquest Mortgage Co., that was one of the nation's largest subprime lenders, spent over US$20 million in political donations [8]. Citigroup Inc., Wells Fargo & Co. Countrywide Financial Corp. and the Mortgage Bankers Association also spent heavily on lobbying and political giving. Today, Countrywide Financial Corp. is virtually bankrupt. An interesting insight to this is the fact that one month before the collapse, the CEO got voted a bonus of $135 million! This illustrates the idea that people were completely ignoring the forerunners of the crisis and thought that everything was just fine.

While these structural financial problems existed, it must be noted that banks clearly failed to identify this. Financial institutions failed on two fronts: risk management and moral hazard reduction. Risk management practices in financial institutions failed because the models that were used to asses risk had not factored in the possibility of a broad downturn in the housing market. Further, several institutions reported that they had not followed their own internal rules for risk management (Bloomberg). Departments within these companies that were making huge profits developing and trading the new securities were allowed to take large risks without adequate internal monitoring. However, there is a more fundamental problem behind this: moral hazard. One of the main underlying problems which is reflected in many ways in the consequences of the crisis is simply that employees of various institutions do not bear the risk of their decisions.

Taking the example of a trader, the positions he takes on the market contain a certain risk with a probability of return. If the investment yields a return, the trader makes a profit and at the end of the year touches a nice bonus. However, if the trader looses on his positions, he still gets paid! In the worst case scenario, he will lose his job (and quickly find a new one), but under no circumstances will he lose his money. There is no such thing as a negative bonus. The bank is bearing all the risk, with the possibility of returns and losses, but the trader who does not bear any risk (or only the risk to not get a bonus or lose his job, which quite frankly can be neglected due to the compensation they have plus the ease to find a new job – depending on the gravity of the situation) has only the perspective of returns in the form of a bonus at the end of the year! This asymmetric situation inevitably leads to a moral hazard. The shocking example of this is that of the trader Jérôme Kerviel, of La Société Générale,

who managed through some manipulations of the risk management systems to lose 4.82 billion Euros (Bloomberg)! This number is so big for a single person to consider losing that it is abating. Clearly, had it been his own money he was investing or had he been bearing a larger part of the risk of these positions, he most likely would not have cheated the risk management systems in order to take such tremendous positions. This problem is not only reflected in the case of trader, but throughout all the employees of financial institutions.

2.3 Consequences

The chain reaction from the described problem can be summarized as in the figure below:

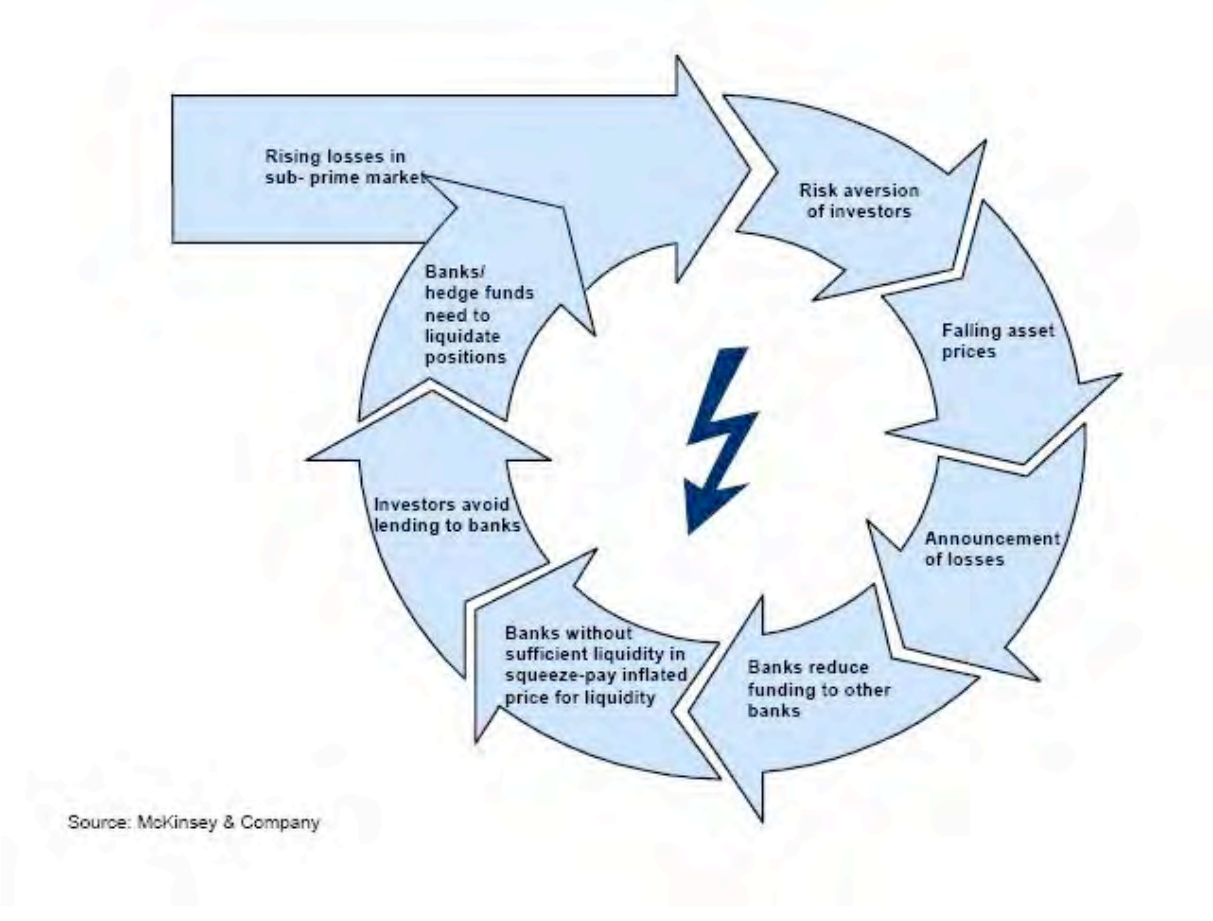


Figure 2.1

This figure provided by McKinsey & Company shows the chain reaction that followed the rising of losses in the subprime market. The reason for this chain reaction is explained in the text, given the described financial structure

At the end of spring 2007, Ben Bernanke, Chairman of the Federal Reserve, stated, "We do not expect significant spillovers from the subprime market to the rest of the economy or the financial system" [17]. At the start of August, the European Central Bank injected 95 billion euros (US$131 billion) and informed banks that they could borrow as much money as they wanted at the bank's current 4% base rate without limit. The Bank of Canada issued a statement that it pledges to "provide liquidity to support the Canadian financial system and the continued functioning of financial markets" [15].

In the second week of August, the Fed reported that the total commercial paper (CP) outstanding fell more than US$90 billion to US$2.13 trillion over the last week. Traditionally,

prime corporate names used the CP market to finance short term cash needs. However, the low levels of interest rates during the past few years has meant that many of these issuers moved away from the CP market and issued low cost debt with maturities ranging from 5 to 10 years. The current lack of demand for CP made it very difficult for borrowers to rollover debt. William Poole, President of the St. Louis Federal Reserve publicly argued against a rate cut (August 16). The Fed took the unusual step of issuing a public statement that Mr. Poole's comments did not reflect Fed policy.

During the same week, a flight to quality occurred, with investors buying Treasuries. The yield on the three month T-bill fell from approximately 4% to as low as 3.4%. The FTSE 100 index declined by 4.1%, with financial companies being the hardest hit. Man Group fell 8.3% and Standard Chartered fell 7.6%. The Unwinding of carry trades caused a sudden 2% increase in the yen/dollar exchange rate. Further unwinding occurred two days later, with hedge funds and institutional investors unwinding carry trades, causing the yen to increase 4% against the dollar, 5.3% against the Euro, 5.8% against the pound, 10.3% against the New Zealand dollar and 11.5% against the Australian dollar [4].

Also during this period, the Fed injected US$5 billion into the money market through 14 day repurchase agreements and another US$12 billion through one day repurchase agreements. The Russian Central Bank injected Rbs 43.1 billion (US$1.7 billion) into the banking system. Foreign investors had started to flee the ruble debt market, causing a liquidity squeeze. The European Central Bank has pumped money into Europe's overnight money markets. Fed has done similar in the US.

Four banks, Citigroup, JP Morgan, Bank of America and Wachovia, each borrowed US$500 million from the Fed [4]. In a statement, JP Morgan, Bank of America and Wachovia, stated that they have substantial liquidity and have the capacity to borrow money elsewhere on more favourable terms. They were trying to encourage other banks to take advantage of the lower discount rate at the Fed window.

During the third week of August, the flight to quality continued. At the start of trading in New York, the yield on the 3 month T-bill was 3.90%, during the day, it fell to 2.51%, and by the end of day, it closed at 3.04%. However, other parts of fixed incomes markets continued to function, with investment grade companies issuing debt: Comcast Corp sold US$3 billion

in notes; Bank of America sold US$1.5 billion in notes and Citigroup US$1 billion in notes. There was a rare high yield issuing by SABIC Innovative Plastics. It sold US$1.5 billion in senior unsecured notes.

The volatility in the foreign exchange market caused some hedge funds to close their yen carry trade positions. Between August 16th and 22nd, investors poured US$42 billion into money market funds. Institutional investors switch from commercial paper to Treasuries.

More recently, in April 2008, the Fed took the unprecedented measure of introducing a new lending facility, called the Primary Dealer Credit Facility (PDCF), for investment banks and securities dealers that give them the possibility to borrow against a wide range of securities as collateral for cash loans. Among other things the securities pledged by dealers must have market prices and "investment grade" credit ratings [8].

Today, the losses incurred by this crisis are enormous. The table below summarizes the top 15 announced losses per bank, as of July 2008, the key word being announced. Indeed, the more worrying aspect, are the reports that state that today's announced losses may represent only one third of the actually losses that have been or will be incurred by this crisis [8]. The consequences have not fully revealed themselves, yet, and inflation as well as economic downturn in the industrial sector are only starting to point their noses [19].

Bank	Losses/Write-downs in billions of US$
Citigroup	40.9
UBS	38.0
Merrill Lynch	31.7
Bank of America	14.9
Morgan Stanley	12.6
HSBC	12.4
JP Morgan Chase	9.7
IKB Deutsche	9.1
Washington Mutual	8.3
Deutsche Bank	7.5
Wachovia	7.3
Credit Agricole	6.6
Credit Suisse	6.3
Royal Bank of Scotland	5.6
Mizuho Financial Group	5.5

Source: Bloomberg

Table 2.1

Bloomberg summary of the total subprime losses announced so far, as of July 2008. This table is very likely to change, and increase. Total subprime losses today exceed 200 billion $US, but some analysts at Bloomberg predict total losses to be $US600 billion!

Since the beginning of this year, economists and government officials have had great concerns over a recession taking place in the U.S. Although not official yet, it is becoming increasingly obvious that the American economy has slipped into recession. The labour market figures point to a shrinking economy: As of June 2008, there has been a jump in the unemployment rate to 5.5% from 4.6% a year earlier and non-farm payrolls have declined 6 months in a row, losing 438'000 jobs since January 2008. Ben Bernanke, chairman of the Federal Reserve, On April 2nd told a congressional committee that output was unlikely to "grow much, if at all, over the first half of 2008 and could even contract slightly" [19].

The hangover's duration will depend on many things, from the strength of foreign economies to the degree to which American firms cut jobs and investment. But top of the list, given the recession's origins in the property bust and the credit crunch, are the fate of the housing market and the resilience of consumer spending. On both counts, the odds are against catastrophe but on a lasting headache.

No one knows by how much, or for how long, America's economy will be weighed down. The IMF's gloom is based in part on its reading of history [4]. An analysis by the fund of post-war housing busts in rich countries, written in 2003, suggests that crashes typically last about four years and are often accompanied by banking crises. Economies end up 8% smaller on average than they would have been had they carried on growing at pre-crunch rates [8]. Perhaps this time will be different, and the hangover will soon be gone. But given the scale of America's housing binge and of the financial crisis the bust has spawned, it seems unlikely.

2.4 Suggested measures to be taken

Regarding the rating agencies, there is a clear need for a better system. One suggestion would be that for a particular instrument that is being rated, there should be a statement regarding the assumptions employed to derive the given rating. All the given factors need to be stated. Also, the meaning of the rating needs to be clearly stated. For example, is a rating a measure of the probability of default occurring over the life of the instrument, a measure of the expected loss averaged over the life of the instrument or something else? Moreover, the sensitivity of the tranche ratings to shocks in whichever area and correlation to these should be disclosed as it can be highly non-linear circumstances [18].

There is also a need for the simplification and standardization of instruments. Many instruments have become too complicated, making reliable pricing or risk management problematic. This is also shown by the fact that when the crisis had hit the markets, investors turned to simple financial instruments, such as bonds or commodities. Also, for many different assets classes, the industry needs to develop markets for indices written on standardized assets. This would help in price discovery and pricing related assets.

Concerning banks, many steps clearly need to be taken. First, there is a need to transparency as to the magnitude of explicit commitments arising from lines of credit, backstop supports and funding for levered buyouts and reputation concerns. There is also need of greater transparency with respect to the nature of assets held by financial institutions, especially assets that are difficult to value. Second, the banks must urgently revise their risk management systems, and integrate major macroeconomic events into these. Global warming, major water-lever rise, sudden shortage of petrol, and all macroeconomic problems that can strike anytime, and this will obviously have consequences on financial products. These factors must be taken into consideration in order for the same mistake not to happen. Third, moral hazard must be reduced. Indeed, it cannot be eradicated, but it can certainly be diminished. Ideas as to achieve this include negative bonuses for traders (meaning if the trader looses money, the bonus can even be that he owes money to the bank), larger portion of the pay that gets put into the company (as stock options or other) and even maybe that if a trader gets fired because of losses, his salary for the months of cumulated losses may be reclaimed! However, the main focus should be on the risk management systems. Although these systems were already in place before, it is apparent that they were not sufficient. Three key measures should

be taken in order to improve this department. First, the people working in this department should be more specialized with this field than it currently has been the case. Experts should be hired, and nothing else. Second, the company as a whole should include risk into their corporate culture. If not every employee is on board and realizing the risks taken at certain times, the system will also end up failing. Finally, the risk department should be better integrated within the other business department. Currently, this is a support department in many companies, whereas it should be within the core business of the bank.

Chapter 3

The yield curve – predicting the crisis

3.1 Definitions

The yield of a debt instrument is the annualized percentage increase in value of the investment. For instance, a savings account that pays an interest rate of 3% per year has a yield of 3%. Generally speaking, the yield earned on such accounts will be dependent on the length of time the money is invested. A bank may offer a savings rate higher than the normal account rate if the customer is prepared to leave the money untouched for a certain number of years. The most common debt instrument on the market is the simple bond. With a bond, the issuer owes the holder a debt and is obligated to repay the principal amount and interest (the coupon) at maturity.

Treasury securities are government bonds issued by the United States Department of Treasury. They are usually referred to as Treasuries. There are four types of treasury securities: Treasury bills (T-bills, mature in one year or less), Treasury notes (T-Notes, mature in two to ten years), Treasury bonds (T-Bonds or Long-Bond, mature in ten to thirty years) and Treasury Inflation Protected Securities (TIPS). A last type of Treasury exists, but this one has been created by the market and is not issued directly by the government: Separate Trading of Registered Interest and Principal Securities (STRIPS). They are T-Notes or T-Bonds (or even TIPS) whose interest and principal portions of the security have been separated or "stripped". They are then sold separately in the secondary market. The name is derived from the notional practice of literally tearing the interest coupons of paper securities (before electronic trading came into practice). The yield of U.S. Treasuries is calculated using the following formula [13]:

$$\text{Yield}(\%) = \left(\frac{\text{Face Value} - \text{Purchase Price}}{\text{Face Value}}\right) \times \frac{360}{\text{Days Till Maturity}} \times 100\% \qquad (1)$$

The yield curve is the relation between the interest rate and the time to maturity of the debt for a given borrower in a given currency. The current interest rates paid on U.S. treasuries for various maturities are the most closely watched yields by the market and are commonly plotted on a graph that is informally called the yield curve. A more precise definition of the yield curve would be the term structure of interest rates [10]. It is more precisely a plot of the yields of the 3-month T-Bill, the 6-month T-Bill, the 2-year T-Note, the 5-year T-Note, the 7-year T-Note, the 10-year T-Bond, the 20-year T-Bond and finally the 30-year T-Bond [1].

In the U.S. (U.S. Treasuries), the Euro-zone (German Bund, French OATs or Italian BTPs), in Japan (JGBs) and in the U.K. (Gilts) the government-issued securities are considered to be risk-free. Moreover, the market for such Treasuries is highly liquid and therefore provides a very good indicator of how the market is doing [1]. For this reason, the yield curve is an essential tool not only for fixed-income investors and issuers, but any finance or economy related department.

Another way to look at the yield curve is to examine the difference between the short-term interest rates paid and the long-term ones. This is commonly known as the yield curve spread. This results in the same as looking at the steepness or the shape of the yield curve, which will be described in more detail in the following section. However, the yield curve spread allows us to examine the movements of the curve over a period of time in two-dimensional graph. Examining the movement of the yield curve over time would require a three-dimensional representation, which would be more difficult to analyze. The typical yield curve spread is the graphical representation of the difference between the 10-year T-Bond yield and that of the 2-year T-Note [3].

3.2 The curve and its shapes

3.2.1 Normal and steep

A normal yield curve is one in which longer maturity bonds have a higher yield compared to shorter-term bonds due to the risks associated with time. The slope of the yield curve is also seen as important: the greater the slope, the greater the gap between short- and long-term rates. The following graph is a typical representation of a yield curve in a growing economy:

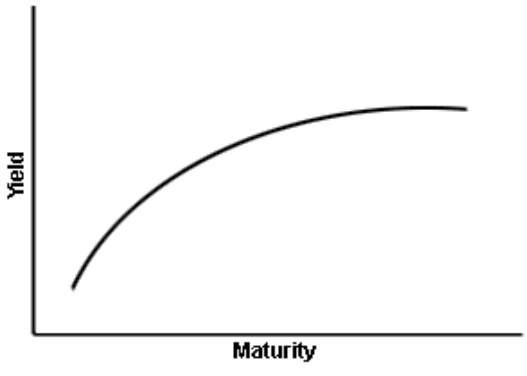
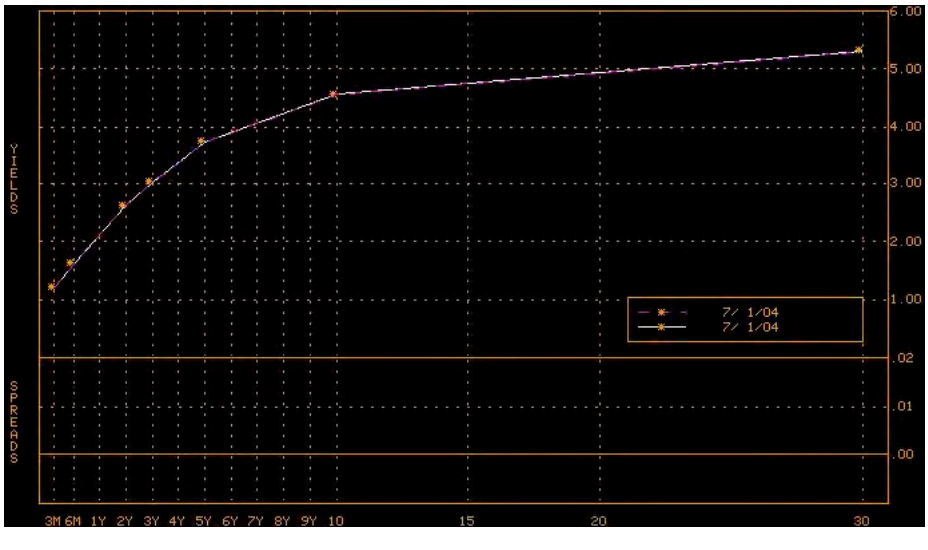


Figure 3.1

A small graph drawn by myself to illustrate the typical shape of a yield curve

This type of yield curve shows confidence in the markets. The steeper it is, the more confidence there is in the future outlook of things. People willing to invest their money for some time will be rewarded. The yield curve spread is positive – typically between 200 and 300 bps [13]. Below, the yield curve from July 2004 illustrating a normal shaped curve.



Source: Bloomberg

Figure 3.2

Bloomberg graph illustrating a normal yield curve. The curve corresponds to the interest rates of July 1st, 2004

3.2.2 Flat or humped

A yield curve in which there is little difference between short-term and long-term rates for bonds of the same credit quality. This type of yield curve is often seen during transitions between normal and inverted curves. The following graph is a typical representation of a yield curve in an insecure economy [2]:

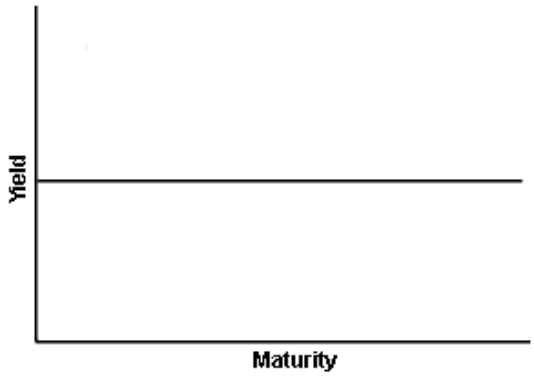
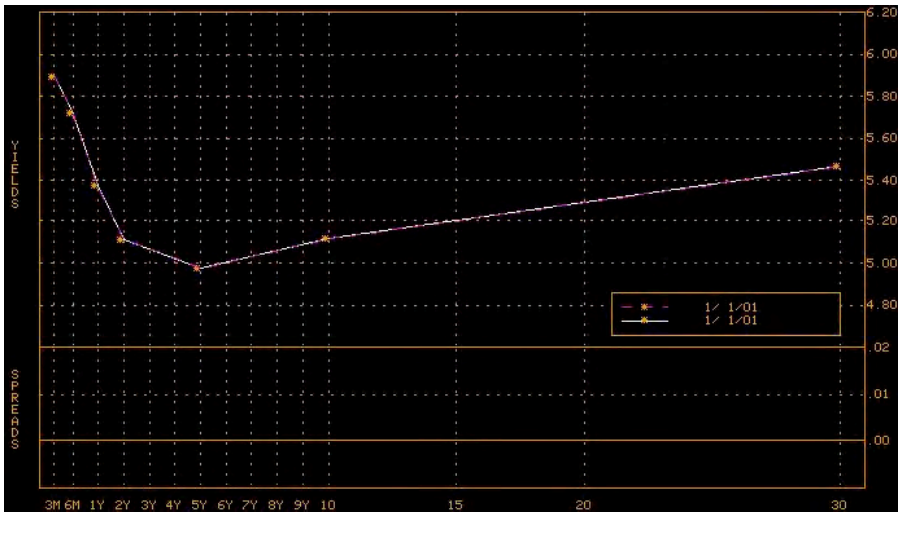


Figure 3.3

A small graph drawn by myself to illustrate a flat yield curve

When short- and long-term bonds are offering equivalent yields, there is usually little benefit in holding the longer-term instruments, meaning that the investor does not gain any excess compensation for the risks associated with holding longer-term securities. For example, a flat yield curve on U.S. Treasury would be one in which the yield on a two-year bond is 5% and the yield on a 30-year bond is 5.1%. Below is the yield curve from January 2001, showing a humped shape, meaning the first half is inverted while the second is normal.



Source: Bloomberg

Figure 3.4

Bloomberg graph illustrating a humped yield curve. The curve corresponds to the interest rates of January 1st, 2001

3.2.3 Inverted

In inverted yield curve is the result of an interest rate environment in which long-term debt instruments have a lower yield than short-term debt instruments of the same credit quality. This type of yield curve is the rarest of the three main curve types. The following graph is a typical representation of a yield curve in an economy with negative outlook [2]:

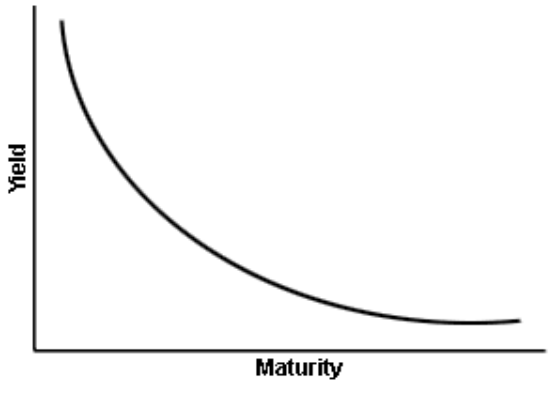
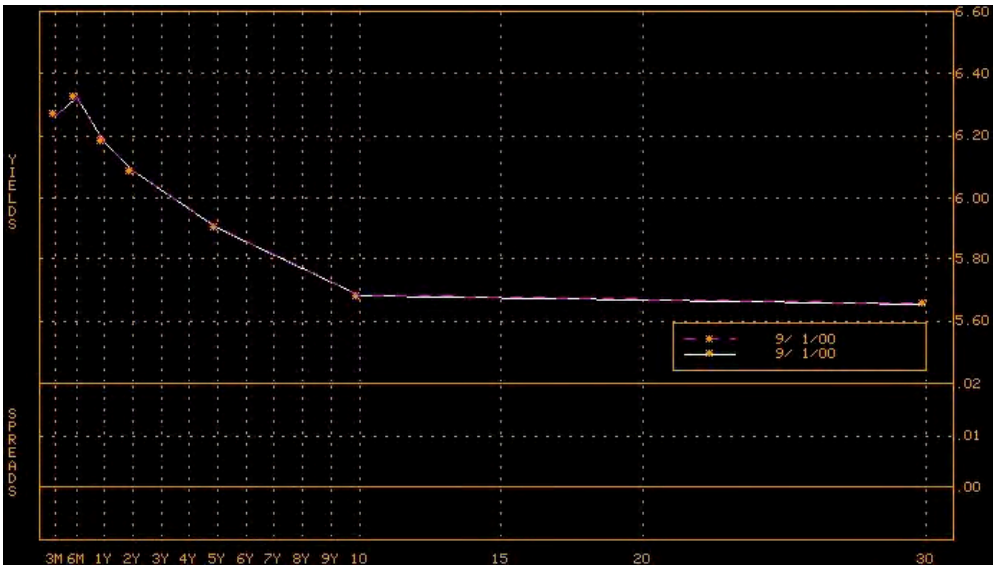


Figure 3.5

A small graph drawn my myself to illustrate an inverted yield curve

Partial inversion occurs when only some of the short-term Treasuries (five or ten years) have higher yields than the 30-year Treasuries do. An inverted yield curve is sometimes referred to as a "negative yield curve" [1]. An inverted yield curve illustrates investors' fears regarding the future, as they are not willing to invest long term because of economic uncertainty. Below is the inverted yield curve from September 2000.



Source: Bloomberg

Figure 3.6

Bloomberg graph illustrating an inverted yield curve. The curve corresponds to the interest rates of September 1st, 2000

3.3 Theory

In this section, a theory that explains the shape of the yield curve will be examined. The theory is comprise of two parts, the first one looking into the yield curve from the point of view of monetary policy, while the second adopts the investors' point of view. The combinations of these two effects shape the yield curve.

When the monetary authority engages in a policy of monetary expansion, the new money is injected into the monetary system at specific points [9]. The effect of additional liquidity is sometimes called the Wicksell effect [12]. The Fisher effect is the change in interest rates caused by changes in the expectations of future inflation. The Wicksell effect and the Fisher effect are opposing forces [12]. The Wicksell effect tends to lower interest rates while the Fisher effect tends to raise them. With a policy of monetary expansion, the Wicksell effect first dominates interest rate movements. As money is injected into the short end of the yield curve (through the monetary base and thus the Fed funds rate) an initial lowering of short rates and a steepening of the slope of the yield curve results.

Bernanke and Blinder (1992) argue that the short rates move while the long rates remain stable [10]. The Fisher effect increases the forward long rates, thus applying upward pressure to long rates. However, the new money is arbitraged across the term structure. The Wicksell effect prevents the long rates from rising. Thus the yield curve rotates instead of shifting, as shown in Figure 3.7. The new yield curve is presented as the dashed curve.

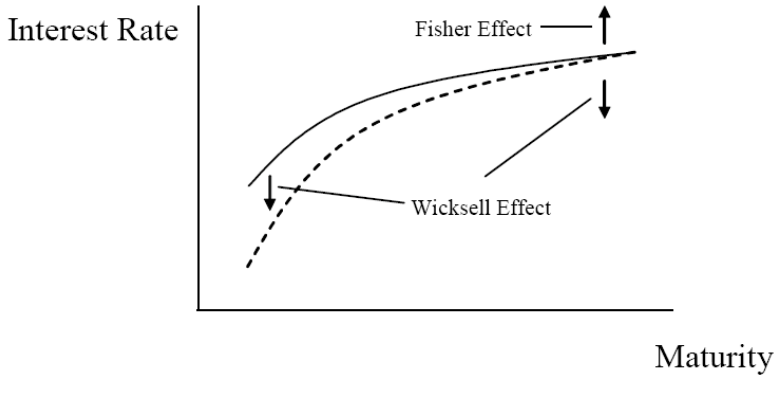


Figure 3.7

Yield curve movements during monetary expansion. New liquidity drags the curve downwards (Wicksell effect) but the future good economic outlook and expectations regarding inflation cancel this effect on the long end of the curve (Fisher effect) and thus the curve steepens

The credit crunch occurs when the monetary authority determines inflation (or expected inflation) is too high and "slams on the monetary brake." The monetary authority's actions force short-term rates to rise. The yield curve rotates instead of shifts because the rate of future inflation is expected to fall. The Wicksell effect dominates the Fisher effect at the short-end of the yield curve and they negate each other at the long-end. Thus the yield curve tends to invert itself, as seen in Figure 3.8.

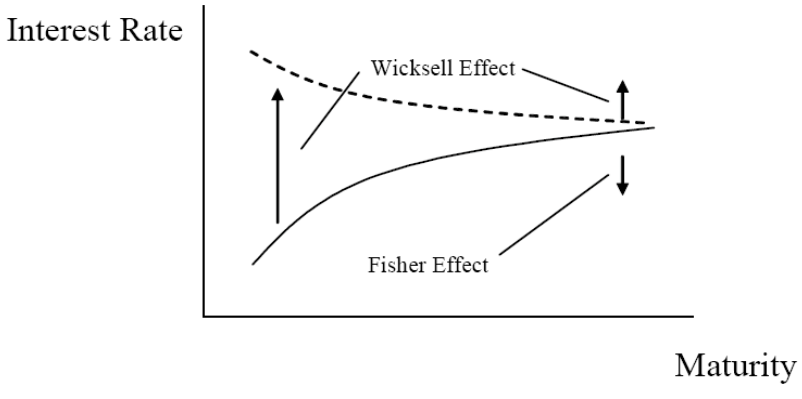
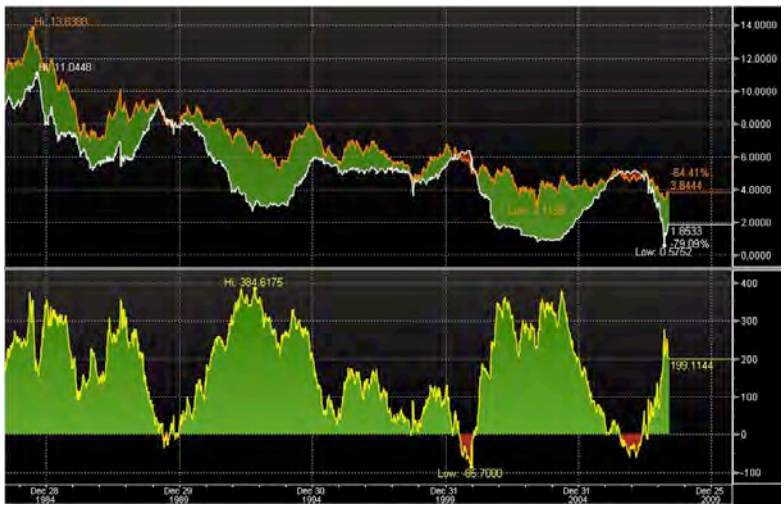


Figure 3.8

Yield curve movement during a credit crunch. The monetary policy forces interest rates to rise (Wicksell effect) but the future negative economic outlook and expectations regarding inflation cancel this effect on the long end of the curve (Fisher effect) and thus the curve flattens and eventually inverses

3.4 History and current shape

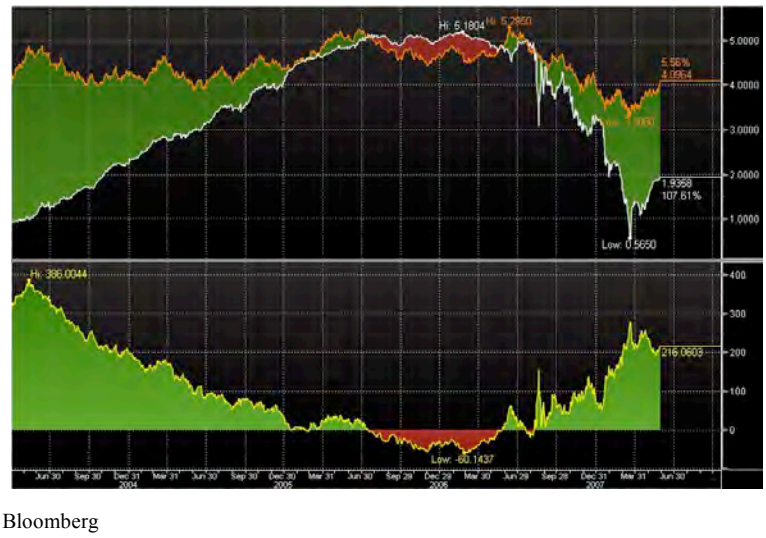
Below are two figures that summarize the evolution of the yield curve over the years. Figure 3.9 represents the yield curve spread from 1983 to today. Figure 3.10 represents the yield curve spread between 2004 and today. The above part of each graph is the yield of each Treasury (the 10-year T-Bond in red and the 2-year T-Note in white). The part underneath, i.e. the yellow line, this is simply the difference between the two yields. A large green area indicates a normal shaped yield curve, while a red area indicates an inverted yield curve.



Source: Bloomberg

Figure 3.9

Figure 3.9 represents the yield curve spread from 1983 to June 2008. The above part of the graph is the yield of each Treasury, the red line being that of the 10-year T-Bond and the white line that of the 2-year T-Note. The part underneath, i.e. the yellow line, this is simply the difference between the two yields (yield of the 10-year T-Bond less that of the 2-year T-Note). Graph complied by myself from Bloomberg data



Source: Bloomberg

Figure 3.10

Figure 3.10 is the same but representing the yield curve spread between June 2004 to 2008

Clearly, the yield curve has suffered many fluctuations throughout history. It may almost seem as if the fluctuations correspond to business cycles, with peaks when economy is booming and low points when the economy is in recession. However, the dates do not correspond. A deeper explanation regarding this will be given in the next session.

As can been seen on the graphs, the United States have recently suffered a yield curve inversion, and is just recovering from it. However, as of mid-April, eight foreign markets are currently dogged by yield-curve inversion or approaching yield inversion (Bloomberg). Last year, the United Kingdom became the first G-8 economy after the United States to suffer yield-curve inversion for the better part of the year until last fall.

Currently, six industrialized markets are mired in yield-curve inversion (Bloomberg). These include Australia, New Zealand, Austria, Norway, Portugal and Switzerland. Two other markets now sport the same interest rates along the short and long end of the yield curve, including Denmark and Italy [23]. This strongly suggests that an increasing number of mature economies are gradually being infected by America's subprime slowdown as interest rates narrow. Historically, the Anglo-Saxon economies have typically followed similar economic cycles. Expansions or contractions in economic activity have been simultaneous events that happen within months of each another. This was the case in 1989-1990 when the United States suffered a recession and the United Kingdom, Australia and New Zealand soon followed suit [8]. In the early 1980s, all three countries suffered the same economic hardships as the United States following a period of surging interest rates and inflation in the late 1970s. The same was true for most developed economies.

The majority of industrialized countries, including the European Union and Scandinavia, will increasingly share the same bond-yield inversion phenomenon that occurred in the United States 18 months ago. Over this period, benchmark 10-year Treasury yields have plummeted from 5.25% in late 2006 to 3.42% recently - a sizable gain for investors (as yield decreases the price increases). Yield curve inversion and economic re-coupling has taken place this year as the majority of mature economies suffer the same fate as the United States.

3.5 Predicting power

3.5.1 Past events

In the previous section, there was a hint as to whether the yield curve spread may correspond to business cycles. In fact, it does, but with a slight "shift" earlier in time. In this section, we shall look into the implications of this.

A business cycle or economic cycle refers to the fluctuations of economic activity regarding the long term growth trend. The cycle involves periods over time of relatively rapid growth and periods of relative stagnation or decline. These fluctuations are often measured using real GDP (Gross Domestic Product). Despite the name "cycles", these fluctuations in economic growth do not follow a purely mechanical pattern and are very difficult to predict. In macroeconomics, a recession is associated with a decline in a country's real GDP. According to a widespread definition, a recession occurs when real growth is negative for two or more successive quarters of a year. However, the United States NBER (National Bureau of Economic Research) ultimately decides whether a given economic period is to be defined as a recession. They define a recession as a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real GDP, real income, employment, industrial production and wholesale-retail sales [5]. Economists, government officials, and businessmen have long searched for accurate business cycle indicators. In order to provide a solution, the relationship between times of recession and the yield curve shall be examined. When looking closer into the officially declared periods of recession by the NBER and mapping them to the yield curve over the years, one notices a staggering relationship. In the table below are the officially declared periods of recession.

From	To
April 1960	February 1961
December 1969	November 1970
November 1973	March 1975
January 1980	July 1980
July 1981	November 1982
July 1990	March 1991
March 2001	November 2001

Source: NBER

Table 3.1

This table lists the officially declared recessions by the United States NBER since 1960

To further highlight this relationship, Figure 3.11 illustrates the 10-year T-Bond and the 1-year T-Bill spread and the 10-year T-Bond and the 3-month T-Bill spread between April 1953 and October 2003. The yellow bands correspond from to the periods where a recession has been officially recorded in the U.S.

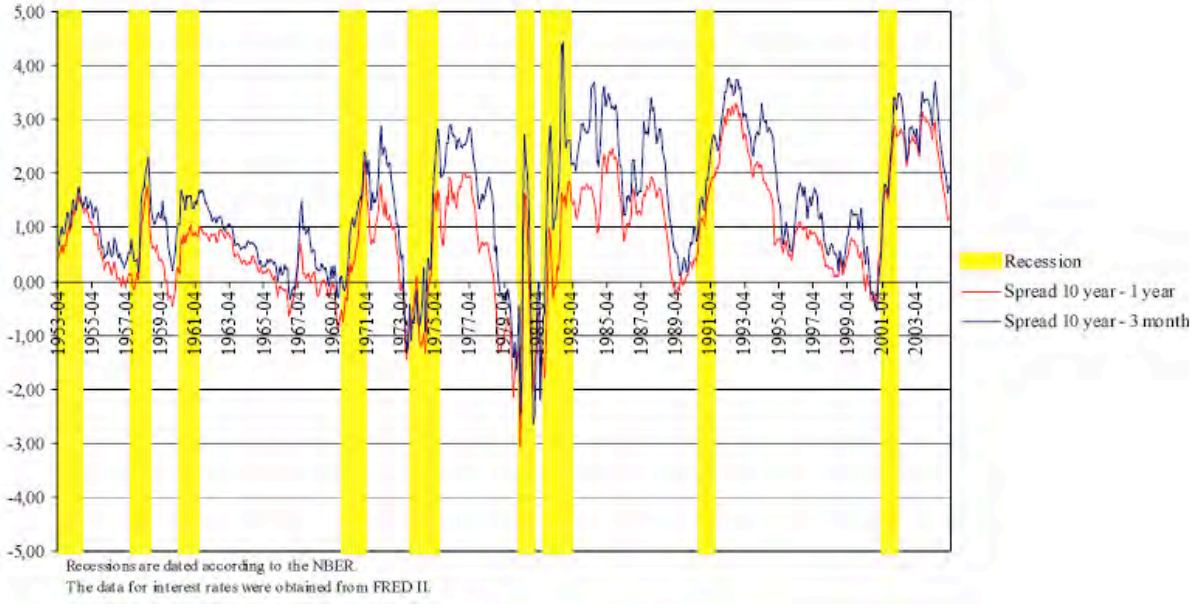
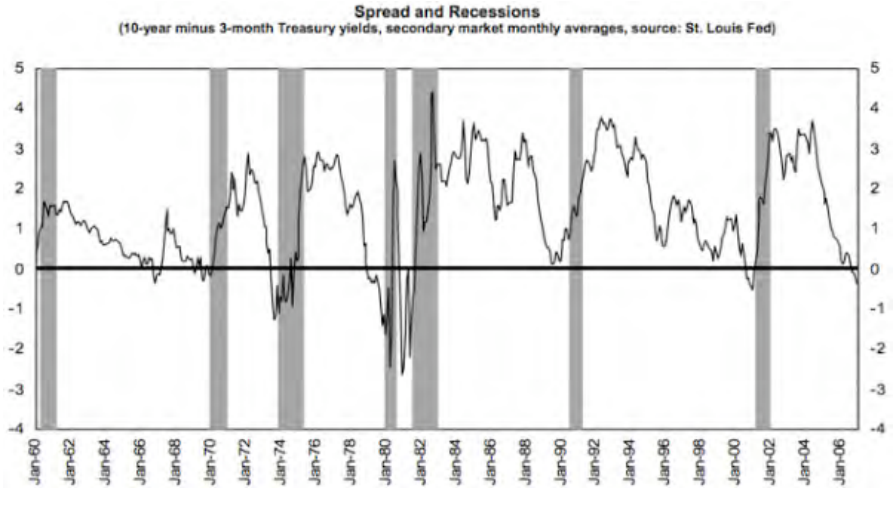


Figure 3.11

This figure maps the recession periods to the yield curve spread. Two spreads were included in this graph, the 10-year minus the 1-year and the 10-year minus the 3-month. This was done for robustness reasons, to prove that not just the convenient spread had been chosen. In this figure we can observe that recession happen almost always after the spread goes negative, and when in recession the spread increases sharply

Another figure from the St. Louis Fed illustrating the same principle:



Source: NBER

Figure 3.12

This figure is very similar to the previous, and was included because it is a bit clearer. The time-scale is slightly different, and only one of the two spread was included in the graph

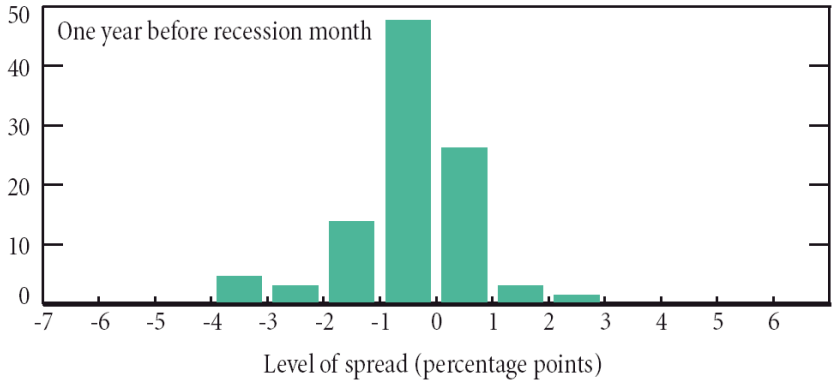
The two following observations can be made: First, a period of recession coincides with a steep increase in the yield curve spread, meaning when the yield curve steepens rapidly. Second, and more importantly, a recession almost always come right after the yield curve spread turns negative, meaning when there is a yield curve inversion. These two observations already show that there is a close link between the shape of the yield curve and times of economic downturn.

An inverted or humped yield curve has occurred no more than 5 quarters before every recession since the mid-1950s. Except for the 1990-1991 (two quarters) recession, the yield curve has inverted in every recession since the mid-1960s. Prior to the 1957- 1958 (three quarters), 1960- 1961 (three quarters) and 1990-1991 (two quarters) recessions, the yield curve spread did not become negative. The lowest points for this spread were 0.24% in February 1957, 0.20% in December 1959 and 0.13% in August 1989 (Bloomberg). Before these recessions, the yield curve was technically humped and not inverted. However, the 10-year/1-year spread was negative in December 1956 and from February through April 1957. The 10-year/1-year spread was also negative in the period of September 1959 through February 1960 and February through September 1989 [6].

There is one instance where an inverted yield curve was not followed by a recession. From September 1966 through January 1967 the yield curve inverted, but no recession took place. Some refer to this occurrence as a false positive, but the second quarter of 1967 did experience a negative growth rate of -0.06% (real GDP). While this decline in real output did not constitute an official recession, it does confirm the relationship under study.

Since the mid-1960s, there have been six official recessions. Except for the 1990-1 recession, monetary policy was tightened in each instance. However, when tightening occurred after the recession started, it cannot be concluded that the recession was caused by a credit crunch. Nonetheless, based on the above sections, it can be stated that the yield curve's sudden shift in shape with a sharp steepening was due to these monetary policies. In five instances, 1966, 1969-70, 1973-5, 1981-2, and 2001, a credit crunch preceded an economic downturn. The recessions that are not preceded by a policy of credit tightening are: 1980, and 1990-1. These recessions were caused by a real resource crunch where economic pressure increased input prices which led to an economic downturn [19].

Therefore, a strong predictor of the upper-turning point of a business cycle is the inverted yield curve. Further data below support this argument.



Source: NBER

Figure 3.13

Exactly one year before the official months of beginning of a recession, the level of spread was measured. With these measures, a historic distribution was compiled, just like a probability distribution. Clearly, the average and the mean are negative

NBER Recession	Number of Months with Negative Monthly Spreads	Minimum Level of Spread
January 1970 – November 1970	10	-0.51
December 1973 – March 1975	6	-1.59
February 1980 – July 1980	12	-2.20
August 1981 – November 1982	10	-3.51
August 1990 – March 1991[a]	3	-0.08
April 2001 – November 2001	7	-0.70

Source: NBER

Table 3.2

This table is similar to the previous one, but contains the relationship with the yield curve. More precisely, it ties each recession to the number of months the yield curve was negative, and the minimum spread level it reached during those months

3.5.2 Future predictability

As stated in section 3.4 and seen in figure 3.10, the U.S. suffered a yield curve inversion 18 months ago. With the description of the consequences in chapter 2 section 3, it is safe to say that the U.S. economy is in recession although it has not been declared yet. In this context, a question comes to mind: could this situation have been prevented or at least predicted?

In order to determine whether a yield curve inversion can be used as a reliable predictor for a recession, a probability model called “Probit Model” shall be examined and explained.

Based on the historical graphs above, we can derive the probability of a recession to be officially announced depending on the level of the yield curve spread. First, the "lag" between the yield curve spread and the supposed beginning of a recession had to be determined. Taking a close look at table 3.1 and figure 3.9, it appears quite clearly that the yield curve seems to have inverted (or was very close to) almost exactly one year ahead of an official recession began. It was therefore decided for a year-ahead forecast to be used, with a tolerance of +/- 2 months. This is the model that was developed by the NBER, where only the key findings will be explained below. Regarding the precise calculations, sensitivity analysis and hypothesis rejection regarding α_0 and α_1 , this has been omitted in this part but can be found within NBER's research papers. We will here focus on the interpretation of these findings.

Sampling the yield curve into a couple of key points, and comparing them with the official dates of recession, a table listing the probability of a recession to take place one year after the yield curve spread was at a specific level can be derived. Obviously, calculations were omitted for high levels of yield curves, as no recession has ever been announced a year after having had a largely positive yield curve spread. The model can be summarized with the following formula:

$$P(NBER_{t,t+1} = 1) = \Phi\ (\alpha_0 + \alpha_1\ SPREAD_t^{10Y\text{-}3M}) \qquad (2)$$

where $NBER_{t,t+1}$ is the dummy variable that takes on a value 1 if there is an NBER-defined recession within the following year; $SPREAD_t^{10Y\text{-}3M}$ denotes the yield curve spread between the 3-month T-Bill and 10-year T-Bond at time t; and $\Phi()$ is the standard normal cumulative distribution function. From this model, the results obtained are listed on the next page:

Recession Probability (Percent)	Value of Spread (Percentage points)
5	1.21
10	0.76
15	0.46
20	0.22
25	0.02
30	-0.17
40	-0.50
50	-0.82
60	-1.13
70	-1.46
80	-1.85
90	-2.40

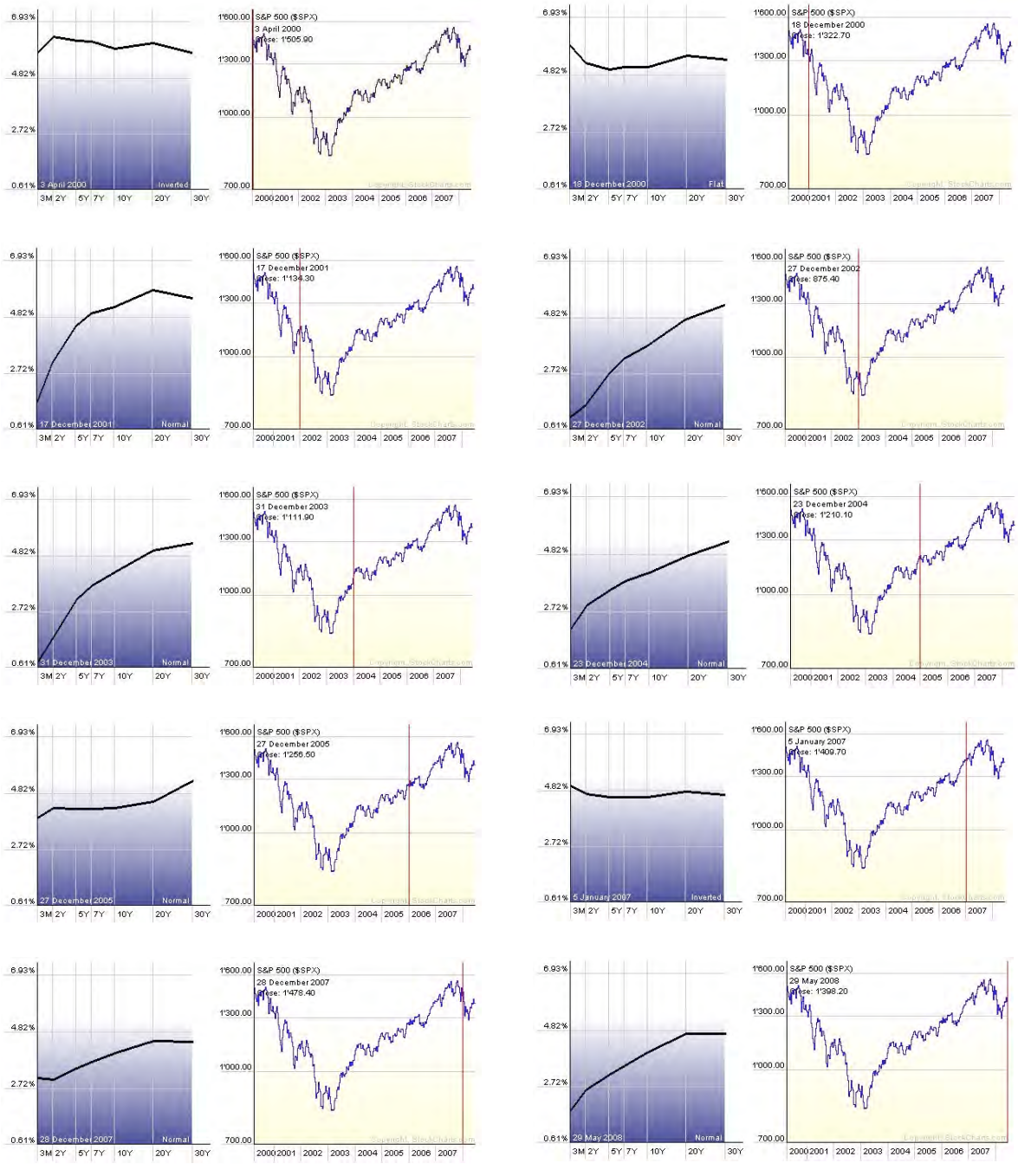
Source: Federal Reserve Bank of New York

Table 3.3

This table links the probability of a recession within the next twelve months to the current level of yield curve spread. These results were obtained using the Probit model, and were listed in the Current Issues Volume 2, Number 7 of the Federal Reserve Bank of New York

A striking observation that can be made based upon these results is that when the yield curve spread is significantly negative, a recession is very likely to take place a year later. This corresponds to the observations made in the previous section. When examining the level of the spreads 18 months ago, meaning a year before the economic downturn started, which was equal to 60.1 bps at its lowest (see figure 3.10), the statistical evidence suggests that the probability that the U.S. are in a recession today is almost 50%.

If the current economic releases are factored in, it seems even more likely that the United States are in a recession. Hence, it can be concluded that the yield curve is a very good predictor of future recessions. To illustrate this given the current situation, on the next page is a series of snapshots of the yield curve's shape compared to the stock market index S&P 500 from April 2000 until today. To be read from left to right. Notice how the yield curve changes shape as the vertical bar runs through the S&P 500 index.



Source: StockCharts

Figure 3.14

This figure is actually comprised of 10 smaller figures that are to be examined going first from let to right, them top to bottom. The right-hand part of each snapshot contains the S&P 500 index as it has been recorded from April 2000 until May 2008. The left-hand part shows the yield curve as it was at the point of time of where the red line crosses the time-scale of the S&P 500 index

Chapter 4

The TED spread – measuring the crisis

4.1 Definitions

Initially, the TED spread was the difference between the 3-month futures contract for U.S. Treasuries and the 3-month contracts for Eurodollars having identical expiration months, as represented by the London Inter Bank Offered Rate (LIBOR). However, since the Chicago Mercantile Exchange dropped the T-Bill futures, the TED spread is now calculated as the difference between the 3-month T-Bill interest rate and the 3-month LIBOR. The name originates from the initialism of "T-Bill" and "ED" – the ticker for the Eurodollar futures contract. In the U.S. fixed income market, it was also known as swap spread which was the first name that was used to describe this difference.

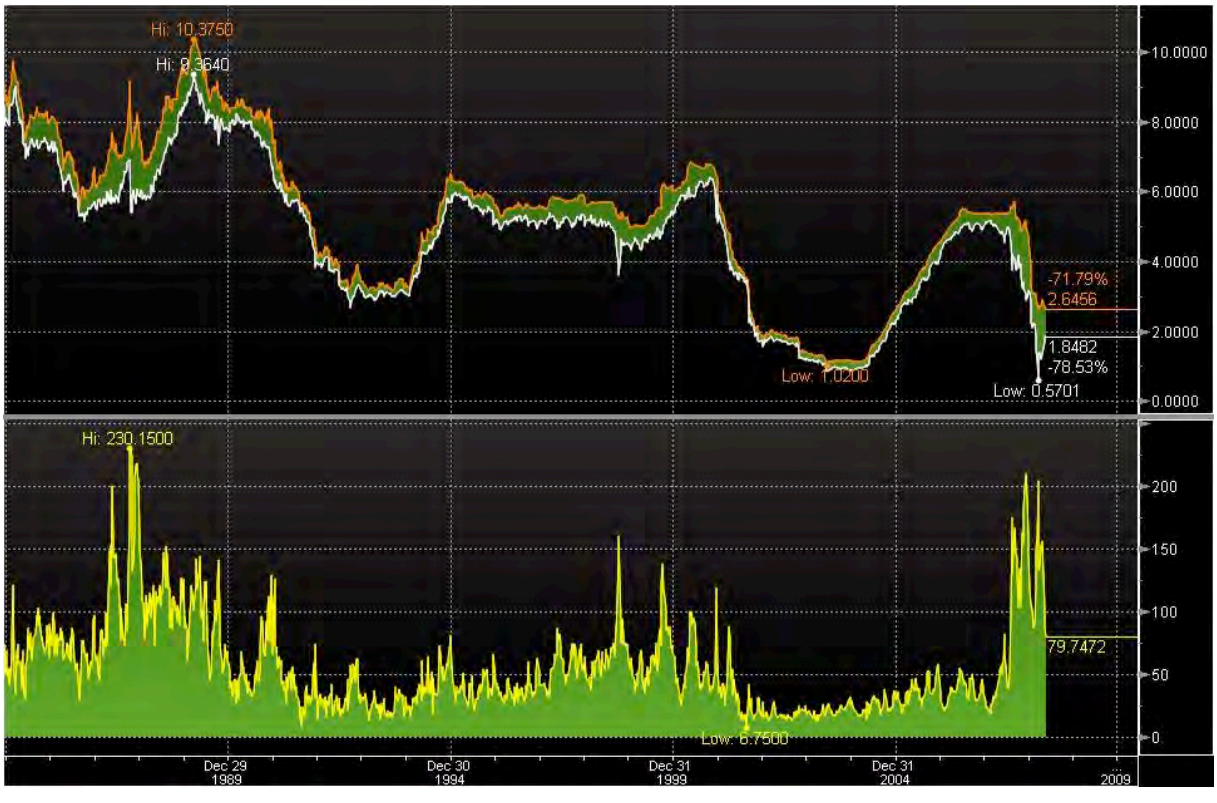
The LIBOR is the interest rate at which banks can borrow funds from other banks in the London Inter Bank market. The LIBOR is derived from a filtered average of the world's most creditworthy banks' inter bank deposit rates. The LIBOR is the most widely used benchmark for short-term interest rates. It's important because it is the rate at which the world's most preferred borrowers are able to borrow money, and as such it is reflected in the rates at which the less preferred borrowers can borrow money (i.e. corporations, etc.) Eventually, it is reflected into the whole financial world.

Since the U.S. T-Bill is considered to be risk-free, the TED spread can be viewed as an indicator of credit risk. The higher above the T-Bill's rate the LIBOR is the less confidence the banks have in each other. A high TED spread can be translated by a fear of credit default by the fellow banks and they therefore increase their inter bank offering rate, whereas the T-Bills remain at the same level or almost since it is considered to be a risk free security. As the spread increases, the risk of default is considered to be increasing, as the spread decreases, the risk of default is considered to be decreasing.

In summary, the magnitude of the TED spread can be viewed as relative default risk premium between commercial banks and the U.S. Treasury. The default risk premium is in turn a function of the general creditworthiness of banks issuing Eurodollar securities, the marginal level of risk aversion in the economy, and the ability of borrowers to repay loans made by banks that issue 90-day Eurodollar securities. If reductions in reserve requirements cause financial market participants to view depository institutions as riskier, then we should observe increases in the TED spread following such announcements. However, there may be several explanations for the TED spread's shape and this will be looked into closer in section 4.3.2 of this chapter.

4.2 History

From the above definition, the TED spread can be interpreted as a barometer of risk. In order to have an idea of what it is equal to in situations of economic prosperity and the levels it can reach during economic turmoil, the following graph of the TED spread's evolution since 1984 until today shall be examined:



Source: Bloomberg

Figure 4.1

TED spread from 1984 until June 2008. The peaks correspond to the various financial crises, including the Black Monday followed by recession in 1987, the LTCM hedge fund meltdown and the dotcom bubble burst in 2000. The above part are the actual rate curves, i.e. 3-month T-Bill interest rate and the 3-month LIBOR, whereas the bottom half is the difference between the two, i.e. the TED spread

Ignoring the TED spread values after 2007, which will be looked into further detail in the next section, it can be observed that the past financial shocks had a clear effect on the TED spread. This supports the idea of it being a barometer of risk.

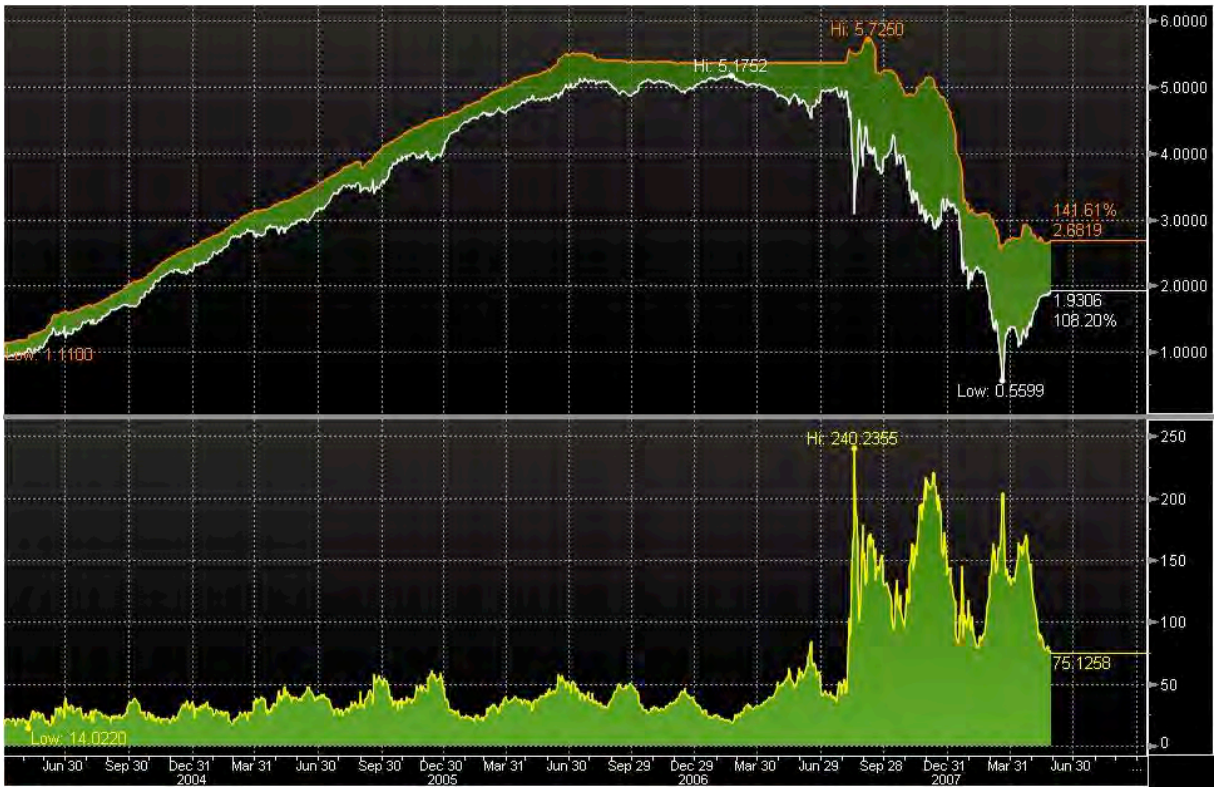
The peaks with a spread above 100 bps include the Black Monday of 1987 which will be remembered as the largest one-day drop in the history of the New York Stock Exchange (NYSE). It overshot the collapse of 28th October 1929, which prompted the Wall Street crash

and the beginning of the Great Depression. In the 1987 meltdown, 22.6% of the value of US stocks was wiped out largely during the first hour of trading on Monday morning [21]. The TED spread skyrocketed to above 230 bps. Following this, the United States went into recession from July 1990 until March 1991. The second series of speaks can be attributed to the LTCM hedge fund failure and the dotcom bubble burst. The latter is recorded as having lasted from March 2000 to the end of 2001 [20], period where the TED spread can be seen taking on large values at repeated times, with a peak above 120 bps. The crash wiped out $5 trillion in market value of technology companies and plunged the United States into recession from March 2001 to November 2001.

4.3 Current situation

4.3.1 Magnitude of the subprime crisis

Based on the above observations, the magnitude of the TED spread can be closely linked to the magnitude of the crisis. As such, the TED spread has been a very interesting indicator regarding the economic outlook. Although not having broken the record spread of the financial crisis of 1987, the TED spread has seen historically high levels in the past year (above 200 bps). The evolution of the spread over the last 4 years is depicted below:



Source: Bloomberg

Figure 4.2

Same figure as 4.1 but with dates ranging from May 2004 until June 2008. Here, the impact of the subprime financial crisis can be better seen. The TED spread has not come down to normal levels since

Two observations are to be made regarding the above figure. First, it is the abating, sudden, increase of spread in August 2007, setting a near all-time record spread. Second, are the unusually low and stable levels of spread recorded for years before it peaked. During the year before August 9, 2007, the 3-month Libor spread above the target federal funds averaged only 11 basis with a standard deviation of a mere 1 basis point; a period of very low volatility. Looking at spreads going back to December 2001 illustrates just how unusual this episode is.

The spread on August 9 was 250 basis points above the pre-August 9, 2007 average. That is 7 times the standard deviation before August 9!

The shock was therefore all the more violent. Given the historic events that followed past TED spread peaks, one can only imagine the size of this crisis. The same probability model as in chapter 3, section 3.5.2 could be derived here. However, the focus of this chapter is to provide various explanations.

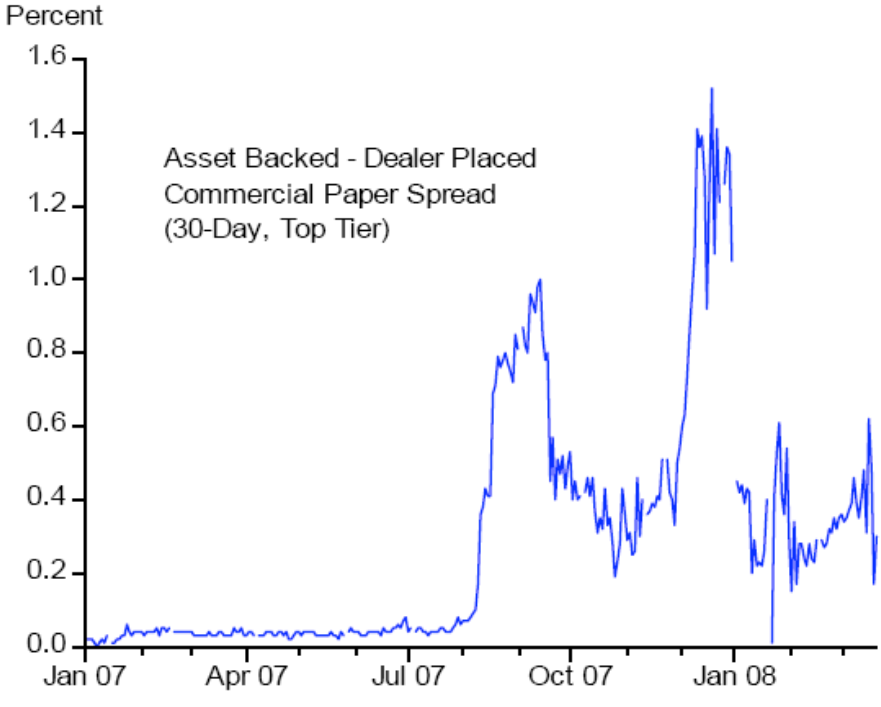
4.3.2 Behind the shape of today's TED spread

This section will focus on the first phase of the crisis, more specifically the period from Thursday, August 9th, 2007 until beginning 2008. That Thursday and Friday of August 2007 turned out to be just the start of a remarkably unusual period of tumult in the money markets, perhaps even qualifying as one of those highly unusual "black swan" events that Taleb (2007) has recently written about [22]. This event raises important questions regarding the mechanism behind the sudden increase in the TED spread, as described above.

Earlier, it was stated that the TED spread could be interpreted as relative default risk premium between commercial banks and the U.S. Treasury. However, there are several factors that need to be taken into account when attempting to explain the underlying of the TED spread. Four potential explanations for its shape to be examined: counterparty risk, liquidity risk, financial reports and expectations of future interest rate changes.

First, and perhaps the most commonly mentioned explanation is "counterparty risk," which has been extensively described above. Recall that inter-bank lending in the Libor market or term fed funds is unsecured. Obviously, this explanation has the virtue of reflecting the widely-reported reality that many banks were writing down the values of securities that they owned. These securities had either been downgraded in terms of quality or were backed by subprime mortgages that were becoming delinquent or going into foreclosure as housing prices stopped increasing and began to fall [8]. Clearly, the continuing decline in housing prices and the slowing economy could easily raise the chances of a further deterioration in the value of mortgage-related assets on the banks' balance sheets, which may be why the TED spread remains relatively high. Moreover, the realization of the risks in derivative securities

based on subprime mortgages triggered doubts about many other aspects of the derivative market. The following two figures illustrate the counterparty risk through other means than the TED spread.



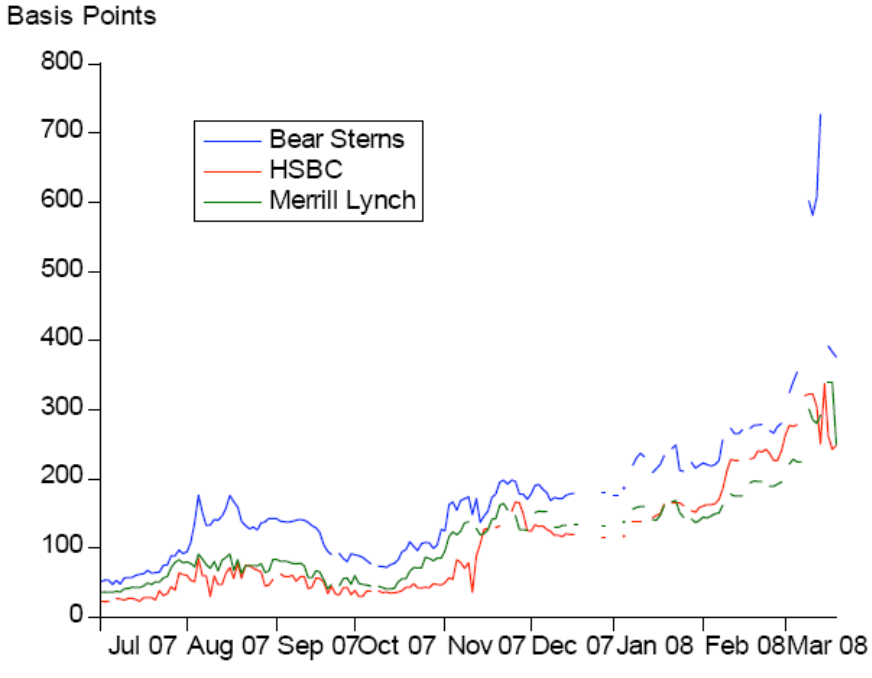
Source: UBS

Figure 4.3

This figure and the next two come from a UBS technical analysis. This one shows the difference between Asset Backed Commercial Paper and Dealer Placed Commercial Paper (yet another type of spread). Because the asset backed CP are linked to the mortgages and the dealer placed CP exclude the more risky parts, this is a good measure of counterparty risk

One of the markets that has been under extreme stress during this period is the market that grew as a mechanism for financing the purchase of home mortgages in the process of assembling them into various derivative securities. Because the commercial paper was backed by these mortgages or by the mortgage pools, they are called asset-backed commercial paper. They are a potential measure of the counterparty risk in commercial banks because banks held this paper either directly or indirectly through their Structured Investment Vehicle (SIV) operations. Figure 4.3 shows the spread between asset-backed commercial paper and dealer-placed commercial paper, which excludes the more risky asset-backed issues, letter of credit issues, and direct issues from firms. Clearly, there was an increase in the spread about the same time as the Libor spreads increased and the patterns of decline and the ups and downs also have similarities. To the extent that this is a good indicator of counterparty risk, this timing lends support for the counterparty risk explanation [14].

Another measure of counterparty risk is the probability that banks might default on their debt. These probabilities can be assessed using the premiums on credit default swaps (CDS) that are like insurance policies for corporate bonds. The buyer of a credit default swap pays a periodic fee to a seller in exchange for the promise of a payment, in the event of bankruptcy or default, of the difference between the par value and the market value of the corporate bond. The more probable it is for a bank to default, the more the CDS is worth. As such, CDS rates are a good indicator of counterparty risk. The following figure shows the rapidly rising rates on five-year CDS for several major financial institutions through March 20, 2008 including Bear Stearns. Note the increase starting in July 2007. Unlike the asset backed commercial paper spread, there is no evidence of a decline in risk at the time that the Libor spreads declined.



Source: UBS

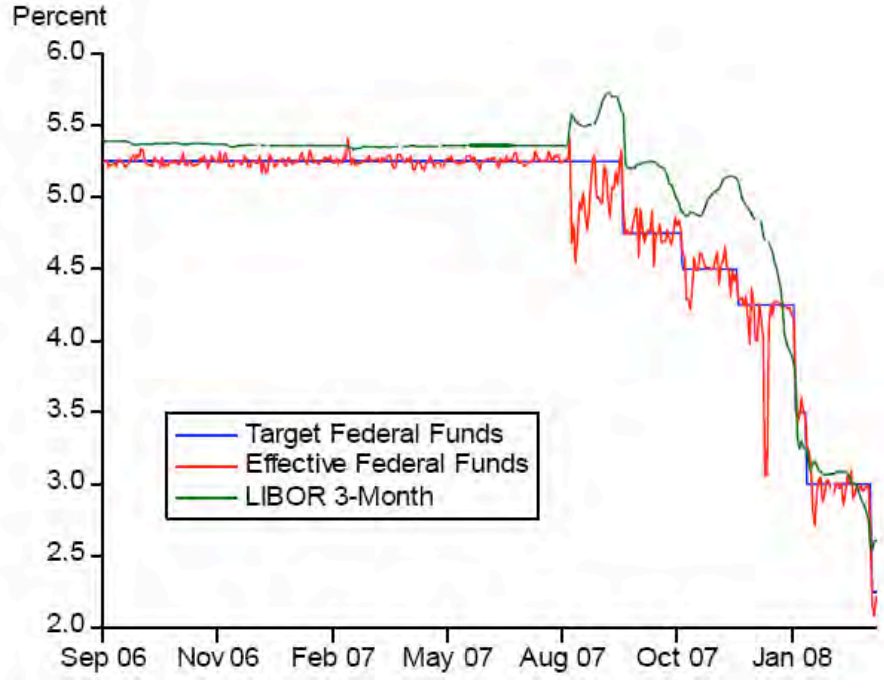
Figure 4.4

CDS curves of Bear Sterns, HSBC and Merrill Lynch from July 2007 to March 2008. This UBS graph clearly shows the counterparty risk sky-rocketing, especially for Bear Sterns when it collapsed, thus another good measure of counterparty risk

Another explanation, which might be called "liquidity risk," is that traders are reluctant to expose the traders' bank's funds during a period of time where those funds might be needed to cover the bank's own shortfalls. Indeed, the trader may not be given the authorization to take as large positions as he used to, which is perceived as a shortage of liquidity by the market [11].

A third and closely related explanation was often heard during the period of November and January. Banks needed liquidity to make sure that their own balance sheets looked respectable in end-of-year financial reports, especially given the stress and scrutiny that many banks had been under.

The fourth explanation relates to expectations of future interest rate changes. Expectations of declining overnight rates, for example, will cause term Libor rates to decline as well, all else equal. Except for the very beginning of the turmoil period, this explanation would tend to bring the spread between the Libor rate and the target Fed funds rate lower because of expectations of future interest rate decline due to policy easing, this increasing the TED spread. It is necessary to take into account this factor when assessing the other factors that could be moving the spread around. The below figure illustrates this effect:



Source: UBS

Figure 4.5

This UBS figure contains 3 curves: The Fed Funds Target, the Fed Funds Effective Rat, and the 3-month LIBOR. In the beginning the spread is wide, but as time passes, the LIBOR and the Effective Fed Fund Rate converge towards the Fed Fund Target, since the market was expecting to see further cuts in rates given the financial crisis

Figure 4.5 shows the various relevant money market rates from September 2006 to March 2008. Looking closer that this figure, it can be seen that the spread between Libor and the fed funds target comes down before cuts in the federal funds rate. Further, toward the end of the

sample in mid February, the spread narrowed significantly, which is likely to be due to expectations of future interest rate cuts, since the market consensus was pushing for further rate cuts.

In conclusion, the likeliest explanation is that the underlying reasons for the TED spread's shape is a combination of the reasons described above. However, according to John B. Taylor and John C. Williams (2008) the counterparty risk is the most prominent of them, followed by the expectations of future interest rates.

Chapter 5

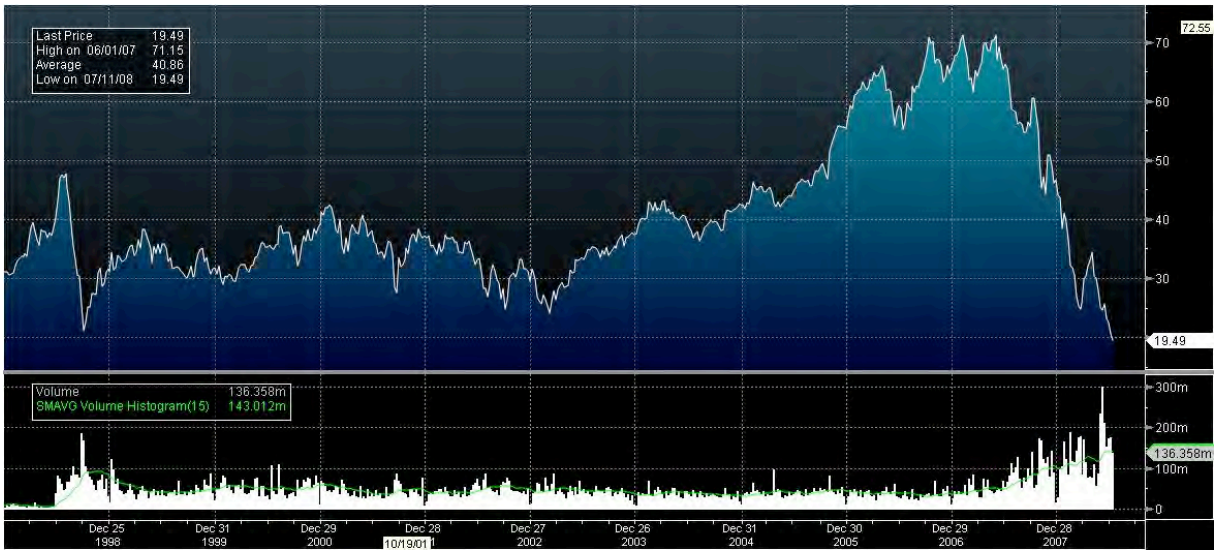
UBS Management – living the crisis

5.1 Relevant facts

UBS, as known today, was formed in 1997 when the Union Bank of Switzerland was acquired by the Basel-based Swiss bank. For ten years it has been a steady performer, outperforming most rival banks, especially its sister Credit Suisse. UBS shareholders almost tripled their net worth and saw their bank repeatedly named among the top 10 world's best banks (Bloomberg).

But suddenly, on October 1st, the bank disclosed that it was writing down $3.4 billion in losses largely due to ill-considered bets on the U.S. subprime market. UBS said it would cut about 1'500 jobs by the end of the year (i.e. 7% of the investment banking workforce) and Marcel Rohner was suddenly called upon to replace Peter Wuffli on July 6th. The head of investment banking Huw Jenkins and the chief financial officer Clive Standish also had to step down. The captain of the giant cruiser UBS, Marcel Ospel (CEO since the Banks merged, and chairman since 2001), remained in command and sent a strong signal that he and his management were going to make a serious effort to deal with shortcomings.

However, as the subprime crisis domino effect unfolds, UBS takes a tough blow. So far, it is the hardest hit bank in Europe, and second-hardest worldwide. Write downs total almost $38 billion and the company plans to cut over 5'500 jobs by the middle of 2009. Investors have re-injected money into the bank, helping it to stay afloat. UBS has sold $15 billion in mortgage assets (Alt-A and subprime assets) to Blackrock Inc, yet still the boat is sinking. On April 1st, the bank announced another net loss of $11.5 billion, which ultimately let to the forced step-down of the banks chairman, Marcel Ospel. This was viewed positively by the investors, but the bank has not recovered yet and the share price is still shrinking at historically low levels since the bank's creation. The graph below shows the evolution of the UBS share price (US Stock Exchange) since the merger.



Source: Bloomberg

Figure 5.1

Figure 5.1 is the UBS share price evolution from December 1997, date the merger was announced, until mid-July 2007. Two observation are to me made. First, it is the strange up and down movement of the share price at the beginning of the curve. This is when UBS was hit by the LTCM hedge fund implosion. Second, and more importantly, it is that the current share price of UBS is lower than it was before the merger. In conclusion, 10 years of work have been destroyed within one year

5.2 Management reaction

UBS management was forced to send a strong signal to shareholders and investors and this is the reason behind the job cuts, the massive sell-off of subprime assets and the step-down of the bank's chairman. However, the bank is still adrift, without a true captain onboard anymore. Whether management decisions through the past year were the correct ones is a question that has every right to be raised.

Given the incredibly large positions the bank had taken within the subprime market, it obviously had to sell-off these assets, or it would have kept on sinking. The banks actions regarding the recapitalization and write-downs have, in my view, been correct. However, its decisions regarding what I will call people management, remains flawed. This may well be the reason for which the bank has still not recovered.

Marcel Ospel is the person behind the banks current structure. The integrated business model he put into place has been a true success for ten years. His departure, viewed as necessary by shareholders, may seem logical as he is the top responsible of the bank and as such he is responsible for the losses incurred. However, this is not the way I see it. The bank lost the one of the few men who was capable of getting the bank out of this situation. Since then, some very peculiar decisions have been made, such as promoting the head of risk management to the board when his department is at the center of the problem. It does not seem to make much sense to remove the chairman and at the same time promoting such a person. However, as my boss once said, in times of prosperity it is the chairman and the board that have the power, but it times of turmoil, it is the shareholders.

Further, the massive layoffs that have started to take pace are questionable. UBS justifies them by declaring redundancies. This may well be the case, but the choice between the various redundant people is very questionable. In my point of view, UBS need fresh blood so to speak, people who are motivated to achieve and stir the bank back into the right heading. Unfortunately, management decided exactly the opposite, and kept the older generation in place. They may have more experience, but from my experience, they certainly have much less motivation. The most applauded decision within the bank was certainly the recruitment of Jerker Johansson from Morgan Stanley as chairman and chief executive of UBS investment bank. Following the already decided layoffs, his handling of the situation has been

exceptional. Unfortunately, more details will not be disclosed here due to confidentiality reasons. But the main point I would like to make is that it is during tough time that people need to be kept. The client must not see the bank sinking in terms of quality of service. Financial statement and media coverage is one thing, but once these events reflect upon a client, this is where it goes too far. It is in times of turmoil that spending needs to be increased in order to reassure the clients. The contrary has been in my view a mistake, and this is when the bank started loosing some clients.

Today, UBS has been forced to contact M&A and restructuring specialist Lazard Frères & Co. for help. In parallel, there are rumors concerning HSBC being interested to by parts or the whole of UBS. The signal is quite clear: the bank is in distress, and should it post another sizable loss at the end of the second quarter of 2008, it may not stay afloat for long.

5.3 Implications on our team

Given the above facts and decisions, it is not hard to imagine that a fixed income team such as ours has suffered a great deal. The layoffs, which did not affect our team directly but prevented us from recruiting much-needed help, had a negative impact on the business. It became very difficult to contact traders for prices or interests, the back office was also downsized which led us to do large parts of their jobs in their stead. At times, over 50% of our day could be occupied by settlement or other types of non-front office problems.

However, the main challenge came on the client side. Indeed, clients were worried by two things at the same time: what was going to happen to our team and their coverage as well as UBS as a whole; and how their investments were doing and what should they do in order to cut losses. These two simultaneous questions, which all of our clients were concerned by, spurred an unsizeable amount of calls and requests from them. Given the difficulties we had on our side, internally, this was probably the most difficult aspect to handle.

Moreover, most news regarding the modifications made within the bank, were known to us via press. This created a weary environment in which to work, where nobody knew where he would in the next month or two. People were less motivated to work, and it was harder and harder to fight against the negative public opinion and results the bank had. The fact that almost no bonus had been given out at the beginning of 2008 and that all employees are already set for an even worse pay in 2009, certainly did not help the motivation.

The worst but at the same time the most interesting aspect was, as mentioned in the introduction, the downsizing of our team. Before my arrival, the team was set to operate as a group of six or more people, with at least two senior managers. As of the first half o 2008, there was one senior manager, one junior team member who joined a bit later than I and myself: an intern. One can easily imagine that not only was the quality of the work produced by our team affected, but also the workload. In fact, clients were the most affected by this situation. They had to go through long waiting times and necessarily fully skilled people in order to perform their desired operations. This unavoidably led to problems, both in terms of trading but also regarding client reputation. Some were very understanding as maybe their own institution was going through the same problem, and others were much more criticizing. However, this did not affect our client relationship, at least not in the short run. Indeed, our

department was responsible for the bulk of the business in Geneva, and clients were more coming to us because of our large business possibilities rather tha for our good relationship management. Obviously, this is not a sustainable strategy but during these hard times we were doing the best we could. It should be mentioned though that it is not during times of crisis that one should reduce the spending, especially to on client relationship, but rather increase it in order to reassure them! It is clearly hard to justify an increase in expenditure when shareholders are losing money, but regarding client relationship and maintaining a bank's reputation (which is what the entire business is built on) there should definitely not be a downsizing affecting the image the client has.

Paradoxically, during these very tough times, our team realized a record-breaking first half of 2008. This can be interpreted as normal given two factors: people were looking to buy bonds since the rates were pushed down by the fed; and people prefer safer investments in time of economic turmoil. However, knowing that at one point in time we were two (my boss and I) on the desk for over a month and that this desk could easily be staffed with six or more people of which two seniors, our performance qualifies rather as exceptional, than as normal. This is especially true knowing that during that time we established a record breaking day, week and month, the reference being my boss's 15-year career. Not a small thing to be proud of.

Unfortunately, this went almost unnoticed, or at least was never stated. People were too busy protecting their own position, and it became more a competing environment than a supportive one. In all this, I was supposed too gather data and investigate matters in order to write this paper. As can be imagined, this became not only difficult, but impossible.

Chapter 6

Concluding remarks

6.1 Significance of the study

The particular aspect of this thesis was to investigate the subprime crisis from the fixed income perspective, which is where the problem appeared. While the trigger for the present financial crisis is the collapse of the housing bubble beginning with defaults in subprime mortgages, it is the financial bubble that resulted from financial innovations over the last three decades that is the fundamental cause of the present crisis. Minsky postulated that the financial system has become more unstable and fragile since the sixties, as financing moved increasingly from hedge financing to speculative financing [24]. Added to this is the structure of derivative transactions and financial products that are so closely interlinked that disruption in any one part has immediate knock-on effects on the other parts. These have multiplied the risks and made the financial system even more fragile and unstable than it was at the time Minsky wrote about it.

With such a fragile financial system, the consequences were all the more dramatic and magnified. These could have been foreseen through the yield curve, which can be used as a relatively good predictor for future recessions. In an attempt to answer the question whether this financial crisis could have been avoided, the following can be concluded: The above summary of how the bubble built up shows us the deep roots of the crisis, and it can hence be concluded that it would have been very difficult to avoid. However, it is clear that it could have been foreseen, and steps could have been taken to dampen its consequences.

During the crisis, the amplitude of the TED spread shows us the magnitude of the problem. It also provided us answers as to why the financials were behaving as they were. Four possibilities were developed where counterparty risk and future expectations about rates were the main ones retained.

This study was all the more significant as it was investigated from an inside perspective. As a recently graduated student, I brought new fresh look into the problem. Most studies done on the topic are more technical and specific, whereas through this thesis I looked into the fundamentals of the crisis while keeping a fixed income perspective. I also gave an insight of what it was to work for such a company, taking into account that I didn't know much when I arrived whether it was about the crisis or the tools used.

Being given the chance to see such a crisis unfold from up close, battling in the front lines within a crippled bank is truly a unique chance. The experience was enhanced by not having to worry, like other employees, about one's future faith within the bank, as my contract was to be terminated in the end of July. The results provided are not revolutionary in concept, but give a feedback that can be used while teaching other students, which was to be honest, my ultimate goal.

6.2 Future work

Many aspects following this study may be developed. Above, I mentioned that some steps may have been taken to dampen the magnitude of the crisis. Examples of these would be very interesting if provided. Also, a probability based model like for the yield curve could have been constructed for the TED spread in order to determine the true amplitude of the crisis, and for how long the U.S. are to be in recession (if that is ever officially announced).

But the main question now is: what kind of recession will this be? Shallow or deep; short or long? So far, it seems remarkably gentle, given that many think America is suffering its worst financial shock since the Great Depression. An idea I would have liked to develop is the use of the Hubbert Curve to determine or at least estimate a couple of key figures such as the total amount of subprime losses that will be incurred by this crisis.

In 1956, Hubbert proposed that fossil fuel production in a given region over time would follow a roughly bell-shaped curve. He later proposed the derivative of the logistic curve for estimating future production using past observed discoveries. Hubbert assumed that production first increases exponentially and that then at some point, a peak output is reached and production begins declining until it approximates an exponential decline [25].

A clear parallel with the announcement of losses, movement on the S&P 500 index or corrections made by the fed can be made. Such parameters as these could have been adapted to be used with the same formula, to estimate to total losses incurred, the duration of the crisis and recession. This would be highly interesting as it could provide yet another way to predict or estimate the future, which given the speculation the Fed seems to be making, would be much needed.

References

[1] N. Anderson, F. Breedon, M. Deacon, A. Derry and M. Murphy. *Estimating and interpreting the yield curve*, 2005, John Wiley & Sons.

[2] Arturo Estrella and Frederic S. Mishkin, *The Yield Curve as a Predictor of U.S. Recessions*, 1996, Federal Reserve Bank of New York, Current Issues Volume 2 Number 7.

[3] Jessica James and Nick Webber. *Interest Rate Modelling*, 2001, John Wiley & Sons.

[4] William O'Donnel, *US Rates Strategy*, 2008, UBS Investment Research, Fixed Income Research.

[5] Paul F. Cwik, The Inverted Yield Curve and the Economic Downturn. *New Perspectives on Political Economy*, Volume 1, Number 1, 2005, pp. 1-37.

[6] Stewart, Jonathan D. and Hein, Scott E. *Reserve Requirement Changes and Money Market Responses*, 2004. Available at SSRN: http://ssrn.com/abstract=488942

[7] Arturo Estrella and Marry R. Trubin, *The Yield Curve as a Leasing Indicator: Some Practical Issues*, 2006, Federal Reserve Bank of New York, Current Issues Volume 12 Number 5.

[8] Andrew Cates, *Global Economic Watch*, 2008, UBS Investment Research, Global Economics Research.

[9] Allen F. and Gale D. Bubbles, *Crises and Policy*, 1999, Oxford Review of Economic Policy.

[10] Kessel, Reuben A., *The Cyclical Behaviour of the Term Structure of Interest Rates*, 1965, NBER, Occasional Paper no. 91.

[11] Owens, Raymond, and Stacey Schreft, *Identifying Credit Crunches*, 1995, Contemporary Economic Policy, 13(2), 63-76.

[12] Damiano Brigo, Fabio Mercurio, *Interest Rate Models - Theory and Practice*, 2001, Springer.

[13] Stewart C. Myers, Franklin Allen and Richard A. Brealey, *Principles of Corporate Finance*, 2007, 9th edition, McGraw-Hill International Edition.

[14] Donald R. van Deventer, Kenji Imai, Mark Mesler, *Advanced Financial Risk Management, An Integrated Approach to Credit Risk and Interest Rate Risk Management*, 2004, John Wiley & Sons.

[15] Mark M. Zandi, *The Economic Fallout*, 2007, Moody's Economy.com.

[16] Michael Mah-Hui Lim, *Old Wine in a New Bottle: Subprime Mortgage Crisis – Causes and Consequences*, 2008, The Levy Economics Institute.

[17] Michel Crouhy and Stuart M. Turnbull, *The Subprime Credit Crisis of 07*, 2008, Natixis.

[18] Martin Neil baily, Douglas W. Elmendorf and Robert E. Litan, *The great credit squeeze: How it happened, how to prevent another*, 2008, Business and Public Policy at Brookings.

[19] The Economist, *The long hangover*, 2008, The Economist.

[20] The Los Angeles Times, *Will dotcom bubble burst again?*, 2006, The Los Angeles Times.

[21] Michel Chossudovsky, *The global financial crisis*, 1997, Third World Network

[22] Nassim Nicholas Taleb, *The black swan, the impact of the highly improbable*, 2007, Random House Inc.

[23] John B. Taylor and John C. Williams, *A black swan in the money market*, 2008, National Bureau of Economic Research.

[24] Hyman P. Minsky, *The Global Consequences of Financial Deregulation*, 1986, Marcus Wallenberg Papers on International Finance

[25] M. King Hubbert, *Hubbert Estimates from 1956 to 1974 of U.S. Oil and Gas*, 1979, Methods and Models for Assessing Energy Resources.

and Bloomberg. This resource has been of incredible value for my research. It contains basically any data one could ever look for. This source is often cited, although no documents are provided to support the facts listed from this source. However, should these figures need to be verified, the information is easily accessible from any Bloomberg platform.

Curriculum Vitae

1982	Born, Neuilly-sur-Seine, France. Swedish Nationality.
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