Financial innovations and risks in the financial system

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Abstract

Financial innovations such as collateralized debt obligations (CDOs) and credit default swaps (CDSs) have been implicated as an important cause of the current financial crisis. This paper firstly reviews the development of CDOs and CDSs as financial instruments to create financial products with wide risk spectrum from those with higher risks and to separate default risk from interest rate/yield risk, and how the popularity of CDOs and CDSs contributed to the genesis of the current financial crisis. It then examines the institutional imperfections which allowed the underestimation and mis-pricing of risk and the blurring of the responsibility for risk that led to the popularity of CDOs and CDSs among other financial innovations. The underestimation and mis-pricing of risk in those novel financial products encourage risk taking by financial institutions and increase risks in the financial system. Asymmetric information and moral hazards are involved during the transaction for CDSs like in other insurance policies, increasing the risk-taking behavior of CDS buyers and the risk of CDS sellers. The multifunctional financial institutions face a more complex risk control task, because its divisions take on many different types of risk. The complexity of risk management in multifunctional institutions is likely to increase the total risk in the financial system; hence the current financial crisis is also a consequence of the prevalence of multifunctional financial institutions. With proper risk assessment and measures to reduce information asymmetry and moral hazard, CDOs and CDSs per se are useful financial instruments to satisfy the investment needs by investors of different risk preferences and to separate and price different types of risk.

Keywords: collateralized debt obligation, credit default swap, risk management, information asymmetry.

1. Introduction

An important feature of the current financial crisis is the prevalence of structured financial products. These structured products are created by forming portfolios of mortgages, loans, corporate bond, and other assets like credit card receivables and then slicing them into different tranches before selling them in the market, a process called securitization. One of the most popular forms of structured financial product is collateralized debt obligations (CDOs). Securitization to construct CDOs was undertaken by commercial and investment banks through special purpose vehicles (SPVs), financial entities which were created by banks to collect principal and interest cash flows from the underlying assets and pass them on to the investors who own the various tranches (Brunnermeier, 2008). The huge losses suffered by financial institutions investing in those financial products marked the beginning of the current financial crisis. Faced with the threat of a meltdown of the entire financial system, central banks and governments in the major western economies have used all their monetary and fiscal tools to prevent a collapse of their financial system.

The current financial crisis has led to recession in major western economies and many emerging economies. The USA, UK, Germany, France and Japan have seen their economy shrinking in the third and fourth quarters of 2008 and first and second quarters of 2009. Although there are some signs that the recession may have bottomed and recovery is in sight, the major western economies are still in bad shapes. There are talks and discussions on the exit strategy for central banks and government from their commitment to maintain financial stability (roughly the synonym to keeping major financial institutions afloat) at any cost, which obviously cannot be a long-term measure in a market economy; but the consensus is that it is too early for central banks and governments to withdraw from their commitments, the monetary and fiscal measures still need to be in place. There have been intense searches and debates for the cause of the current financial crisis and policy choices among the academics, business people and government officials. It is believed that the current financial crisis arises because of the interaction of three factors: 1) the capital inflow to the United States from countries with current account surplus and cheap exports to the developed economies from emerging markets; 2) the financial innovations which mis-price the risk and obscure the

responsibility for risk; and 3) the loose monetary policy of central banks, especially the US Federal Reserve (Boeri T and Guiso L, 2008; Brunnermeier, 2008).

Among the three factors that contribute to the genesis of the current financial crisis, financial innovations have been closely associated with the financial sector and financial professionals. Financial innovations have been viewed by some people as the results of greed in financial professionals. It is true that financial innovations enable investors and financial institutions to take too much risk, although the details of how these cause financial crisis are still being studied and debated. The two financial innovations that bear most criticisms are CDO and credit default swap (CDS). CDOs facilitated the subprime mortgage lending, which was an important trigger of the current crisis. CDSs created a complex network of counterparties in risk transfer and asset risk insurance and blurred responsibility for risk, such that bankruptcy of one major institution like the American International Group (AIG) might bring down the whole financial system with it. This complexity in risk assessment and responsibility makes it nearly impossible for the government not to rescue the big financial institutions when they run into difficulties.

When the two financial innovations, CDOs and CDSs, were first developed, they were considered important contributions in finance (Greenspan 2007; The Economist 2007) because they reshape the risk profiles, provide more liquidity to the market, and separate default risk from interest/yield risk of assets. It was not envisaged then that CDOs and CDSs would contribute to the current financial crisis. Even though financial innovations, especially CDOs and CDSs, are blamed for the current crisis, it is still worthwhile to have a more detailed analysis on the relationship between current financial crisis and financial innovations such as CDOs and CDSs to make sure that was the case. Therefore, the aim of this paper is to review the development of CDOs and CDSs as financial instruments and how CDOs and CDSs contributed to the genesis of the current financial crisis. It then examines the institutional imperfections which allowed the underestimation and mis-pricing of risk and the blurring of the responsibility for risk.The paper is organized as follows: Section 2 analyzes the development and properties of CDOs; Section 3 examines the development and properties of CDSs; Section 4

investigates the cause(s) of underestimation and mis-pricing of risk. Section 5 will summarize and conclude.

2. Collateralized debt obligation (CDO)

CDOs are a type of structured asset-backed security (ABS) whose value is derived from a portfolio of fixed-income underlying assets. The underlying securities in a CDO are split into different risk classes, or tranches. Each CDO consists of a collection of tranches and of an underlying portfolio of debt, such as corporate bonds. The tranches are separated according to their risk level (senior, mezzanine, and junior or equity levels) (Moody's Investors Service 2001; Fender and Kiff 2004). The safest tranche (often known as the "super senior" tranche) offers a relatively low interest rate, but is first to be paid out of the cash flows to the CDO originators. The junior tranches receive higher interest rates, but will be paid after the senior and mezzanine tranches. The owners of the most junior tranche will be paid only after all other tranches have been paid. In the event of default by a proportion of the borrowers, the junior or equity tranches would be first to incur losses, followed by mezzanine and finally by senior tranches. The super tranches have AAA rating, equivalent to government bonds, and they are protected by third-party insurance (CDS), which improves their ratings. The tranches are separated in such a way that a specific rating is ensured for each tranche. The CDOs can be pooled and resold as CDOs of CDOs, the so-called the CDOs-squared. The CDOs-squared can be further repackaged as CDOs-cubed (Mizen 2008).

The first CDO was issued in 1987 by bankers at now-defunct Drexel Burnham Lambert Inc. for Imperial Savings Association, a savings institution. In 1990s, CDOs became a fast growing sector of the asset-backed securities market. Based on whether the CDOs own underlying assets, they can be classified as cash CDOs which own underlying assets and synthetic CDOs which do not own underlying assets. The underlying assets in cash CDOs are a portfolio of cash assets, such as loans, corporate bonds, asset-backed securities or mortgage-backed securities. Synthetic CDOs do not own cash assets like bonds or loans. They provide credit protection to a portfolio of fixed income assets without owning those assets through the use of CDSs. The CDOs receive periodic cash

payments (premiums) from CDS buyers in exchange for assuming the risk of loss on a specific asset in the event that asset experiences a default or other credit event. There are also hybrid CDOs which are an intermediate instrument between cash CDOs and synthetic CDOs and contain both cash assets and CDSs.

CDOs can be divided into following four categories based on their underlying assets: 1) collateralized loan obligations (CLOs) where CDOs are backed primarily by leveraged bank loans; 2) collateralized bond obligations (CBOs) where CDOs are backed primarily by leveraged fixed income securities; 3) collateralized synthetic obligations (CSOs) where CDOs are backed primarily by credit derivatives; 4) structured finance CDOs (SFCDOs) where CDOs backed primarily by structured products (such as asset-backed securities and mortgage-backed securities).

The CDO market is a "rated" market, where investors buy CDOs using the ratings as a reference and issuers of CDOs want their products to be rated according to scales that were comparable to those for bonds (Fender and Kiff, 2004). CDOs are based on a portfolio of different assets, which have different probabilities of default and different recovery rates when defaulted, moreover, the correlations between different assets also affect the overall risk assessments; therefore, it is not an easy task to give CDOs an proper rating.

An important factor in the growth of CDOs was the introduction by David X. Li of Gaussian copula models in 2000 (Li 2000), which makes the rapid pricing of CDOs possible. The method developed by Li is to model default correlation using market data on the prices of credit default swaps (CDSs); so default correlation can be obtained even without looking at historical default data. Before the introduction of Gaussian copula models, the most well-known CDO rating methodology is the one based on Moody's primary quantitative approach for generating expected loss (EL) estimates for CDO tranches – the so-called binomial expansion technique (BET), introduced in 1996. The method relies on the use of a simple diversification measure, the "diversity score" (DS), which is used to map the underlying CDO portfolio into a hypothetical portfolio consisting of DS homogeneous assets (Fender and Kiff 2004; Salmon 3002). Before Moody's adoption of Li's Gaussian copula default function formula, Moody's had insisted that CDOs meet a diversity score – that is, each CDO should contain different

types of assets, such as commercial mortgages, student loans and credit card debts, as well as the popular subprime debt. This was standard practice in investment to guard against risk by diversification.

On August 10 2004, the rating agency Moody's incorporated Li's Gaussian copula default function formula into its rating methodology for collateralized debt obligations, which changed tested practice of diversification in controlling default risk. With Li's formula, Moody's no longer needs to diversify in CDOs because it now had a model that can gauge the interrelatedness of risks with mathematical certainty. A week after Moody's, the world's other large rating agency, Standard & Poor's, changed its methodology, too. The new CDO rating methodology enables CDOs built solely out of subprime mortgage debt. The magic of the Gaussian copula correlation model led to repackage of high-risk mortgages into triple-A-rated investor gold. The CDO market exploded. Fig. 1 shows the growth of CDOs issued from 2000 to 2008. There was a dramatic growth in CDOs by the second half of 2007 and a sudden drop in 2008.

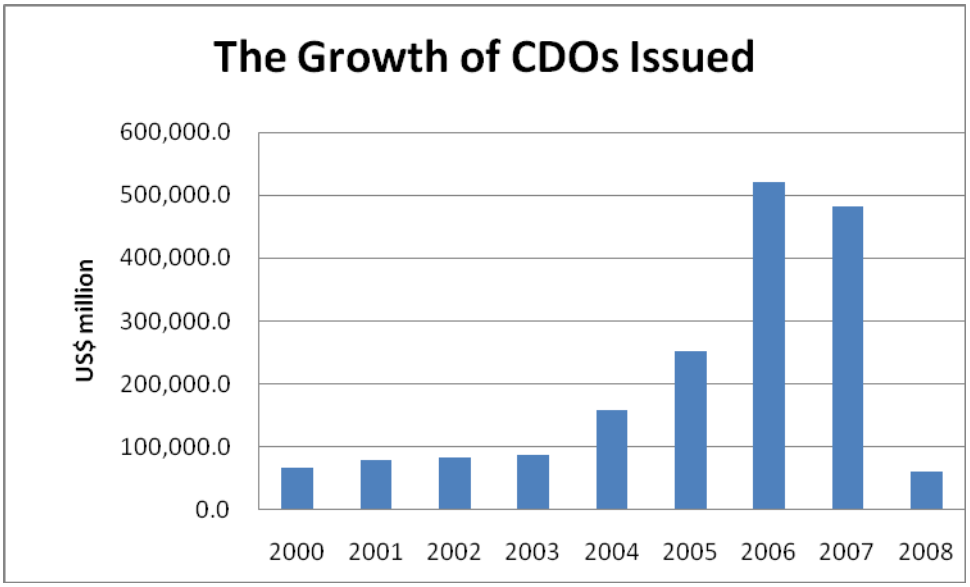

Fig. 1 The growth of CDOs issued between 2000 and 2008. The volume of CDOs issued was relatively small before the adoption of Li's Gaussian copula default function formula by rating agencies. Source: SIFMA

CDOs, like all asset backed securities, enable the originators of the underlying assets to transfer credit risk to institutional or individual investors. The risk and return for investment in CDOs depends directly on how the CDOs and their tranches are defined and on the assumptions and methods used to define the risk and return of the tranches. The performance of the underlying assets in the CDOs also affects the risk and returns for the investors. The issuers of CDOs earn a commission at time of issue and management fees during the life of the CDO. The transfer of credit risk and the ability to earn substantial fees from originating and securitizing loans may provide the incentives for CDO originators to favor loan volumes rather than loan quality. Since the issuers of CDOs may have better knowledge about the underlying assets than the investors, if the rating agencies underestimate the risk of CDOs, investors will unwittingly take on too much risk.

The growth of CDOs increased the supply of credit to homebuyers, which would be a positive development in the economy had the risk of mortgage-based CDOs been adequately assessed. In the traditional model of mortgage financing, banks and building societies receive deposits from savers and make loans to home buyers. The mortgage payments from borrowers are used for paying the interests on the deposits. If the lenders do not buy insurance for their loans against default, they have to shoulder the default risk. In this "originate and hold" business model, where the risk lies and who is responsible are clearly defined. The banks and building societies have every incentive to monitor the credit-worthiness of borrowers and the risk involved. The insurance companies selling protection policies also have the incentive to monitor risks in this type of business. Since mortgages are long maturity assets, in the "originate and hold" business model only institutions with a large depositor base or the GSEs can act as mortgage originators. The amount of loans which they can make is limited by the deposits and their own capital.

Securitization enhances the capacity for financial institutions to invest in long maturity assets, which allows almost everyone to become a mortgage broker. CDOs

enable banks to transfer the credit risk to the buyers of CDOs. Instead of "originate and hold", the new business model becomes "originate and distribute", where banks make loans and then sell the structured products to other financial institutions (Brunnermeier 2008). The transfer of credit risk in this business model distances the borrower from the (end) lenders, and leads to two disadvantages in terms of risk control and management. First, it is difficult to know who holds what risk. By selling the structured products to other financial institutions, banks may think that they have got rid of the credit risk. However, the risk may well come back to the issuing bank because the buyers might have bought CDSs from the same issuing bank. Banks' businesses have become much broader and more complex since the 1986 "Big Bang" in the UK (the US had introduced a similar reform in 1975 and Japan in 1998). Second, the banks' incentives to carefully examine the loan applications and to monitor (and even to collect) the approved loans are drastically reduced because the risk is now mainly borne by other financial institutions (Brunnermeier 2008; Keys et al 2008).

The popularity of structured financial products is largely due to two factors. One is the low interest rate and low return of usual investment instruments, which drives the search for assets with high returns and acceptable risk level. The other is the underestimate of risk in the property market. Low interest rates and relatively steady economic growth (the Great Moderation) since mid 80s drove up property prices as well as stock prices. Because of cheap credit the demand for properties increased, which drove up house prices. Increasing house prices stimulated further the demand for properties, since potential home buyers worried about further price increases in future and wanted to buy before any further price increases. Such a positive feedback in house price expectations led to a housing boom Fig.2). When prime mortgages dried up, mortgage brokers offered no-documentation mortgages, piggyback mortgages (a combination of two mortgages in order to reduce the down payment in terms of total loans by not making a down payment for the second mortgage), NINJA ("no income, no job or assets") loans, and adjustable rate mortgages with a low teaser rate to attract borrowers. With increasing house prices, default was not a particular worry for the lenders since they could refinance using the value of the house (which would be higher than the value of the original loan). Between 2003 and 2006, for example, the share of subprime loans made with little or no

documentation of income approximately doubled and the share of piggyback loans quadrupled (Anderson 2007). However, house prices could go down as well as up. These subprime mortgages had been granted under the premise that house prices could only rise, making any background check unnecessary.

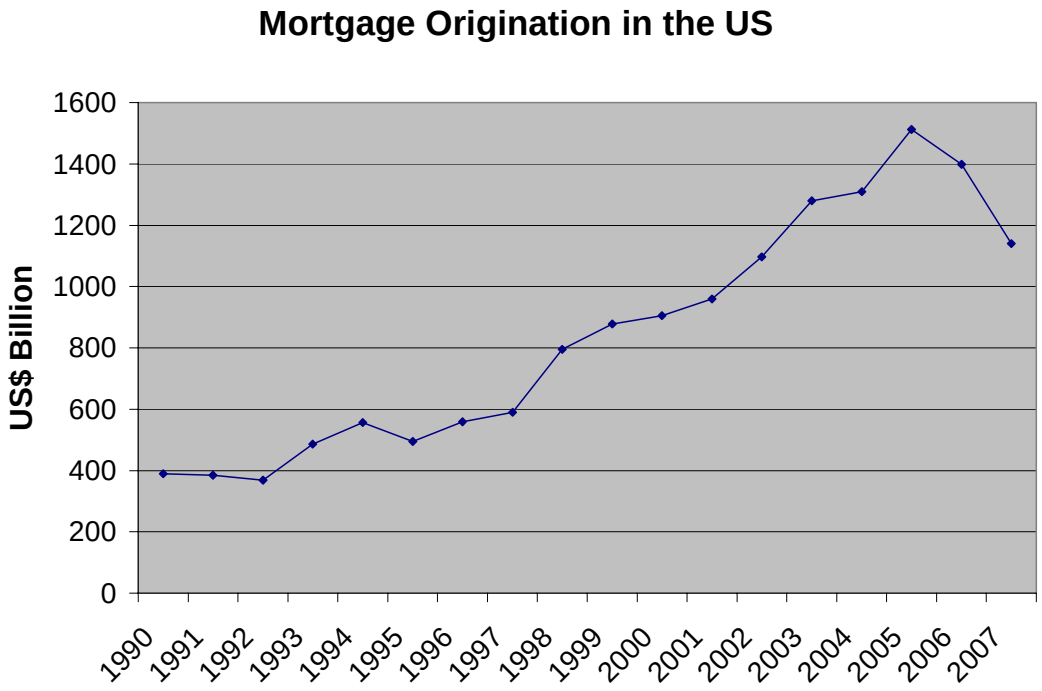

Fig.2 The growth of mortgage origination in the US. The volume dramatically increased in 1997 and since. Source: Mortgage Bankers Association.

From the above analysis, it is not the CDOs that are inherently leading to the financial crisis. It is the underestimate of risk and the lack of appreciation of the complexity of the financial world that were causing problems, especially when diversification in CDOs was replaced with Li's Gaussian copula default function formula. "And because the copula function used CDS prices to calculate correlation, it was forced to confine itself to looking at the period of time when those credit default swaps had been in existence: less than a decade, a period when house prices soared. Naturally, default correlations were very low in those years. But when the mortgage boom ended abruptly and home values started falling across the country, correlations soared."(Salmon 2009) Commission at time of issue and management fees during the life of the CDOs may have

a role in managers' decision in pursuing volume rather than quality, but this seems to play a less important part.

3. Credit default swap (CDS)

Another financial innovation that is prominent in the current crisis is the CDS, which allows investors to separate the risk of interest-rate movements from the risk that a borrower will not repay. As mentioned in the preceding section, CDS plays an important role in pricing CDOs according to Li's Gaussian copula default function formula. A CDS is a swap contract in which the buyer of the CDS makes a series of payments to the seller and, in exchange, receives a payoff if a credit instrument (a bond or loan) goes into default. In some CDSs the payoff may be triggered by a company undergoing restructuring, bankruptcy, or even just having its credit rating downgraded. CDSs grew rapidly up to now since it emerged in the past decade (Fig.3). By the end of 2008, the CDS market had a notional value of $45 trillion.

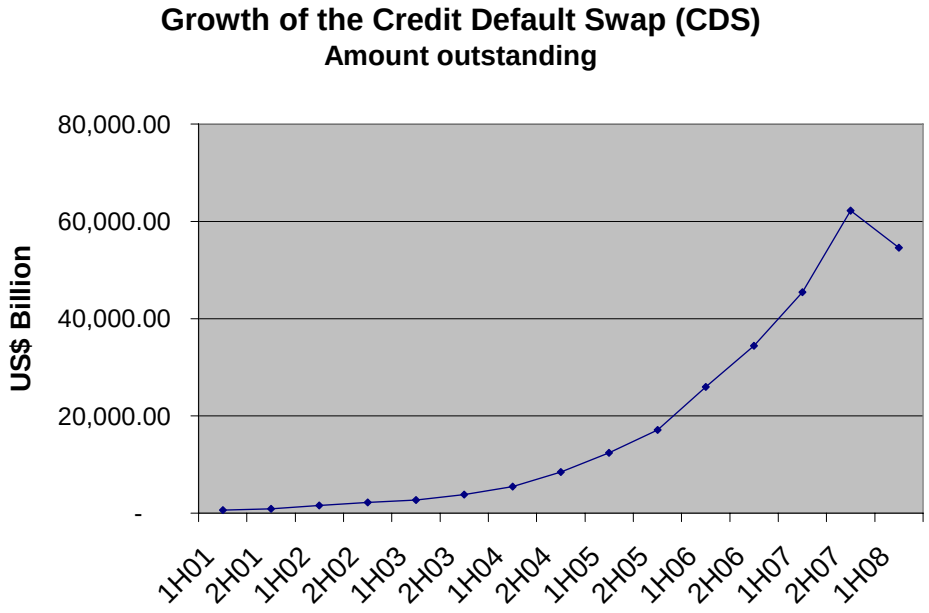

Fig.3 The growth of the credit default swaps (CDSs). Source: ISDA.

With the design and development of CDSs, for an investor, she has a choice whether to lend directly to borrowers or sell investors credit default swaps, insurances against those same borrowers defaulting. The investor gets a regular income stream either way. No matter whether it is interest payments or insurance payments, the investor lost money if the borrower defaults. The returns on both strategies are nearly identical, but the supply of bonds is different from the supply of CDSs because an unlimited number of credit default swaps can be sold against each borrower. The supply of swaps isn't constrained the way the supply of bonds is, so the CDS market can grow extremely rapidly. The growth of the CDS market also stimulated the development of synthetic CDOs, which use solely CDSs as underlying assets.

The first modern credit default swaps were issued in 1997 by J P Morgan Chase. Blythe Masters of JP Morgan and her colleagues conceived the idea of credit default swap in 1994 and the CDSs were designed to shift the risk of default to a third party (Tether 2008). The first CDS involved JPMorgan selling the credit risk of Exxon to the European Bank of Reconstruction and Development. CDS contracts have been considered to be a kind of insurance against default risk, because the buyer pays a premium and, in return, receives a sum of money if one of the events specified in the contract occurs. When a bank makes a loan or buy a corporate bond, it can insure itself by buying a CDS. The CDS buyer pays a premium (a periodic fixed insurance fee) to the CDS seller in exchange for a payment if the borrower defaults. With CDSs, the default risk is transferred from the lenders to the CDS sellers. Instead of keeping the loans or corporate bonds on the bank’s own book and buying CDSs against default risks, the bank can sell them to other investors. Since default is a relatively rare occurrence (historically around 0.2% of investment grade companies will default in any one year), in most CDS contracts the only payments are the premium payments from buyer to seller.

If a credit event occurs then CDS contracts can either be physically settled or cash settled. In physical settlement the protection seller pays the buyer par value, and in return takes delivery of a debt obligation of the reference entity. In cash settlement the protection seller pays the buyer the difference between par value and the market price of a debt obligation of the reference entity. Many parties made CDS contracts for speculative purposes, without actually owning any debt for which they wanted to insure

against default. The outstanding notional of CDS contracts is now a much larger than the outstanding notional value of its debt obligations.

For investors there are at least two risks when they buy bonds or lend a loan to others. One is interest risk and the other default risk. Uncertainty or risk exists in most financial assets, with risk taking being rewarded with extra expected returns. Riskless assets can only earn the lower riskless return. Pricing an asset is essentially an assessment of its risk. The development of various financial derivatives is primarily intended to spread and control risk. CDSs are very useful instrument for transferring and distributing risks, and they provide an important measure of risk which reflects the risk assessment by the market. Alan Greenspan, the chairman of the Fed from 1987 to 2006, welcomed the growth of CDSs. In his book, "The Age of Turbulence" (2007), he argued: "Being able to profit from the loan transaction but transfer credit risk is a boon to banks and other financial intermediaries which, in order to make an adequate rate of return on equity, have to heavily leverage their balance sheets by accepting deposit obligations and/or incurring debt. A market vehicle for transferring risk away from these highly leveraged loan originators can be critical for economic stability, especially in a global environment."

For CDS to be useful, its risk needs to be properly quantified and priced. The problem with the widespread of CDSs is that as risk is dramatically underestimated, the insurance companies and banks selling CDSs will take too much default risk and banks make too many risky loans with the expectation that losses will be covered by the CDSs. When incidences of credit default are high, the insurance companies may be unable to fulfill their obligations; if an insurance company collapses, the assets of banks that bought CDSs from the failed insurance company will become uninsured and subsequently downgraded. Concerns on the health of those banks will further aggravate their problems, leading to worries on a meltdown of the entire banking system.

An innovation may be used for a purpose not originally intended. As the market matured, CDSs are more likely to be used by investor seeking to profit from perceived mispricing than by banks seeking to hedge against default. Bear Stearns' CDS spread widened dramatically in the period leading up to its collapse, indicating that buyers take out protection on the bank with the expectation to profit from the collapse of the bank.

This widening in the CDS spread might be responsible for the perception that Bear Stearns was vulnerable. When the investment firm Carlyle Capital defaulted on US$ 17 billion of debt on 14 March 2008, the investors started to worry about the health of investment banks. Bear Stearns was the smallest and most leveraged investment bank with large mortgage exposure; its liquidity situation worsened as clients fled from it. It was taken over by JP Morgan Chase in a rescue package arranged by the Federal Reserve Bank of New York. The Federal Reserve Bank of New York agreed to guarantee $30 billion of Bear Stearns assets, mostly mortgage-related.

Underestimating risk is responsible for both heavy investing in CDOs and overselling CDSs. American International Group (AIG) had been excessively selling CDS protection without hedging against the possibility that the reference entities might decline in value, exposing the insurance giant to potential losses over $100 Billion. In September Federal Reserve and government have to bailout AIG because AIG were counterparties in a very large number of CDS transactions and its bankruptcy may bring down the whole financial system. The risk of counterparties defaulting has been amplified during the 2008 financial crisis and this is an example of systemic risk, risk which threatens an entire market. The size of the CDS market and deregulation may have increased the systemic risk.

4. Underestimate of risk

The rating agencies played an important role in the development of structured products. The fastest growth of CDOs and CDSs seems to have happened after the introduction of Li's Gaussian copula default function formula. Given that Li's model relies on the past correlations between CDSs of two financial assets, their ratings tended to underestimate the risk because those correlations were based a) on historical data of mortgage default and delinquency rates when credit standards were tight; b) on the fact that past housing downturns were regional phenomena, which gives a cross-regional diversification benefit. The assumed low mortgage default rate and low cross-regional correlation of house prices boosted the AAA-rating tranches and encouraged unwitting risk taking. Apart from the fact Li's model relies on correlation in the recent past when economy is booming, the rating agencies collect the highest fees for structured product up

front, which may also contribute to the favorable ratings received by structured products. The excessive risk taking by investors is because the investors believe that the CDOs and CDSs have risks lower than they actually have. Such wrong belief in the risk level is to certain extent the consequence of inadequate information sharing with investors by issuers and rating agencies. Since issuers and rating agencies have better information on the risk of underlying assets and the assumptions used to make the ratings, there is also a moral hazard issue in the underestimation of risk in structured financial products.

Besides the imperfections of rating models like Li's Gaussian copula default function formula, the lack of a central clearing house in CDO and CDS transactions may also contribute to the underestimate of risk. Before the crisis those are over-the-counter transactions. In the US central clearing operations are being tried, which is operated by InterContinental Exchange (ICE). Members of the Intercontinental clearinghouse will have to have a net worth of at least $5 billion and a credit rating of A or better to clear their credit-default swap trades. A clearinghouse acting as the buyer to every seller and seller to every buyer can reduce the risk of a counterparty defaulting on a transaction.

The Basel accord (the first version in 1988) established minimum capital standards for banks to address the issue of the mismatch between their assets and liabilities. The assets are usually long-term loans to companies and consumers, which are very illiquid and cannot be called back when the banks need cash. The liabilities are deposits by consumers and investors that can be withdrawn overnight. When depositors worry about the health of a bank, a bank run may cause failure of the bank. The bank run may then spread and lead to a collapse of the financial system. The Basel accord required banks to set aside capital against contingencies such as default of bigger borrowers. The capital required is based on the overall risk of assets. Setting aside capital instead of lending it reduces banks' profitability, so that banks try to find ways around the rules when they think there is no serious risk if they have lower capital provision than the Basel accord requires. This leads to the popularity of three financial innovations in the current crisis: a) securitization which shifts assets off banks' balance-sheets; b) the SPVs and the structured investment vehicles (SIVs) to hold high risk assets; and c) CDSs to reduce the risk of borrowers defaulting.

Securitization and SPVs provide several advantages for banks (Gorton and Souleles 2005). Forming portfolios from different types of asset exploits the power of diversification, which reduces risk at least in theory. Tranches with an AAA rating can be created from underlying assets which may be considered too risky for some institutional investors. Slicing the portfolio into different tranches enables the SPV to market different parts of the product to investors with different risk appetites. The tranches are then sold to pension funds, hedge funds, structured investment vehicles (SIVs), and conduits, etc. The SPVs are not under the direct control of their parent banks, and their off balance-sheet status allows them to make use of assets for investment purposes without incurring risks of bankruptcy to the parent organization. The reason for the popularity of the SPVs and SPVs is that banks do not perceive the risk in using them to investing in or issuing structured financial products such CDOs.

The multifunctional financial institutions face a more complex risk control task, because its divisions take on many different types of risk. With unifunctional financial institutions, the responsibility for risk or asset losses is very clear. With multifunctional financial institutions, the risk has been offloaded by one division issuing CDOs may well come back to the issuing bank because the buyers might have bought CDSs from the same issuing bank. Since the 1986 “Big Bang” in the UK (the US had introduced a similar reform in 1975 and Japan in 1998), banks’ businesses have become much broader and more complex. The complexity of risk management in multifunctional institutions is likely to increase the total risk in the financial system; hence the current financial crisis is also a consequence of the prevalence of multifunctional financial institutions.

Before the current financial crisis, the low interest rate and low volatility economy provides an ideal environment for the growth of credit. Prime mortgages soon dry up and the financial institutions lending to home buyers need to expand into markets with more risky mortgages. The financial innovations with CDOs and CDSs supply those institutions with the tools for liquidity and risk protection. It is not the idea of financial innovations or their designs that are responsible for the current financial crisis. It is the underestimate of risk both in applying those models in rating assets and the desire of banks to earn more profits that are responsible for the current financial crisis.

For the time being, with all the rescue packages, the risk that banks will be unable to roll over their short-term funding has receded, since governments are, in effect, acting as counterparties now. Credit-default swap (CDS) spreads on banks, a measure of their risk of bankruptcy, decreased substantially. However, the banking sector may not be ready to return to normal yet. The monetary policy in major western economies is in its loosest time. Governments' debt guarantees are still in place. The low interest rate by the Federal Reserve after the burst of internet bubble and 9.11 has been blamed for causing the current financial crisis. The current monetary policy is probably looser than that period, and the interest rate lower. What will happen if this lower interest rate is kept for longer than that after internet bubble and 9.11?

5. Conclusion

The current financial crisis arises because of the interaction of three factors, the capital inflow to the United States from countries with current account surplus and cheap exports to the developed economies from emerging markets; the financial innovations that helped to underestimate risk and mis-price the risk; and the loose monetary policy of central banks, especially the US Federal Reserve.

The financial innovations CDO and CDS are useful tools to reshape the risk profiles of a portfolio of assets and to separate interest rate risk from the default risk. If their risk has been properly evaluated and priced, they could help to hedge against risks. However before the current crisis, the CDS has seriously underestimated the risk involved in mortgage lending and its associated financial products. Since Li's Gaussian copula default function formula is used in rating CDOs and CDSs are used to derive correlations between two assets and price the CDOs, the risk is seriously underestimated given the historical CDS data only cover the recent booming period. Because the risks associated with the synthetic financial products CDO and CDS are underestimated, financial institutions and individual investors investing in these financial products would inevitably take too much risk.

In summary, financial innovations including CDOs and CDS can be useful tools for improving risk management and provide the synthetic assets for investors. The

current financial crisis is not inherently due to the financial innovations. It is more because people underestimated risk in applying these financial models.

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