A Primer on Credit Derivatives

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Abstract

Credit derivatives have rapidly become a key financial tool in the capital markets as a way to accept or transfer credit risk. These instruments have had a significant effect on financial markets, both in easing the trading of credit risk and increasing the complexity of financial transactions. The impact of credit derivatives is so extensive that anyone involved in enterprise risk management (ERM) must develop a basic understanding of these vehicles. Some insurers now routinely use credit derivatives as a financial management technique, and others are likely to do this in the future. Even if an insurer does not directly trade credit derivatives, understanding this aspect of the financial markets, and the key credit derivative metrics, is becoming increasingly important. This paper explains the development of the credit derivative market, describes the most common types of credit derivatives, discusses how insurers can and do use these instruments and explains the role they played in the financial market turmoil of 2008.

1. Introduction

Enterprise risk management (ERM) entails a comprehensive treatment of all the risks an organization faces. In order to manage risks on an enterprise wide basis, decision makers need to have a basic understanding of all significant risks and how they are related. Credit derivatives played a major role in the financial crisis of 2008, with many banks, investment banks and insurers incurring unexpectedly large losses from credit derivatives. In some cases, the organizations failed; others required massive government bailouts to remain solvent. From subsequent comments it became clear that many board members, risk officers and other executives did not clearly understand the risks involved in the credit derivatives they traded. This paper is intended to help those involved in ERM gain a basic understanding of these financial instruments.

A credit derivative is simply a financial instrument that allows one to assume or cede credit risk exposure. Credit derivatives can be based on corporate debt, government debt, residential or commercial real estate mortgages, or other types of loans. Credit risk is transferred with a traded insurance-like contract between two parties, neither of which need be the issuer nor the holder of the actual bonds or loans at risk. The value of the contract is “derived” primarily as a function of the default risk profile of the debtor, which leads to the term, credit “derivative.”

Credit derivatives are used to speculate on or insure an entity’s ability to meet its debt obligations. In some cases, credit derivatives are written on a portfolio of debt instruments, rather than a single issue. If the participant ceding the risk is already exposed to this credit risk, then the transaction would be considered a risk management technique; if the participant does not have any other exposure to the credit risk, then this transaction would be speculation. The credit risk element is separate from interest rate risk, or from the cost of capital for the participant (commonly termed funding risk). Credit derivatives can be used to reduce credit risk arising from ownership of debt instruments in a manner analogous to that used by property insurers that purchase reinsurance in order to reduce concentrations in their accumulated risk from wind storms in Florida, for example.

Credit derivatives were first developed in the mid-1990s, and rapidly grew to become an extensively traded financial instrument. The key innovation of credit derivatives is the ease with which one may trade the credit risk separately from the underlying debt. The global credit derivatives market grew from $180 billion notional value[1] in 1996 to over $20 trillion in 2006. In 2006, the $20 trillion notional value of credit derivatives exceeded the aggregate value of international debt securities, which was approximately $18 trillion. By June 2008, the global credit derivative market grew to $57 trillion (BIS, 2008). However, the boom in the credit derivatives market over the last two years was not due to a doubling in the value of international debt—in fact, international debt only grew to $24 trillion by June 2008 (Brown, 2008).

The credit crisis of 2008 drastically impacted the credit derivative market. From June 2008 to December 2008, the notional value of the market dropped by more than half, to only $26.803 trillion Dec. 26, 2008 (Depository Trust & Clearing Corporation, 2009). According to Robert Pickel, CEO and executive director of the International Swaps and Derivatives

[1] The notional value is an index on which the performance of the contracts is calculated. Notional value need not be funded and does not change hands, so it is not actually equivalent to the face value of bonds.

Association (ISDA), part of the decrease was a result of industry efforts to exit offsetting trades to reduce risk and increase operational efficiency

Prior to 2008, the accelerated growth in credit derivatives was largely driven by increased demand from banks and financial institutions to manage their risk accumulations to debt service. Banks were the initial drivers of growth as they managed their capital leverage and credit risk line. They were expected to remain important players in their roles as market makers, as well as through their proprietary trading and structured credit desks.

The increased demand was fueled in part by tighter capital management rules in the Basel central banking accords. In the United States, loans could be allocated no capital if they were hedged by credit derivatives. Consequently, credit derivatives were embraced as a sound risk management tool since they allowed the separate pricing of the credit risk component of their overall market risk, and were believed to provide an effective hedge against a position in the credit market. However, this view overlooked counterparty risk, or the risk that the organization that accepted the credit risk could fulfill its commitment. This risk is similar to the risk of a catastrophe reinsurer being unable to pay claims after a major hurricane. Counterparty risk became obvious during the credit crisis of 2008, as regulators and market participants came to realize that credit derivatives are not guaranteed “insurance.” Defaults on these instruments then spread through the market, leading credit derivatives to be blamed for helping to expedite the demise of several financial organizations (Zingales, 2008).

Theoretically, hedging credit risk accumulations through various capital market options mitigates systemic and material volatility risk to banks' earnings and book values. This highlights the very essence of risk management. A pervasive friction is eased and simultaneously the existing market attracts capital from "unrelated" markets. Originators of commercial and consumer loans were aware that they are not always the best businesses to retain the credit risk from holding others' debts over time, and were able to use credit derivatives to protect themselves from the risk and pass it along to another player in the market. Diversification is the key to all risk management strategies, and the business of lending and borrowing is no different. However, it became painfully clear through the credit crisis of 2008 that the risk was not being mitigated by diversification. Credit derivatives themselves did not necessarily increase diversification in the credit market as many of the underlyings on the derivatives were correlated. Furthermore, banks and other financial institutions whose business focuses on credit exposure were not significant net buyers of credit protection (see Figure 2 below). Institutions whose business did not focus around issuing credit and who could emerge as potential net sellers of credit protection often held mortgage- or credit-backed securities as assets.

In addition to bank demand and diversification of market participants, the tremendous growth of the credit derivatives market up through 2008 was aided by the fact that credit derivative trades could be unfunded. Investors can buy/sell arbitrarily large positions in a particular credit for reasons of speculation, and since investors do not need to make an upfront payment, they can leverage their positions. However, it is exactly the lack of a funding requirement that sparked many of AIG's problems in 2008 (discussed below). As the probability of default of the underlyings shot up, so did collateral calls on AIG's credit derivatives. Since

AIG was under-funded, it had to negotiate to reduce the level of collateral required. The standardization of documentation and the emergence of newer product applications that delve further into sub-risk components of market credit risk (i.e., volatility, recovery rate arbitrage and correlation) have also fueled the recent expansion of the global credit markets. This expansion has brought about an increase in the credit risk exposures assumed by financial institutions such as insurance enterprises. Some of these counterparties were seeking enhanced underwriting returns, and independent of any credit derivatives trading, some were seeking to effect asset risk hedging strategies.

This paper will provide a general overview of credit derivatives and their applications as they emerged primarily as a banking risk management technique, then evolved toward more refined and complex credit risk trading schemes, and finally played a key role in the financial crisis of 2008. It will highlight emerging risk areas that will affect actuaries and other financial risk management professionals in their overall role in ERM.

2. Market Participants

Although credit derivatives were developed as a method of shifting credit risk, the use of credit derivatives is not limited to commercial banks' risk management departments. As seen in the detailed breakdown of market participants in Table 1, banks and corporations were usually net buyers of credit risk protection, while hedge funds, mono-line insurers (financial guaranty insurers), (re)insurance companies, pension funds and mutual funds emerged as significant net sellers of credit risk through 2006 (and projected to 2008). Table 1 illustrates the relative role of the different participants in the credit derivative market from 2000 through 2006 and projects a forward forecast.

TABLE 1
Total Market Share by Notional Value Through 2006 with 2008 Projection

<table>
<tr><th>Year / [Volume in USD bn]</th><th colspan="2">2000 / [$893]</th><th colspan="2">2002 / [$1,952]</th><th colspan="2">2004 / [$5,021]</th><th colspan="2">2006 / [$20,207]</th><th colspan="2">2008 (Est.) / [$33,120]</th></tr>
<tr><th>Market Participant</th><th>Buyers of Credit Protection</th><th>Sellers of Credit Protection</th><th>Buyers of Credit Protection</th><th>Sellers of Credit Protection</th><th>Buyers of Credit Protection</th><th>Sellers of Credit Protection</th><th>Buyers of Credit Protection</th><th>Sellers of Credit Protection</th><th>Buyers of Credit Protection</th><th>Sellers of Credit Protection</th></tr>
<tr><td>Banks—Trading Activities</td><td rowspan="2">81%</td><td rowspan="2">63%</td><td rowspan="2">73%</td><td rowspan="2">55%</td><td rowspan="2">67%</td><td rowspan="2">54%</td><td>39%</td><td>35%</td><td>36%</td><td>33%</td></tr>
<tr><td>Banks—Loan Portfolio</td><td>20%</td><td>9%</td><td>18%</td><td>7%</td></tr>
<tr><td>Hedge Funds</td><td>3%</td><td>5%</td><td>12%</td><td>5%</td><td>16%</td><td>15%</td><td>28%</td><td>32%</td><td>28%</td><td>31%</td></tr>
<tr><td>Pension Funds</td><td>1%</td><td>3%</td><td>1%</td><td>2%</td><td>3%</td><td>4%</td><td>2%</td><td>4%</td><td>3%</td><td>5%</td></tr>
<tr><td>Corporations</td><td>6%</td><td>3%</td><td>4%</td><td>2%</td><td>3%</td><td>2%</td><td>2%</td><td>1%</td><td>3%</td><td>2%</td></tr>
<tr><td>Mono-Line Insurers</td><td rowspan="3">7%</td><td rowspan="3">23%</td><td rowspan="2">3%</td><td rowspan="2">21%</td><td>2%</td><td>10%</td><td>2%</td><td>8%</td><td>2%</td><td>8%</td></tr>
<tr><td>Reinsurers</td><td>3%</td><td>7%</td><td>2%</td><td>4%</td><td>2%</td><td>4%</td></tr>
<tr><td>Other Insurance Companies</td><td>3%</td><td>12%</td><td>2%</td><td>3%</td><td>2%</td><td>5%</td><td>2%</td><td>6%</td></tr>
<tr><td>Mutual Funds</td><td>1%</td><td>2%</td><td>2%</td><td>3%</td><td>3%</td><td>4%</td><td>2%</td><td>3%</td><td>3%</td><td>3%</td></tr>
<tr><td>Other</td><td>1%</td><td>1%</td><td>2%</td><td>0%</td><td>1%</td><td>1%</td><td>1%</td><td>1%</td><td>2%</td><td>1%</td></tr>
</table>

Source: British Bankers' Association Credit Derivatives Report 2006.

However, as seen below in Table 2, when larger categories are examined, most large categories of market participants were neither significant net sellers nor net buyers of credit protection in either 2006 or 2008. Rather, most of these groups netted out their positions.

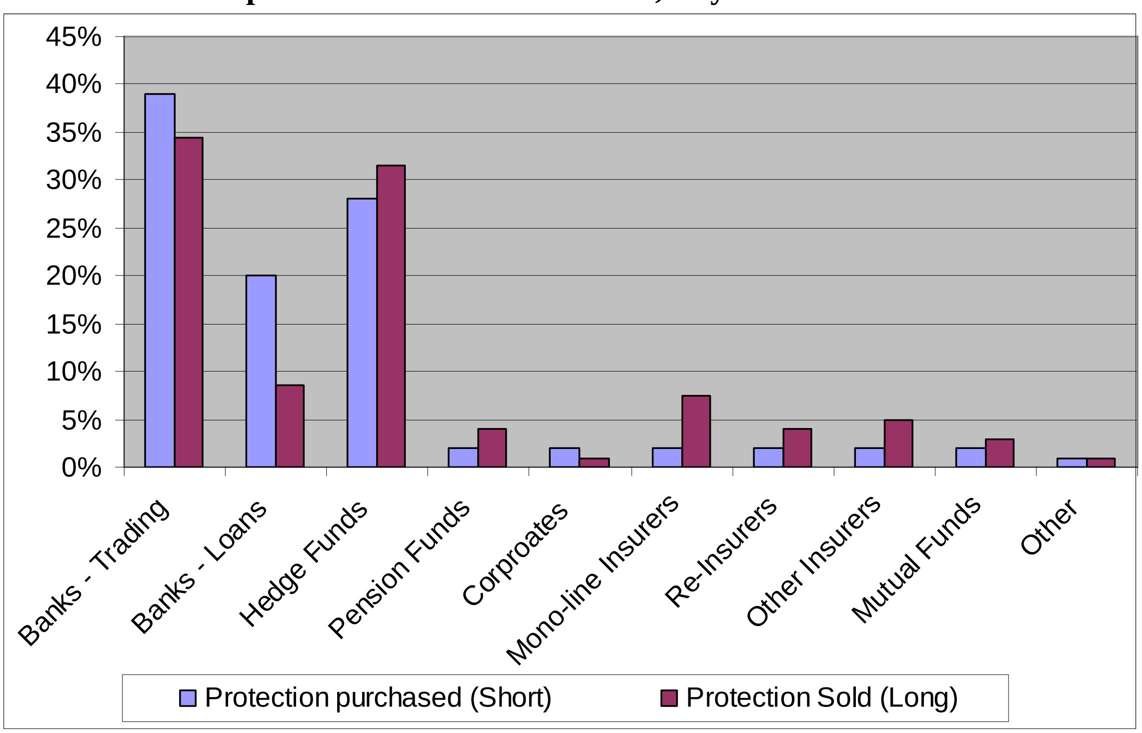
Reporting dealers (market makers in credit derivatives) were the largest market participants in 2006 and their market share grew to 2008, while the other categories of participants realized share declines.

TABLE 2
Total Market Share by Notional Value 2006 Through 2008

Year / [Volume in USD bn]	June 06/ [$20,352]		June 07/ [$42,580]		June 08/ [$57,325]	
Market Participant	**Buyers of Credit Protection**	**Sellers of Credit Protection**	**Buyers of Credit Protection**	**Sellers of Credit Protection**	**Buyers of Credit Protection**	**Sellers of Credit Protection**
Reporting Dealers (gross)	68%	69%	71%	71%	73%	74%
Banks and Security Firms	16%	16%	15%	14%	15%	15%
Other Financial Institutions	12%	12%	13%	13%	10%	10%
Insurance and Financial Guaranty Firms	1%	0%	1%	0%	1%	0%
Non-financial Institutions	3%	2%	1%	1%	1%	1%

Source: BIS Semi-annual OTC Derivatives Statistics at end-June 2008.

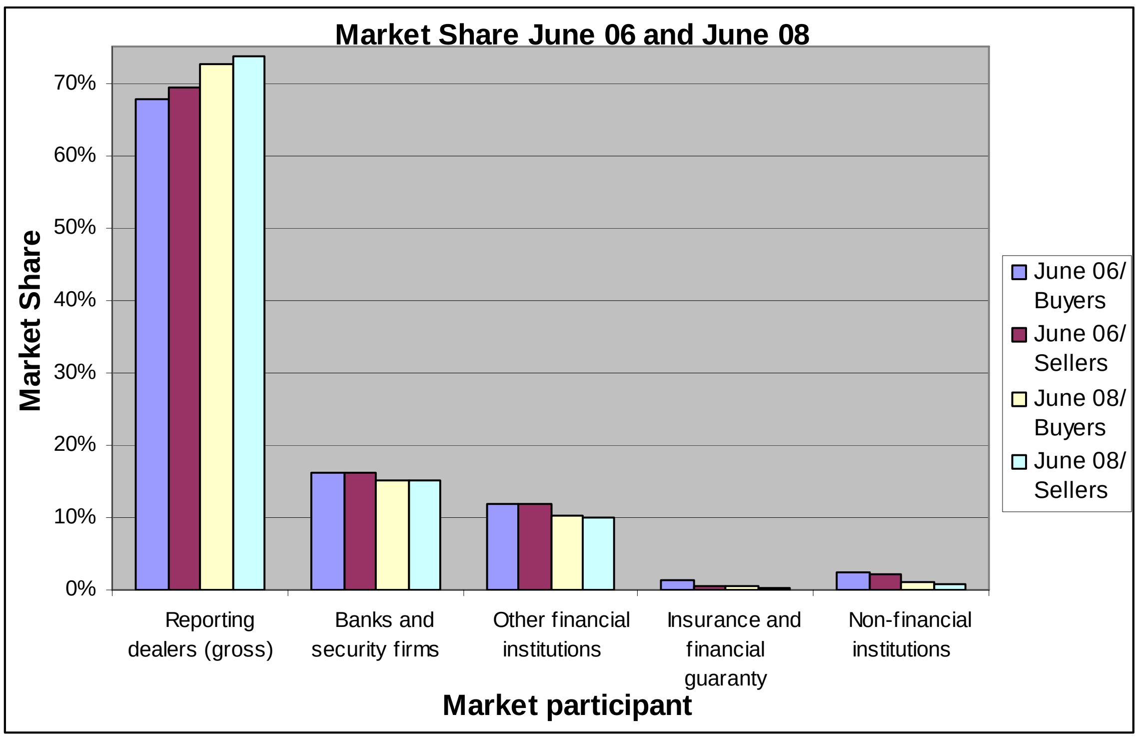
Figure 1
Comparison of 2006 Market Share, Buyers versus Sellers



Source: Source: British Bankers' Association Credit Derivatives Report 2006.

The two charts provide different breakdowns of who is paying for default protection and who is receiving income from selling it. Firms that are net sellers are taking a long position on credit risk and receiving income from their positions. Firms that are net buyers are taking a short position on credit risk, and reducing their risk exposure. Figure 1 provides a more detailed breakdown of market share, while Figure 2 provides market share for broader categories in both 2006 and 2008.

Figure 2
Comparison of 2008 Market Share, Buyers Versus Sellers



Source: BIS Semi-annual OTC Derivatives Statistics at end-June 2008.

Banks were once the primary participants in the credit derivatives market. Following the adoption of the Basel Accord in 1988 by the G-10 and other nations, banks have been required to hold more capital for riskier assets. Banks looked to reduce the amount of capital required to satisfy regulatory requirements. Banks were able to reduce capital required by securitizing loans since securitized pools of debt require less capital under Basel than individual loans. Banks also developed the credit default swap (CDS) market to decrease risk exposure accumulations within their commercial loan operations. The banking markets will likely continue to use credit derivatives for hedging both single-name (i.e., Exxon, for example) and broad market credit exposures (i.e., the telecommunications sector, for example).

In the past, commercial banking market makers such as Citibank and JP Morgan were constrained in their ability to provide liquidity because of regulatory limits on the amount of credit exposure they could have to any single company or business sector. The use of credit derivatives allows these securities dealers to trade more efficiently and employs less capital. Credit derivatives afford these firms the opportunity to hold onto their physical bond inventories during the tight credit cycles by keeping their credit risk profile neutral.

Credit risk has moved from highly regulated banks (with strict capital requirements) to other investors. Other firms or investors may be better suited or more diversified in holding the risk, but as is evident in the positive correlation of the underwriting cycle gains and default rates, investors may not fully understand how credit exposure fits with their portfolios. In addition, banks are usually the cushion in times of turmoil or panic while other investors will be quick to sell, even at fire-sale prices. Furthermore, what banks thought was a credit risk neutral position may not have been, because they may not have correctly accounted for the counterparty risk inherent in the purchase of credit protection. Consequently, the net effect of the Basel regulations and the securitization and protection trends it spurred may have been to increase risk in the markets.

Corporations use credit derivatives to manage credit risk exposure to key customers or critical suppliers. The liquidity, transparency of pricing, and more refined structural options available in the CDS market offer an efficient alternative to traditional credit insurance. Some corporations invest in CDS indices (i.e., CDX and iTraxx) and structured credit products (i.e., collateralized debt obligations (CDOs) and asset-backed securities (ABS)) comprised of pools of mortgages, auto or other consumer loans) in an effort to embellish returns on pension assets or on other balance sheet cash.

Hedge funds have continued to increase their presence and have been integral to expanding the variety of trading strategies. An important interest to hedge funds is the possibility of long-short CDS trading strategies, particularly those involving reference entities that are in the process of merging or being acquired. Acquired companies are generally expected to have improving credit spreads, while the purchasing company often has a diminished credit profile over the short term. Hedge funds have been the primary users of new products that facilitate the trading of more complex sub-risk elements.

Due to hedge funds' significant role in the credit derivatives market, trouble for hedge funds (such as the struggles they faced as a result of exposure to the subprime market in summer 2007) has repercussions for banks and other lenders who have purchased credit protection. Should a credit event occur for a particular debt, hedge funds that were sellers of protection for that debt may not be able to cover their obligations, damaging purchasers of the protection who thought they had already hedged their risk. A hedge fund would need to be in extreme duress for this outcome to occur, but amidst the trouble in the credit markets some hedge funds have faced this “worst case.” For example, Sowood Capital Management sold its portfolio to Citadel Investment Group in August 2007 for fear they would not be able to meet their margin calls and other obligations.

Hedge funds also use credit derivatives to make bets on the credit markets. Many use borrowed money (or are exposed by default swaps that require no upfront investments or capital in reserve) to make these bets. While some hedge funds have realized significant returns with this strategy, players on the other sides of those bets are often hedge funds whose losses could ripple through the credit derivatives market.

Asset managers have begun using the CDS market as a relative value tool, or to provide a structural feature (i.e., particular maturity date, senior versus subordinate debt, cash flow versus synthetic, etc.) that is not available in the bond trading market. Also, the ability to use the CDS market to take a bearish position is readily available. For example, an asset manager might purchase three-year protection to hedge a 10-year bond position on an entity where the credit is currently considered to be in financial distress but is expected to perform well if it survives the next few years of the credit cycle.

The participation of insurance companies in the CDS market can be separated into two distinct groups: 1) life insurers and 2) mono-lines and (re)insurers. Life insurers typically use CDSs to sell protection (long credit risk) to enhance the return of their asset portfolio. Mono-lines (the common term for financial guaranty insurers) are in the business of assuming “investment grade” debt service exposures for a variety of asset-backed securities [15].

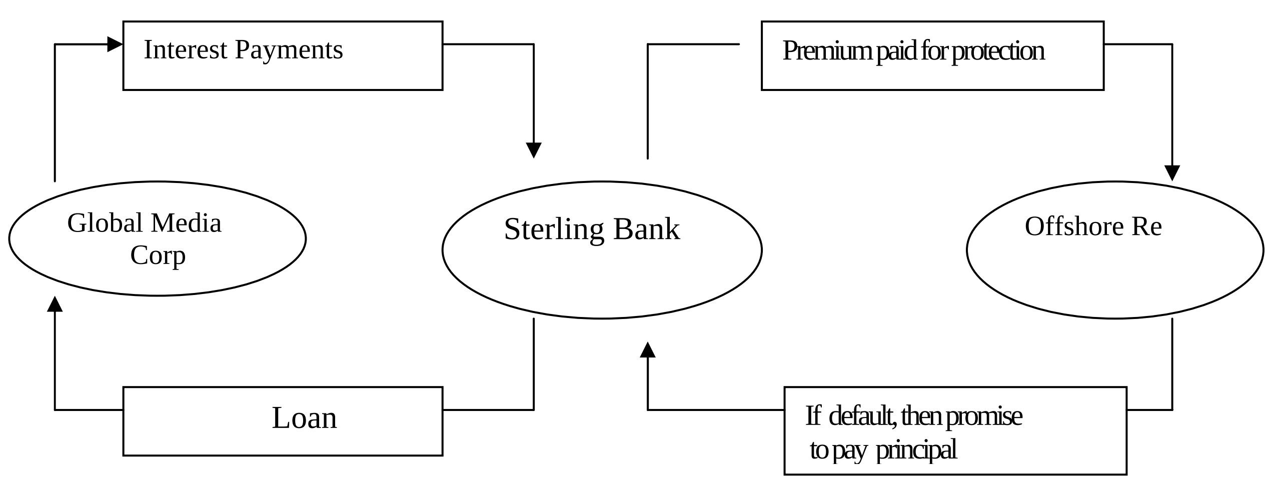
3. Example of a CDS Market Transaction

Let us review the example of a three-year loan from Sterling Bank to Global Media Corporation (GMC). Subsequent to providing the loan Sterling Bank buys protection for this particular GMC loan from Offshore Re, a reinsurance company. Sterling Bank expects to receive periodic interest payments from GMC and a final repayment of the principal loan balance in three years. Sterling Bank faces the credit risk that GMC may go bankrupt and fail to meet its interest or repayment obligations.

The yield that Sterling Bank earns on this loan, like most loans, can be broken down between the risk free yield and the risk premium for bearing the risk of loan default. This "risk premium" is a function of both the probability of default and Sterling Bank's underwriting risk aversion. We will separately quantify each of the risk components in Section 7.

In a CDS, Sterling Bank buys protection from Offshore Re, against a default by GMC. The aggregate contractual arrangements are summarized in the deal diagram below.

Figure 3
Credit Default Swap on a Single Corporate, Between a Bank and a Reinsurer



The buyer of the CDS (Sterling Bank) receives the benefit of protection for credit risk in exchange for periodic premium payments (usually quarterly in arrears) until the contract expires or a predetermined credit event occurs. Credit events are detailed in the credit swap insurance contract between Sterling Re and Offshore Re and identified as: 1—bankruptcy, 2—obligation acceleration, 3—obligation default, 4—failure to pay, 5—repudiation/moratorium and 6—restructuring. Since all credit events except restructurings (not considered a credit event since 2003) are linked to default of the reference entity (Global Media Corp), the term "credit event" is replaced by "default."

In the event of a default by GMC, Sterling Bank will receive a payoff from Offshore Re equal to the difference between the face value and the market value of the underlying debt minus the CDS premium that has accrued since the last periodic payment date.

When a GMC default occurs, there are two accepted settlement procedures or "protocols" between Offshore Re and Sterling Bank: 1—physical settlement (the more commonly used protocol) and 2—cash settlement. In a physical settlement, Sterling Bank provides to Offshore Re the notional value of deliverable obligations of the reference entity (GMC). Offshore Re then remits to Sterling Bank the notional amount paid in cash.

In a cash settlement, Offshore Re pays Sterling Bank the face value minus the recovery rate of GMC loan amount; known as the *loss given default*. The recovery rate is calculated by either referencing quotes from market dealers or by observing market prices over some period subsequent to the occurrence of default by GMC.

To further illustrate, suppose that Sterling Bank purchases a three-year CDS security with a spread (i.e., insurance risk premium) equal to 300 basis points (bps; i.e., 3.00 percent) and that the notional value of the underlying debt is $20 million. Sterling Bank then makes quarterly payments of 0.03 times $20 million divided by 4, which equals $150,000. In the case that GMC defaults the settlement is as follows (assuming a 40 percent recovery rate): Offshore Re compensates Sterling Bank for the loss on the face value, which is $12 million ($20 million x .40) and Sterling Bank pays the insurance risk premium that accrued since the last payment. For example, if the default occurs two months after the last premium was paid, the accrued premium would be 2/3 times $150,000 or $100,000.

The bank has effectively hedged its credit risk with the CDS. It has parted with a portion of the loan yield (to pay the premium for the insurance protection of 300 bps in the example above) but has deemed that to be a fair trade for reduced volatility in the next credit cycle.

When the loan was initially recorded as a liability on Sterling Bank's balance sheet, the risk of default, and the expected rate of recovery given default, were assessed by Sterling's loan officers based upon a review of private data from its long banking relationship with GMC about developments in the sector and changes to the company's structure and management. This assessment was largely separate from daily movements in GMC's stock price or bond ratings.

Offshore Re does not have a long-term relationship with GMC. Its primary interest is in the premium it can earn on GMC's default swap. When the CDS is on Offshore Re's balance sheet, it must be booked in accordance with fair value accounting (FAS 157), which is subject to daily fluctuations. Daily market movements in GMC’s equity and bond prices feed directly into the estimation of default and expected loss given default, thereby affecting the recorded asset value on its books, via a booking process known as the mark-to-market (MTM) adjustments. As the bond and equity prices fall, the probability of loss increases, and the MTM adjustment yields a diminished position (i.e., a decrease in the quarterly income and also a reduction in Offshore Re’s book value). As described subsequently in the case of AIG, companies that assumed large positions of credit protection experienced huge accounting losses from the write-down of the asset values during the credit crisis of 2008.

When asset values of the credit derivatives positions fall, the reinsurer may look for an effective hedge for its own credit derivative retentions. Offshore Re could hedge its position by shorting bonds if a liquid market exists, although if such a market existed, there would be little need for CDSs on bank loans in the first place. The equity market of the borrower (e.g., GMC) is much more liquid, and as a result, insurers will often short the GMC stock in order to hedge their credit risk.

(Re)insurers often sell protection (i.e., taking a long position on credit risk) as a source of additional underwriting premium or to diversify their portfolios to include credit risk.

These insurance markets need to be careful to avoid the “short squeeze,” whereby they may seek to hedge their credit risk positions by shorting equities. As markets fall, insurers typically respond by selling more, which in turn may lead to an accelerated downturn and exacerbate liquidity and volatility.

Insurers have often resorted to a strategy of selling when the market is falling and buying when the market is rising. When falling markets are met not by speculators but by further selling, a liquidity vacuum develops and volatility can spike suddenly. For insurers this situation is called a “short squeeze.” This would be very similar to the experience of “portfolio insurance” in October 1987, when institutions following this strategy sold extensively on the initial market decline, precipitating further selling and further price declines [11]. It is not yet known if this trading impacted the market decline of 2008.

4. Credit Derivative Product Types and Key Terms

Single name CDSs are still the most widely used product and have been the cornerstone of the credit derivatives market. However, full index trades and tranched index trades have taken off since 2004 and grew in market share through 2007.

TABLE 3
Credit Derivative Volumes by Product Type

Product Type	2004	2006
Single-name credit default swaps (CDSs)	51.0%	32.9%
Full index trades	9.0%	30.1%
Synthetic collateralized debt obligations (CDOs)	16.0%	16.3%
Tranched index trades	2.0%	7.6%
Credit linked notes	6.0%	3.1%
Others	16.0%	10.0%

Source: British Bankers' Association Credit Derivatives Report 2006.

Table 4
Credit Default Swaps Volumes by Product Type

Product Type	June 06	June 07	June 08
Single-name CDSs	68%	57%	58%
Multi-name CDSs	32%	43%	42%

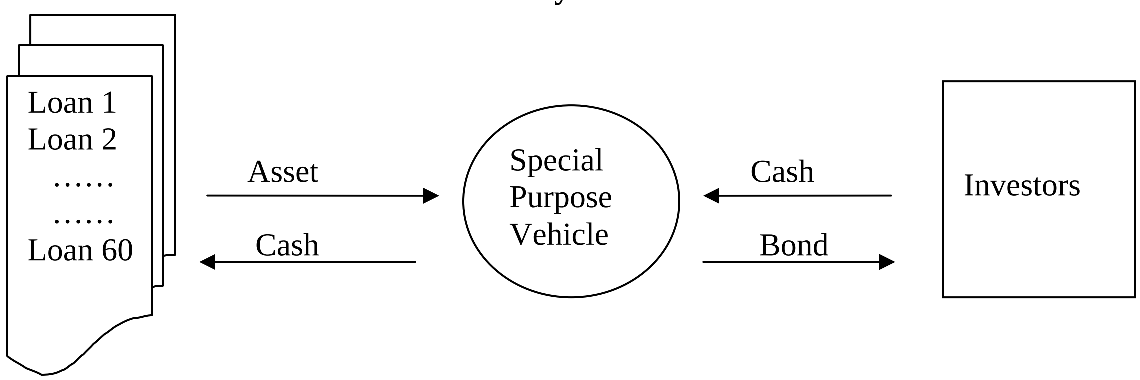
Single name CDSs are just that. The reference entity is a single corporation (i.e., Microsoft) or a sovereign (i.e., Chile). CDSs on sovereigns (see Table 5) increased from 2006 to 2008, along with swaps on entities with ratings BB or below. The notable increase in share of swaps on BB or below rated entities is likely due to ratings changes as companies' troubles were revealed through the unfolding of the credit crisis in 2007 and 2008. The trade turns on whether or not the reference entity encounters a *credit event* during the term of the contract. Unlike loss events with traditional insurance, the credit derivative guarantee is irrevocable and unconditional (and waives all defenses, including fraud) and results in the guarantor stepping into the shoes of the issuer. This is a significant departure from traditional insurance whereby a claim is made and negotiations begin as to what extent the claim is deemed valid. In the credit derivatives market, the protection seller pays the protection buyer at the time of credit event and argues with the issuer later. Absent that type of claims paying protocol (known as a “capital market” standard), investors would have no incentive to purchase default protection.

TABLE 5
Single Name Credit Derivative Volumes by Type 2006–2008

Type	June 06	June 07	June 08
Sovereigns	5%	6%	7%
Non-sovereigns	95%	94%	93%
Investment grade (AAA-BBB)	67%	65%	66%
BB and below	14%	13%	20%
Non-rated	18%	22%	13%

Synthetic CDOs are among the most complex instruments in the market today. Synthetic CDOs are typically "structured" transactions in which a special purpose entity (SPE) is established to sell credit protection on a range of underlying assets via individual CDSs. The SPE in turn issues several prioritized tranches of notes to investors, with note proceeds typically invested in collateral consisting of high-quality government paper to meet contingent CDS payments, while note holders (in order of seniority) receive both cash flows on the underlying collateral and the premiums on the special purpose vehicle (SPV) default swaps. Synthetic CDOs provided an attractive way for banks and other financial institutions to transfer credit risk on pools of loans or other assets without selling the assets. Examples of the type of underlying collateral that can be “securitized” include mortgages, auto loans and other consumer debt. Lending companies that specialize in subprime mortgages will periodically bundle up these loans and sell off the credit risk of the riskier lower tranches of the pool to investors for roughly two-thirds of the collective spreads on the loans. In 2007 and 2008, the housing market crash sparked defaults of the riskier debt in these CDOs (especially mortgage-based CDOs). The fall in value of the CDOs, plus the outright payout obligations as more and more debt defaulted, caused massive losses for investors in CDOs. Furthermore, the crisis was exacerbated as key cogs—investment banks and commercial banks—to the financial system also experienced losses since they kept some CDOs on their books when they became harder to sell. Many insurers had invested in highly rated synthetic CDOs as an alternative to bonds. As the ratings on these instruments are lowered, insurers may be forced to sell them to meet regulatory requirements on the quality of debt held. These forced sales can further depress the market and generate even larger losses for the CDO investors.

Figure 4
Structure of Synthetic CDOs



Credit derivative index trades are usually comprised of a generic basket of single name swaps with standardized terms. Recently, tradable CDS indexes have also been introduced that allow investors quick and easy ways to buy and sell market-wide or sector credit risk. In June 2004, the two main CDS indexes, *iboxx* and *Trac-x*, were merged into the *Dow Jones iTraxx* index that since has set a new standard when it comes to liquidity, transparency and diversification [7]. Large exposure (negative or positive) to a diversified pool of credit risks is now much easier to gain, and the liquidity of the *iTraxx* market has attracted hedge funds. Unlike other multi-name CDSs, such as first-to-default baskets, index swaps provide exposure to unnamed reference entities. These blind pools were the fastest growing products, allowing investors to buy and sell a customized cross section of the credit market much more efficiently than they could if they were dealing in individual credit derivatives. However, such blind pool trades raise a modicum of moral hazard as the buyer and seller do not always have the same access to inside information related to the reference entities.

Credit-linked notes, or CLNs, are known as funded credit derivatives, because the protection seller pays the entire notional value of the contract up front. In contrast, CDSs pay only in case of default and are therefore referred to as unfunded. CLNs are often used by borrowers to hedge against credit risk and by investors to enhance their holdings' yields.

Other product types include credit spread options, swaptions, variance swaps, constant maturity swaps and credit contingent swaps.

5. Credit Derivative Contract Standards

Credit derivatives are similar to options in the form of bond insurance, and have been available since interest rate volatility became a key concern for financial markets. Banks seeking to hedge credit risk in their loan portfolios led the initial growth in the early 1990s. The size and liquidity of the credit derivatives market has recently developed in response to a broader range of participants (i.e., private equity firms, hedge funds, asset managers, insurers, etc.) seeking to purchase and sell credit risk protection. By the late 1990s it was apparent that standardized wordings and the uniform application of capital market standards were needed to enable these dissimilar markets to trade credit risk exposure more efficiently and effectively.

The International Swap and Derivatives Association (ISDA) set and defined standard credit events (i.e., bankruptcy, failure to pay and restructuring) and standardized terms of CDS contracts in 1999, substantially aiding development of this market [JP Morgan]. CDS contracts now commonly include a standard confirmation letter, incorporating the 2003 ISDA Credit Derivative Definitions, and follow the ISDA Master Agreement. These forms cover the following key elements:

A. Which credit instruments could trigger the CDS

B. What obligations are covered under the contract

C. The notional value of protection provided

D. What events would define a credit event that would trigger coverage

E. What settlement procedures would apply.

Standardization reduces the costs and increases liquidity. The only unique information required for a particular transaction is the elements that differ for each trade, including the reference entity, maturity date, spread over Libor[2] and notional value. These conventions have helped this market grow rapidly.

One concern over any new credit instrument is how it would fare in adverse circumstances. Before the most recent and severe test of these instruments during the credit crisis of 2008, the corporate defaults of the early 2000s (e.g., WorldCom, Parmalat, Delphi, Calpine, Northwest and Delta) tested this market and the strength of the standard conventions. At least in the first instance, markets did function effectively, with over $50 billion of contracts involving thousands of separate contracts settled without litigation or disputes that adversely impacted the market [JP Morgan]. Thus far, settlements in the credit derivatives market have been orderly through 2008. The most notable bankruptcy of Lehman did not lead to any disruptions in the market caused by the settlement process. The settlement process should be enhanced once central clearinghouses are established for these derivatives. Despite the clarification the contract standards provided, valuation of credit derivatives remains an issue for market players. Sellers of credit protection don't have as much information about loans and their issuers as the original lenders do, making it hard for sellers to adequately price credit insurance. Information asymmetry can be exacerbated with trades of blind pools.

[2] *Libor* is an acronym for London InterBank Offered Rate, and is the most widely used benchmark for short-term interest rates. Libor is the rate that credit-worthy international banks generally charge each other for large overnight Eurodollar loans. It is effectively the AA bank loan rate in the capital markets and is compiled and released each business day. As banks are primary participants in the credit markets, Libor is viewed as the funding rate, or what it costs an institution to raise money to engage in the credit markets.

As illustrated by the ratings for the subprime mortgage market, sellers of protection can't count on ratings agencies to be reliable. In 2000, when mortgages with "piggyback" loans (a mortgage and a second loan for the down payment) were first being issued, ratings agencies determined "piggyback" loans to have risk similar to that of typical mortgages. Consequently, more of these mortgages were marketed than might have been had they been given lower ratings. In 2001, Standard & Poor's did recognize an increased level of risk associated with these loans, but still allowed mortgage pools to be comprised of up to 20 percent subprime mortgages before receiving a ratings penalty. In 2006, Standard & Poor's found through a proprietary study that subprime loans were 43 percent more likely to default than conventional loans. However, they did not change ratings on existing securities. It was not until spring of 2007 that agencies slashed their ratings for subprime loans following high default and foreclosure rates as the housing market deteriorated. Congress and regulators are scrutinizing the ratings process in an attempt to develop a system that can provide accurate ratings.

6. ISDA Credit Events and Settlements

A credit event is the frequency trigger for a *loss given default* and the 1999 ISDA definitions appeared to provide fairly straightforward and concise default triggers (delayed payment, restructuring, bankruptcy, etc.). However, the market went through some growing pains to define certain actions as credit events.

This can be illustrated by the real market event that follows. In August 2000, Conseco's bank debt was restructured. While the restructuring included a deferral of the loan's maturity by three months, it also included an increased coupon, a new corporate guarantee and additional covenants in favor of the lenders. Thus, because lenders were compensated for the maturity extension, Moody's did not consider the restructured debt to be a "diminished financial obligation," and thus not a "distressed exchange" default. However, because of the maturity extension, the restructuring was considered a "credit event" under the ISDA "restructuring" definition and triggered loss payments under the CDSs written on Conseco. This is a perfect example of a loss event under the ISDA "restructuring" definition that Moody's did not consider to be a default.

Thus, any "restructuring" definition should look at the totality of the circumstances (e.g., whether the lenders/investors have been compensated for the reduction or deferral) to determine whether the restructured obligation is truly a "diminished financial obligation."

The 2003 ISDA revisions eliminated restructuring as a default event and also removed any material gray areas. However, in the capital markets all terms and conditions are subject to negotiation, so participants are required to fully understand these contracts.

Based on the 2003 ISDA conventions, there is a three-step procedure for physical settlement:

1. Notification of a credit event

   Either the buyer or the seller of credit protection can provide notice to the counterparty that a credit event has occurred. Documentation can be based on public sources such as news reports or articles, or a company announcement. Although notice would typically be given as soon as an event occurs, contract provisions allow notice to be given any time up to 14 days after the contract matures, which could be long after the event. This delay is important for valuing a CDS, as the seller of the protection, once the credit event has occurred, will be required to make a payment whenever the notice is provided, so this liability should be booked.

2. Notice of physical settlement

   Following notification of a credit event, the buyer is required to provide a "notice of physical settlement" within 30 days. This notice must specify the particular debt instruments (loans or bonds) that will be delivered.

3. Delivery of bonds

   Following the notice of physical settlement, the credit protection buyer generally delivers the debt instruments to the seller within three days. The buyer should deliver debt instruments with a face value equal to the notional value of the CDS in order to get the full protection purchased. However, if fewer bonds are submitted, the payment will be reduced proportionally.

More recently, an alternative settlement mechanism known as the CDS protocol has been developed by ISDA in conjunction with the derivatives and securities dealers. The new settlement protocol allows investors to cash or physically settle contracts at a recovery rate determined through an auction process.

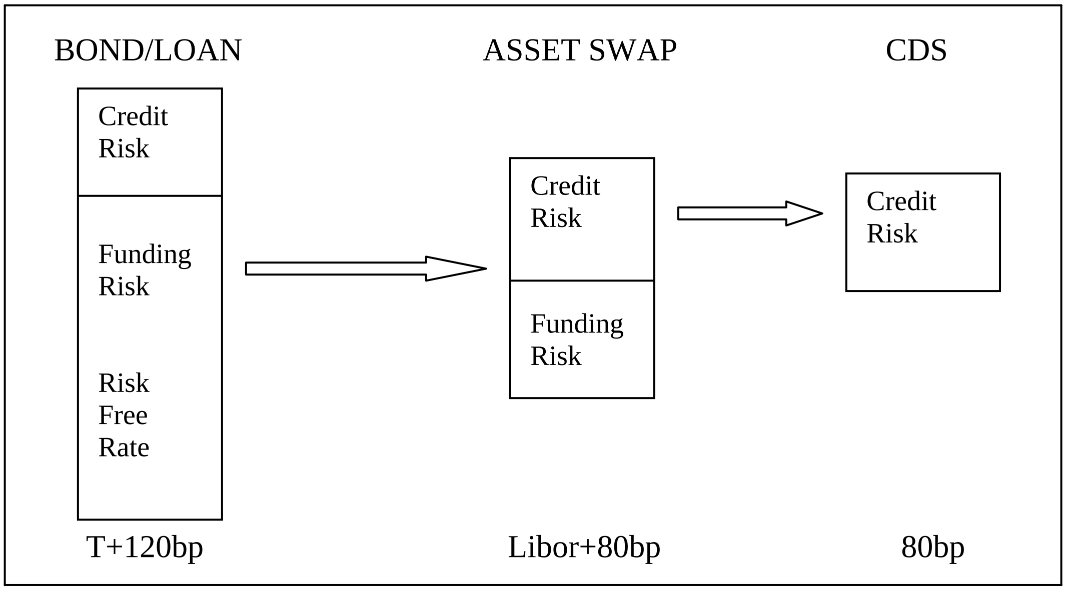
7. Bonds Versus Credit Default Swaps

A typical fixed rate coupon bond for a single corporation is designed to compensate the bond holder for three components: credit risk, funding risk and the risk free rate.

Credit risk compensates the investor for the chance that the particular corporation may default on its debt. Funding risk represents the cost of capital for the investor. As the credit market originated with major banks, the spread of Libor (the rate at which banks can obtain short-term funding) over the risk free rate (as measured by U.S. Treasury securities) is commonly used to measure this component. In general, the swap spread (which is the swap yield – risk free rate) is used to reflect funding risk. This can be viewed as the hurdle rate for an investor or the cost of capital for that investor.

Bonds and CDSs on the same individual credit will usually trade closely with each other, since both reflect the market's view of its default risk. The pure credit risk element of the loan at issue is encapsulated by the CDS. CDSs are not measured by a spread over a benchmark; rather, the spread is the annual premium (coupon) the credit protection buyer is willing to pay and the protection seller is willing to receive. Any credit that is considered to have a relatively higher default probability will in turn carry a relatively higher spread. In order to compare bonds with CDSs it is requisite to split out the spread of the bond that compensates the bondholder for assuming the credit risk element of the issuer.

Figure 5
Comparing Bond Yields and the Spread on CDS



Source: JPMorgan, Credit Derivatives Handbook Detailing Credit Default Swaps Products, Markets and Trading Strategies, page 45.

For example, assume a bond that is paying a yield of U.S. Treasury rate plus 120 bps. In order to remove the interest rate risk from owning this bond, an investor can swap the fixed interest payments received from owning the bond for a series of floating rate payments through an agreement with a third party known as an asset swap. In order to place a value on the credit risk inherent in a fixed rate bond, a two-step process must be followed. First, the cost of exchanging the fixed rate bond for a floating rate bond needs to be determined. In financial markets, this is a straightforward transaction, commonly termed a “plain vanilla” fixed-for-floating swap. The investor holding the fixed income security agrees to swap the fixed rate payments in return for payments from a counterparty based on a floating rate that is usually defined as Libor (a rate that can change each day) plus a spread. The spread is calculated to set the present value of the fixed rate payments to equal the present value of the floating rate payments, and depends on the term structure of interest rates that exists when the contract is established.

In the example illustrated on Figure 5, the floating rate equivalent turns out to be Libor plus 80 bps. The fixed rate payer in this transaction now pays the fixed interest rate on the notional value to the floating rate payer, and receives a payment each quarter (or whatever timing was included in this swap) equal to Libor plus 80 bps. Now the fixed rate payer is no longer concerned about interest rate changes as it receives payments that fluctuate with interest rates

The second step involved in estimating the credit risk requires the investor to determine the cost of capital for funds to purchase the underlying bond. As the market initially developed around banks, it is commonly assumed that an investor can borrow at Libor. Thus, if a bank purchased this bond, its spread would be the yield on the bond less its borrowing costs, or (Libor + 80bp) – Libor = 80 bp.

For example, consider a three period bond. Given that the price is determined by:

Bond Price = $\left[c_1/(1+m_1+z)\right]+\left[c_2/(1+m_2+z)^2\right]+\left[(c_3+FaceValue)/(1+m_3+z)^3\right]$

Where, c_i = coupon at time i, and;

m_i = Zero coupon rate to maturity based on the swap rate curve.

We solve for z in the above equation which yields the bond's implicit spread.

If a bond has an implicit spread that is less than the CDS spread for the same credit and same maturity trades, the market has a negative (bearish) view of this credit over the term of the loan. Conversely, if the spread on the bond is higher than the CDS spread, the market has a positive (bullish) view of this issue.

8. Credit Spreads, Option Volatility and Equity Prices

The markets for equities, options on equities and credit derivatives are all large, liquid markets, where news about companies, macro-economic events and market conditions are quickly reflected in prices and spreads. When an unexpected piece of adverse information is reported, for example, equity prices tend to fall, credit spreads tend to rise, and the implied volatility of options on equity usually increases. Thus, these markets are closely related, and movements in prices and spreads can be expected to be correlated.

Based upon analyses and investor presentations by credit experts at JP Morgan, the following relationships can be expected.

8.1 Equity Prices Versus CDS Spreads

In general, these markets would be inversely related. If market expectations regarding the financial conditions of a company are improving, then equity prices would normally increase and the CDS spreads would decrease as the company's chances of defaulting on debt would be reducing. Occasionally this relationship will not hold, such as when a leveraged buyout increases the equity price, but as the likelihood of a default on the debt of the restructured company would increase, then the CDS spreads would also increase.

8.2 Equity Price Versus Implied Volatility

The price of an option on a company's equity is based on five factors: the current price of the stock; the exercise price of the option; the time to maturity of the option; the current interest rate; and the volatility of the underlying stock price. All of these factors except the volatility are readily determined. Using the current price of an option and applying an appropriate option pricing model allows investors to calculate the implied volatility of the equity of that company (the value that, when used for volatility, sets the model price equal to the actual price). The price of a company's equity and the implied volatility of its options tend to be inversely related based on the "leverage effect." The debt-to-equity ratio declines as a stock's price increases, which reduces the leverage of the firm. The stock price is then expected to be less volatile due to the lower leverage.

8.3 CDS Spread Versus Implied Volatility

Both the CDS spread and the implied volatility measure the risk of a company, although on different components. The CDS spread reflects the likelihood of a default on its debt; implied volatility reflects the stability of its equity price. A very risky firm would be expected to have high values for both of these measures, whereas a low risk firm would have a lower CDS spread, and likely a more stable stock price.

9. Role of Insurers in the Credit Derivative Market

Based on the British Bankers Association—Credit Derivatives Report 2006, insurance companies as a whole have become the third largest sellers of credit protection with a combined market share of 17 percent. Insurance companies are also significant purchasers of credit protection through credit derivatives.

Insurance companies use credit derivatives as a part of several trading strategies. Insurance companies sell credit protection to gain quick exposure to the credit market, sell protection to gain a higher return than direct investment in underlying credit, and buy protection to hedge a bond the insurance company owns.

When an insurance company has funds to allocate to credit investments, credit derivatives can provide a more liquid market than bonds. An insurance company might sell protection for a single bond with a CDS or for a credit default index and purchase Treasuries or AAA asset-backed bonds rather than purchasing a bond. The company would look for a credit derivative with risks in line with that of the desired security. The purchase of a "safe" security provides a venue for the funds with a low return, funds the credit derivative trade and provides inflows whose duration corresponds to that of the underwriting portfolio. When bonds of the appropriate maturity and risk become available, the insurance company can sell its "safe" security and exit its credit derivative position.

The purchase of an AAA bond or Treasury along with the sale of credit protection can also be used to earn a higher return than the purchase of a credit obligation. Sometimes an insurance company will be able to earn a higher return from the yield on the “safe” security and the premiums from the sale of credit protection than on a corporate bond.

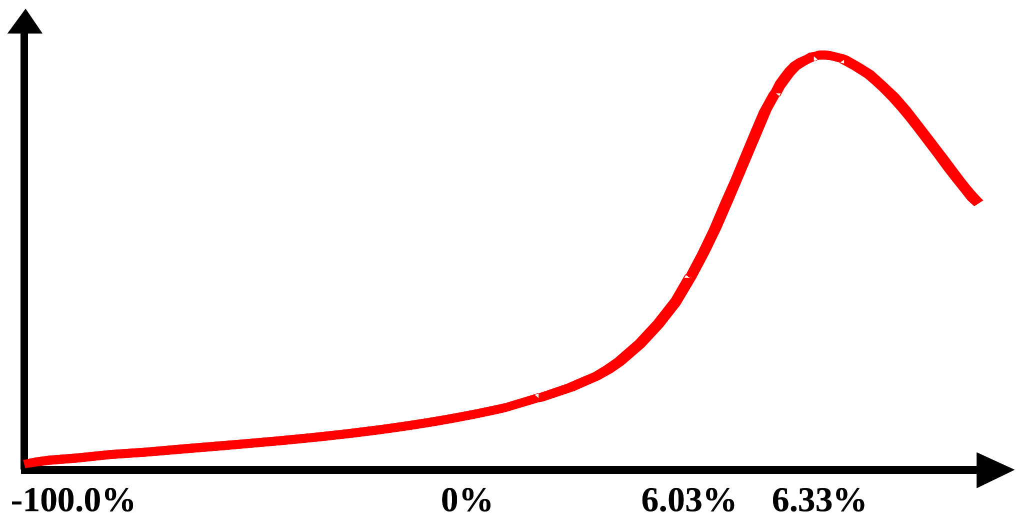
Insurance companies may also purchase protection as a hedge for bonds the company owns. Insurance companies might do this rather than sell the bond to avoid a loss on the bond or to speculate about the credit curve of the issuer. The insurance company would execute the latter strategy by, for example, purchasing five-year credit protection on a bond with a 15-year maturity.

When entering into credit derivative trades, insurance companies should carefully consider their expected return along with their maximum loss compared with the purchase of a low-risk security such as a Ginnie Mae. Consider this strategy for investment in a Ginnie Mae along with the sale of protection through a CDX. The investor has $10 million to invest and purchases $10 million in Ginnie Maes for a return of 5.63 percent. The investor also sells protection for Dow Jones CDX.NA.IG with a notional value of $10 million for an inflow of 0.70 percent from the spreads. The credit default index has a default range of 0–100 percent and an expected value of 0.30 percent.

- Expected return = 5.63% + 0.70% - 0.30% = 6.03%
- Max return = 6.33% (if there are no defaults)
- Min return = -100% (all the bonds in the portfolio default and nothing can be recovered)

The investor has gained an additional expected return of 0.30 percent; however, the investor has assumed exposure to a 100 percent loss if all the credit obligations in the index default.

Figure 6
Probability Distribution



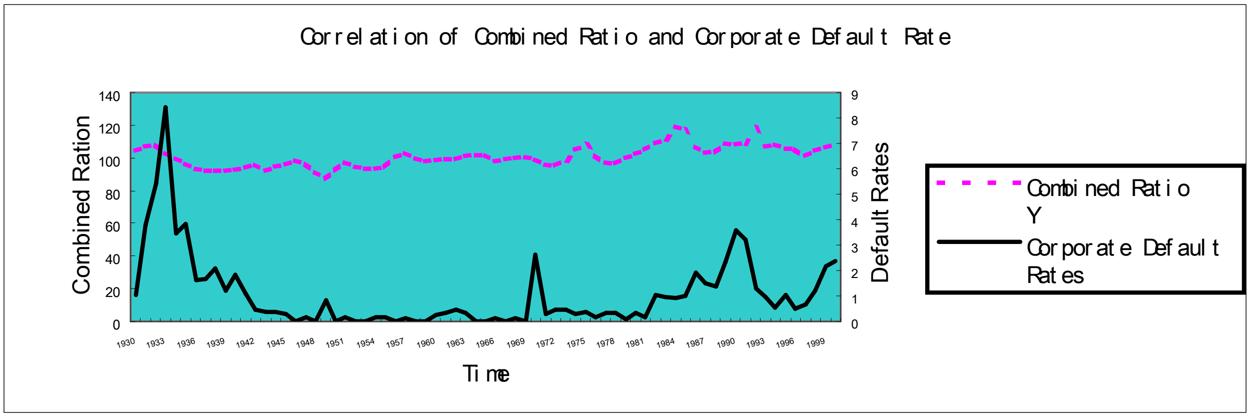
There are two significant risks inherent in this strategy that go beyond predicting the next credit cycle. These include MTM booking effects and the correlation of credit defaults with the insurance cycle.

The MTM is necessitated by financial reporting as well as the need to monetize existing contracts. It is largely a function of the probability of default (and survival) over time. The CDSW model is available on Bloomberg and is a market standard tool for calculating the MTM adjustment on CDS contracts. To access this model simply type "CDSW <Go>" on Bloomberg. In concept the MTM on a CDS contract is roughly equal to the notional amount of the contract multiplied by the difference between the contract spread and the market spread (in basis points per annum) and the risk-adjusted duration of the contract.

Consequently, for insurance companies that are increasingly becoming net sellers of credit risk protection, if the spread widens (i.e., credit outlook deteriorates) in a given accounting quarter, this results in a material reduction in current period income. This income loss is unrealized but impairs book value and is difficult to explain or reconcile to market analysts unfamiliar with these types of fluctuations in the valuation of an insurance company. Likewise, when credit spreads tighten (i.e., credit outlook improves), there are apparent windfall impacts that can cause irrational exuberance that will not be repeated in future accounting periods. Because the notional value of credit derivative trade is so very large, small changes in quarter end market spreads can cause material volatility to the earned income bookings and distort growth in book value estimates.

A significant portion of the growth by the insurance industry in selling net credit protection is based on the notion that introducing a modicum of credit risk into the existing portfolio of life and/or property & casualty risks will further diversify its book. The expectation is that the credit cycle is separate and distinct and therefore uncorrelated with the traditional insurance underwriting cycles. By introducing a slice of credit risk into the mix, these insurers expect the cycles to partially offset and thereby reduce income volatility and further stabilize growth in book value of their respective enterprises over time.

Figure 7
Correlation of Combined Ratio and Corporate Default Rate



Source: Moody's Investors Service Inc., "Default and Recovery Rates of Corporate Bond Issuers, 1920-2005"; A.M. Best Company, Inc. "Best's Aggregates & Averages—Property/Casualty," 2000, 2001; Alfred M. Best Company Inc., "Best's Fire and Casualty Aggregates and Averages," 1940, 1941.

The correlation ratio of combined ratio and corporate default rate is 0.258, so it clearly shows the positive correlation of bond default and insurance company combined ratio.

The positive correlation between the insurance underwriting cycle and default frequency in the graph is a bit surprising, and although the R^2 is relatively low there are two key observations to be made. The correlation is neither zero nor is it negative. As such, any positive correlation between the credit cycle and the insurance underwriting cycle will act as a drag on earnings. Additionally, positive correlations (albeit even a small one) will increase the capital requirements for those insurers that have assumed significant net credit risk exposure. This is a bit of a double whammy as the pro forma planning expects some diversification benefit from creating a broader basket of aggregate risks.

10. CDSW Model

Bloomberg uses the credit default swaps function to evaluate the price of CDSs. It bases the function on the credit default swaps model that was modified by Hull and White in 2000. The following will present the price model and how to use the Bloomberg software to evaluate the credit default price.

To evaluate a $1 notional principal plain vanilla CDS, Hull and White assume that default events, Treasury interest rates and recovery rates are mutually independent. This assumption should be carefully assessed. In practice some of the above conditions are unlikely to be met. Some research has been done on the relationship of recovery rate and default rate. Hu and Perraudin (2002) used Moody's data from January 1971 to January 2000 to find the correlation between quarterly aggregate recoveries and default rates; the typical correlation for post-1982 quarter is –22 percent, while from 1971–2000 the correlation is –19 percent. Moody's (1930–2005) and other researchers corroborated the apparent negative correlation [17].

At the same time, the assumption overlooks the effect of economic conditions. For example, in a severe recession (as seen in the recession of 2008), interest rates could decline, default rates increase and recovery rates decline as well if there is a glut of fire sale assets on the market simultaneously. John Frye concluded in an economic downturn, recovery of bond will decline 20–25 percent from normal year average [9]. The current experience in the subprime mortgage market shows this interaction. Subprime lenders offer mortgages to borrowers with weaker credit scores at interest rates of higher than regular mortgage market. Consequently, subprime borrowers are more likely to be susceptible to the interest increasing, since their interest payments are already so significant. In this case, rising interest rates increased mortgage defaults on floating rate mortgages while housing prices (which impact recovery rates) declined, in part because of the higher interest rates and tighter mortgage lending rules.

They also assume that the claim in the event of default is the face value plus accrued interest. Given these assumptions, the Hull and White model is as follows:

T: Life of CDS

$q(t)$: Risk-neutral default probability density at time t

$\hat{R}$: Expected recovery rate on the reference obligation in a risk-neutral world. This is assumed to be independent of the time of the default and the same as the recovery rate on the bonds used to calculate $q(t)$.

$u(t)$: Present value of payments at the rate of $1 per year on payment dates between time zero and time t

$e(t)$: Present value of an accrual payment at time t equal to $t - t^*$ when t^* is the payment date immediately preceding time t.

$v(t)$: Present value of $1 received at time t

w: Total payments per year made by CDS buyer

s: Value of w that causes the CDS to have a value of zero

π: The risk-neutral probability of no credit event during the life of the swap

$A(t)$: Accrued interest on the reference obligation at time t as a percent of face value

The value of π is one minus the probability that a credit event will occur by time T .It can be calculated from $q(t)$:

$$\pi = 1 - \int_0^T q(t)dt .$$

When a default occurs at time $t(t\langle T)$, the present value of the payments is $w[u(t) + e(t)]$. If there is no default prior to time T, the present value of the payments is $wu(T)$. The expected present value of the payments is, therefore:

$$w\int_0^T q(t)[u(t) + e(t)]dt + w\pi u(T).$$

Given our assumption about the claim amount, the risk-neutral expected payoff from the CDS is

$$1 - [1 + A(t)]\hat{R} = 1 - \hat{R} - A(t)\hat{R}$$

the present value of the expected payout from the CDS is

$$\int_0^T [1 - \hat{R} - A(t)\hat{R}]q(t)v(t)dt$$

and the value of the CDS to the buyer is the present value of the expected payoff minus the present value of the payments made by the buyer or

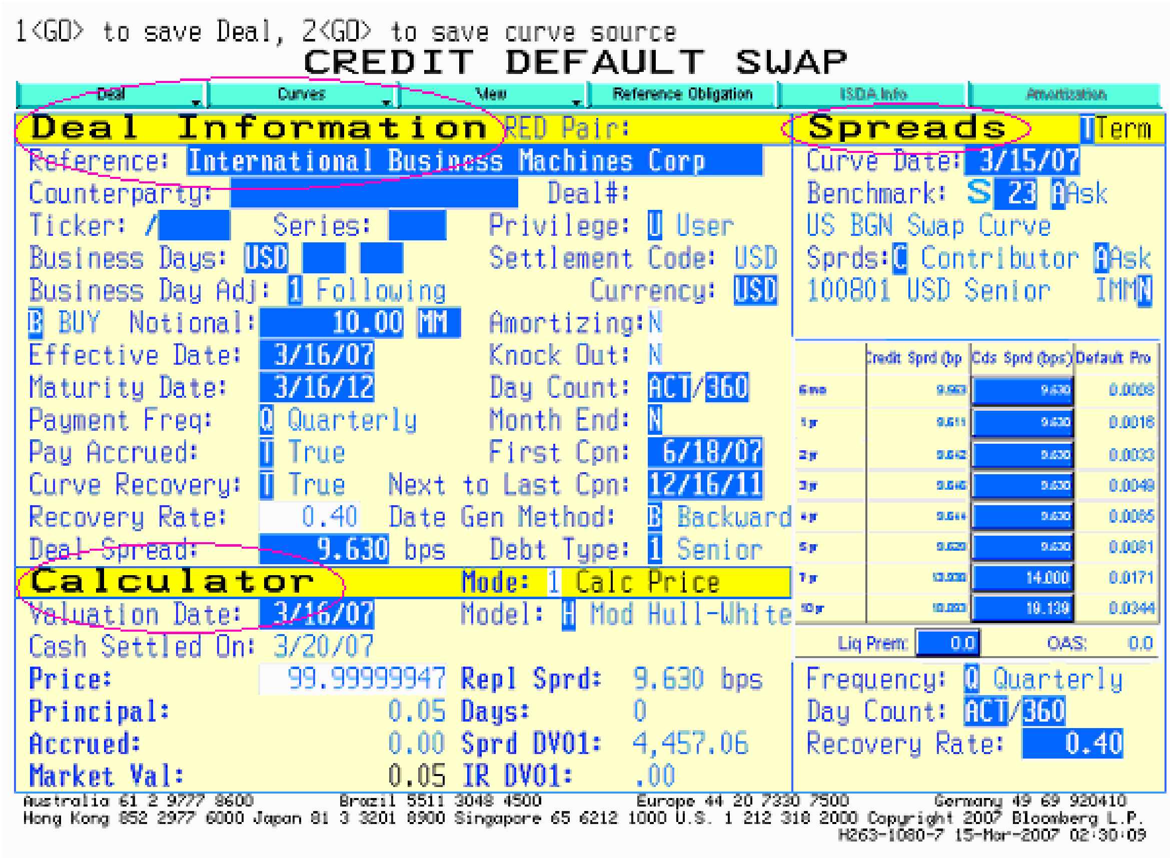
$$\int_0^T [1 - \hat{R} - A(t)\hat{R}]q(t)v(t)dt - w\int_0^T q(t)[u(t) + e(t)]dt - \pi wu(T).$$

The CDS spread, s is the value of w that makes this expression zero:

$$s = \frac{\int_0^T [1 - \hat{R} - A(t)\hat{R}]q(t)v(t)dt}{\int_0^T q(t)[u(t) + e(t)]dt + \pi u(T)}.$$

The CDSW model uses the function above to price the CDS spread. There are three areas in the CDSW screen of Bloomberg: deal information, spreads and calculator. In Figure 8 we indicate these with the green circles.

Figure 8
Bloomberg CDSW Function Using Hull-White Pricing Model—IBM Five-Year Spread Evaluated on March 16, 2007

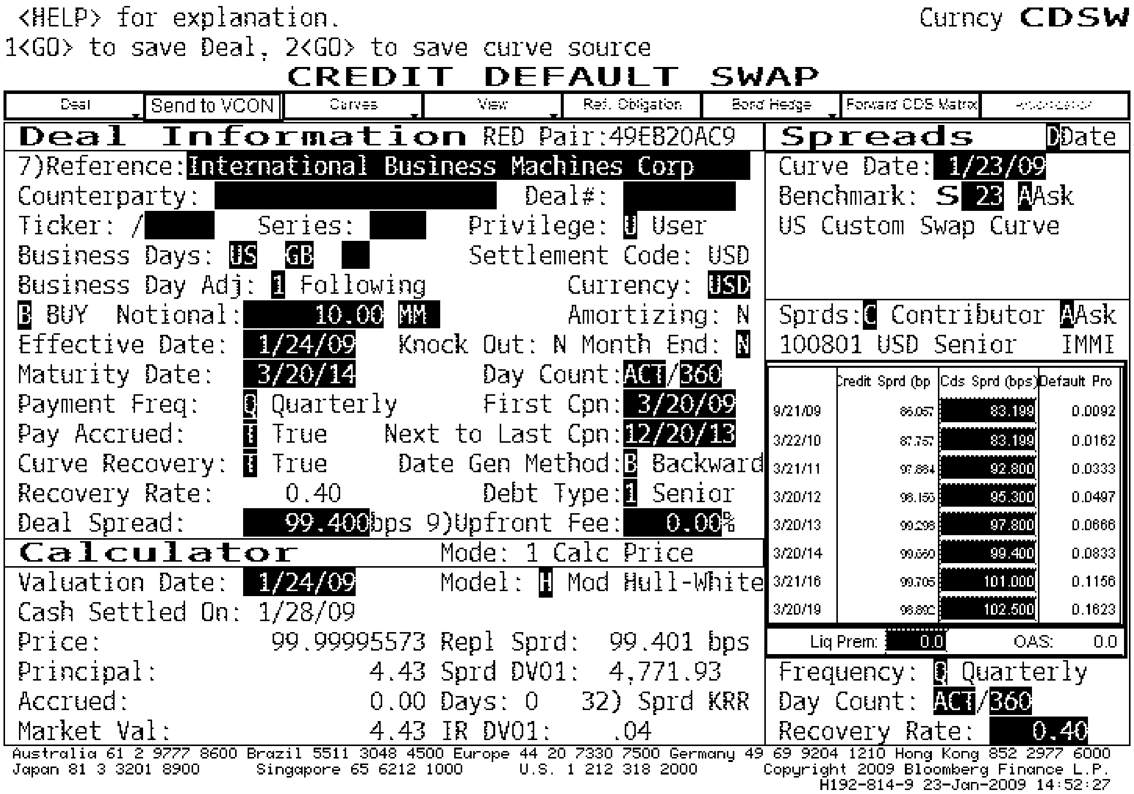


In the deal section investors can input the company name of underlying asset; notional value; and time payment frequency. "B" is show buyer of default protection. In the calculator field, investors can choose the swap valuation model, i.e., the Hull-White model, and type <GO> to get the price that sellers received. The term Sprd DV01 means the change in market value when the par spread curve is increased by 1 bp (0.01 percent) and IR DV01 means the change in market value when the swap curve is increased by 1 bp (0.01 percent). In the spread section Benchmark indicates the swap curve selected as the riskless curve. By default the swap curve is determined by deal currency (e.g., curve 23 for USD, 45 for EUR, 13 for JPY). These spreads (bps) represent the swap spread added to the benchmark curve to credit risky CDS deals. For

Figure 8, the reference is International Business Machine Corp with a notional of 10 million. The output shows deal spread is 9.63 bps, the amount the protection buyer pays to the seller each year. For example, a deal spread of 9.63 bps to be paid quarterly implies four installments of 2.4075 bps over the course of a year.

Subsequent to March 2007, the spread for protection on IBM debt increased. A protection buyer would have to pay a spread of 29.151 bps for protection on Aug. 30, 2007 for five years of credit protection compared to the indicated 9.630 bps in March for a five-year swap. Spreads for credit derivatives continued to rise throughout the economy through 2009 as the credit crisis deepened. In the case of IBM, credit default spreads on five-year bonds (with the same reference identity) were up from 29.151 bps in August 2007 to 99.400 on Jan. 24, 2009 (Figure 9). Furthermore, one of the main indicators of spreads in the credit markets, the spread for the North America Investment grade CDX, reached its high point near 280 bps in November 2008, up from 170 bps in October 2008 (MarketWatch, 2008 and Markit, 2008).

Figure 9
Bloomberg CDSW Function Using Hull-White Pricing Model—IBM Five-Year Spread Evaluated on Jan. 24, 2009



<HELP> for explanation. Curncy CDSW
1<GO> to save Deal, 2<GO> to save curve source

CREDIT DEFAULT SWAP

Deal | Send to VCON | Curves | View | Ref. Obligation | Bond Hedge | Forward CDS Matrix

Deal Information RED Pair:49EB20AC9

7)Reference: International Business Machines Corp
Counterparty: [redacted] Deal#: [redacted]
Ticker: /[redacted] Series: [redacted] Privilege: U User
Business Days: US GB Settlement Code: USD
Business Day Adj: 1 Following Currency: USD
B BUY Notional: 10.00 MM Amortizing: N
Effective Date: 1/24/09 Knock Out: N Month End: N
Maturity Date: 3/20/14 Day Count: ACT/360
Payment Freq: Q Quarterly First Cpn: 3/20/09
Pay Accrued: T True Next to Last Cpn: 12/20/13
Curve Recovery: T True Date Gen Method: B Backward
Recovery Rate: 0.40 Debt Type: 1 Senior
Deal Spread: 99.400 bps 9)Upfront Fee: 0.00%

Calculator Mode: 1 Calc Price

Valuation Date: 1/24/09 Model: H Mod Hull-White
Cash Settled On: 1/28/09
Price: 99.99995573 Repl Sprd: 99.401 bps
Principal: 4.43 Sprd DV01: 4,771.93
Accrued: 0.00 Days: 0 32) Sprd KRR
Market Val: 4.43 IR DV01: .04

Spreads D Date

Curve Date: 1/23/09
Benchmark: S 23 A Ask
US Custom Swap Curve

Sprds: C Contributor A Ask
100801 USD Senior IMMI

	Credit Sprd (bp	Cds Sprd (bps)	Default Pro
9/21/09	86.057	83.199	0.0092
3/22/10	87.757	83.199	0.0162
3/21/11	97.884	92.800	0.0333
3/20/12	98.155	95.300	0.0497
3/20/13	99.298	97.800	0.0666
3/20/14	99.660	99.400	0.0833
3/21/16	99.705	101.000	0.1156
3/20/19	98.800	102.500	0.1623

Liq Prem: 0.0 OAS: 0.0

Frequency: Q Quarterly
Day Count: ACT/360
Recovery Rate: 0.40

Australia 61 2 9777 8600 Brazil 5511 3048 4500 Europe 44 20 7330 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000
Japan 81 3 3201 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000

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11. Credit Derivatives and the Financial Crisis of 2008

While credit derivatives experienced explosive growth through 2007 as investments and risk management instruments, credit derivatives themselves introduced the potential for disruption in the financial system and losses at entities with large exposures to the instruments. The potential hazards of credit derivatives came to fruition with the credit crisis of 2008; several major financial institutions were driven to bankruptcy, sale or bailout, due to or exacerbated by exposure to the credit derivatives market. Of those firms, credit derivatives caused the most significant problems for AIG. Part of the difficulties at the hardest hit institutions stemmed from their reliance on short-term debt and subsequent inability to roll over or pay off debt the next period.

Credit derivatives, the instruments once hailed as innovative and sound risk management tools were blamed for many of the problems in the financial markets in 2008. In response, derivatives traders and market participants are working on risk-reduction measures for the market including working with regulators to expedite approval of clearinghouses for credit derivatives trading. Interested market participants are also pointing to the liquidity and information provided by the derivatives market as the credit market dried up in the crisis.

The systemic risk resulting from counterparty exposure in the credit derivatives market first came to light with the near collapse of Bear Stearns in March 2008. Bear was overleveraged and faced losses related to the mortgage and debt markets. The Fed worked with Bear and JP Morgan (the main potential buyer for Bear) to negotiate a deal to save Bear Stearns. The Fed pushed the deal in order to avoid the shock to the financial system associated with the failure of an investment bank that housed a significant amount of counterparty risk.

JP Morgan agreed to buy Bear for $2 per share on March 16, 2008—a total of $236.2 million, a huge discount for equity that was trading at $70 per share the week before (*USAToday*, 2008). The government helped push JP Morgan to acquire Bear by providing $30 billion to provide for some of Bear's illiquid assets (*The Economist*, 2009). However, Bear's shareholders threatened to veto the deal at that price, and JP Morgan had not yet agreed to guarantee Bear's positions. Without JP Morgan's Fed-backed and proprietary capital to back Bear's positions, Bear would have to file for bankruptcy. As long as doubt remained as to whether JP Morgan would back Bear, Bear's customers refused to continue to do business. Bear needed the deal for survival and was able to renegotiate with JP Morgan to a sale price of $10 per share, enough to prevent Bear's investors from wanting to block the sale. JP Morgan then bought enough Bear stock to back its assets (Boyd, 2008).

While the Fed helped reduce some of JP Morgan's risk in the acquisition, the deal did increase risk for JP Morgan as it assumed Bear's bad assets. For example, JP Morgan already had $77.2 billion in notional value of credit derivatives at the end of 2007 and added $13.4 billion in additional exposure with its acquisition of Bear. However, overall notional exposure may have been less than this number as some of Bear's and JP Morgan's may have netted out offsetting derivatives. Furthermore, JP Morgan was better positioned than Bear to handle losses and collateral calls on these exposures (Cole, 2008).

The settlement mechanism in the CDS market was tested when Fannie Mae and Freddie Mac were placed into conservatorship by the government, which counted as a credit event. The recovery rates on Fannie and Freddie's debt were high because of their government backing, reducing the effects of the credit event on the market. However, the event did cause ripples in the markets as buyers of the $1 trillion in protection of Fannie and Freddie worked to try to recover their "insurance claim" (Ng and Rappaport, 2008a).

One way to settle the CDSs was to deliver a Fannie or Freddie bond and receive close to 100 percent of face value (because the government backing made the recovery rate almost 100 percent). However, this method of settling had two adverse effects. First, smaller players who wrote credit default protection on Fannie or Freddie might not be able to deliver the face value to the protection buyers. Furthermore, credit protection buyers who did not actually possess Fannie and Freddie bonds were driving up the prices of these bonds as they sought to use them to settle their credit default purchase. Other investors decided to wait for the cash settlement auction to recover their claims (Ng and Rappaport, 2008b).

Lehman was the next significant financial institution facing bankruptcy during the credit crisis. In September 2008, Lehman experienced losses and write-downs stemming from real estate holdings (mostly on subprime mortgage assets Lehman retained on its books) and turmoil in the credit markets. The credit freeze left Lehman short of new capital, and Lehman Brothers declared bankruptcy in September despite efforts to convince the government and others in the industry of the systemic risks associated with its bankruptcy. The Wall Street firms that met in a New York Fed meeting the weekend before the bankruptcy decided that they would not guarantee a purchase of Lehman by a bank or another firm. Instead, they decided to pool their resources and achieve an orderly wind-down of Lehman's assets by purchasing Lehman's assets ranging from leveraged loans to real estate (Craig, Lucchetti, Mollenkamp and Ng, 2008).

One of the main worries associated with the Lehman Brothers bankruptcy resulted from Lehman's positions in the CDS market. Lehman had both bought and sold billions in CDSs, and many investors bought credit protection on Lehman itself. A Lehman bankruptcy would force Lehman's counterparties to re-hedge their credit exposure, and would force those institutions that sold insurance on Lehman's debt to pay out large sums to their counterparties. In order to reduce some of the systemic effects, the International Swaps and Derivatives Association (ISDA) held a session over the weekend before Lehman's bankruptcy to net out positions between counterparties with Lehman. However, traders involved said that little progress was made due to heterogeneity in the contracts' terms. (Craig, Lucchetti, Mollenkamp and Ng, 2008). As CDSs with Lehman disappeared following the official bankruptcy, the turmoil for Lehman's counterparties of re-hedging their positions and for entities that wrote insurance on Lehman to pay out claims spilled over to other financial institutions. Worry increased amongst investors who sought to hedge positions with other hedge funds, brokerages and the two remaining investment banks, sending swap spreads soaring. For example, on Sept. 18, 2008, it cost $900,000 to insure $1 million of Morgan Stanley debt for five years (Ng, 2008).

As Lehman neared bankruptcy and frantically looked for a buyer or bailout, Merrill Lynch recognized it would have to take quick action to prevent ending up alongside Lehman. Bank of America opted to buy the relatively stronger Merrill as Lehman moved to declare bankruptcy. Merrill had taken aggressive steps to shore up capital and to reduce holdings of risky assets, including the sale of $30 billion of CDOs in July at 22 cents on the dollar. Despite these efforts, Merrill had billions in write-downs in 2008 from exposure to mortgage-backed securities and other risky assets, combined with a highly levered balance sheet (Fitzpatrick, Karnitschnig and Mollenkamp, 2008).

At the same time that Lehman was forced into bankruptcy and Merrill rushed to find a buyer, credit derivatives were causing even more problems for AIG, who wrote derivatives on billions of dollars of debt (from corporate debt to multi-sector CDOs) through its subsidiary, AIG Financial Products Corp. Exposure was especially problematic for AIG because it wrote billions in swaps, meaning it was required to post collateral as default risk on the underlying increased and subject to the full payout if the underlying debts defaulted.

The risks caused by these assets at AIG came to the fore as the mortgage-backed securities' (for which AIG had "written insurance" in the form of credit derivatives) risk of default shot up. As the credit crisis deepened, default risk on corporate debt and other loans rose as well. AIG was required to post additional collateral on the credit protection it had sold. Some of this collateral was required in the form of cash payments to AIG's counterparties (Mollenkamp, Ng and Siconolfi, 2008). One of AIG's main failings in valuing its swaps when they were originally sold was their failure to recognize their risk from collateral calls if many of the swaps required significant collateral simultaneously and the effect of write-downs on the value of the swaps (even if none of the underlying debts actually defaulted) (Mollenkamp, Ng, Pleven and Smith, 2008).

Counterparties began to ask AIG for billions in collateral beginning in August 2007. However, AIG was able to negotiate and post less than asked because its valuation of the swaps was still higher than the valuations of many of AIG's counterparties. As the value of the debt on which the swaps were written decreased even further and AIG's exposure to the swaps became more obvious in 2008 (especially when AIG's credit rating was cut in September), AIG was forced to post more collateral and write-down the swaps, leaving them near bankruptcy (Mollenkamp, Ng, Pleven and Smith, 2008).

AIG's demise was especially threatening at the height of the credit crisis. Many of the entities who purchased credit protection from AIG did so as a hedging measure. These entities may have purchased protection to reduce capital requirements for the credit positions those institutions held or to hedge their own positions in the credit derivatives market. For example, Merrill Lynch bought significant protection from AIG on the multi-sector CDOs (credit default obligations comprised of hundreds of securities, each of which was in turn backed by multiple loans) it sold. When AIG stopped writing new protection on multi-sector CDOS in 2005, its exposure was already near $80 billion (Mollenkamp, Ng, Pleven and Smith, 2008).

Many large commercial banks had large total exposure to CDS, although their net exposure was much smaller because they had hedged their positions with counterparties such as AIG. If AIG were to go bankrupt, rendering those contracts void, AIG's counterparties would need to re-hedge their positions. Then protection buyers would be short capital in the eyes of creditors and regulators. These counterparties would rush to buy protection in order to hedge their positions again. Given the massive amount of credit protection sold by AIG, pressure would have mounted in the credit derivatives market as AIG's counterparties attempted to find new protection sellers, thus raising protection prices (Zingales, 2008).

Furthermore, companies using positions with AIG to reduce capital requirements might still be able to meet requirements at the lower protection level, but they may face difficulty in the future if the underlying were actually to default. If the loss of protection left them short of capital, they could raise capital instead of purchasing protection on the underlying debt from another party. Capital was in short supply and thus expensive or impossible to come by at the time of AIG's difficulties. If counterparties failed to meet capital requirements, the counterparties themselves could be forced into bankruptcy. A ripple effect could ensue if these counterparties had sold protection to other parties (Zingales, 2008).

The U.S. government stepped in to prevent the systemic turmoil that might have resulted from an AIG bankruptcy. The government issued an $85 billion loan in September 2008 to AIG, which came along with a 79.9 percent share in AIG (preferred, dividend shares). After AIG used much of the original loan to fund collateral calls, the government altered its intervention plan, first raising the total value of the package to $123 billion, then to $150 billion on Nov. 10, 2008. The second restructuring reduced the loan amount to $60 billion, but cut the interest rate and extended the loan term from two to five years as well. Additionally, the government also gave AIG $40 billion in capital in exchange for preferred, dividend paying shares (the government's stake in AIG remained the same with the restructuring) (Pleven, 2008). The government lent a total of $52.5 billion to two LLCs newly established to buy CDOs that AIG had insured and residential mortgage-backed securities that were part of AIG's securities lending collateral portfolio (Federal Reserve Press Release, 2008). The government would first acquire any payments from these CDOs to repay their loan, and once it was repaid, to recoup AIG's capital. Additional profits would be split (Barris and Cowley, 2008).

Despite the relief provided to AIG by the November restructuring, the company is still in need of cash. Much of the bailout funds from the government had been used as collateral against AIG's swaps, which continued to fall in value (Mollenkamp, Ng, Pleven and Smith, 2008). AIG has been scrambling to divest businesses and assets to raise capital, a feat only made more difficult by the credit crisis, which leaves potential buyers with fewer options for funding (*Wall Street Journal*, 2008). AIG has had difficulty finding buyers of even profitable businesses that were not directly dealing in the investments that caused AIG's near-bankruptcy. For example, AIG sold Hartford Steam Boiler to Munich Re for $742 million in January 2009, far short of the $1.2 billion AIG paid for the specialty reinsurer in 2000 (Cimilluca, Karnitschnig and Pleven, 2008). AIG is especially interested in quickly raising capital to pay back the government in order to attempt to renegotiate the terms of the bailout (Eckblad and Pleven, 2008).

AIG's troubles (and now the taxpayers' troubles, who have an 80 percent share in AIG) also continue to be reflected in its share price, which dropped from $21.96 on Sept. 2, 2008 to $3.95 by Oct. 1, 2008, and has continued to fall to $1.69 on Jan. 2, 2009 (Yahoo! Finance, 2009). Part of the reason for the sustained low share value has been the recent exposition of losses from speculative gambles on the part of AIG on the credit derivatives market, which are not covered under the government bailout (Mollenkamp, Ng and Siconolfi, 2008).

Aside from the potential for far-reaching systemic risks, credit derivatives also pose idiosyncratic risks to investors far removed from large investment banks or financial institutions. Spreading idiosyncratic risks across countries and investors was exactly one of the benefits of credit derivatives hailed by academics and industry advocates, and is now leaving many entities decimated by losses from credit derivative exposure. Public sector and non-profit organizations from municipalities to charities invested heavily in synthetic CDOs. For example, Australian town councils invested $A600 million in CDOs (U.S. $423.85 million), while five school districts in Wisconsin invested $200 million in CDOs. These investors essentially sold insurance on the bond defaults of hundreds of companies through the CDOs. Thus, the investors gained from the "premiums" they received on the CDOs (Whitehouse, 2008).

However, the CDOs were riskier than a pool of the bonds themselves, because investors would be wiped out if only a small percentage of the companies covered (usually around 3–6 percent) defaulted. Investors in these CDOs are writing down the CDOs and taking losses as the risk of default increases and, in some cases, as some of the underlying bonds default. Many of these entities facing losses claim that they did not understand the risks of CDOs when they invested. Many CDOs were designed to meet the minimum requirement for the highest credit ratings (and received high credit ratings while still promising high returns), and most of these are now at junk status (Whitehouse, 2008).

In addition to the causing losses at the level of the individual entity, systemic risk from synthetic CDOs is exacerbating the current credit crisis. Investors in these CDOs are seeking to hedge these instruments by purchasing CDSs on the underlying companies, which pushed swap spreads to record highs in November 2008. In addition to pushing up the price for others seeking to hedge credit risk, the increased swap spreads are making it hard for corporations to borrow, because potential lenders look to the CDS markets to determine how costly the loans would be to insure (Whitehouse, 2008).

Credit derivatives are privately traded contracts on the over-the-counter (OTC) market, through inter-dealer brokers, and thus lacked the pervasive oversight of many other financial instruments. Calls for increased regulation and oversight were heightened by the credit crisis of 2007 and 2008. As a response, three exchanges pushed for the establishment of credit derivatives clearinghouses, and regulators in the United States moved to expedite their creation. Players expect that moving credit derivatives trading to central clearing will increase information about buyers, sellers and trade volumes and reduce counterparty-risk by ensuring funds are available before clearing trades and effectively acting as a counterparty to any trade. However, critics are worried about concentrating counterparty risk with the clearinghouse (Fairless, 2008).

The OTC market poses an impediment to the transparency required to reduce or at least allow market participants to fully understand their counterparty risk. In OTC markets for stocks and bonds, the Financial Industry Regulatory Authority prohibits brokers from sharing or using customer information in a way that distorts trades. Knowledge of another market participant’s intentions before trading can allow certain parties to distort prices in their favor, and thus is usually viewed as unethical. However, given the potential counterparty risk associated with the OTC swaps trades, participants argue information about the identity of the counterparty for credit derivatives trades may actually help reduce participants’ risk, and potentially systemic risk.

Central clearing could potentially help to eliminate this ethical problem by reducing counterparty risk. Since CDSs aren't technically defined as securities and thus are not officially regulated by the Financial Industry Regulatory Authority, the rules are unclear as to how brokers can use information about credit derivatives trades. Aside from this gray area, regulators such as the New York State Attorney General and the SEC are investigating manipulation in the swaps trading market; they are looking for market players who may have spread false information to manipulate prices. Manipulation of swap prices has repercussions for more than just the derivatives market; especially as the credit market has thinned, prices in the CDS market have greatly influenced prices for the underlying's stocks and bonds for some firms (Ng and Rappaport, 2008b).

In addition to these investigations into the swaps market, there are calls to mandate trading of credit derivatives on an exchange. Senate Agriculture Committee Chairman Tom Harkin is proposing a bill that requires all OTC derivatives to be traded on an exchange. His bill, the Derivatives Trading Integrity Act, would mandate regulation of all derivatives by the Commodity Futures Trading Commission (CFTC), including derivatives such as CDSs that are currently excluded from regulation. Regulation by the CFTC would mean credit derivatives could be subject to speculative position limits and federal reporting requirements (Lynch, 2008).

NYSE Euronext (New York Stock Exchange parent) partnered with LCH Clearnet Group Ltd., a U.K. trade-clearing house, to set up a CDS clearing house in Europe. Following its European launch, the NYSE Euronext clearinghouse was the first to receive a temporary exemption by the SEC on Dec. 23, 2008 for CDS trades to be cleared in the United States. The

SEC's move finally moved the United States closer to creating a clearinghouse for credit derivatives trading—a system that regulators and some industry professionals had been calling for since the Bear Stearns sale in March 2008 (Cameron and Scannell, 2008). The CME Group (Chicago Mercantile Exchange parent) and partner Citadel Investment Group received approval for the Credit Market Derivatives Exchange from the New York Fed and the CFTC and is awaiting the SEC exemption (Cameron and Scannell, 2008). They are also in discussions with six potential equity stakeholders as part of an effort to raise a $7 billion fund to back credit derivatives trades made on its clearing system. The third exchange attempting to establish a credit derivatives clearinghouse, Intercontinental Exchange Inc., is still awaiting all approvals, but has the backing of nine of the credit derivatives market's largest participants (Bunge, 2008). Regulators are granting approvals to multiple clearing systems in an effort to maintain competition in the credit derivatives clearing industry (Cameron and Scannell, 2008).

Brokers in the OTC market are also working to reduce risk in the credit derivatives market through measures to increase transparency. They are pushing for more electronic trades (where prices are more transparent)—no credit derivatives were traded electronically in early 2006, but by late 2008, 80 percent of index trades and 50 percent of single name trades were executed electronically. Brokers are also stepping up efforts to check trade details and cancel overlapping trades (Fairless, 2008).

12. Lessons for Enterprise Risk Management

The rapid growth in credit derivatives and the recent financial crisis caused, at least in part, by these instruments provide several valuable lessons for those involved in ERM. These include:

1. Manage for risk, not for regulation. Although banks were able to reduce or eliminate capital allocated to debt hedged with CDSs under applicable regulations, the banks still faced counterparty risk in the event the seller of the CDS could not perform. Risk does not disappear just because regulations do not recognize it.
2. Understand all the significant risks the organization is assuming. This admonition applies to the chief risk officer, to other executives and to board members. If a risk is too complex for its board and officers to understand, the organization should not be accepting that risk. If an organization does not understand an investment it is offered, it should decline. Comprehension cannot be delegated down the hierarchy or to investment advisers.
3. Link incentives to risk. Compensation must reflect the risk assumed to achieve particular outcomes, not just the outcome. Employees should not be compensated simply for volume or growth if those factors significantly increase risk for the firm. If employees are allowed to bet the fortunes of the company and receive high compensation when the results are favorable, they will naturally have an incentive to do so. During the financial crisis of 2008, the high compensation received by executives and other employees of firms that subsequently went bankrupt or required government bailouts drew widespread criticism. Those firms were not providing the proper incentives to employees from the standpoint of their shareholders, debtholders or other stakeholders.

13. Summary

An attractive feature of credit derivatives is their ability to express more granular credit views than the cash bond markets. These more refined positions increase the financial complexity of insurance valuation, which necessitates more informed monitoring of the impacts of the following sub-risk components:

- Relative value, or long and short views between credits
- Capital structure (i.e., senior versus subordinated trading)
- The shape of a company's credit curve
- Macro strategies, i.e., investment grade versus high yield portfolio trading using index products
- Volatility and the timing and patterns of defaults, or correlation trading

Once the upheaval of the current financial crisis is over, it is likely that the credit derivatives market will resume its growth and continue to proliferate newer and more exotic credit risk products. It is also reasonable to expect that management of the credit risk retentions will increasingly become the purview of financial mathematicians and actuaries. Developing a working knowledge of the uses and applications of credit derivatives may soon be requisite of any insurance market professional, including actuaries.

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