Credit Derivatives: An Overview

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Abstract

Credit derivatives arose from the demand by financial institutions to hedge and diversify credit risk, but they have now become a major investment tool as well. Almost all credit derivatives take the form of the credit default swap, which transfers the default risk of one or more corporations or sovereign entities from one party to the other. Up until 2004, the majority of credit default swaps were written on single names, but after the introduction of widely accepted credit indices in 2004 the major impetus to growth and market liquidity has been credit default swaps on indices. The major challenges facing credit derivatives in their first years of existence were resolving ambiguities in reference entities and in definitions of credit events. Since the introduction of index trading and the widespread entry of hedge funds, the major challenges have been in settlement after credit events and in addressing operational backlogs that resulted from increasing numbers of novations. Now that hedge funds are an established part of the market, the next issue of interest is likely to be whether credit derivatives activity will move to exchanges.

A derivative is a bilateral agreement that shifts risk from one party to another; its value is derived from the value of an underlying price, rate, or index. A credit derivative is an agreement designed explicitly to shift credit risk between the parties; its value is derived from the credit performance of one or more corporation, sovereign entity, or security.

Credit derivatives arose in response to demand by financial institutions, mainly banks, for a means of hedging and diversifying credit risks similar to those already used for interest rate and currency risks. But they also have grown in response to demands for low cost means of taking on credit exposure. The result has been that credit has gradually changed from an illiquid risk that was not considered suitable for trading to a risk that can be traded much the same as others.

The plan of the paper is as follows. The first section describes credit default swaps, total return swaps, and asset swaps, but focuses mainly on the mechanics and risks of credit default swaps. The paper then describes the market for credit default swaps and how it evolved, followed by an overview of pricing and the risk management role of the dealer. Next, the paper considers the costs and benefits of credit derivatives and describes some recent policy issues. The paper concludes with a consideration of the possible future direction of the market.

How credit derivatives work

The vast majority of credit derivatives take the form of the *credit default swap* (CDS), which is a contractual agreement to transfer the default risk of one or more *reference entities* from one party to the other (Figure 1). One party, the protection buyer, pays a periodic fee to the other party, the protection seller, during the term of the CDS. If the reference entity defaults, declares bankruptcy, or another *credit event* occurs, the protection seller is obligated to compensate the protection buyer for the loss by means of a specified *settlement* procedure. The protection buyer is entitled to protection on a specified face value, referred to in this paper as the notional amount, of reference entity debt. The reference entity is not a party to the contract, and it is not necessary for the buyer or seller to obtain the reference entity's consent to enter into a CDS.

Risks associated with credit default swaps. In contrast to interest rate swaps but similar to options, the risks assumed by the protection buyer and protection seller are not symmetrical. The protection buyer effectively takes on a short position in the credit risk of the reference entity, which thereby relieves the buyer of exposure to default. By giving up reference entity credit risk, the buyer effectively gives up the opportunity to profit from exposure to the reference entity. In return, the buyer takes on (1) counterparty default exposure to simultaneous default by reference entity and protection seller ("double default"), and (2) counterparty replacement risk of default by protection seller only. In addition, the protection buyer takes on basis risk to the extent that the reference entity specified in the CDS does not precisely match the hedged asset. A bank hedging a loan, for example, might buy protection on a bond issued by the borrower instead of negotiating a more customized, and potentially less liquid, CDS linked directly to the loan. Another example would be bank using a CDS with a five-year maturity to hedge a loan with four years to maturity. Again, the reason for doing so is liquidity, although as CDS markets expand the concentration of liquidity in specific maturities should lessen.

The protection seller, in contrast, takes on a long position in the credit risk of the reference entity, which is essentially the same as the default risk taken on when lending directly to the reference entity. The main difference between the two is the need to fund a loan but not a sale of protection. The protection seller also takes on counterparty risk because the seller will lose expected premium income if the buyer defaults.

One exception to the above risk allocation is the *funded CDS* (also called a *credit-linked note*), in which the protection seller lends the notional amount to the protection buyer in order to secure performance in the event of default. In a funded CDS the protection buyer is relieved of counterparty exposure to the protection seller but the seller now has exposure to the buyer along with exposure to the reference entity. In order to reduce the seller's exposure to the buyer, the parties sometimes establish a special purpose vehicle that stands between the two parties and is independent of default by the protection buyer.

CDS mechanics. Taking each of the features of the CDS in turn, the reference entity refers to the party on which protection is written. For the simplest (*single name*) form of CDS, the reference entity is an individual corporation or government. If a corporate reference entity is taken over by another, the protection typically shifts to the acquiring entity. If a reference entity de-merges or spins off a subsidiary, CDS market participants have developed a set of criteria, known as successor provisions, for determining the new reference entities.

A CDS with more two or more—usually between three and ten—reference entities is known as a *basket CDS*. In the most common form of basket CDS, *the first to default CDS*, the protection seller compensates the buyer for losses associated with the first entity in the basket to default, after which the swap terminates and provides no further protection. CDS referencing more than ten entities are sometimes referred to as portfolio products. Such products are generally used in connection with synthetic securitizations, in which a CDS transfers credit risk of loans or bonds to collateralized debt obligation (CDO) note holders in lieu of a true sale of the assets as in a cash securitization (Figures 2a & 2b).

A major source of credit derivatives growth since 2004 has been index CDS, in which the reference entity is an index of as many as 125 corporate entities. An index CDS offers protection on all entities in the index, and each entity has an equal share of the notional amount. The two main indices are the CDX index, consisting of 125 North American investment grade firms, and the iTraxx index, consisting of 125 euro-based firms, mainly investment grade. In addition, there are indices for North American sub-investment grade firms, for European firms that have been downgraded from investment grade, and for regions such Japan and Asia excluding Japan. In addition to CDS on indices, market participants can buy or sell protection on tranches of indices, that is, on a specific level of losses on an agreed notional amount of an underlying index. For example, an investor can sell protection on the 3-7% tranche of the CDX Investment Grade Index with a notional amount of $100 million, which means the investor could be required to compensate a protection buyer for losses on the index in excess of $3 million but not beyond $7 million, for a maximum of $4 million.

Recent innovations in CDS have extended protection to reference obligations instead of entities. CDS on asset-backed securities (ABS), for example, provide protection against credit events on securitized assets, usually securitized home equity lines of credit. In addition, CDS can specify CDO notes as reference obligations. Finally, Loan CDS can reference leveraged loans to a specific entity.

With regard to credit events, the confirmation of a CDS deal specifies a standard set of events that must occur before the protection seller compensates the buyer for losses; the parties to the deal decide which of those events to include and which to exclude. Which events are chosen varies according to the type of reference entity. First, the most commonly included credit event is *failure to pay*. Second, *bankruptcy* is a credit event for corporate reference entities, but not for sovereign entities. Third, *restructuring*, which refers to actions such as coupon reduction or maturity extension undertaken in lieu of default, is generally included as a credit event for corporate entities. Restructuring is sometimes referred to as a "soft" credit event because, in contrast to failure to pay or bankruptcy, it is not always clear what constitutes a restructuring that should trigger compensation. Fourth, *repudiation* or *moratorium* provides for compensation after specified actions of a government reference entity and is generally relevant only to emerging market reference entities. Finally, *obligation acceleration* and *obligation default*, which refer to technical defaults such as violation of a bond covenant, are rarely used.

The third feature of a CDS, the settlement method, refers to the means by which the protection seller compensates the buyer in the event of default. There are two types of settlement, *physical settlement* and *cash settlement*. If a credit event triggers a CDS with physical settlement, the protection buyer delivers to the protection seller the defaulted debt of the reference entity with a face value equal to the notional amount specified in the CDS. In return, the protection seller pays the par value, that is, the face amount, of the debt. If the event occurs in a CDS with cash settlement, an auction of the defaulted bonds takes place in order to determine the post-default market value. Once this value is determined, the protection seller pays the buyer the difference between the par value, which is equal to the CDS notional amount, and the post-default market value. Physical settlement was the standard settlement method for most CDS until 2005, but is in the process of being replaced by cash settlement for reasons that will be discussed in a later section.

The last major feature of a credit default swap is the premium, commonly known as the CDS spread; it will be discussed in more detail in a later section. The spread is essentially the internal rate of return that equates the expected premium flows over the life of the swap to the expected loss if a default occurs at various dates. The buyer and seller agree on the spread on the trade date, and the spread remains constant for the life of the CDS; the only exception is a *constant maturity CDS*, in which the credit spread is reset periodically to the current market level. The CDS spread is quoted as an annual premium, such as 1.00 percent or 100 basis points per annum, but is actually paid in quarterly installments during the year.

Transaction mechanics. In the early stages of a trading relationship, the contracting parties conduct credit analysis of each other and negotiate the terms of the agreement under which future transactions will take place. For over-the-counter derivatives, including credit derivatives, the most commonly used agreement is the International Swaps and Derivatives Association (ISDA) Master Agreement. The Agreement includes terms that the parties wish to include in all future transactions, for example, governing law, covenants, and so on. Once the parties execute the Agreement, it serves as the contract under which all future OTC derivatives deals take place. Each deal is evidenced by a confirmation, which contains the terms of the individual transaction such as reference entity, maturity, premium, notional amount, credit events, and other transaction-specific terms. The terms of the confirmation in turn draw from the ISDA Definitions pertaining to the product; for CDS, the relevant definitions are the 2003 ISDA Credit Derivatives Definitions.

Execution of a deal involves negotiating the deal terms, which as mentioned above are listed in the confirmation. The generation of the confirmation is of particular importance because it is necessary that both parties agree on the same terms; if they do not specify precisely the identity of the reference entity, for example, it is possible that a protection buyer might claim that the entity defaulted but the payer might refuse payment because the entity described in the confirmation is not identical to the one that defaulted. In most transactions, market participants will choose from a standard menu of contract terms, which have been developed by means of ISDA committees. As in all OTC derivatives, however, the parties are free to negotiate terms that differ from market standards.

Following the execution of the trade, the parties will monitor for occurrence of credit events. In addition, the parties will also have to amend trades to account for succession events in which the reference entity changes form as mentioned previously. Finally, if a credit event occurs the parties settle the CDS obligations according to procedures set forth in the ISDA documentation.

Other credit derivatives. The credit default swap in various forms accounts for the vast majority of credit derivatives activity. There are three related products that deserve mention, however.

First, a *total return swap* transfers to total economic performance of a reference obligation from one party (total return payer) to the other (total return receiver). In contrast to a credit default swap, the total return swap transfers market risk along with credit risk. As a result, a credit event is not necessary in order for payment to occur between the parties.

A total return swap works as follows (Figure 3). The total return payer normally owns the reference obligation, and agrees to pay the total return on the reference obligation to the receiver. The total return is generally equal to interest plus fees plus the appreciation or depreciation of the reference obligation. The total return receiver, for its part, will pay a money market rate, usually Libor, plus a negotiated spread, which is generally independent of the reference obligation performance. The spread is generally bounded by funding costs: the upper bound is the receiver's cost of funding, and the lower bound is the payer's cost of funding the reference obligation. If a credit event or a major decline in market value occurs, the total return will become negative so the receiver will end up compensating the payer. The end result of a total return swap is that the total return payer is relieved of economic exposure to the reference obligation but has taken on counterparty exposure to the total return receiver. The most common total return receivers are hedge funds seeking exposure to the reference obligation on terms more favorable than by funding a direct purchase of the obligation; this is sometimes known as "renting the balance sheet" of the total return payer, which is normally a well-capitalized institution such as a bank.

In addition to total return swaps, *asset swaps* are sometimes classified as credit derivatives although they are in fact interest rate derivatives. Whatever their classification, they are relevant to credit derivatives because they are related by arbitrage to credit default swaps. An asset swap combines a fixed rate bond or note with an interest rate swap (Figure 4). The party that owns the bond pays the coupon into an interest rate swap with a similar maturity to the bond. Because the bond coupon is typically larger than the current swap rate for that maturity, the Libor leg of the floating rate swap is increased by a spread equal to the difference between the underlying bond coupon rate and the interest rate swap rate prevailing on the trade date. Because the interest rate swap effectively strips out the interest rate risk of the bond, the bondholder is left mainly with the credit risk of the bond (along with some counterparty credit risk on the swap). The asset swap spread compensates the bondholder for the credit risk; for this reason, the asset swap spread should be related by arbitrage to the credit default swap spread. This relationship will be discussed in more detail in the section on Pricing.

One last type of credit derivative is the *credit spread option*, which gives the buyer the right but not the obligation to pay or receive a specified credit spread for a given period. Such products were never more than 5 percent of notional amounts outstanding and are now about 1 percent (British Bankers Association 2006), so they are of mainly historical interest. It appears that credit spread options have given way to swaptions on CDS, which give the buyer the right but not the obligation to buy or sell CDS protection.

In the remainder of this paper, credit derivatives and credit default swaps will mean the same thing unless otherwise specified.

The market for credit derivatives

According to the British Bankers Association, the notional amount outstanding of credit derivatives has grown from $180 billion in 1997 to over $20 trillion in 2006 (Chart 1). Other surveys report higher numbers. ISDA, for example, began collecting CDS notional amounts in 2001, and reports growth from $632 billion in 2001 to over $34 trillion by the end of 2006; annual growth has exceeded 100 percent since mid-2004. And the Bank for International Settlements, which began collecting comprehensive statistics in 2004, reports growth of notional amount from $6.4 trillion at the end of 2004 to over $20 trillion as of June 2006 (BIS 2006).

Average notional amounts for individual deals range from $10 million to $20 million for North American investment grade credits, and are about €10 million for European investment grade credits; sub-investment grade credits have notionals that average about half the amounts for investment grade (JP Morgan Chase 2006). The most liquid maturities center on five years, but liquidity is increasing for shorter maturities and for longer maturities out to ten years (BBA 2006).

Table 1 shows the breakdown by product type. According to the British Bankers Association, CDS on indices have recently passed CDS on single names as the dominant product type (BBA 2006). Single name CDS were 38 percent of notional amount outstanding in 1999, grew to as high as 51 percent in 2004, and are 33 percent as of 2006. CDS linked to indices and to tranches of indices have grown from virtually nothing in 2003 to 38 percent of outstandings. Finally, CDS referencing portfolios of names in synthetic securitization transactions have declined slightly from 18 percent in 2000 to just over 16 percent in 2006. The "Others" category includes total return swaps and asset swaps, which are now less than 6 percent of outstandings; in 2000, in contrast, total return swaps were 11 percent of outstanding amounts, asset swaps were 12 percent (BBA 2002).

Tables 2 and 3 show the breakdown of market participant by type. Banks and securities firms were dominant in 2000, at over 80 percent of protection buyers and over 60 percent of protection sellers. By 2006, they had declined in importance to about 60 percent of buyers and 44 percent of sellers. Recent data distinguish between banks' trading activities and credit portfolio management activities: trading activities are roughly balanced between buying and selling protection, while credit portfolio managers appear more likely to hedge by buying protection rather than to seek diversification through selling protection. Insurance companies tend to be active as sellers of protection; they were 23 percent of sellers (and 7 percent of buyers) in 2000 but dropped to 17 percent of sellers by 2006. The most significant change has been in the importance of hedge funds, which tend to function as both buyers and sellers: In 2000, hedge funds were 3 percent of buyers and 5 percent of sellers, but by 2006 had grown to 28 percent of buyers and 32 percent of sellers.

Table 4 shows the most common CDS counterparties from 2002 through 2005, which essentially shows the most active dealers in the market. Finally, Table 5 shows the most common reference entities for single name CDS, both by deal count and by underlying notional amount (Fitch 2006).

Evolution of the market. Charles Smithson (2003) has identified three stages in the evolution of credit derivatives activity. The first "defensive" stage was the late 1980s and early 1990s, and was characterized by ad hoc attempts by banks to lay off some of their credit exposures. In addition, products such as securitized asset swaps bore some resemblance to credit default swaps in that they paid investors a credit spread while providing for delivery of the underlying asset to the investor in the event of a default.

Stage two, which began about 1991 and lasted through the mid- to late-1990s, saw the emergence of an intermediated market, in which dealers applied derivatives technology to the transfer of credit risk while investors entered the markets to seek exposure to credit risk (Spinner 1997). Examples of dealer applications of derivative technology include two transactions by Bankers Trust (Das 2006, pp. 269-70). The first involved a total return swap with another bank client seeking to free up credit lines with a major client. The swap enabled to bank to pass its credit risk to Bankers Trust, which in turn hedged its risk by selling the client's bonds short. The second involved a funded first-to-default CDS on several Japanese client banks, against which Bankers Trust had substantial credit exposure in the form of in-the-money options. Although defensive in nature from Bankers Trust's viewpoint, the transaction appealed to investors seeking yield enhancement by buying the credit-linked notes issued by Bankers Trust.

Another innovation during this phase was the synthetic securitization structure, as mentioned above and shown in Figure 2b. Synthetic securitization represented the extension of credit derivatives to structured finance, that is, to the combining of derivatives with cash instruments or with other derivatives in order to attain a desired exposure. The first synthetic securitization transactions included the Glacier transaction, developed by SBC Warburg (now UBS), and the Bistro transaction, developed by J.P. Morgan (now JP Morgan Chase). Glacier was a *funded structure*, which means that SBC transferred to investors the entire credit risk of approximately $1.75 billion of loans by means of credit-linked notes. Bistro, in contrast, was a *partially funded structure*, in which Morgan transferred to investors approximately 10 percent of the credit risk by means of a credit default swap while retaining any loss beyond that in the form of a "super-senior" tranche. Although the transactions appear defensive from UBS and Morgan's point of view, they also appealed to investors seeking exposure to credit risk..

Investors benefited from the above second stage innovations in at least two ways. First, investors could attain exposure to loans, which had previously been out of reach due to the lack of a credit processing infrastructure among buy-side firms. Second, investors could attain exposure to credit risk without having to accept exposure to interest rate risk as well; asset swaps were an early means of attaining such exposure.

The third stage saw the maturing of credit derivatives from a new product into one resembling other forms of derivatives. Single-name credit default swaps emerged during this period as the "vanilla," or generic, credit derivatives product, while structured finance groups combined credit derivatives into "arbitrage" CDO packages geared to investor demands. Major financial regulators issued guidance for the regulatory capital treatment of credit derivatives, which served to clarify the constraints under which the emerging market would operate. Further, ISDA in 1999 issued a set of standard Credit Derivatives Definitions for use in connection with the ISDA Master Agreement. Finally, dealers began warehousing risks, for example, and running hedged and diversified portfolios of credit derivatives.

During this stage, the market encountered a series of challenges that led to calls for further refinement to the documentation. One such problem was restructuring. The 1999 Definitions included debt restructuring—that is, actions such as lowering coupon or extending maturity—as a credit event triggering payment under a CDS. The definition was put to the test with the restructuring in 2000 of loans to Conseco. Banks agreed to extend the maturity of Conseco's senior secured loans in return for higher coupon and collateral; protection was thereby triggered on about $2 billion of CDS. Protection buyers then took advantage of an embedded "cheapest to deliver" option in CDS by delivering long-dated senior unsecured bonds, which were deeply discounted—worth about 40 cents on the dollar—relative to the restructured loans, which were worth over 90 cents on the dollar. Protection sellers ended up absorbing losses that were greater than those incurred by protection buyers, which led many sellers to question the workability of including restructuring. The problem was complicated further by the insistence by some regulators that CDS cover restructuring in order for a CDS hedge to qualify for capital relief. The result, arrived at through ISDA committee efforts, was a set of modifications to the definition of restructuring that placed some limits on deliverable bond maturity and therefore on the cheapest to deliver option.

Another problem involved apportioning credit protection when a reference entity de-merges or spins off part of its activities into new entities. The problem arose in the United Kingdom in 2000, when National Power de-merged into two companies, one of which inherited 56 percent of National Power's obligations and the other held the rest. The problem was to determine the new reference entity for CDS referencing National Power, but the 1999 Definitions did not provide sufficient guidance to assure the market that courts would agree on the outcome. The result was to develop a set of detailed "Successor" provisions, which provided quantitative thresholds for such cases.

Yet another problem was debt moratoria or repudiations in emerging markets. During the Argentine debt crisis of 2002, there were several changes of government, involving a succession of officials that made threats regarding debt repudiation. The problem arose that, under the 1999 Definitions, it might be possible to declare a repudiation credit event following a statement by a government official even if in the end the government did not fail to pay its obligations. In order to reduce the risk of declaring a credit event prematurely, ISDA developed more stringent criteria for such an event.

The foregoing problems led to the issuance by ISDA in 2003 of a new set of Credit Derivatives Definitions. At this point, one can add a fourth stage to those catalogued by Smithson, namely, the development of a liquid market. In addition to the new ISDA Credit Derivatives Definitions, dealers in 2003 began to trade according to certain standardized practices—standard settlement dates, for example—that went beyond those adopted for other OTC derivatives. Further, index trading began on a large scale in 2004 and grew rapidly after that. The wide acceptance of index trading at that time was in part the result of the merger of the iBoxx and Trac-x credit indices into iTraxx for Europe and CDX for North America. The mergers provided market participants with a single index, subject to transparent rules and a high degree of standardization, for each major market. At the same time, dealers took deliberate measures to promote liquidity in index trading; such measures included the development of master confirmations, commitments to quote tight bid-offer spreads, and allowing investors to trade out of an old index and "roll" into the new one at mid-market spreads. Index trading was more appealing to investors than single-name trading because indices provide diversified exposure instead of concentrating it on one name. The results went well beyond expectations: According to one survey, index product growth was 900 percent in 2005 (Fitch 2006).

This last stage saw the entry of hedge funds on a large scale as both buyers and sellers (Tables 2 and 3). Hedge funds use credit derivatives in a variety of ways, all of which tend to augment market efficiency and price discovery as well as to increase liquidity. First, hedge funds use credit derivatives in their convertible bond arbitrage activities in order to strip out unwanted credit risk. Second, hedge funds can buy and sell protection in order to profit from perceived mispricing. Finally, hedge funds engage in basis trading between credit default swaps and assets swaps on cash bonds. All these activities serve to increase liquidity and efficiency in the market.

Pricing, valuation, and risk management

CDS pricing and valuation. The premium for a credit default swap is commonly known as a CDS spread, and is quoted as an annual percentage in basis points of the notional amount. Although quoted as an annual percentage, protection buyers actually pay the spread on a quarterly basis, that is, in four installments per year. Further, in contrast to other OTC derivatives, CDS have standard payment dates, namely, March 20, June 20, September 20, and December 20; these standard payment dates also serve as standard maturity dates. CDS transacted prior to a standard payment date are subject to a "stub" period up to the first standard payment date and follow the standard schedule afterwards. A CDS with a five-year maturity agreed on May 1, 2007, for example, would become effective on May 2 with accrued premium due on June 20; subsequent payments would occur on regular dates after until maturity on June 20, 2012. If the spread for a distressed credit is sufficiently high, the CDS will trade "up-front," that is, the buyer will pay the present value of the excess of the premium over 500 basis points at the beginning of the trade, and pay 500 basis points per annum for the life of the swap.

There are two basic ways of determining a CDS spread, namely, from asset swap spreads and from calculation of expected CDS cash flows. Assets swaps, which were described in a preceding section and shown in Figure 4, are related to credit default swaps because both products serve to unbundle credit risk. In an asset swap, an investor purchases a cash bond—preferably priced at par—and pays the bond coupon into an interest rate swap of the same maturity. As mentioned previously, the swap counterparty adjusts the Libor leg of the swap for the difference between the bond coupon rate and the par swap rate for the same maturity; the difference is known as the asset swap spread and compensates the investor for the default risk on the bond.

The asset swap spread performs essentially the same function as a CDS spread, so the two should be related by arbitrage. If CDS spreads are low relative to asset swap spreads, for example, a dealer or investor could buy an asset-swapped bond and offset it by buying protection (selling the credit short) and locking in a profit. Such arbitrage should lead to convergence between CDS spreads and asset swap spreads (narrowing of the basis). Arbitrage in the other direction is not as straightforward, however: If CDS spreads are higher than asset swap spreads, arbitrage requires selling protection (long the credit) and selling the bond short, which is not always feasible and will depend crucially on the liquidity of the underlying bond market.

The possibility of arbitrage between CDS and asset swaps will nonetheless tend to reduce the basis between the two rates. But other factors are also at work to keep the rates from converging (Choudhry 2006). Supply and demand factors might affect the price of CDS relative to bonds in several ways. Structured finance activity, for example, might lead to sales of protection to fund CDO notes, thereby driving down CDS spreads relative to bonds. Similarly, investors with high funding costs might prefer to take on credit risk by selling protection rather than by purchasing bonds financed by borrowing, again driving down spreads relative to bond yields. And in the other direction—along with difficulty in conducting basis trades involving short bond positions—a bond trading below par will tend to push CDS spreads higher relative to bond yields. The reason is that a protection seller pays out the difference between par value and post-default price, while an investor who bought the bond below par has lost only the difference between the below-par purchase price and the post-default price. The result of the above factors is that, even if asset swap spreads will not in most cases converge to CDS spreads, they are a reasonable starting point for calculating the spread.

As an alternative to relying on asset swap spreads, CDS pricing models seek to calculate CDS spreads by calculating expected cash flows. In such models, the CDS spread is an internal rate of return that equates present value of expected premium payments to present value of expected loss payments, that is:

$$\text{PV}(\text{Expected spread payments}) = \text{PV}(\text{Expected default losses})$$

where:

$$\text{PV}(\text{Expected spread payments}) = \text{Spread} \times \sum_{i=1}^{n} \text{DCF}_i \times \text{PS}_i \times \text{PV}_i(\text{N})$$

and

$$\text{PV}(\text{Expected default losses}) = \text{LGD} \times \sum_{i=1}^{n} \text{CPD}_i \times \text{PV}_i(\text{N})$$

using the following notation:

Spread = Fixed CDS spread

DCF_i = Day count fraction relevant to period i

PS_i = Probability of no default from inception to period i

$\text{PV}_i(.)$ = Present value operator for period i

N = Notional amount of CDS protection

LGD = Loss rate given default, equal to (1 – Recovery rate); assumed fixed

PD_i = Probability of default in period i

Solution of the model involves calculating the spread that equates net present value to zero—that is, an internal rate of return—under an assumed LGD. The survival and default probabilities come from outside the model; alternatively, market spreads can be used to calculate implied probabilities of default under an assumed LGD. For simplicity, the above equations ignore accrued spread, which in the event of default would be payable by the buyer to the seller for the fraction of the period from the last premium payment date to the default date.

After inception, the value of the CDS will depend mostly in changes in credit quality as reflected in current credit spreads. Given that the CDS spread for a transaction remains fixed, the mark-to-market value of the CDS will be equal to the present value of the spread differences over the life of the CDS, taking account of survival probabilities and, again, ignoring accrued premium. Letting Spread_0 equal the CDS spread fixed at inception and Spread_i equal the current market spread, mark-to-market value from the buyer's point of view is:

$$\text{MTM}_i = (\text{Spread}_i - \text{Spread}_0) \times \sum_{i=1}^{n} \text{DCF}_i \times \text{PS}_i \times \text{PV}_i(\text{N})$$

If the buyer were to unwind at this point (to be discussed in the section on novations), the above equation represents the amount payable to the buyer.[1]

Just as there are difficulties using asset swap spreads, there are problems associated with models such as that described above. A major difficulty is that the model requires that one assume an LGD and furnish exogenous probabilities of default in order to calculate an implied CDS spread. Alternatively, one could use current market CDS spread calculate an implied probability of default, but doing so would still require assuming an LGD. Assumptions regarding recoveries therefore are important to CDS pricing and valuation. In practice, market participants can model the effect of alternative LGD assumptions, and can set aside reserves against differences in assumptions (JP Morgan Chase 2006, pp. 92-93; Chaplin 2005, p. 105).

Risk management. The purpose of a derivatives dealer, along with making a two-way market, is to earn profits by managing the risk of a portfolio of derivatives. For credit derivatives, the risk management function is similar in form to that for other types of derivatives. When a dealer takes on risk from a client, the dealer typically hedges the risk but might elect to leave some of the risk uncovered; the willingness of dealers to leave some risks uncovered—that is, to speculate—adds liquidity to the market but requires close management.

Typically, however, dealers hedge their risks in some manner. Most simply, a dealer might offset the risk of a new deal against that of other clients. Further, the dealer might hedge the risk of a deal in the underlying market, that is, the cash bond market; for that reason, credit derivatives and corporate bond risks are often managed together. Finally, a dealer might choose to offset risks by means of offsetting transactions with other dealers; this is a primary function of the interdealer market.

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[1] For a more detailed practitioner-oriented discussion of CDS pricing, see Chaplin (2005).

In the early stages of credit derivatives as described above, risk management essentially consisted of laying off one's own risks. As the market developed into a two-sided market, dealers assumed the role of intermediaries between buyers and sellers and taking on the basis risk between the two. In these early stages of development, dealers tended to hedge new transactions with offsetting cash market positions to the extent feasible or else with offsetting transactions.

As the market has developed, additional hedging alternatives have become available. The growth of index CDS, for example, has increased the flexibility of dealers in their risk management activities. After the advent of widely-traded index CDS, market liquidity increased significantly and new market participants entered both as buyers and sellers. In such an environment, the business has evolved into a "flow" business: That is, traders tend to remain "flat" by buying and selling continually instead of by taking large open long or short positions. But trading desks also can use index CDS to hedge their single-name CDS. For example, on any given day spreads tend to move in the same direction, so index swaps might be a reasonable hedge of a diversified single-name CDS portfolio; as with other hedges, the dealer would assume and manage the basis risk between the two.[2]

Along with the market risks of their deal portfolios and the accompanying basis risks, dealers manage a host of other risks. First, counterparty credit risk is a major component of all OTC derivatives activity. Counterparty risk management begins with ISDA or other relevant transaction documentation, followed by measurement of both current exposure and potential losses if default were to occur in the future, and finally by collateralization of net exposures. Second, dealers manage such risks as time decay, in which deals lose value as they approach

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[2] This is roughly equivalent to hedging interest rate swaps with Treasury bonds or an equity portfolio with S&P 500 futures.

maturity. Finally, dealers manage model risks, which are associated with the simplifying assumptions as well as unidentified errors in pricing models; in order to anticipate the possibility of model deficiencies, dealers calculate potential losses from modeling errors and set aside reserves to cover them.[3]

One unique aspect of credit derivatives activity compared with other OTC derivatives is in liquidity management. Credit derivatives are characterized by a higher degree of standardization than are other forms of OTC derivative, although the standard terms are not mandatory as in exchange-traded futures. As noted above, CDS involve standard payment and maturity dates. Further, each type of reference entity involves a standard set of credit events and other terms. Standard terms facilitate trading by simplifying negotiation as well as simplifying such tasks as unwinds; they also simplify the ability of market participants to engage in arbitrage between CDS indices and underlying names. The reason credit derivatives participants have adopted a higher degree of standardization is the different nature of credit risk from other underlying risks. Unlike interest rate swaps, in which the various risks of a customized transaction can be isolated by traders and offset in liquid underlying money and currency markets, credit default swaps involve "lumpy" credit risks that do not lend themselves to decomposition. Standardization is therefore a substitute for decomposition. Yet despite the higher degree of standardization, CDS retain their essential nature as OTC rather than standardized transactions: Parties to CDS deals remain free to diverge from the market standard and to customize transactions to whatever extent they agree.

Benefits and costs of credit derivatives

[3] Chaplin 2005, pp. 100-106.

Benefits. Credit derivatives emerged in response to two long standing problems in banking. First, lending operated under the handicap that hedging credit risk was seldom if ever feasible. In financial terms, the problem was that it was not generally feasible to take a short position in credit. Although it is theoretically possible to sell a corporate bond short, many borrowers do not have liquid debt outstanding so borrowing for a short sale is often not feasible. The result is that, if a credit deteriorates, there is little a lender can do to protect itself prior to default other than taking collateral, which might not be effective in many distressed cases, or by selling the loan, which normally requires the consent of the borrower.

A second problem was diversification of credit risk. Financial economists have long noted the benefits of applying a portfolio approach to loans by means of diversification (Flannery 1985), but practical considerations made diversification difficult to achieve in practice. Relationship considerations, for example, were an obstacle to diversification by deliberately reducing exposure to major clients. Further, the statistical properties of credit risk—that is, non-normality of loss distributions and the resulting effect of specification errors in determining losses in the tail of the distributions—suggest that a truly diversified loan portfolio requires a significantly larger number of credits than would an equity or bond portfolio (Smithson 2003, pp. 34-38). In practice, therefore, the most practically feasible way to diversify a lending business is to grow to a large size by means of acquisition of other banks.

Buying protection by means of credit derivatives provide a solution to both of the foregoing problems. By providing a means of taking a short credit position, credit derivatives enable banks to hedge their exposure to credit losses. A major benefit is that; in contrast to loan sales, consent of the reference entity is not required for a CDS. As a result, lenders also have a solution to the second problem, diversification. By hedging selectively, a bank can reduce its exposure to certain entities, thereby attaining its diversification objective without jeopardizing the client relationship.

Another benefit to the protection buyer is the ability to act on a negative credit view. If an investor believes that the market is overly optimistic about a reference entity's prospects, for example, the investor can buy protection now in anticipation of deterioration. If the investor's view turns out to be correct, it can unwind the transaction at a profit by selling protection on the entity. Such speculative activity has the beneficial effect of adding liquidity to the market and of increasing the quality of price discovery (International Monetary Fund 2006, Chapter II).

Market participants can also use CDS to engage in arbitrage between markets. In convertible bond arbitrage, for example, an investor buys a convertible bond in which the embedded equity option is underpriced, uses an asset swap to hedge out the interest rate risk, and then buys credit protection to hedge out the credit risk. The result is that the investor is left with a pure equity exposure, which is the object of the arbitrage.

With regard to sellers of protection, credit derivatives enable market participants to attain exposure in the form of a long credit position. A financial institution seeking to diversify its credit exposure might, for example, sell CDS protection as an alternative to making loans or buying bonds. This is especially helpful to institutions that seek credit exposure but lack the legal infrastructure for lending; it is also helpful to banks seeking to diversify their loan portfolios but lacking direct relationships with desired credits. Further, selling protection allows an investor with a high cost of funding to take on credit exposure without incurring the cost of funding. It is important in such cases that the investor realizes that the exposure to losses is the same as if it were lending directly.

The ability to sell protection also allows market participants to act on a view that a reference entity's credit quality will improve. In this case, the investor would sell protection now in the hope of unwinding it later by purchasing it at a lower price. As mentioned above, such activity adds liquidity to the market and increases the quality of price discovery.

Another benefit of credit derivatives is that they add transparency to credit markets (Kroszner 2007). Prior to the existence of credit derivatives, it was difficult to determine a price for credit risk and there was no accepted benchmark for credit risk. As credit derivatives become more liquid and cover a wider range of entities, however, lenders and investors will be able to compare pricing of cash instruments such as bonds and loans with credit derivatives. Further, investors will be able to engage in relative value trades between markets, which will lead to further improvements in efficiency and price discovery.

At a higher level, economic stability stands to benefit from the ability to transfer credit risk by buying and selling protection. As with other derivatives, the cost of risk transfer is reduced so risk is dispersed more widely into deeper markets. The result is that economic shocks should have less effect than was the case prior to the existence of derivatives. There are several objections to such an argument, however, and these will be considered in the next section.

Costs. It is often argued that the flip side of wider and deeper risk transfer is that, instead of exerting a stabilizing influence on markets, it is potentially destabilizing because it transfers risk from participants that specialize in credit risk—that is, banks—to participants with less experience in managing credit risk—for example, insurers and hedge funds (Economist 2005, for example). In addition, there is the danger that anything used to disperse risk can also be used by investors seeking yield enhancement to concentrate risk. Finally, these new institutions generally fall outside the regulatory reach of agencies that oversee various aspects of the credit markets.

There are weaknesses with such arguments, however. While it is true that banks traditionally specialize in managing credit risk, for example, it is also true that traditional bank lending has tended to concentrate credit exposures in a narrow class of institutions, namely, commercial banks. Further, one could argue that non-bank institutions might in many cases have liability structures that are more suitable than those of banks for bearing credit risks (International Monetary Fund 2006, Chapter II). But even if one were to accept the questionable argument that non-bank investors are inevitably less skilled than banks at managing credit risk, it would also be the case that credit losses would have less effect on any one institution than was the case when credit was limited mostly to banks. Finally, the argument that transferring credit risk outside strictly regulated institutions ignores the potential moral hazard associated with regulated markets. That is, because less regulated institutions are less likely to be protected by an official safety net, there are likely to be substantial incentives among such institutions to identify, measure, and manage credit exposures (Kroszner 2007).

Another commonly cited cost of credit derivatives is that it reduces incentives of lenders to analyze and monitor credit quality because they now have the ability to off-load credit risk (Jackson 2007, for example). The result is a decrease in overall credit quality. Again, there are weaknesses to such arguments, mainly that hedging is not costless. As is true with other risks, when one hedges away a risk, one also hedges away the opportunity to profit. A possible exception to this rule would be systematic underpricing of CDS protection relative to loan risk, for which there is no evidence. Another possible exception is a “lemons” argument that lenders use collateralized debt obligations to off-load risks to protection sellers, although one would expect that such a practice, if widespread, would induce CDO note buyers to build expectations of higher losses into the price of the credit protection they provide. Yet another exception would be the possession by lenders of inside information about credit quality, on which they could act by buying underpriced protection. This issue has already received extensive attention by the financial industry (Joint Market Practices Forum, 2003), however, and one would not expect such activity be a systematic feature of credit derivatives markets.

A corollary to the above argument that lenders with access to credit protection are indifferent to risk is that credit derivatives, as do other forms of risk transfer, inevitably involve a moral hazard effect that leads to higher risk overall (Plender 2006). In other words, risk reduction at the individual entity level can mean higher risk at the system level. Such an argument has an element of plausibility in that, when market participants are able to hedge a risk, they are able to increase the amount of risk they take. But even if firms do take on more risk than before, one could argue that, so long as firms do not take on excessive amounts of risk, the system is in fact safer because the individual institutions that hedge are less vulnerable to market shocks.

Recent credit derivatives policy issues

Novations and operational backlogs. The entry of hedge funds and other investors into credit derivatives has been an important factor in the development of CDS market liquidity and efficiency. Such investors enter primarily to take positions. As described above, an investor who believes protection on a reference entity to be underpriced can buy protection in anticipation that spreads will widen; if the view turns out to be correct, the fund reverses the transaction at a profit. Similarly, a fund that believes that a distressed credit's prospects will improve could sell protection in the hope of unwinding at a profit if the improvement occurs.

In order to understand the novations problem, it is necessary to understand how OTC derivatives trade. OTC derivatives do not trade in the same way as securities, that is, by means of transfer of ownership. Instead, they trade "synthetically" by three different means, each of which involves payment by one party to the other of a transaction's mark-to-market value. First, the parties can agree to a *termination* (or *tear-up*), under which they agree to extinguish the original obligation following payment. Second, one party can enter into an *offsetting transaction*, which leaves the original transaction in place but effectively cancels out its economic effect. Finally, a party can enter into a *novation*, also known as an *assignment*, under which the party (transferor) transfers its rights and obligations under the transaction to a third party (transferee) in exchange for a payment. Following the novation, the parties to the transaction are the transferee and the remaining party. The ISDA Master Agreement requires a transferor to obtain prior written consent from the remaining party before a novation takes place.

Until relatively recently, novations were relatively infrequent; the usual method of exiting a transaction was an offsetting transaction. As hedge funds became more active in CDS, however, novations became increasingly common. Investors, and especially hedge funds, tend to prefer unwind through novation to unwind through offset because they are reluctant to incur additional credit exposure in the form of an offsetting swap. And they generally prefer novation to termination because termination limits unwind possibilities to the original counterparty and has the potential of providing insights into trading strategies to the counterparty. The result was an increase in novations, especially as index trading grew; one estimate placed novations at 40 percent of trade volume (CRMPG II 2005).

Novations became a problem because of failure of participants to follow established procedure. First, an investor wishing to step out of a transaction via novation might not obtain prior consent from the remaining party. Second, the transferee might not verify that the transferor had obtained clearance. Finally, the remaining party, which might not have been aware of the novation until the first payment date following, might later on back-date its books to the novation date and simply change the counterparty name. The finger pointing went further: When dealers complained that investors failed to obtain consent, investors countered that remaining parties might give consent but fail to transmit the necessary information to the back office in a timely manner. Although novations in such cases did not typically lead to significant adverse credit exposures for dealers—transferees are virtually always dealers and therefore better capitalized than the hedge fund transferors—they did present substantial operational problems in the form of confirmation backlogs.

The industry was aware of the problem. ISDA addressed the issue in 2004 by developing novation definitions, a standard novation confirmation, and a best practices statement. Regulators were also aware of the problem, and in some cases expressed concern publicly (Evans 2005). A solution did not ensue, however, because of competitive pressures and the lack of incentive to act alone. On the one hand, dealers were aware of the problem and would benefit if all parties to novations followed established procedures. But on the other hand, refusing to agree to novations if procedures were not followed would lead to losing potentially profitable business to those dealers that did not insist on proper procedures. The industry consequently found itself in a Prisoners' Dilemma situation in which each party would benefit from adhering to proper procedures but had no means of knowing whether other parties would do so as well. The result was no change, and confirmation backlogs increased.

During August 2005, however, Federal Reserve Bank of New York President Timothy Geithner invited fourteen major credit derivative dealers to a meeting to discuss CDS operations issues, with particular attention to confirmation backlogs. At the meeting, which occurred the following month, the dealers agreed to reduce backlogs and to report their progress periodically.

The effort to reduce backlogs led to increased efforts within ISDA to complete a solution to the novations issue. The solution, known as the ISDA Novations Protocol was announced just before the New York Fed meeting in September (Raisler and Hunt 2006). The protocol entailed extensive negotiation between dealers, hedge funds, and other participants, and specified a set of explicit duties for the parties to a novation. Under the protocol, parties wishing to act as transferees are required to obtain prior consent, but are now able to do so electronically. If the remaining party provides consent prior to 6 pm New York time, the novation is complete; the remaining party can respond by email. If the remaining party does not provide consent prior to 6 pm, the transferor and transferee enter into an offsetting transaction that obtains a similar economic result to the novation.

Market participants were given a deadline to sign on to the ISDA Novation Protocol; dealers agreed not to transact novations with parties that did not agree. In order to provide assurance that remaining parties would not respond promptly to novation requests, dealers committed to specific standards for responding by the deadlines in the protocol. The result has been considered a success: 2,000 parties signed on to the original Novation Protocol, and almost 190 entities have signed on to a version designed for new participants.

Initial assessments of the protocol have been favorable. These assessments have corresponded to reports that the industry has made considerable progress in reducing confirmation backlogs and increasing overall operational efficiency. According to the New York

Fed, by September 2006 the 14 largest dealers had reduced the number of all confirmations outstanding by 70 percent and of confirmations outstanding past 30 days by 85 percent. Further, the dealers had doubled the share of trades confirmed electronically to 80 percent of total trade volume (Federal Reserve Bank of New York 2006).

The case of novations demonstrates that collective action problems can threaten the feasibility of private sector efforts, but that thoughtful regulatory action can facilitate a solution. Although all parties had an interest in a solution, none believed the other side was willing to take the necessary steps. Further, competitive considerations made dealers reluctant to exert pressure on one of their most active client groups. The regulatory intervention provided sufficient cover for dealers to insist on adherence by their clients. In this case, a relatively light touch by a regulator was sufficient to bring about a solution.

CDS settlement following credit events. As mentioned earlier, credit derivative index trades have been the major factor in recent growth in credit derivatives. The result of this growth was a new challenge, namely, that the amount of credit protection outstanding is far greater than the supply of underlying debt that could be delivered if a credit event were to occur. The problem manifested itself in a series of corporate bankruptcies in the North American auto parts companies (Collins & Aikman, Delphi, Dana, and Dura), airlines (Delta and Northwest), and power companies (Calpine). Because of the expanded interest in credit derivatives caused by the introduction of indices, the amount of credit derivatives outstanding was in some cases reported to be as much as ten times the amount of bonds actually available to settle trades when there is a credit event. This imbalance called into question the ability of the industry to achieve traditional physical settlement in an orderly manner, which led to calls by industry participants to substitute cash settlement for physical settlement for index trades.

The problem was that existing CDS contracts called for physical settlement after credit events. In addition, current documentation provides that the cash settlement will be determined by dealer poll by each dealer, which was not considered feasible given the large number of market participants that would be trying to buy deliverable debt at the same time. With regard to the first problem, counterparties are free to substitute cash for physical settlement if they so agree, but doing so on a large scale could require bilateral negotiations between each pair of counterparties. Further, developing an alternative to dealer poll required an industry solution. The solution proposed by ISDA was that firms move to cash settlement by means of a protocol, which allows market participants to amend their contracts on a multi-lateral basis rather than engaging in bilateral negotiations. In essence, market participants can agree to industry-wide and standardized amendments to their contracts. Parties that agree to be bound by the protocol's terms effectively amend their credit derivative contracts without negotiating directly with other firms. In addition, the protocol provided an alternative means by which a cash settlement price could be determined.

The protocol in this case allowed market participants to shift from physical settlement to cash settlement using a price generated in an auction for the defaulted bonds. In the first protocol, held in May 2005 for auto parts supplier Collins & Aikman, there was a single Deliverable Obligation. The next one addressed the bankruptcy filings of U.S. airlines Delta and Northwest, which offered multiple deliverable obligations. Delphi, another auto parts company, was a particularly challenging one as the volume of trades on the name was high: It was estimated by Merrill Lynch and Fitch Ratings that there was $28 billion of exposure on this name, but only $2.2 billion par of bonds available and $3 billion in loans outstanding (Fitch Ratings 2005).

Experience with subsequent credit events has led what appears to be a long term solution. First, although cash settlement will be the standard, institutions will have the option to settle physically with their dealers if they so choose. Second, the cash settlement protocol will, unlike the early versions, apply to both index and single-name CDS, as well as other products such as swaptions. Third, the new system, following further experience, will be incorporated into the next set of credit derivatives definitions.

Remaining issues

In considering the future of credit derivatives, two subjects come to mind. The first is the potential for further innovation and growth of credit derivatives. The second is the possibility that credit derivatives might evolve into a standardized, exchange traded product.

Growth and innovation could occur along several dimensions. One dimension is type of contract. There have some variations on the CDS such as credit swaptions and constant maturity default swaps, but the CDS has proven to be an adaptable product and is unlikely to be displaced. To the extent that product innovation occurs, it is likely to take the form of structured finance applications tailored to investor demands for tailored exposures. An example of such a product is the single tranche CDO, which provides investors with exposure to credit risk through a customized CDS portfolio.

Another dimension is type of risk. Until recently, CDS were written on entities or groups of entities. But recent innovations have extended CDS protection to obligations instead of industries. CDS on asset backed securities (ABS), for example, have enabled investors to access securitized risks without having to make a direct investment. The result is that supply constraints are less of a factor. Other examples include CDS on leveraged loans and on preferred stock, which again are referenced to financial instruments of a particular type.

Yet another dimension is new market participants. The major new entrant, as discussed above, has been hedge funds. It is not clear, however, if there are other significant entrants waiting in the wings. Tables 2 and 3 above suggest that mutual funds and pension funds have shown some growth, but prudential restrictions on allowable risks might continue to limit the role of such buy-side firms. Second, it is conceivable that retail investors might begin to participate, but the history of over-the-counter derivatives, which have remained overwhelmingly wholesale in nature, suggests that retail investors are unlikely to be a major factor. If retail investors do show an appetite for credit investing, it is likely that they will participate through banks and securities firms that serve as intermediaries. A third possibility is that regional banks will increasingly participate in the market, possibly by selling protection as a means of diversifying their portfolios. As Tables 2 and 3 show, however, bank portfolio managers are significantly more likely to use credit derivatives to shed credit risk than to take credit risk on.

A final possibility is that nonfinancial corporations might enter the market as they have for interest rate, currency, and commodity derivatives, but so far they have not done so in any significant way (Smithson and Mengle 2006). In the early days of credit derivatives, corporations were considered a potential source of business because of credit risks embedded in corporate balance sheets as receivables and supplier relationships. Further, corporate credit exposures could be a "natural hedge" for dealers' exposures to investors and would help dealers balance their CDS portfolios at low cost. Corporate activity did not materialize, however, largely because of basis risks: The nature of corporate exposures is difficult to match up to a specific amount of protection and possibly on a specific reference entity.

With regard to the evolution of credit default swaps into standardized, exchange-traded futures contracts, there are as of this writing several projects underway. First, futures on the iTraxx Europe credit index began trading on Eurex on March 27, 2007. The product is based on a five-year index with a fixed income; a new contract will be issued every six months. The contract will be cash settled, with the payout based on the ISDA CDS settlement auction. Second, the Chicago Mercantile Exchange is developing a futures contract on single-name credit default swaps. Contracts will be written on three reference entities chosen by the exchange. If a credit event occurs, the contracts will have a fixed recovery rate. The CME is also developing an index contract. Third, the Chicago Board Options Exchange is developing a credit default option, which involves an up-front payment and a binary payout of $100,000 per contract if a credit event occurs. Finally, the Chicago Board of Trade and Euronext.Liffe are each planning futures contracts based on a credit index, but details are not yet available.

The arguments for exchange-traded credit derivatives products are similar to those for other types of derivative. First, exchanges could provide enhanced liquidity and price discovery by means of standardization and centralized trading. Second, by making the exchange clearing house the counterparty to each trade and by imposing universal margin requirements, credit futures could provide a means of reducing counterparty credit risk to users. Finally, credit derivatives might in some cases provide a means for dealer to hedge their exposures as they do for interest rate, commodity, and equity derivatives.

Whether CDS trading migrates to exchanges will depend largely on the degree of substitutability between over-the-counter CDS and the new credit futures products. At the same time, it is not clear whether CDS and credit futures will share the same complementarities that they have in other markets. With regard to substitutability, OTC derivatives and futures compete to some degree as substitutes but, on closer examination, tend to appeal to different groups of users. If investors perceive the CDS market as being insufficiently liquid, or if counterparty risk is a major consideration, then some volume might move to the exchanges. But it appears that index CDS have attained a high degree of liquidity already, so it is not yet clear whether they will be motivated to abandon dealers for exchanges.

With regard to complementarity, it is not clear that futures would provide the same hedging and price discovery function that they do for other over-the-counter derivatives. Given the degree of standardization of CDS, dealers are apparently able to trade balanced books without significant residual risks that need to be laid off on exchanges. Further, dealers might not find price discovery information for a small number of selected reference entities to be particularly useful. Still, if credit futures attract significant liquidity dealers might seek to incorporate the price information into their risk management activities.

It is possible, however, that credit derivatives have already evolved into a mature product and that future growth will resemble that of interest rate and other derivatives. That is, products will become increasingly commoditized but will also become known to a wider range of users. The past ten years have seen credit evolving from a largely illiquid product into an increasingly tradable product, in which risks are managed in the same way as other market risks. Perhaps the next ten years will see the spread of this new credit risk management technology more deeply into the financial system.

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Figure 1: Credit default swap

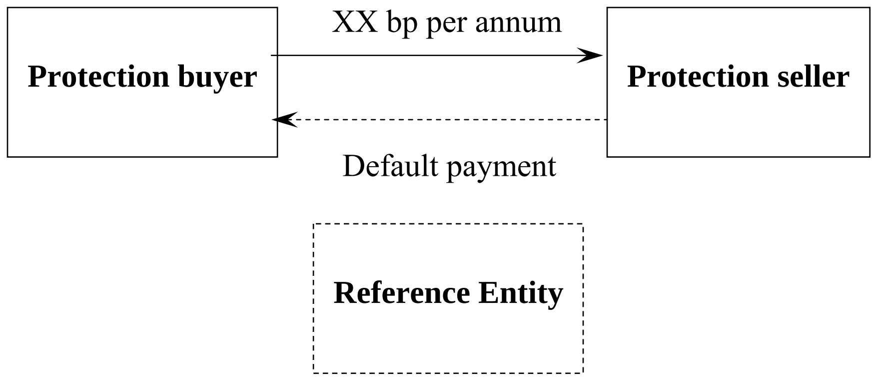


Figure 2a: Cash securitization

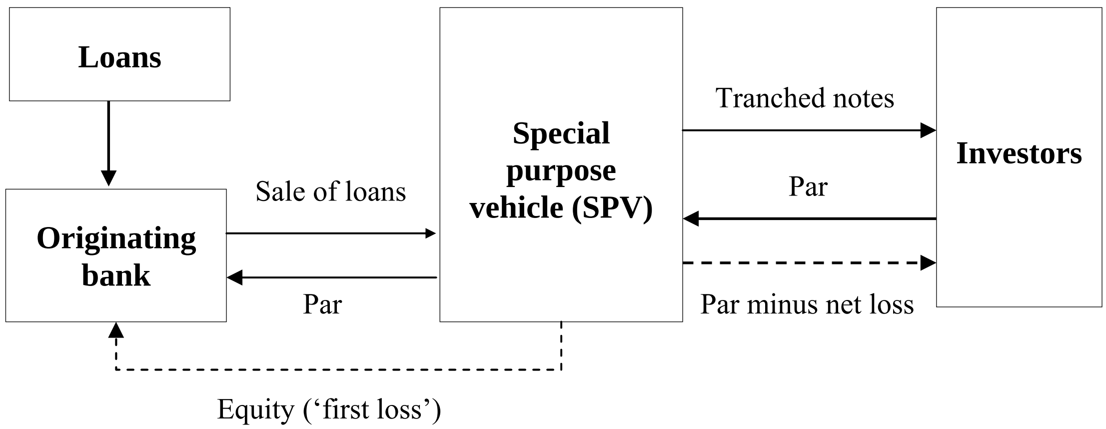


Figure 2b: Synthetic securitization

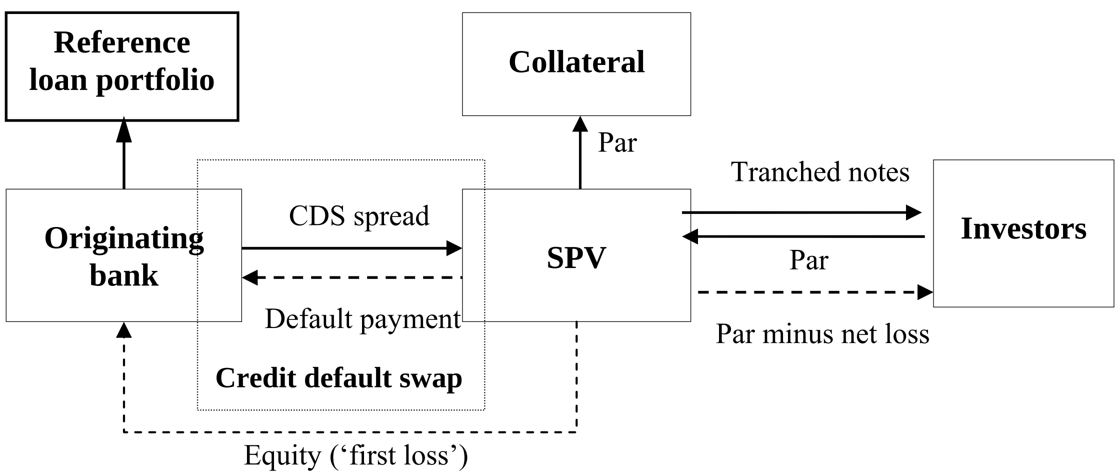
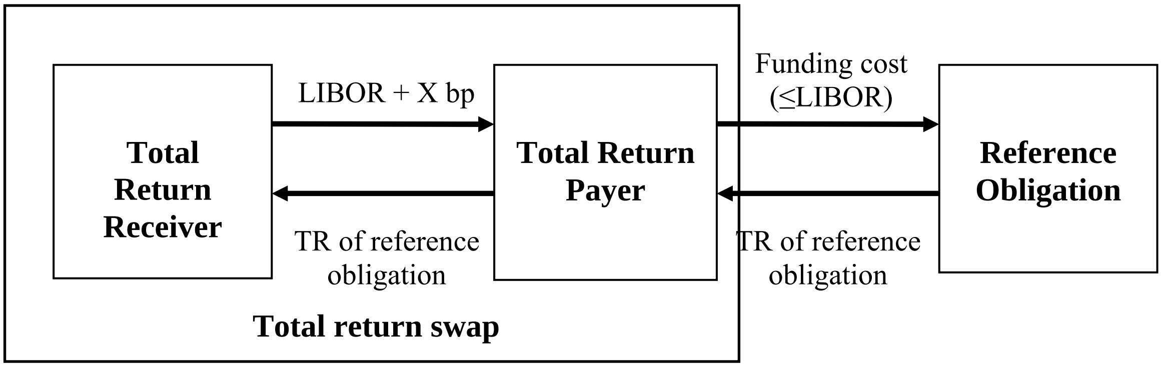
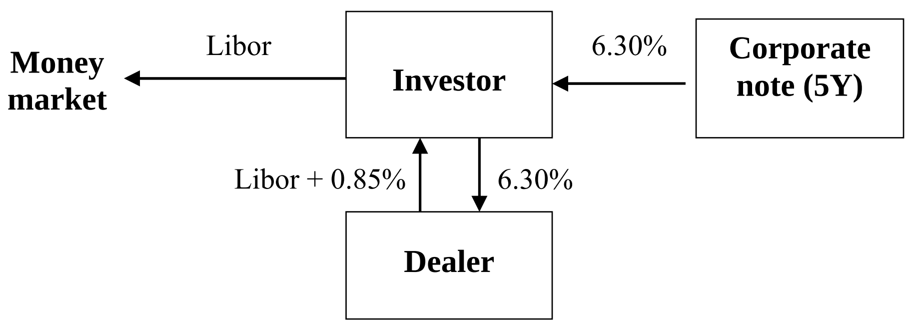


Figure 3: Total return swap



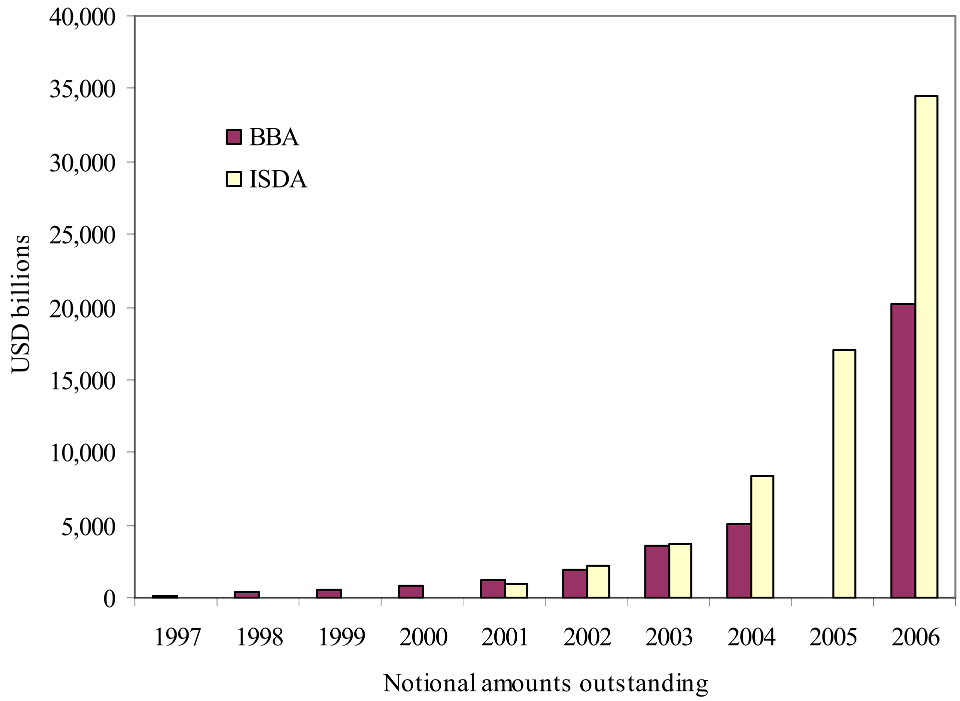
Total Return (TR) = Interest + Fees ± (Appreciation/Depreciation) – Default losses

Figure 4: Asset swap



Assume:
5Y USD interest rate swap rate = 5.45%
Par bond coupon = 6.30%
⇒ Asset swap spread = 0.85%

Chart 1: Growth of credit derivatives



Sources:
British Bankers Association (2006)
ISDA Market Surveys, 2001-2006

Table 1: Credit derivative product mix

	2000	2002	2004	2006
Single-name credit default swaps	38	45	51	33
Basket products	6	6	4	2
Full index trades			9	30
Tranched index trades			2	8
Synthetic CDOs – Fully funded			6	4
Synthetic CDOs – Partially funded			10	13
Credit linked notes (Funded CDS)	10	8	6	3
Credit spread options	5	5	2	1
Equity linked credit products			1	0
Swaptions			1	1
Others	41	36	8	6

Source: British Bankers Association (2006)

Table 2: Buyers of protection, by institution type

Type of institution	2000	2002	2004	2006
Banks (including securities firms)	81	73	67	59
Banks - Trading activities				39
Banks - Loan portfolio				20
Insurers	7	6	7	6
Mono-line insurers		3	2	2
Re-insurers			3	2
Other insurance companies		3	2	2
Hedge funds	3	12	16	28
Pension funds	1	1	3	2
Mutual funds	1	2	3	2
Corporates	6	4	3	2
Other	1	2	1	1

Source: British Bankers Association (2006)

Table 3: Sellers of protection, by institution type

Type of institution	2000	2002	2004	2006
Banks (including securities firms)	63	55	54	44
Banks - Trading activities				35
Banks - Loan portfolio				9
Insurers	23	33	20	17
Mono-line insurers		21	10	8
Re-insurers			7	4
Other insurance companies		12	3	5
Hedge funds	5	5	15	32
Pension funds	3	2	4	4
Mutual funds	2	3	4	3
Corporates	3	2	2	1
Other	1	0	1	1

Source: British Bankers Association (2006)

Table 4: 25 largest CDS counterparties

2005	2004	2003	2002
Morgan Stanley	Deutsche Bank	JP Morgan Chase	JP Morgan Chase
Deutsche Bank	Morgan Stanley	Deutsche Bank	Merrill Lynch
Goldman Sachs	Goldman Sachs	Goldman Sachs	Deutsche Bank
JP Morgan Chase	JP Morgan Chase	Morgan Stanley	Morgan Stanley
UBS	Merrill Lynch	Merrill Lynch	CSFB
Lehman Brothers	CSFB	CSFB	Goldman Sachs
Barclays	Lehman Brothers	UBS	UBS
Citigroup	Merrill Lynch	Lehman Brothers	Lehman Brothers
CSFB	Citigroup	Citigroup	Citigroup
BNP Paribas	Bear Stearns	Bear Stearns	Commerzbank
Merrill Lynch	Barclays	Commerzbank	Toronto Dominion
Bear Stearns	BNP Paribas	BNP Paribas	BNP Paribas
Bank of America	Bank of America	Bank of America	Bank of America
Dresdner	Dresdner	Dresdner	Bear Stearns
ABN Amro	HSBC	ABN Amro	Societe Generale
HSBC	Commerzbank	Societe Generale	Royal Bank of Canada
Societe Generale	Royal Bank of Scotland	AIG	Barclays
Calyon	Societe Generale	Barclays	Dresdner
Royal Bank of Scotland	ABN Amro	Toronto Dominion	Royal Bank of Scotland
AIG	Toronto Dominion	Calyon	ABN Amro
Commerzbank	Wachovia	HSBC	CIBC
HVB	Calyon	Ambac	Rabobank
IXIS	KfW	CDC IXIS	WestLB
CIBC	Royal Bank of Canada	KfW	HVB
Royal Bank of Canada	WestLB	Royal Bank of Scotland	AIG

Source: Fitch Ratings (2006)

Table 5: Top reference entities, gross protection bought and sold, end-2005

	Largest by count		Largest by volume	
	Protection Sold	**Protection Bought**	**Protection Sold**	**Protection Bought**
1	General Motors/ GMAC	General Motors/ GMAC	General Motors/ GMAC	General Motors/ GMAC
2	Daimler Chrysler	Ford/FMC	Ford/FMC	Ford/FMC
3	Ford/FMC	Daimler Chrysler	Brazil	Brazil
4	France Telecom	France Telecom	Daimler Chrysler	Daimler Chrysler
5	General Electric/ GECC	Telecom Italia	Italy	Italy
6	Telecom Italia	Volkswagen	France Telecom	General Electric/ GECC
7	Volkswagen	Brazil	Russia	Russia
8	Italy	General Electric/ GECC	General Electric/ GECC	France Telecom
9	Deutsche Telekom	Italy	Turkey	Telecom Italia
10	Brazil	Deutsche Telekom	Mexico	Turkey
11	Russia	Mexico	Telecom Italia	Mexico
12	Turkey	Russia	Volkswagen	Volkswagen
13	Fannie Mae	Telefonica	Deutsche Telekom	Gazprom
14	AT&T	AT&T	AT&T	AIG
15	France	AIG	Gazprom	AT&T
16	Portugal	Philippines	France	Deutsche Telekom
17	Mexico	Turkey	Fannie Mae	France
18	Altria Group	Bank of America	Hutchison Whampoa	Hutchison Whampoa
19	Deutsche Bank	Eastman Kodak	Japan	Japan
20	Morgan Stanley	Goldman Sachs	AIG	Fannie Mae
21	Eastman Kodak	JP Morgan Chase	Spain	Goldman Sachs
22	Freddie Mac	Suez	BAT	Boots
23	Gazprom	Time Warner	Portugal	Philippines
24	Germany	BBVA	Boots	JP Morgan Chase
25	Japan	Bombardier	Countrywide	PCCW-HK Telephone

Source: Fitch Ratings (2006)