

Credit Derivatives and Their Potential to Synthesize Riskless Assets

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Credit derivatives are financial contracts that allow the transfer of credit risk from one market participant to another, potentially facilitating greater efficiency in the pricing and distribution of credit risk among financial market participants. The simplest and most common form of a credit derivative is the credit default swap.

The holder of a debt security issued by XYZ Corp., say, enters into a contract with a derivatives dealer to make periodic payments to the dealer in exchange for a lump-sum payment in the event of default by XYZ during the term of the derivatives contract. The investor thus effectively transfers the risk associated with default to the dealer. In market parlance, the corporate bond investor in this example is the buyer of protection; the dealer is the protection seller; and the issuer of the corporate bond is called the reference entity.

I discuss the market for credit derivatives, highlighting its rapid growth in recent years and where the market is likely to go in the future. I also discuss methods for pricing credit derivatives and illustrate simple strategies involving the use of credit derivatives to synthesize an asset with a credit risk profile that at least in principle resembles that of Treasury securities. Once the credit derivatives market reaches its full maturity, such strategies could potentially be appealing to buy-and-hold investors who are attracted to the safety of U.S. Treasury securities.

I. MARKET OVERVIEW

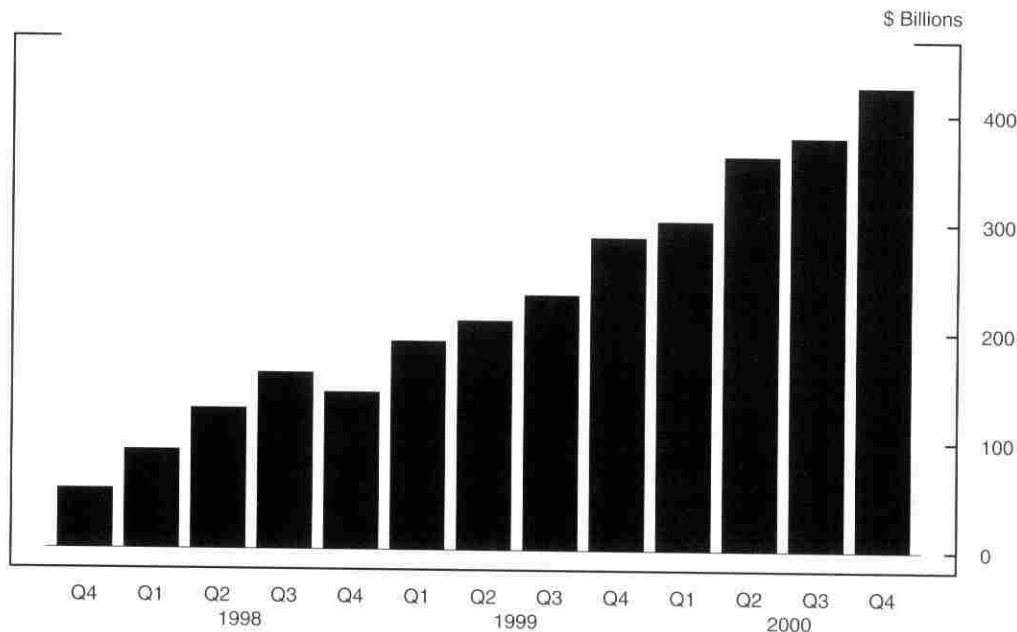
Credit derivatives are negotiated over the counter in a market that has grown spectacularly in recent years. Still, the market is small compared to the overall derivatives market, and it has not yet reached the liquidity, transparency, standardization, and widespread market participation of more mature markets. For instance, according to Bank Call Report data, credit derivatives represented about 1% of the total notional amount of derivatives at U.S. commercial banks in mid-2002, although their share of the total has risen substantially in recent years.¹

As shown in Exhibit 1, notional amounts outstanding in credit derivatives at U.S. commercial banks increased from around \$50 billion in late 1997 to over \$400 billion in the fourth quarter of 2000. (By mid-2002, that figure was close to \$500 billion.)

The market is developing outside the United States as well. According to a survey by the British Bankers' Association (BBA), the global credit derivatives market is estimated to be at least twice as large as the U.S. market (*Credit Derivatives Report 2001/2002* [2002]). From virtually non-existent in the early 1990s, the global credit derivatives market has come to constitute nearly \$2 trillion in notional amount outstanding today and is projected to more than double by 2004. The exact size of U.S. and global credit derivatives markets, however, is difficult to estimate, given the poten-

EXHIBIT 1

Notional Amounts of Credit Derivatives at U.S. Commercial Banks



Source: Federal Reserve, Call Reports.

tial for overcounting when contracts involve more than one reporting market participant as well as that notional amounts outstanding considerably overstate the net exposure associated with those contracts.

Uses of Credit Derivatives

As with any other derivative instrument, credit derivatives can be used either to take on more risk or to avoid (hedge) it. A market participant who is exposed to the credit risk of a given corporation can hedge such an exposure by buying protection in the credit derivatives market. Likewise, an investor may be willing to take on that credit risk by selling protection and thus enhance the expected return on a portfolio.

Credit derivatives can be used to create positions that would otherwise not easily be established in the cash market. Suppose an investor has a negative view on the future credit quality of a given corporation. One strategy for such an investor would be to short its bonds, but the corporate repurchase market and other mechanisms for taking short positions in corporates are not well developed for most individual corporate issuers.

By buying protection in a credit default swap, the investor can essentially mimic the cash flows of a short

position in the corporation's debt. Should the corporation default, the investor is able to buy the defaulted debt for its recovery value in the open market and sell it to the credit derivatives counterparty for its face value.

Market Participants

The main users of credit derivatives are large banks, followed by securities firms and insurance companies. While banks and securities firms act both as sellers and buyers of protection, insurance companies, which have reportedly increased their market participation substantially in recent years, are primarily protection sellers, presumably using their expertise at evaluating risk. Non-financial corporations have increasingly come to the market, but primarily to buy protection to hedge their exposure in vendor financing deals. Hedge funds are also relatively active participants, arbitraging perceived mispricings between the cash and derivatives markets, and thus participating on both sides. Other participants include pension funds and mutual funds, although their participation in the market is very small.

Banks use credit derivatives both to diversify their credit risk exposures and to free up capital from regulatory constraints. Say a bank wants to moderate its exposure to a given client, but does not want to incur the costs

of transferring loans made to that client to another bank. (Part of the cost might be a potential deterioration in the bank's relationship with the client.) The bank can, without having to notify its client, buy protection against default by the client in the credit derivatives market. Even though the loans remain on the bank's books, the associated credit risk has been transferred to the bank's counterparty in the credit derivative contract.

This also illustrates banks' use of credit derivatives to reduce their regulatory capital requirements. Under current Basle standards, a bank is generally required to hold 8% of its exposure in corporate loans as a regulatory capital reserve. If its credit derivatives counterparty is a bank located in an Organization for Economic Cooperation and Development country, and the bank can demonstrate that the credit risk associated with the loans has been effectively transferred to the OECD bank, the bank's regulatory capital charge falls from 8.0% to 1.6%.

II. TYPES OF CREDIT DERIVATIVES

In a broad sense, credit derivatives can be classed into two main groups. Single-name instruments provide protection against default by a single reference entity, such as the credit default swap we have described. Multiname credit derivatives are contracts that are contingent on default events in a pool of reference units. Multiname instruments allow investors and issuers to transfer the credit risk associated with a portfolio of risky securities, rather than deal with each security in the portfolio separately.

Single-name instruments account for the majority of the credit derivatives market, but the use of multiname products has grown substantially in recent years.

Single-Name Credit Derivatives

Credit Default Swaps. The credit default swap (CDS) is the most common form of a single-name instrument. Indeed, the CDS is the most common credit derivative, serving as the building block for many complex multiname products. According to the British Bankers' Association [2002], CDS account for about 45% of the global derivatives market in terms of notional amounts outstanding, although anecdotal accounts suggest that CDS account for a much greater share of the total activity in the credit derivatives market.²

In a plain vanilla CDS, the protection buyer agrees to make periodic payments (the swap *spread* or premium) over a predetermined number of years (the *maturity* of

the CDS) to the protection seller in exchange for a payment in the event of default by a third party (the *reference entity*). Typically, CDS premiums are paid quarterly. The most common maturities are three, five, and ten years; the five-year maturity is especially active (see O'Kane [2001]).

The premium is set as a percentage of the total amount of protection bought (the notional amount). For instance, the parties might agree that the CDS will have a notional amount of \$100 million. If the annualized swap spread is 40 basis points, the protection buyer will pay \$100,000 every quarter to the protection buyer. If no default event occurs during the life of the CDS, the protection seller simply pockets the premium payments. Should a default event occur, however, the protection seller becomes liable for the difference between the face value of the debt obligations issued by the reference entity and their recovery value.

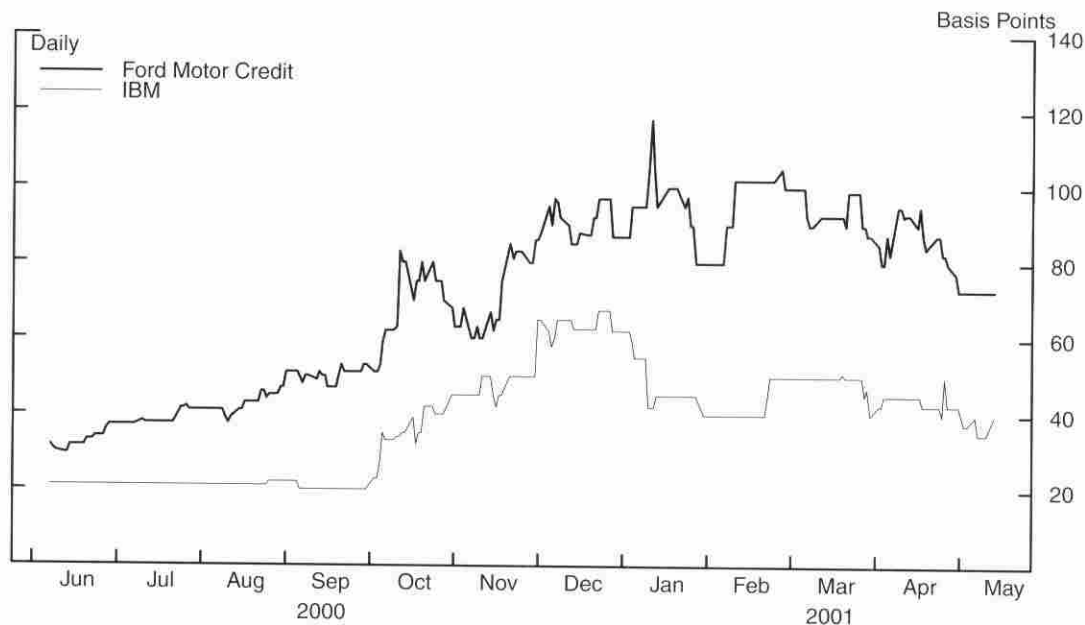
In the event of default, CDS can be settled physically or in cash. The settlement choice is determined when entering the contract. In a physically settled swap, the protection buyer has the right to sell the defaulted assets to the protection seller for their face value. In a cash-settled swap, the counterparties agree to poll market participants to determine the recovery value of the defaulted assets, and the protection seller is liable for the difference between face and recovery values. By far the majority of CDS in the United States are physically settled.

The adoption of standardized documentation for credit default swaps has played an important role in the development and liquidity of this segment of the credit derivatives market. As in the interest rate swap market, the use of master agreements sponsored by the International Swaps and Derivatives Association (ISDA) is a common market practice, significantly reducing legal risk and setup and negotiation costs. Nonetheless, there remains some ambiguity in the standardized documentation as to what constitutes the legal definition of a default event, especially in the treatment of debt restructuring by reference entities.

Credit default swaps are the most liquid type of credit derivative. Although market prices for such contracts are still not widely disseminated, some dealers have started to post daily CDS spreads for a number of reference entities. The presence of such quotes suggests that prices in this market could potentially become useful indicators of investors' perceptions of credit risk and their willingness to bear it.

EXHIBIT 2

Selected Five-Year Credit Default Swap Spreads



Source: JP Morgan Chase.

Exhibit 2, for example, shows market quotes for credit default swap premiums for Ford Motor Credit and IBM, two of the reference entities viewed as benchmarks in the credit default swap market. The data show that the cost of buying protection against default even by these two highly rated companies rose appreciably in October 2000, at the same time uncertainty about the overall economic outlook was increasing. On net, the premiums had reversed only part of that increase during the first few months of 2001. (CDS spreads for most reference entities followed a similar pattern in late 2000 and early 2001.)

The data also show that the cost of buying default insurance on Ford Motor Credit, which is rated A by Standard & Poor's, is about twice as high as that for IBM, which is rated A+.

The series shown in Exhibit 2 are mid-market quotes. Bid-ask spreads in the CDS market can be as narrow as 5 basis points for more commonly negotiated contracts, which are those written on large financial and non-financial corporations. Spreads can be appreciably wider for lower-rated reference entities that are seen as headed for financial distress.

Other Single-Name Credit Derivatives. The asset swap is another example of a financial contract often clas-

sified as a credit derivative. Asset swaps allow investors to take pure credit positions regarding a particular issuer. In an asset swap, an investor can buy a fixed-rate liability issued by a reference entity and simultaneously enter an interest rate swap whose fixed rate and payment dates exactly match those of the fixed-rate liability. The floating rate in such a swap is conventionally quoted as a spread over short-term LIBOR, called the *asset swap spread*.

The end result of an asset swap is a synthetic floating-rate liability issued by the reference entity, which means that the investor effectively transfers the interest rate (market) risk of the fixed-rate liability to its asset swap counterparty, retaining only the credit risk component. According to the BBA, around 7% of the credit derivatives market in terms of notional amounts outstanding represents asset swaps.

Other single-name credit derivatives include credit spread options and total return swaps. A credit spread option is a derivatives contract whose payoff is based on the credit spread of the reference entity relative to some strike level. As with other options, the contract specifies the strike level and maturity of the option, as well as whether it is a call or put option.

In a total return swap, an investor (the total return receiver) enters into a derivatives contract to receive all the cash flows associated with a given reference asset without actually ever owning the asset. In exchange for such cash flows, the investor makes periodic payments, conventionally quoted as a spread over short-term LIBOR, to its derivatives counterparty (the total return payer). Should the issuer of the reference asset default during the term of the total return swap, the investor sustains the associated loss. Otherwise, at maturity of the total return swap, the total return payer pays the difference between the prevailing price of the reference asset and its price at the inception date of the contract.

Total return swaps are discussed in detail by Tavakoli [2001], who also addresses other types of credit derivatives.

Multiname Credit Derivatives

A credit derivative can also be written on a portfolio or "basket" of assets, such as a portfolio of business loans. The simplest form of such a derivative is called a *basket swap*.

A common example is a *first-to-default* basket. Payment by the protection seller is triggered by a default event by any of the reference entities included in the portfolio. Effectively, if the protection buyer is long the portfolio, exposure to credit risk is limited by transferring some of that risk to the protection seller. Second- and third-to-default baskets are similarly defined.

A multiname credit derivative may also be set up as a portfolio default swap, specifying the transfer of risk not in terms of defaults by individual reference entities represented in the portfolio but rather in terms of the extent of the default-related loss in the overall portfolio.

In a portfolio default swap with a first-loss tranche of, say, 10%, investors in that tranche (first-loss protection sellers) are exposed to however many individual defaults are necessary to lead to a 10% loss in the overall portfolio. Second- and third-loss portfolio default swaps are defined similarly.

Portfolio default swaps can be thought of as the building blocks for synthetic collateralized debt obligations (CDO). While a simple credit default swap allows a bank to synthesize the sale of a loan, a synthetic CDO lets a bank transfer part of the credit risk in an entire portfolio of loans without incurring the costs of transferring the loans themselves off its balance sheet. As in a conventional CDO, the cash flow of a synthetic CDO is directed to various tranches to suit the risk appetites of different investors. Thus, while investors in the most senior

tranches face very low default risk, those in the first-loss (equity) tranche will be the first to absorb any default-related losses in the portfolio.

Credit-Linked Notes

Certain investors are prevented from entering into derivatives contracts, either by law or by internal investment policies. Credit-linked notes allow such investors to derive some of the benefits of credit derivatives, both single-name and multiname.

Credit-linked notes are regular debt obligations with an embedded credit derivative. They can be issued either directly by a corporation or bank or by highly rated special-purpose vehicles created by dealers. The coupon payments made by a CLN effectively transfer the cash flow of a credit derivatives contract to individual investors.

Suppose ABC Investments would like to take on the risk associated with the debt of XYZ Corp., but all of XYZ's debt is composed of bank loans, and ABC cannot simply sell protection in a credit default swap because its investment policy prevents it from entering into a derivatives contract. Let us assume that the size of ABC Investments' desired exposure to XYZ Corp. is \$100 million.

One way to gain the desired exposure to XYZ's debt is for ABC Investments to purchase \$100 million in credit-linked notes that reference XYZ Corp. The issuer of the notes may take ABC Investments' \$100 million and buy highly rated debt obligations to serve as collateral for its CLN liability toward ABC Investments. At the same time, the CLN issuer enters into a credit default swap with a third party, selling protection against a default by XYZ Corp.

From that point on, the CLN issuer will simply pass through the cash flows associated with the credit default swap—net of administrative fees—to ABC Investments. In the event of default by XYZ Corp., the CLN issuer will pay its default swap counterparty, and the credit-linked note terminates; ABC Investments receives only the recovery value of XYZ's defaulted debt. If no default occurs, ABC Investments will continue to receive the coupon payments associated with the credit-linked note until its maturity date, at which point it will also get its principal back.

It should be clear that a credit-linked note is simply a funded way to enter into a credit derivatives contract. Indeed, CLNs can be written based on more complex credit derivatives, such as a synthetic CDO.

III. PRICING OF CREDIT DERIVATIVES

In a frictionless financial market, the pricing of a credit derivative depends only on the economic fundamentals of the reference entity or entities and the derivative counterparties. In practice, however, other factors, such as liquidity of the cash and derivative markets in the corporate debt market, undeveloped repo markets, and market segmentation also affect derivatives prices, driving a wedge between the theoretical prices suggested by fundamentals and observed market prices.

Fundamental Factors

To keep things simple, I start by assuming that financial markets operate without frictions. In addition, I focus on the determinants of credit default swap spreads, although many of my general points generalize to more complex credit derivatives.

The pricing of credit default swaps is fundamentally linked to four main factors:

1. Credit risk of the reference entity.
2. Expected recovery rates associated with the reference entity and the protection seller.
3. Credit risk of the protection seller.
4. Default correlation between the reference entity and the protection seller.

The importance of the first two factors is clear. The greater the likelihood of default by the reference entity and, assuming that the protection seller does not default on its CDS obligation, the lower the post-default value of the defaulted debt—which the protection provider buys for its par value in the event of default—the more expensive the protection.

The last two factors highlight a significant element for purchasers of protection in the credit default swaps market: the credit quality of the protection seller. Indeed, the protection buyer is subject to two types of risk regarding its credit derivatives counterparty. Should the protection seller default before the reference entity, the protection buyer is exposed to *replacement risk*, or the risk that the price of default insurance on the reference entity might have risen since the original default swap was negotiated. The protection buyer's greatest risk, however, is that both the protection seller and the reference entity default at the same time. Such a joint event is typically much less likely than a default by the protection seller alone, especially

when the default correlation between the reference entity and the protection seller is low.

As is the case for other derivatives, the effect of counterparty credit risk in the pricing of credit default swaps is reduced by the use of netting arrangements and collateral agreements among counterparties, although the latter are more prevalent in the interdealer market.

Pricing a Credit Default Swap

It typically costs nothing to enter into a CDS because the quoted spread is such that the CDS has zero market value when it is first entered into. The question then is how to find the value of such a spread.

I outline two approaches to pricing a CDS. The first is relatively model-free and based on simple arbitrage arguments. The second relies on credit risk models. In describing both approaches, I abstract from a discussion of how the credit quality of the protection seller is factored into the pricing of a CDS, implicitly assuming that effective measures to mitigate counterparty credit risk have been put in place.³

A simple approach to approximately price a CDS that does not require the use of a model is to set up a portfolio with simple securities that replicate the cash flows of the CDS. In the absence of arbitrage opportunities, the cost of setting up the replicating portfolio gives the price of the CDS.

Example 1. Consider an investor who is offered the choice of one of two portfolios:

- A long position in a risky floater yielding $R^f + S$ combined with a short position in a riskless floater yielding R^f .
- A short position (protection seller) in a CDS written on the risky floater.

We assume that both floaters have the same maturity, coupon dates, and face values (\$1), and that they sell at par immediately after their coupon payment dates. To keep things even simpler, let us postulate further that the recovery rate on the risky floater is zero and that default can occur only immediately after the coupon payment dates.⁴

What are the cash flows associated with each portfolio? For as long as the issuer of the risky floater does not default, the first portfolio yields S every period. For the second portfolio, the CDS has a cash flow of P every period, where P is the CDS spread.

In the event of default, the holder of the portfolio of floaters ends up with a short position in the risk-free floater, which translates into a liability of \$1, given that the floater is valued at par on its coupon payment dates. The protection seller in the CDS is liable for the CDS payoff, which is also worth \$1. Thus, when there is a default, both portfolios have the same payoff.⁵

Furthermore, neither portfolio requires a cash outlay when it is set up. The proceeds of the short sale of the riskless floater are used to finance the purchase of the risky floater, and it costs nothing to enter into a plain vanilla CDS. As a result, in the absence of arbitrage, it must be the case that the cash flows of the two portfolios when there is no default must also be the same, $P = S$. Thus, under the conditions set out, the spread that applies to a CDS written on a given corporation is the same as the risk spread associated with a par floater issued by that corporation.

Example 1 highlighted the tight correspondence between the CDS spread for a given reference entity and the borrowing costs facing that entity. Missing, however, are several important aspects of reality. For instance, I have thus far ignored the fact that, for a leveraged investor, the first portfolio has to be funded on the balance sheet, while the second does not. A slightly more realistic example addresses this issue.

Example 2. Using the same notation and assumptions, now consider two scenarios:

- The investor finances the purchase of the risky floater, by repoing it out, paying the repo rate $R^f + F$. (Alternatively, we can think of $R^f + F$ as the rate at which the investor can obtain financing for the portfolio.) Assuming no default by the issuer of the risky floater, the investor receives $R^f + S$ every period and pays out $R^f + F$ to its repo counterparty. In the event of default, the risky floater becomes worthless, and the investor ends up owing \$1 to its repo counterparty. The investor's cash flows are: $S - F$ (no default) and $-\$1$ (default).
- An investor sells \$1 worth of protection in a CDS written on the same risky floater. The cash flows associated with such a CDS position are: P (no default) and $-\$1$ (default).

Again, notice that neither strategy requires an initial cash outlay, and both have the same payoff in the event of default. Thus, in the absence of arbitrage opportunities and market frictions, it must then be the case that they have the

same payoff in the absence of default, i.e., the CDS premium P must be equal to the difference between the risky floater spread S and the investor's funding cost F :

$$P = S - F \quad (1)$$

This result differs from the result in Example 1 because we are now explicitly taking into account the fact that the first portfolio has to be funded on the balance sheet of a leveraged investor, while the CDS is an unfunded instrument.

Although the static replication approach to pricing a CDS relies on rates on par floaters issued by the reference entity, most corporate debt issued in the United States is fixed-rate liabilities. In practice, however, we can circumvent this problem by resorting to the asset swap market. The methods hold if we 1) substitute the par floater spread, S , with the asset swap spread associated with the reference entity in question, and 2) redefine R^f as short-term LIBOR in order to conform with the quoting convention for asset swaps.

Assessing the Static Replication Approach

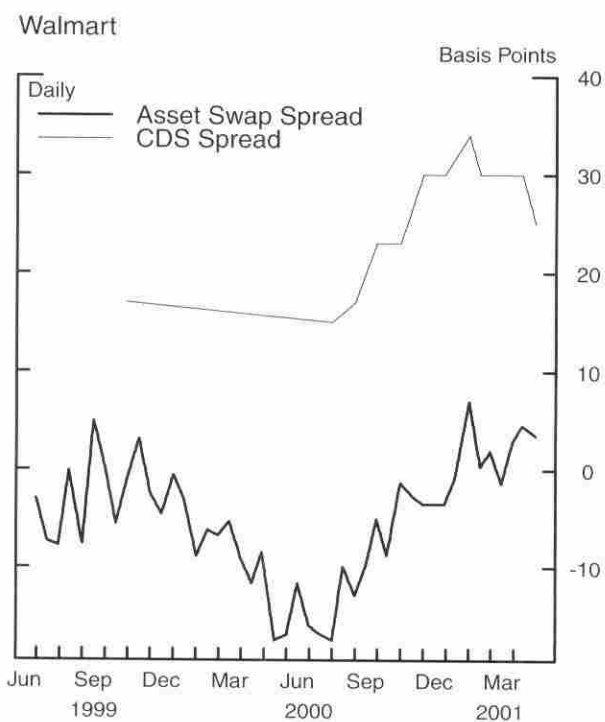
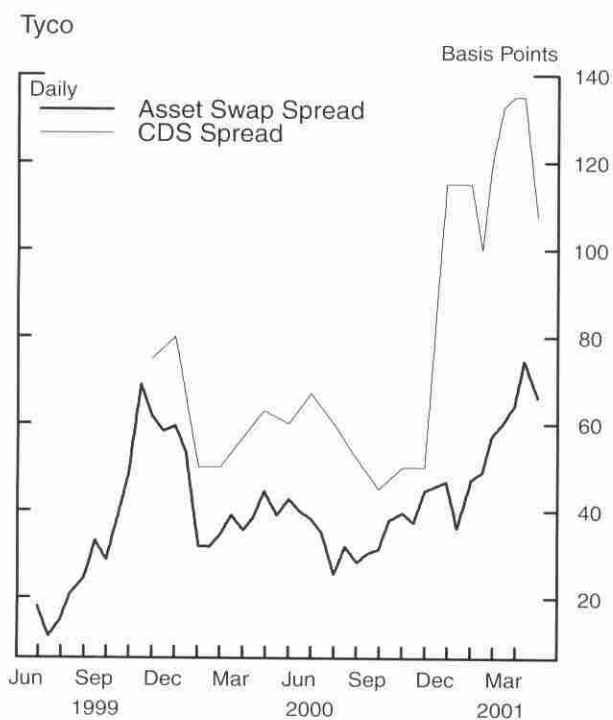
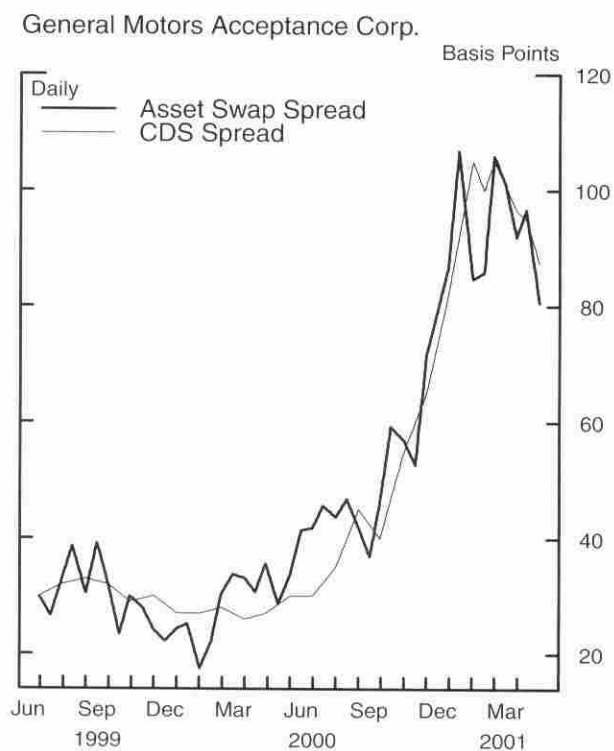
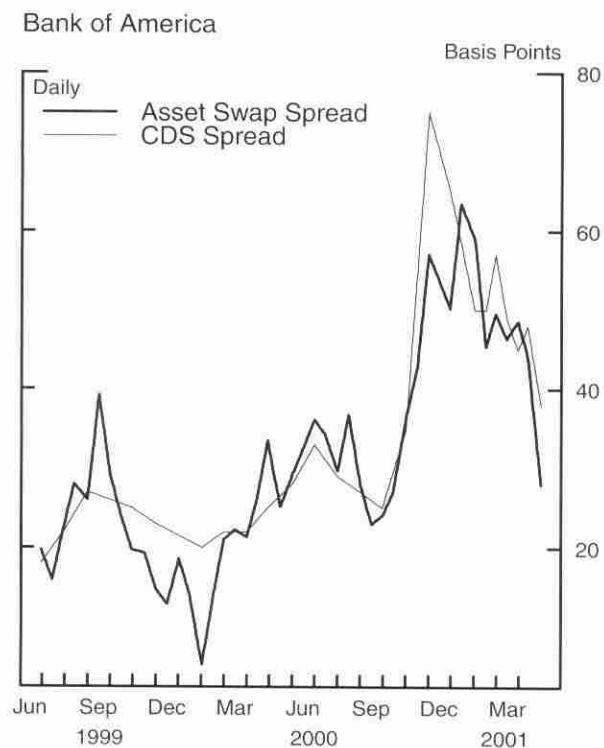
We can use observed market quotes to verify how well the data support the simple valuation relationships uncovered in the examples. As an illustration, the four panels in Exhibit 3 show quotes on credit default swaps and asset swaps for four investment-grade reference entities that underlie some of the most frequently negotiated credit default swaps: Bank of America, General Motors Acceptance Corp. (GMAC), Tyco International, and Walmart, rated A+, A, A-, and AA, respectively, by Standard & Poor's.

CDS and asset swap spreads for Bank of America and GMAC do line up closely and are thus consistent with the results of the static replication approach. The CDS spreads for Tyco and Walmart, however, are substantially above what would be suggested by the asset swap market, displaying what market participants call *positive bias*. The divergence between CDS and asset swap spreads for these reference entities highlights the role that market segmentation and idiosyncratic supply and demand factors still play in the developing CDS market.

For instance, the substantial positive bias associated with Tyco is largely tied to strong demand by convertible bond investors for buying protection against Tyco. Tyco had issued substantial amounts of convertible debt, but the investors who bought such bonds were focusing primarily

EXHIBIT 3

Informal Test of Static Replication Approach



Source: Lehman Brothers. (Quotes are shown for contracts maturing in five years.)

on the cheapness of an embedded call option on Tyco's stock, while using the CDS market to shed the credit risk associated with Tyco. In addition, administrative and legal costs are also factored into CDS spreads in practice, and even CDS for reference entities that borrow at sub-LIBOR, such as Walmart, tend to be slightly positive.

Another factor that contributes to positive bias is the fact that participation in the CDS market is limited either by investors' lack of familiarity with credit derivatives or, as noted above, by legal restrictions and internal investment policies of certain institutional investors. For some reference entities, a liquidity premium on CDS, reflecting the poorer liquidity of the CDS market relative to the cash (corporate bond) market for those entities, may also be a factor leading to positive bias.

Using Credit Models to Price a CDS

Under some circumstances, static replication techniques may prove impracticable. For instance, one might be interested in buying or selling protection against a reference entity that has no actively traded marketable debt outstanding. Credit risk models are an alternative tool for pricing credit default swaps and more complicated credit derivatives. I outline below the basic steps that make up the model-based approach to pricing a CDS.

As before, we start out with the observation that pricing a default swap means determining the premium or spread p that will be paid periodically by the protection buyer. Let R denote the recovery rate associated with the reference entity and \$1 be the notional amount of the CDS. Taking p initially as given, we first compute the expected present values of the premium and protection legs of a contract that matures at a future date T .

To value the premium leg, we note that it is equivalent to a security that pays p per period until either a default event occurs or the CDS reaches its maturity, whichever is earlier. Let $EPV(\text{premium})$ denote the expected present value of such payments. To value the protection leg, we note that it is equivalent to a contingent claim that pays $(1 - R)$ if the reference entity defaults before T . Let $EPV(\text{protection})$ denote the expected present value of such a payment.

Thus, the value of the CDS spread, p , is such that

$$EPV(\text{Premium}) = EPV(\text{Protection}) \quad (2)$$

where the expected present values are derived from theoretical models that incorporate specific assumptions about the behavior of market interest rates and default rates in order to generate a probability distribution function for default times (see, e.g., Hull and White [2000, 2001]).

IV. POTENTIAL FOR SYNTHETIC RISKLESS ASSETS

In theory, market participants could combine holdings of risky assets with protection bought in the credit derivatives market to financially engineer an asset that, similar to U.S. Treasury securities, is essentially free from default risk. Returning to Examples 1 and 2, consider an investor who buys a risky floater issued by XYZ Corp. and simultaneously purchases protection in a CDS. Such an investor is then fully insured against the possibility of default by XYZ Corp., provided the protection seller is able to make good on its commitment in the credit default swap. Indeed, in the absence of counterparty credit risk, the investor is effectively left with a synthetic riskless floater.

In practice, however, the synthetic floater is not quite riskless in that the investor still has some exposure to both replacement risk and a simultaneous default by the protection seller and XYZ Corp. Of course, the use of collateral agreements helps mitigate concerns about counterparty credit risk, but posting collateral is expensive, and amounts pledged typically cover less than the total net exposure between counterparties.⁶

Synthetic collateralized debt obligations (CDO) can also be used to generate close substitutes to the credit risk characteristics of Treasuries. As noted above, portfolio default swaps can be used to direct the cash flow of a synthetic CDO to various tranches, with the most senior tranches virtually free from default risk.

As with a traditional CDO, the various tranches of a synthetic CDO are formally rated by the leading credit rating agencies. For instance, in its simplest form, a synthetic CDO may have three tranches: an equity tranche, rated below BBB; a mezzanine tranche, rated BBB; and a senior tranche rated AAA. An increasingly common variation on this arrangement, however, is for the senior tranche to be divided up further to create what is commonly called a super senior tranche, which benefits from the subordination of the senior tranche and thus has better-than-AAA risk. For the super senior tranche to sustain a default-related loss, defaults in the underlying portfolio would have to be great enough to engulf the entire AAA-rated senior tranche, which is a very remote risk.

While the synthetic CDO market has grown rapidly in recent years, it is estimated to make up only about 20% of the notional amount outstanding in the global credit derivatives market. The use of synthetic CDOs moreover has been mainly motivated by the needs of commercial banks to free up regulatory capital, rather than to offer investors an alternative to the safety of U.S. Treasury securities—and indeed, U.S. banks tend to retain the super senior tranches of synthetic CDO on their balance sheets.

On the whole, while it is conceivable that financial market participants could in principle combine holdings of risky assets with collateralized default protection bought in the credit derivatives market to effect the large-scale creation of synthetic private sector assets that are virtually free of default risk, the credit derivatives market is still in its formative stages and will reach full maturity only in years to come.

An issue that currently makes such synthetic assets less than risk-free (besides counterparty risk) is what some market participants have called legal risk (see, e.g., Tolk [2001]). This is the risk that too broad a definition of what constitutes a credit event (default) in the standardized credit derivatives documentation may expose investors to unintended risks, such as the risk of having to pay for a credit event that goes beyond commonly accepted definitions of default. In early 2001, for instance, Moody's Investors Services downgraded even the senior tranches of some synthetic CDO issued in the late 1990s because of such risks.

V. CONCLUDING REMARKS

The credit derivatives market has experienced remarkable growth in recent years, but it is still a relatively small and young market. Nonetheless, the prospects of continued growth, greater standardization of market practices, and further improvements in mitigating counterparty credit risk in the future may point to significant benefits for the overall financial markets.

In addition to enabling efficiency gains in the pricing and distribution of credit risk, a fully mature credit derivatives market could help create a new asset class: If the credit derivatives market eventually becomes sufficiently developed to allow for the large-scale creation of synthetic assets that are virtually free from default risk, it may help meet the demands of buy-and-hold investors who currently favor the safety of U.S. Treasury securities.

Several unfolding developments may play important roles in the future of the credit derivatives market. First, the market outlook will be affected by further efforts by participants to harmonize diverging views on what types of default events should be covered in the standardized contracts. Second, the provisions of the Basle II Accord on credit derivatives are still being negotiated, and they may affect the way commercial banks use credit derivatives. Finally, current market trends suggest increased participation of non-banks in the market and the growing use of more complex credit derivatives in portfolio risk management.

ENDNOTES

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¹Extensive discussions of credit derivatives and the evolution of the market can be found in *The J.P. Morgan Guide to Credit Derivatives* [1999], O'Kane [2001], Rule [2001], and Tavakoli [2001].

²CDS are much more common than multiname credit derivatives such as synthetic collateralized debt obligations, but the latter have substantially higher notional amounts.

³Hull and White [2001] describe a model-based pricing framework that explicitly allows for the effect of counterparty risk in the pricing of credit default swaps.

⁴These assumptions can be relaxed, and the basic results would still hold.

⁵With time-varying interest rates, the static replication argument outlined would generally fail if I use fixed-rate notes instead of floating-rate notes to replicate the CDS cash flows. This occurs because a fixed-rate note is not generally valued at par after it is issued, and thus the liability of the short-seller in the event of default could well be different from \$1.

⁶A common practice in the interdealer market is for market participants to call for additional collateral after their marked-to-market exposure to a particular counterparty has risen beyond a previously agreed-upon threshold level.

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