Credit Derivatives: Instruments, Applications, and Pricing

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MJPA
To my wife, Mary, and to my children, Madeleine and Marcus, for their enduring patience

FJF
To my sister, Lucy

MC
To Yves Gaillard, respect, and an inspiration to us all

RRC
To my wife, Hsing-Yao

Published by John Wiley & Sons, Inc., Hoboken, New Jersey
Published simultaneously in Canada

ISBN: 0-471-46600-X

Printed in the United States of America

10 9 8 7 6 5 4 3 2 1

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Preface

The credit derivative market has grown from a few customized trades in the early 1990s to a large, organized market that trades billions of dollars each year. This market has expanded to reflect the growing demand from asset managers, corporations, insurance companies, fixed income trading desks, and other credit-sensitive users to buy and sell credit exposure.

In this book we provide a comprehensive examination of the credit derivatives market. As the title of the book indicates, we cover the practical applications of credit derivatives as well as the most current pricing models applied by asset managers and traders. We also discuss investment strategies that may be applied using these tools.

Our soup to nuts approach begins with an overview of credit risk. In many cases, credit is the predominant, if not overwhelming, economic exposure associated with a note, bond, or other fixed-income instrument. We discuss the nature of credit risk, discuss its economic impact, and provide graphical descriptions of its properties.

We next discuss some of the basic building blocks in the credit derivative market: credit default swaps, asset swaps, and total return swaps. These chapters are descriptive in nature to introduce the reader to the credit derivatives market.

The following chapters provide numerous examples of credit derivative applications. Specifically, we describe the credit-linked note market as well as synthetic collateralized debt obligations. Credit derivatives are used to provide the underlying credit exposure embedded within these fixed-income instruments. These chapters demonstrate how credit derivatives are efficient conduits of economic exposure that would otherwise be difficult to acquire in the cash markets.

The next group of chapters provides the mechanics for the modeling and pricing of credit risk. These chapters are more quantitative in nature as is necessary to provide a thorough review of current credit pricing models. However, our goal is not to dazzle the reader with out knowledge of rigorous mathematics, but rather, to provide a comprehensive framework in which credit derivative contracts can be efficiently priced.

Finally, we provide a discussion on the accounting and tax treatment of credit derivatives. Throughout the book, we provide numerous examples of credit derivatives, their practical applications, and where pricing information can be found through *Bloomberg* and other sources. Our ultimate goal is to provide the reader with a complete guide to credit derivatives, whether it be for reference purposes, day to day use, or strategy implementation.

We would like to thank Abukar Ali of Bloomberg L.P. in London for his assistance with the chapter on credit-linked notes (Chapter 6) and help with Bloomberg screens. We benefited from insightful discussions regarding credit default swap pricing with Dominic O'Kane of Lehman Brothers in London.

The views, thoughts, and opinions expressed in this book represent those of the authors in their individual private capacity. They do not represent those of Mark Anson's employer, the California Public Employees' Retirement System, nor KBC Financial Products (UK) Limited or KBC Bank N.V. or of Moorad Choudhry as an employee, representative or officer of KBC Financial Products (UK) Limited or KBC Bank N.V.

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CHAPTER 1

Introduction

Derivatives are financial instruments designed to efficiently transfer some form of risk between two or more parties. Derivatives can be classified based on the form of risk that is being transferred: interest rate risk (interest rate derivatives), credit risk (credit derivatives), currency risk (foreign exchange derivatives), commodity price risk (commodity derivatives), and equity prices (equity derivatives). Our focus in this book is on credit derivatives, the newest entrant to the world of derivatives.

Credit derivatives are financial instruments that are designed to transfer the credit exposure of an underlying asset or assets between two parties. With credit derivatives, an asset manager can either acquire or reduce credit risk exposure. Many asset managers have portfolios that are highly sensitive to changes in the credit spread between a default-free asset and credit-risky assets and credit derivatives are an efficient way to manage this exposure. Conversely, other asset managers may use credit derivatives to target specific credit exposures as a way to enhance portfolio returns. In each case, the ability to transfer credit risk and return provides a new tool for asset managers to improve performance. Moreover, as will be explained, corporate treasurers can use credit derivatives to transfer the risk associated with an increase in credit spreads.

Credit derivatives include credit default swaps, asset swaps, total return swaps, credit-linked notes, credit spread options, and credit spread forwards. In addition, there are index-type products that are sponsored by banks that link the payoff to the investor to a specified credit exposure such as emerging or high yield markets. By far the most popular credit derivatives is the credit default swap. Credit default swaps include single-name credit default swaps and basket default swaps. Credit default swaps have a number of applications and are used extensively for flow trading of single reference name credit risks or, in

portfolio swap form, for trading a basket of reference credits. Credit default swaps and credit-linked notes are used in structured credit products, in various combinations, and their flexibility has been behind the growth and wide application of the synthetic collateralized debt obligation and other credit hybrid products.

Credit derivatives are grouped into funded and unfunded instruments. In a *funded credit derivative*, typified by a credit-linked note, the investor in the note is the credit protection seller and is making an upfront payment to the protection buyer when buying the note. In an *unfunded credit derivative*, typified by a credit default swap, the protection seller does not make an upfront payment to the protection buyer. In a funded credit derivative, the protection seller is in effect making the credit insurance payment upfront and must find the cash at the start of the transaction; whereas in an unfunded credit derivative the protection, payment is made on termination of the trade (if there is a credit event).

Unlike the other types of derivatives, where there are both exchange-traded and over-the-counter (OTC) or dealer products, as of this writing credit derivatives are only OTC products. That is, they are individually negotiated financial contracts. As with other derivatives, they can take the form of options, swaps, and forwards. Futures products are exchange-traded and, as of this writing as well, there are no credit derivative futures contracts.

Moreover, there are derivative-type payoffs that are embedded in debt instruments. Callable bonds, convertible bonds, dual currency bonds, and commodity-linked bonds are examples of bonds with embedded options. A callable bond has an embedded interest rate derivative, a convertible bond has an embedded equity derivative, a dual currency bond has an embedded foreign exchange derivative, and a commodity-linked bond has an embedded commodity derivative. Derivatives have made it possible to create many more debt instruments with complex derivative-type payoffs that may be sought by asset managers. These debt instruments are in the form of medium-term notes and referred to as structured products.

Credit derivatives are also used to create debt instruments with structures whose payoffs are linked to or derived from the credit characteristics of a reference asset (reference obligation), an issuer (reference entity), or a basket of reference assets or entities. Credit-linked notes (CLNs) and synthetic collateralized debt obligations (CDOs) are the two most prominent examples. In fact, the fastest growing sector of the market is the synthetic CDO market. Credit derivatives are the key to the creation of synthetic CDOs.

ROLE OF CREDIT DERIVATIVES IN FINANCIAL MARKETS

In discussing the role of credit derivatives in the U.S. financial market, Alan Greenspan, Chairman of the Federal Reserve Board, in a speech in September 2002 stated:

> More generally, such instruments appear to have effectively spread losses from defaults by Enron, Global Crossing, Railtrack, WorldCom, and Swissair in recent months from financial institutions with largely short-term leverage to insurance firms, pension funds, or others with diffuse long-term liabilities or no liabilities at all. In particular, the still relatively small but rapidly growing market in credit derivatives has to date functioned well, with payouts proceeding smoothly for the most part. Obviously, this market is still too new to have been tested in a widespread down-cycle for credit. But so far, so good.[1]

There have been and continue to be mechanisms for protecting against credit risk but these mechanisms have been embedded within bond structures and loan agreements and not traded separately. Examples in bond structures are private mortgage insurance in residential mortgage-backed securities, insurance wraps provided by monoline insurance companies for municipal bonds and asset-backed securities, and letters of credit. The issuance of bonds backed by collateral in the structured finance market has required the transfer of assets. In the case of collateralized loan obligations, loans have to be transferred to a special purpose vehicle. This is a disadvantage for legal reasons—in some countries the borrower must approve the assignment of a loan—and business reasons—potential impairment of banking client relationships. The growth of the market for synthetic CDOs is a testament to this desire not to transfer assets.

Credit derivatives are a natural extension of the long-term trend of shifting credit risk from banks to nonbank investors who are willing to accept credit risk for the potential of an enhanced yield. Consider, for example, the public market for bonds. This debt instrument is simply a substitute for bank borrowing. In the United States, the typical publicly traded bond was one that at issuance had an investment-grade rating. Thus, credit risk of investment-grade corporate borrowers was shared by banks and nonbank investors via bond issuance. This is a relatively new economic phenomena in many non-U.S. countries where bond markets

[1] "World Finance and Risk Management," speech presented at Lancaster House, London, U.K., September 25, 2002.

are developing. In the 1980s, noninvestment grade rated issuers whose primary funding source was commercial loans were able to access the public bond markets. Since the early 1990s, there was the rapid growth of the asset-backed securities market in which the credit risk of various loans was shifted from bank portfolios to the portfolios of nonbank investors. The syndicated loan market has provided the same transference of credit risk. In each of these cases, however, a nonbank investor has had to obtain the necessary funding to obtain credit exposure. With the arrival of credit derivatives, a nonbank entity can obtain credit exposure but need only make a payment if a credit event occurs.

Surveys of capital market participants have identified the usage of these instruments. A summer 2001 survey by Greenwich Associates of 230 North American financial entities (banks, insurance companies, and fund managers) and corporations about their credit derivatives trading activities found that 150 indicated that they currently used derivatives and 80 were nonusers.[2] However, of the nonusers, 40% indicated that they planned to use credit derivatives in the future.

Understanding of credit derivatives is critical even for those who wish not to use these instruments. As Chairman Greenspan stated:

> The growing prominence of the market for credit derivatives is attributable not only to its ability to disperse risk but also to the information it contributes to enhanced risk management by banks and other financial intermediaries. Credit default swaps, for example, are priced to reflect the probability of net loss from the default of an ever broadening array of borrowers, both financial and nonfinancial.
>
> As the market for credit default swaps expands and deepens, the collective knowledge held by market participants is exactly reflected in the prices of these derivative instruments. They offer significant supplementary information about credit risk to a bank's loan officer, for example, who heretofore had to rely mainly on in-house credit analysis. To be sure, loan officers have always looked to the market prices of the stocks and bonds of a potential borrower for guidance, but none directly answered the key question for any prospective loan: What is the probable net loss in a given time frame? Credit default swaps, of course, do just that and presumably in the process embody all relevant market prices of the financial instruments issued by potential borrowers.

[2] Peter B. D'Amario, *North American Credit Derivatives Market Develops Rapidly*, Greenwich Associates, January 9, 2002.

MARKET PARTICIPANTS

The credit derivatives market consists of three groups of players:

- End-buyers of protection
- End-sellers of protection
- Intermediaries[3]

End-buyers of protection are entities that seek to hedge credit risk taken in other parts of their business. The predominate entity in this group are commercial banks. For the reasons explained later in this chapter, there are also insurance, pension funds, and mutual funds that seek protection for credits held in their portfolio. End-sellers of protection are entities that seek to diversify their current portfolio and can do so more efficiently with credit derivatives. An entity that provides protection is seeking exposure to a specific credit or a basket of credits.

Intermediaries include investment banking arms of commercial banks and securities houses. Their key role in the credit derivatives market is to provide liquidity to end-users. They trade for their own account looking for "arbitrage" and other opportunities. In addition, some will assemble using credit derivatives structured products which, in turn, they may or may not manage.

TYPES OF CREDIT RISK

To appreciate the various types of credit derivatives, we must review the underlying risk which these new financial instruments transfer and hedge. They include:

- Default risk
- Downgrade risk
- Credit spread risk

Default risk is the risk that the issuer of a bond or the debtor on a loan will not repay the outstanding debt in full. Default risk can be complete in that no amount of the bond or loan will be repaid, or it can be partial in that some portion of the original debt will be recovered.

[3] David Rule, "The Credit Derivatives Market: Its Development and Possible Implications For Financial Stability," G10 Financial Surveillance Division, Bank of England.

Downgrade risk is the risk that a nationally recognized statistical rating organization such as Standard & Poor's, Moody's Investors Services, or Fitch Ratings reduces its outstanding credit rating for an issuer based on an evaluation of that issuer's current earning power versus its capacity to pay its debt obligations as they become due.

Credit spread risk is the risk that the spread over a reference rate will increase for an outstanding debt obligation. Credit spread risk and downgrade risk differ in that the latter pertains to a specific, formal credit review by an independent rating agency, while the former is the financial markets' reaction to perceived credit deterioration.

In this section we provide a short discussion on the importance of credit risk. In particular, we provide a review of the credit risks inherent in three important sectors of the debt market: high-yield bonds, highly leveraged bank loans, and sovereign debt. Each of these markets is especially attuned to the nature and amount of credit risk undertaken with each investment. Indeed, most of the discussion and examples provided in this book will focus on these three sectors of the debt market.

Credit Risk and the High-Yield Bond Market

A fixed-income debt instrument represents a basket of risks. There is the risk from changes in interest rates (interest rate risk as measured by an instrument's duration and convexity), the risk that the issuer will refinance the debt issue (call risk), and the risk of defaults, downgrades, and widening credit spreads (credit risk). The total return from a fixed-income investment such as a corporate bond is the compensation for assuming all of these risks. Depending upon the rating on the underlying debt instrument, the return from credit risk can be a significant part of a bond's total return.

However, the default rate on credit-risky bonds can be quite high. Estimates of the average default rates for high-yield bonds range from 3.17% to 6.25%.[4] In fact, default rates have been as high as 11% for high-yield bonds in any one year.[5] Three factors have been demonstrated to influence default rates in the high-yield bond market. First, because defaults are most likely to occur three years after bond issuance, the length of time that high-yield bonds have been outstanding will influence the default rate. This factor is known as the "aging

[4] See Edward Altman, "Measuring Corporate Bond Mortality and Performance," *The Journal of Finance* (June 1991), pp. 909–922; and Gabriella Petrucci, "High-Yield Review—First-Half 1997," Salomon Brothers Corporate Bond Research (August 1997).

[5] See Jean Helwege and Paul Kleiman, "Understanding the Aggregate Default Rates of High-Yield Bonds," *The Journal of Fixed Income* (June 1997), pp. 55–61.

affect." Second, the state of the economy affects the high-yield default rate. A recession reduces the economic prospects of corporations. As profits decline, companies have less cash to pay their bondholders. Finally, changes in credit quality affects default rates. Studies that will be discussed in Chapter 2 have demonstrated that credit quality is the most important determinant of default rates, followed by macroeconomic conditions. The aging factor plays only a small role in determining default rates.[6]

Credit derivatives, therefore, appeal to asset managers who invest in high-yield or junk bonds, real estate, or other credit-dependent assets. The possibility of default is a significant risk for asset managers, and one that can be effectively hedged by shifting the credit exposure.

In addition to default risk for noninvestment grade bonds, there is the risk of downgrades for investment-grade bonds and the risk of increased credit spreads. For instance, in the year 2002, S&P had 272 rating changes for investment-grade issues: 231 were rating downgrades and 41 were rating upgrades. For Moody's for the same year, there were 244 upgrades and 46 downgrades for the 290 rating changes by that rating agency.[7]

With respect to credit spread risk, in the United States, corporate bonds are typically priced at a spread to comparable U.S. Treasury bonds. Should this spread widen after purchase of the corporate bond, the asset manager would suffer a diminution of value in his portfolio. Credit spreads can widen based on macroeconomic events such as volatility in the financial markets.

As an example, in October of 1997, a rapid decline in Asian stock markets spilled over into the U.S. stock markets, causing a significant decline in financial stocks.[8] The turbulence in the financial markets, both domestically and worldwide, resulted in a flight to safety of investment capital. In other words, investors sought safer havens for their investments in order to avoid further losses and volatility. This flight to safety resulted in a significant increase in credit spreads of corporate bonds relative to U.S. Treasuries.

For instance, at June 30, 1997, corporate bonds rated BB by Standard & Poor's were trading at an average spread over U.S. Treasuries of 215 bps.[9] However, by October 31, 1997, this spread had increased to

[6] Helwege and Kleiman, "Understanding the Aggregate Default Rates of High-Yield Bonds," p. 57.

[7] *Global Relative Value*, Lehman Brothers, Fixed Income Research, July 21, 2003, p. 135.

[8] For instance, the Dow Jones Industrial Average suffered a one-day decline of value of 554 points on October 27, 1997.

[9] See Chase Securities Inc., "High-Yield Research Weekly Update," *Chase High-Yield Research*, November 4, 1997, p. 43.

319 bps. For a $1,000 market value BB rated corporate bond with a duration of five, this resulted in a loss of value of about $52.50 per bond.

In their simplest form, credit derivatives may be nothing more than the purchase of credit protection. The ability to isolate credit risk and manage it independently of underlying bond positions is the key benefit of credit derivatives. Prior to the introduction of credit derivatives, the only way to manage credit exposure was to buy and sell the underlying assets. Because of transaction costs and tax issues, this was an inefficient way to hedge or gain exposure.

Credit derivatives, therefore, represent a natural extension of the financial markets to unbundle the risk and return buckets associated with a particular financial asset, such as credit risk. They offer an important method for asset managers to hedge their exposure to credit risk because they permit the transfer of the exposure from one party to another. Credit derivatives allow for an efficient exchange of credit exposure in return for credit protection.

However, credit risk is not all one-sided. There are at least three reasons why an asset manager may be willing to assume the credit risk of an underlying corporate bond or issuer. First, there are credit upgrades as well as downgrades. For example, in the year 1999, S&P had 207 rating changes for investment-grade issues: 85 were rating upgrades and 122 were rating downgrades. For the same year, of the 202 rating changes for investment-grade issues by Moody's, there were 88 upgrades and 114 downgrades.[10] A factor affecting credit rating upgrades is a strong stock market which encourages public offerings of stock by credit-risky companies. Often, a large portion of these equity financings are used to reduce outstanding costly debt, resulting in improved balance sheets and credit ratings for the issuers.

A second reason why an asset manager may be willing to sell corporate credit protection is that there is an expectation of other credit events which have a positive effect on an issuer. Mergers and acquisitions, for instance, have historically been a frequent occurrence in the high-yield corporate bond market. Even though a credit-risky issuer may have a low debt rating, it may have valuable technology worth acquiring. High-yield issuers tend to be small- to mid-cap companies with viable products but nascent cash flows. Consequently, they make attractive takeover candidates for financially mature companies.

The third reason is that with a growing economy, banks are willing to provide term loans to companies that have issued high-yield bonds at more attractive rates than the bond markets. Consequently, it has been

[10] *Global Relative Value*, p. 135.

advantageous for companies to redeem their high-yield bonds and replace the bonds with a lower cost term loan from a bank. The resulting premium for redemption of high-yield bonds is a positive credit event which enhances portfolio returns for an asset manager.

Credit Risk and the Bank Loan Market

Similar to high-yield corporate bonds, a commercial loan investment represents a basket of risks. There is the risk from changes in interest rates (interest rate risk), the risk that the borrower will refinance or pay down the loan balance (call risk), and the risk of defaults, downgrades, and widening credit spreads (credit risk). The total return from a commercial loan is the compensation for assuming all of these risks. Once again, the credit rating of the borrower is a key determinant in the pricing of the bank loan.

The corporate bank loan market typically consists of syndicated loans to large- and mid-sized corporations. They are floating-rate instruments, often priced in relation to LIBOR. Corporate loans may be either revolving credits (known as "revolvers") that are legally committed lines of credit, or term loans that are fully funded commitments with fixed amortization schedules. Term loans tend to be concentrated in the lower-credit-rated corporations because revolvers usually serve as backstops for commercial paper programs of fiscally sound companies. Therefore, we will primarily focus on the application of credit derivatives to term bank loans.

Term bank loans are repriced periodically. Because of their floating interest rate nature, they have reduced market risk resulting from fluctuating interest rates. Consequently, credit risk takes on greater importance in determining a commercial loan's total return.

Since the mid-1990s, the bank loan market and the high-yield bond market have begun to converge. This is due partly to the relaxing of commercial banking regulations which have allowed many banks to increase their product offerings, including high-yield bonds. Contemporaneously, investment banks and brokerage firms have established loan trading and syndication desks. The credit implications from this "one-stop" shopping are twofold.

First, the debt capital markets have become less segmented as commercial banks and investment firms compete in the bank loan, high-yield bond, and private placement debt markets. This has led to more flexible, less stringent bank loan constraints. This increased competition for business in the commercial loan market has resulted in more favorable terms for debtors and less credit protection for investors.

Second, hybrid debt instruments with both bank loan and high-yield bond characteristics are now available in the capital markets. These hybrid commercial loans typically have a higher prepayment penalty than standard commercial loans, but only a second lien (or no lien) on assets instead of the traditional first claim. Additionally, several commercial loan tranches may now be offered as part of a financing package, where the first tranche of the bank loan is fully collateralized and has a regular amortization schedule, but the last tranche has no security interest and only a final bullet payment at maturity. These new commercial loans have the structure of high-yield bonds, but have the floating rate requirement of a bank loan. Consequently, the very structure of these hybrid bank loans make them more susceptible to credit risk.

Just like the high-yield bond market, bank loans are also susceptible to the risk of credit downgrades (downgrade risk) and the risk of increased credit spreads (credit spread risk). As an example of credit spread risk during the U.S. economic recession of 1990–1991, the credit spread for B rated bank loans increased on average from 250 bps over LIBOR to 325 bps, as default rates climbed to 10%.[11] Not surprisingly, over this time period the total return to B rated bank loans underperformed the total return to BBB and BB rated bank loans by 6.41% and 8.64%, respectively. Conversely, during the economic expansion years of 1993–1994, the total return to B rated bank loans outperformed the total return to BBB and BB rated bank loans by 3.43% and 1.15% as the default rate for B rated loans declined in 1993 and 1994 to 1.1% and 1.45%, respectively.[12]

In the event of a default, commercial bank loans generally have a higher recovery rate than that for defaulted high-yield bonds due to a combination of collateral protection and senior capital structure. Nonetheless, estimates of lost value given a commercial bank loan default are about **35%** of the loan value.[13] Even for asset-backed loans, which are highly collateralized and tightly monitored commercial loans, where the bank controls the cash receipts against the collateralized assets, the average loss of value in the event of default is about 13%.[14]

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[11] See Elliot Asarnow, "Corporate Loans as an Asset Class," *The Journal of Portfolio Management* (Summer 1996), pp. 92–103; and Edward Altman and Joseph Bencivenga, "A Yield Premium Model for the High-Yield Debt Market," *Financial Analysts Journal* (September–October 1995), pp. 49–56.

[12] See Asarnow, "Corporate Loans as an Asset Class," p. 96, and Altman and Bencivenga, "A Yield Premium Model for the High-Yield Debt Market," p. 51.

[13] See Asarnow, "Corporate Loans as an Asset Class," p. 94; and Barnish, Miller and Rushmore, "The New Leveraged Loan Syndication Market," p. 85.

[14] See Asarnow, "Corporate Loans as an Asset Class," p. 95.

The loss in value due to a default can have a significant impact on the total return of a bank loan. For a commercial bank loan the total return comes from two sources: The spread over the reference rate (LIBOR plus) and the return from price appreciation/depreciation. As might be expected, B rated bank loans are priced on average at higher rates than BBB rated bank loans—an average 250–300 bps over LIBOR compared to 50 bps over LIBOR for BBB rated loans. Yet, over the time period 1988–1994, the cumulative return to B rated bank loans was 10 percentage points less than that for BBB rated loans.[15] The lower total return to B rated loans was due to a price return of –10.26%. Simply put, changes in credit quality reduced the total return to lower-rated bank loans despite their higher coupon rates.

Credit risk, however, can also provide opportunities for gain. Over the same time period, the cumulative total return to BB rated bank loans exceeded that of BBB bank loans by 11.6%.[16] Part of this higher return was due to higher interest payments offered to induce investors to purchase the lower rated BB bank loans, but a significant portion, over 5%, was due to enhanced credit quality. Consequently, over this time period, asset managers had ample opportunity to target specific credit risks and improve portfolio returns.

Similar to the high-yield corporate bond market, the ability to isolate credit risk and manage it independently of underlying investment positions is the key benefit of credit derivatives. Prior to the introduction of credit derivatives, the only way to manage credit exposure was to buy and sell bank loans or restrict lending policies. Because of transaction costs, tax issues, and client relationships, this was an inefficient way to hedge or gain exposure.

Furthermore, credit derivatives offer an attractive method for hedging credit risk in lieu of liquidating the underlying collateral in a bank loan. Despite the security interest of a fully collateralized bank loan, there may be several reasons why a bank manager or asset manager may be reluctant to liquidate the collateral.

From a bank manager's perspective, the decision to liquidate the collateral will undoubtedly sour the customer relationship. Most banks consider loans as part of a broader client relationship that includes other noncredit business. Preserving the broader relationship may make a bank reluctant to foreclose.

Conversely, institutional investors focus on commercial loans as standalone investments and consider the economic risks and benefits of foreclosure. From their perspective, seizure of collateral may provoke a

[15] See Asarnow, "Corporate Loans as an Asset Class," p. 95.
[16] See Asarnow, "Corporate Loans as an Asset Class," p. 95.

litigation defense by the debtor. The attempt to foreclose on collateral may result in dragging the investor into protracted litigation on issues and in forums that the institutional investor may wish to avoid. Additionally, foreclosure by one creditor/investor may trigger similar responses from other investors leading to a feeding frenzy on the debtor's assets. The debtor may have no choice but to seek the protection of the bankruptcy laws which would effectively stop all seizures of collateral and extend the time for collateral liquidation. Lastly, there may be possible collateral deficiencies such as unperfected security interests which could make collateral liquidation problematic.[17]

The seizure, holding, and liquidation of collateral is also an expensive course of action. The most obvious costs are the legal fees incurred in seizing and liquidating the collateral. Additional costs include storage costs, appraisal fees, brokerage or auction costs, insurance, and property taxes. Hidden costs include the time spent by the investor and its personnel in managing and monitoring the liquidation process.

In sum, there are many reasons why the seizure and liquidation of collateral may not be a feasible solution for bank loan credit protection. Credit derivatives can solve these problems through the efficient exchange of credit risk. Furthermore, credit derivatives avoid the inevitable disruption of client relationships.

Credit Risk in the Sovereign Debt Market

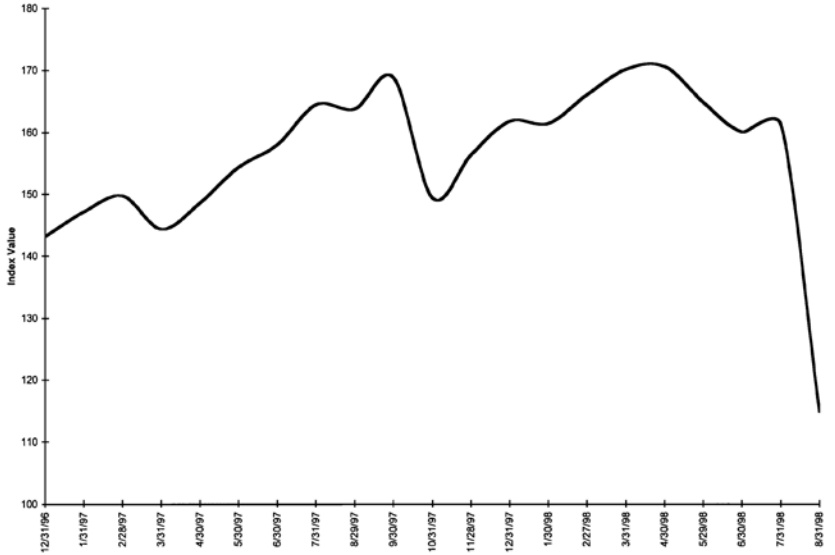
Credit risk is not unique to the domestic U.S. financial markets. When investing in the sovereign debt of a foreign country, an investor must consider two crucial risks. One is *political risk*—the risk that even though the central government of the foreign country has the financial ability to pay its debts as they come due, for political reasons (e.g. revolution, new government regime, trade sanctions), the sovereign entity decides to forfeit (default) payment.[18] The second type of risk is default risk—the same old inability to pay one's debts as they become due.

A sovereign government relies on two forms of cash flows to finance its government programs and to pay its debts: taxes and revenues from state-owned enterprises. Taxes can come from personal income taxes, corporate taxes, import duties, and other excise taxes. State-owned enterprises can be

[17] A security interest is effective between a lender and a borrower without any perfection. Perfection is the legal term for properly identifying an asset as collateral for a bank loan such that other lenders and creditors will not attach their security interests to the identified collateral except in a subordinated role.

[18] This raises the interesting idea of whether such a construct as a political derivative could be developed. While this may currently seem farfetched, it is no less implausible than credit derivatives once appeared.

EXHIBIT 1.1 JPMorgan Chase EMBI Index



oil companies, telephone companies, national airlines and railroads, and other manufacturing enterprises.

In times of economic turmoil such as a recession, cash flows from state-owned enterprises decline along with the general malaise of the economy. Additionally, tax revenues decline as corporations earn less, as unemployment rises, and as personal incomes decline. Lastly, with a declining foreign currency value, imports decline, reducing revenue from import taxes.

The extreme vicissitudes of the sovereign debt market are no more apparent than in the emerging market arena. Here, the "Asian Tigers"—Hong Kong, Taiwan, Korea, and Singapore—enjoyed a real average growth rate over the 1986–1996 period of about 8% per year. During this period, investors could have earned an average of 14% by investing in the public (or quasi-public) debt of these countries.

However, as the "Asian Contagion" demonstrated, the fortunes of the emerging market countries can deteriorate rapidly. Exhibit 1.1 presents the monthly price chart for JPMorgan Chase's Emerging Bond Index (EMBI) from December 31, 1996 to March 2003. EMBI is a weighted average of the returns to sovereign bonds for 15 emerging market countries from Latin America, Eastern Europe, and Asia.

As Exhibit 1.1 demonstrates, the performance of the EMBI index was generally positive for most of 1997, with a total return of more than 18% for the first three quarters of 1997. However, this good performance soured dramatically in the month of October. From a high of almost 172 on October 7, the index tumbled to 144 by November 10, a decline of over 16%. In the space of about one month, the declining fortunes of a broad sample of emerging market sovereigns wiped out most of the gains which had been earned over the nine previous months.

Once again, we point out that credit risk is not all one sided. Even though there was a rapid decline in the credit quality of emerging market sovereign debt in 1997, such a steep retreat presented opportunities for credit quality improvement. For instance, from its low point of 144 in November 1997, the EMBI index rebounded to a value of 172 by the end of March 1998, a gain of over 19%. Those investors who chose to include emerging market debt in their portfolios in the first quarter of 1998 earned excellent returns. In fact, the returns to the EMBI for the first quarter of 1998 outperformed U.S. Treasury bonds.

Even so, this recovery was short lived. Unfortunately, history often repeats itself. In August 1998 the Russian government defaulted on its outstanding bonds, sending the emerging bond market into another tailspin. This resulted in a one month decline of the EMBI Index of over 27% in August 1998.

For example, consider the Russian 10% government bond due in 2007. In July 1997 when this bond was issued, its credit spread over a comparable U.S. Treasury bond was 350 bps. As of July 1998, this credit spread had increased to 925 bps, an increase of 575 bps. In fact, the change in credit spread was so large, it was even greater than the current effective yield of a 30-year U.S. Treasury bond in July 1998!

The Russian bond was sold with a coupon of 10% in July 1997. In July 1998, the credit spread was 925 bps. The Russian bond had nine remaining annual coupon payments and a final balloon payment of $1,000 at maturity. The rate on a 9-year U.S Treasury bond was 5.8%. Therefore, the current value of the bond in 1998 was about $759.46. This represented a decline of $240.53, or 24% of the Russian bond's face value in one year's time.

If you think that the above example may be extreme, consider that in August 1998 the Russian economy suffered a total collapse and the credit spread for Russian debt increased to 5,300 bps over comparable U.S. Treasury bonds! This tremendous widening of credit spreads led to billions of dollars of losses by banks, brokerage houses, and hedge funds, as Russian investments were written down to 10 cents on the dollar.

VISUALIZING CREDIT RISK

The discussion in the previous section demonstrates that emerging market debt is subject to considerable credit risk. Sudden drops of the JPMorgan Chase EMBI index indicate the extent to which credit events can hit quickly and harshly in emerging market debt. A default in one emerging country can lead to widening credit spreads across all emerging markets. In addition, as the Russian bond example demonstrates, emerging market debt is subject to considerable default risk.

The same is true for high-yield corporate bonds. Credit events can have a devastating impact on the value of the bonds. To analyze this risk, we graphed the frequency distribution of the Salomon Smith Barney High Yield Index and the JPMorgan Chase EMBI index. The frequency distribution of returns provides a graphical depiction of the range and likelihood of returns associated with credit-risky bonds. From such a distribution, we can calculate the mean return, the standard deviation, the skew, and the kurtosis of the return distribution.

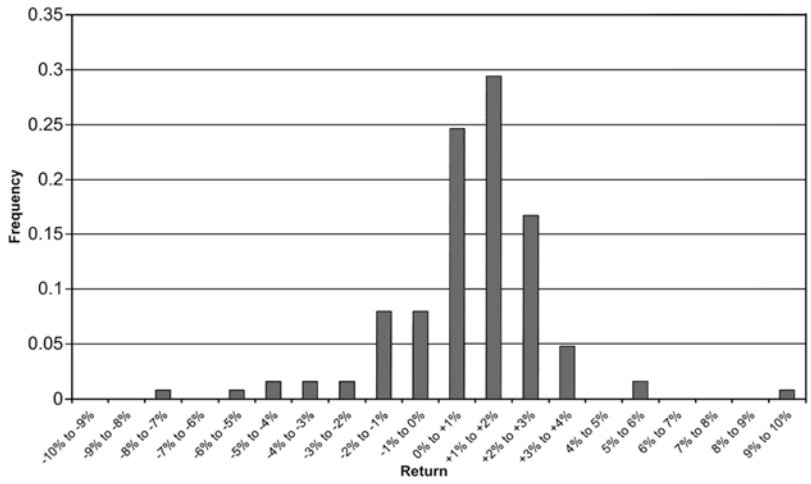
Return distributions can be described by what are known as "moments" of the distribution. Most market participants understand the first two moments of a distribution: they identify the mean and variance of the distribution. Often in finance, it is assumed that the returns to financial assets follow a normal, or bell-shaped, distribution. However, this is not the case for credit-risky assets.

Credit-risky assets are typically exposed to significant downside risk associated with credit downgrades, defaults, and bankruptcies. This downside risk can be described in terms of kurtosis and skewness. *Kurtosis* is a term used to describe the general condition that the probability mass associated with the tails of a return distribution, otherwise known as "outlier events," is different from that of a normal distribution. The condition of large tails in the distribution is known as *leptokurtosis*.[19] This means that the tails of the distribution have a greater concentration of mass (more outlier events) than what would be expected if the returns were symmetrically distributed under a normal distribution.

The skew of a distribution is also measured relative to a normal distribution. A normal distribution has no skew—its returns are symmetrically distributed around the mean return. A negative skew to a distribution indicates a bias towards downside exposure. This means that there are more frequent large negative outliers than there are large positive outliers. This indicates a return profile biased towards large negative returns.

[19] The converse of leptokurtosis is *platykurtosis*—the condition where the tails of the distribution are thinner than that of a normal distribution.

EXHIBIT 1.2 **Return Distribution on the Salomon Smith Barney High-Yield Index, 1990–2000**



Kurtosis	4.233	E(Return)	0.78%	Sharpe	0.157
Skewness	–0.434	Std. Dev.	2.13%	Risk Free	0.005

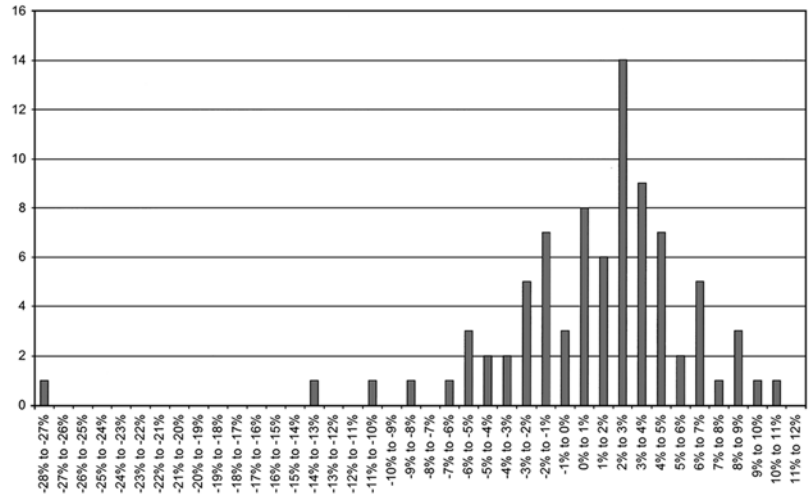
In Exhibit 1.2 we present the frequency return distribution for high-yield bonds over the time period 1990–2000. Over this time period, high-yield bonds had a negative skew value of –0.434 as well as a large positive value of kurtosis of 4.233. This distribution demonstrates significant leptokurtosis. Specifically, the distribution of returns to high-yield bonds demonstrates a significant downside tail. This "fat" tail reflects the credit event risk of downgrades, defaults, and bankruptcies.

Emerging market fares even worse. Exhibit 1.3 presents the frequency distribution of the returns for emerging market bonds. Emerging market debt has an even larger negative skew value as well as a larger value of kurtosis compared to high-yield bonds. Once again, the negative skew combined with large tails leads to considerable exposure to downside credit risk. Emerging market debt has a "fatter" tail than high-yield bonds. The "fat" negative tail associated with emerging market bonds reflects the risk of downgrades, defaults, and widening credit spreads.

RISKS OF CREDIT DERIVATIVES

While credit derivatives offer investors alternative strategies to access credit-risky assets, they come with specialized risks.

EXHIBIT 1.3 **Return Distribution on the JPMorgan Chase Emerging Market Composite, 1990–2000**



Average:	0.96%	Sharpe:	9.52%	Skewness:	–2.086
Std. Dev:	5.34%	Kurtosis:	8.889		

First, there is *operational risk*. This is the risk that traders or asset managers could imprudently use credit derivatives. Since these are off-balance sheet contractual agreements, excessive credit exposures can be achieved without appearing on an investor's balance sheet. Without proper accounting systems and other back-office operations, an investor may not be fully cognizant of the total credit risk it bears.

Second, there is *counterparty risk*. This is the risk that the counterparty to a credit derivative will default on its obligations. It is ironic that a credit protection buyer, for example, can introduce a new form of credit risk into a portfolio (counterparty risk) from the purchase of a credit derivative. For a credit protection buyer to suffer a loss, two things must happen: (1) there must be a credit event on the underlying credit-risky asset; and (2) the credit protection seller must default on its obligations to the credit protection buyer.

Another source of risk is *liquidity risk*. As noted in this chapter, currently there are no exchange-traded credit derivatives. Instead, they are traded over the counter as customized contractual agreements between two parties. The very nature of this customization makes credit derivatives illiquid. Credit derivatives will not suit all parties in the financial markets, and a party to a custom-tailored credit derivative contract may not be able to obtain the "fair value" of the contract when trying to sell a position.

Finally, there is *pricing risk*. As the credit derivative market has matured, the mathematical models used to price derivative contracts have become increasingly complex. These models, described in later chapters of this book, are dependent upon sophisticated assumptions regarding underlying economic parameters. Consequently, the prices of credit derivatives are very sensitive to the assumptions of the model employed.

FUTURE GROWTH OF THE CREDIT DERIVATIVES MARKET

The British Bankers Association (BBA) estimated that the global credit derivatives market (excluding asset swaps) was about $1.2 trillion by the end of 2001. Expectations are that the credit derivatives market will grow rapidly in the next few years. The BBA projects that without considering asset swaps the global credit derivatives market will grow to $4.8 trillion by 2004; the market is projected to exceed $5 trillion if asset swaps are included.[20]

As with every financial innovation, there will be setbacks in the market. As discussed in later chapters, several have already occurred in the credit derivatives market. These have provided critics of credit derivatives with ammunition. The criticisms are the same as those advanced for all derivative products and several cash market products such as high-yield bonds and asset-backed securities.

While the market will grow, the impediments to growth are the following:

- Documentation of the transactions
- Liquidity and transparency
- Counterparty risk
- Complexity of pricing
- Hedging difficulty
- Information asymmetries
- Lack of understanding by end users

We will discuss documentation of a credit derivative transaction in Chapter 3. What is important to understand is that the documentation defines what a credit event is. This definition is obviously crucial since it specifies when the credit protection buyer is to receive one or more payments from the credit protection seller. Market participants are structuring transactions to be more specific about what constitutes a credit event.

[20] British Bankers Association, *Credit Derivatives Report 2002*.