# THE J.P. MORGAN GUIDE TO CREDIT DERIVATIVES

**With Contributions from the RiskMetrics Group**

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## Introduction

Credit Derivatives are continuing to enjoy major growth in the financial markets, aided and abetted by sophisticated product development and the expansion of product applications beyond price management to the strategic management of portfolio risk. As Blythe Masters, global head of credit derivatives marketing at J.P. Morgan in New York points out: “In bypassing barriers between different classes, maturities, rating categories, debt seniority levels and so on, credit derivatives are creating enormous opportunities to exploit and profit from associated discontinuities in the pricing of credit risk”.

With such intense and rapid product development Risk Publications is delighted to introduce the first Guide to Credit Derivatives, a joint project with J.P. Morgan, a pioneer in the use of credit derivatives, with contributions from the RiskMetrics Group, a leading provider of risk management research, data, software, and education.

The guide will be of great value to risk managers addressing portfolio concentration risk, issuers seeking to minimise the cost of liquidity in the debt capital markets and investors pursuing assets that offer attractive relative value.

## About J.P. Morgan

With roots in commercial, investment, and merchant banking, J.P.Morgan today is a global financial leader transformed in scope and strength. We offer sophisticated financial services to companies, governments, institutions, and individuals, advising on corporate strategy and structure; raising equity and debt capital; managing complex investment portfolios; and providing access to developed and emerging financial markets.

J.P. Morgan's performance for clients affirms our position as a top underwriter and dealer in the fixed-income and credit markets; our unmatched derivatives and emerging markets capabilities; our global expertise in advising on mergers and acquisitions; leadership in institutional asset management; and our premier position in serving individuals with substantial wealth.

We aim to perform with such commitment, speed, and effect that when our clients have a critical financial need, they turn first to us. We act with singular determination to leverage our talent, franchise, résumé, and reputation - a whole that is greater than the sum of its parts - to help our clients achieve their goals.

### Leadership in credit derivatives

J.P. Morgan has been at the forefront of derivatives activity over the past two decades. Today the firm is a pioneer in the use of credit derivatives - financial instruments that are changing the way companies, financial institutions, and investors in measure and manage credit risk.

As the following pages describe, activity in credit derivatives is accelerating as users recognise the growing importance of managing credit risk and apply a range of derivatives techniques to the task. J.P. Morgan is proud to have led the way in developing these tools - from credit default swaps to securitisation vehicles such as BISTRO - widely acclaimed as one of the most innovative financial structures in recent years.

We at J.P. Morgan are pleased to sponsor this Guide to Credit Derivatives, published in association with Risk magazine, which we hope will promote understanding of these important new financial tools and contribute to the development of this activity, particularly among end-users.

In the face of stiff competition, Risk magazine readers voted J.P. Morgan as the highest overall performer in credit derivatives rankings. J.P. Morgan was was placed:

1sr credit default swaps - investment grade
1st credit default options
1st exotic credit derivatives
2nd credit default swaps - emerging
2nd basket default swaps
2nd credit-linked notes

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## CreditMetrics

Launched in 1997 and sponsored by over 25 leading global financial institutions, CreditMetrics is the benchmark in managing the risk of credit portfolios. Backed by an open and transparent methodology, CreditMetrics enables users to assess the overall level of credit risk in their portfolios, as well to identify identifying risk concentrations, and to compute both economic and regulatory capital.

CreditMetrics is currently used by over 100 clients around the world including banks, insurance companies, asset managers, corporates and regulatory capital.

## CreditManager

CreditManager is the software implementation of CreditMetrics, built and supported by the RiskMetrics Group.

Implementable on a desk-top PC, CreditManager allows users to capture, calculate and display the information they need to manage the risk of individual credit derivatives, or a portfolio of credits. CreditManager handles most credit instruments including bonds, loans, commitments, letter of credit, market-driven instruments such as swaps and forwards, as well as the credit derivatives as discussed in this guide. With a direct link to the CreditManager website, users of the software gain access to valuable credit data including transition matrices, default rates, spreads, and correlations. Like CreditMetrics, CreditManager is now the world's most widely used portfolio credit risk management system. ■

For more information on CreditMetrics and CreditManager, including the Introduction to CreditMetrics, the CreditMetrics Technical Document, a demo of CreditManager, and a variety of credit data, please visit the RiskMetrics Groups website at www.riskmetrics.com, or contact us at:

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# 1. Background and overview: The case for credit derivatives

## What are credit derivatives?

Derivatives growth in the latter part of the 1990s continues along at least three dimensions. Firstly, new products are emerging as the traditional building blocks – forwards and options – have spawned second and third generation derivatives that span complex hybrid, contingent, and path-dependent risks. Secondly, new applications are expanding derivatives use beyond the specific management of price and event risk to the strategic management of portfolio risk, balance sheet growth, shareholder value, and overall business performance. Finally, derivatives are being extended beyond mainstream interest rate, currency, commodity, and equity markets to new underlying risks including catastrophe, pollution, electricity, inflation, and credit.

Credit derivatives fit neatly into this three-dimensional scheme. Until recently, credit remained one of the major components of business risk for which no tailored risk-management products existed. Credit risk management for the loan portfolio manager meant a strategy of portfolio diversification backed by line limits, with an occasional sale of positions in the secondary market. Derivatives users relied on purchasing insurance, letters of credit, or guarantees, or negotiating collateralized mark-to-market credit enhancement provisions in Master Agreements. Corporates either carried open exposures to key customers' accounts receivable or purchased insurance, where available, from factors. Yet these strategies are inefficient, largely because they do not separate the management of credit risk from the asset with which that risk is associated.

For example, consider a corporate bond, which represents a bundle of risks, including perhaps duration, convexity, callability, and credit risk (constituting both the risk of default and the risk of volatility in credit spreads). If the only way to adjust credit risk is to buy or sell that bond, and consequently affect positioning across the entire bundle of risks, there is a clear inefficiency. Fixed income derivatives introduced the ability to manage duration, convexity, and callability independently of bond positions; credit derivatives complete the process by allowing the independent management of default or credit spread risk.

Formally, credit derivatives are bilateral financial contracts that isolate specific aspects of credit risk from an underlying instrument and transfer that risk between two parties. In so doing, credit derivatives separate the ownership and management of credit risk from other qualitative and quantitative aspects of ownership of financial assets. Thus, credit derivatives share one of the key features of historically successful derivatives products, which is the potential to achieve efficiency gains through a process of market completion. Efficiency gains arising from disaggregating risk are best illustrated by imagining an auction process in which an auctioneer sells a number of risks, each to the highest bidder, as compared to selling a "job lot" of the same risks to the highest bidder for the entire package. In most cases, the separate auctions will yield a higher aggregate sale price than the job lot. By separating specific aspects of credit risk from other risks, credit derivatives allow even the most illiquid credit exposures to be transferred from portfolios that have but don't want the risk to those that want but don't have that risk, even when the underlying asset itself could not have been transferred in the same way.

### What is the significance of credit derivatives?

Even today, we cannot yet argue that credit risk is, on the whole, "actively" managed. Indeed, even in the largest banks, credit risk management is often little more than a process of setting and adhering to notional exposure limits and pursuing limited opportunities for portfolio diversification. In recent years, stiff competition among lenders, a tendency by some banks to treat lending as a loss-leading cost of relationship development, and a benign credit cycle have combined to subject bank loan credit spreads to relentless downward pressure, both on an absolute basis and relative to other asset classes. At the same time, secondary market illiquidity, relationship constraints, and the luxury of cost rather than mark-to-market accounting have made active portfolio management either impossible or unattractive. Consequently, the vast majority of bank loans reside where they are originated until maturity. In 1996, primary loan syndication origination in the U.S. alone exceeded $900 billion, while secondary loan market volumes were less than $45 billion.

However, five years hence, commentators will look back to the birth of the credit derivative market as a watershed development for bank credit risk management practice. Simply put, credit derivatives are fundamentally changing the way banks price, manage, transact, originate, distribute, and account for credit risk. Yet, in substance, the definition of a credit derivative given above captures many credit instruments that have been used routinely for years, including guarantees, letters of credit, and loan participations. So why attach such significance to this new group of products? Essentially, it is the precision with which credit derivatives can isolate and transfer certain aspects of credit risk, rather than their economic substance, that distinguishes them from more traditional credit instruments. There are several distinct arguments, not all of which are unique to credit derivatives, but which combine to make a strong case for increasing use of credit derivatives by banks and by all institutions that routinely carry credit risk as part of their day-to-day business.

Bilateral financial contract in which the Protection Buyer pays a periodic fee in return for a Contingent Payment by the Protection Seller following a Credit Event.

First, the Reference Entity, whose credit risk is being transferred, need neither be a party to nor aware of a credit derivative transaction. This confidentiality enables banks and corporate treasurers to manage their credit risks discreetly without interfering with important customer relationships. This contrasts with both a loan assignment through the secondary loan market, which requires borrower notification, and a silent participation, which requires the participating bank to assume as much credit risk to the selling bank as to the borrower itself.

The absence of the Reference Entity at the negotiating table also means that the terms (tenor, seniority, compensation structure) of the credit derivative transaction can be customized to meet the needs of the buyer and seller of risk, rather than the particular liquidity or term needs of a borrower. Moreover, because credit derivatives isolate credit risk from relationship and other aspects of asset ownership, they introduce discipline to pricing decisions. Credit derivatives provide an objective market pricing benchmark representing the true opportunity cost of a transaction. Increasingly, as liquidity and pricing technology improve, credit derivatives are defining credit spread forward curves and implied volatilities in a way that less liquid credit products never could. The availability and discipline of visible market pricing enables institutions to make pricing and relationship decisions more objectively.

Second, credit derivatives are the first mechanism via which short sales of credit instruments can be executed with any reasonable liquidity and without the risk of a short squeeze. It is more or less impossible to short-sell a bank loan, but the economics of a short position can be achieved synthetically by purchasing credit protection using a credit derivative. This allows the user to reverse the "skewed" profile of credit risk (whereby one earns a small premium for the risk of a large loss) and instead pay a small premium for the possibility of a large gain upon credit deterioration. Consequently, portfolio managers can short specific credits or a broad index of credits, either as a hedge of existing exposures or simply to profit from a negative credit view. Similarly, the possibility of short sales opens up a wealth of arbitrage opportunities. Global credit markets today display discrepancies in the pricing of the same credit risk across different asset classes, maturities, rating cohorts, time zones, currencies, and so on. These discrepancies persist because arbitrageurs have traditionally been unable to purchase cheap obligations against shorting expensive ones to extract arbitrage profits. As credit derivative liquidity improves, banks, borrowers, and other credit players will exploit such opportunities, just as the evolution of interest rate derivatives first prompted cross-market interest rate arbitrage activity in the 1980s. The natural consequence of this is, of course, that credit pricing discrepancies will gradually disappear as credit markets become more efficient.

A key distinction between cash and physical settlement: following physical delivery, the Protection Seller has recourse to the Reference Entity and the opportunity to participate in the workout process as owner of a defaulted obligation.

Third, credit derivatives, except when embedded in structured notes, are off-balance-sheet instruments. As such, they offer considerable flexibility in terms of leverage. In fact, the user can define the required degree of leverage, if any, in a credit investment. The appeal of off- as opposed to on-balance-sheet exposure will differ by institution: The more costly the balance sheet, the greater the appeal of an off-balance-sheet alternative. To illustrate, bank loans have not traditionally appealed as an asset class to hedge funds and other nonbank institutional investors for at least two reasons: first, because of the administrative burden of assigning and servicing loans; and second, because of the absence of a repo market. Without the ability to finance investments in bank loans on a secured basis via some form of repo market, the return on capital offered by bank loans has been unattractive to institutions that do not enjoy access to unsecured financing. However, by taking exposure to bank loans using a credit derivative such as a Total Return Swap (described more fully below), a hedge fund can both synthetically finance the position (receiving under the swap the net proceeds of the loan after financing) and avoid the administrative costs of direct ownership of the asset, which are borne by the swap counterparty. The degree of leverage achieved using a Total Return Swap will depend on the amount of up-front collateralization, if any, required by the total return payer from its swap counterparty. Credit derivatives are thus opening new lines of distribution for the credit risk of bank loans and many other instruments into the institutional capital markets.

This article introduces the basic structures and applications that have emerged in recent years and focuses on situations in which their use produces benefits that can be evaluated without the assistance of complex mathematical or statistical models. The applications discussed will include those for risk managers addressing portfolio concentration risk, for issuers seeking to minimize the costs of liquidity in the debt capital markets, and for investors pursuing assets that offer attractive relative value. In each case, the recurrent theme is that in bypassing barriers between different asset classes, maturities, rating categories, debt seniority levels, and so on, credit derivatives create enormous opportunities to exploit and profit from associated discontinuities in the pricing of credit risk. ■

## 2. Basic credit derivative structures and applications

The most highly structured credit derivatives transactions can be assembled by combining three main building blocks:

1. Credit (Default) Swaps
2. Credit Options
3. Total Return Swaps

### Credit (Default) Swaps

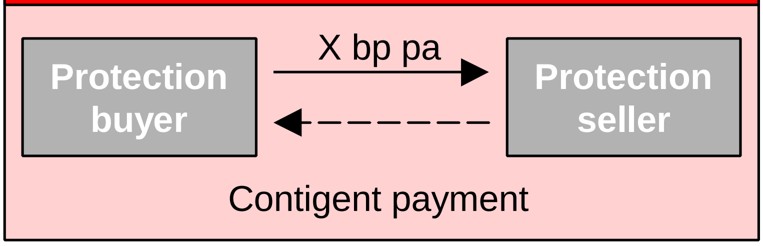
The Credit Swap or ("Credit Default Swap") illustrated in Chart 1 is a bilateral financial contract in which one counterparty (the Protection Buyer) pays a periodic fee, typically expressed in basis points per annum, paid on the notional amount, in return for a Contingent Payment by the Protection Seller following a Credit Event with respect to a Reference Entity.

The definitions of a Credit Event, the relevant Obligations and the settlement mechanism used to determine the Contingent Payment are flexible and determined by negotiation between the counterparties at the inception of the transaction.

Since 1991, the International Swap and Derivatives Association (ISDA) has made available a standardized letter confirmation allowing dealers to transact Credit Swaps under the umbrella of an ISDA Master Agreement. The standardized confirmation allows the parties to specify the precise terms of the transaction from a number of defined alternatives. In July 1999, ISDA published a revised Credit Swap documentation, with the objective to further standardize the terms when appropriate, and provide a greater clarity of choices when standardization is not appropriate (see *Highlights on the new 1999 ISDA credit derivatives definitions*).

The evolution of increasingly standardized terms in the credit derivatives market has been a major development because it has reduced legal uncertainty that, at least in the early stages, hampered the market's growth. This uncertainty originally arose because credit derivatives, unlike many other derivatives, are frequently triggered by a defined (and fairly unlikely) event rather than a defined price or rate move, making the importance of watertight legal documentation for such transactions commensurately greater.

Figure 1: Credit (default) swap




A Credit Event is most commonly defined as the occurrence of one or more of the following:

(i) Failure to meet payment obligations when due (after giving effect to the Grace Period, if any, and only if the failure to pay is above the payment requirement specified at inception),

(ii) Bankruptcy (for non-sovereign entities) or Moratorium (for sovereign entities only),

(iii) Repudiation,

(iv) Material adverse restructuring of debt,

(v) Obligation Acceleration or Obligation Default. While Obligations are generally defined as borrowed money, the spectrum of Obligations goes from one specific bond or loan to payment or repayment of money, depending on whether the counterparties want to mirror the risks of direct ownership of an asset or rather transfer macro exposure to the Reference entity.

The Contingent Payment can be effected by a **cash settlement mechanism** designed to mirror the loss incurred by creditors of the Reference Entity following a Credit Event. This payment is calculated as the fall in price of the Reference Obligation below par at some pre-designated point in time after the Credit Event. Typically, the price change will be determined through the Calculation Agent by reference to a poll of price quotations obtained from dealers for the Reference Obligation on the valuation date. Since most debt obligations become due and payable in the event of default, plain vanilla loans and bonds will trade at the same dollar price following a default, reflecting the market's estimate of recovery value, irrespective of maturity or coupon. Alternatively, counterparties can fix the Contingent Payment as a predetermined sum, known as a "binary" settlement.

The other settlement method is for the Protection Buyer to make **physical delivery** of a portfolio of specified Deliverable Obligations in return for payment of their face amount. Deliverable Obligations may be the Reference Obligation or one of a broad class of obligations meeting certain specifications, such as any senior unsecured claim against the Reference Entity. The physical settlement option is not always available since Credit Swaps are often used to hedge exposures to assets that are not readily transferable or to create short positions for users who do not own a deliverable obligation.

### A few highlights on the new 1999 ISDA credit derivatives definitions

**Further standardisation of terms with 38 presumptions for terms that are not specified**

The new ISDA documentation aims for further standardisation of a book of definitions. Where parties do not specify particular terms, the definitions may provide for fallbacks. For example, where the Calculation Agent has not been specified by the parties in a confirmation to a transaction, it is deemed to be the Protection Seller.

**Tightening of the Restructuring definition**

Previous Restructuring definition referred to an adjustment with respect to any Obligation of the Reference Entity resulting in such Obligation being, overall, "materially less favorable from an economic, credit or risk perspective" to its holder, subject to the determination of the Calculation Agent. The definition has been amended in the new ISDA documentation and now lists the specific occurrences on which the Restructuring Credit Event is to be triggered.

**"The Matrix": Check-list approach for specifying Obligations and Deliverable Obligations**

Selection of (1) Categories and (2) Characteristics for both Obligations and Deliverable Obligations. Counterparties have to choose one Category only for Obligations and Deliverable Obligations but may select as many respective Characteristics as they require.

**New concepts/timeframe for physical settlement**

For physically-settled default swap transactions, the new documentation introduces the concept of Notice of Intended Physical Settlement, which provides that the Buyer may elect to settle the whole transaction, not to settle or to settle in part only. The Buyer has 30 days after delivery of a Credit Event Notice to notify the other part of its intentions with respect what it intends to physically settle after which if no such notice is delivered, the transaction lapses.

**Dispute resolution**

New guidelines to address parties' dissatisfaction with the recourse to a disinterested third party. The creation of an arbitration panel of experts has been considered.

**Materiality clause**

In certain contracts, the occurrence of a Credit Event has to be coupled with a significant price deterioration (net of price changes due to interest rate movements) in a specified Reference Obligation issued or guaranteed by the Reference Entity. This requirement, known as a Materiality clause, is designed to ensure that a Credit Event is not triggered by a technical (I.e, non-credit-related) defaut, such as a disputed or late payment or a failure in the cleaning systems. The Materiality clause has disappeared from the main body of the new ISDA confirmations, and is now the object of an annex to the document.

## Addressing illiquidity using Credit Swaps

In some cases, credit swaps have substituted other credit instruments to gather most of the liquidity on a specific underlying credit risk. Credit Swaps deepen the secondary market for credit risk far beyond that of the secondary market of the underlying credit instrument.

Credit Swaps, and indeed all credit derivatives, are mainly inter-professional (meaning non-retail) transactions. Averaging $25 to $50 million per transaction, they range in size from a few million to billions of dollars. Reference Entities may be drawn from a wide universe including sovereigns, semi-governments, financial institutions, and all other investment or sub-investment grade corporates. Maturities usually run from one to ten years and occasionally beyond that, although counterparty credit quality concerns frequently limit liquidity for longer tenors. For corporates or financial institutions credit risks, five-year tends to be the benchmark maturity, where greatest liquidity can be found. While publicly rated credits enjoy greater liquidity, ratings are not necessarily a requirement. The only true limitation to the parameters of a Credit Swap is the willingness of the counterparties to act on a credit view.

Illiquidity of credit positions can be caused by any number of factors, both internal and external to the organization in question. Internally, in the case of bank loans and derivative transactions, relationship concerns often lock portfolio managers into credit exposure arising from key client transactions. Corporate borrowers prefer to deal with smaller lending groups and typically place restrictions on transferability and on which entities can have access to that group. Credit derivatives allow users to reduce credit exposure without physically removing assets from their balance sheet. Loan sales or the assignment or unwinding of derivative contracts typically require the notification and/or consent of the customer. By contrast, a credit derivative is a confidential transaction that the customer need neither be party to nor aware of, thereby separating relationship management from risk management decisions.

Similarly, the tax or accounting position of an institution can create significant disincentives to the sale of an otherwise relatively liquid position – as in the case of an insurance company that owns a public corporate bond in its hold-to-maturity account at a low tax base. Purchasing default protection via a Credit Swap can hedge the credit exposure of such a position without triggering a sale for either tax or accounting purposes. Recently, Credit Swaps have been employed in such situations to avoid unintended adverse tax or accounting consequences of otherwise sound risk management decisions.

More often, illiquidity results from factors external to the institution in question. The secondary market for many loans and private placements is not deep, and in the case of certain forms of trade receivable or insurance contract, may not exist at all. Some forms of credit exposure, such as the business concentration risk to key customers faced by many corporates (meaning not only the default risk on accounts receivable, but also the risk of customer replacement cost), or the exposure employees face to their employers in respect of non-qualified deferred compensation, are simply not transferable at all. In all of these cases, Credit Swaps can provide a hedge of exposure that would not otherwise be achievable through the sale of an underlying asset.

### Exploiting a funding advantage or avoiding a disadvantage via credit swaps

When an investor owns a credit-risky asset, the return for assuming that credit risk is only the net spread earned after deducting that investor's cost of funding the asset on its balance sheet. Thus, it makes little sense for an A-rated bank funding at LIBOR flat to lend money to a AAA-rated entity that borrows at LIBID. After funding costs, the A-rated bank takes a loss but still takes on risk. Consequently, entities with high funding levels often buy risky assets to generate spread income. However, since there is no up-front principal outlay required for most Protection Sellers when assuming a Credit Swap position, these provide an opportunity to take on credit exposure in off balance-sheet positions that do not need to be funded. Credit Swaps are therefore fast becoming an important source of investment opportunity and portfolio diversification for banks, insurance companies (both monolines and traditional insurers), and other institutional investors who would otherwise continue to accumulate concentrations of lower-quality assets due to their own high funding costs.

On the other hand, institutions with low funding costs may capitalise on this advantage by funding assets on the balance sheet and purchasing default protection on those assets. The premium for buying default protection on such assets may be less than the net spread such a bank would earn over its funding costs. Hence a low-cost investor may offset the risk of the underlying credit but still retain a net positive income stream. Of course, as we will discuss in more detail, the counterparty risk to the Protection Seller must be covered by this residual income. However, the combined credit quality of the underlying asset and the credit protection purchased, even from a lower-quality counterparty, may often be very high, since two defaults (by both the Protection Seller and the Reference Entity) must occur before losses are incurred, and even then losses will be mitigated by the recovery rate on claims against both entities.

### Lowering the cost of protection in a credit swap

*Contingent credit swap*

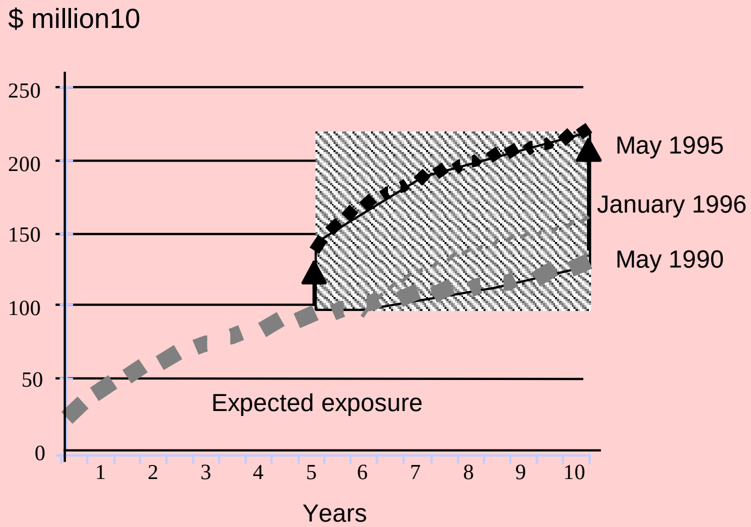
Contingent credit swaps are hybrid credit derivatives which, in addition to the occurrence of a Credit Event require an additional trigger, typically the occurrence of a Credit Event with respect to another Reference Entity or a material movement in equity prices, commodity prices, or interest rates. The credit protection provided by a contingent credit swap is weaker -thus cheaper- than the credit protection under a regular credit swap, and is more optimal when there is a low correlation between the occurrence of the two triggers.

### *Dynamic credit swap*

Dynamic credit swaps aim to address one of the difficulties in managing credit risk in derivative portfolios, which is the fact that counterparty exposures change with both the passage of time and underlying market moves.  In a swap position, both counterparties are subject to counterparty credit exposure, which is a combination of the current mark-to-market of the swap as well as expected future replacement costs.

Chart 2 shows how projected exposure on a cross-currency swap can change in just a few years.  At inception in May 1990, prevailing rates implied a maximum exposure at maturity of $125 million on a notional of $100 million. Five years later, as the yen strengthened and interest rates dropped, the maximum exposure was calculated at $220 million.  By January 1996, the exposure slipped back to around $160 million..

**Figure 2:The instability of projected swap exposure**




The shaded area shows the extent to which projected peak exposure on a 10-year yen/$ swap with principal exchange, effective in May 1990, fluctuated during the subsequent five and a half years

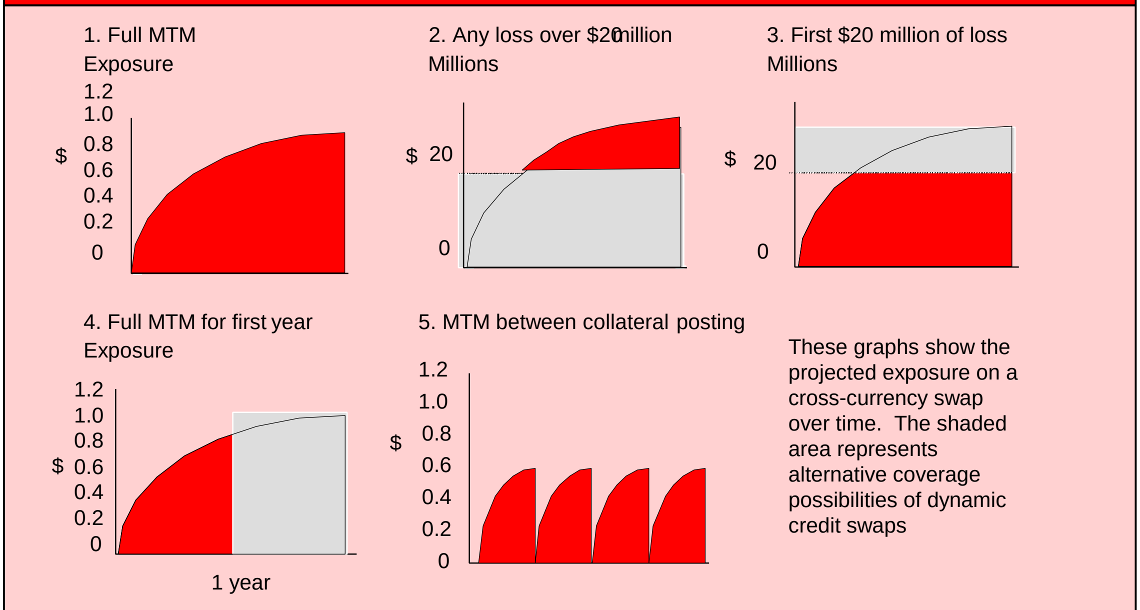
Swap counterparty exposure is therefore a function both of underlying market volatility, forward curves, and time.  Furthermore, potential exposure will be exacerbated if the quality of the credit itself is correlated to the market; a fixed rate receiver that is domiciled in a country whose currency has experienced depreciation and has rising interest rates will be out-of-the-money on the swap and could well be a weaker credit.

Key distinction between Credit Swap and TR Swap:
A Credit Swap results in a floating payment only following a Credit Event, while a TR Swap results in payments reflecting changes in the market value of a specified asset in the normal course of business.

An important innovation in credit derivatives is the Dynamic Credit Swap (or "Credit Intermediation Swap"), which is a Credit Swap with the notional linked to the mark-to-market of a reference swap or portfolio of swaps. In this case, the notional amount applied to computing the Contingent Payment is equal to the mark-to-market value, if positive, of the reference swap at the time of the Credit Event (see Chart 3.1). The Protection Buyer pays a fixed fee, either up front or periodically, which once set does not vary with the size of the protection provided. The Protection Buyer will only incur default losses if the swap counterparty and the Protection Seller fail. This dual credit effect means that the credit quality of the Protection Buyer's position is compounded to a level better than the quality of either of its individual counterparties. The status of this credit combination should normally be relatively impervious to market moves in the underlying swap, since, assuming an uncorrelated counterparty, the probability of a joint default is small.

Dynamic Credit Swaps may be employed to hedge exposure between margin calls on collateral posting (Chart 3.5). Another structure might cover any loss beyond a pre-agreed amount (Chart 3.2) or up to a maximum amount (Chart 3.3). The protection horizon does not need to match the term of the swap; if the Buyer is primarily concerned with short-term default risk, it may be cheaper to hedge for a shorter period and roll over the Dynamic Credit Swap (Chart 3.4).

**Figure 3:The instability of projected swap exposure**




TR Swaps transfer an asset's total economic performance, including - but not restricted to its credit related performance

A Dynamic Credit Swap avoids the need to allocate resources to a regular mark-to-market settlement or collateral agreements. Furthermore, it provides an alternative to unwinding a risky position, which might be difficult for relationship reasons or due to underlying market illiquidity.

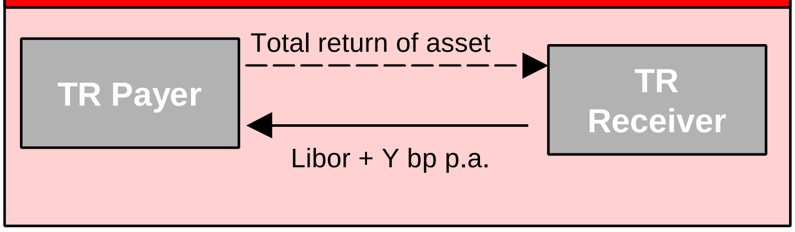
Where a creditor is owed an amount denominated in a foreign currency, this is analogous to the credit exposure in a cross-currency swap. The amount outstanding will fluctuate with foreign exchange rates, so that credit exposure in the domestic currency is dynamic and uncertain. Thus, foreign-currency-denominated exposure may also be hedged using a Dynamic Credit Swap.

### Total (Rate of) Return Swaps

A Total Rate of Return Swap ("Total Return Swap" or "TR Swap") is also a bilateral financial contract designed to transfer credit risk between parties, but a TR Swap is importantly distinct from a Credit Swap in that it exchanges the total economic performance of a specified asset for another cash flow. That is, payments between the parties to a TR Swap are based upon changes in the market valuation of a specific credit instrument, irrespective of whether a Credit Event has occurred.

Specifically, as illustrated in Chart 4, one counterparty (the "TR Payer") pays to the other (the "TR Receiver") the total return of a specified asset, the Reference Obligation. "Total return" comprises the sum of interest, fees, and any change-in-value payments with respect to the Reference Obligation. The change-in-value payment is equal to any appreciation (positive) or depreciation (negative) in the market value of the Reference Obligation, as usually determined on the basis of a poll of reference dealers. A net depreciation in value (negative total return) results in a payment to the TR Payer. Change-in-value payments may be made at maturity or on a periodic interim basis. As an alternative to cash settlement of the change-in-value payment, TR Swaps can allow for physical delivery of the Reference Obligation at maturity by the TR Payer in return for a payment of the Reference Obligation's initial value by the TR Receiver. Maturity of the TR Swap is not required to match that of the Reference Obligation, and in practice rarely does. In return, the TR Receiver typically makes a regular floating payment of LIBOR plus a spread (Y b.p. p.a. in Chart 2).

**Figure 4: Total return swap**



### Synthetic financing using Total Return Swaps

A TR Swap can be seen as a balance sheet rental from the TR Payer to the TR Receiver.

When entering into a TR Swap on an asset residing in its portfolio, the TR Payer has effectively removed all economic exposure to the underlying asset. This risk transfer is effected with confidentiality and without the need for a cash sale. Typically, the TR Payer retains the servicing and voting rights to the underlying asset, although occasionally certain rights may be passed through to the TR Receiver under the terms of the swap. The TR Receiver has exposure to the underlying asset without the initial outlay required to purchase it. The economics of a TR Swap resemble a synthetic secured financing of a purchase of the Reference Obligation provided by the TR Payer to the TR Receiver. This analogy does, however, ignore the important issues of counterparty credit risk and the value of aspects of control over the Reference Obligation, such as voting rights if they remain with the TR Payer.

Consequently, a key determinant of pricing of the "financing" spread on a TR Swap (Y b.p. p.a. in Chart 2) is the cost to the TR Payer of financing (and servicing) the Reference Obligation on its own balance sheet, which has, in effect, been "lent" to the TR Receiver for the term of the transaction. Counterparties with high funding levels can make use of other lower-cost balance sheets through TR Swaps, thereby facilitating investment in assets that diversify the portfolio of the user away from more affordable but riskier assets.

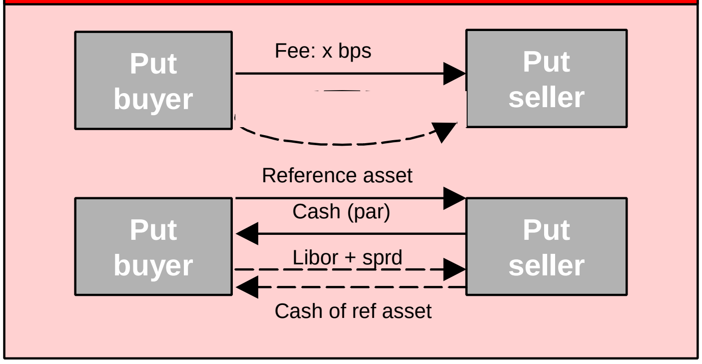
Because the maturity of a TR Swap does not have to match the maturity of the underlying asset, the TR Receiver in a swap with maturity less than that of the underlying asset may benefit from the positive carry associated with being able to roll forward short-term synthetic financing of a longer-term investment. The TR Payer may benefit from being able to purchase protection for a limited period without having to liquidate the asset permanently. At the maturity of a TR Swap whose term is less than that of the Reference Obligation, the TR Payer essentially has the option to reinvest in that asset (by continuing to own it) or to sell it at the market price. At this time, the TR Payer has no exposure to the market price since a lower price will lead to a higher payment by the TR Receiver under the TR Swap.

Other applications of TR Swaps include making new asset classes accessible to investors for whom administrative complexity or lending group restrictions imposed by borrowers have traditionally presented barriers to entry. Recently insurance companies and levered fund managers have made use of TR Swaps to access bank loan markets in this way.

### Credit Options

Credit Options are put or call options on the price of either (a) a floating rate note, bond, or loan or (b) an "asset swap" package, which consists of a credit-risky instrument with any payment characteristics and a corresponding derivative contract that exchanges the cash flows of that instrument for a floating rate cash flow stream. In the case of (a), the Credit Put (or Call) Option grants the Option Buyer the right, but not the obligation, to sell to (or buy from) the Option Seller a specified floating rate Reference Asset at a pre-specified price (the "Strike Price"). Settlement may be on a cash or physical basis.

Figure 5: Credit put option




The more complex example of a Credit Option on an asset swap package described in (b) is illustrated in Chart 5. Here, the Put buyer pays a premium for the right to sell to the Put Seller a specified Reference Asset and simultaneously enter into a swap in which the Put Seller pays the coupons on the Reference Asset and receives three- or six-month LIBOR plus a predetermined spread (the "Strike Spread"). The Put seller makes an up-front payment of par for this combined package upon exercise.

Credit Options may be American, European, or multi-European style. They may be structured to survive a Credit Event of the issuer or guarantor of the Reference Asset (in which case both default risk and credit spread risk are transferred between the parties), or to knock out upon a Credit Event, in which case only credit spread risk changes hands

As with other options, the Credit Option premium is sensitive to the volatility of the underlying market price (in this case driven primarily by credit spreads rather than the outright level of yields, since the underlying instrument is a floating rate asset or asset swap package), and the extent to which the Strike Spread is "in" or "out of" the money relative to the applicable current forward credit spread curve. Hence the premium is greater for more volatile credits, and for tighter Strike Spreads in the case of puts and wider Strike Spreads in the case of calls. Note that the extent to which a Strike Spread on a one-year Credit Option on a five-year asset is in or out of the money will depend upon the implied five-year credit spread in one year's time (or the "one by five year" credit spread), which in turn would have to be backed out from current one- and six-year spot credit spreads.

### Yield enhancement and credit spread/downgrade protection

Credit Options have recently found favor with institutional investors as a source of yield enhancement. In buoyant market environments, with credit spread product in tight supply, credit market investors frequently find themselves underinvested. Consequently, the ability to write Credit Options, whereby investors collect current income in return for the risk of owning (in the case of a put) or losing (in the case of a call) an asset at a specified price in the future is an attractive enhancement to inadequate current income.

Buyers of Credit Options, on the other hand, are often institutions such as banks and dealers who are interested in hedging their mark-to-market exposure to fluctuations in credit spreads: hedging long positions with puts, and short positions with calls. For such institutions, which often run leveraged balance sheets, the off-balance-sheet nature of the positions created by Credit Options is an attractive feature. . Credit Options can also be used to hedge exposure to downgrade risk, and both Credit Swaps and Credit Options can be tailored so that payments are triggered upon a specified downgrade event.

Such options have been attractive for portfolios that are forced to sell deteriorating assets, where preemptive measures can be taken by structuring credit derivatives to provide downgrade protection. This reduces the risk of forced sales at distressed prices and consequently enables the portfolio manager to own assets of marginal credit quality at lower risk. Where the cost of such protection is less than the pickup in yield of owning weaker credits, a clear improvement in portfolio risk-adjusted returns can be achieved.

### Hedging future borrowing costs

Credit Options also have applications for borrowers wishing to lock in future borrowing costs without inflating their balance sheet. A borrower with a known future funding requirement could hedge exposure to outright interest rates using interest rate derivatives. Prior to the advent of credit derivatives, however, exposure to changes in the level of the issuer's borrowing spreads could not be hedged without issuing debt immediately and investing funds in other assets. This had the adverse effect of inflating the current balance sheet unnecessarily and exposing the issuer to reinvestment risk and, often, negative carry. Today, issuers can enter into Credit Options on their own name and lock in future borrowing costs with certainty. Essentially, the issuer is able to buy the right to put its own paper to a dealer at a pre-agreed spread. In a further recent innovation, issuers have sold puts or downgrade puts on their own paper, thereby providing investors with credit enhancement in the form of protection against a credit deterioration that falls short of outright default (whereupon such a put would of course be worthless). The objective of the issuer is to reduce borrowing costs and boost investor confidence. ■

# 3. Investment Applications

### Generic investment considerations: Building tailored credit derivatives structures

Maintaining diversity in credit portfolios can be challenging. This is particularly true when the portfolio manager has to comply with constraints such as currency denominations, listing considerations or maximum or minimum portfolio duration. Credit derivatives are being used to address this problem by providing tailored exposure to credits that are not otherwise available in the desired form or not available at all in the cash market.

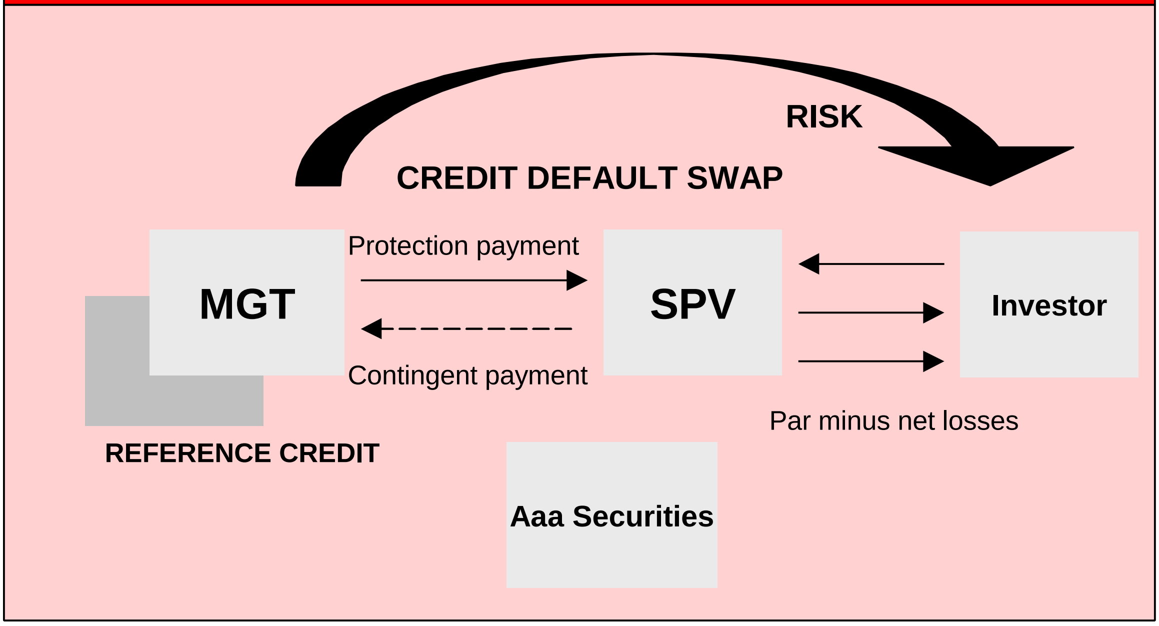
Under-leveraged credits that do not issue debt are usually attractive, but by definition, exposure to these credits is difficult to find. It is rarely the case, however, that no economic risk to such credits exists at all. Trade receivables, fixed price forward sales contracts, third party indemnities, deep in-the-money swaps, insurance contracts, and deferred employee compensation pools, for example, all create credit exposure in the normal course of business of such companies. Credit derivatives now allow intermediaries to strip out such unwanted credit exposure and redistribute it among banks and institutional investors who find it attractive as a mechanism for diversifying investment portfolios. Gaps in the credit spectrum may be filled not only by bringing new credits to the capital markets, but also by filling maturity and seniority gaps in the debt issuance of existing borrowers.

In addition, credit derivatives help customize the risk/return profile of a financial product. The credit risk on a name, or a basket of names, can be “re-shaped” to meet investor needs, through a degree of capital/coupon protection or in contrary by adding leverage features. The payment profile can also be tailored to better suit clients’ asset-liability management constraints through step-up coupons, zero-coupon structures with or without lock-in of the accrued coupon.

### Credit-Linked Notes can be used to create funded bespoke exposures unavailable in the capital markets.

Unlike credit swaps, credit-linked notes are funded balance sheet assets that offer synthetic credit exposure to a reference entity in a structure designed to resemble a synthetic corporate bond or loan. Credit-linked notes are frequently issued by special purpose vehicles (corporations or trusts) that hold some form of collateral securities financed through the issuance of notes or certificates to the investor. The investor receives a coupon and par redemption, provided there has been no credit event of the reference entity. The vehicle enters into a credit swap with a third party in which it sells default protection in return for a premium that subsidizes the coupon to compensate the investor for the reference entity default risk.

**Figure 1: The credit-linked note issued by a special purpose vehicle**




The investor assumes credit risk of both the Reference Entity and the underlying collateral securities. In the event that the Reference Entity defaults, the underlying collateral is liquidated and the investor receives the proceeds only after the Credit Swap counterparty is paid the Contingent Payment. If the underlying collateral defaults, the investor is exposed to its recovery regardless of the performance of the Reference Entity. This additional risk is recognized by the fact that the yield on the Credit-Linked Note is higher than that of the underlying collateral and the premium on the Credit Swap individually.

In order to tailor the cash flows of the Credit-Linked Note it may be necessary to make use of an interest rate or cross-currency swap. At inception, this swap would be on-market, but as markets move, the swap may move into or out of the money. The investor takes the swap counterparty credit risk accordingly.

Credit-Linked Notes may also be issued by a corporation or financial institution. In this case the investor assumes risk to both the issuer and the Reference Entity to which principal redemption is linked.

### Credit overlays

Credit overlays consist of embedding a layer of credit risk, in credit derivatives form, into an existing financial product. Typically, the credit overlay will be added onto an interest rate, equity or commodities structure thus creating a hybrid product with more attractive risk/returns features.

For example, combining the principal risk of a credit-linked note with an equity option, allows to significantly improve the participation in the option payoff.

**Example: using a credit overlay in an equity-linked product**

- An SPV issues structured notes indexed on a basket of food company equities
- With the proceeds from the note issuance, the SPV purchases AAA-rated Asset Backed Securities which will remain in the vehicle until maturity
- The SPV enters into a credit swap with Morgan in which Morgan buys protection on the same basket of food company credit exposures
- The Credit Swap is overlaid onto the AAA-rated securities, thus creating credit and equity Linked Notes referenced on the basket of food companies
- The yield on the Credit Linked Notes is used to fund the call option on the equity basket, the Credit Overlay allows for an enhanced Participation in the Equity Basket Performance
- At maturity, the investor receives par plus the payout of the call option.  Should a Credit Event occur on the Underlying Portfolio of Reference Entitites, the principal repaid at maturity would be reduced by the amount of losses incurred under the Credit Event

Similar structures where the basket is replaced by an equity-index also enjoy strong investor appeal

*Using credit overlays as part of an asset restructuring*

Portfolio managers may also express an interest to repackage some of their holdings, re-tailoring their cashflows to better suit asset-liabilities management constraints. The addition of a credit risk overlay to the repackaged assets effectively creates a funded credit derivative, the existing portfolio being used as collateral to the structure. By using credit derivatives as part of such restructuring, the investor achieves three goals: (i) restructuring the cashflows into a more desirable profile, (ii) diversifying the investment portfolio and (iii) enhancing the return of the newly created note.

## Achieving superior returns by introducing leverage in a credit derivatives structure

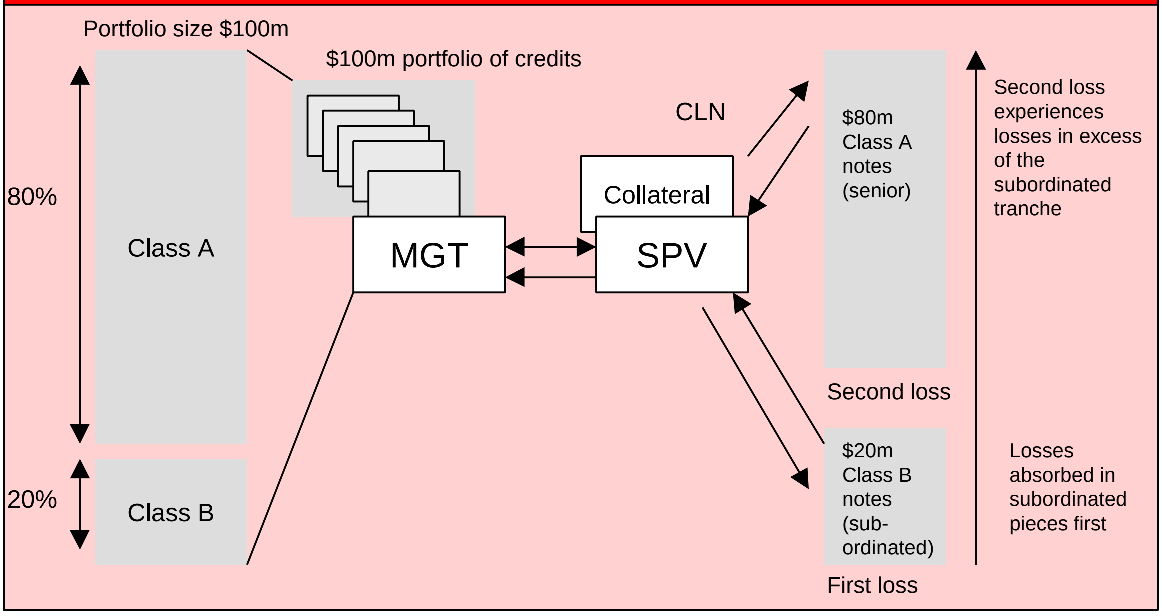
*Tranched credit risk:*

Simply, leverage in a credit structure is the process of re-apportioning risk and return. Leverage is commonly introduced in a basket of credits by tranching the portfolio into junior and senior pieces. The protection seller who commits to indemnify the protection buyer against the first X% lost as a result of credit events (see Exhibit) effectively has a leveraged position, his underlying exposure being much larger than his notional at stake.

If the size of the first-loss piece is large enough to stand more than one credit event – i.e. absent any first-to-default trigger-, the portion of notional having suffered a loss will either be liquidated at the time of default, or settled at maturity. In most first-loss structures, the coupon will step-down after the credit event, to reflect the reduction in the notional at stake. However, in less risky tranches, such as second-loss (or mezzanine) pieces, it is often possible to build a coupon-protection feature without substantially deteriorating the overall return.

First-loss or mezzanine credit positions can be transferred either in unfunded form or via credit-linked notes. Examples of traded mezzanine credit linked notes include the Bistro securities described in the previous chapter. In addition, more recent variations of leveraged credit linked notes have combined credit derivatives and existing Collateralized Bond Obligation (CBO) technology to create structures where the portfolio of credit default swaps is not static but managed by a third party, who may be the investor himself.

**Figure 2: Tranched Credit Risk**



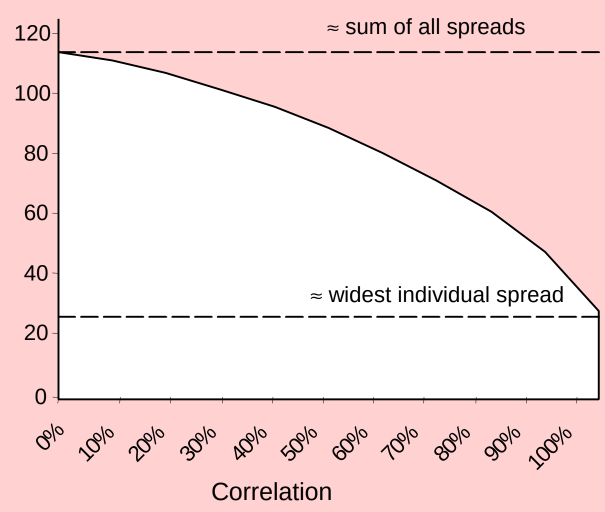
## First-to-default credit positions

In a **first-to-default basket**, the risk buyer typically takes a credit position in each credit equal to the notional at stake. After the first credit event, the first-to-default note (swap) stops and the investor no longer bears the credit risk to the basket. First-to-default Credit Linked Note will either be unwound immediately after the Credit Event – this is usually the case when the notes are issued by an SPV - or remain outstanding – this is often the case with issuers - in which case losses on default will be carried forward and settled at maturity. Losses on default are calculated as the difference between par and the final price of a reference obligation, as determined by a bid-side dealer poll for reference obligations, plus or minus, in some cases, the mark-to-market on any embedded currency/interest rate swaps transforming the cashflows of the collateral.

**First-to-default structures** are substantially pair-wise correlation plays, and provide interesting yield-enhancing opportunities in the current tight spread environment. The yield on such structures is primarily a function of (i) the number of names in the basket, i.e. the amount of leverage in the structure and (ii) how correlated the names are. The first-to-default spread shall find itself between the worse credit's spread and the sum of the spreads, closer to the latter if correlation is low, and closer to the former if correlation is high (see Exhibit). Intuition suggests taking first-to-default positions to uncorrelated names with similar spreads (hence similar default probabilities), in order to maximize the steepness of the curve below, thus achieving a larger pick-up above the widest spread.

Returns can be further improved via the addition of a **mark-to market feature**, whereby the investor also takes the mark-to-market on the outstanding credit default swaps. Valuation of that mark-to-market can be computed by comparing the reference spread to an offer-side dealer poll of credit default swap spreads.

**Figure 3: First-to-default spread curve**



An alternative way to create a leveraged position for the investor is to use zero coupon structures, i.e. delay the coupon payments in a credit linked note, and reinvest the accruals.

**De-leveraging exposures to riskier credit through a degree of capital and/or coupon protection**

Finally, leverage can be introduced by overlaying a degree of optionality for the protection buyer's benefit. Substitution options whereby the protection buyer has the right to substitute some of the names in the basket, by another pre-defined set of names or any other credit but subject to a number of guidelines, allow for significant yield enhancement.

By providing the flexibility to customize the riskyness of cashflows, credit derivative structures can alternatively be used as a way to access new, riskier asset classes. An investor with a high-grade corporates portfolio of credits may want to invest in a high-yield name, without significantly altering the overall risk profile of his holdings. This can be done by protecting part or whole of the principal of a swap/note. In some case, a minimum guaranteed coupon might be offered in addition to principal protection.

**Example 1:**

A 20-year USD capital-guaranteed credit linked note on Venezuela can be decomposed into a combination of (i) a zero-coupon Treasury and (ii) a series of Venezuela-linked annuity-like streams representing the coupons purchased from the note proceeds less the cost of the Treasury strip

While, as mentioned earlier, delaying the interest payments can be a powerful mean to enhance returns, equally, the leverage thus created can be significant.

**Example 2:**

Consider a 15-year zero-coupon structure on an emerging market/high yield credit where a credit event occurs after 13 years: the accrued amount lost this close to maturity is significant. Some investors may not want or may not be allowed (for regulatory purposes) to put such a large amount of coupon at stake. Such risk can be reduced by building-in an accruals lock-in feature, whereby if a credit event occurs, the investor receives, at maturity, whatever coupon amount has accrued up to the credit event date.

To summarize, we have seen that credit derivatives allow investors to invest in a wide range of assets with tailored risk-return profile to suit their specific requirements. The asset can be a credit play on a portfolio of names, with or without leverage. We have also seen how to add a degree of credit exposure into a non-credit product, via an overlay mechanism. The nature and extent of the credit risk embedded in an asset determines the pricing of the asset, which is the focus of the next chapter. ■

# 4. Pricing Considerations

### Predictive or theoretical pricing models of Credit Swaps

A common question when considering the use of Credit Swaps as an investment or a risk management tool is how they should correctly be priced. Credit risk has for many years been thought of as a form of deep out-of-the-money put option on the assets of a firm. To the extent that this approach to pricing could be applied to a Credit Swap, it could also be applied to pricing of any traditional credit instrument. In fact, option pricing models have already been applied to credit derivatives for the purpose of proprietary "predictive" or "forecasting" modeling of the term structure of credit spreads.

A model that prices default risk as an option will require, directly or implicitly, as parameter inputs both default probability and severity of loss given default, net of recovery rates, in each period in order to compute both an expected value and a standard deviation or "volatility" of value. These are the analogues of the forward price and implied volatility in a standard Black-Scholes model.

However, in a practical environment, irrespective of the computational or theoretical characteristics of a pricing model, that model must be parameterized using either market data or proprietary assumptions. A predictive model using a sophisticated option-like approach might postulate that loss given default is 50% and default probability is 1% and derive that the Credit Swap price should be, say, 20 b.p. A less sophisticated model might value a credit derivative based on comparison with pricing observed in other credit markets (e.g., if the undrawn loan pays 20 b.p. and bonds trade at LIBOR + 15 b.p., then, adjusting for liquidity and balance sheet impact, the Credit Swap should trade at around 25 b.p.). Yet the more sophisticated model will be no more powerful than the simpler model if it uses as its source data the *same market information*. **Ultimately, the only rigorous independent check of the assumptions made in the sophisticated predictive model can be market data**. Yet, in a sense, market credit spread data presents a classic example of a joint observation problem. Credit spreads imply loss severity given default, but this can only be derived if one is prepared to make an assumption as to what they are simultaneously implying about default likelihoods (or vice versa). Thus, rather than encouraging more sophisticated theoretical analysis of credit risk, the most important contribution that credit derivatives will make to the pricing of credit will be in improving liquidity and transferability of credit risk and hence in making market pricing more transparent, more readily available, and more reliable.

### Mark-to-market and valuation methodologies for Credit Swaps

Another question that often arises is whether Credit Swaps require the development of sophisticated risk modeling techniques in order to be marked-to-market. It is important in this context to stress the distinction between a user's ability to mark a position to market (its "valuation" methodology) and its ability to formulate a proprietary view on the correct theoretical value of a position, based on a sophisticated risk model (its "predictive" or "forecasting" methodology). Interestingly, this distinction is recognized in the existing bank regulatory capital framework: while eligibility for trading book treatment of, for example, interest rate swaps depends on a bank's ability to demonstrate a credible valuation methodology, it does not require any predictive modeling expertise.

Fortunately, given that today a number of institutions make markets in Credit Swaps, valuation may be directly derived from dealer bids, offers or mid market prices (as appropriate depending on the direction of the position and the purpose of the valuation). Absent the availability of dealer prices, valuation of Credit Swaps by proxy to other credit instruments is relatively straightforward, and related to an assessment of the market credit spreads prevailing for obligations of the Reference Entity that are pari passu with the Reference Obligation, or similar credits, *with tenor matching that of the Credit Swap, rather than that of the Reference Obligation itself*. For example, a five-year Credit Swap on XYZ Corp. in a predictive modeling framework might be evaluated on the basis of a postulated default probability and recovery rate, but should be marked-to-market based upon prevailing market credit spreads (which as discussed above provide a joint observation of implied market default probabilities and recovery rates) for five-year XYZ Corp. obligations substantially similar to the Reference Obligation (whose maturity could exceed five years). If there are no such five-year obligations, a market spread can be interpolated or extrapolated from longer and/or shorter term assets. If there is no prevailing market price for pari passu obligations to the Reference Obligation, adjustments for relative seniority can be made to market prices of assets with different priority in a liquidation. Even if there are no currently traded assets issued by the Reference Entity, then comparable instruments issued by similar credit types may be used, with appropriately conservative adjustments. Hence, it should be possible, based on available market data, to derive or bootstrap a credit curve for any reference entity.

### Constructing a Credit Curve from Bond Prices

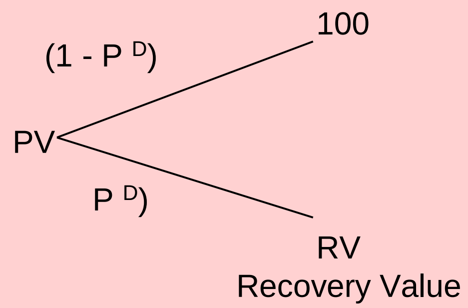
In order to price any financial instrument, it is important to model the underlying risks on the instrument in a realistic manner. In any credit linked product the primary risk lies in the potential default of the reference entity: absent any default in the reference entity, the expected cashflows will be received in full, whereas if a default event occurs the investor will receive some recovery amount. It is therefore natural to model a risky cashflow as a portfolio of contingent cashflows corresponding to these different default scenarios weighted by the probability of these scenarios.

Example: Risky zero coupon bond with one year to maturity.

At the end of the year there are two possible scenarios:

1. The bond redeems at par; or
2. The bond defaults, paying some recovery value, RV.

The decomposition of the zero coupon bond into a portfolio of contingent cashflows is therefore clear[1].




$$PV = \frac{1}{(1 + r_{\text{risk free}})} [(1 - P^D) \times 100 + P^D \times RV]$$

This approach was first presented by R. Jarrow and S. Turnbull (1992): “Pricing Options on Financial Securities Subject to Default Risk”, Working Paper, Graduate School of Management, Cornell University.

This approach to pricing risky cashflows can be extended to give a consistent valuation framework for the pricing of many different risky products. The idea is the same as that applied in fixed income markets, i.e. to value the product by decomposing it into its component cashflows, price these individual cashflows using the method described above and then sum up the values to get a price for the product.

This framework will be used to value more than just risky instruments. It enables the pricing of any combination of risky and risk free cashflows, such as capital guaranteed notes - we shall return to the capital guaranteed note later in this section, as an example of pricing a more complex product. This pricing framework can also be used to highlight relative value opportunities in the market. For a given set of probabilities, it is possible to see which products are trading above or below their theoretical value and hence use this framework for relative value position taking.

### Calibrating the Probability of Default

The pricing approach described above hinges on us being able to provide a value for the probability of default on the reference credit. In theory, we could simply enter probabilities based on our appreciation of the reference name's creditworthiness and price the product using these numbers. This would value the product based on our view of the credit and would give a good basis for proprietary positioning. However, this approach would give no guarantee that the price thus obtained could not be arbitraged against other traded instruments holding the same credit risk and it would make it impossible to risk manage the position using other credit instruments.

In practice, the probability of default is backed out from the market prices of traded market instruments. The idea is simple: given a probability of default and recovery value, it is possible to price a risky cashflow. Therefore, the (risk neutral) probability of default for the reference credit can be derived from the price and recovery value of this risky cashflow. For example, suppose that a one year risky zero coupon bond trades at 92.46 and the risk free rate is 5%. This represents a multiplicative spread of 3% over the risk free rate, since:

$$\frac{100}{(1 + 0.05)(1 + 0.03)} = 92.46$$

If the bond had a recovery value of zero, from our pricing equation we have that:

$$92.46 = \frac{1}{(1.05)} \left[(1 - P^D) \times 100 + P^D \times 0\right]$$

and so:

$$P^D = 1 - \frac{1}{(1.03)}$$

So the implied probability of default on the bond is 2.91%. Notice that under the zero recovery assumption there is a direct link between the spread on the bond and the probability of default. Indeed, the two numbers are the same to the first order. If we have a non-zero recovery the equations are not as straightforward, but there is still a strong link between the spread and the default probability:

$$P^D = \frac{100\left(1 - \dfrac{1}{(1+s)}\right)}{(100 - RV)} \approx \frac{s}{(1 - RV/100)}$$

This simple formula provides a "back-of-the-envelope" value for the probability of default on an asset given its spread over the risk free rate. Such approximation must, of course, be used with the appropriate caution, as there may be term structure effects or convexity effects causing inaccuracies, however it is still useful for rough calculations.

This link between credit spread and probability of default is a fundamental one, and is analogous to the link between interest rates and discount factors in fixed income markets. Indeed, most credit market participants think in terms of spreads rather than in terms of default probabilities, and analyze the shape and movements of the spread curve rather than the change in default probabilities. However, it is important to remember that the spreads quoted in the market need to be adjusted for the effects of recovery before default probabilities can be computed. Extra care must be taken when dealing with Emerging Market debt where bonds often have guaranteed principals or rolling guaranteed coupons. The effect of these features needs to be stripped out before the spread is computed as otherwise, an artificially low spread will be derived.

### Problems Encountered in Practice

In practice it is rare to find risky zero coupon bonds from which to extract default probabilities and so one has to work with coupon bonds. Also the bonds linked to a particular name will typically not have evenly spaced maturities. As a result, it becomes necessary to make interpolation assumptions for the spread curve, in the same manner as zero rates are bootstrapped from bond prices. Naturally, the spread curve and hence the default probabilities will be sensitive to the interpolation method selected and this will affect the pricing of any subsequent products.

Assumptions need to be made with respect to the recovery value as it is impossible, in practice, to have an accurate recovery value for the assets. It is clear from the equations above that the default probability will depend substantially on the assumed recovery value, and so this parameter will also affect any future prices taken from our spread curve.

A more theoretical problem worth mentioning relates to the meaning of the recovery assumption itself. In the equations above, we have assumed that each individual cashflow has some recovery value, RV, which will be paid in the event of default. This allowed us to price a risky asset as a portfolio of risky cashflows without worrying about when the default event occurred. If this assumption held, we should expect to see higher coupon bonds trading higher than lower coupon bonds in the event of default (since they would be expected to recover a greater amount). The reason this does not occur in practice is that, while accrued interest up until the default is generally a valid claim, interest due *post* default is generally not a viable claim in work-out. As a result, when defaults do occur, assets tend to trade like commodities and the prices of different assets are only distinguished based on perceived seniority rather than coupon rate. One alternative recovery assumption is to assume that a bond recovers a fixed percentage of outstanding notional plus accrued interest at the time of default. Whilst this is more consistent with the observed clustering of asset prices during default it makes splitting a bond into a portfolio of risky zeros much harder. This is because the recovery on a cashflow coming from a coupon payment will now depend on when the default event occurred, whereas the recovery on a cash flow coming from a principal repayment will not.

### Using Default Swaps to make a Credit Curve

For many credits, an active credit default swap (CDS) market has been established. The spreads quoted in the CDS market make it possible to construct a credit curve in the same way that swap rates make it possible to construct a zero coupon curve. Like swap rates, CDS spreads have the advantage that quotes are available at evenly spaced maturities, thus avoiding many of the concerns about interpolation. The recovery rate remains the unknown and has to be estimated based on experience and market knowledge.

Strictly speaking, in order to extract a credit curve from CDS spreads, the cashflows in the default and no-default states should be diligently modeled and bootstrapped to obtain the credit spreads. However, for relatively flat spread curves, approximations exist. To convert market CDS spreads into default probabilities, the first step is to strip out the effect of recovery. A standard CDS will pay out par minus recovery on the occurrence of a default event. This effectively means that the protection seller is only risking (100-recovery). So the real question is how much does an investor risking 100 expect to be paid. To compute this, the following approximation can be used:

$$\mathbf{S}_{RV\,=\,O} \approx \frac{S_{Market}}{(1 - RV/100)}$$

Notice the similarity between this equation and the earlier one derived for risky zero coupon bonds. Here the resulting zero recovery CDS spread is still a running spread. However, as an approximation it can be treated as a credit spread, and therefore:

$$\text{Default probability} \approx 1 - \frac{1}{(1 + S_{RV=0})^{t}}$$

This approximation is analogous to using a swap rate as a proxy for a zero coupon rate. Although it is really only suitable for flat curves, it is still useful for providing a quick indication of what the default probability is. Combining the two equations above:

$$\text{Default probability} \approx 1 \quad \frac{1}{\left(1 + \frac{S_{Market}}{1 - RV/100}\right)^{t}}$$

## Linking the Credit Default Swap and Cash markets

An interesting area for discussion is that of the link between the bond market and the CDS market. To the extent that both markets are trading the same credit risk we should expect the prices of assets in the two markets to be related. This idea is re-enforced by the observation that selling protection via a CDS exactly replicates the cash position of being long a risky floater paying libor plus spread and being short a riskless floater paying libor flat[1] . Because of this it would be natural to expect a CDS to trade at the same level as an asset swap of similar maturity on the same credit.

However, in practice we observe a basis between the CDS market and the asset swap market, with the CDS market typically – but not always - trading at a higher spread than the equivalent asset swap. The normal explanations given for this basis are liquidity premia and market segmentation. Currently the bond market holds more liquidity than the CDS market and investors are prepared to pay a premium for this liquidity and accept a lower spread. Market segmentation often occurs because of regulatory constraints which prevent certain institutions from participating in the default swap market even though they are allowed to source similar risk via bonds. However, there are also participants who are more inclined to use the CDS market. For example, banks with high funding costs can effectively achieve Libor funding by sourcing risk through a CDS when they may pay above Libor to use their own balance sheet.

Another more technical reason for a difference in the spreads on bonds and default swaps lies in the definition of the CDS contract. In a default swap contract there is a list of obligations which may trigger a credit event and a list of deliverable obligations which can be delivered against the swap in the case of such an event. In Latin American markets the obligations are typically all public external debt, whereas outside of Latin America the obligations are normally all borrowed money. If the obligations are all borrowed money this means that if the reference entity defaults on any outstanding bond or loan a default event is triggered. In this case the CDS spread will be based on the spread of the widest obligation. Since less liquid deliverable instruments will often trade at a different level to the bond market this can result in a CDS spread that differs from the spreads in the bond market.

For contracts where the obligations are public external debt there is an arbitrage relation which ties the two markets and ought to keep the basis within certain limits. Unfortunately it is not a cheap arbitrage to perform which explains why the basis can sometimes be substantial. Arbitraging a high CDS spread involves selling protection via the CDS and then selling short the bond in the cash market. Locking in the difference in spreads involves running this short position until the maturity of the bond. If this is done through the repo market the cost of funding this position is uncertain and so the position has risk, including the risk of a short squeeze if the cash paper is in short supply. However, obtaining funding for term at a good rate is not always easy. Even if the funding is achieved, the counterparty on the CDS still has a credit exposure to the arbitrageur. It will clearly cost money to hedge out this risk and so the basis has to be big enough to cover this additional cost. Once both of these things are done the arbitrage is complete and the basis has been locked in. However, even then, on a mark-to-market basis the position could still lose money over the short term if the basis widens further. So ideally, it is better to account for this position on an accrual basis if possible.

### Using the Credit Curve

As an example of pricing a more complex structure off the credit curve, we shall now work through the pricing of a 5 year fixed coupon capital guaranteed credit-linked note. This is a structure where the notional on the note is guaranteed to be repaid at maturity (i.e. is not subject to credit risk) but all coupon payments will terminate in the event of a default of the reference credit. The note is typically issued at par and the unknown is the coupon paid to the investor. For our example we shall assume that the credit default spreads and risk free rates are as given in Table 1:

**Table 1: Cumulative Default Probabilities**

| Year | Risk Free | CDS Spread | Cumulative default prob[1] |
|---|---|---|---|
| 1 | 5.00% | 7.00% | 7.22% |
| 2 | 5.00% | 7.00% | 13.91% |
| 3 | 5.00% | 7.00% | 20.13% |
| 4 | 5.00% | 7.00% | 25.89% |
| 5 | 5.00% | 7.00% | 31.24% |

The capital guaranteed note can be decomposed into a risk-free zero coupon bond and a zero recovery risky annuity, with the zero coupon bond representing the notional on the note and the annuity representing the coupon stream. As the zero coupon bond carries no credit risk it is priced off the risk free curve. In our case:

$$\text{Zero Price} = \frac{100}{(1.05)^5} = 78.35$$

So all that remains is to price the risky annuity. As the note is to be issued at par, the annuity component must be worth 100 - 78.35 = 21.65. But what coupon rate does this correspond to? Suppose the fixed payment on the annuity is some amount, C. Each coupon payment can be thought of as a risky zero coupon bond with zero recovery. So we can value each payment as a probability-weighted average of its value in the default and no default states as illustrated in Table 2:

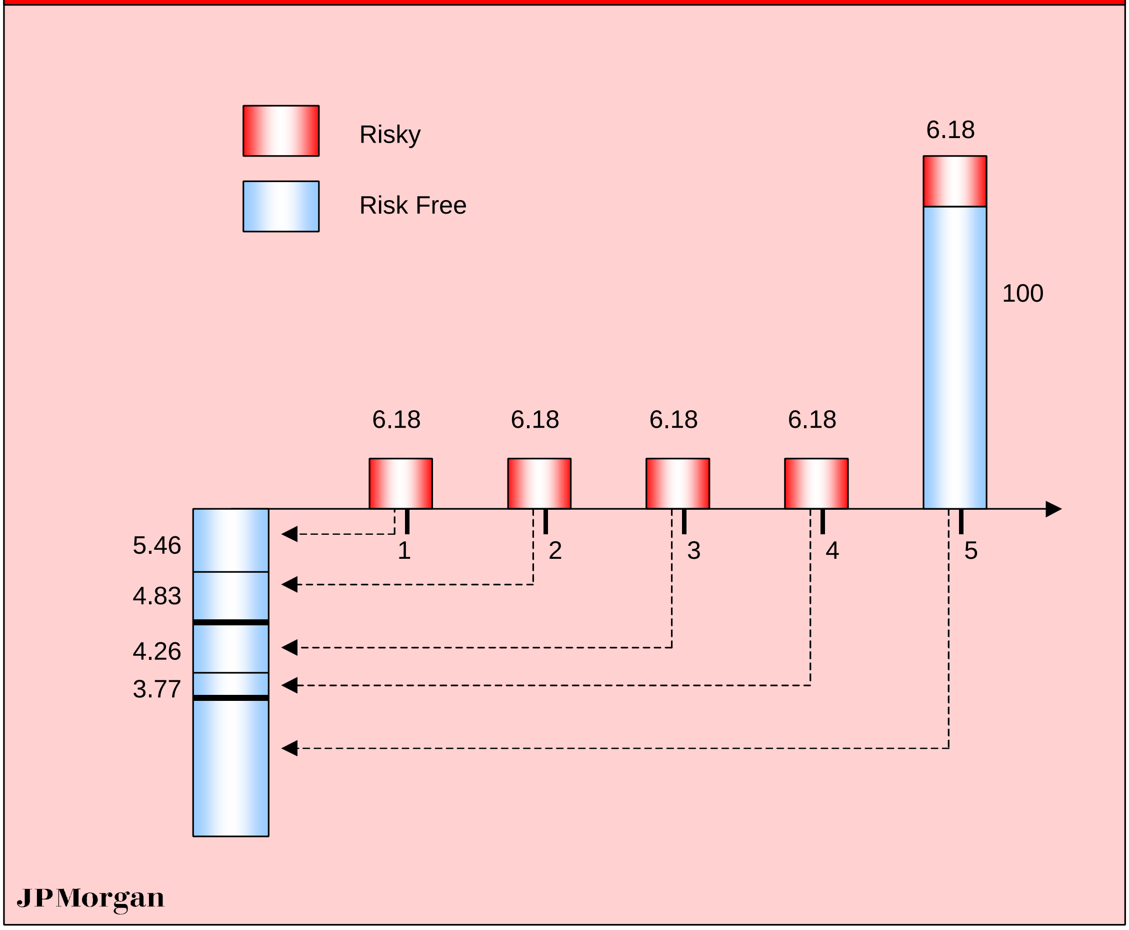
**Table 2: Coupon paid under a capital-protected structure**

| Year | Discount Factor | Forward Value | PV |
|---|---|---|---|
| 1 | 0.9524 | C*0.9278 + 0*0.0722 | C*0.8837 |
| 2 | 0.9070 | C*0.8609 + 0*0.1391 | C*0.7808 |
| 3 | 0.8638 | C* 0.7988 + 0*0.2013 | C*0.6900 |
| 4 | 0.8227 | C*0.7411 + 0*0.2589 | C*0.6097 |
| 5 | 0.7835 | C*0.6876 + 0*0.3124 | C*0.5388 |

So the payment on the annuity should be:

$$C = 21.65 / (0.8837 + 0.7808 + 0.6900 + 0.6097 + 0.5388)$$
$$C = 6.18$$

**Valuing a fixed coupon capital guaranteed note**



## Counterparty considerations: pricing the two-name exposure in a credit default swap

In a credit swap the Protection Buyer has credit exposure to the Protection Seller contingent on the performance of the Reference Entity. If the Protection Seller defaults, the Buyer must find alternative protection and will be exposed to changes in replacement cost due to changes in credit spreads since the inception of the original swap. More seriously, if the Protection Seller defaults *and* the Reference Entity defaults, the Buyer is unlikely to recover the full default payment due, although the final recovery rate on the position will benefit from any positive recovery rate on obligations of *both* the Reference Entity and the Protection Seller.

Counterparty risk consequently affects the pricing of credit derivative transactions. Protection bought from higher-rated-counterparties will command a higher premium. Furthermore, a higher credit quality premium; protection purchased from a counterparty against a Reference Entity is less valuable if a simultaneous default on the two names has a higher probability.

The problem of how to compute and charge for counterparty credit exposure is in large part an empirical one, since it depends on computing the joint likelihood of arriving in different credit states, which will in turn depend on an estimate of credit quality correlation between the Protection Seller and Reference Entity, which cannot be directly observed. Fortunately, significant efforts have been undertaken in the area of default correlation estimation in connection with the development of credit portfolio models such as CreditMetrics.

The following expression describes a simple methodology for computing a “counterparty credit charge” (CCC), as the sum of expected losses due to counterparty (CP) default across N different time periods, t, and states of credit quality (R) of the Reference Entity (RE) from default through to AAA. Given an estimate of credit quality correlation, it is possible to estimate the joint likelihood of the Reference Entity being in each state, given a counterparty default, from the respective individual likelihoods or arriving in each state of credit quality. Since loss can only occur given a default of the counterparty, we are interested only in the default likelihood of the counterparty. However, since loss can occur due to changes in the mark-to-market (MTM) of the Credit Swap caused by credit spread fluctuations across different states of the Reference Entity, we are interested in the full matrix of credit quality migration likelihoods of the Reference Entity.

Typically, the counterparty credit charge is subtracted from the premium paid to the Protection Seller and accounted for by the Protection Buyer as a reserve against counterparty credit losses.

$$CCC = (100\% - \text{Recovery Rate}_{CP})* \sum_{t=t_0}^{tN} \sum_{R=Def}^{AAA} \text{Prob}_{Joint}\{CP_{\text{In default}} RE_{\text{Rating} = R}\} * Op_{\text{Rating} = R}$$

CP = Counterparty

RE = Reference Entity

N = Number of time periods, t

R = Rating of the Reference Entity in time t

Op = Price of an option to replace a risky exposure to RE instate R at time t with a riskless exposure, ie. When RE has defaulted, value is (100% - Recovery Rate RE) ie. When RE has not defauled , value is (100% - MTM of Credit Swap, based on credit spreads)

# 5. CreditMetrics – A portfolio approach to credit risk

The evolution of the credit derivatives has not been an isolated event. The facility afforded by credit derivatives to more actively manage credit risk is certainly notable in its own right. However, this facility to manage risk would be incomplete without methods to identify contributors to portfolio risk. Not surprisingly, the advent of public portfolio credit risk models has coincided with the growth of the credit derivatives markets. The models now allow market participants to recognize sources of risk, while credit derivatives provide flexibility to manage these sources.

In this chapter, we will survey the various publicly available credit models, and describe the CreditMetrics model in greater detail. We will then describe a number of practical uses of the CreditMetrics model.

## Credit portfolio models – a survey

The year 1997 was an important one for the analysis of credit portfolios, with the publication of three models for portfolio credit risk. In order of publication, the models were:

- CreditMetrics, published as a technical document by J.P.Morgan, and now further developed by the RiskMetrics Group,k LLC, who also markets a software implementation, CreditManager,
- CreditRisk + published as a technical document by CreditSuisse, Finanacial Products, and
- Credit Portfolio View, published as two articles in Risk magazine by Thomas Wilson of McKinsey and Company.

Thus, in the span of just over six months, the number of publicly documented models for assessing portfolio risk grew from zero to three. That there were three differing approaches to the same problem might have led to an emphasis on modeling discrepancies, but it led instead to a greater emphasis that the problem – credit risk in a portfolio context – was crucial to address.

The three models above, and indeed any conceivable model of portfolio credit risk, share two features. The first is the treatment of default as a significant downward jump in exposure value, which necessitates default probabilities and loss severities as inputs; the second is the development of some structure to describe the dependency between defaults of individual names.

It is important to realize that none of the three models above provide the default probabilities of individual names as output, and so all three must rely on external sources for this parameter. In fact, the default probability for a given issuer or counterparty is analogous to the volatility of an asset when considering market risk; that is, it is the foremost (though not necessarily only) descriptor of the stand alone risk of the exposure in question. However, the situation in credit risk is more complicated. For an exposure to a foreign currency, it is possible to observe that currency's exchange rate over time and arrive at a reasonable estimate of the rate's volatility. For an exposure to a particular counterparty, looking at the counterparty's history tells us nothing about its likelihood of defaulting in the future; in fact, that we have an exposure at all is a likely indication that the counterparty has not defaulted before, though it certainly could default in the future.

Since the examination of individual default histories is not helpful, a number of methods have been developed to estimate default probabilities. The first is to score or rank individual names, categorize names historically according to their credit score, and then measure the proportion of similar names that have defaulted over time. This is the approach taken by the rating agencies, wherein they have credit ratings (scores) for a vast array of names and over a long history, and report, for example, the proportion of A-rated names that default within one year. For portfolio models, it is possible to extrapolate from this information, and assign A-rated names the historical default probability for that rating. For names large enough to carry ratings, the results provided by the agencies are most commonly used because of the widespread acceptance of their ratings and the large coverage and history of their databases. For smaller, non-rated names, other credit scoring systems can be utilized in a similar vein. Additionally, this approach can be extended to one where the fluctuation of default rates over time is explained by factors such as interest rates, inflation, and growth in productivity.

Clearly, the approach mentioned above involves a tradeoff: historical default information becomes useful, but at the expense of granularity. That is, it is necessary to sacrifice name specific information, and use default probabilities that are only particular to a given credit rating or score. In order to ascertain the default probability for a particular name, the two most common methods utilize, where possible, current market information rather than history. One approach is to observe the price of a name's traded debt, and to suppose that the discrepancy between this price and the price of a comparable government security is attributable to the possibility that the name may default on its debt. A second approach is to utilize the equity markets, and extract a firm's default probability from its equity price, the structure of its liabilities, and the observation that equity is essentially a call option on the assets of the firm.[2]

While the three models each treat the value changes resulting from defaults, and thus require default probabilities as inputs, the CreditMetrics model also treats value changes arising from significant changes in credit quality, such as a ratings downgrade, short of default. This additional capacity of the model necessitates additional data, namely the probabilities of such quality changes. The probabilities are available also from the agency approaches mentioned above. We will discuss this data further in the next section.

The most significant structural difference between the three models is in how they construct dependencies between defaults. The CreditRisk+ model builds dependencies by stipulating that all names are subject to one or more systemic and volatile default rates. In the simplest case, all names depend on one default rate. In some scenarios, the rate is high and all the names have a greater chance of defaulting, while in others the rate is lower, and the names all have a lesser chance of defaulting. The default probabilities discussed earlier represent the average default rate in this context. The dependence of many names on a mutual default rate essentially creates a correlation between the names, and the volatility of the default rate, which is an input to the model, determines the level of correlation. The Credit Portfolio View model also treats the variation in default rates (and more generally, in rating change probabilities) but rather than simply assigning a volatility to the rate, the model explains the fluctuations in the default rate through fluctuations in macroeconomic variables. In the CreditMetrics model, rather than explaining a systemic factor like the default rate, we model each name's default as contingent on fluctuations in the assets of the individual firm. The dependency between individual defaults is then built by modeling the correlations between firm asset values.

Although there appear to be fundamental differences in the three approaches; in fact the frameworks are quite similar. Naturally, the publication of so many approaches was followed by efforts to compare them. The consensus of the comparisons has been that if the model inputs are set consistently, the models will give very similar results. Empirical comparisons have shown some discrepancies, though due to inconsistent model inputs rather than disparities in the model frameworks. Thus, the burden has passed from developing frameworks to identifying good data.

We move now to a more detailed discussion of the CreditMetrics model and its required imputs.

### An overview of the CreditMetrics model

As we have already discussed, CreditMetrics models the changes in portfolio value that result from significant credit quality moves, that is, defaults or rating changes. The model takes information on the individual obligors in the portfolio as inputs, and produces as output the distribution of portfolio values at some fixed horizon in the future. From this distribution, it is possible to produce statistics which quantify the portfolio's absolute risk level, such as the standard deviation of value changes, or the worst case loss at a given level of confidence. While this gives a picture of the total risk of the portfolio, we may also analyze our risks at a finer level, examining the risk contribution of each exposure in the portfolio, identifying concentration risks or diversification opportunities, or evaluating the impact of a potential new exposure. Examples and applications of these outputs will be provided in the next section. Here, we describe the model itself in more detail.

The model is best described in three parts:

1. The definition of the possible "states" for each obligor's credit quality, and a description of how likely obligors are to be in any of these states at the horizon date.

2. The interaction and correlation between credit migrations of different obligors.

3. The revaluation of exposures in all possible credit states.

### Step 1 – the states of the world

The definition of an obligor's possible credit states typically amounts to selecting a rating system, whether an agency system or an internal one, whether a coarse system with seven states, or a fine one with plus or minus states added. The crucial element here is that we know the probabilities that the obligor migrates to any of the states between now and the horizon date. That the user provides this information to the model is what differentiates CreditMetrics from a credit scoring model. The most straightforward way to present the probabilities is through a transition matrix; an example appears in **Table 1**. A transition matrix characterizes a rating system by providing the probabilities of migration (within a specified horizon) for all of the system's states.

**Table 1: Example one-year transition matrix - Moody's rating system**

| | Aaa | Aa | A | Baa | Ba | B | Caa | D |
|---|---|---|---|---|---|---|---|---|
| Aaa | 93.38% | 5.94% | 0.64% | 0.00% | 0.02% | 0.00% | 0.00% | 0.02% |
| Aa | 1.61% | 90.53% | 7.46% | 0.26% | 0.09% | 0.01% | 0.00% | 0.04% |
| A | 0.07% | 2.28% | 92.35% | 4.63% | 0.45% | 0.12% | 0.01% | 0.09% |
| Baa | 0.05% | 0.26% | 5.51% | 88.48% | 4.76% | 0.71% | 0.08% | 0.15% |
| Ba | 0.02% | 0.05% | 0.42% | 5.16% | 86.91% | 5.91% | 0.24% | 1.29% |
| B | 0.00% | 0.04% | 0.13% | 0.54% | 6.35% | 84.22% | 1.91% | 6.81% |
| Caa | 0.00% | 0.00% | 0.00% | 0.62% | 2.05% | 4.08% | 69.19% | 24.06% |

Among the most widely available transition matrices are those produced by the major rating agencies, which reflect the average annual transition rates over a long history (typically 20 years or more) for a particular class of issuers (e.g. corporate bonds or commercial paper). While this information is useful, and the agency default rates have become benchmarks for describing the individual categories, the use of average transition matrices for credit portfolio modeling is often criticized for its failure to capture the credit cycle. In other words, since the matrices only represent averages over many years, they cannot account for the current year's credit transitions being relatively benign or severe. A number of methods are now available to address this. One is to select smaller periods of the agency history, and create matrices based, for example, only on the transitions in 1988 to 1991. A second is to explicitly model the relationship between transitions and defaults and macroeconomic variables, such as spread levels or industrial production. Regardless of the transition matrix ultimately chosen as the "best", because of the difficulties inherent in default rate estimation, it is prudent to examine the portfolio under a variety of transition assumptions.

### Step 2 – revaluation

While the first step concerns the description of migrations of individual credits, to complete the picture, we need a notion of the value impact of these moves. This brings up the issue of revaluation. In short, we assume a particular instrument's value today is known, and wish to estimate its value, at our risk horizon, conditional on any of the possible credit migrations that the instrument's issuer might undergo.

Consider a Baa-rated, three year, fixed 6% coupon bond, currently valued at par. With a one year horizon, the revaluation step consists of estimating the bond's value in one year under each possible transition. For the transition to default, we value the bond through an estimate of the likely recovery value. Many institutions use their own recovery assumptions here, although public information is available. For the non-default states, we obtain an estimate of the bond's horizon value by utilizing the term structure of bond spreads and risk-free interest rates. In the end, we arrive at the values in **Table 2**. With the information in **Table 2**, we have all of the stand-alone information for this bond; consequently, we can calculate the expectation and standard deviation of the bond's value at the horizon.

**Table 2: Values at Horizon for three year 6% Baa bond**

| Rating at horizon | Probability | Accrued Coupon | Bond value | Bond plus coupon |
|---|---|---|---|---|
| Aaa | 0.05% | 6.0 | 100.4 | 106.4 |
| Aa | 0.26% | 6.0 | 100.3 | 106.3 |
| A | 5.51% | 6.0 | 100.1 | 106.1 |
| Baa | 88.48% | 6.0 | 100.0 | 106.0 |
| Ba | 4.76% | 6.0 | 98.5 | 104.5 |
| B | 0.71% | 6.0 | 96.2 | 102.2 |
| Caa | 0.08% | 6.0 | 93.3 | 99.3 |
| D | 0.15% | 6.0 | 40.1 | 46.1 |
| | | Mean | 99.8 | 105.8 |
| | | St. dev. | 2.36 | 2.36 |

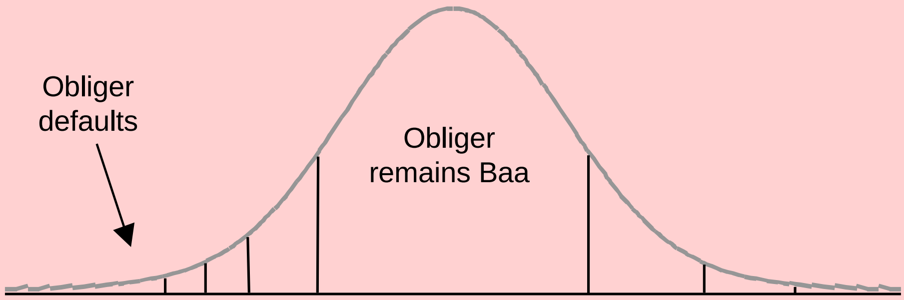
To incorporate other types of exposures only involves defining the values in each possible future rating state of the underlying credit. Essentially, this amounts to building something like **Table 2**. For some exposure types (for example, bonds and loans), all that is necessary to build this table are recovery assumptions and spreads, while for others (commitment lines or derivative contracts), further information is required. Assuming a riskless derivative counterparty, the simple credit derivatives of the previous chapter can be incorporated in the same way. To account for counterparty risk as well involves some slight enhancements, but is not complicated.[1]

### Step 3 – building correlations

The final step is to construct correlations between exposures. To do this, we posit an unseen "driver" of credit migrations, which we think of as changes in asset value. Our approach is conceptually similar to, and certainly inspired by, the equity based models mentioned previously. The intuition behind these models is that default occurs when the value of a firm's assets drops below the market value of its liabilities. In our case, we do not seek to observe asset levels, nor to use asset information to predict defaults; the stand-alone information for each name (in particular the name's probability of default) is provided as a model input through the specification of the transition matrix. Rather, assets are used only to build the interaction between obligors.

To begin our construction of correlations, we assume that asset value changes are normally distributed. We then partition the asset change distribution for each name according to the name's transition probabilities. For the Baa-rated obligor above (with default probability equal to 0.15%), the default partition (which conceptually can be thought of as the obligor's liability level) is chosen as the point beyond which lies 0.15% probability; the CCC partition is then chosen to match the obligor's probability of migrating to CCC, and so on. The result is illustrated in **Figure 1**.

**Figure 1: Partition of asset change distribution for a Baa obliger**




| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Asset return | <-3.0 | -3.0→-2.8 | -2.8→-2.4 | -2.4→-1.6 | -1.6 →1.5 | 1.5 →2.7 | 2.7 →3.3 | >3.3 |
| New rating | Default | Caa | B | Ba | Baa | A | Aa | Aaa |
| Value | 40.1 | 93.3 | 96.2 | 98.5 | 100.0 | 100.1 | 100.3 | 100.4 |

A common misinterpretation of this step is that by using a normal distribution for asset value changes, we are somehow not accounting for the well documented non-normality in the returns of credit driven assets. This is not the case, as it is only the driver of credit changes for which we assume a normal distribution, but not the changes in asset values themselves. In fact, if we consider the values (from **Table 2**) with the partition in **Figure 1**, we see that a two standard deviation increase in asset value produces an appreciation of 0.1, whereas an equally likely two standard deviation decrease produces a depreciation of 1.5; similarly, a three standard deviation asset value increase yields an appreciation of 0.3, but an equivalent decrease yields a depreciation of 59.9. This is the type of skew that is expected in credit distributions.

In the portfolio framework, once the partitions are defined for every obligor, it only remains to describe the correlation between asset value changes. Rather than attempting to observe these changes directly, we take correlations in equity returns as a proxy for the asset value correlations. This is primarily a practical decision, and allows us to then estimate correlations using reliable data. As in the prior two steps, however, it is crucial to examine the sensitivity of the model to uncertainties in the data. While the correlation estimates are designed to be stable and applicable over long horizons such as one year, market events may rapidly change correlation structures; to evaluate the impact of these changes, it is recommended to analyze the portfolio under both normal and "stressed" correlation conditions.[1]

With the correlations defined, the model is completely specified. In principle, it is possible to explicitly calculate the probabilities of all joint rating transitions (e.g. obligor 1 defaults, obligor 2 downgrades, obligor 3 stays the same rating, etc.). In practice, it is faster to obtain the portfolio distribution through a Monte Carlo approach. Thus, for a single scenario, we draw from a multivariate normal distribution to produce asset value changes, read from the partitions to identify the changes with new rating states and exposure values, and aggregate the individual exposures to arrive at a portfolio value for the scenario. Examples of this process for strongly and weakly correlated two obligor portfolios are illustrated in **Figures 2** and **3**. Repeating this process over a large number of scenarios, we accumulate a large number of equally likely portfolio values, and are able to estimate the Value at Risk, and other descriptive statistics, of the portfolio.

Figure 2**: Two Baa bonds, strong correlation. Mean=199.6, St.Dev.=4.13.**

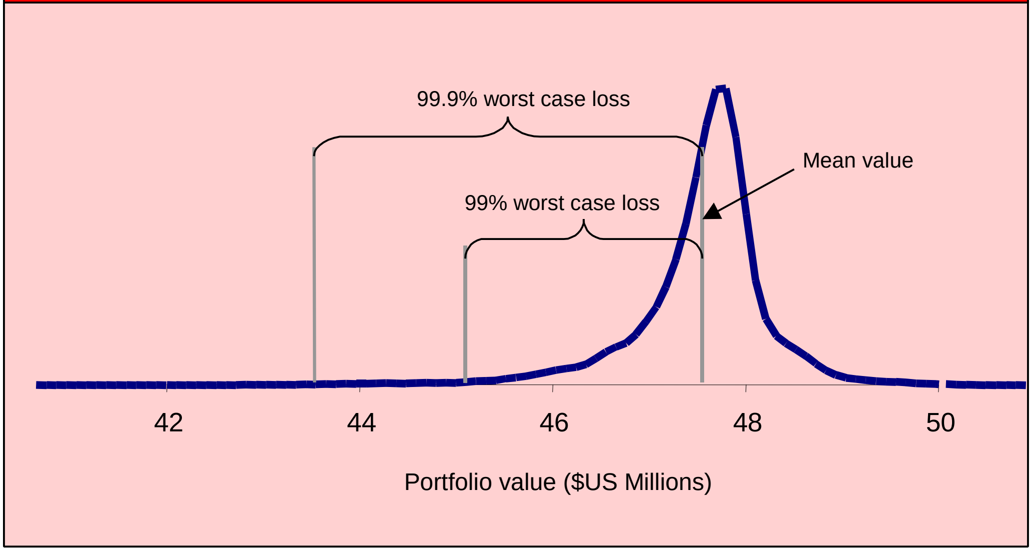
## Applications

### Estimation of economic capital

The first application of the approach outlined above is to evaluate the absolute risk of a portfolio. To do so, it has become common to report the portfolio's Value at Risk (VaR) – the maximum amount the portfolio might lose over a given time horizon, with a given level of confidence. For trading portfolios, it is common to report the VaR for a one day horizon with a 95% confidence level, corresponding roughly to the maximum portfolio daily loss over one month, or a ten day horizon with a 99% confidence level, corresponding to the maximum two week loss over a five year period. In these cases, VaR is used mostly as a communication tool; traders and managers have intuition for the worst loss over these timeframes, and so VaR is informative. For credit portfolios, with a horizon such as one year, even VaR at a low confidence level like 90% gives a worst case one year loss over a ten year period.

Beyond its use as a communication tool, VaR for credit portfolios is more appropriate to assess economic capital. For a bank investing in a portfolio on a funded basis, a key question is how much capital needs to be allocated to cover worst case portfolio losses. At an institutional level, the question is how much capital the institution needs to protect against major downturns and guarantee solvency. In both cases, it is easy to frame the problem in terms of VaR. **Figure 4** presents a portfolio distribution that might result from an application of CreditMetrics. The left-most vertical bar represents the value below which the portfolio will fall with 0.1% probability; the second bar from the left represents the level below which the portfolio will fall with 1% probability. Thus, with capital equal to the distance from the mean value to the left-most bar, there is a 99.9% chance that the capital will be sufficient to absorb the portfolio loss, and thus only a 0.1% chance of insolvency.

**Figure 4: Portfolio distribution and economic capital**



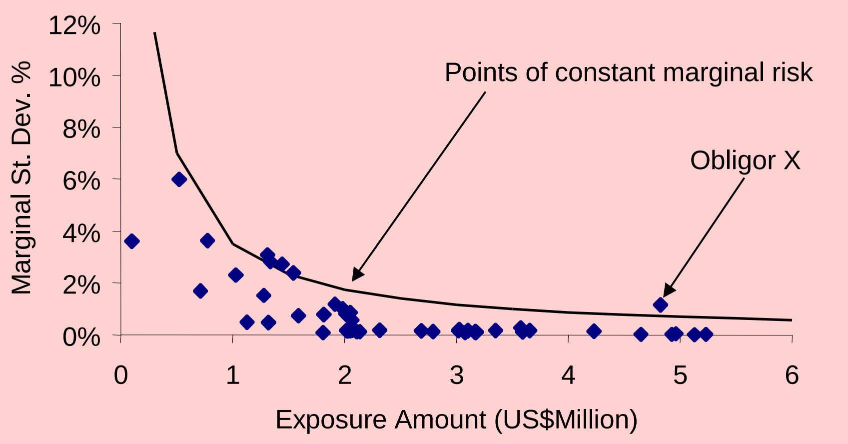
With the availability of portfolio models and the visibility of agency transition matrices, it has become common for institutions to choose a target rating, and take the default probability for this rating as a VaR confidence level. Thus, if an institution wishes to maintain a Baa rating, they would take the 0.15% default probability from **Table 1**, and compute their required economic capital at a 99.85% confidence level. Moreover, the institution would assess new transactions by their contribution to the capital at this level. In the remainder of this section, we will discuss the risk contribution outputs of the model, and how these may be used for active risk management.

### Identification of risk reducing transactions

With the liquidity concerns that accompany credit portfolios, the portfolio manager is often limited to decisions to continue to hold an exposure or to sell it entirely. While the impact of a sale on the portfolio's expected return is straightforward and involves only an analysis of the exposure in question, the risk impact of a sale involves the entire portfolio. Clearly, other things being equal, the sale of an exposure that represents an overconcentration of the portfolio (whether to a single obligor or to an industry sector) will reduce portfolio risk more than the sale of an exposure that represents less concentration. To quantify this point, we define an exposure's marginal risk as the amount the portfolio risk will be reduced were we to sell the exposure.

In **Figure 5**, we present the marginal risks for a sample portfolio. Each point represents an exposure, with the exposure's size indicated on the horizontal axis, and the exposure's marginal risk as a percent of its size indicated on the vertical axis. For each exposure, the product of its horizontal and vertical positions gives its total marginal risk; thus, curves such as the one in the figure indicate exposures with the same risk contribution. We have identified the exposure to Obligor X, a Baa-rated obligor in the financial sector, as the largest risk contributor.

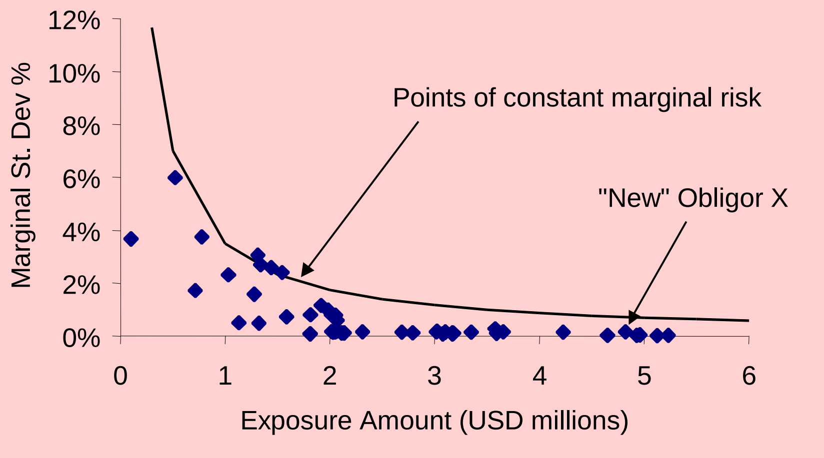
**Figure 5: Marginal risks for sample 50 bond portfolio**



There are two factors that may account for the Obligor X exposure's large risk contribution. One is that it is very risky, even on a stand-alone basis; this could be the case here, as the Obligor X exposure is quite large relative to the portfolio, and could embody a significant obligor concentration. The second is that the exposure is strongly correlated with other exposures in the portfolio, and is contributing to a large industry or sector concentration. In general, these two factors act in concert, but we may investigate the relative importance of the two by examining a strategy that eliminates the correlation risk but leaves the stand-alone risk unchanged.

The strategy is to sell the exposure to Obligor X, and replace the exposure by one with identical stand-alone characteristics (coupon, credit rating, maturity, etc.) but with no correlation to the rest of the portfolio. In this way, the stand-alone risk is unchanged, but we eliminate any risk that derives from the Obligor X exposure's dependence on other exposures. In our case, this provides a significant risk reduction. In **Figure 6**, we present the new marginal statistics, and see that what had been our largest risk contributor is now in line with the other exposures. Additionally, we see in **Table 3**, that our reallocation has the effect of materially reducing the absolute portfolio risk, with no impact at all on expected return. While such an opportunity may not always be available, this example illustrates the benefits of better diversification, and suggests that portfolio managers might seek out opportunities, whether through direct sales and purchases as here or through derivative transactions, to manage their portfolio concentrations.

**Figure 6: Marginal risks for sample 50 bond portfolio, after reallocation**



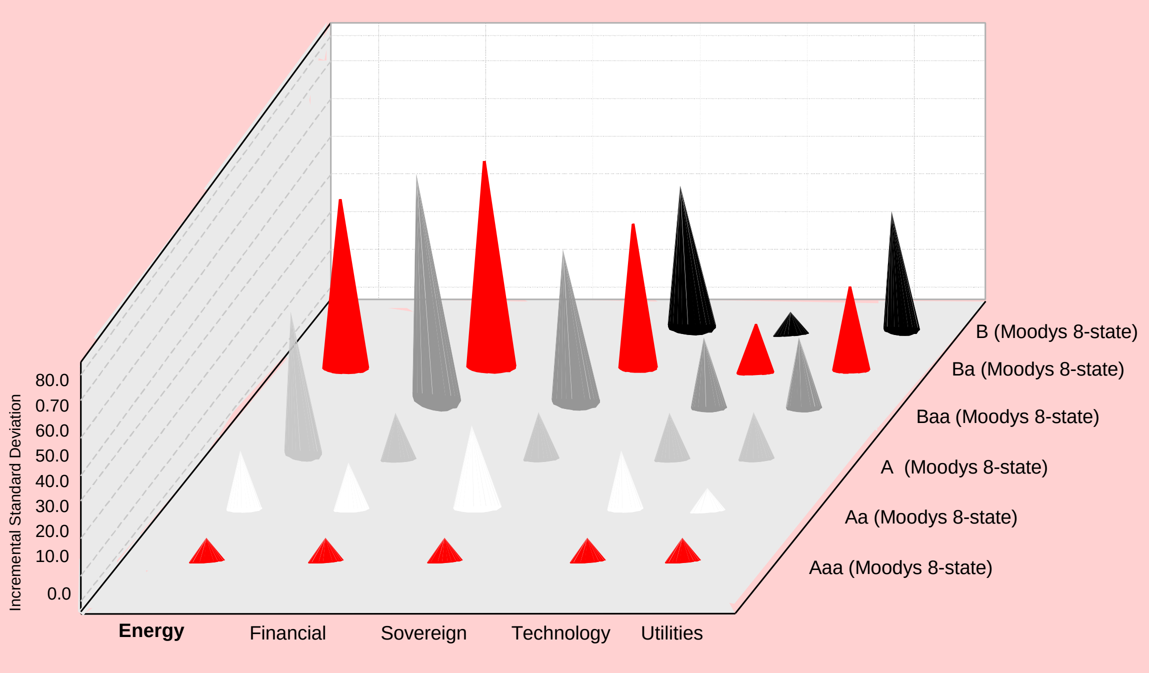
| Table 3: Effect of reallocation on portfolio risk | | | |
|---|---|---|---|
| | Before reallocation | After reallocation | Reduction |
| Expected return | 5.3% | 5.3% | 0% |
| Standard deviation | 659, 800 | 585, 100 | 11% |
| 5th Percentile loss | 897, 700 | 856, 200 | 4.6% |
| 1st percentile loss | 2,623, 000 | 2,483, 000 | 5.3% |

### Decisions to extend and price credit

While the previous analysis focused on existing exposures, it is often desirable to be more prospective. When an asset manager faces the decision to take on a new exposure, or a bank ponders extending the credit of an existing obligor, it is necessary to examine the effect of this new position on the portfolio risk. This effect will affect both the choice to take on exposure, and how this exposure is priced. Ideally, we would like run the model to reassess the portfolio given any potential transaction. In practice, we are not likely to conceive of every possible transaction we are likely to face, nor would the risk contribution of so many hypothetical deals be informative.

To reduce the problem, it is convenient to group our exposures – by rating and industry sector, for example – and communicate the risk contribution of additional exposure to these groups. Here, the marginal analysis of the previous section is less appropriate; we are not interested in the effect of removing a sector altogether, but rather in the effect of adding to the sector incrementally. Thus, in this case, we report the impact of a small percentage increase in our exposure to each sector and rating. The results for the sample bond portfolio are presented in **Figure 7**.

**Figure 7: Incremental Standard deviation by credit rating and industry sector**



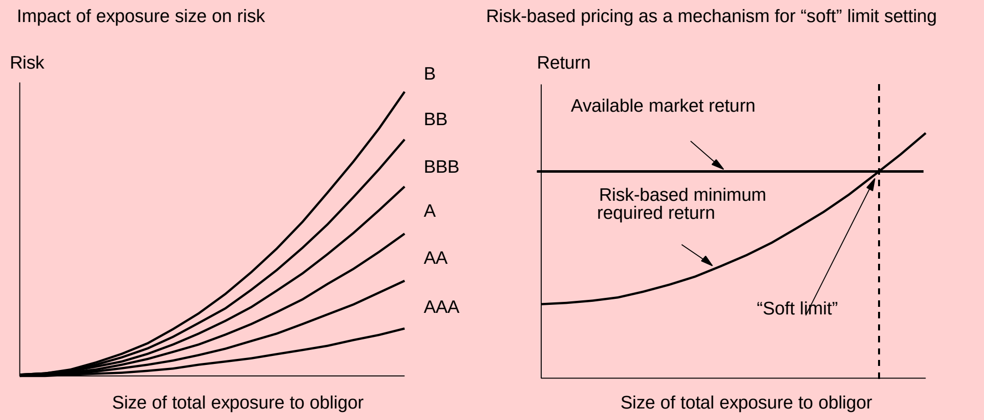

Not surprisingly, we see that Baa-rated obligors in the financial sector (such as Obligor X) will contribute more risk as we increase our exposure to this sector. In addition, Ba-rated exposures in the financial and energy sectors also represent high incremental risk, suggesting that credit be extended less liberally to these sectors, or at least that these concentrations be reflected in the pricing of further exposures. The higher ratings appear attractive for all sectors, though the returns here may not be as enticing as for the lower ratings. Most striking, however, is the diversification opportunity into Ba-rated obligors in the energy sector, where there is the potential to obtain comparable yields to Ba-rated financials or energy companies, but with a fraction of the incremental risk.

### Risk-based credit limits

A third application of the model is to set credit limits based on risk contributions. Traditionally, limits have been set based on exposure size (e.g. no single exposure greater than $20 million) or on rating (e.g. no exposure to sub-investment grade names). We could represent these limits by vertical and horizontal lines, respectively, on plots such as **Figure 5**. As we discussed previously, however, points along the curve in **Figure 5** represent equal risk contributions; thus it is more sensible to set limits like the curves, stipulating that an exposure contribute more than a given amount to portfolio risk.

Ultimately, we would like to link the exposure limit for each obligor to the return available in the market for such an exposure. Obligor and industry concentration effects are such that the risk contribution of an individual obligor increases with the size of the exposure to the obligor; further, the risk increase is greater at higher exposure levels. This relationship is illustrated in the left plot of **Figure 8**. For each increment in exposure to the obligor, a higher return is required to compensate for the increased risk. At some point, this required return will be greater than the return available. The point of intersection between the required and available returns, as shown on the right of **Figure 8**, should serve as a target for the exposure to the obligor.

**Figure 8: Exposure targets based on risk-return tradeoff**




## Conclusions

Employees of the RiskMetrics Group are often asked whether CreditMetrics (or for that matter, credit portfolio models in general) has succeeded. Perhaps the best way to evaluate its success is to return to three reasons given in 1997 for the release of the model:

To build liquidity and transparency in the credit markets,

To improve the dialogue with regulators, and

To improve the dialogue with clients

To the first point, while it would be presumptive to claim credit models as a cause, it is likely more than coincidental that volume and variety in the credit markets have increased steadily since 1997. New bond issuance in the United States hit a record level in 1997, and increased a further 17% in 1998; meanwhile, the growth of issuers in the European Community has outpaced the rest of the world. In securitizations, particularly Collateralized Debt Obligations, where the understanding of portfolio effects is crucial, yearly volume increased four-fold from 1996 to 1998, and is on pace for another 20% gain in 1999. All of this has been accompanied by the rise of the credit derivatives that are the subject of this volume.

Certainly, regulators took notice of the portfolio models, particularly given the model sponsors' implicit (and at times explicit) criticism of the Bank for International Settlements (B.I.S.) capital rules. The Federal Reserve Bank of New York hosted a conference on the future of capital regulation in February, 1998, and the Bank of England and the Financial Services Authority hosted another conference on credit risk modeling in September, 1998. Following this interest were consultative papers by Committee on Banking Supervision of the B.I.S.: one in April, 1999 on the state of credit risk modeling, and a second in June, 1999 proposing changes in the capital adequacy regulations. Though the proposed changes do not yet account for portfolio effects, they do represent a significant step toward accurately recognizing credit quality in the calculation of regulatory capital.

Lastly, the interest from clients has been overwhelming. JP Morgan and the RiskMetrics Group have distributed over 15,000 copies of the *CreditMetrics Technical Document*, while the CreditMetrics website continues to receive three to five thousand hits per month. CreditManager, the software implementation of the model, is now installed at over 100 institutions worldwide. As volume and liquidity continue to increase, particularly in Europe and emerging markets, and as opportunities for risk management through derivatives continue to develop, we expect the interest in credit portfolio models to only accelerate in the future. ■

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# 6. Bank regulatory treatment of credit derivatives

The advent of credit derivatives to the international banking forum has yet to be greeted with a definitive regulatory response from the Bank of International Settlements (BIS) for uniform global application. Rather, regulators regionally, through their publication of guidelines for banks within their respective jurisdictions, have part fuelled and part responded to the rapid growth of the credit derivatives market, a growth which has seen, in the U.S. alone, volume in terms of notional outstanding increase by over 400% over the last two years.[1]

This chapter outlines the regulatory approach to credit derivatives and discusses certain variations in the treatments of specific issues from jurisdiction to jurisdiction.

The reduction in risk effected though buying protection on an asset via a credit derivative is seen as analogous to that afforded by a bank guarantee on that asset, and in consequence the regulatory approach to the former is consistent with the well-established approach to the latter as set forth in the Basle Capital Accord.[1]

*'Unfunded' credit derivatives*

As the credit exposure of the Protection Seller to the Reference Entity in a credit derivative transaction is substantially identical to that of a lender to or bondholder of the same Reference Entity, the capital which the Protection Seller is required to hold against the position is just as it would be if a standby letter of credit or guarantee had been written. Accordingly, notional exposure of the Protection Seller on the Banking Book is registered for the purposes of calculating regulatory capital, dependent upon the risk weighting of the Reference Entity asset forth in the 1998 Basle Accord; namely 100% for corporates, 20% for OECD banks and 0% for OECD sovereigns.[1]

Capital relief is afforded the Protection Buyer provided that it can be demonstrated that the credit risk of the underlying asset has been transferred to the Protection Seller. Should the terms of the credit derivative not adequately capture the risk parameters of the underlying instrument – for example through restrictive definitions of credit events or stringent materiality thresholds – then protection cannot be recognised. Where it is, it has normally been the case in regulatory determinations thus far that the risk weighting of the underlying assets may be replaced by that of the Protection Seller. For example, protection referenced to a loan to a European corporate bought in credit derivative form from an OECD bank would have the effect of re-weighting the asset from 100% to the risk weighting of the OECD bank, 20%.

While treatment of the bank buying protection in this way recognises some of the reduction of risk effected in such a transaction, it is not evident that to require the same amount of capital to be held against a position not at risk until default of two independent credits as against a position at risk to default of one of them only is to recognise adequately the much lower risk profile of the bank in the former scenario. Indeed, in the interests of encouraging prudent and effective risk management techniques by banks, this is an issue highlighted by the Basle Committee on Banking Supervision

**Basle Committee on Banking Supervision**

- ***69.*** *The committee is aware that the Accord does not fully capture the extent of the risk-reduction that can be achieved by credit risk mitigation techniques. Under the Accord's current substitution approach, the risk-weight of the collateral or guarantor is simply substituted for that of the original obligor. For example, a 100% risk -weighted loan guaranteed by a bank attracts the same risk-weight as the bank guarantor. However, in the above example, a bank would only suffer losses if both the loan and its guarantor default.*
- ***70.*** *On this basis, the size of the capital requirement might more appropriately depend on the correlation between the default probabilities of the original obligor and the guarantor bank. If the default of the guarantor were certain to be accompanied by the default of the borrower, then the current substitution approach would be appropriate. But, if the probabilities of default are essentially unrelated, then a smaller capital charge than currently exists would be justified. In this context, the Committee has considered whether it would be possible to acknowledge the double default effect by applying a simple haircut to the capital charge that currently results from substituting the risk weight of the hedging instrument for that of the underlying obligor. Such a haircut would need to be set at a prudently low level.*

Annex 2 Section E No. 2 (69-72), " A New Capital Adequacy Framework" (June 1999)

The regulatory treatment of the Protection Buyer in a credit derivatives transaction also serves to highlight some of the inadequacies of the present risk weighting system, whereby a bank buying protection from a corporate – be it even one of the highest credit rating – may not reduce capital held against the protected asset.

*Funded' credit derivative structures*

'Funded' credit derivatives – i.e. Credit Linked Note (CLN) structures – are usually distinguished in regulatory treatises from their 'unfunded' brethren, albeit that regulatory treatment of the two are very similar.[1]

For the Protection Buyer, where an asset is fully or partly hedged by a funded credit derivative, the efficacy of the hedge is again recognised in a reduction of the risk weighting for the Buyer. The risk weighting of the hedged asset is replaced with that of the collateral to the credit swap, i.e. where the collateral is cash or government securities which are 0% risk weighted, there is no capital requirement against the hedged asset.

The exposure of the Noteholder – the equivalent of a Protection Seller in a 'funded' credit derivative transaction – is to the Reference Credit, to the collateral, and often (and in varying degrees) to the Protection Buyer, but regulations have thus far diverged in their approach to this exposure. APRA's suggested treatment is conservative in that the risk weighting of the Seller's exposure is calculated by summing the risk weights of the Protection Buyer and the Reference credit. BAKred, considers that as the amount of the redemption depends both on the financial standing of the debtor of the reference asset and also on that of the buyer, the weighting of the exposure should be at the higher of the risk weightings of the Buyer and Reference credit. The UK FSA guidance additionally captures situations where the issuer of the CLN is a Special Purpose Vehicle (SPV), such that, consistent with the BAKred, the weighting of the exposure is recorded at the higher of the risk weights of the reference obligor and the counterparty holding the funds and, where applicable, the collateral security.[3]

### *'Basket' structures*

For the Protection Buyer in a first-to-default basket structure, protection is recognised in respect of one of the assets within the basket only. The asset with the lowest risk weighting or smallest dollar amount is usually considered protected and assigned the risk weighting of the Protection Seller. However the FSA in the UK affords the Protection Buyer discretion in the choice of asset recognised as protected[3].

The regulatory approach of the FRB and OFSI to first-to-default baskets is for the Protection Seller to weight their exposure at the level of the riskiest asset in the basket. That this treatment does not contemplate the increased probability of default from exposure to each of the assets in the basket, implying that the risk of selling protection on a basket of assets with one or more weighted at 100% is equivalent to selling protection on just one of those 100% risk weighted assets has caused other regulators to take a more much more conservative approach, summing the individual risk weighted exposures in the basket such that the resulting capital charge is capped at the maximum payout possible under the swap (i.e. effectively a deduction from capital). The regulators advocating this approach, however, acknowledge its "shortcoming", particularly in cases where assets in the basket are strongly correlative, in which case the UK FSA and the Commission Bancaire advocate bespoke treatment on a case-by-case basis. In the words of APRA[4];

*"The shortcoming of this alternative approach is that it ignores the first-to-default feature of the basket product; by assuming an exposure to each asset in the basket it can be argued that this approach is particularly conservative."*

*"n principle then, the appropriate capital treatment is one that incorporates the default correlations between asset values as well as the first-to-default aspect of the credit derivative."*

### *Asset mismatches*

Key to the utility of credit derivatives is that a bank's credit exposure arising through ownership of a certain obligation of a certain entity may be completely hedged without making explicit reference to that obligation. For example, a bank with a bilateral loan to a corporate might have difficulties in finding a counterparty willing to sell credit protection referenced to that loan, and instead buy protection referenced to a more well-known and liquid bond of the same company.

It is of paramount concern to regulators that from a credit perspective the hedged asset be identical to the reference asset in the credit derivative (or, where there is no reference asset, that the hedged asset is eligible for protection under the terms of the credit derivative), i.e. that if a default occurs on the hedged asset, a credit event will be triggered simultaneously under the credit derivative, and recovery rates will be the same.

In consequence, for protection to be recognised and the capital requirement reduced, the two obligations should be issued by the same legal entity, and the reference asset should be *pari passu* or lower in seniority of claim than the hedged asset. The UK FSA, BAKred, FRB and APRA also require that there be mutual cross-default clauses between the assets, albeit that while it is necessary that that the default of an underlying should trigger the credit derivative, it is not clear why the reverse should apply.

Where the hedged asset is exactly the same from a credit perspective as the reference asset, its risk weighting is replaced with that of the Protection Seller. On the whole, however, although asset mismatches do not necessarily manifest zero risk reduction, regulators have tended to be conservative in the treatment of their occurrence even to the extent of not allowing any regulatory capital relief on the position thus hedged. The Commission Bancaire in France, on the other hand, grasps the problem of non-identical credit hedging in the same currency by limiting the capital reduction effect through the application of a flat 10% deduction from the hedge notional which can be recognised for capital purposes .

### *Maturity mismatches*

Under certain conditions it can be preferable (principally on the basis of cost efficiency) to hedge an asset of distant maturity for a shorter period. The problem with this strategy is that the Protection Buyer retains forward exposure to – and hence a forward capital requirement for – credit risk of the underlying asset. However, in the example of a ten year asset hedged through a seven year credit derivative transaction, there is real economic risk reduction which ought to be recognised in some risk weighted asset reduction.

If the hedge has in excess of one year remaining tenure but does not cover the full maturity of the hedged asset, many regulators impose an additional risk weight of 50% of the unhedged weighting of the hedged asset to take account of the forward exposure. For example, the weighting of a 100% risk weighted asset guaranteed by a 20% risk weighted counterparty would be 70%.

The assumption this represents is that forward exposure resulting from maturity mismatching is analogous in risk terms to a committed but undrawn credit facility to a corporate (which is risk weighted at 50%). The key distinction, however, is that whereas an undrawn commitment may become drawn at any time without notice (whereupon the facility would become 100% risk weighted to the extent of draw-down), potentially doubling the capital requirement, the fixed maturity of the credit derivative hedge means that a bank knows in advance precisely when the additional capital will be required. Given that it is generally accepted by regulators that an unfunded commitment to a corporate borrower is weighted at 50%, albeit that it may be drawn down on *at any time*, it would seem to be an inconsistency that where a ten year asset is hedged for the next seven, and hence the likelihood of the additional capital requirement in the first seven years is contingent solely on the credit of the OECD bank, the risk weighting should be greater than 50% in the years prior to the maturity of the hedge. Indeed, since a hedge to maturity with an OECD bank on a drawn corporate loan is recognised in a re-weighting to 20% (a re-weighting which the Basle Committee has acknowledged may be overly conservative), it is questionable whether in the years prior to the maturity of the hedge the credit position of the bank is such that the risk weighting should be much greater than 20%. Given the economic efficacy of hedging practices such as this, the current regulations would seem to be a disincentive to prudent risk management.

In recognition of this, the Australian regulator APRA uses a “straight line” method, which recognises protection on the percentage of the underlying asset that is covered by the hedge. Hence for a 10 year asset protected by a 9 year credit derivative, 90% of the exposure would be risk weighted according to the Protection Seller, with the remaining 10% of exposure weighted at the level of the underlying asset. Again, the credit derivative must have a remaining maturity of at least one year to be recognised as a hedge.

Pursuit of the ideal economic compromise often leads to the step-up and call structure. Take for example a ten year loan held by a bank which expects the fee for protection on that asset to be lower in four years time than it is today. To capture that upside, while prudently protecting against the possibility of severe downside (spreads widen significantly), the bank buys a four year into six step-up callable credit swap whereby the fee for protection increases after four years, at which time the bank has the right but not the obligation to call the swap. Such a structure effectively manifests a total hedge on the loan to maturity for the first four years, eliminating a significant portion of the forward exposure, depending on the level of step up. Most regulatory treatises do not opine on the step up and call, but concern often arises as to the level of step-up. The Financial Services Authority in the UK, for example, treats the call date as the maturity of the derivative, giving no credit at all for the post-call protection.

*Currency mismatches*

**Table 1: Specific fisk factors for trading book assets (Basle Capital Accord standardised approach)**

| Category | Remaining maturity | Weighting factor | Equivalent "risk-weighting" |
|---|---|---|---|
| Government | N/A | 0.00 | 0.00 |
| Qualifying | 6 months or less | 0.25 | 3.125% |
| | Over 6 to 24 months | 1.00 | 12.500% |
| | Over 24 months | 1.60 | 20.000% |
| Other | N/A | 8.00 | 100% |

Where the credit derivative hedge is denominated in a currency different to that of the underlying instrument, the regulatory approach has been various. The BAKred requires regular mark-to-market procedures, whereby the hedge notional is re-marked to the currency of the underlying instrument to determine in what amount the underlying instrument may be considered hedged, while in the United Kingdom and Francea fixed reduction in notional protection recognised has been adopted (UK 8%,France 10%), albeit that the FSA allows full notional protection to be recognised where adequate cross currency hedging is demonstrated[4].

### *Treatment of credit derivatives in the Trading Book*

Trading book eligibility is generally driven by qualitative requirements of an intent to trade or hedge the position, coupled with the requirement that the position be marked-to-market through the income statement[1].

Assets in trading accounts are subject to the BIS-mandated market risk capital rules. Under these rules, capital must be held for general market risk, specific risk, and counterparty risk. The regulations outlined below apply to the standard method used to calculate regulatory capital, but in most jurisdictions banks may apply to have their own internal models approved for assessing general market and specific risks.

### *Specific Risk*

As with general market risk, there is general provision for banks to elect either to adopt the standardised approach to specific risk or to use their own internal models.. Table 1 illustrates standardised specific risk factors that vary by the category of the underlying instrument and by maturity. These differ most notably from the older banking book risk-weightings in the case of “qualifying” debt positions. Qualifying positions include OECD bank debt and OECD corporate debt if investment grade or of equivalent quality and issued by a corporate with instruments listed on a recognised stock exchange. For qualifying debt positions, the risk factors equate to weightings of 3.125% for positions with tenor of six months or less, 12.5% for positions with tenor of more than six but no more than 24 months, and 20% for positions with tenor of over 24 months. Non-qualifying debt carries a factor equivalent to 100%, and OECD government debt has a factor of 0%. This is most significant in that the market risk capital rules link capital charges to maturity and credit quality and consequently treat open exposures to investment grade corporates significantly more favourably than exposures held in the banking book.

The guidelines set forth by regulators for the treatment of credit derivatives in the trading book under the standardised approach envisage some netting of specific risks in long and short positions, but only in the case of substantially "matched" positions, usually defined as those with identical maturities, reference assets, and structures. The requirement for identical structures means that a loan or bond may only be hedged with a Total Return Swap of identical maturity referencing that specific asset, but not with a Credit Swap, even one with identical maturity and referencing that specific asset. In addition, Total Return Swaps and Credit Swaps may only be offset by identical transactions but not by each other. Offsetting positions that do not meet the necessary requirements to be considered matched do not achieve any capital relief but require capital against the specific risk of either the long or the short position, whichever is greater. Given the additional requirement to hold capital against counterparty risk, this treatment can result in increased capital requirements.

### *Counterparty Risk*

As with all derivatives, the amount of counterparty risk capital required will depend on a value representing the current replacement cost of the contract if positive, found by marking the contract to market, plus an add-on to reflect potential future exposure, determined by reference to maturity and underlying risk type. Although no factors have yet been developed for credit derivatives specifically, the conservative approach adopted by the Federal Reserve requires the use of equity add-ons for investment grade exposures and commodity add-ons for others. The UK FSA applies interest rate factors to investment grade and equity to all other assets. Risk-weighting then proceeds according to the weighting of the swap counterparty (0% for OECD sovereigns, 20% for OECD banks, 50% for corporates).

### *Large Exposures*

The Basle Committee suggested in their best practice guide for bank supervisors, *Measuring and controlling large credit exposures* (1991) that the limit for single exposures be between 10-25% of total capital. Where counterparty exposure to a Protection Seller is generated through the purchase of protection on a large credit position, for example on a portfolio of loans in a synthetic securitisation transaction, regulators generally consider that this exposure should not necessarily be reported as a large exposure for large exposures reporting purposes. Indeed, the FSA in the UK, and BAKred in Germany both prudently allow the Protection Buyer in a credit swap to choose whether to record their large exposure to the counterparty or to the underlying asset, notwithstanding which exposure they choose to register for capital adequacy purposes[2].

The UK FSA provides that Protection Sellers in funded credit derivatives must record their exposure to both the reference asset and the counterparty. Where the credit derivative is referenced to multiple assets, the Seller must record large exposures for all the assets.

The rules for credit derivative hedges where the Buyer may reduce their large exposures are particularly stringent. Maturity mismatches are treated as undrawn commitments for capital requirements, and as such are counted as large exposures. Hence a credit derivative with a shorter maturity precludes the possibility of reducing a large exposure. Nor do the UK FSA allow protection to be recognised for large exposures purposes where the base currency of a funded credit derivative is different from that of the underlying asset[1].

The BAKred rules are even more stringent, requiring that the counterparty to an unfunded credit derivative in the banking book is a Zone A government or central bank in order for the reduction in exposure to be recognised for large exposures purposes. In the trading book, a reduction in exposure is permitted regardless of the nature of the counterparty, but an additional exposure to the Protection Seller must be counted. As per the UK FSA rules no reduction in exposure is permitted if the assets have different residual maturities for any type of credit derivative contract.

The Protection Seller in a TRS or CLN contract must consider their exposure to both the obligor of the reference asset and the Protection Buyer, albeit that only the higher of the exposures to the Buyer or to the reference asset need to be considered for the purposes of determining utilisation. For the Seller in a credit default swap, the Protection Seller must count the exposure to the reference asset obligor only, as for the BAKred treatment of options[1].

### *The New Capital Adequacy Framework*

In part due to the development of the credit derivatives market and the enhanced risk management capabilities afforded banks through their use, the Basle Committee on Banking Supervision is seeking to introduce a new capital adequacy framework to replace the 1988 Basle Capital Accord. The Committee's much-anticipated proposal, "*A New Capital Adequacy Framework*" released on June 3 1999, sets out a number of potential changes to the Accord and is aimed as soliciting responses from interested parties.

Key to the proposal is the modification of the current arbitrary system for risk-weighting bank assets in an attempt more accurately to reflect credit risk. As such the committee is proposing the use of external credit rating agencies to risk-weight issuer obligations. The Committee has also raised the possibility of banks using internal credit ratings and credit risk modelling, but recognise the difficulty in a broad application of both these methods at present. Implementation of these proposals which will have broad implications for the banking industry in particular and the credit markets, in particular the credit derivatives market, in general.

### *Risk weighting by credit rating*

The greatest risk-weighting changes proposed are to exposures at both ends of the credit spectrum across all types of credit entity. In respect of sovereigns it is proposed that the current system of discrimination solely according to their OECD status be formally replaced by risk weighting according to the credit rating of the sovereigns themselves. Hence exposures to non-OECD sovereigns rated triple- or double-A such as Singapore and Taiwan would carry much lower (0%) risk weightings, while exposures to OECD sovereigns rated below Aa3/AA- such as Mexico, Poland, Greece and Turkey, presently weighted at 0%, will be attract higher capital requirements.

The same would be true with respect to OECD and non-OECD bank exposures, albeit that for their treatment the Committee proposes two options, one based on the risk of the sovereign in which the bank is incorporated, the other on the assessment of the individual bank, and is seeking feedback on which (or a combination) is more appropriate.

In respect of corporates, the new proposals do not affect those rated anywhere between single-A to single-B, but will make a significant difference to the funding costs of those with triple-A and double-A ratings, who would be weighted at 20%, the same weighting to which OECD bank exposures are subject under the current regime.

The table below provides a broad summary of the risk weightings suggested by the Committee for sovereigns, banks and corporates based on external ratings.

**Table 2: Proposed BIS capital adequacy risk-weightings by risk type**

| | AAA to AA- | A+ to A- | BBB+ to BBB- | BB+ to B- | Below B- | Unrated |
|---|---|---|---|---|---|---|
| Sovereigns | 0% | 20% | 50% | 100% | 150% | 100% |
| Banks-Option 1* | 20% | 50% | 100% | 100% | 150% | 100% |
| Banks-Option 2* | 20% | 50% | 50% | 100% | 150% | 50% |
| Corporates | 20% | 100% | 100% | 100% | 150% | 100% |

* Risk-weighting based on risk-weighting of sovereign in which the bank is incorporated, whereby bank assigned one category worse than its sovereign (for example, if sovereign has a 20% risk-weighting, the bank would achieve 50%)

** Risk-weighting based on the assessment of the individual bank

*Source: Basle Committee on Capital Adequacy, A New Capital Adequacy Framework, June 1999*

*Re-weighting other exposure types*

The table below outlines risk-weighting proposals of the Committee for other types of exposure;

**Table 3: Other exposure types**

| | | |
|---|---|---|
| Securitisation | AAA to AA-<br>A+ to A-<br>BBB+ to BBB-<br>BB+ to BB-<br>Below B+ or unrated | 20%<br>50%<br>100%<br>150%<br>Deducted from capital |
| Mortgage assets | Residential Mortgages<br>Commercial Mortgages | Risk weighting remains at 50%<br>"…(commercial mortgages) do not, in principle, justify other than a 100% weighting of the loans secured" |
| 364 day bank facilities | Credit conversion factor of off-balance sheet commitments, presently 0% for obligations shorter than a year, increase to 20%, unless the obligation is unconditionally cancellable or provides for effective cancellation upon deterioration in borrower's credit quality. | |
| Other risks | The Committee is also in the process of implementing a framework to assess capital requirements for interest rate risk in the banking book and operational risk | |

### *Implications for the credit derivatives market*

Implementation of the new Basle proposals will significantly alter banks' regulatory capital management imperatives and hence can be expected to change the complexion of the credit derivatives market. The hedging of bank exposures, for example, thus far principally driven by banks managing economic exposure in respect swap counterparty exposures, will likely increase in volume as regulatory capital requirements increase for exposures to banks rated below double-A. This is also likely for lower-rated OECD sovereigns, while the converse would be true of highly rated corporate and non-OECD sovereign exposures.

Another effect on the credit derivatives market may arise from the much-enlarged universe of providers of capital-effective credit protection which the proposals potentially envisage. Assuming the treatment outlined in section 1 (above) is extended so that a bank buying protection on a 100% risk-weighted exposure from a highly rated corporate may re-weight the exposure to 20%, the demand from banks for credit protection from non-banks will greatly increase. Apart from the obvious benefits to non-banks already active in the credit derivatives market, therefore, new capital adequacy regulations promise to open it up to corporates more generally.

The new Basle proposals are a clear signal that economic risk is to play a much greater role in determining bank capital adequacy requirements. This has far-reaching implications for the credit derivatives market as the regulatory regime increasingly fosters the prudent and sophisticated management of economic capital.

"Capital-adequacy treatment of credit derivatives" *APRA April 1999 [http://www.apra.gov.au/]*

"A new Capital Adequacy Framework" Correlative paper, *issued by the Basle Committee on Banking Supervision, June 1999*

International convergence of capital measurement and capital standards" *Basle Committee on Banking Supervision, July 1998 (amended April 1998, January 1996, April 1995, July 1994, November 1991)*

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# 7. Synthetic securitisation

Since 1997, credit derivatives have entered the mainstream of global structured finance as tools in a number of large, high profile securitisations of assets that cannot as easily be managed using more traditional techniques. By combining credit derivatives with traditional securitisation tools in collateralised loan obligations (CLOs) or mortgage backed securitisations (MBSs), for example, structures can be tailored to meet specific balance sheet management goals with much greater efficiency. Specifically, credit derivatives have assisted banks in reducing economic and/or regulatory capital, preserving a low funding-cost advantage, and maintaining borrower and market confidentiality.

### Traditional Securitisation

Consider a portfolio of bank loans to corporations. Traditional securitisation techniques for such a portfolio would involve the creation of a CLO, in which the originating bank would assign or participate its loans to a special purpose vehicle (SPV), which in turn would issue two or more classes of securities in the capital markets. Typically, the originating bank would retain much of the economic risk to the pool of loans by purchasing the most junior (equity) tranche of the SPV securities. The extent to which the transaction would achieve regulatory capital relief for the bank would depend upon the size of the retained first loss position. According to the low level recourse rules governing securitisations in the US, a retained first loss piece of 8% or greater would result in no capital relief, but smaller retained first loss positions would result in required capital equal to the lesser of 8% and the size of the recourse position.

While a CLO can achieve a number of goals including regulatory capital relief, financing of a loan portfolio, and off-balance sheet treatment of the portfolio for GAAP purposes, it has certain inefficiencies. For example, for a bank that enjoys low-cost unsecured financing, the cost of funding usually achieved by such transactions is unattractive, since even the most senior, typically triple A rated, securities are sold at the relatively high Libor “plus” spreads which prevail in the asset-backed securities market. Thus, in seeking to manage regulatory capital, the bank is effectively forced to accept an inefficient financing cost. Moreover, transferring the legal ownership of assets to the SPV via assignment requires borrower notification and (often) consent, introducing the risk of adverse relationship consequences. The alternative of participating loans to the vehicle will normally cause the vehicle’s overall rating to be capped at that of the originating bank with adverse consequences for the overall cost of funding and more generally on capacity for the originating bank’s name in the market. Structures that avoid this particular problem can be structurally and legally complex and require extensive rating agency involvement, which in sum impedes the speed with which such a transaction can normally be executed. Finally, CLOs cannot be readily applied to loans that are committed but undrawn, such as revolving credit lines, or backstop liquidity facilities.

### Synthetic securitisations

As alternatives to traditional securitisation, transactions have been and are being developed that make use of credit derivatives to transfer the economic risk but not the legal ownership of the underlying assets. Credit derivatives can be used to achieve the same or similar regulatory capital benefits of a traditional securitisation by transferring the credit risk on the underlying portfolio. However, as privately negotiated confidential transactions, credit derivatives afford the originating bank the ability to avoid the legal and structural risks of assignments or participations and maintain both market and customer confidentiality.

Thus, credit derivatives are stimulating the rapidly growing asset-backed securitisation market by stripping out and repackaging credit exposures from the vast pool of risks that do not naturally lend themselves to securitisation, either because the risks are unfunded (off-balance sheet), because they are not intrinsically transferable, or because their sale would be complicated by relationship concerns. In so doing, by enhancing liquidity and bringing new forms of credit risk to the capital markets, credit derivatives enable both buyers and sellers of risk to benefit from the associated efficiency gains. We introduce both CLN and credit-swap structures on the following sections.

### *Credit-Linked Notes*

In several securitisations, the credit risk of loans on the originating bank's balance sheet has been transferred to the securitisation SPV via the sale of credit-linked notes rather than the assignment or participation of the loans themselves. CLNs are funded assets that offer synthetic credit exposure to a reference entity or a portfolio of entities in a structure designed to resemble a corporate bond or loan. The simplest form of CLN is a bank deposit issued by the originating bank whose principal redemption is linked to a credit event of a reference credit. Alternatively, CLNs may be issued by an SPV that holds collateral securities (usually government securities, repurchase agreements on government securities, or high quality (triple-A) asset backed securities) which are financed through the issuance of those notes. The SPV enters into a credit swap with the originating bank in which it sells default protection in return for a premium that subsidises the coupon to compensate the investor for the reference entity default risk. In each case, the investor receives a coupon and par redemption, provided there has been no credit event of the reference entity. The value of a CLN as opposed to a traditional sale or participation of assets is that a) the structure is confidential with respect to the bank's customers and b) the CLN or credit swap terms generally allow the bank the flexibility to use the contract as a hedge for any senior obligation of the reference entity (including loans, bonds, derivatives, receivables and so on).

### *Broad Index Secured Trust Offering ("BISTRO")*

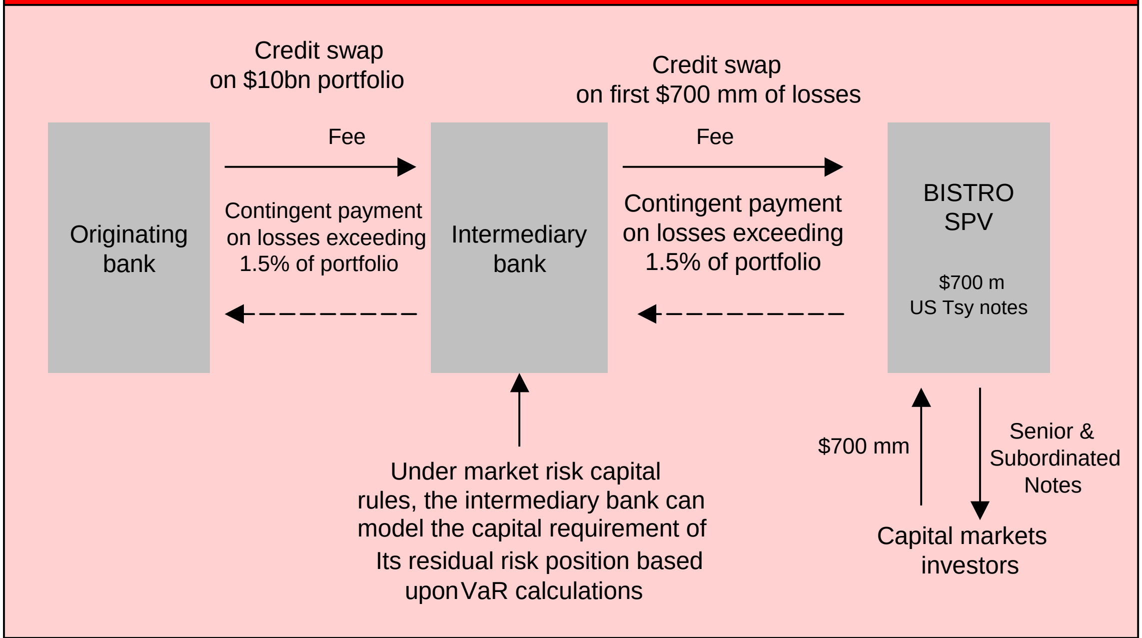
Since late 1997, the market has seen several innovative structures which have exploited the unfunded, off-balance sheet nature of credit derivatives (as opposed to funded CLNs) to allow a bank to purchase the credit protection necessary to mimic the regulatory capital treatment of a traditional securitisation while preserving its competitive funding advantage. Such structures have the advantage of being equally applicable to the exposure of both drawn and undrawn loans.

This type of structure is exemplified by a transaction known as BISTRO, a J.P. Morgan proprietary product which has been applied to more than $20 billion of bank credit risk since its first introduction in December 1997. In this structure, an originating bank buys protection from J.P. Morgan on a portfolio of corporate credit exposures via a portfolio credit swap. Morgan, in turn, purchases protection on the same portfolio from an SPV. The credit protection may be subject to a "threshold" (In Chart 11, equal to 1.50%) relating to the aggregate level of losses which must be experienced on the reference portfolio before any payments become due to the originating bank under the portfolio credit swap. Since this threshold represents economic risk retained by the originating bank, it is analogous to the credit enhancement or equity stake that a bank would provide in a traditional securitisation using a CLO.

The BISTRO SPV is collateralised with government securities or repurchase agreements on government securities which it funds through the issuance of notes which are credit-tranched and sold into the capital markets. In a critical departure from the traditional securitisation model, the BISTRO SPV issues a substantial smaller note notional, and has substantially less collateral, than the notional amount of the reference portfolio. Typically, the BISTRO collateral will amount to only 5-15% of the portfolio notional. Thus, only the first 5-15% of losses (after the threshold, if any) in a particular portfolio are funded by the vehicle, leaving the most senior risk position unfunded. The transactions are structured so that, assuming the portfolio has a reasonable amount of diversification and investment grade-average credit quality, the risk of loss exceeding the amount of BISTRO securities sold is, at most, remote, or in rating agency vernacular, better than "triple A."

To achieve regulatory capital relief, it is necessary for the originating bank to make use of a third party bank (J.P. Morgan in this example) to intermediate between the BISTRO SPV and itself because of the large notional mismatch between the underlying portfolio and the hedge afforded by the SPV. Provided that the third party bank is able to apply internal models to its residual risk position in a trading book, this risk will not consume a disproportionate amount of regulatory capital for the intermediating bank.

**Figure 1: BISTRO structure**



Credit derivative structures such as BISTRO significantly reduce the legal, systems, personnel and client relationship costs associated with a traditional securitisation. They reduce the amount of time needed to execute a transaction of significant size. They can achieve efficient leverage in leaving the senior most risks in diversified portfolios unfunded and distributing substantial volumes of credit risk in much smaller capital markets transactions. In addition, while a traditional securitisation can efficiently hedge only funded credit risk, a credit derivative transaction can hedge a much broader universe of credit exposures including unfunded commitments, letters of credit, derivatives, revolvers, settlement lines, mortgage insurance lines, and trade receivables. Furthermore, synthetic securitisation technology can be applied to any asset class to which traditional securitisation can be applied, for example commercial and residential mortgages, car loans, personal loans, and unrated middle-market corporate loans. The wider universe of credits available via a credit derivative structure means a larger, more diverse, portfolio can be executed with clear benefits in terms of cost, regulatory capital, and economic risk. Furthermore, in a BISTRO, the originating bank (should it so chose) avoids any linkage of the transaction to its own name, thereby avoiding reputation risk with respect to the market and individual borrowers. This arms-length nature of the BISTRO is a benefit when rating agencies assess credit implications for the bank.

### Investor considerations – case study: value in BISTRO

As banks become more active in managing their portfolios, and as they determine that CLOs may not always fit their needs, there has been strong growth in the synthetic securitisation market. This growth has been further driven by;

- Investor preference to maintain returns and increase portfolio diversity without going down the credit curve

- Developments, such as J.P. Morgan's CreditMetrics , in the application of credit portfolio theory, together with investor acceptance of rating agency portfolio analysis

- The simplicity, from both a bank's and investor's point of view, of a pure, straightforward credit risk position

J.P. Morgan introduced the first BISTRO in December 1997 and since that time the market for this product has expanded to over $2 billion (with underlying exposure in excess of $23 billion). Like other ABS, BISTRO notes have been fully collateralised by assets – so far government bonds (U.S. Treasuries) rather than credit-risky assets - but unlike other ABS are actually exposed to the credit risk of a reference portfolio which is larger than the notes themselves (e.g., $1 billion of BISTRO notes backed by $1 billion of Treasuries may be exposed to the credit risk of a $10 billion reference portfolio). As seen in the diagram above, credit risk is introduced into the BISTRO Trust through the portfolio credit swap. Under the terms of this portfolio credit swap, Morgan Guaranty Trust Company of New York ("MGT") pays a fee to the BISTRO Trust in return for which the trust is obligated to make a contingent payment to MGT at maturity if credit events occur. Payments will be made by the BISTRO Trust only after, and to the extent that, losses due to credit events have exceeded the first-loss threshold. Tranched notes issued by the BISTRO Trust effectively assume layers of portfolio credit risk like any other ABS or CLO.

Credit events are based on industry-standard ISDA credit swap definitions and include bankruptcy, failure to pay, cross acceleration, restructuring or repudiation. Losses are assessed either by a computation of final work-out value for companies emerging from bankruptcy prior to maturity or by soliciting bids from the market for senior unsecured obligations.

The ongoing fee paid by MGT under the portfolio credit swap is the source of the spread component of the coupon on the BISTRO notes, while the underlying Treasury collateral is the source of the majority of the coupon: e.g., a 6.00% coupon might result from 5.40% paid from Treasuries and 0.60% paid by MGT. Past BISTRO transactions have also used an interest rate swap to allow the Trust to issue LIBOR-based floating rate notes.

### *Relative Value – credit considerations*

BISTRO synthetic securitisations to date have been characterised by strong credit quality and highly diverse reference portfolios.

Levels of diversification, measured by number of entities, average exposure per entity and number of industries represented, are reflected in Moody's diversity scores for BISTRO portfolios which, in comparison, are similar to CLOs and higher than CBOs:

| Table 1: Average diversity score | |
|---|---|
| BISTRO | 40-90 |
| CLOS | 40-90 |
| CBOs | 25-35 |

BISTRO portfolios thus far have been solidly investment grade in respect of their weighted average rating, and each reference entity within the portfolios has been rating agency rated. Strong investment-grade credit portfolios exhibit considerably lower loss characteristics than those of sub-investment grade and consumer assets (such as single-B consumer loan pools, before the addition of credit enhancement, and the double-B debt portfolios common in other corporate credit securitisations), and of course lower loss volatility and severity than single-name corporate bonds. In addition, timing of defaults is end-weighted for higher rated portfolios: according to historical corporate bond default research, the average time to default for speculative-grade credits is much shorter than that for investment-grade credits.

All exposures within the BISTRO portfolios are at the senior unsecured level for which rating agency studies have shown historical recovery rates upon default to have been around 50%.

In transactions executed to date, investors know the specific names and amounts of exposures comprising the BISTRO portfolio at issue. Banking secrecy laws (particularly in Europe), however, mean that it can be necessary to restrict disclosure of the underlying names while revealing other key characteristics such as industry, rating, domicile and notional amount. In order to enhance flexibility to the issuer, furthermore, where portfolios are high quality, it can be preferable for certain limited substitution of exposures in the portfolio to be allowed.

Credit enhancement provides a similar multiple of protection against historical loss experience relative to comparably-rated securities. First-loss protection is provided via the threshold amount which is analogous to the first-loss excess spread position in credit card ABS trusts or the first-loss equity piece in a CLO. The threshold amount in BISTRO is fully subordinated to the investor’s position. Losses are first absorbed by this threshold and then allocated up through the BISTRO capital structure, so that senior classes benefit from credit enhancement provided by both the fully subordinated junior classes and the threshold.

As noted, synthetic securitisation investors are exposed to a pool which is several times the principal amount of notes issued (e.g., $1 billion of BISTRO notes may be exposed to a $10 billion pool, whereas $1 billion of CLO notes would be exposed to only a $1 billion pool.) This difference is explicitly taken into account in the rating agency analysis, which essentially "equalises" an investor's loss exposure between these two structures through the required credit enhancement levels. In fact, BISTRO investors receive similar loss coverage protection when compared on an "apples-to-apples" basis to a CLO pool of similar quality.

*Relative Value – structural considerations*

The BISTRO structure also benefits from minimal sponsor/servicer risk: exposure to MGT is only in respect of the spread over government collateral. In addition, neither MGT nor any third party actively manages or trades the reference portfolios, which to date have been static throughout the life of the transaction. Furthermore, credit events are determined with reference to publicly available information and losses are valued in a transparent way that is not reliant upon any single institution's servicing capability.

*Relative Value – cash flow considerations*

Coupon payments derive from the government collateral and MGT until maturity. Even following a credit event, investors are guaranteed to receive timely interest payments on the full principal to maturity, since this interest is derived from the fixed coupon received on the underlying government securities plus the spread paid by MGT in the form of credit swap fees. On the other hand, in traditional ABS, the coupon is dependent upon cash receipts on the underlying assets, and losses are passed through to investors as incurred over the life of the transaction. In these structures, such shortfalls or defaults would generally cause investors in these transactions to stop receiving their coupon (or to receive their coupon on a reduced amount of securities if partial writedowns occur). In effect, the guaranteed coupon provides an additional and unique source of credit and yield enhancement for BISTRO investors.

Principal repayment is protected from market value declines and exposed only to losses from credit events at maturity. Losses on BISTRO securities can arise only from credit events on entities in the reference portfolio, so market value declines will not affect the cash flow of the notes or the capitalisation of the transaction. Furthermore, thus far, BISTRO notes have had hard bullet maturities, irrespective of the occurrence of credit events, with the principal repayment to BISTRO investors attributable to the bullet repayment of principal on the underlying Treasury securities. Unlike CLOs and other ABS structures, losses arising from any credit events in the BISTRO portfolio will be settled at maturity. This payment mechanism is an advantage of BISTRO notes relative to traditional ABS and corporate bonds, which are typically exposed to principal shortfalls and defaults throughout their life.

BISTRO notes have no prepayment risk and unlikely 20-day extension risk. If there is a credit event within 20 business days of the maturity date, the maturity will be extended by 20 business days to ensure proper settlement. In sum, the structure provides "clean" cash flows resembling corporate bonds.

*Relative Value – liquidity*

Key to J.P. Morgan's BISTRO programme has been a desire to establish a broad benchmark in synthetic securitisation technology in order to enhance liquidity and ease of relative value assessment, with the result that terms, structural mechanics and documentation of recent BISTRO transactions have become reasonably standardised, and a secondary market for AAA notes has developed, improved by third-party dealer participation in some underwritings.

Synthetic securitisation structures have been benefiting from increased investor focus on structured products. Investors are becoming increasingly aware of the structures and their similarities to CLOs as they become an established vehicle for risk transference, with wide and growing applicability of BISTRO technology for a number of financial institutions and financial assets. Furthermore, the senior notes on BISTRO structures have been ERISA-eligible which further expands the universe of potential investors in the United States.

*Relative Value – spread considerations*

BISTRO provides an opportunity for investors to enhance yield by taking leveraged exposure to high quality assets rather than single name exposure to lower-rated credits which would likely be more sensitive to an economic downturn.

While the spread environment has been volatile, both AAA-rated and BBB-rated BISTRO notes continue to offer an attractive yield pick-up relative to comparable spread product. Although BISTRO spreads still reflect the novelty of the product and, to a certain extent, a desire by investors to be paid for structure, this differential is likely to shrink over time as investors become increasingly comfortable with the structure and as liquidity improves.

# 8. Conclusion

The use of credit derivatives has grown exponentially since the beginning of the decade. Transaction volumes have picked up from the occasional tens of millions of dollars to regular weekly volumes measured in hundreds of millions, if not billions, of dollars. Banks remain among the most active participants, but the end-user base is expanding rapidly to include a broad range of broker-dealers, institutional investors, money managers, hedge funds, insurers, and reinsurers, as well as corporates. Growth in participation and market volume is likely to continue at its current rapid pace, based on the unequivocal contribution credit derivatives are making to efficient risk management, rational credit pricing, and ultimately systemic liquidity. Credit derivatives can offer both the buyer and seller of risk considerable advantages over traditional alternatives and, both as an asset class and a risk management tool, represent an important innovation for global financial markets with the potential to revolutionise the way that credit risk is originated, distributed, measured, and managed.

### Credit derivatives and portfolio credit risk modeling

Advances in the application of modern portfolio theory to credit portfolios have revealed powerful arguments for more active credit risk management. For example, loans have a lower default correlation than their corresponding equity correlation (due to the low likelihood that two remote events will occur simultaneously). The implication of low default correlations is that the systematic risk in a credit portfolio is small relative to the nonsystematic or individual contribution to risk of each asset. The greater the component of nonsystematic risk in a portfolio, the greater the benefits of diversification, and vice versa. To view the problem another way, indices provide good hedges of risk in equity portfolios, but not in debt portfolios: It takes many more names to fully diversify a credit portfolio than an equity portfolio, but when those diversification benefits are achieved, they are considerable. An inadequately diversified portfolio, on the other hand, can result in significantly lower return on risk ratios than would seem intuitively obvious. The conclusion? Given the opportunity, portfolio managers should actively seek to hedge concentrated risks and diversify with new ones.

The evolution of better models for credit risk measurement and better tools for credit risk management are mutually reinforcing: traditionally, without the tools to transfer credit risk, it was not possible to properly respond to the recommendations of a portfolio model. Conversely, without a portfolio model, the contribution of credit derivatives to portfolio risk-return performance has been difficult to evaluate. However, as such technology becomes more widespread, as the necessary data become more accessible and as credit derivative liquidity improves, the combined effect on the way in which banks and others evaluate and manage credit risks will be profound. Banks have already adopted a more proactive approach to trading and managing credit exposures, with a corresponding decline in the typical holding period for loans. It is becoming increasingly common to observe banks taking exposure to borrowers with whom they have no meaningful relationships and shedding exposure to customers with whom they do have relationships to facilitate further business. Such transactions are occurring both on a one-off basis and increasingly via the use of large bilateral portfolio swaps, which in a sense are simply a less radical and more effective solution than a bank merger to the problem of a poorly diversified customer base. Banks increasingly have the ability to choose whether to act as passive hold-to-maturity investors or as proactive, return-on-capital driven originators, traders, servicers, repackagers, and distributors of the loan product. Ironically, this process will resemble the distribution techniques employed by those institutions that have been disintermediating banks in the capital markets for years. It also seems inevitable that greater transaction frequency and the availability of more objective pricing will prompt a movement toward the marking-to-market of loan portfolios.

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### Other implications

While it is true that banks have been the foremost users of credit derivatives to date, it would be wrong to suggest that banks will be the only institutions to benefit from them. Credit derivatives are bringing about greater efficiency of pricing and greater liquidity of all credit risks. This will benefit a broad range of financial institutions, institutional investors, and also corporates in their capacity both as borrowers and as takers of trade credit and receivable exposures. Just as the rapidly growing asset backed securitisation market is bringing investors new sources of credit assets, the credit derivatives market will strip out and repackage credit exposures from the vastly greater pool of risks which do not naturally lend themselves to securitisation, either because the risks are unfunded (off-balance-sheet), because they are not intrinsically transferable, or because their sale would be complicated by relationship concerns. By enhancing liquidity, credit derivatives achieve the financial equivalent of a “free lunch” whereby both buyers and sellers of risk benefit from the associated efficiency gains.

It is not surprising, then, to learn that credit derivatives are a group of products that, while innovative, are coming of age. When they first emerged in the early 1990s, credit derivatives were used primarily by derivatives dealers seeking to generate incremental credit capacity for derivatives counterparties with full credit lines. Since then, they have evolved into a tool used routinely by commercial and investment banks and other institutional investors in the course of credit risk management, distribution, structuring, and trading, with liquidity beginning to rival or even exceed that of the secondary loan trading market in the United States and the asset swap market in Europe. Most recently, corporate risk managers have begun to explore the use of the product as a mechanism for hedging their own costs of borrowing, as well as managing credit exposures to key customers. No official numbers are available on European market volumes however the OCC statistics suggest that the U.S. credit derivatives market outstanding notional volume is approximately $229 billion (market defined as US commercial banks and foreign branches in the US). The market is dominated by three main players with Morgan Guaranty Trust holding 48% market share. While these numbers are tiny relative to the size of the global credit markets and other derivatives markets (both measured in the trillions of dollars), today credit derivatives remind many of the nascent interest rate and equity swap markets of the 1980s – a product whose potential for growth derives from both enormous need and an enormous underlying marketplace. For risk managers, credit derivatives are a flexible tool to restructure the illiquid components of credit portfolios. For institutional investors, they represent a new asset class that may be engineered to meet the demands of the investor and extract relative value.

## 9. Glossary

Credit derivatives continue to increase in both number and complexity of products as existing products are fine-tuned or new products developed. The glossary below, provided by J.P. Morgan is a concise, yet invaluable, guide to the latest products and structures on offer.

### Asset Swap

A package of a cash credit instrument and a corresponding swap that transforms the cashflows of the non-par instrument (bond or loan), into a par (floating interest rate) structure. Asset swaps typically transform fixed-rate bonds into par floaters, bearing a net coupon of Libor plus a spread, although cross-currency asset swaps, transforming cashflows from one currency to another are also common.

### BISTRO

BISTRO (Broad Index Secured Trust Offering), the synthetic securitisation programme developed by J.P. Morgan, is a vehicle that transfers tranched credit exposure to large, diversified portfolios of commercial or consumer loans from the securitising bank to investors. Over $50 billion of bank credit risk has been securitised using BISTRO technology since December 1997.

### Capital-protected credit-linked note (CLN)

A credit-linked note where the principal is partly or fully guaranteed to be repaid at maturity. In a 100% principal-guaranteed credit-linked note, only the coupons paid under the note bear credit risk. Such a structure can be analysed as (i) a Treasury strip and (ii) a stream of risky annuities representing the coupon, purchased from the note proceeds minus the cost of the Treasury strip.

### Credit (default ) swap

A bilateral financial contract in which one counterparty (the protection buyer or buyer) pays a periodic fee, typically expressed in basis points per annum on the notional amount, in return for a contingent payment by the other counterparty (the protection seller or seller) after a credit event of the reference entity. The contingent payment is designed to mirror the loss incurred by creditors of the reference entity in the event of its default. The settlement mechanism may be cash or physical.

### Credit event

Determined by negotiation between the parties at the outset of a credit (default) swap. Markets standards include the existence of publicly available information confirming the occurrence, with respect to the reference credit, of bankruptcy, repudiation, restructuring, failure-to-pay, cross-default or cross-acceleration.

### Credit (default) swap

A bilateral financial contract in which one counterparty (the protection buyer or buyer) pays a periodic fee, typically expressed in basis points per annum on the notional amount, in return for a contingent payment by the other counterparty (the protection seller or seller) after a credit event of the reference entity. The contingent payment is designed to mirror the loss incurred by creditors of the reference entity in the event of its default. The settlement mechanism depends on the liquidity and availability of reference obligations.

### Credit option

Put or call options on the price of either (a) a floating rate note, bond, or loan or (b) an asset swap package, consisting of a credit-risky instrument with any payment characteristics and a corresponding derivative contract that exchanges the cash flows of that instrument for a floating rate cash flow stream, typically three- or six-month Libor plus a spread.

### Credit spread option

A bilateral financial contract in which the protection buyer pays a premium, usually up front, and receives the present value of the difference between the spread prevailing on the exercise date between the yield of the reference obligation and some benchmark yield (usually Treasuries or Libor) and the strike spread, if positive (a credit spread cap or call), or alternatively if negative (a credit spread floor or put).

### Credit-linked note

A security, typically issued from a collateralised special Purpose vehicle (SPV), which may be a company or business trust, with redemption and/or coupon payments linked to the occurrence of a credit event. Credit-linked notes may also be issued on an unsecured basis directly by a corporation or financial institution.

### Dynamic credit swap or credit intermediation swap

A credit swap with a dynamic notional that for a fixed-fee provides the protection buyer with a contingent payment that matches the mark-to-market on any given day of a specified derivative (or other market-sensitive instrument).

### Substitution option

A bilateral financial contract in which one party buys the right to substitute a specified asset or one of a specified group of assets for another asset at a point in time or contingent upon a credit event.

### Two-name exposure

Credit exposure that the protection buyer has to the protection seller, which is contingent on the performance of the reference credit. If the protection seller defaults, the buyer must find alternative protection and will be exposed to changes in replacement cost due to changes in credit spreads since the inception of the original swap. More seriously, if the protection seller defaults *and* the reference entity defaults, the buyer is unlikely to recover the full default payment due, although the final recovery rate on the position will benefit from any positive recovery rate on obligations of *both* the reference entity and the protection seller.

### Total (rate of) return swap

A bilateral financial contract in which the total return of a specified asset is exchanged for another cash flow. One counterparty (the TR payer) pays the total return (interest plus fees plus price appreciation less price depreciation) of a specified asset, the reference obligation, and (usually) receives Libor plus a spread from the other counterparty (the TR receiver). Price appreciation or depreciation may be calculated and exchanged at maturity or on an interim basis.

### First-to-default swap

A credit default swap where the protection seller takes on exposure to the first entity suffering a credit event within a basket. The credit position in each name in the basket is typically equal to the notional of the first-to-default swap. Losses are capped at the notional amount.

### First-loss swap

Credit default swaps whereby the protection seller commits to indemnify the protection buyer for a pre-defined amount of losses incurred following one or more credit events in the portfolio.