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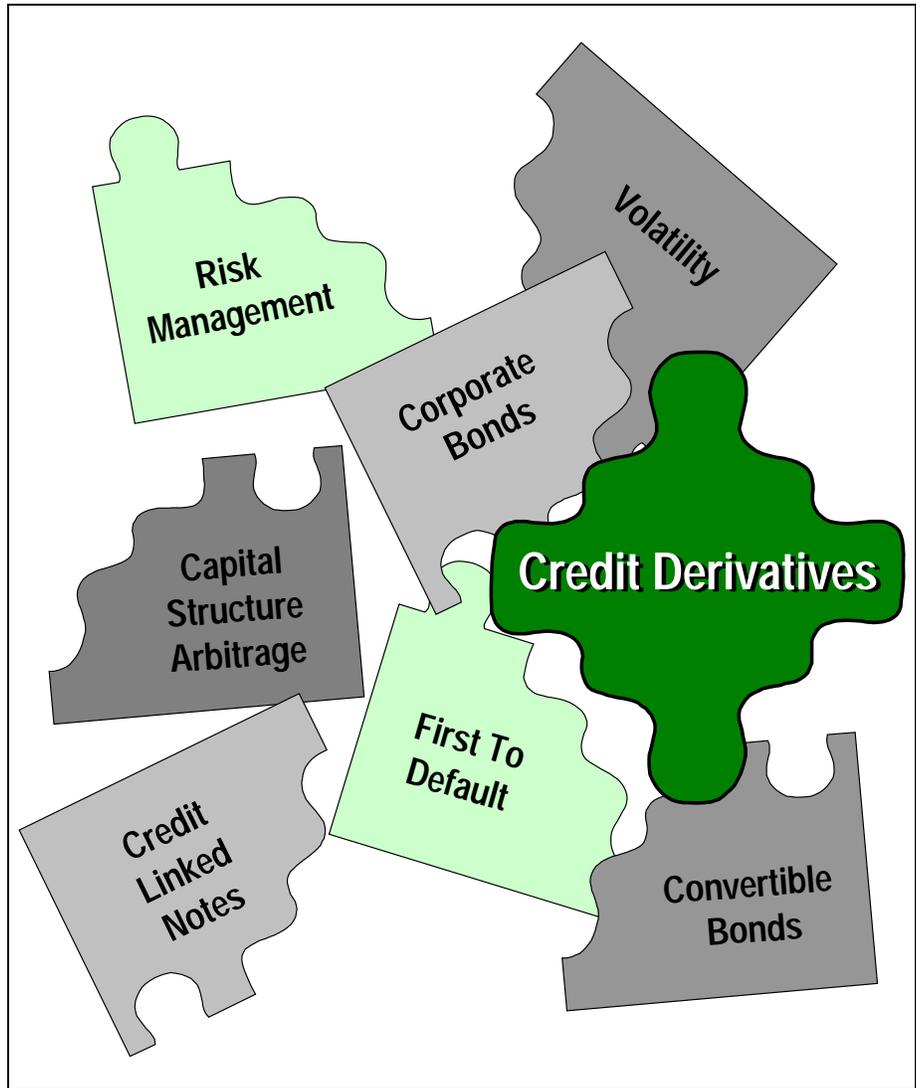
Credit Derivative Handbook 2003

A Guide to Products, Valuation, Strategies and Risks

Europe

Derivatives

The Key Piece In The Puzzle



Refer to important disclosures at the end of this report.

Merrill Lynch Global Securities Research & Economics Group
Global Fundamental Equity Research Department

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1. Market Evolution: Going Mainstream?

Credit derivative markets have grown rapidly since the mid-1990s. We think that the outlook for growth remains strong as the product is increasingly adopted by traditional mainstream credit investors as a tool for maximising returns.

The Role of Credit Derivatives

We view credit derivatives as the most important new mechanism for transferring credit risk.

In simple terms, credit derivatives are a means of transferring credit risk between two parties by way of bilateral agreements. Contracts can refer to single credits or diverse pools of credits (such as in synthetic Collateralized Debt Obligations, CDOs, which transfer risk on entire credit portfolios). Credit derivative contracts are over-the-counter (OTC) and can therefore be tailored to individual requirements. However, in practice the vast majority of transactions in the market are quite standardised.

Within an economy a broad variety of entities have a natural need to assume, reduce or manage credit exposures. These include banks, insurance companies, fund managers, hedge funds, securities companies, pension funds, government agencies and corporates. Each type of player will have different economic or regulatory motives for wishing to take positive or negative credit positions at particular times. Credit derivatives enable users to:

- hedge and/or mitigate credit exposure;
- transfer credit risk;
- generate leverage or yield enhancement;
- decompose and separate risks embedded in securities (such as in convertible bond arbitrage);
- synthetically create loan or bond substitutes for entities that have not issued in those markets at chosen maturities;
- proactively manage credit risk on a portfolio basis;
- use as an alternative vehicle to equity derivatives (such as out-of-the-money equity put options) for expressing a directional or volatility view on a company; and
- manage regulatory capital ratios.

Conventional credit instruments (such as bonds or loans) do not offer the same degree of structural flexibility or range of applications as credit derivatives.

A fundamental structural characteristic of credit derivatives is that they de-couple credit risk from funding. Thus players can radically alter their credit risk exposures without actually buying or selling bonds or loans in the primary or secondary markets.

Credit default swaps (CDS) are developing into an increasingly standardised means of transferring credit risk – not just between entities but between different markets for risk. We believe that the development of a deep and relatively liquid credit derivative market has the potential to play an important role in efficiently allocating credit risk within economies.

Arguably, the differing capital adequacy requirements of different types of credit investor can distort this efficient credit allocation. If this is the case then an effective and standardised market for credit risk may tend to promote “capital efficient” in addition to “efficient” allocation of credit.

Credit derivatives are relatively pure credit instruments, which de-couple credit from funding . . .

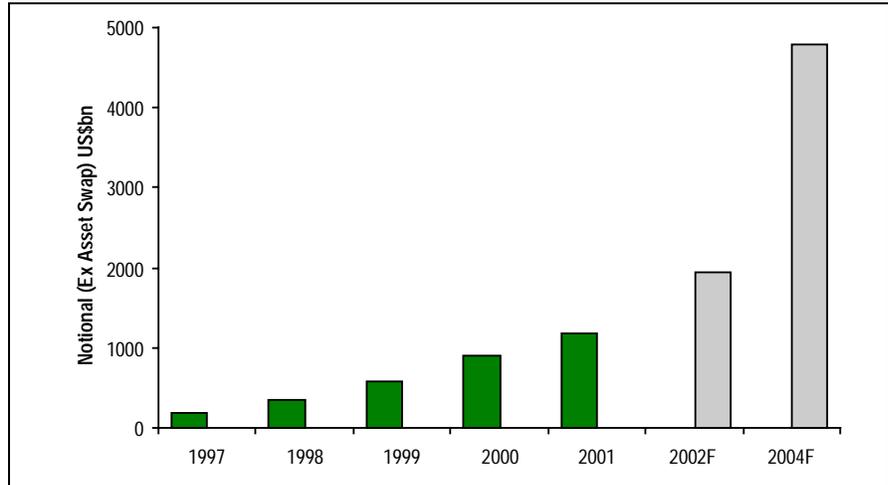
. . . and can drive efficiency in risk allocation . . .

. . . and/or capital efficiency

Market Size

The most recent “Credit Derivatives Report” published by the British Bankers Association (BBA) surveyed 25 major international players on their involvement in the market. As of year-end 2001 the survey estimated that global market size was \$1,189bn (excluding asset swaps) and forecast that it would reach \$1,952bn by 2002 and \$4,799bn by 2004 (See Chart 1).

Chart 1: Global Credit Derivative Market Size Estimates



Source: BBA Credit Derivatives Report 2001/2002

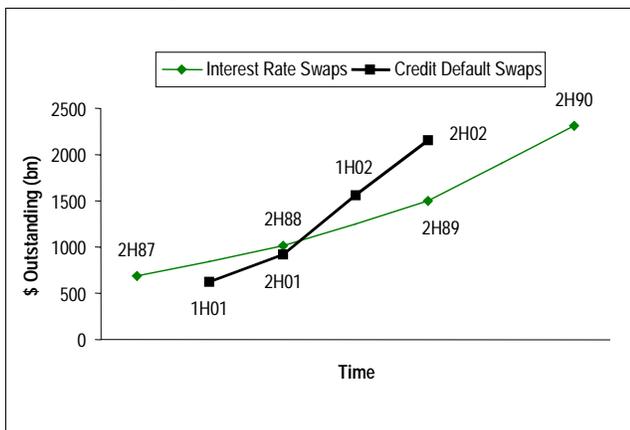
Market surveys highlight the rapid growth trend

In March 2003 ISDA released the results of its semi-annual derivative market survey. In compiling this data, ISDA surveys its member firms around the world. In the latest release, 97 firms responded with credit default swap data. ISDA adjusts the results to reflect double-counting amongst the dealer community. Even after such adjustments, the survey shows total credit default swap outstandings of \$2.15 trillion as of end 2002. This figure represents 37% growth from six months earlier and 134% growth from a year earlier.

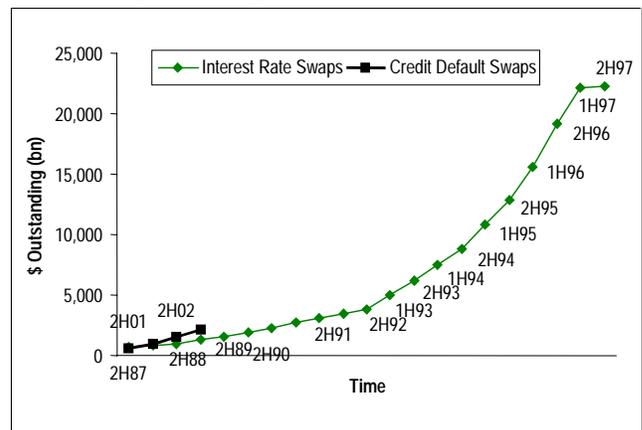
■ Interest Rates Swaps, Asset Swaps and CDS

In Chart 2 we contrast the growth of the CDS market over the last two years with the interest rate swap (IRS) market when that market was of similar size. In Chart 3 we show a longer-term perspective of CDS versus how the IRS market developed over time.

Whilst we are not convinced that credit derivatives markets can achieve the long-term growth rates achieved by interest rates swaps, we do expect continued growth in the market as there is better price transparency and more liquidity in the market for hedging and unwinding trades. Our expectations for continued growth are in line with BBA’s 4 year average of 54% per annum. We feel that BBA’s estimates for 2004 are reasonable and expect the growth to be fuelled by new entrants into the market as clients gain comfort with the product, a growing pool of underlying Reference Entities, and gradual movement towards global documentary standardisation.

Chart 2: Close Up of CDS Market vs IRS in Late 1980s


Source: ISDA News Release 19 March 2003

Chart 3: Long Term Perspective of CDS Growth vs IRS


Source: ISDA News Release 19 March 2003

From bond markets to banks

The developing interest rate swap market of the 1980s made possible the asset swap market. In this way, an instrument designed to shift *interest rate risk* has facilitated the transfer of *credit risk* between distinct types of investor groups within the economy.

Asset swaps are hardly new but are worth mentioning in this respect. By simply combining a cash bond purchase with an interest rate (and, if appropriate, currency) swap, a fixed-rate bond can be transformed into a floating rate asset. As the cashflow profile of such an asset is essentially the same as a term loan – albeit with a higher yield for a given credit – asset swaps are typically bought by banks for long-term investment purposes. As this occurs there is a net transfer of credit risk from mainstream bond market investors to lending bank portfolios.

Table 1: Innovation Provides Shorter Routes to the Same End

Purpose	The Old Long Route	The Shortest Route
Transfer interest rate risk	Loan/deposit pairs to create fixed vs floating	Interest rate swaps
Transfer currency rate risk	The "Parallel Loan" market – same as above, but different currencies	Currency swaps Fixed/Fixed, Fixed/Float, Float/Float
Transfer credit risk	Asset swap (bond plus interest rate or currency swap) plus LIBOR funding	Default swaps

Source: Merrill Lynch

Market Structure

■ By Product

CDS are the most important and widely used product in the credit derivatives market while the growth of synthetic-CDO type products remains strong. The BBA survey estimates that CDS accounted for 45% of the notional principal outstanding at the end of 2001, down from 54% in 1996. The decrease in relative importance has been driven by the rapid growth in importance of synthetic-CDO type products (which themselves are constructed out of default swaps).

Default swaps are the most important product...but portfolio products are the fastest growing

Table 2: Composition of the CDS Market

	1999	2001
Credit Default Swaps	38%	45%
Portfolio / CLO Products	18%	22%
Credit Linked Notes	10%	8%
Total Return Swaps	11%	7%
Baskets	6%	6%
Credit Spread Products	5%	5%
Asset Swaps	12%	7%

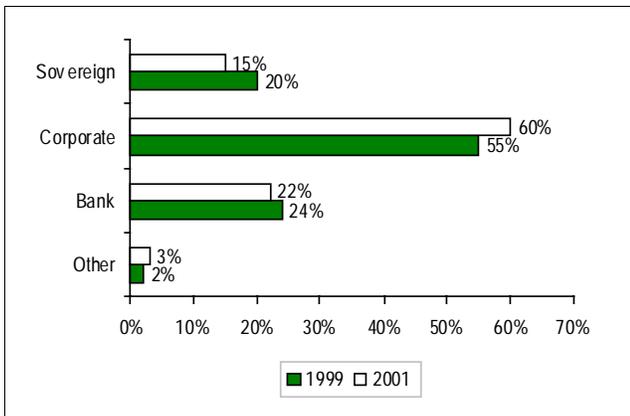
Source: BBA

■ Where is Activity Concentrated?

In Chart 4 to Chart 7 we use BBA data to highlight the type of contract that predominate in the market. The most frequent combinations are:

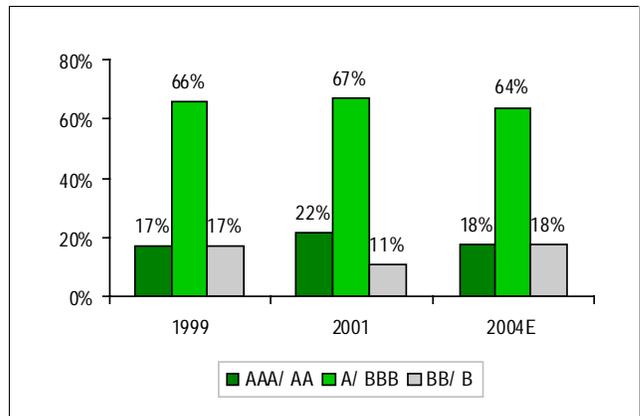
- Non-financial corporate Reference Entities.
- Mid-or-low investment grade ratings.
- 5-year maturity at inception.
- Transactions booked in the US or London.

Chart 4: Credit Derivative Reference Entity By Sector



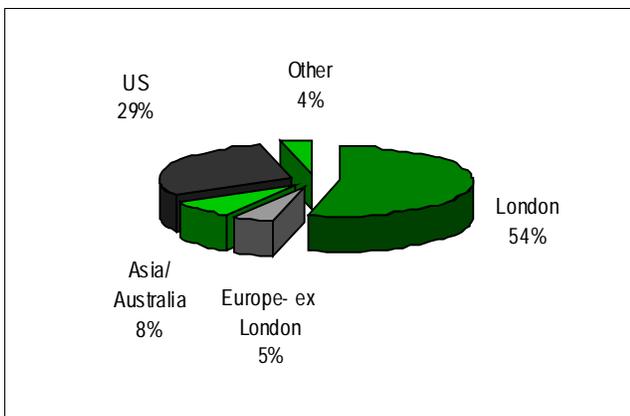
Source: BBA Credit Derivatives Report 2001/2002

Chart 5: Credit Derivative Reference Entity By Rating



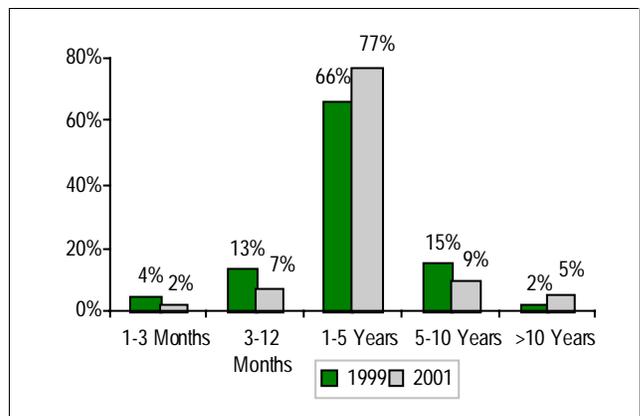
Source: BBA Credit Derivatives Report 2001/2002

Chart 6: Credit Derivative By Region

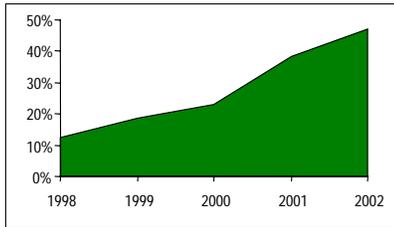


Source: BBA Credit Derivatives Report 2001/2002

Chart 7: Credit Derivative Reference Entity By Maturity



Source: BBA Credit Derivatives Report 2001/2002

Chart 8: Credit Derivatives / Global Bond Credit Markets (HG / HY / EMG)


Source: BBA, Merrill Lynch Index System

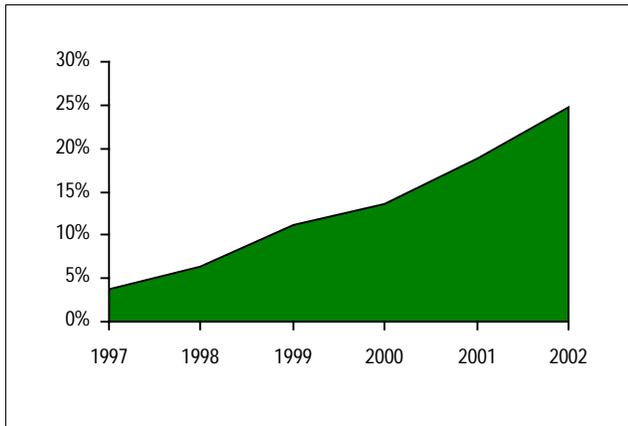
Size Relative to the Corporate Bond Market

Most surveys put the credit derivative market in the region of two trillion dollars. Although credit derivative growth has been faster, the market is still smaller than the global bond markets for credit which currently total \$4.1 trillion¹.

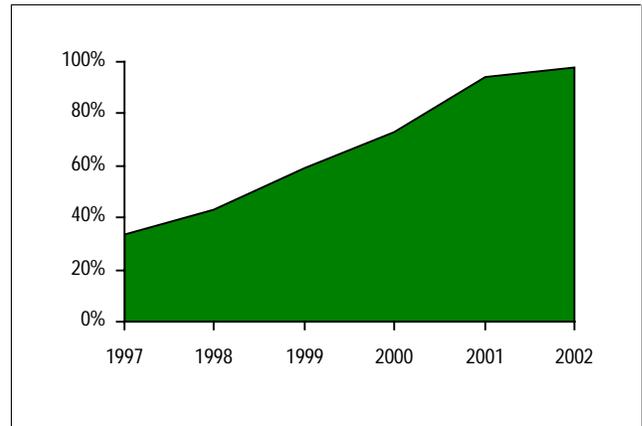
However, if we focus in on the parts of the market where credit derivatives are particularly active, we find a completely different story.

■ Relative Geographical Penetration

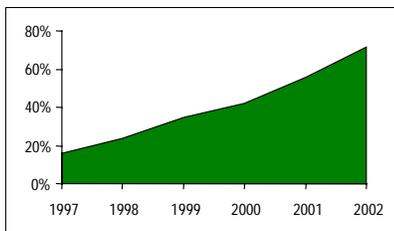
The relative penetration of credit derivatives is somewhat different by geographical region. In Chart 9 and Chart 10 we show the estimated size of the US and European HG credit derivative market relative to the broad high grade indexes in the two regions. Whilst the credit derivatives have grown to about a quarter of the size of the US market, they have grown to almost the same size as the European bond market. We believe this contrast reflects 1) the relative youth of the European corporate bond market and 2) a greater proportion of inter-dealer CDS transactions in Europe.

Chart 9: US HG Contacts vs HG Index


Source: Merrill Lynch estimates

Chart 10: European HG Contracts vs HG Index


Source: Merrill Lynch estimates

Chart 11: Credit Derivatives / Bonds in HG Non Financial Corporates


Source: Merrill Lynch estimates

■ Non-Financial Corporate Penetration

Alternatively, if we narrow the analysis to non-financial investment grade contracts and bonds, the relative importance of credit derivative also increases. Estimates of the growing penetration of credit derivatives in this global sub-sector are illustrated in Chart 11.

¹ Combined par value of Merrill Lynch's Global Investment Grade and High Yield & Emerging Markets indexes (GOBC & HI00).

Table 3: Market Share of Protection & Net Flows

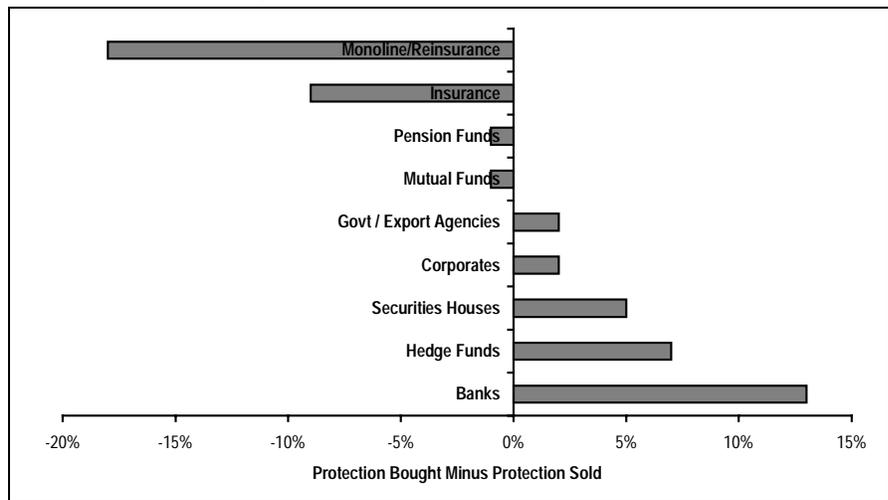
	Share of Buying	Share of Selling
Banks	52%	39%
Hedge Funds	12%	5%
Securities Houses	21%	16%
Corporates	4%	2%
Govt / Export Agencies	2%	0%
Mutual Funds	2%	3%
Pension Funds	1%	2%
Insurance	6%	33%

Source: BBA Credit Derivatives Report 2001/2002

Market Participants

BBA survey data provide indications of credit derivative flows between economic sectors. Table 3 shows that the largest participants in the market are banks, insurance companies and securities companies. More interestingly, the insurance sector stands out as the dominant net seller of protection (Chart 12), absorbing a significant amount of credit risk from banks in particular but also from hedge funds and securities companies. We believe that a significant proportion of the credit risk transferred to monoline insurance companies by banks is in the form of super-senior tranches of synthetic CDOs which represents low-risk low-return assets.

Chart 12: Sectoral Net Buyers (Sellers) of Protection



Source: BBA Credit Derivatives Report 2001/2002

Banks

Banks are the dominant market users, and have particularly large market share as buyers of protection. While initially focused on regulatory capital relief and portfolio transactions, the focus is now arguably migrating to economic capital relief and single name transactions, becoming selective sellers of protection and using the process to facilitate primary market syndications. Perhaps more interesting on the bank side is that US data from the Office of the Comptroller of the Currency (OCC) suggest that (as with interest rate swaps) activity is concentrated in a small number of very large banks. Of the \$634bn notional principal of outstanding contracts as of 31 December 2002, 91% was comprised by just 3 banking groups and the largest bank had a 58% market share (see Chart 13).

Insurance companies

Although default swaps are in many ways similar to insurance policies there are important differences. For example, an insurance policy typically requires an underlying insurable interest and actual loss whereas credit protection can be bought whether or not the buyer has an underlying risk exposure which needs hedging. In most countries insurance companies have regulatory constraints limiting direct usage of derivatives. For this reason, many of the credit derivative transactions are structured into Credit Linked Notes (CLNs) or principal protected notes, which are collateralized by zero coupon bonds. Insurance companies are also significant investors in the various tranches of synthetic CDOs.

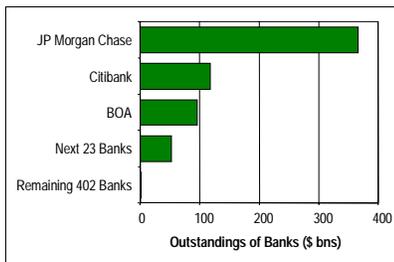
Transactions can also be booked through “transformer” captive offshore insurance companies, which sell credit protection in the market and buy an insurance policy with virtually identical terms and conditions from an insurance company. The advantage of such vehicles over CLNs is that they are capable of entering into policies that can be booked in the underwriting business.

... and not least

The market share for hedge fund buying activity has tripled from 1999 to 2001. Strategies such as convertible bond arbitrage² use default swaps to hedge the credit risk component of convertible bond positions and isolate exposure to cheap embedded equity options. Other uses involve combining either long or short CDS positions against offsetting equity or equity derivative positions in capital structure arbitrage opportunities.

Corporations are significant buyers of credit protection. Such activity is typically motivated by the need to reduce customer exposure through receivables or vendor financing.

Chart 13: US Commercial Bank CD Contracts



Source: OCC data as of 31 December 2002

Cash based investors are increasingly active

Outlook for Growth

We expect a significant proportion of new players in the default swap market to be banks. This may be surprising given their dominant but shrinking market share of this sector. However, as we noted above, bank transactions are currently concentrated on the balance sheets of a few very large institutions (Chart 13 uses US OCC data by way of example). We expect other banks around the world to become steadily more active in this market to the extent that their portfolios permit. The sort of transactions that banks are naturally suited to include:

- Mitigating risk in highly illiquid loan portfolios which can become overly concentrated by industry, geography, rating or issuer. For this, banks are natural buyers of protection. Strategies for macro portfolio management are becoming increasingly sophisticated and typically may be linked to a market linked Merton model type of risk management system. The results of such divisions can result in large scale activity in the CDS market.
- Low yielding loans to highly-rated corporate relationships are extremely capital inefficient as they require a 100% risk weighting under current BIS guidelines³ (at least until 2006 when the new Basel Accord is due to come into force). The extension of such loans may however be important in relationship terms and may be necessary to win other kinds of more profitable business. Capital relief can be available for banks buying protection to offset other equivalent credit exposures⁴.
- Finally, in order to generate greater returns over tight loan market spreads, there is an incentive for banks to sell protection when pricing in this market is attractive. Such positioning may be done through selling a default swap or by purchasing an obligation of a funded special purpose vehicle such as a credit linked note.

As depicted in Table 3 traditional cash based credit investors such as mutual and pension funds are currently a very small force in the credit derivative market. Although there is no published data on this, it is our observation that at this stage, most major fund managers are investigating the market, making preparations to enter the market or beginning to use CDS based products.

Whilst individual funds and managers will have to continue to address constraints on the use of derivatives we expect a rise in market share as these flexible, efficient and often attractively priced credit tools are used to express direct credit views and for overall portfolio management. Such constraints may be due to nature of mandate, internal policies, legal or regulatory issues. We expect continuing innovation to drive this sector of the market as dealers develop structures which can be used by particular funds whilst also limit the counterparty exposure of the dealer. Within this sector of the market we expect to see considerable focus on synthetic CDO products.

² Refer to CDS Investor Strategies (Chapter 7).

³ Refer to Bank Capital Treatment (Chapter 13).

⁴ Same as the above footnote.

2. Credit Default Swap Basics

Default swaps are a means of transferring credit risk between counterparties. This section gives an overview of the basics using an example transaction. In later sections we explore these basics in greater detail.

What is a Credit Default Swap?

Credit Default Swaps (CDS) are the most important and widely used instrument in the credit derivative market. In essence a default swap is a bilateral OTC agreement, which transfers a defined credit risk from one party to another. The buyer of credit protection pays a periodic fee to an investor in return for protection against a **Credit Event** experienced by a **Reference Entity** (i.e. the underlying credit that is being transferred).

Contracts are documented under International Swap And Derivatives Association Inc. (ISDA) swap documentation and the 1999 ISDA Credit Derivative Definitions as amended by various supplements. On 6 May, it is planned that the revised 2003 definitions come into effect.

In this section of the report we aim to explain the basic cashflows and mechanisms of a credit default swap and compare these to total return swaps. We also mention other important features such as **Credit Events** and **Reference Entities** and **Deliverable Obligations**. Each of these are important topics in their own rights and are discussed in more detail in CDS Structural Roadmap (Chapter 8).

■ Are You a Buyer or a Seller?

Credit default swaps are also known as “**protection**”. Transactions in the market are usually referred to in terms of either buying or selling protection. This can be confusing since a seller of protection is assuming credit risk. In the underlying swap documentation, the fixed payer is the protection buyer (the fixed payment being the regular premium) and the floating payer is the protection seller (the floating payment being the underlying cash payment of the notional amount following a “Credit Event”).

Sellers of protection are buyers of credit

Table 4: The Two Parties in a Credit Default Swap

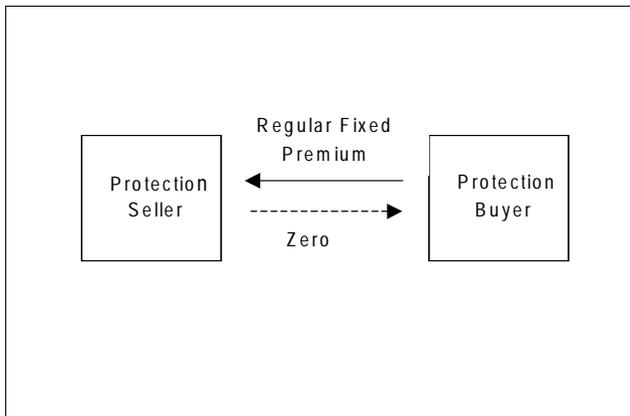
Credit Default Swap Market	Swap Payment	Underlying Credit Position
Protection Buyer	Fixed	Short (selling a bond)
Protection Seller	Floating	Long (buying a bond)

Source: Merrill Lynch

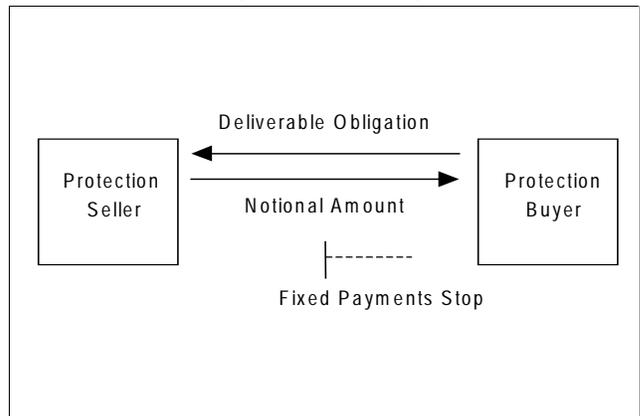
■ What are the Cashflows?

Under a typical default swap the buyer of protection pays to the seller a regular premium (usually quarterly), which is specified at the beginning of the transaction. If no Credit Event, such as default, occurs during the life of the swap, these premium payments are the only cashflows. Like many other swaps there is no exchange of underlying principal. Following a Credit Event the protection seller makes a payment to the protection buyer. Typically this payment takes the form of a physical exchange between the buyer and seller. The protection buyer provides the seller any qualifying debt instrument (known as Deliverable Obligation) of the Reference Entity in return for a cash payment amounting to its full aggregate notional amount (i.e. par). The protection buyer stops paying the regular premium following the Credit Event. The net loss to the protection seller, is therefore par less the recovery value on the delivered obligation.

Buyers of protection pay a quarterly “spread”

Chart 14: Pre-Credit Event Flows


Source: Merrill Lynch

Chart 15: Flows Flowing Credit Event (physical settlement)


Source: Merrill Lynch

Just because a Credit Event has occurred it does not necessarily mean that the claim on the Reference Entity will be worthless. Credit default contracts are structured to effectively replicate the experience of a cash market holder of an obligation of the Reference Entity. At least some payments may be made to creditors even if the company is wound up. As recovery values (or the market value of debt following default) are typically at a deep discount to par, the default swap buyer has effectively received protection on this price deterioration.

■ Cash or Physical Settlement?

Default swaps are typically subject to physical settlement

The transaction described above involves **physical settlement**. The market convention is for such physical settlement although it is possible to **cash settle**. In such cases, following a credit event, the protection seller would provide a single cash payment reflecting the extent to which a market valuation of a specified debt obligation of the reference entity has fallen in value.

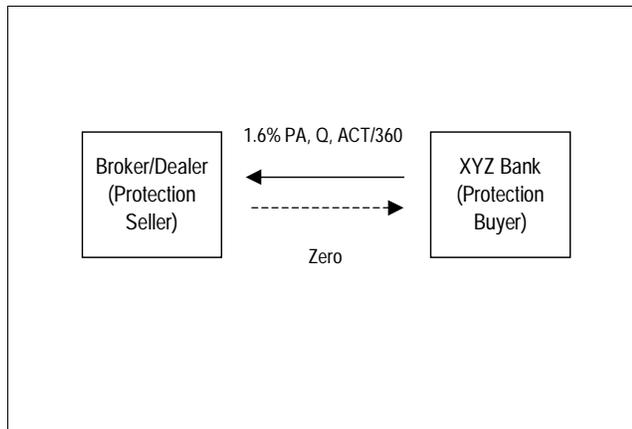
A Working Example

As an example we use a hypothetical transaction between a broker/dealer and XYZ Bank. In this case the broker/dealer sells protection (takes credit risk) on \$10mn EuroAutos AG to XYZ Bank.

The term of the transaction is 5 years. In return for the protection that the broker/dealer is providing over this five-year period, XYZ Bank agrees to pay a fixed fee of 1.6% per annum payable quarterly.

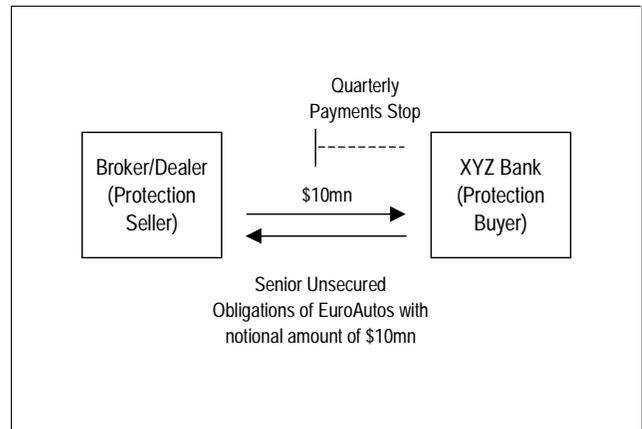
Settlement is physical. Thus, should a Credit Event occur, XYZ Bank would be able to deliver any qualifying senior unsecured EuroAutos paper to the broker/dealer in return for a \$10mn payment and then the contract (and all future payments) would terminate.

Chart 16: Pre-Credit Event Flows



Source: Merrill Lynch

Chart 17: Flows If a Credit Event Occurred



Source: Merrill Lynch

Chart 16 and Chart 17 illustrate two potential scenarios for this transaction. In the first chart, no EuroAutos Credit Event occurs and XYZ Bank simply continues to pay the 160bps annual premium to the broker/dealer. For XYZ Bank there is, therefore, a negative accrual relating to these payments.

The second chart however depicts a scenario in which a Credit Event occurs two years into the transaction. In this case XYZ Bank pays the broker/dealer the premium of 160bps for the two years preceding the Credit Event and then receives \$10mn from the broker/dealer in return for delivering any qualifying senior unsecured debt obligation with a notional amount of \$10mn. Following such Credit Event it is likely that EuroAutos’ debt would be trading substantially below par – and the broker/dealer would be expected to bear the loss resulting from the diminution of value.

Table 5: Example Cashflows under “no default” and Credit Event At 2 Years Scenarios

	No EuroAutos Credit Event		EuroAutos Credit Event At 2 Years	
	XYZ Bank	Broker/Dealer	XYZ Bank	Broker/Dealer
Pays	160bps for 5 years	zero	160bps for 2 years, then EuroAutos Deliverable Obligation	\$10mn
Receives	zero	160bps for 5 years	\$10mn	160bps for 2 years, then Recovery Value

Source: Merrill Lynch

A third and more likely scenario, would in fact be that the transaction is hedged, crossed or unwound prior to maturity. For example, if 6 months into this transaction, EuroAutos’ credit spreads widen and XYZ Bank is able to hedge by selling protection to the broker/dealer for 190bps, then XYZ Bank will lock in a 30bps running surplus for the remaining life of the swap. Remember, however, that the remaining transaction life is uncertain since it will terminate at the sooner of 4½ years or the occurrence of a Credit Event. Thus the profitability of the hedging transaction cannot be ascertained by simply calculating the present value of a 30bps annuity over 4½ years. In practice, such calculations are usually based on default probabilities and expected recoveries following default⁵.

⁵ Refer to Unwinding Default Swaps (Chapter 4).

3. Valuation of Credit Default Swaps

This chapter explains the asset swap approach to pricing credit default swaps. It also looks at funding cost arbitrage as another valuation metric and gives an introduction to how default probability models are used to imply the survivability of a reference entity.

*Relationship with asset swaps
key driver of pricing*

Valuation Factors

In terms of cashflow profile, a credit default swap is most readily comparable with a par floating rate note funded at Libor or an asset swapped fixed-rate bond financed in the repo market. Though default protection should logically trade at a spread relative to a risk-free asset, in practice it trades at a level that is benchmarked to the asset swap market. Most banks look at their funding costs relative to LIBOR and calculate the net spread they can earn on an asset relative to their funding costs. LIBOR represents the rate at which AA-rated banks fund each other in the interbank market for a period of 3-6 months. Although this is a useful pricing benchmark it is not a risk free rate.

Intuitively, the price of a credit default swap will reflect several factors. The key inputs would include the following:

- probability of default of the reference entity and protection seller;
- correlation between the reference entity and protection seller;
- joint probability of default of the reference entity and protection seller;
- maturity of the swap; and
- expected recovery value of the reference asset.

Though several sophisticated pricing models exist in the market, default swaps are primarily valued relative to asset swap levels. This assumes that an investor would be satisfied with the same spread on a credit default swap as the spread earned by investing the cash in the asset (taking into account the funding cost of the institution for the particular asset).

*A credit default swap is
equivalent to a financed
purchase of a bond with an
interest rate hedge*

The Asset Swap Approach to Pricing

Default swap pricing is based on arbitrage relationships between the derivative and cash instruments. Rather than using complicated pricing models to estimate default probability, we can use a simpler pricing mechanism which assumes that the expected value of credit risk is already captured by the cash market credit spreads.

A credit default swap is equivalent to a financed purchase of a bond with an interest rate hedge. It is an unfunded transaction requiring no initial cash outlay. As a result, the relative value of a credit default swap is compared to an asset swap rather than a bond's underlying spread over treasuries. An unfunded position in the bond would have to be financed in the repo market.

In a simplified model, the default swap should trade at the same level as an asset swap on the same bond. The asset swap provides a context for relative value because reference assets have transparent prices.

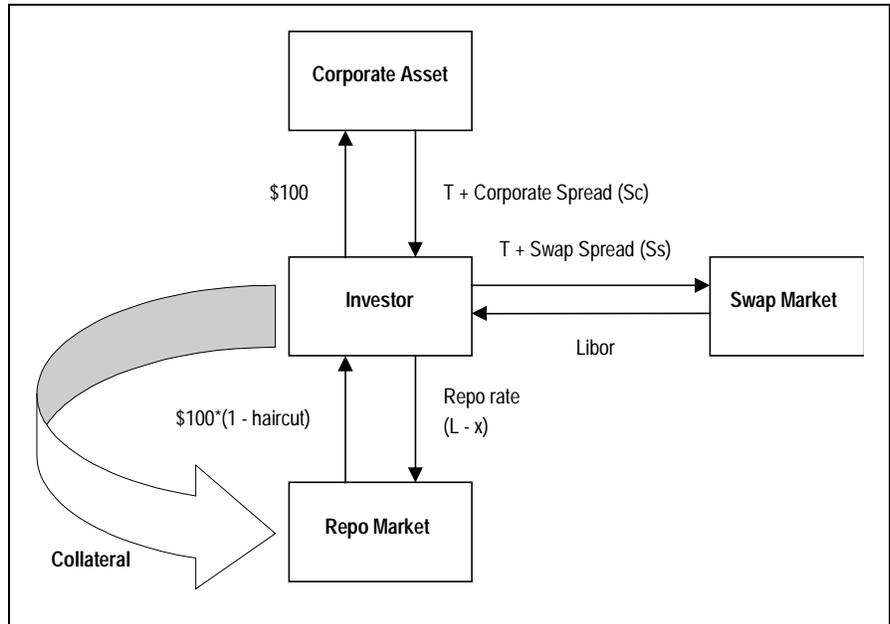
Default swap exposure can be replicated in the following way:

- Purchase a cash bond with a spread of $T + S_C$ for par.
- Pay fixed on a swap ($T + S_S$) with the maturity of the cash bond and receive Libor (L).
- Finance the bond purchase in the repo market. The repo rate is quoted at a spread to Libor ($L - x$).
- Pledge bond as collateral and is charged a haircut by the repo counterparty.

This sub-section is based on earlier work by Mary Rooney

$T =$ Treasury yield to maturity
 $S_C =$ Corporate Spread
 $S_S =$ Swap Spread
 $L =$ LIBOR rate
 $x =$ implied repo premium

Chart 18: Replicating Default Swap Exposure, Protection Seller



Source: Merrill Lynch

The interest rate swap component eliminates the duration and convexity exposure of the cash bond. Without this hedge, the trade would be equivalent to a leveraged long position in the fixed rate corporate asset ($T + S_C - (L - x)$).

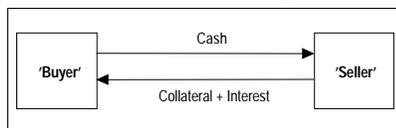
Bond purchase is financed in the repo market

Since a credit default swap is an unfunded transaction, the bond purchase needs to be financed. This financing is achieved with a bond repo. In a repo, collateral is traded for cash. The collateral 'seller' borrows cash and lends collateral (a repo) (see Chart 19). The collateral 'buyer' borrows the collateral and lends cash (a reverse repo). The repo bid/offer refers to the rate at which the collateral can be bought. The bid is higher than the offer since it is the cost of buying cash and selling collateral.

Two important components of a repo trade are:

- **Haircut:** This is defined as the difference between the securities purchased and the money borrowed. The lender of cash charges a haircut for the loan in order to compensate for market risk of collateral as well as counterparty risk.
- **Repo rate:** This is the financing charge for the collateral. It varies according to the demand to borrow (or lend) the security. This rate has been denoted as $L - x$, since several liquid credits have repo rates that are usually, but not always, less than Libor.

Chart 19: Standard Financing Trade



Source: Merrill Lynch.

Table 6: Cash Flows of Default Swap Replication (Protection Seller)

Investor Trade	Receive	Pay
Buy Cash Bond	$T + S_C$	100
Swap Hedge	L	$T + S_S$
Repo	100	$L - x$
Total Cash Flows	$T + S_C + L + 100$	$100 + T + S_S + x$

Source: Merrill Lynch Assume no haircut.

The haircut represents the capital in the trade. As a result, institutions with the cheapest cost of capital will be able to assume this credit exposure for the lowest net cost. If we assume a haircut of 0 for simplicity, then Table 6 shows that the net cash flow is:

$$(S_C - S_S) + x$$

If the repo rate for the bond was Libor flat ($x = 0$) the exposure would simply be the asset's swap spread ($S_C - S_S$).

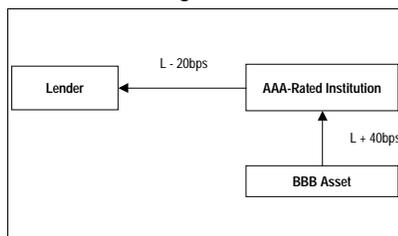
This cash flow is similar to that received by a protection seller on a default swap, i.e., a simple annuity stream expressed in basis points for the life of the trade. If the bond defaulted, the repo would terminate and the investor would lose the difference between the purchase price and recovery price of the bond.

In efficient markets, arbitrage relationships should drive default swap levels towards the asset swap level. Any mispricing between the markets would be arbitrated away by market makers. For example, if the default premium is greater than the asset swap level, protection sellers would enter the market and drive the default swap premium down towards the asset swap level.

Refer to important disclosures at the end of this report.

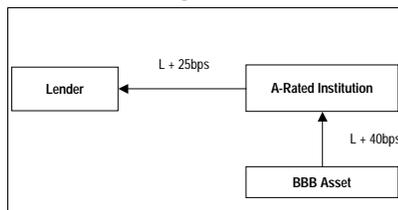
Funding cost arbitrage is a key driver of the default swap market

Chart 20: Cash Flows for AAA Institution Holding BBB-rated Asset



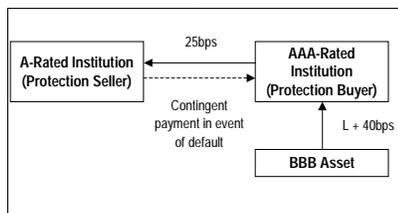
Source: Merrill Lynch.

Chart 21: Cash Flows for A-rated Institution Holding BBB-rated Asset



Source: Merrill Lynch.

Chart 22: Cash Flows After Entering a Credit Default Swap Transaction



Source: Merrill Lynch.

Funding Cost Arbitrage

From the perspective of a protection buyer there are arbitrage forces which tend to link the cash and default markets. If an investor has purchased a floating rate asset at par, it can fund this either via on-balance-sheet borrowing or in the repo market. The investor's carry would be the differential between the FRN yield and the cost of borrowing. The break-even level the investor should be willing to pay for protection would be this differential between the floating rate asset's yield and the funding cost.

We can explain this credit arbitrage with the aid of an example. Let's assume the following:

- Cost of funding for AAA-Rated Institution = $L - 20\text{bps}$
- Cost of funding for A-Rated Institution = $L + 25\text{bps}$
- Income from BBB-Rated Asset = $L + 40\text{bps}$

The net spread for the AAA-rated institution from holding the BBB-rated asset is:

$$L + 40 - (L - 20) = 60\text{bps}$$

The net spread for the A-rated institution from holding the BBB-rated asset is:

$$L + 40 - (L + 25) = 15\text{bps}$$

If the AAA-rated institution wanted to reduce its risk to the BBB-rated asset without selling it in the public market, it could enter into a credit default swap as a protection buyer.

If the A-rated institution wanted exposure to the BBB-rated asset, it would be more attractive to sell protection on the BBB-rated asset if the default premium was more than its net spread from buying the bond in the cash market, i.e. $\text{default premium} > 15\text{bps}$.

In addition, since the credit default swap is an unfunded transaction, the A-rated institution would not have to show the asset on its balance sheet.

Let's assume the AAA-rated and A-rated institutions enter into a credit default swap (Chart 22) where the default premium = 25bps.

Following this transaction, we have the following:

- The net spread for AAA-rated institution (protection buyer) = $60 - 25 = 35\text{bps}$.
- The net spread for A-rated institution (protection seller) = 25bps (the swap is an unfunded transaction for the seller).

The AAA-rated institution is now exposed to a credit whose rating is defined by the correlation between the BBB-rated asset and the A-rated counterparty. If we assume there is no correlation between the two, the synthetic asset created by a combination of these two would be rated AA⁻⁶. The coupon on this synthetic asset is $L + 15\text{bps}$ ($L + 40 - 25$).

Both institutions are better off after entering into a credit default swap transaction:

- AAA-rated institution has created a better quality synthetic asset.
- A-rated institution earns a higher spread than cash market for taking on a similar level of credit risk.

For this arbitrage to work, the funding cost of the protection seller must be greater than the funding cost of the buyer. However supply and demand conditions may lead to trades that are done even when this condition is not satisfied, i.e., the funding cost of the protection seller may be equal to or less than that of the protection buyer. For example, banks could lower regulatory capital from 100% to 20% by buying credit protection on a 100% BIS risk-weighted asset

⁶ *Rating Letter & Credit-Backed Bonds*, June 1999, S&P.

*Trading desks actively look for
arbitrage opportunities*

from an OECD bank. Alternatively, a bank may need to expand credit lines to do more business with the reference entity and may not want to be seen as selling this risk in the public market.

In practice, “street” trading desks actively look for such “arbitrage” opportunities. For example, a major bank’s credit trading desk, which funds its long credit positions at LIBOR + 10bps, will typically look for situations where protection is available at spreads of 10bps or more tighter than the cash market. Clearly each trading desk has different funding costs and positioning limits, but such market forces tend to limit the extent to which protection in major-bond issuing names can trade through asset swap spreads. In theory, the trading desks with the lowest cost of funding should determine how far through the cash market the default swap can trade. If repo financing is available, the pricing will be driven by the financing rate available.

From the perspective of a protection seller, in theory the analogous types of arbitrage conditions should apply. However, in practice it is very difficult to borrow chosen bonds to establish long-term short positions. Thus when prices diverge substantially between the cash and the default market, it is usually when default spreads are wider and there is a shortage of protection sellers. Assuming this widening of protection costs is not the result of a significant deterioration in the credit quality of the reference entity, the spreads may slowly move back closer together as longer-term credit investors take the opportunity to enhance returns by selling protection directly or indirectly through funded vehicles such as credit linked notes (CLNs).

*Default swaps don’t trade
through LIBOR in the same
way that AAA borrowers can*

Default swap levels on sub-LIBOR borrowers would clearly not reflect LIBOR spreads but funding cost via, for example, repo. **Thus minimum default spreads are bounded at zero.**

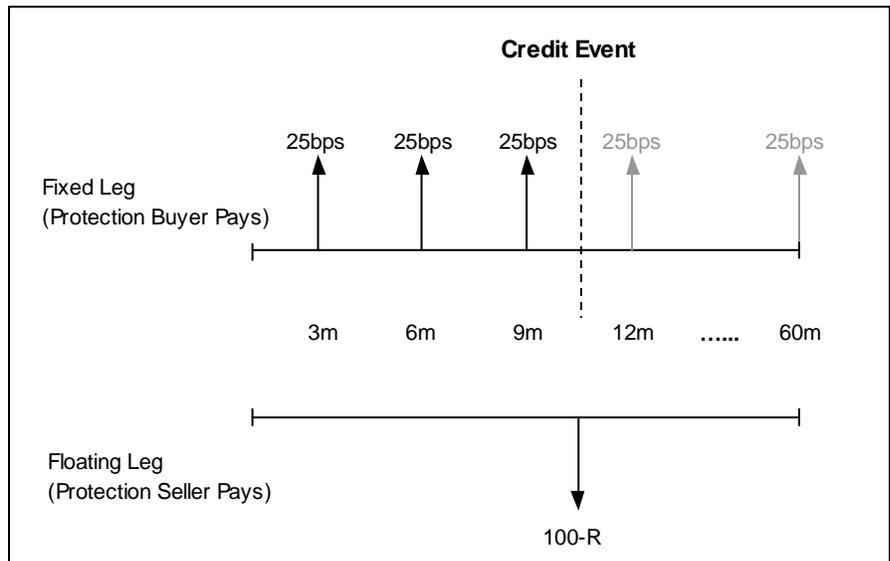
*Market pricing driven by
demand and supply flows*

Default Probability Models

In practice, supply and demand as well as the arbitrage relationship with asset swaps tends to be the dominant factor driving pricing of default swaps. Technical models for pricing default swaps tend to be used more for exotic structures and off-market default swap valuation (unwinds, for example). These models calculate the implied default probability of the reference entity as a means of discounting the cash flows in a default swap. While the mathematics of such models is involved, the essential inputs – Spread and Recovery Rate – are used to interpolate (‘bootstrap’) a time-series of **Survival Probabilities** of the reference entity. A typical recovery rate assumption in the default swap market for senior unsecured contracts is 35%.

*CDS contracts have zero net
value to both the buyer and
seller at inception*

A default swap consists of two legs. The buyer of protection pays quarterly payments to the protection seller until the earlier of a credit event or maturity of the contract. We term this the *Fixed Leg*. The seller of protection pays the difference between par and the recovery value of the delivered obligation should a credit event occur during the contract. We term this the *Floating Leg*. These flows are shown in Chart 23 for a default swap at 100bps. **At the inception of a default swap, the Risky PV of the Fixed Leg must equal the Risky PV of the Floating Leg.** i.e., on-market default swaps have zero net present value.

Chart 23: Default Swap Cashflows Due from the Buyer and Seller of Protection


Source: Merrill Lynch

Following a credit event the protection seller is exposed to a payment of $100-R$, where R is the recovery rate of the delivered obligation. The recovery rate is lowered by the protection seller's exposure to cheapest-to-deliver (CTD) risk⁷. This risk can be significant in the case of a "soft" restructuring where the seller could be delivered an obligation trading substantially lower than the restructured obligation.

Mathematically, the two sets of cash flows can be approximated in a simple model as:

$$\text{Risky PV}_{\text{FIXED}} = \sum_{i=1}^N S \times DF_i \times SP_i \times \alpha_i$$

Where,

S is the per-annum CDS spread

N is the number of coupon periods

DF_i is the riskless discount factor from time t_0 to t_i

SP_i is the Survival Probability of the reference entity from time t_0 to t_i

α_i is the accrual factor from t_{i-1} to t_i

$$\text{Risky PV}_{\text{FLOATING}} = \sum_{i=1}^N (1-R) \times DF_i \times (SP_{i-1} - SP_i)$$

Where,

R is the recovery rate on the delivered obligation.

Calculating Survival Probabilities from CDS spreads and recovery rate assumptions is a quantitative process that is explored further in Unwinding Default Swaps (Chapter 4). Survival Probabilities play much more of an active role in determining the mark-to-market profits on a CDS unwind.

CDS cashflows:

The buyer of protection pays quarterly premium to the seller until the earlier of a credit event or maturity

The seller of protection pays par less recovery to the protection buyer if there is a credit event during the life of the contract

At inception: PV of both legs are equal

Survival Probability used to discount swap cashflows

Survival probability more important for CDS unwinds

⁷ The CTD risk can be explained as follows: if different pari-passu obligations are trading at different market prices following a credit event, it is likely that the protection seller will be delivered the least favourable (or cheapest) alternative.

Pricing Conventions – Points Upfront Default Swaps

■ Capital-at-Risk

The relative value comparison between asset swapped par bonds and credit default swaps is quite straightforward. When the bond is trading significantly away from par, an additional level of risk is introduced. The capital-at-risk for a bond investor is the market price paid for that bond whilst the default swap seller is effectively exposed to the par value of debt. More precisely, following a credit event the protection seller will expect to lose the difference between the notional size of the contract and the recovery value on the cheapest to deliver obligation of the reference entity.

Other things being equal therefore, selling protection should be most attractive where cash market instruments are trading above par and less attractive versus bonds trading at a discount. Thus the positive bases that are typical for deteriorating credits have fundamental justification as well as technical drivers.

As the credit situation deteriorates further and investors perceive a real risk of default occurring, the market value of cash bonds fall and tend to converge towards the expected recovery value of the asset class. As premiums on credit default swaps push upwards towards 1000bps sellers of protection tend to melt away, notwithstanding the very high current yields in comparison with the cash market. This behaviour reflects:

- Huge comparative capital exposure. If for example, a bond is trading at 60c and the expected recovery value is 50c the expected loss following default would be 10c. With a default swap the capital at risk would be 50c.
- Following a credit event and settlement the default swap would be terminated, and no cashflows from the high running yield would be payable. Thus for a 1000bps premium the first quarterly payment of 250bps would not be received for 3 months.

■ Points-Upfront

Credits that are viewed as very high risk tend to trade on a "**points-upfront**" basis in the default swap market. According to this convention, dealers quote default in two parts:

1. a lump sum in **bond points** paid or received upfront; and
2. a quarterly running premium in **bps**.

The upfront points and the running yield are together equivalent to a conventional default premium, i.e., the risky PV of the cashflow streams should be identical. The points paid upfront by a protection buyer is analogous to the discount on the equivalent bond. Once the lump sum payment is made, the default swap position becomes economically identical to a basic CDS with an off-market spread. Dealers who sell protection on a distressed credit use the points-upfront convention to receive the equivalent bond discount on the settlement date. In other words, they receive a significant portion of the conventional premium upfront and a smaller running premium (relative to the conventional premium) on a quarterly basis.

One feature of the points-upfront CDS is the reduced exposure to spread movements: spread tightening will provide a smaller mark-to-market gain than a position that only pays a running premium, while spread widening will result in a smaller loss.

Comparison between protection and par bonds is quite straightforward . . .

. . . but gets tricky when bonds trade at a deep discount

Distressed credits trade on points-upfront basis . . .

. . . analogous to the discount on an equivalent bond

Reduced exposure to spread movements

4. Unwinding Default Swaps

When entering into credit default swaps, the well established arbitrage relationship with the cash market is typically the relative value starting point. The procedure for unwinding default swap trades though is a key difference between cash and synthetic credit markets. The methodology and results can at first be counterintuitive.

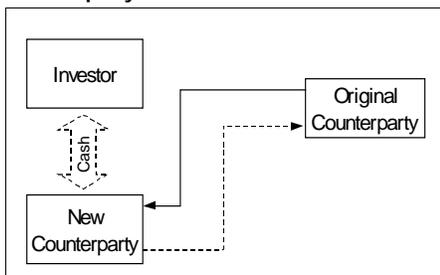
CDS mark-to-market values move in line with current market premiums . . .

. . . but unwind mechanics differ from cash bonds

Three ways to book P&L on an existing default swap

Terminating the swap with the original counterparty

Chart 24: Assigning a CDS to a New Counterparty



Source: Merrill Lynch

Comparing Cash and Default Markets

■ Default Swaps are ‘Spread’ Products

While the payouts on credit default swaps are dependent upon the occurrence of pre-defined credit events, default swaps can nonetheless be thought of as credit ‘spread’ instruments whose premiums move in relation to the changing credit quality of the underlying reference entity. As a result, the mark-to-market value of an existing default swap will move as its default swap premium moves over the course of time.

■ Unwinding Cash Market Positions

Unwinding a holding in the cash market is straightforward, simply involving selling the bond. Following this transaction there should be no residual flows or contractual obligations between the investor and its counterparty. And with the exception of unwinding any interest rate hedges the P&L is essentially defined by the change in price of the bond. In the credit derivative market the mechanics of unwinds are typically more involved, and counter-intuitively, the P&L of unwinding a default swap will usually be different from that of unwinding a swapped bond for any given parallel change in spread/default premium.

Three Ways to Unwind a Default Swap

An investor with a long or short position in an existing default swap can monetise a change in the default swap premium, and realise P&L, in three ways:

■ Agreeing An Unwind Payment with the Original Default Swap Counterparty in Termination of the Transaction

The investor receives/pays the current mark-to-market value of the existing default swap from/to the current default swap counterparty. One of the benefits of terminating (or ‘tearing up’) an existing trade is that all future cashflow streams are cancelled and ongoing legal risk (i.e. possible disputes over deliverable obligations) is removed. This method also has potentially advantageous capital treatment.

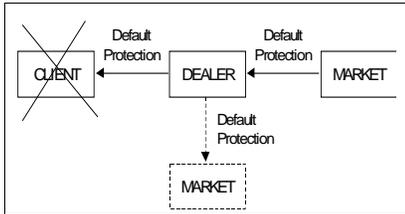
■ Assignment to Another Counterparty

Default swaps can also be assigned to a new counterparty that simply ‘replaces’ the investor in the default swap. In this case, the investor receives/pays the current mark-to-market value from/to the new counterparty. The original counterparty and the new counterparty become parties to the CDS contract, with the investor ending its involvement (Chart 24). Assignment will also be subject to the protection buyer agreeing to take on the counterparty risk of the protection seller. Again this may reduce legal/capital risk for the investor who has closed its position.

2003 Definitions incorporate a new article to address the assignment (Novation) of credit derivative transactions. A Novation Agreement and a Novation Confirmation are now available to assist counterparties in documenting and obtaining the requisite consents to the assignment of default swap contracts.

Offsetting transaction

Chart 25: Replacing Terminated Swaps



Source: Merrill Lynch

■ **Entering into an Offsetting Transaction**

The final alternative is to enter into an offsetting long or short protection position with another counterparty. Offsetting transactions are not as popular with end investors as they require the signing of further documentation and added legal risk. Nonetheless, unwinding with another counterparty may be the most desirable option for holders of illiquid positions where better unwind terms may be available away from the original counterparty and where an assignment is not possible.

Offsetting transactions are used extensively by dealers when unwinding positions for themselves and clients. This is because dealers will need to replace terminated default swaps to remain hedged. Chart 25 shows that following a termination of an existing client default swap contract, the dealer must replace this offsetting transaction by entering into a default swap with the market to remain hedged. **For this reason, valuing offsetting transactions is essential to the understanding of swap unwind pricing methodology.**

Mark-to-market payments, as reflected in the unwind default swap level, will, therefore, reflect the risk that the dealer assumes in having to source an additional default swap to remain hedged.

Conceptualising Default Swap Mark-to-Market Values

Can think of mark-to-market in terms of an offsetting transaction . . .

Intuitively, the mark-to-market value of a default swap should equate to the cost of entering into an offsetting transaction. For an investor who has sold protection, the offsetting trade constitutes buying protection on the same reference entity with essentially the same terms as the original trade. The main variations in the contracts will be a) Pricing, reflecting market movements and b) Contract Term, so that the new contract expires on the same date as the existing contract.

. . . that results in an annuity

For example, if an investor sells 5yr protection at 150bps, then a tightening in the default swap premium of the reference entity to 100bps would result in a positive mark-to-market value. The investor is effectively receiving a 150bps cash flow stream while current market levels would only provide him with 100bps (ignoring bid/offer). Similarly, if premiums subsequently widened to 200bps, the mark-to-market value becomes negative. The investor is not being compensated enough in this case.

Discounting this annuity derives the mark-to-market value

Conceptualising this mark-to-market value requires an analysis of the resultant flows that would arise if the two offsetting transactions were put in place. For simplicity, if we assume that the payment dates of the two trades match perfectly, then the investor is effectively long, or short, an annuity payment (the aggregate of the premiums) until the maturity of the original default swap. The mark-to-market is then derived by discounting the annuity.

Chart 26 shows how the mark-to-market value can be thought of for an investor who has sold 5yr protection at 150bps and wishes to mark-to-market the position after one year. In this case, we assume the current market premium to buy protection on the same reference entity (for 4yrs) is 100bps. Thinking in terms of two offsetting trades, the investor can be considered long a 4yr 50bps annuity. Discounting this annuity would then give the investor the mark-to-market value of his original default swap position.

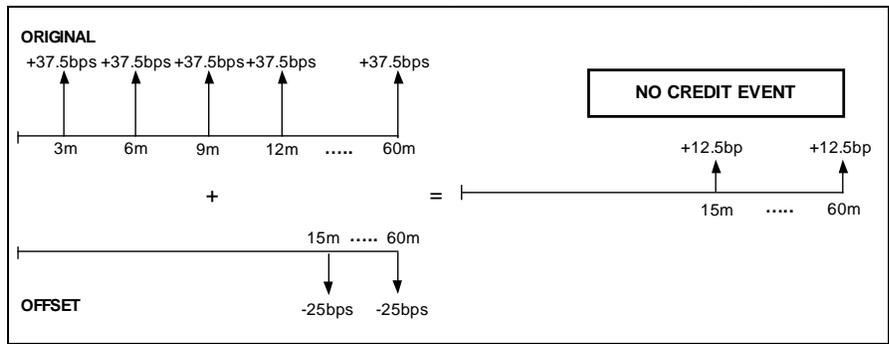
Resulting cash flows from:

Selling 5yr Protection @150bps

+

*Buying 4yr Protection @100bps
1yr later*

Chart 26: Mark-to-Market Value Can Be Thought of In Terms of the Resulting Annuity



Source: Merrill Lynch

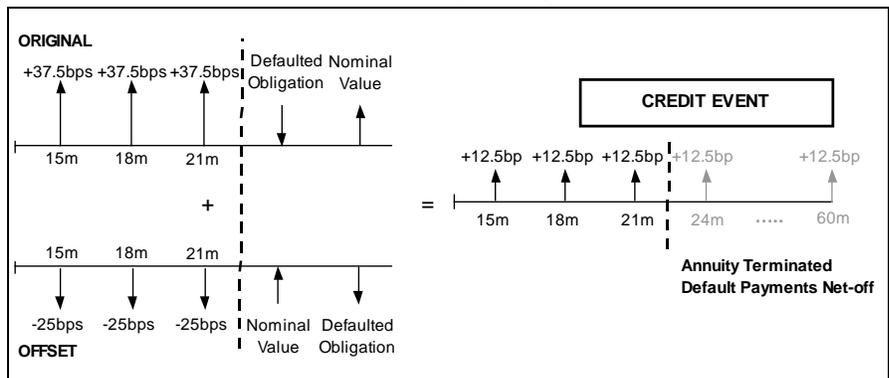
Annuity is risky ...

Risky Cash Flows

The above methodology is, however, incomplete since, the annuity stream is not risk free. Credit events during the remaining life of the parallel contracts would put an end to the annuity payment. Following a credit event, both legs of the long and short protection positions would net out and terminate, leaving the investor flat. Since the annuity may cease prior to its maturity, the carry earned by the investor may fall short of the expected carry. Chart 27 below shows the case where a credit event terminates the annuity prior to its maturity.

... and terminates following a credit event

Chart 27: Credit Event Terminates The Annuity Leaving An Investor Flat



Source: Merrill Lynch

■ **Survival Probabilities As Weighting Factors**

Cash flows are weighted by survival probabilities ...

To factor this risk into the value of the annuity, each cash flow in the annuity stream must be weighted by the probability of there being **no credit event** before that cash flow date. We introduced these weighting factors, called the **Survival Probabilities** of the credit default swap, in Valuation of Credit Default Swaps (Chapter 3). The expected value of the annuity, and hence our mark-to-market on the existing swap position can now be defined as:

$$MTM = \sum_{i=1}^S \text{Annuity}(\$) \times SP_i \times DF_i$$

Where,

Annuity(\$)

S is the number of coupon periods in the annuity

SP_i is the Survival Probability of the reference entity from time t₀ to t_i

DF_i is the riskless discount factor from time t₀ to t_i

... which reduce absolute mark-to-market value

The introduction of survival probabilities (between 0 and 1) has the effect of reducing the **absolute** mark-to-market value. This will mean a **smaller gain** from the unwind of a **profitable** default swap position but also a **smaller loss** from the unwind of an **unprofitable** default swap position.

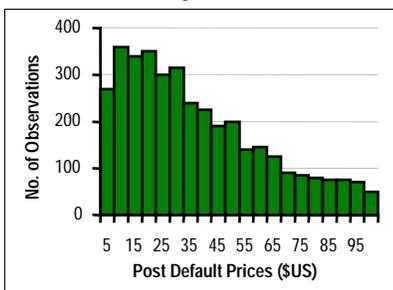
Risk-free discount factors → risky discount factors

Mark-to-market dependent upon survival probabilities

Survival probabilities driven by recovery assumptions

'Recovery' in CDS different from recovery of an obligation

Chart 28: Recovery Rate Distribution



Distribution of Recovery Rates for Straight Bond Issues, 1982-2002
Source: Moody's, ML

Recovery in the bond market is not identical to recovery in CDS markets

■ From 'Riskless' Curves to 'Risky' Curves

Another way of interpreting the above equation is to say that the annuity payments are discounted using Risky Discount Factors. In this case, the Risky Discount Factors are given by (Survival Probability × Risk-Free Discount Factor) at each cash flow date.

Given these Risky Discount Factors, we can restate the above equation as:

$$MTM = \text{Annuity} \times PV01 (\$)$$

where PV01(\$) is defined as the \$ present value of a 1bp risky annuity⁸ terminating at the earlier of a credit event or the maturity of the original default swap.

It is immediately clear from the above definitions that the mark-to-market of an existing default swap position will be dependent upon the determined survival probability rates.

Modeling Default and Survival Probabilities

The implied Survival Probabilities of a credit default swap can be calculated from a model of default and recovery. The normal approach is to calculate them using market data, particularly the on-market CDS spread curve, and also an assumption about the recovery rate of deliverable obligations in the default swap contract. We talk more about Survival Probability curves in the next section.

■ Determining Recovery Rates

In the bond market, we define the Recovery Rate of a defaultable obligation as the percentage of par claim of the obligation recovered by investors following default. Recovery rates depend not only on the actual recovery rate post default but also the time taken for the recovery rate to be realised. The recovery at the date of default involves discounting the recovery rate on the day it is recovered to the date of default. The delay could be due to legal reasons or the time taken to value the assets following default. The recovery rate assumption by rating agencies is based on the trading price of the defaulted instrument and is valid if the investors can liquidate the position immediately. Empirical studies by rating agencies have looked at recovery rates of defaulted bond issuers over time (Table 7).

Table 7: Average Defaulted Bond Recovery Rates by Security and Priority, 1982-2002

Priority in Capital Structure	Average Recovery (%)			
	1982-2002	1982-2000	2001	2002
Secured Bank Loan	61.6	67.3	64.0	51.0
Senior Secured	53.1	52.1	57.5	48.7
Senior Unsecured	37.4	43.8	35.5	34.0
Subordinated	30.4	31.9	15.8	24.4
All Bonds	37.2	39.1	34.7	34.3

Source: Moody's: *Default & Recovery Rates of Corporate Bond Issuers*, David T. Hamilton et al., February 2003

The definition of recovery in the CDS market is slightly different from the definition of recovery in the bond market. In the CDS market, **recovery is defined as the market price of the delivered obligation** in the default swap contract following a credit event. Although rating agency statistics may be a good proxy, there are other reasons why the recovery rates may not be identical. For the purposes of this report we interchangeably use "default" and "credit event". In reality, "default" as captured by rating agency statistics may sometimes be a more severe test than certain credit events. Moody's, for example, notes three categories of default for the purposes of its ratings and historical default statistics:

⁸ PV01(\$) = (Notional/10,000) × ∑ (Survival Prob × Risk-Free Discount Factor).

Refer to important disclosures at the end of this report.

In general, survival probabilities won't take account of 'softer' credit events

- missed or delayed interest or principal payments;
- bankruptcy or receivership; and
- distressed exchange either leaving investors with a diminished financial obligation or an exchange for the apparent reason of avoiding default.

Furthermore, restructuring or obligation acceleration⁹ can sometimes be considered “soft” credit events. Additionally post recovery statistics reflect such “hard default” whereas the expected recovery following for example a “soft” restructuring credit event would likely be significantly higher than for a liquidation. Against this, however, protection sellers assume the cheapest-to-deliver risk following a credit event.

■ What Do Recovery Statistics Tell Us?

While average recovery rates over a set time period may be a good starting point, they do not highlight the dispersion of recovery values for each class. However, Moody's does highlight the overall recovery rate distribution for straight bond issues from 1982-2002, shown in Chart 28. On the whole, we infer that:

Overall distribution does not appear to be normal

- The recovery rate is a function of the seniority of the obligation.
- The recovery rate distribution is asymmetrical and skewed with a trailing right side tail.

Data from Standard & Poor's highlights the standard deviation of recovery rates for corporate issues and bank debt, shown in Table 8. We infer the following:

Considerable dispersion around the mean

- The data exhibits a considerable amount of dispersion around the mean for each class of debt.
- Bank debt has the highest recovery rate and is generally less volatile than the other debt classes (except maybe the junior subordinated).

Table 8: Recovery Rates and Their Dispersion for U.S. Corporate Issues, 1988-2001 & 1997-2001

Class of Debt	1988 - 2001		1997 - 2001		
	Recovery Rate (%)	Standard Deviation (%)	Recovery Rate (%)	Standard Deviation (%)	
Bank Debt	84.9	26.1	Bank Debt	79.9	29.4
Senior Secured Bond	69.3	31.1	Senior Secured Bond	54.1	34.0
Senior Unsecured Bond	52.8	35.4	Senior Unsecured Bond	44.0	33.6
Senior Subordinated	36.1	32.6	Senior Subordinated	24.0	29.0
Subordinated	32.2	35.3	Subordinated/Junior Sub	15.1	22.9
Junior Subordinated	19.2	30.2			

Source: Standard & Poor's

Recovery rates have fallen below their historical averages in the last two years

Table 7 highlights the extent to which average recovery values have changed over the last few years. Recovery rates across all types of debt instruments have generally fallen below their historical averages over the last two years, where on average only \$34 was recovered in these years.

Decline in recovery rates has not been uniform

However, the decline in recovery rates has not been uniformly distributed across the capital structure. In 2001, the average recovery rates for senior secured bonds increased, while recovery rates for senior unsecured and subordinated bonds fell sharply. The trend reversed in 2002 though, as senior and secured bonds saw their average recovery rates fall, while subordinated bond recovery rates rose significantly.

Recovery rates vary significantly across industries and within an industry

Even by industry, average recovery rates can vary dramatically both across industries and within an industry (Table 9).

⁹ Although Obligation Acceleration is no longer in standard usage for European investment grade corporate default swaps, it remains relevant for unwinds of existing swaps.

Table 9: Average Defaulted Bond Recovery Rates (\$) by Industry (1982-2002)

	Average	Minimum	Maximum	Std Dev	Count
Banking	25.4	1.25	96.4	20.3	56
Financial Institutions	57.2	1.00	98.0	29.9	301
Industrial	36.9	0.28	125.0	24.9	2,456
Insurance	32.7	8.00	94.5	26.4	53
Public Utilities	62.3	2.65	101.3	25.59	181
Telecom	20.0	0.25	91.25	16.24	435

Source: Moody's: *Default & Recovery Rates of Corporate Bond Issuers*, David T. Hamilton et al., February 2003

■ **Recovery Rates → Default Probabilities → Survival Probabilities**

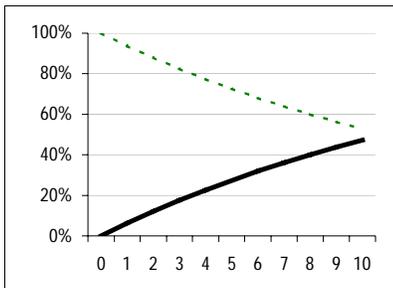
While the models used to create a time-series of Survival Probability rates for a default swap can be quite complex, we can simplify the main points in the process:

Survival probabilities are derived from observable credit spreads ...

- A basic starting assumption is that **market observable credit spreads capture the market view of the riskiness of an obligor’s debt** (although they may well reflect other structural factors). This risk (as implied by credit spreads) depends on the **probability of default** as well as the **severity of loss following default**¹⁰. Hence for a given credit spread and under certain recovery rate assumptions, we can approximate probability of default.
- Given the close linkages between asset swap spreads and default swap premiums, this information is also contained in the on-market CDS curve (although default swap premiums also reflect other issues such as counterparty risk). Where an issuer has relatively few traded points along its curve, a flat spread curve could be used as an approximation.
- A recovery value is assumed for a deliverable obligation in the default swap contract. The choice of recovery rate will reflect the factors mentioned in the previous section.
- In the modeling process, it is common to view default as a surprise event, with a certain ‘intensity’ (often defined as the ratio of spread to (1-recovery)¹¹). Under certain assumptions, these models interpolate (‘bootstrap’) a time-series of Survival Probabilities.

... and a recovery rate assumption

Chart 29: Cumulative Default and Survival Probabilities



Survival Probability is the Dashed Line
Source: Merrill Lynch

■ **An Example of a Survival Probability Time-Series**

In Table 10, we show the results of this process in constructing a time-series of survival probabilities for a default swap. We assume that 5yr senior protection is quoted at 380bps, and we also assume a **40% Recovery Rate** on the senior debt of the reference entity.

¹⁰ Expected Loss = Loss Exposure × Default Probability × (1 - Recovery Rate).
¹¹ See Duffie and Singleton (1998).

Table 10: The Survival Probability and Cumulative Default Probability Curve

Tenor t (in years)	Survival Probability SP_t	Cumulative Probability of Default, $(1 - SP_t)$	Probability of Default in Period
Today	100%	-	-
1	93.8%	6.2%	6.2%
2	88.0%	12.0%	5.8%
3	82.5%	17.5%	5.4%
4	77.4%	22.6%	5.1%
5	72.6%	27.4%	4.8%
6	68.1%	31.9%	4.5%
7	63.9%	36.1%	4.2%
8	60.0%	40.0%	3.9%
9	56.2%	43.8%	3.7%
10	52.8%	47.2%	3.5%

Source: Merrill Lynch

Sensitivity of Survival Probability to the Recovery Rate Assumption

Recovery rate assumptions drive the shape of a survival probability curve

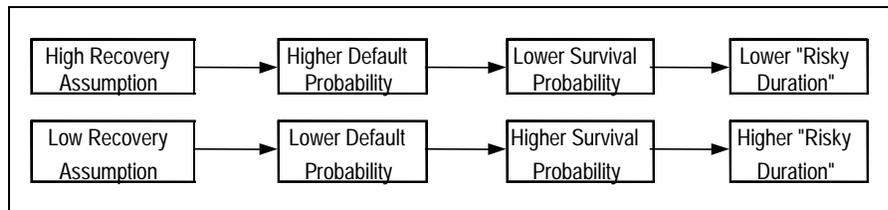
Assumptions about recovery rates will be a factor determining the shape of the Survival Probability curve. In Chart 30 we show how different recovery rate assumptions translate into different survival probability rates. This relationship can be summarized as follows:

For a **given credit spread**, a **high recovery** assumption implies a higher probability of default (relative to a low recovery assumption) and hence a **lower Survival Probability**.

Similarly, for a **given credit spread**, a **low recovery** assumption implies a lower probability of default (relative to a high recovery assumption) and hence a **higher Survival Probability**.

Chart 30: The Effect of Recovery Assumption on Implied Survival Probability (Implied by a Given Default Premium)

For a give default premium, a high recovery assumption translates into a lower survival probability (relative to a low recovery assumption)



Source: Merrill Lynch

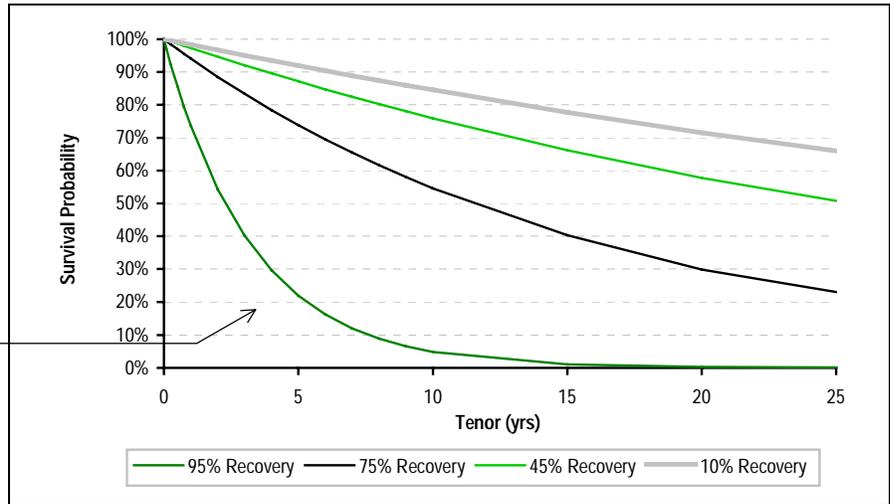
In Chart 31 below we show a time-series of Survival Probability rates for a broad range of recovery rate assumptions. We note that **Survival Probability is a decreasing function of recovery rate and also of time**.

In the case of a 45% recovery, Chart 31 implies a 5yr default swap has approximately an 87% chance of not being triggered before maturity.

Chart 31: How Survival Probability Varies with Time for Different Recovery Assumptions (For a Given Default Premium)

Survival probability is a decreasing function of time and recovery rate

For low recovery rate assumptions, survival probability decreases approximately linearly over time. For high recovery rate assumptions, this relationship is more 'convex'



Assuming Current Default Swap Spread of 150bps.
Source: Merrill Lynch

An Example of Unwinding Credit Default Swaps

■ A Case Study

Investor buys protection from Broker/Dealer and unwinds it one year later at a profit

Table 11: Example of an Existing Trade to be Unwound

Existing Trade Details	
<i>Investor:</i>	Bank A
<i>Counterparty:</i>	Broker/Dealer
<i>Trade Initiation Date:</i>	10-Apr-2002
<i>Trade Type:</i>	Bank A buys 5y default protection
<i>Reference Entity:</i>	ABC Corp
<i>Reference Obligation (Senior Debt):</i>	ABCO 6% June-2008, rated Baa2/BBB
<i>Trade Currency:</i>	EUR
<i>Notional:</i>	€10,000,000
<i>Premium:</i>	Bank A pays Broker/Dealer 2% per annum (Quarterly in arrears, ACT/360)
Unwind Details	
<i>Trade Unwind Date:</i>	10-Apr-2003
<i>Unwind Premium:</i>	2.30%
Mark-To-Market Value	Positive

Source: Merrill Lynch

Investor has three options . . .

Bank A can choose one of the following options to unwind the existing default swap position:

1. Ask Broker/Dealer to unwind the position and pay Bank A the positive mark-to-market value. Bank A is no longer party to the default swap transaction.
2. Assignment (with agreement of all three parties involved) of the trade to a third counterparty who pays the investor the mark-to-market value. Bank A is no longer party to the default swap transaction.
3. Bank A enters into an offsetting transaction (sells protection) with another counterparty. Bank A is party to 2 different default swaps.

. . . which provide similar mark-to-market payments

Assuming the same unwind levels and recovery rates are attainable in all three cases, the mark-to-market payment is the same for all three options.

Table 12: Survival Probabilities for Unwinding the Trade Example

Tenor	Survival Probability
0	100.0%
1mo	99.7%
3mo	98.9%
6mo	97.8%
9mo	96.9%
1yr	95.9%
2yr	91.9%
3yr	88.1%
4yr	84.5%

Source: Merrill Lynch

All mark-to-market calculations use the principle of an offsetting transaction. However, the key difference is that the offsetting transaction is hypothetical in cases 1 and 2 but actual in case 3.

Assume Bank A chooses option 1. The trade mechanics are as follows:

- The mark-to-market would reflect a hypothetical trade where Bank A sells 4yr protection on ABC Corp at 2.300% on a notional amount of €10,000,000.
- The net position would therefore be economically equivalent to Bank A being long a 30bps risky annuity stream until 10 April 2007.
- Using a 45% recovery value assumption and the current market quote of 230bps, we can derive the implied survival probabilities for the default swap (Table 12). Together with the risk-free discount factors we derive a PV01 of **€3,520**.
- A 30bps risky annuity stream has a mark-to-market value for the investor of **€105,612**. ($30 \times \text{€3,520}$).

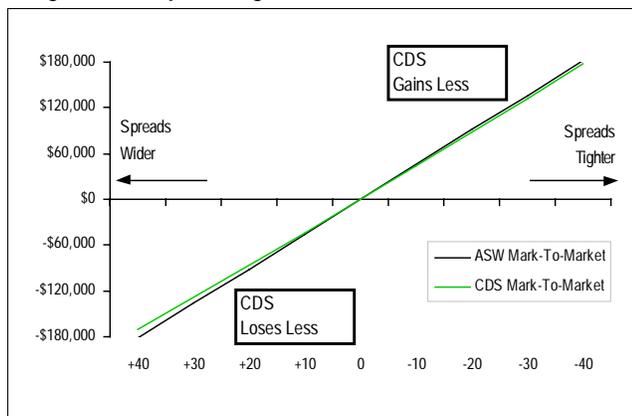
■ A Note on MTM Differences Between Bonds and Default Swaps

In the above example we have showed how a typical unwind valuation might work. It is important to note, however, that the resultant mark to market will typically be different from a comparable cash-market unwind. In general, **a long or short default swap position will have a smaller positive or negative change in value for a given spread change than a comparable asset swap**. In other words, the differing valuation methodology of the two instruments leads to the default swap having a lower “risky duration”.

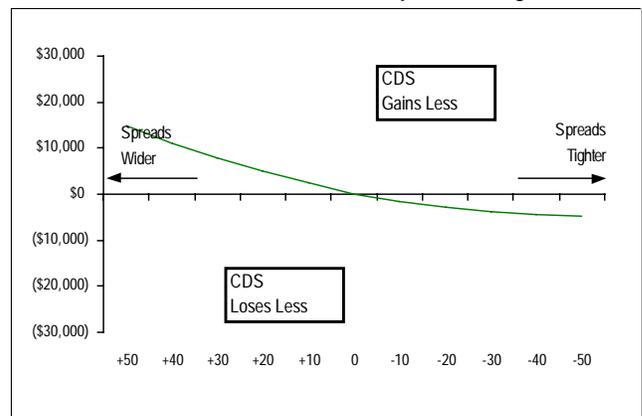
Take the following simple example. An investor purchases \$10mn of a five-year bond at par which asset swaps to Libor+100bps. The investor also undertakes a similar risk position in the default swap market by selling \$10mn of default protection to the same maturity generating a premium of 100bps. If both spreads immediately widen by 20bps, then the loss on the default swap would be lower than the loss on the asset swap. Conversely, however, a simultaneous tightening of spreads would yield a greater profit on the bonds than the gain on the default swap. These two payoffs are plotted in Chart 32 and the difference in payoff between the two trades is shown in Chart 33. For the default swap transaction we have assumed a 45% recovery for the unwind calculation.

Default swaps have a lower “risky duration”

Meaning that for equal spread/premium widening the default swap loses less

Chart 32: Impact of Spread Change on Short Protection and Long Asset Swap Holdings


Source: Merrill Lynch

Chart 33: Difference in P&L Between the Two Transactions (Default Less Cash) for Simultaneous Spread Changes


Source: Merrill Lynch

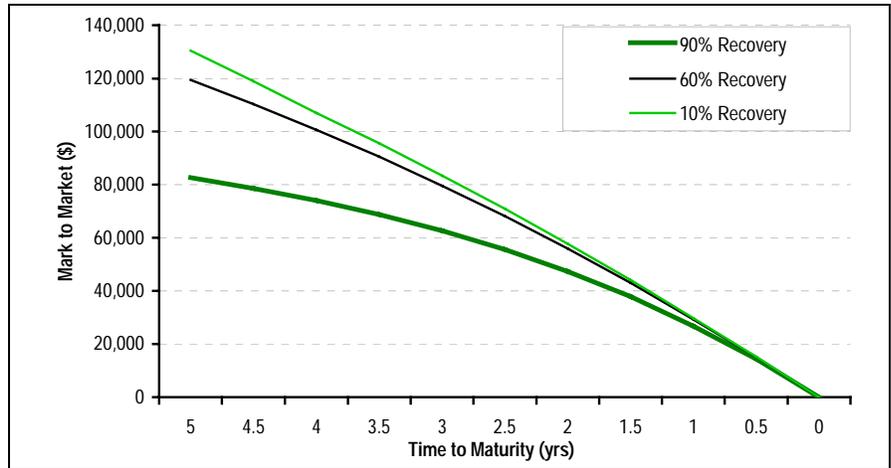
Sensitivities of the Mark-to-Market Amount

Clearly a main driver of the mark-to-market value is the recovery rate assumption but the mark-to-market also has other sensitivities:

■ Time Sensitivity ('Theta')

The mark-to-market of a default swap will also have time dependence. Over time, the mark-to-market declines towards zero with its shortening maturity as less risky cash flows in the annuity remain. This time dependence is shown below in Chart 34. **The mark-to-market becomes more sensitive to changes in the recovery value assumption the longer the default swap has to maturity.**

Chart 34: How Mark to Market Values Decline Over Time for Different Recovery Rates



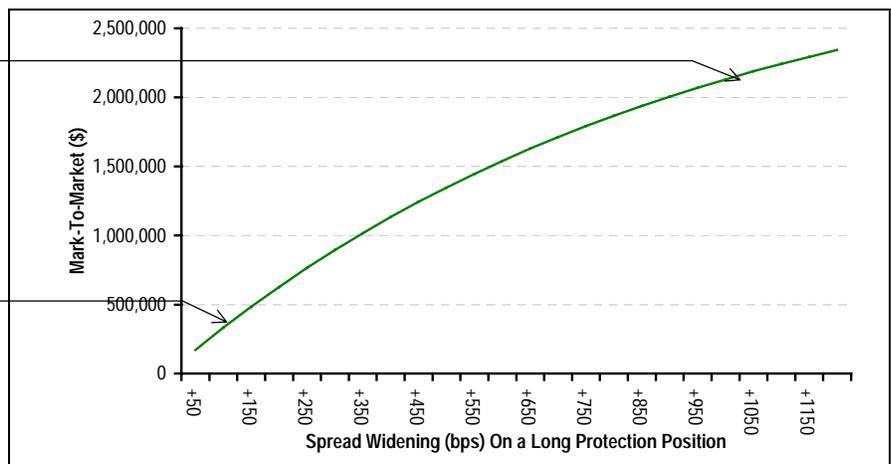
Source: Merrill Lynch

■ Incremental Mark-to-Market

For a given recovery rate assumption, Survival Probability rates are a decreasing function of market premiums. In other words, for a given recovery rate assumption, wider default premiums reflect greater probability of default and hence a lower survival probability.

In Chart 35 below, we show the mark-to-market increase on a long protection position as a result of an increase in premiums. The influence of Survival Probability at wider premiums can be seen from the declining slope of the mark-to-market curve. The incremental mark-to-market from a long protection position declines as premiums move wider.

Chart 35: Incremental Mark-to-Market Declines as Default Premiums Increase



Assuming long protection position of 100bps unwound after 1yr with recovery assumption of 65%.
Source: Merrill Lynch

Mark-to-market also has time dependence – 'Theta'

Recovery value assumption more important the longer the default swap has to maturity

For a given recovery value, higher premiums mean lower survival probability

Declining slope of mark-to-market curve

Flatter slope of the mark-to-market curve for higher premium levels

Steeper slope of the mark-to-market curve for lower premium levels

5. Valuing the CDS Basis

Defining the Basis

The arbitrage relationship¹² provides a fundamental linkage between default swap premiums and asset-swapped par bonds. However, the yields on the two instruments frequently do not correspond to what this arbitrage relationship tells us. The difference between the asset swap spread and the CDS premium is known as the CDS basis. If the CDS premium is higher than the asset swap yield, the basis is said to be **positive**. If the CDS is tighter the basis is **negative**.

$$\text{CDS BASIS} = \text{CDS PREMIUM} - \text{ASSET SWAP SPREAD}$$

Which Relative Value Benchmark to Use?

However, there is more than one structure of asset-swap package in the market, and when bond prices begin to move away from par these differing structures start to produce different measures of risk.

To further complicate matters there is the Z-spread valuation measure which provides a differing methodology to asset swaps. None of these measures is perfect, but it is important to understand their pluses and minuses when looking at bonds trading away from par. In such circumstances, the correct choice of valuation measure will be crucial in determining absolute (as opposed to relative) value.

We provide a guide to all three spread measures.

Asset Swap Structures and Benefits

An asset swap is a transaction which transforms the cashflows of a bond through the application of one or more swaps. For example, bond coupons can be swapped from fixed into floating rate or vice versa, interest and principal can be swapped into a different currency, or the yield from a security can be swapped to a cashflow based on an index in another asset class. We concentrate on the first case for comparison with default swaps.

A fixed-floating asset swap is an over-the-counter package product consisting of two simultaneous trades:

- The asset swap buyer purchases a fixed-rate bond from the asset swap seller (usually a bank who has put the structure together).
- The asset swap buyer enters into an off-market interest rate swap with the asset swap seller. In the swap, the bond's coupons form the fixed leg payment, in return for receiving LIBOR plus (or minus) an agreed fixed spread on the floating leg. The maturity of the swap is the same as the maturity of the asset.

This structure enables investors to gain exposure to a bond's credit risk with minimal interest rate risk. Creating synthetic floating-rate assets may be desirable if higher yields are available than on the straight floating-rate debt of an issuer, or if the required maturity exposure is not available in floating-rate form. Banks, hedge funds and securities companies, which fund on a floating-rate basis, are natural buyers of such products.

As a result, if there is an active asset swap market, bond prices can never become too cheap relative to similar floating-rate issues. As a result, asset swaps tend to create a natural floor to bond prices and help reduce the price volatility of bonds.

¹² See Valuation of Credit Default Swaps (Chapter 3).

The choice of which asset swap structure to use is crucial when bonds move away from par

Asset swaps are used to transform the cashflows of bonds

Investors can gain synthetic exposure to FRNs or create higher-yielding assets

While there are many variations of asset swap structure – forward starting, cross-currency, callable, and others – there are two types of fixed-floating structure that the market uses, both of which can give different asset swap spreads.

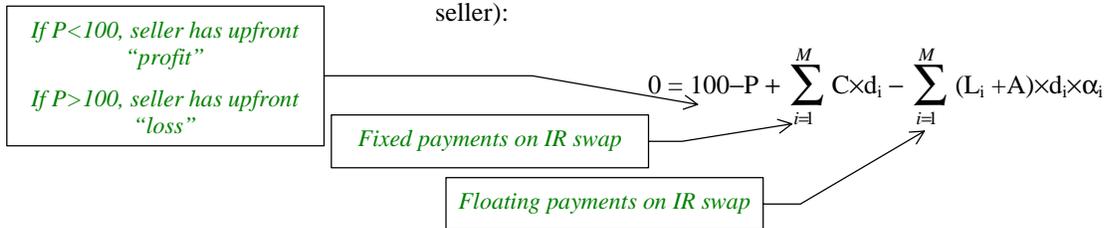
Par-Par structure most common swap form

Par Structure

The most frequently used is the “par in-par out” structure. Under a par structure, the asset swap buyer effectively buys the package from the asset swap seller at par, regardless of the cash price of the bond, and the notional amount of the swap is equal to the face value of the underlying bond.

Tax and accounting reasons may make it advantageous to buy and sell non-par assets at par through such an asset swap structure. If the bond is trading below par, the asset swap seller can be thought of as effectively having an upfront “profit”. If the bond is trading above par, the asset-swap seller effectively has an upfront “loss”.

At initiation, the PV of all the cashflows must be zero. As such, the asset swap spread satisfies the following equation (from the perspective of the asset swap seller):



Where,

- P is the cash price of the bond,
- A is the Par-ASW spread,
- d_i is the i^{th} discount factor (derived from swap market),
- L_i is the i^{th} LIBOR rate set at time t_{i-1} and paid at time t_i ,
- C is the bond’s coupon,
- α_i is the accrual factor in the appropriate daycount basis.

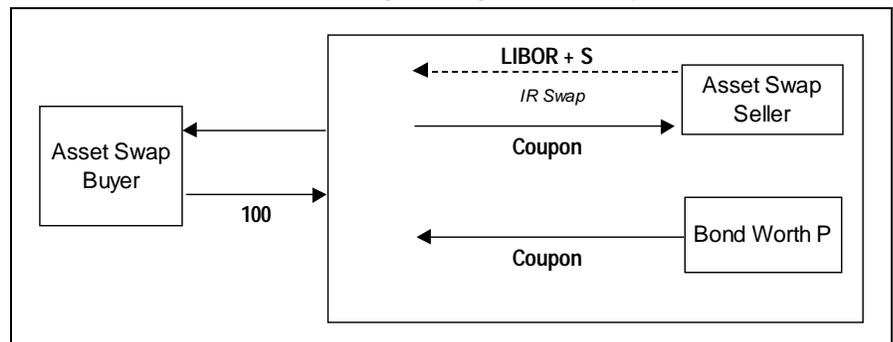
Upfront “profit” or “loss” impacts Par-ASW spread

Thus any upfront profit or loss will impact the spread that the asset swap buyer receives. If the bond is trading at 85c, for example, the remaining 15c can be thought of as “subsidising” the floating rate spread over the life of the asset swap. As the swap progresses towards maturity, this deposit will decrease, and other things being equal, the bond’s market price will accrete towards par.

Counterparty risk is greatest at initiation of a par asset swap

Paying par to buy an asset swap on a discount bond results in the asset swap buyer having an immediate exposure to the asset swap seller equal to par minus the bond price (the opposite is true for a premium bond). Hence, under this structure, counterparty risk is greatest at initiation and falls to zero at maturity.

Chart 36: In a Par Structure the Package is Bought for 100 Irrespective of Bond Price



Source: Merrill Lynch. ‘S’ denotes the Par-ASW Spread.

If the bond defaults the IR swap component does not stop as well

One of the disadvantages of asset swaps is that the credit performance of the underlying bond and the swap are not linked – if the bond defaults before maturity the interest rate swap component of the structure does not automatically stop. In this instance, the asset swap buyer has to continue paying the fixed leg of the swap – despite losing the ability to fund the leg with the coupon of the bond – or unwind the swap position incurring a MTM profit or loss. The asset swap buyer also loses the par redemption of the bond, receiving whatever recovery rate the bond issuer pays.

Market structure asset swaps used less frequently

Market Structure

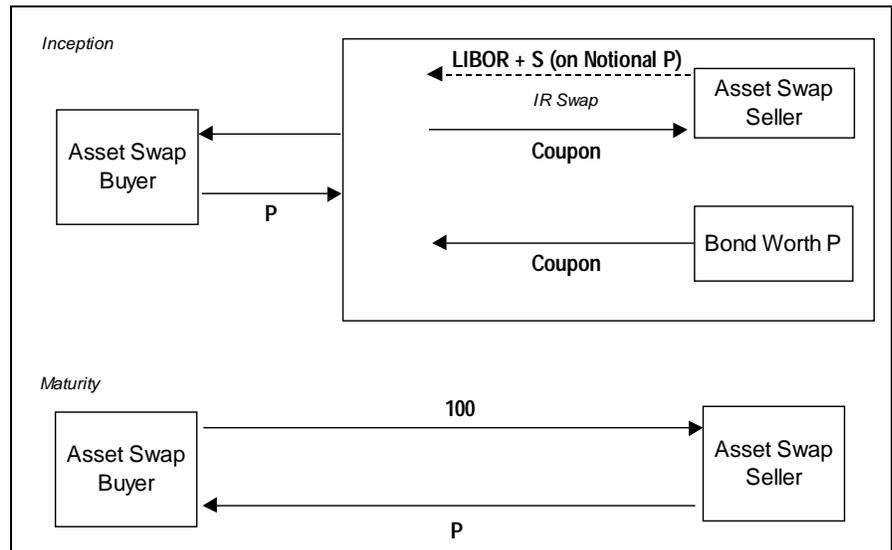
Under a “market in-market out” structure, the investor buys the package at the cash market price (not par) of the bond and the notional amount of the floating leg is equal to the bond price. At maturity there is an exchange of par for the original cash market price. In this structure the asset swap seller has no upfront “profit” or “loss”. If a bond is trading at 85c, for example, the asset swap buyer would buy the package at 85c but also make a net payment of 15c to the asset swap seller at the end of the transaction term.

Using the notation above (and with A now the Market-ASW spread), we have at inception that:

$$0 = \sum_{i=1}^M C \times d_i - \frac{P}{100} \sum_{i=1}^M (L_i + A) \times d_i \times \alpha_i + (100 - P) \times d_M$$

Final exchange of notionals

Chart 37: Market-Market Structure Involves a Net Payment at Maturity



Source: Merrill Lynch. 'S' denotes the Market-ASW Spread.

With this variation of asset swap, counterparty risk starts at zero and increases to its largest at maturity. Moreover, counterparty risk in the market structure is the reverse of the par structure: for a discount bond, the par structure exposes the asset swap buyer to counterparty risk but the market structure exposes the asset swap seller to counterparty risk, and vice versa. In Chart 38 we summarise the counterparty exposures of both structures.

Counterparty exposure is reversed when going from par to market structures

Chart 38: Counterparty Risk for Par and Market ASW Structures

	Discount Bond	Premium Bond
Par Structure	Asset swap buyer takes counterparty risk (Front loaded)	Asset swap seller takes counterparty risk (Front loaded)
Market Structure	Asset swap seller takes counterparty risk (Back loaded)	Asset swap buyer takes counterparty risk (Back loaded)

Source: Merrill Lynch

As bond prices fall, par structure spreads are lower than market structure spreads

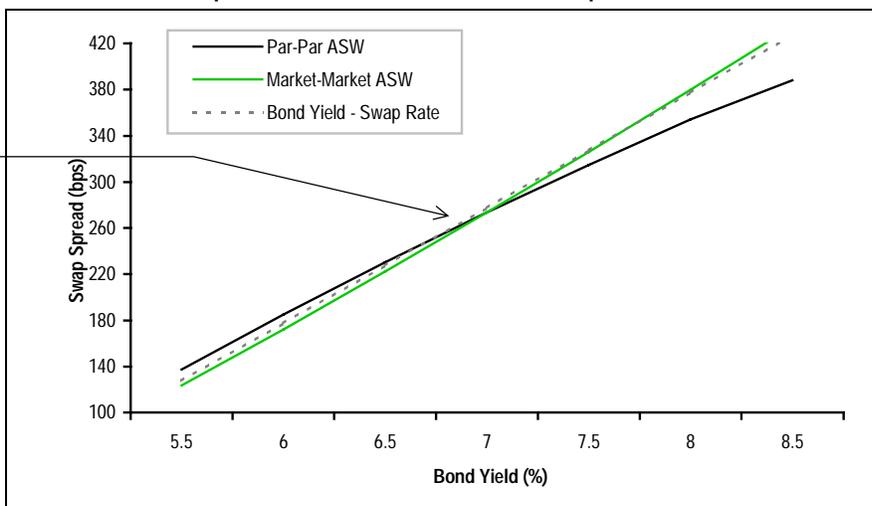
Par-ASW spreads tend to underestimate risk as bond prices fall

It can be shown that the Market-ASW spread will be $(100/P) \times A$, where A is the Par-ASW spread for the same bond. Clearly, as bond prices fall below par, the Market-ASW spread will be higher than the Par-ASW spread, and vice versa for above par bonds.

The relationship between the Par-ASW, Market-ASW and the Interpolated Spread (defined as bond yield – implied swap rate) is shown in Chart 39. Where a bond price is near par, both the Par-ASW and Market-ASW spreads are relatively close to each other and furthermore, are very near to the interpolated spread measure of risk. As bond prices fall though, the asset swap measures diverge, with the Par-ASW spread being lower than the Market-ASW spread. Conversely, as bond prices rise above par, the Market-ASW spread will be lower than the Par-ASW spread (but the divergence between the two measures will be limited as spreads tend to zero).

Chart 39: Relationship Between Par and Market Structure Spreads

Par-ASW and Market-ASW spreads converge when bond prices are at par



Source: Merrill Lynch. € 10yr, 7% annual bond. Market-ASW = $(100/P) \times$ Par-ASW.

Asset swap spreads are bond specific measures of credit risk

Due to the different natures and benefits of both structures, an asset swap spread tends to be a bond-specific measure of credit risk. Under the par structure for instance, two bonds with the same maturities and yields may produce different asset-swap spreads if they have different cash market prices, but their interpolated spread would be the same. This is because part of the Par-ASW spread represents the adjustment needed to compensate the asset swap seller for any upfront “profit” or “loss” associated with a non-par bond – but this upfront amount is returned to the asset swap buyer via the floating rate leg with a different daycount basis. This structural feature magnifies the asset swap spread discrepancy the further the bond is trading from par. For a discount bond, this has the effect of “damping” the net return and producing a lower asset swap spread relative to the true risk.

As a result, a better measure for comparing the credit quality of different bonds – and more importantly for relative value with default swaps – is the Z-Spread (or Zero Volatility Spread) measure.

Interpolated spreads will be volatile and the Z-spread measure attempts to reduce this volatility

Cashflows can be valued off the swap market as well

Adjust the discount curve until the discounted cash flows equal the cash market price

Z-Spread (Zero Volatility Spread)

The nominal spread on a bond represents the basis point difference between the yield-to-maturity of the bond and the yield of a comparative maturity benchmark. The yield-to-maturity represents a blended rate received by the investor on the whole series of cash flows of a bond. One drawback of the nominal spread measure is that the term-structure of the benchmark curve is not taken into account. Since in any given period, the benchmark yield differs from the yield-to-maturity, the nominal spread will be “volatile”. The Z-spread valuation measure corrects for this volatility by measuring the spread that the investor realises over the entire benchmark curve if the bond is held to maturity. The Z-spread is a more accurate risk measure than the nominal spread when the yield curve is steep.

A bond’s cash market price indicates the value assigned to its cash flows by the bond market. In the same manner, we can also value the bond’s cash flows in the swap market – using discount factors derived from the swap market – which gives an “implied value” of the bond.

The Z-spread corrects for discrepancies in the cash market price and “implied value”. For instance, a bond trading at par could have an “implied value” of 105 in the swap market. The Z-Spread calculation is the constant spread (continuously compounded) applied to each swap market discount rate, such that the “implied value” is equal to the cash market price.

This is achieved by a trial and error method – if the discounted cash flows produce an “implied value” above the market price, the Z-spread is increased, and vice-versa.

Table 13: Example of a Z-Spread Calculation – € 10yr 6% (Annual) Bond at 92 Cash Price

Term	Forward LIBOR Rates	Discount Rates	Swap-Implied PV	New Discount Rates (with Z-Spread Adjustment) ¹	New Swap-Implied PV
today		1.000		1.000	
1yr	2.48%	0.975	5.85	0.950	5.70
2yr	2.95%	0.947	5.68	0.898	5.39
3yr	3.69%	0.913	5.48	0.843	5.06
4yr	4.22%	0.875	5.25	0.787	4.72
5yr	4.57%	0.837	5.02	0.733	4.40
6yr	4.93%	0.797	4.78	0.680	4.08
7yr	5.22%	0.757	4.54	0.629	3.77
8yr	5.42%	0.717	4.30	0.580	3.48
9yr	5.61%	0.679	4.07	0.535	3.21
10yr	5.68%	0.642	68.02	0.492	52.19
PV			113.01		92

While the bond market values the instrument at 92, the swap market’s value of the instrument is 113.01

By applying a constant spread to each discount factor¹ we can equate the “implied value” to the cash market price

ASW Spread: 252bps
Z-Spread: 265bps

Source: Merrill Lynch

¹ New discount factor = old discount factor + exp(Z × t), where Z is the Z-Spread (adjusted for daycount).

Finding par bonds to asset swap is increasingly rare

Relative Value With Default Swaps

The well-established arbitrage relationship with asset swaps is based on a fixed-rate bond trading at par. In practice, finding benchmark par-bonds to assess for relative value may be difficult. On the one hand, credit concerns surrounding many higher profile issuers have driven bond prices below par, and on the other, tightening credit spreads combined with a falling yield environment have put upward price pressure on older bond issues with higher coupons.

Falling yields have pushed corporate bond prices above par

Chart 40: Par-Weighted Price of ER00 Index Moves Higher



Source: Merrill Lynch

With non-par bonds though, it is dangerous to assume that the arbitrage relationship with asset-swapped bonds still holds. As credit quality worsens, asset swap spreads are influenced by the degree that the bond price is away from par – the par-par structure, for instance, may underestimate the true risk of the bond.

Monitoring value in negative basis trades requires shrewd use of the correct valuation measure

Perhaps the most important practical application of relative and absolute value is with the monitoring of negative basis trades. As credit quality worsens, and the basis strengthens, the choice of bond risk measure becomes critical to assessing whether the package should be held further (in anticipation of further basis strengthening) or unwound for a profit.

Monitoring Asset Swaps and Z-Spreads

Bloomberg™ provides its own version of an Asset Swap and Z-Spread calculator. Investors can monitor the differences in these two measures by typing ASW <GO> on Bloomberg. The following example is for a FIAT discount bond. In this instance the Z-Spread gives a higher risk measure than the Par-ASW measure.

Chart 41: Using Bloomberg ASW Function to Value Asset Swaps and Z-Spreads

ASSET SWAP CALCULATOR			
FIAT FIN & TRADE FIAT 6 1/4 02/10 84.370/87.370 (9.42/8.76)			
Currency		Bond	
From EUR To EUR	Buy/Sell	S Par Amt	1000 M
	Workout	2/24/10 @	100.0000
Spot F/X 1.000		Swap	
Trade Settlement		Fixed	3.96050% ACT/ACT 1
3/24/03		Floating	2.49422% ACT/360 2
		Swap Par Amt(FLT)	1000 M
		Underlying Curves	
		Price Date	EU 3/19/03 45<SWDF#> 45
		Crv Settle	3/24/03 A<B/A/M>A
		Z-Spread	484.4 bp
Gross Spread Valuation			
Implied Value	113.8395	Money	264.7M = Spread(bp) 427.2
Swapped Spread Details			
Calculate	3	Money	Spread(bp)
1: Bond Price	87.37000 / 8.75554%		
Swap Price	100	Cash Out	-12.6300 126.3M = 203.8 bp
2: Swap Rate	3.96050%	Bond Cpn	6.2500 138.4M = 223.4
		Redemption Premium / Discount	0.0000% 0.0 = 0.0
		Funding Spread	0.0 bp 0.0M = 0.0
3: Swapped Spread			427.2 bp
1 <Go> for X-currency spread summary, 2 <Go> to save, 3 <Go> to update swap crv			

Z-Spread higher than par-par ASW spread as bond price significantly lower than par

Par-Par ASW spread

Source: Bloomberg

6. What Drives The Basis?

The yield of corporate bonds and premiums on default swaps are linked through the asset swap arbitrage relationship. In theory, the spreads should trade closely in line. In reality it is the exception rather than the norm for CDS to trade on a flat basis to the cash market. In fact, the relationship can be highly volatile and the levels can diverge greatly. The CDS basis can be negative or positive as an end result of a range of forces both structural and technical pulling the CDS in different directions.

The Main Drivers

Market valuations are distorted by lumpy flows

Although the default swap and cash bond markets are essentially just different markets for credit risk, they are not necessarily used by the same participants. In fact certain flows in the protection market can lead to significant default-pricing volatility and substantial divergences in yields for the same underlying credits.

Table 14: Credit Default Swap Basis Drivers

	Pulls Protection Tighter (Negative Basis)	Drives Protection Wider (Positive Basis)	Either Tighter or Wider (Uncertain Impact)
MARKET FLOW	Synthetic CDOs/Portfolio Products	CB Issuance / Arbitrage	Fixed Rate Debt Illiquid
BASIS DRIVERS		Negative Credit View Repo Market Optionality	
STRUCTURAL	CDS is Unfunded	"Soft" Credit Events in CDS	Coupon Step-Up (down) Language in Bonds
BASIS DRIVERS	CDS offers Investment Flexibility	Cheapest-to-Deliver Option	
	Debt Trades Above Par in Cash Market	Debt Trades Below Par in Cash Market	
	CDS Counterparty Risk		

Source: Merrill Lynch

Market Flows That Drive The Basis

■ Synthetic CDOs/Portfolio Products

Synthetic CDOs imply net protection selling on broad range of credits

A key factor that can drive default swap spreads tighter on a broader range of credits is the launch of large synthetic CDO transactions. In order to sell synthetic credit risk into these structures, the originating investment banks will typically have to build up long credit positions (sell protection) in a wide range of names before or immediately after the transaction which will tend to pull the **overall CDS market tighter**.

In order for a CDO to optimise leverage, rating and funding costs the underlying portfolio of credits must be highly diversified by name, industry and geography. Credits which offer a different profile from the heaviest weightings in the index may not be very liquid in the CDS market but are very important for the overall economics of CDOs and tend to attract a disproportionate offer pulling in CDS premiums. In the cash market by contrast investors tend to focus much more on large liquid issues that have heavy index weightings.

■ Fixed Rate Debt Illiquid

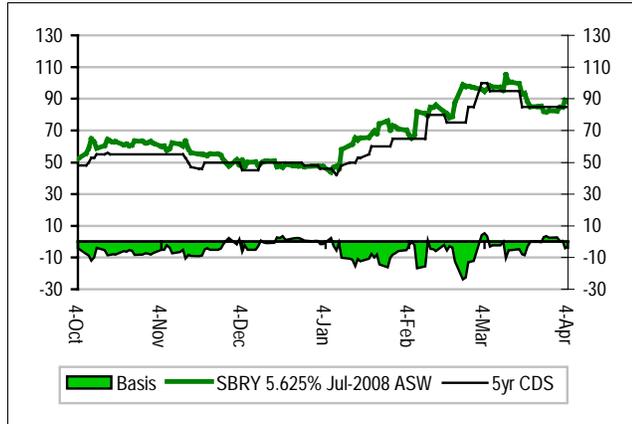
The illiquidity of a company's fixed rate debt can have a distorting impact on the CDS basis. Illiquidity can weaken or strengthen the basis.

If CDS more liquid than debt . . .

In the cash market, investors will typically favour large liquid benchmark bonds and demand additional spread on illiquid paper. Investors looking for exposure to credits that have illiquid debt outstanding can opt to sell protection on the credit instead. In this case, protection can be more liquid and this tends to **pull CDS spreads tighter**.

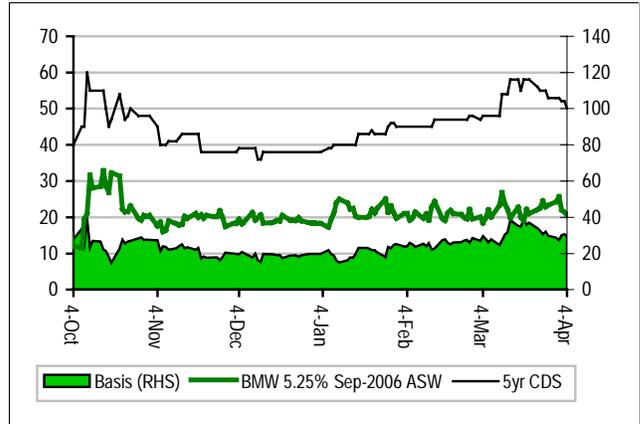
An example of this situation arguably is Sainsbury's, which is consistently indicated as having a negative basis although this is based on limited bond turnover.

Chart 42: Sainsbury's CDS Basis



Source: Merrill Lynch

Chart 43: BMW CDS Basis



Source: Merrill Lynch

. . . but, if debt is tightly held

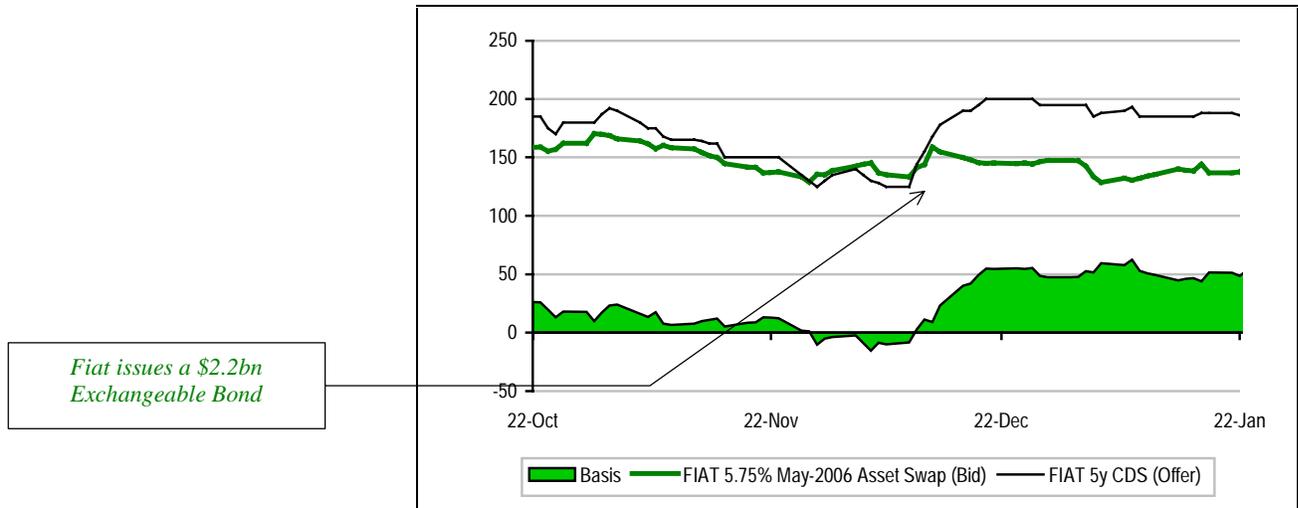
Sometimes, however, the illiquidity of an issue may not be due to its small size but due to its popularity with retail investors and its place as a core holding in domestic funds. In such cases, this debt can trade very tight even through volatile markets and the basis can be positive. A good example of this is BMW, whose bond debt is very tightly held, and the **CDS trades wider**.

■ **Convertible Bond Issuance**

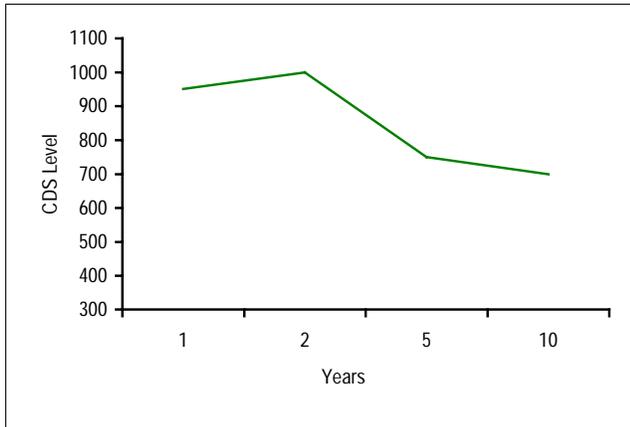
Credit hedging activity by CB investors widens the basis

A typical situation where the **CDS is driven wider** by market flows is during and following the issuance of a convertible bond. In such circumstances CB investors may look to unlock “cheap” equity volatility by hedging credit risk – the credit derivative market typically offers the most effective means of doing this quickly in large size. The following chart illustrates the impact on FIAT’s basis following the issuance of a \$2.2bn bond exchangeable into GM equity.

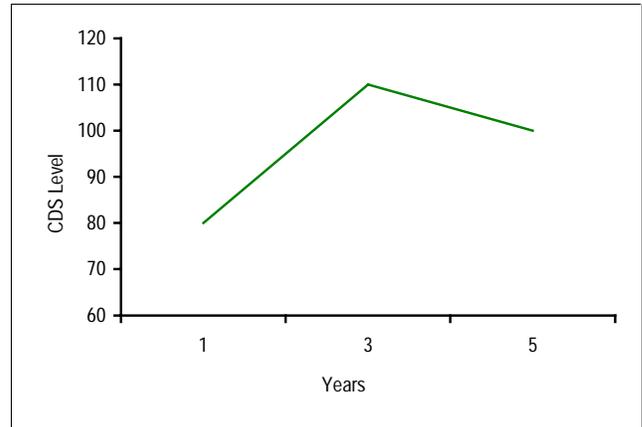
Chart 44: Fiat Default Swap Widened Sharply Following its Exchangeable Issue in 2002



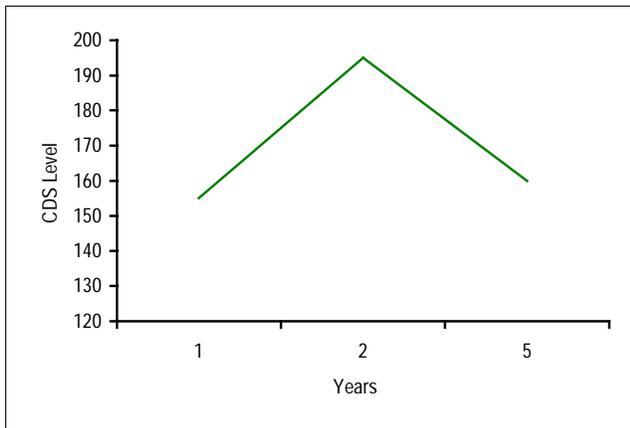
Source: Merrill Lynch

Chart 45: FIAT CDS Curve


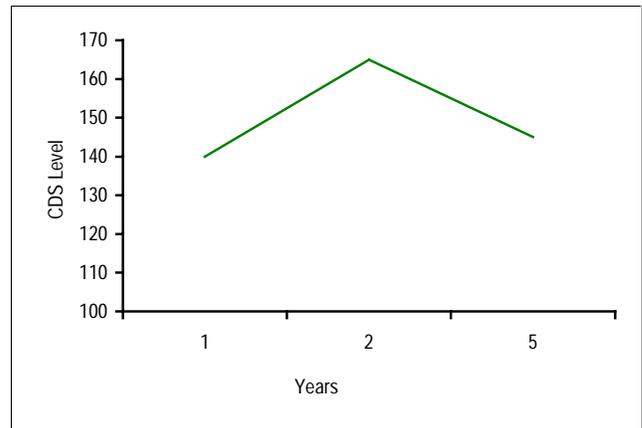
Source: Merrill Lynch

Chart 46: ViE CDS Curve


Source: Merrill Lynch

Chart 47: TMMFP CDS Curve


Source: Merrill Lynch

Chart 48: UNWS CDS Curve


Source: Merrill Lynch

The convertible bond is typically hedged to the put date. This hedging activity impacts the default swap curves by introducing a "kink" at the put date of the convertible. The charts above highlight this effect.

■ Negative Credit View

Easier to short credit in protection market

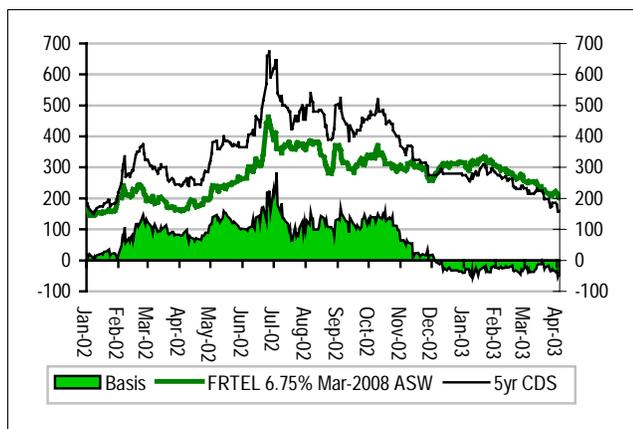
Default swaps offer a means of taking a generic credit view by either selling protection (long credit) or buying protection (short credit). This is probably most important when that view is negative, as buying protection is typically much more straightforward than arranging term borrowing of bonds for selling short. As a result, the protection buyer may be willing to pay more for protection than the bid side of the asset swap spread **driving the basis wider**.

In addition to outright bear strategies, CDS can be extremely useful for hedging illiquid credit exposures (such as loans or counterparty risk concentrations). Indeed the British Bankers Association Credit Derivatives Report 2002 estimated that, with 52% of the market, banks are by far the biggest buyers of protection. Such hedging of credit exposures is made realistic by partial capital relief that is generally made available by bank regulators.

As the CDS is typically the instrument of choice for banks hedging worrisome exposures and hedge funds expressing aggressively bearish views, the CDS market is often viewed as a barometer of sentiment towards an issuer. This characteristic is illustrated in Chart 49 to Chart 52. With France Telecom, the basis widened to almost 300 in the middle of last year as the market worried about the company's liquidity and leverage. Interestingly as the markets started to turn

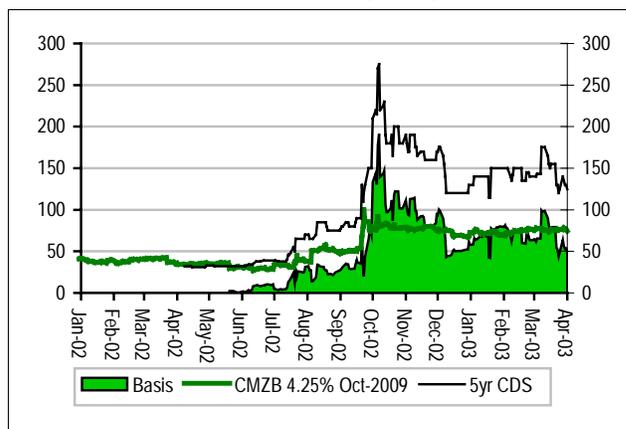
more bullish on FRTEL in November 2002, this basis collapsed. In the case of Commerzbank, worries about the German banking system in September 2002 saw default swap levels blow out much more rapidly than bond spreads causing the basis to balloon wider. With Endesa, the basis widening was slow but persistent as investors grew cautious on credits with Latin American exposure. Finally, when Vivendi Environnement needed to renegotiate certain terms of its convertible bond due to the financial problems of its parent, this was accompanied by a sharp widening of the basis.

Chart 49: France Telecom CDS Basis



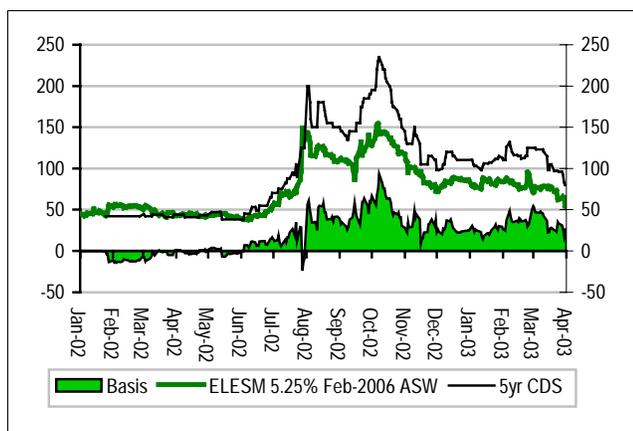
Source: Merrill Lynch.

Chart 50: Commerzbank CDS Basis (senior)



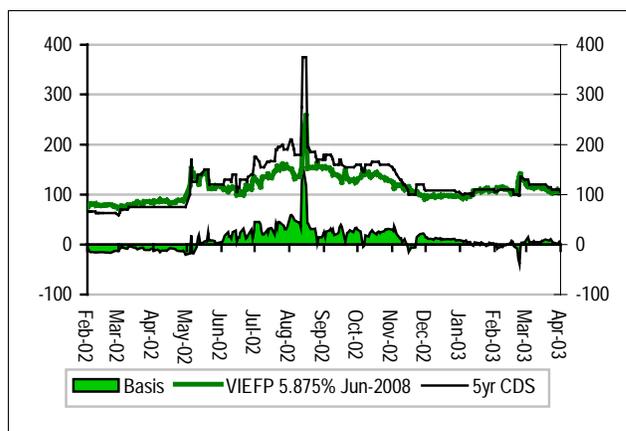
Source: Merrill Lynch.

Chart 51: Endesa CDS Basis



Source: Merrill Lynch.

Chart 52: Vivendi Environnement CDS Basis



Source: Merrill Lynch

■ Repo Market Optionality

Repo market option for cash bond investor widens basis

An investor in a bond typically has alternative means of financing that position either as a normal on-balance sheet holding or in the repo market. The lowest cost option will typically be favoured.

Bonds can usually be funded in the repo market at or around Libor. If the bond becomes special, the investor would be able to roll over the funding at a cheaper level. However, the reverse is true if the bond is not special in the repo market, i.e. the funding could increase above Libor. However, this would be capped by the investor's own cost of funding. The cash bond investor, therefore, holds a repo market option that makes the bond more attractive than the default and would tend to **drive the basis wider**.

Structural Basis Drivers

Default swaps effectively lock in funding at LIBOR

■ Selling Protection is an Unfunded Investment

A key difference between selling protection and buying an asset swap is that the default swap is unfunded. However, the protection seller is effectively locking a spread relative to LIBOR. Thus, for an investor which is funded above LIBOR selling protection tends to be particularly attractive. In our opinion, this represents a key advantage for the synthetic market for two reasons:

1. Most market participants and “street” trading desks fund their credit books at spreads above LIBOR. Default swaps therefore give the opportunity of generating greater carry than similarly yielding asset swaps.
2. Losing the necessity to fund the credit purchase, makes it easier for credit buyers to leverage their credit views without actually borrowing.
3. The unfunded nature of credit derivatives is an important structural attraction of selling protection which tends to **pull CDS spreads tighter**.

Broadening of credit names and different maturities

■ Investment Flexibility

A further advantage of default swaps for credit investors is that they can greatly enhance investment flexibility for investors who are reliant wholly on the cash market. Investors who maintain a long credit view can take advantage of the CDS market in the following ways:

- The CDS market can be actively traded in names which are not existing major bond issuers. This can allow credit investors to achieve greater diversification of risk exposures.
- Even amongst existing issuers, the existence of a default swap curve in 1, 3, 5 and 10 years can offer investors a broader range of maturities from which to construct a portfolio.
- The flexibility provided above would, other things equal, attract protection sellers leading to tighter protection spreads and consequently a **tighter basis**.

Protection buyers take significant counterparty risk and demand tighter spreads

■ Counterparty Risk

Default swaps offer a synthetic means of assuming or managing credit risk. The risk profile is, however, more complex than positioning a cash bond where repayment is dependent only on the performance of an underlying bond. With a CDS, the contractual arrangement is with the swap counterparty rather than the underlying credit. Thus, the protection buyer is exposed not only to the default risk of the Reference Entity but also to the ability of the counterparty to make good under the default swap. A loss due to counterparty risk would occur if following a Credit Event, the counterparty also defaulted – thus correlation of credit risk is central to this joint-event equation. The higher the correlation of default risks the greater the risk for the protection buyer. Thus, for example buying protection on an Italian bank from another Italian bank should be more risky than buying the protection from a similarly rated US institution. Counterparty risk is discussed in more detail in Chapter 12.

As the protection buyer also assumes the counterparty risk of the seller, this will tend to reduce the premium it is willing to pay and therefore **tighten the basis**.

All Pari-passu claims rank equal, but some are less equal than others

■ Cheapest-to-Deliver Option

Following a Credit Event, a protection buyer is able to deliver any qualifying loan or bond in return for a full par payment (assuming physical settlement). Thus, if different pari-passu obligations are trading in the market at significantly different market prices it is likely that the protection seller will likely end up owning the least favourable (lowest price) alternative. Other things equal, protection sellers should be compensated for this risk. Interestingly, however, given the extensive

credit derivative activity referencing major credits, following a default there can be large demand for the cheapest-to-deliver bond from protection buyers – this can lead to a market “squeeze” on these bonds with the paradoxical effect of their price rising. The cheapest to deliver option is a structural factor, which tends to **drive CDS premiums wider**.

■ "Soft" Credit Events

Restructuring can give rise to "soft" credit event

CDS contracts that include the Restructuring credit event (old-R, mod-R or mod-mod-R) could give rise to "soft" credit events. A Restructuring credit event can be triggered by any of five events which range from "hard" restructurings such as debt-for-equity swap to "soft" restructurings such as extension of maturity.

In “hard” restructuring situations, it is likely that for a given seniority, the debt of an issuer will trade at a similar cash price irrespective of maturity or currency. In a “soft” scenario though, debt may still trade on a yield basis and cash prices may not converge. The protection buyer’s “Cheapest-to-Deliver” option is therefore typically of greater value in “soft” restructuring scenarios and **would tend to drive the basis wider**.

■ Coupon Step-Up Language

Step-up (step-down) language would widen (tighten) the basis

Since 2000, it has been increasingly common for issuers to provide coupon step-up language in their bond issues. Under such structures, coupons increase if the credit rating of the issuer is downgraded and may step-down again if the rating subsequently rises.

In the event of a *downgrade*, holders of bonds with step-up language would benefit from a coupon increase. However, sellers of default protection would not receive this benefit. As a result, the default swap should trade wider than the step-up bonds, i.e. the basis should be positive. The reverse would be true, i.e. basis would be negative, if in the event of an *upgrade*, the bonds with step-down language suffer from a coupon decrease unlike the protection premium.

Where the rating trend is negative, coupon step-up language exerts a widening impact on the basis but can exert a tightening influence when the credit trend is improving.

■ Debt Trades Below or Above Par

Basis widens (narrows) if debt trades below (above) par

Below Par

A seller of protection is exposed to the par amount following a credit event unlike a cash bond where the buyer is exposed only to the price paid for the bond. As a result, the protection seller would demand a higher spread than the bond if the bond is trading at a discount to par, i.e. the **basis should be wider**.

Above Par

The reverse is true when the bond is trading at a premium to par, i.e. the protection seller is exposed to a lower amount than the cash investor. **The basis should therefore be tighter**.

Although . . .

Whilst the above points on bond price are extremely important analytical points when considering the relative riskiness of CDS, there are caveats. The bond market is aware of the increased capital at risk when investing in a bond trading above par and this may already be reflected in a higher yield for higher priced issues (i.e. tighter basis). Secondly, an asset-swap is a package product with the asset swap spread reflecting not only credit risk but also the initial “loan” or “deposit” to/from the asset-swap seller. As a result, a standard par-par asset swap will tend to generate a higher asset swap spread (and therefore tighter basis) than a below par bond with an identical yield-to-maturity.

Other Basis Relationships

We can also observe relationships between basis and spread, basis volatility and equity volatility.

*Negative basis bounded by
arbitrage forces . . .*

■ **Basis & Credit Quality**

The basis can range from a small negative to a large positive. When a negative basis occurs, it is typically on high quality credits where the bonds are trading at relatively tight spreads in the cash market. As the basis becomes more and more negative, investors that have a low cost of funding would step in to buy the bond and buy protection to maturity and receive a positive carry. Subject to funding cost and capital considerations, investors should be willing to continue to put on such package trades until the negative basis disappears. Thus arbitrage forces act to prevent a negative basis from falling below a particular level. In practice, we find that negative basis situations of over 20bps are relatively rare.

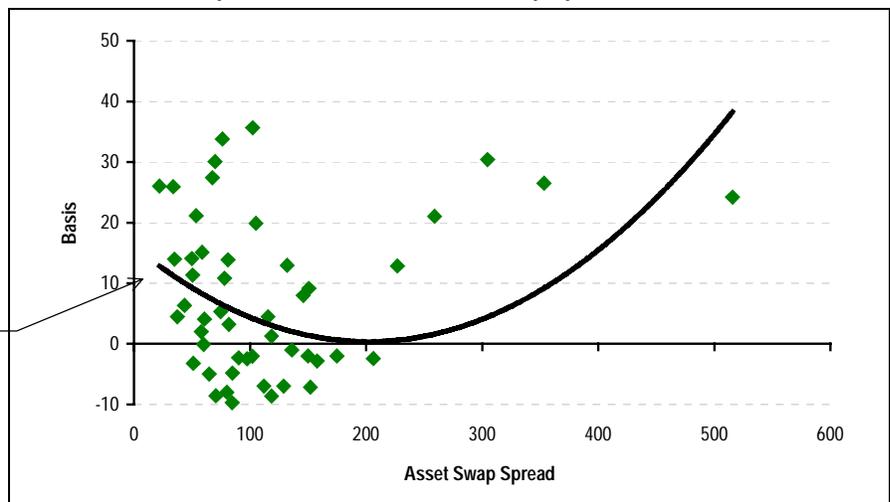
Because there are fewer practical arbitrage forces to quickly pull back protection spreads when they are much wider than the cash market, there are often opportunities to sell protection and generate a much higher yield.

*. . . while basis widens as credit
deteriorates*

As the credit quality deteriorates, we expect the basis to widen. However, we note that for extremely high rated entities the basis also tends to rise. Whilst it is common for triple-A rated credits to trade through Libor, it makes no sense to sell credit protection for a negative premium, i.e. the default swap premium should be positive.

We observe that the average basis tends to increase as spreads increase. As such it is quite rare for a negative basis to be available where the asset swap spreads is above 200bps. We highlight this relationship in the chart below.

Chart 53: Relationship Between Basis and Asset Swap Spread



*Bonds of higher quality
issuers trade through LIBOR
but CDS premiums bound at
zero*

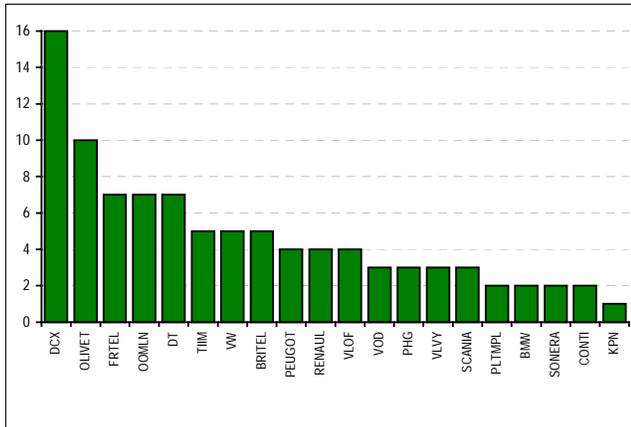
Source: Merrill Lynch

■ **Basis Volatility**

The basis can also be relatively volatile as a result of general market flows and due to uncertainties in the fundamental position of the company. We look at the historical volatility of the basis for benchmark names by averaging the daily basis movement over the last year. The chart below highlights that over the last year average basis volatility ranged from a high of 20bps to a low of 1bp.

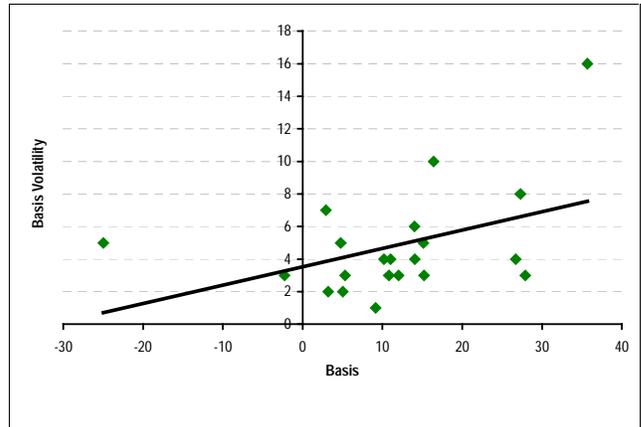
We also looked at the relationship between basis volatility and the basis (see Chart 55). Generally speaking, the wider the basis the greater the volatility of the basis which is an intuitively satisfying result. Credits that have high basis volatilities relative to the basis might be attractive candidates for protected bond strategies.

Chart 54: Historical Basis Volatility (bps) for Benchmark Names



Source: Merrill Lynch. Basis volatility is trailing two-week average daily basis change.

Chart 55: Basis Volatility Increases With Basis



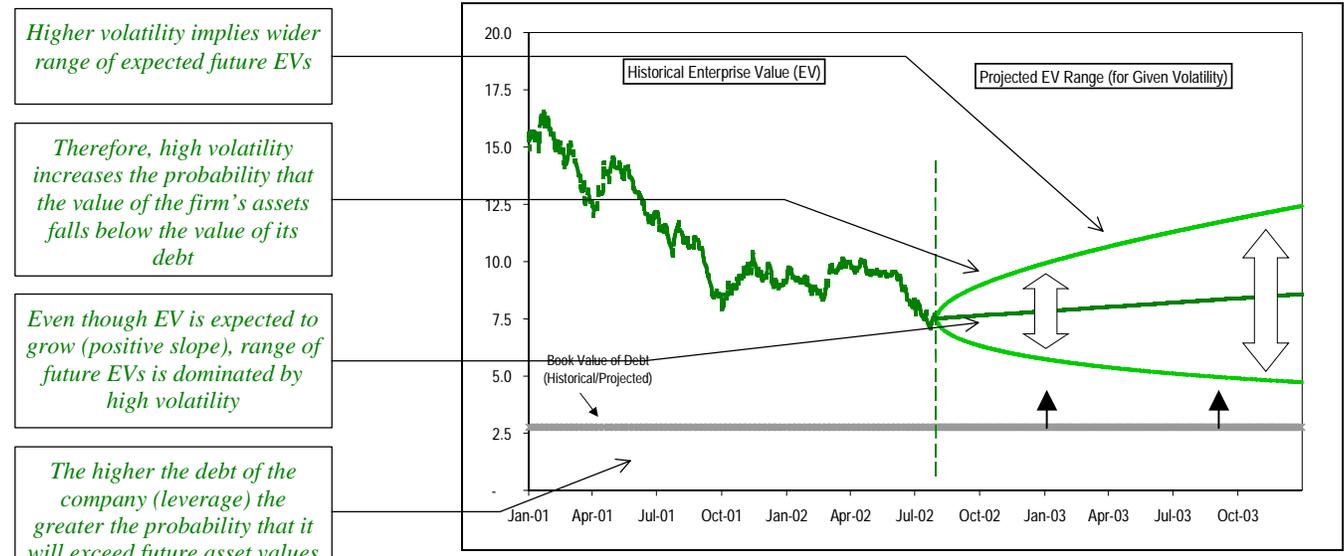
Source: Merrill Lynch. Basis volatility is trailing two-week average daily basis change.

Equity Volatility and Default Basis

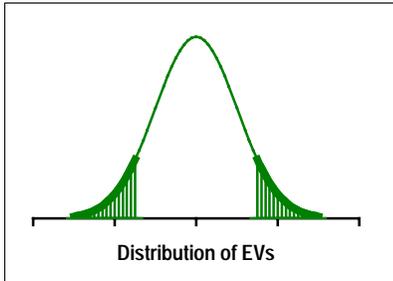
This section is contributed by Jón G. Jónsson

Credit spreads are viewed as an increasing function of a firm’s asset volatility and leverage under contingent claims models. The Enterprise Value (EV) of firms with high asset volatility (which is approximated by the volatility of their equity) has a higher probability of taking on extreme (“tail”) values, including those that would be below the debt of the company.

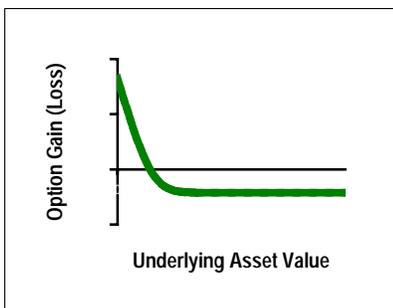
Chart 56: Illustration of the Enterprise Value-Volatility-Leverage Relationship



Source: Merrill Lynch

Chart 57: High Volatility Increases Probability of Extreme (Tail) EV Values


Source: Merrill Lynch

Chart 58: Return Profile of a Long Put/Protection Position


Source: Merrill Lynch

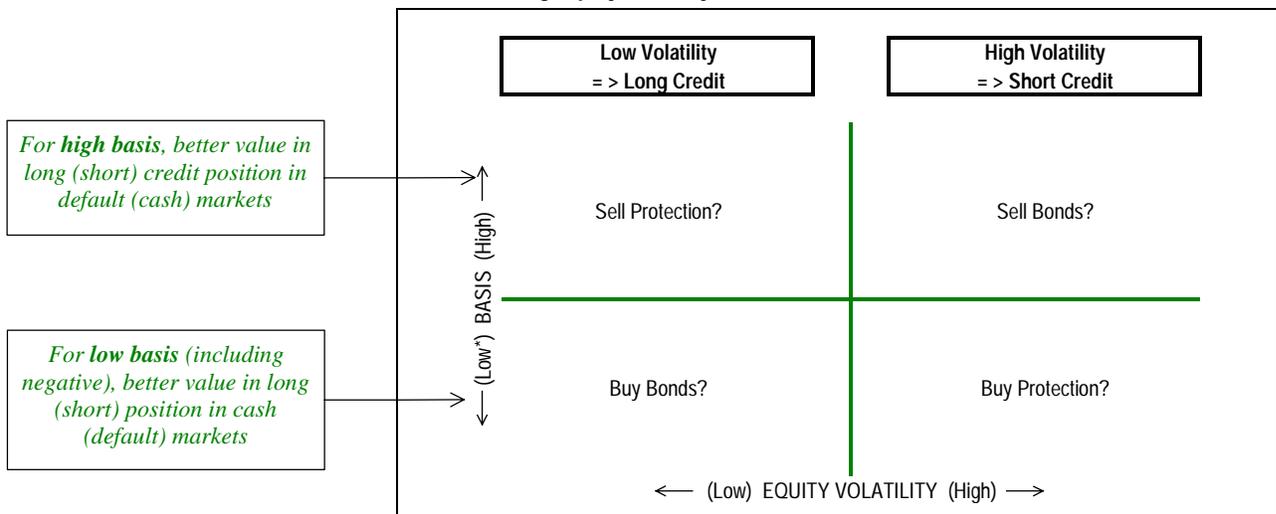
All other things equal, investors should be attracted to buying protection in a company whose assets are volatile (and therefore more likely to reach extreme or “tail” values). Since the return profile of a long protection position is similar to a put option (“small” running premium with the possibility of a “large” terminal pay-off), buyers should be more likely to end up “in the money” owning protection in companies with volatile assets.

The default basis can also be viewed as a risk indicator. If the basis is negative, then there are investors willing to take a long credit position (i.e., sell protection) at lower spreads than the cash market. Conversely, if the basis is positive, there are (risk averse) investors unwilling to accept the asymmetric pay-off of selling default protection at cash market spreads. If cash market spreads are primary indicators of credit risk, the basis can be thought of as a secondary indicator of credit risk.

Given the above, the **sale of default protection** should therefore be more attractive than purchase of a bond when the **basis is high relative to volatility** of the firm. In contrast, the **purchase of default protection** should also be more attractive than sale of a bond when the **basis is low relative to volatility**.

We do not expect to see low basis trades for highly leveraged issuers with volatile assets to remain available for long. Hedge funds could see them as an attractive opportunity to buy firm volatility cheaply, particularly given the longer tenor of the default swap in a market where credit spreads and equities are so correlated.

The relationship between volatility and the basis has also information content for cash investors unable to buy credit default swaps. It may be too expensive to purchase default protection (high positive basis) just when one would need it (high volatility), but that may prove to be the best signal to sell the bonds.

Chart 59: Using Equity Volatility & Basis for Relative Value in Cash vs Default Markets


Source: Merrill Lynch. * Including negative basis.

7. CDS Investor Strategies

Credit has grown from a simple long/short directional investment into a wide range of next generation CDS-based strategies. Default swaps have rapidly developed into a major sector within global credit markets. The most obvious uses for investors are as higher yielding ways of going long a credit or as a “cheap” means to take a credit short. However, the risk transference structure of the CDS is more flexible than plain vanilla bonds and can be employed in a wide variety of more sophisticated investor strategies.

Cheap Longs/Shorts

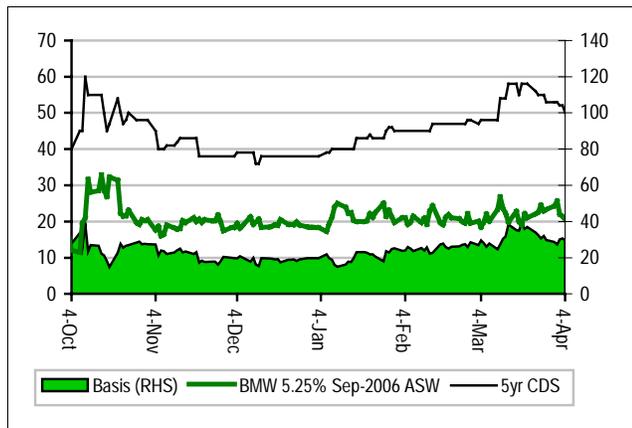
The most basic strategy is to invest via credit derivatives when a higher yield is available . . .

. . . or to buy protection as a cost effective credit short

In What Drives The Basis? (Chapter 6) we explained the different factors that give rise to a difference between the protection and the comparable asset swap spread. The most simple strategy to exploit anomalies that emerge is the **cheap long**. This is a situation in which it is more advantageous to take exposure to a credit via a CDS than through the cash market. Such opportunities occur when the basis between the CDS and the asset swapped spread is positive, i.e. the income generated by selling protection is greater than yield generated by buying a similar maturity asset swap. However, a positive basis alone, is not sufficient for qualification as a “cheap long” since there may be a fundamentally good reason why the CDS trades wider. However, if the basis is positive and has recently widened for technical reasons, it probably represents a “cheap long” opportunity.

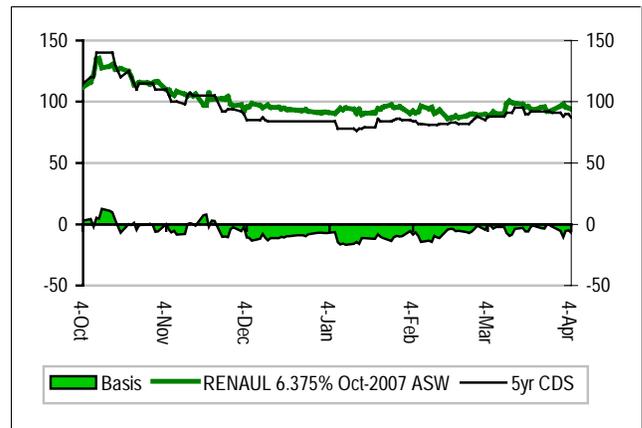
A **cheap short**, on the other hand, refers to a situation where the CDS market can be used to take a “low cost” bearish view on a credit or the market. Most obviously “cheap short” opportunities occur when the basis is negative, i.e. the protection is trading tighter than the asset swapped spread. However, given the difficulty in locking in term borrowing of corporate bonds for selling short, CDS “cheap short” opportunities can be attractive even where the basis is positive but the cash market trades tight and there is scope for fundamental volatility.

Chart 60: “Cheap Long” – BMW



Source: Merrill Lynch

Chart 61: “Cheap Short” – Renault



Source: Merrill Lynch

In Chart 60 we illustrate the case of BMW which has typically traded at a wider level in the CDS market than in the cash market and might be considered a “cheap long” opportunity by investors. By contrast, Renault in Chart 61 may be considered a cheap short since its CDS more often than not trades through its asset swap.

Credit Linked Notes (CLNs)

■ Structure

CLNs are fully funded balance sheet instruments . . .

CLNs are fully funded balance sheet instruments that offer the holder synthetic credit exposure to a reference entity (or multiple reference entities) in a structure resembling a synthetic corporate bond or loan. Credit risk can be transferred in return for payment of interest and repayment of par. CLN issuance can either be direct issuance by financial institutions, for instance, or issuance by a Special Purpose Vehicle that holds collateral securities financed through the issuance proceeds. In this section, we concentrate on the latter form of CLN structure.

. . . with embedded CDS

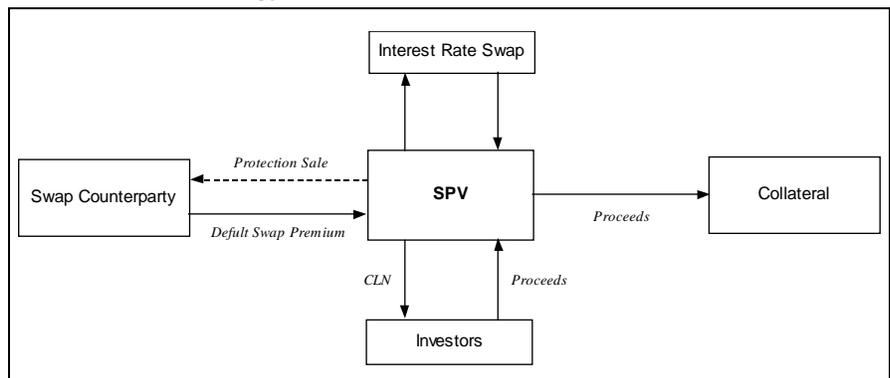
CLNs are created by embedding credit derivatives in new issues from an SPV. Thus the CLN investor achieves synthetic exposure to a CDS in a funded security form. The SPV does the following:

- The issuance proceeds from the CLN are used by the SPV to purchase pre-agreed collateral to fund the CDS.
- SPV simultaneously enters into a CDS with a highly rated swap counterparty (such as a dealer) whereby it sells credit protection in return for an ongoing premium.
- SPV grants a security interest in the collateral against the SPV's future performance under the above default swap.

Three CLN components: SPV, collateral and CDS

As shown in Chart 62, the CLN can be deconstructed into its three main components: the SPV, the collateral, and the credit default swap. The SPV may also need to enter into an interest rate swap (or a cross-currency swap) to reduce interest rate risk and to tailor the required cashflows of the note. For instance, a swap component may be necessary if the collateral cashflows are fixed-rate but CLN cashflows are required in floating-rate form. At inception, any swap would be on-market but as markets move, the swap may move in or out-of-the-money.

Chart 62: Structure of a Typical CLN



Source: Merrill Lynch

■ Enhanced Coupon

Enhanced Coupon

The performance of the CLN is linked to the performance of the reference entity. The CLN coupon, which can be fixed or floating, is the sum of the funding element from the collateral and the default swap premium received from the swap counterparty. The CLN investor receives this enhanced coupon and par redemption provided there has been no credit event on the reference entity or the collateral has not defaulted.

■ Credit Event

Following a credit event, the note accelerates

If a credit event occurs to the reference entity during the life of the CLN, then assuming physical delivery, the swap counterparty delivers a qualifying obligation to the SPV of equal notional amount to the CLN. In turn, the SPV delivers this

obligation to the investor in lieu of any future coupons or principal redemption. The collateral is sold to form the par payment made by the SPV to the swap counterparty under the terms of the default swap. The CLN is redeemed by the issuer at zero percent. Any accrued interest from the collateral or default swap premium forms an accrued CLN coupon, which the investor receives.

Collateral risk

If the collateral has a market value in excess of 100% at the time of a credit event, the investor further receives this excess as the default swap counterparty is entitled to only 100% of the notional amount. Similarly, if the market value of the collateral is less than 100%, then the default swap counterparty reduces the amount of defaultable obligations it delivers, with this reduction having the same economic value as the shortfall. In instances where the market value of the collateral has deteriorated significantly, such that the withheld obligations become greater than the obligations to be delivered, the investor receives nothing and the default swap counterparty suffers a loss under the contract. The investor is exposed to only the notional value of the CLN and cannot lose more.

■ **Credit Exposure of the Investor**

Exposure of investor

An investor in a CLN has exposure to the credit risk of the reference entity, credit risk associated with the collateral securities and counterparty risk associated with the protection buyer. However, to the extent that the pre-agreed collateral is highly rated and also that the swap counterparty is highly rated, most of the emphasis is on the credit risk of the reference entity. Where the SPV has entered into an interest rate/currency swap, there may also be a potential exposure to these swap counterparties.

■ **What Are the Advantages of CLNs?**

- Relative Value – CLNs give investors the opportunity to exploit anomalies in pricing between cash and protection markets. In particular where the default swap basis widens and the credit story remains acceptable to the investor, significant yield enhancement can be achieved.
- Tailored Exposure – CLNs can be used to gain exposures to reference entities in a variety of currencies, maturities and coupon structures that may not be available in the cash market. They may also be used to gain greater leverage to credit risk.
- Maturity – as the protection period is not tied to any particular issue, it is possible to synthetically create a maturity that is different from existing debt issues by the reference entity. In particular, this means that investors who have lines for the credit which are shorter than outstanding issues can use CLNs to shorten the maturity.
- Non-issuers – similarly, CLNs can be created by referencing credits which have not yet issued in the bond market. This can help with portfolio construction and diversification.
- No Direct Derivatives Contract – whilst the CLN contains embedded interest rate and credit default swaps, there is no need for the investor itself to enter into either contract.
- Counterparty Risk/Credit Line Usage – investing in a CLN does not use up counterparty credit limits relating to the sale of protection or the interest rate swap. This feature is relevant for lower-rated investors, but also for those who are highly correlated to the reference credit. Protection buyers are exposed to the credit risk of the SPV collateral and not the CLN investor.
- Infrastructure – Selling protection via a funded purchase of a CLN will bypass the need for infrastructure and pricing systems necessary for default swap trading.
- Listed – CLNs can be listed and are transferable in the same way as other bond issues.

■ What Are the Disadvantages of CLNs?

- Liquidity – CLN issues are usually much smaller than corporate bond issues and do not have plain vanilla credit structures – thus whilst freely transferable they will not typically be liquid. Shorter maturities as discussed above can to a certain extent mitigate this.
- Cheapest to Deliver – If a credit event does occur to the reference entity, physical settlement of the default swap will likely consist of the lowest priced bond ranking pari-passu with the reference obligation.
- Medium Term View – There are fixed costs (legal costs) associated with the creation of the SPV and the various aspects of the CLN. These fixed costs are irrespective of notional size or maturity, and will be reflected in the pricing of the issue. Thus we think CLNs make more sense for a medium-term investment horizon rather than for short-term trading purposes.

CLN collateral should be acceptable to both issuer and CDS counterparty

■ Choice of CLN Collateral

The collateral serves two purposes: 1) it provides a base return to the CLN investor and 2) it acts as collateral for the default swap counterparty. As a result, the chosen collateral must be acceptable to both parties. Typical collateral may be obligations issued by the swap counterparty or asset-backed AAA paper (GIC-backed, for example). Asset-backed paper typically trades at a positive spread over LIBOR (whereas AAA government debt trades at a spread through LIBOR). Using ABS paper minimises the negative carry to a non-AAA investor of funding a AAA rated security. The choice of collateral should be such as to minimise the risk of joint probability of default of the reference entity and the collateral.

■ Special Purpose Vehicles

Benefits of SPV

An SPV is an independent company (in the US it is a trust) primarily designed to enter into certain limited transactions to enable it to issue debt customised to a specific payout profile or suitable to investors. Each SPV issue is collateralised separately and has recourse only to a defined pool of assets. So while the same SPV can issue any number of notes, no two issues will impact each other. An appointed and independent trustee ensures that the interests of all parties to the SPV – the default swap counterparty and the CLN investor – are considered and preserved. The SPV can be situated in a number of jurisdictions, providing tax benefits, and the issued CLN can be rated and/or listed as required.

Buy Bond, Buy Protection

Protected Bond Packages

Protected bond packages involve an investor buying a bond and simultaneously buying credit protection on the same credit to maturity. Two types of protected packages can be attractive: **negative basis** and **small positive basis** trades. There are a number of considerations in weighing up the relative attraction of protected bond packages. These fall into the following categories:

Negative basis trades offer positive carry . . .

■ Carry

Negative basis trades are the most obviously attractive type of protected package since they generate a positive carry. The trade involves taking a long position in the cash market and simultaneously buying credit protection on the same reference entity at a **tighter** level than the asset swap spread on the underlying bond. For investors who can fund at LIBOR, such packages are self-funding for the life of the transaction. This carry in itself is, however, often not wide enough to entice investors to buy these packages since funding costs will typically be above LIBOR and there may be other capital or administrative costs to consider.

... plus a chance to profit from future volatility

■ Volatility

The real attraction of these trades is “free” or “cheap” exposure to market volatility with limited credit downside. As the cash bond market and the default markets are driven by different buying and selling flows, day by day and month by month, the basis can be highly variable. This volatility may reflect technically driven market movements (such as convertible bonds issuance) or fundamental credit developments (such as banks buying protection against worrying loan exposures).

With a negative basis trade, the investor can often take advantage of this volatility by unwinding both legs of the trade at a profit if the basis swings from negative to significantly positive. Negative basis opportunities are most frequently available on high quality credit situations where the bonds are trading at relatively tight spreads in the credit market. Indeed as spreads get wider, the basis also tends to get more strongly positive. Small positive basis packages that have exhibited high historical basis volatility can also be attractive candidates if investors believe that the high historical volatility is a good indication of the range in which the basis might be expected to trade in the future.

Tends to benefit with credit deterioration

■ Moderately Bearish

Although the holder of the package is essentially credit hedged, the structure is typically most profitable in bearish scenarios.

- The basis tends to be most positive when spreads are wide or widening. Moreover, when credits deteriorate significantly, bids for bonds typically remain but liquidity in protection offers can dry up. Being long protection can therefore be a highly advantageous position.
- Credit events tend to be broader than events of default, which will tend to favour protection buyers.
- The protection holder is the beneficiary of the “cheapest-to-deliver” (CTD) option in the settlement of default swaps.

Bond documentation, e.g. ratings language

■ Bond Documentation

The CTD option will be more valuable if the bond has underlying documentary features which suggests that the bond will not be the CTD following a credit event. Differing covenant language between individual bond issues is a factor which can drive divergence of price performance following credit deterioration or corporate restructuring. Thus being long the issue with the strongest covenants together with protection can be advantageous.

Documentary protection may also take the form of ratings-triggered coupon step-up language. Negative basis strategies can be particularly attractive for bonds with ratings driven coupon step up language – since a credit ratings deterioration could trigger an improvement in the carry on the transaction. Against this, however, many issues also have coupon step down language following upgrades, which can reverse the above impact. Such language is, therefore, most attractive on credits which have a negative trend.

Most attractive with low priced bonds

■ “Dollar” Price of the Bond

Negative basis trades are particularly attractive when the underlying long position in the bond is purchased at a low dollar price. Default contracts effectively provide credit protection for a par value claim on a credit whilst the potential loss on the long position should be capped at the price that the bond is purchased at.

Conversely, there is a degree of principal exposure with these packages when the underlying bond is trading at a premium. In such cases however, this exposure should be weighed against the positive expected value of the CTD option. Where the option is valuable, this may serve as a natural hedge against buying a slightly above-par bond if held until a credit event occurs.

Long Gamma and Risky BPV

Recovery assumption determines P&L on CDS position

■ Unwind Profits or Losses

The profit and loss impact of a given change in the yield on the default swap will not necessarily be the same as for the swapped cash bond. In fact, for an *equal* spread widening in a long 5yr asset-swap and equivalent long 5yr protection position, the loss on the asset-swap will be greater than the gain on the CDS position. This is because buying protection is a long gamma position. This is due to the *survivability* of the annuity stream, which was bought at a lower cost and sold at a higher cost. While the investor has a positive annuity for the remaining life of the trade, the probability of a credit event (and thus elimination of the annuity) is greater at the higher cost than at the lower cost.

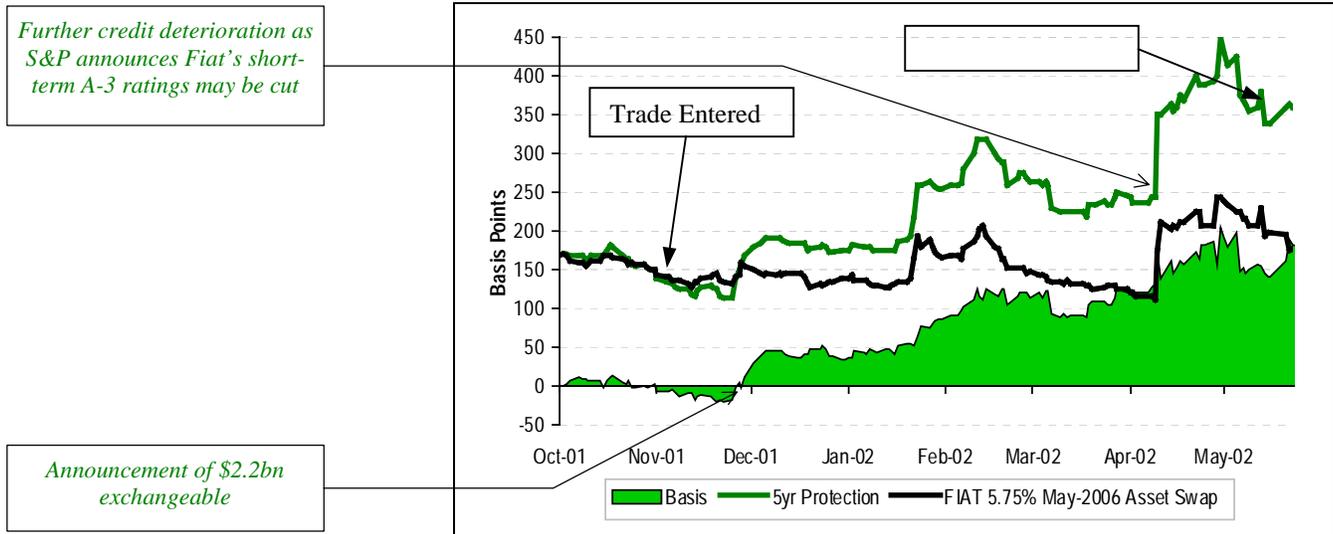
The protection unwind also assumes a below par recovery value. Typically a 35% recovery is assumed for senior unsecured obligations. For recovery assumptions greater than 35%, the P&L on the CDS unwind would be lower and vice-versa. As a result, it is not possible to calculate the present value of a negative basis trade by simply discounting the positive carry over the transaction lifetime.

A full description of unwind mechanics is included in Unwinding Default Swaps (Chapter 4).

■ A Fiat Basis Trade Case Study

In Chart 63 we illustrate the market trends for FIAT asset swap and default. This represented a successful basis trade between November 2001 and May 2002. As can be seen, the basis widened sharply following issuance of a \$2.2bn exchangeable and then later further still on the back of sustained bearish credit sentiment.

Chart 63: FIAT Basis Trend November 2001 to June 2002



Source: Merrill Lynch

In Table 15, we examine how a zero basis trade would have performed based on being unwound six months later.

Table 15: Illustration of P&L for a FIAT Flat Basis Trade

	Buy Package	Sell Package
Notional	€ 10,000,000	
Funding	3mo €LIBOR	
Bond Details	FIAT 5.75% 25-May-2006	
Trade Date	26-Nov-2001	28-May-2002
Bond Price (plus Accrued)	103.5	96.0
LIBOR Spread	140 bps	220 bps
Matched to Maturity CDS	140 bps	380 bps
Basis	0 bps	+160 bps
Profit & Loss on Trading Strategy		
Profit (Loss) on Bond Sale (net of Funding)	€ (289,000)	
Profit (Loss) on CDS Unwind (40% Recovery)	€ 856,000	
Net Profit (Loss)	€ 567,000	

Source: Merrill Lynch

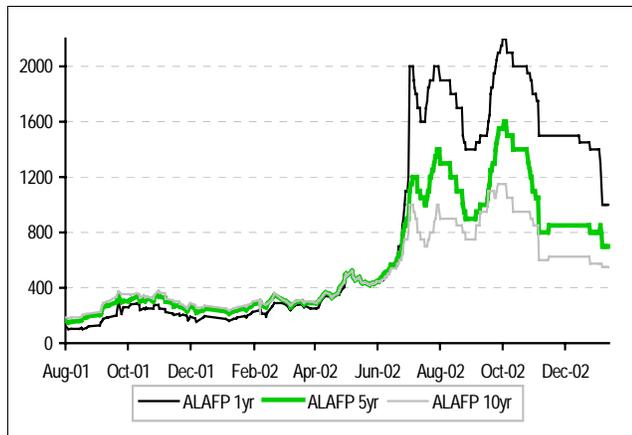
Inverted Curve Trades

■ Curve Inversion in the Default Swap Market

CDS curves can move from steep to inverted as credit quality worsens

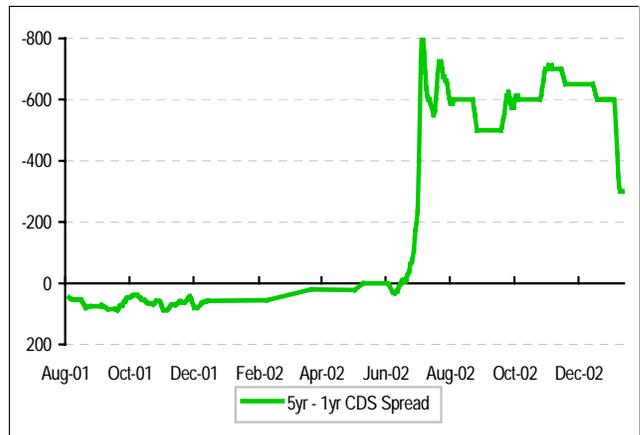
In the cash bond market, as an issuer’s credit quality deteriorates, bonds move from being traded on a spread basis to being traded on a price basis as expected recovery values become a more important part of the valuation equation. As a result, the spread curves of issuers move from being upward-sloping, to inverted (the yield on shorter-dated bonds will be higher than the yield on longer-dated bonds). Default swap curves can also become inverted, with hedgers and bears aggressively buying protection through the shorter-dated contracts. This may occur particularly where the market perceives a realistic chance of a credit event in the near future. In some instances, the inversion in the default swap market may be greater than that in the cash market since protection sellers don’t have the benefit of owning a security trading below par.

Chart 64: ALAFP 1yr, 5yr and 10yr CDS Quotes (bps)



Source: Merrill Lynch

Chart 65: ALAFP 5yr minus 1yr (bps)



Source: Merrill Lynch

Default curve inversion may present an opportunity to shorten maturity and enhance yield, or to benefit from a tightening in the basis between default and cash at the shorter-dated part of the curve. Volatility in default swap premiums tends to be more pronounced in the shorter dated contracts. Alcatel’s default swap curve throughout 2002 shows the extent of the inversion (between 1yr and 5yr contracts) when credit situations turn bearish.

Sell shorter dated and buy longer dated

■ “Cheap” Forward Protection

Curve inversion in the default market also offers investors an opportunity to purchase forward protection at reduced levels. This strategy is attractive to investors who are essentially bearish on a credit, but do not anticipate default during the initial period of the transaction.

Forward protection can be achieved by **simultaneously buying longer dated protection and selling shorter dated protection**. This strategy subsidises the cost of protection by selling shorter dated protection at a wider spread. In such a strategy the investor has offsetting CDS positions during the shorter term while receiving a positive carry.

Consider the following example with respect to a hypothetical credit: an investor buys 5yr protection for 300bps and sells 1yr protection for 500bps thus receiving a positive carry of 200bps in year 1. This is equivalent to buying 4yr protection 1yr forward for 241bps (derived from model). The possible outcomes of this strategy are outlined below.

- **Credit event in year 1:** The investor is completely hedged and receives positive carry up to the occurrence of the credit event.
- **Credit event between year 1 and year 5:** This is a good outcome for the investor who receives the positive carry in year 1 and benefits thereafter by being long protection. The best possible outcome for the investor would require the credit event to occur immediately after year 1, i.e., the investor would receive the full positive carry in the first year and not make any payment.
- **No credit event in 5 years:** This is the worst outcome for the investor who is long protection from years 1 to 5. However, the cost of protection has been subsidised by the carry in the first year.
- The table below highlights the P&L for the above scenarios for a hypothetical credit with default curve inversion.

Table 16: Illustration of P&L for a Cheap Forward Protection Trade

	Buy 5yr CDS	Sell 1yr CDS
Premium (in bps)	300	500
Notional Amount (in €)	€ 10,000,000	€ 10,000,000
Credit Event After 6 months	Bps	in €
Income from 1yr CDS	250	€ 250,000
Outflow for 5yr CDS	-150	-€ 150,000
<i>Net P&L</i>		€ 100,000
Credit Event at Year 3		
Income from 1yr	500	€ 500,000
Outflow for 5yr	-900	-€ 900,000
Recovery Rate	40%	
Profit from 5yr CDS	60%	€ 6,000,000
<i>Net P&L</i>		€ 5,600,000
No Credit Event in 5 Years		
Income from 1yr	500	€ 500,000
Outflow for 5yr	-1500	-€ 1,500,000
<i>Net P&L</i>		-€ 1,000,000
<i>Net P&L versus Outright 5 Year Protection Purchase</i>		€ 500,000

Source: Merrill Lynch

Sub-Versus-Senior CDS Strategies

■ Protection Levels and Recovery Expectations

Default spreads tell us about relative recovery assumptions . . .

Across all instruments, subordinated debt trades wider than senior, although differentials in this yield vary considerably. In the cash market, such spread variations may reflect differing evaluations of default risk or expected recovery following default.

In the credit default swap market however, the credit event probability of senior and subordinated contracts should be identical since a common definition of “obligations” applies to all contracts unless otherwise specified. It is market convention to define the obligations on which a credit event can occur as “borrowed money” – which makes no distinction based on seniority of claim.

Thus the sub-to-senior spread differential in default swap contracts is driven fundamentally by expected recovery values. If subordinated spreads are double those of senior, then the expected subordinated loss following default is double that of senior. Thus a 80% senior recovery (20% loss) would imply a 60% subordinated recovery (40% loss) whilst a 50% senior recovery (50% loss) would imply a 0% subordinated recovery (100% loss).

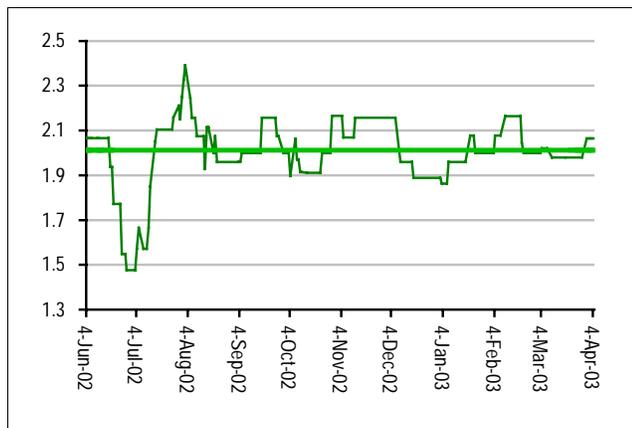
. . . and changing sub-to-senior relationships imply changing recovery assumptions

Further, although protection spreads may move frequently as expectations of default risk shift, any change in the sub-to-senior default premium ratio implies changing relative recovery value assumptions.

For example, if the senior-to-sub spread ratio dropped from 2.0x to 1.5x this implies that expectations of relative recoveries for subordinated have improved. An 80% senior recovery (20% loss) expectation implies a 70% subordinated recovery (30% loss) expectation. And subordinated recovery would not hit 0% until expected senior recovery fell to 33% (67% loss).

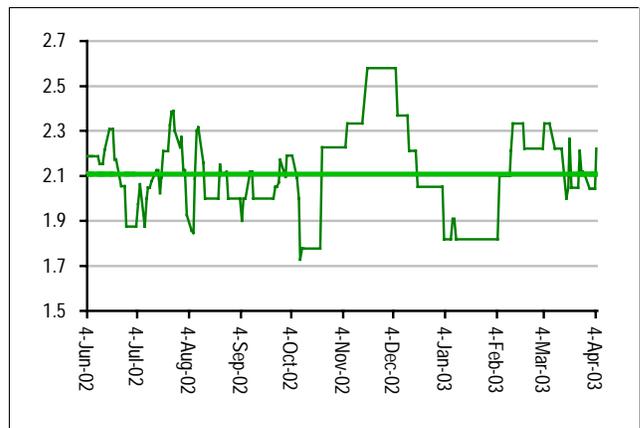
■ Banks and Insurance Companies

Chart 66: RBOS Sub Senior Ratio



Source: Merrill Lynch

Chart 67: STAN Sub Senior Ratio



Source: Merrill Lynch

Differing experience in bank and insurance markets

For major **European banks**, there is an active credit derivative market on both a senior and subordinated level. While default spreads have been relatively volatile for the sector, the average sub-to-senior ratio for the sector as a whole has remained fairly steady at 2x (see Chart 66 and Chart 67 for typical examples). This implies that market assumptions on relative recovery values for banks have remained unchanged.

Less back history for insurance company subordinated protection

The default swap market has historically been less active in **insurance** company credits, and particularly in respect to subordinated contracts. The current fundamental problems facing the sector have changed this situation and activity has grown in contracts referencing the major names.

Potential opportunity to take offsetting subordinated and senior positions

In the current market, there is a marked distinction between insurance and bank sub-senior ratios. **Whilst banks typically trade at about 2x (mid-to-mid), insurance companies trade closer to 1.5x.** Through these levels the market is implying a significantly closer recovery between senior and subordinated recoveries in the insurance sector than in the bank sector.

■ Cash Flow Neutral Trading Strategies

One way of playing changes in sub-to-senior ratios is to take flat-carry offsetting positions in senior and subordinated protection. For example, where the sub-to-senior ratio is high (relative to peers or historical averages), a potential strategy is to sell subordinated protection and buy senior protection (in proportion to the sub-to-senior ratio). This strategy has a couple of angles. First, it offers the chance to unwind at a profit if the sub-to-senior ratio “normalises” to historical averages or peer-group levels. Secondly, if a credit event occurs, the pay-offs will reflect the actual relative recoveries in subordinated and senior debt.

For those insurance companies or banks where the sub-to-senior ratio is lower than expected based on historical data or peer group comparisons, a potential strategy is to buy subordinated protection and sell a greater notional amount of senior protection (in a multiple of the sub-to-senior ratio).

Table 17: STAN Sub-Senior Strategy

	Bps	Notional	in € (per annum)
<i>Initiate on 4 Dec 2002</i>			
Sell 5y Sub (Bid)	115	€ 10,000,000	€ 115,000
Buy 5y Senior (Offer)	50	€ 23,000,000	€ 115,000
<i>Mid-to-Mid Sub/Senior Ratio</i>	2.6		
<i>Unwind After 2 months on 4 Feb 2003</i>			
Buy 5y Sub (Offer)	105	€ 10,000,000	€ 105,000
Sell 5y Senior (Bid)	50	€ 23,000,000	€ 115,000
<i>Mid-to-Mid Sub/Senior Ratio</i>	1.8		
<i>Net Risky P&L (per annum)</i>			€ 10,000

Source: Merrill Lynch

This section is written by
Jeremy Wyett

Convertible Bond Hedging with CDS

Hedging is the technique of managing, or trying to eliminate, specific “unwanted” risks, whilst retaining “wanted” risks. Convertible bonds can incorporate equity, interest rate, issuer credit and currency risks, therefore skilful convertible hedging is the most useful way to isolate only the type of exposure the investor feels comfortable with. The transferring – or hedging – of any one of these risks can make the difference between a profit and a loss. The presence of hedgers impacts all investors as their positions affect valuations and market dynamics for all convertibles. With the development of the CDS market, and the decline in the equity markets, convertible hedge investors are also making their effect felt in the CDS market.

■ Return Profile

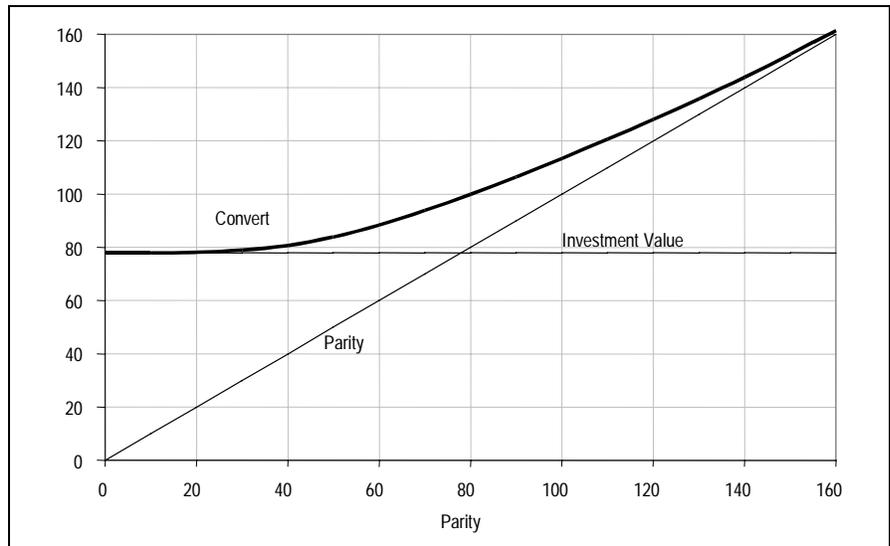
Before we explain why convertible hedgers use the CDS market, firstly we should explain expected convertible bond price behaviour plus the concept of delta hedging as this is the basic form of convertible hedging.

Chart 68 below gives an example of convertible bond behaviour, this is for a normal, plain vanilla convertible that redeems in cash at maturity i.e. not mandatory or of an exotic nature. As the share price (and parity) declines, fixed income characteristics of the instrument will override equity market valuations. At this point, the price of the instrument will be primarily supported by the investment value (bond floor) of the bond – i.e. what the issue should be worth

without equity optionality. Note that the chart is a simplification, as in reality as the shares approach zero the bond floor is unlikely to hold. Similarly, when the share price rises, the convertible will become more equity sensitive.

Chart 68: Convertible Price vs Parity

As parity declines the convertible is supported by the investment value while on the upside the convertible is lifted by gains in parity



Source: Merrill Lynch

Parity is the value of the convertible upon immediate conversion. This is also known as the intrinsic value or conversion value. Parity is expressed in the same terms as the convertible.

$$\text{Parity} = \text{Current Stock Price} \times \text{Conversion Ratio} \times \text{Current FX Rate}$$

For issues that are traded in percent then this is expressed as a percentage of Nominal value as the equation reads:

$$\text{Parity} = 100 \times \frac{\text{Current Stock Price} \times \text{Conversion Ratio} \times \text{Current FX Rate}}{\text{Nominal Value}}$$

Note: When the shares and Bond are denominated in the same currency then the FX rate is 1. Most normally the nominal value is 1000 for convertibles traded in percent.

■ Delta Hedging

The simplest and most common form of convertible hedging is Delta hedging. Here the goal is to neutralise the equity market risk. Most hedged investors wish to take a view on, say, richening of valuations without any exposure to the stock price. Delta hedging would be the primary way of isolating this type of exposure. Contrary to popular opinion hedgers generally do not care whether the underlying shares in a hedge go up or down – the hedger only cares that they move in some direction.

Here the hedger will borrow shares and carry out a short sale of equity against the long convertible position. The number of shares to be sold short will be calculated by multiplying the conversion ratio of the bond by the number of bonds held and then by Parity Delta.

Parity Delta is defined as the points change in theoretical value for a one unit move in parity, it can also be expressed as a percentage. The convertible hedger will have a model that will produce this figure. The conversion ratio is the number of shares into which each bond may be converted.

So, for example, if a bond has a conversion ratio of 100 shares and a parity delta of 30%, for each bond held on a Neutral Hedge, the hedger will borrow and short sell 30 shares. Now, if a hedger has a particular view about the future performance of the underlying shares or considers that the actual parity delta differs in some way from that produced by the model they may decide to sell more shares short, known as a “Heavy” hedge, or less shares, known as a “Light” hedge.

This position will be managed by the hedger according to movements in parity delta and any views on heavy or light hedges. This will be done by either borrowing more shares to sell short if the parity delta increases or a view for a heavier hedge is taken, or buying shares back if parity delta reduces or a view for a lighter hedge is taken.

■ Credit Hedging Using CDS

The convertible hedger will also look to hedge credit risk where possible and desirable. By desirable, we mean that if a convertible is trading far in the money (equity price far above conversion price – far right of Chart 68), it is unlikely that a hedger will be so concerned about hedging the credit risk. Of course, the opposite is true as well in that as the convertible moves closer to investment value, so finding a way to hedge the credit risk becomes far more important.

In the last 18 months the profile of the European convertible markets has become less equity sensitive as equity indices declined, in turn convertible hedgers have therefore become very credit risk orientated. With the growth in the credit default market, many convertible hedgers have focussed their credit hedging activities towards the credit default swap market.

Establishing the Credit Hedge

For the purposes of this example we shall assume that the convertible hedger has a position in a convertible with the following terms:

Table 18: Example Convertible Bond Hedge

Characteristic	Example
Nominal Size:	€1000
Price:	105%
Coupon:	2%pa
Maturity:	30 March 2006 with cash redemption at 100%
Conversion Ratio:	25 shares per bond
Parity Delta:	30%
Credit Sensitivity:	-0.25 points for 10bps move in the credit spread
Position Size:	€10mn nominal or 10,000 bonds

Source: Merrill Lynch

We should point at this stage that there is not necessarily just one method for a hedger to determine the level of credit protection to be purchased and the example that follows is just one of the possible ways to approach the calculation.

The hedger decides to buy credit default swap protection against the nominal value of the position, €10mn. The current price of the CDS is 120bps. In terms of the contract it is also likely that the hedger will either settle for 5 year protection or get the maturity date of 30 March 2006 matched.

We should explain at this point that it is very likely that the convertible hedger will have a convertible model which calculates parity delta and the credit sensitivity based on various inputs. In this example the model is saying that for a 10bps widening in the credit spread the theoretical value of the convertible is expected to decline by 0.25 points.

The hedger needs to find out what they would expect to pay for an additional 10bps protection over the next 3 years (assuming protection to maturity). This we can work out by assuming, for example, an interest rate of 4% and then working out the net present value of 10bps per year which works out at 27.75bps.

For a 10bps widening of the credit spread on the nominal value of the convertible bond position, the hedger expects a loss of 0.25 points. The hedger has also worked out that the net present value of the additional 10 basis points in protection over the next three years is circa 27.75bps. So, for a neutral credit hedge protecting the Eur10mn nominal position, the value of credit default swap protection that needs to be purchased is:

$$€10mn \times 0.0025/0.002775 = €9,009,009 \text{ (probably rounded to €9mn).}$$

Some Other Points to be considered are:

1. At the same time as the purchase of the credit default protection is taking place, the hedger will be borrowing 75,000 shares (10,000 bonds with a conversion ratio of 25 shares per bond on a 30% parity delta) for short sale (assuming a neutral hedge).
2. If the convertible has a put date, the protection would normally be to the put date and not maturity.
3. CDS protection for convertibles is normally limited to convertible bonds, in other words where the convertible redeems in cash, is not a mandatory issue or one where the issuer has the choice of delivering a share equivalent at maturity.
4. In a similar way to 'Heavy' and 'Light' hedging for the equity short sale, so a hedger may develop a view on the credit risk or direction and therefore decide to buy more or less credit protection than the amount indicated in the example.

This section is written by
Jón G. Jónsson and Arik Reiss

***Stock + Default Protection =
Wings Trade***

***The combination of (1)
“bombed-out” stocks, (2) high
volatility, (3) tight CDS spreads
and (4) favorable restructuring
documentation in CDS
contracts provide for an
attractive Wings Trade
environment***

Wings Trades

■ Wings Trades Defined

A “Wings Trade” encompasses a simultaneous purchase of shares and default protection. The combination is designed to produce very positive returns in the case of extreme changes (“doubling of the shares” or “default”) in the company’s enterprise value over the investment horizon period. Since the default protection is funded by the (anticipated) dividend income from the stock, Wings Trades are only feasible for issuers that trade at high dividend yields relative to their CDS Premium. The “Wings Ratio” is the ratio of (a) the notional amount of default protection to (b) the notional amount of stock purchased.¹³ Because Wings Trades are usually structured to have a “zero carry”, the Wings Ratio is frequently determined by the ratio of (1) dividend yield to (2) CDS premium.

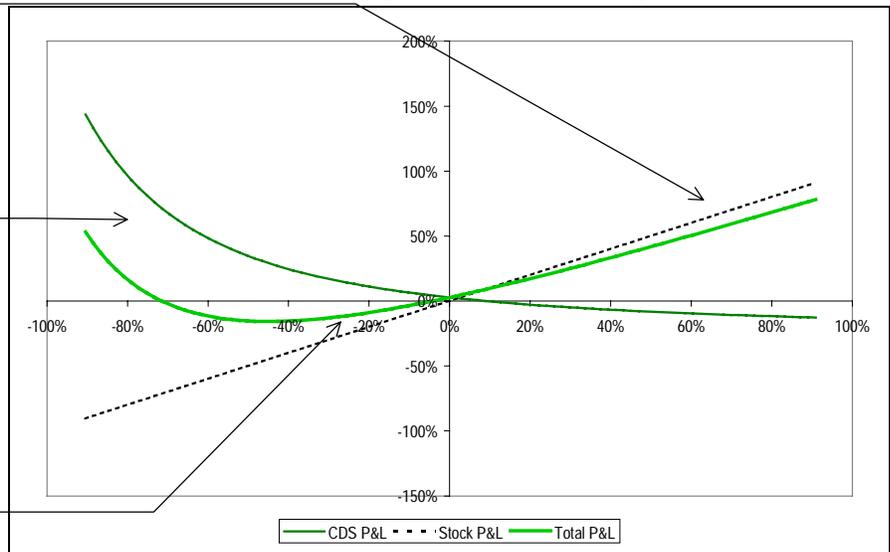
Wings Trades may be particularly intriguing in the current environment. First, investors, who have suffered large losses on “bombed out” equities, are balancing the prospects of recovery (“Bullish Scenario”) with the possibilities of even further losses (“Bearish Scenario”). Second, implied equity volatility is high, so a straddle strategy through the equity options market may be too costly. Finally, credit spreads remain tight, particularly in the CDS market. A Wings Trade is structured to produce profits in extreme outcomes. Wings Trades can therefore be particularly useful on companies whose assets are volatile and subject to extreme valuations, e.g., tobacco companies and companies with asbestos liabilities. Since Wings Trades are premised upon financing the credit default swap purchase with a dividend-paying underlying stock, they would only be suitable on issuers whose dividends are considered to be “secure” and not at a risk of being cut.

¹³ Even though a Wings Trade is not structured like a hedge, the Wings Ratio is sometimes referred to as the Hedge Ratio.

Stock P&L:
 Will dominate positive pay-offs should stock price rise sharply

CDS P&L:
 Because the notional amount of CDS is a multiple of the stock investment, losses from significant share price declines should be offset by CDS gains from the resulting deterioration in the credit profile of the company

Total P&L:
 Because the trade is structured for a zero-carry, there is 0 P&L in a status quo scenario. In between the two "Wings", however, small declines in the share price, that do not trigger a sharp spread widening, produce a negative Total P&L

Chart 69: Illustrative Profit & Loss Diagram of a Theoretical Wings Trade


Source: Merrill Lynch

- (1) **High Wings Ratio**, (2) **Secure Dividend Income** and (3) **Buy Recommendation on Stock** are overriding considerations

Using equity derivatives markets

Other considerations include (a) recent stock declines, (b), high asset volatility, (c) "binary outcomes" issuers and (d) LBO candidates

■ **Identifying Prospects**

To identify prospective candidates for a Wings Trade investors should focus on those companies that have a:

1. High Wings Ratio (determined by the ratio of Dividend Yield to CDS Premium).
2. "Secure" Dividend Income, and
3. "Buy" Recommendation on Underlying Stock.

If an investor wishes to lock in current dividend expectations, he/she can do so by synthesizing the long equity position in the derivative market. For example, the price of a futures contract is based on the market expectations of dividend pay-out during the life of the contract. If an investor buys the contract today, any dividend cut at a later date would be compensated for by a corresponding increase in the price of that contract. (Therefore, the market-implied dividend yield rate is at all times priced into stock futures contracts. It is captured, or effectively locked in, at the time the contract is purchased.) The theoretical pay-off for a Wings Trade can therefore also be effected by the purchase of a futures contract (rather than the stock) and a CDS. In the absence of a futures contract, the position can also be replicated in the options market through a purchase of an at-the-money (ATM) call and a simultaneous sale of an ATM put. Please see *European Equity Derivatives Weekly* 24 January 2003 (Reiss/Schneider/Amanti/Maras).

Other considerations include: (a) "bombed-out" equities¹⁴, (b) high asset volatility, (c) binary outcome issuers, and (d) potential leveraged buy-out (LBO) candidates. Asset volatility can be indicated by the Merrill Lynch volatility rating on the stock or implied equity volatility on its options. Issuers facing binary outcomes ("boom" or "bust") could include companies facing litigation exposure (asbestos, tobacco or other severe product liability), companies whose capital structure recommendations are binary (Buy recommendation on stock, Underweight recommendation on the credit) due to volatility. LBO candidates offer the prospects of profits on both the CDS (deteriorating credit) and the stock leg (takeover premium) of a Wings Trade. By the same token, companies whose deteriorating credit profile could result in a rights issue for re-capitalization, would produce losses on both legs.

¹⁴ These would only include companies whose shares may have fallen by more than one-half, but credit ratings and spreads still in the investment grade range.

For a “zero carry”, investors can purchase default protection on a notional amount equal to 3.4x, or the dividend yield (4.8%) divided by default protection (1.4%)

The Actual Hedge Ratio may differ from the zero carry ratio

The number of shares that have to be purchased (at the current price) for the notional amount

The P&L of a Wings Trade is assessed for at least three different scenarios, typically over a one-year or a six-month period

Input Analysis

Table 19: Illustrative Inputs for Wings Trade for Company XYZ

Inputs	
Current Dividend Yield	4.80%
Current Credit Default Swap Premium	<u>1.40%</u>
Implied Wings Ratio	3.4x
Actual Hedge Ratio	4.0x
Credit Default Swap Notional Amount	<u>10,000,000</u>
Stock Notional Amount	2,500,000
Current Share Price	25.00
Number of Shares	100,000

Source: Merrill Lynch. Amounts in euros, except Number of Shares.

Outputs & Scenario Analysis

Although the term of the underlying Credit Default Swap is normally five years, the profitability and loss (P&L) of a Wings Trade is typically assessed over a one-year or a six-month period. The P&L of a Wings Trade for a company is typically developed for at least three types of scenarios:

1. a sharp increase in its share price;
2. a credit event (such as default); and
3. a significant decline in the share price (without a corresponding deterioration in credit fundamentals).

The first two scenarios should produce positive returns, but the last one negative. A particularly useful sensitivity analysis could assume the recovery of the company’s share price to a 52-Week-High or collapse to a 52-Week-Low (unless, of course, it is at either extremes currently) over the one-year investment horizon of the Wings Trade. Unless the credit risk of the company is anticipated to change over the investment horizon, we believe it is reasonable to assume that the price of the Credit Default Swap would react correspondingly, given the high correlation between equity and credit markets. We believe it is reasonable (as a first step at least) to assume a total loss (99.9%) of equity value following a Credit Event. (Of course, there are possibilities that a Credit Event could occur, even though shares have not collapsed). **We note, however, that the P&L analysis of a CDS position around a “less than a significant change” (such as ± one standard deviation) in the stock price is highly subjective.**

We assume that the CDS premium follows the share price and that shares suffer total loss upon a Credit Event

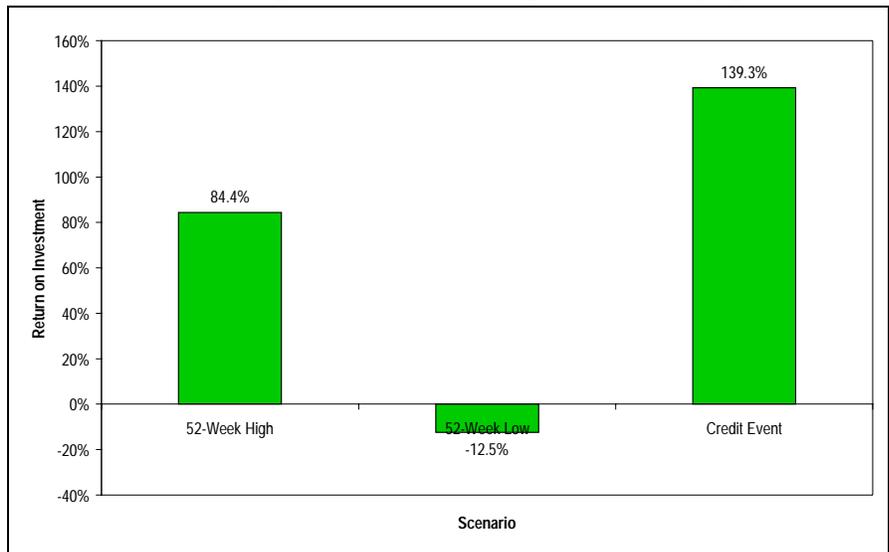
- Recovery Rate assumptions*
- Any decreases in the share prices will generally produce losses, unless a Credit Event occurs*
- Should no Credit Event occur, the CDS can be unwound at a profit or loss*

Table 20: Illustrative Wings Trade Scenario Analysis for Company XYZ

Assumptions	52-Week High	52-Week Low	Credit Event
Stock Increase (Decrease)	100.0%	-24.0%	-99.9%
Stock Price	€ 50.0	€ 18.0	€ 0.0
Default Bid	40bps	250bps	
Invested Amount	2,500,000	2,500,000	2,500,000
Recovery Rate			40.0%
Break-Even Recovery Rate			74.8%
Profit (Loss) from Stock	2,500,000	(700,000)	(2,497,500)
Profit (Loss) from Default Swap	(371,195)	408,315	6,000,000
Net Carry	<u>(20,000)</u>	<u>(20,000)</u>	<u>(20,000)</u>
Total Profit (Loss)	2,108,805	(311,685)	3,482,500

Source: Merrill Lynch

A Wings Trade has negative returns if share prices fall, but not sharply enough to have share losses offset by positive returns from credit default swap

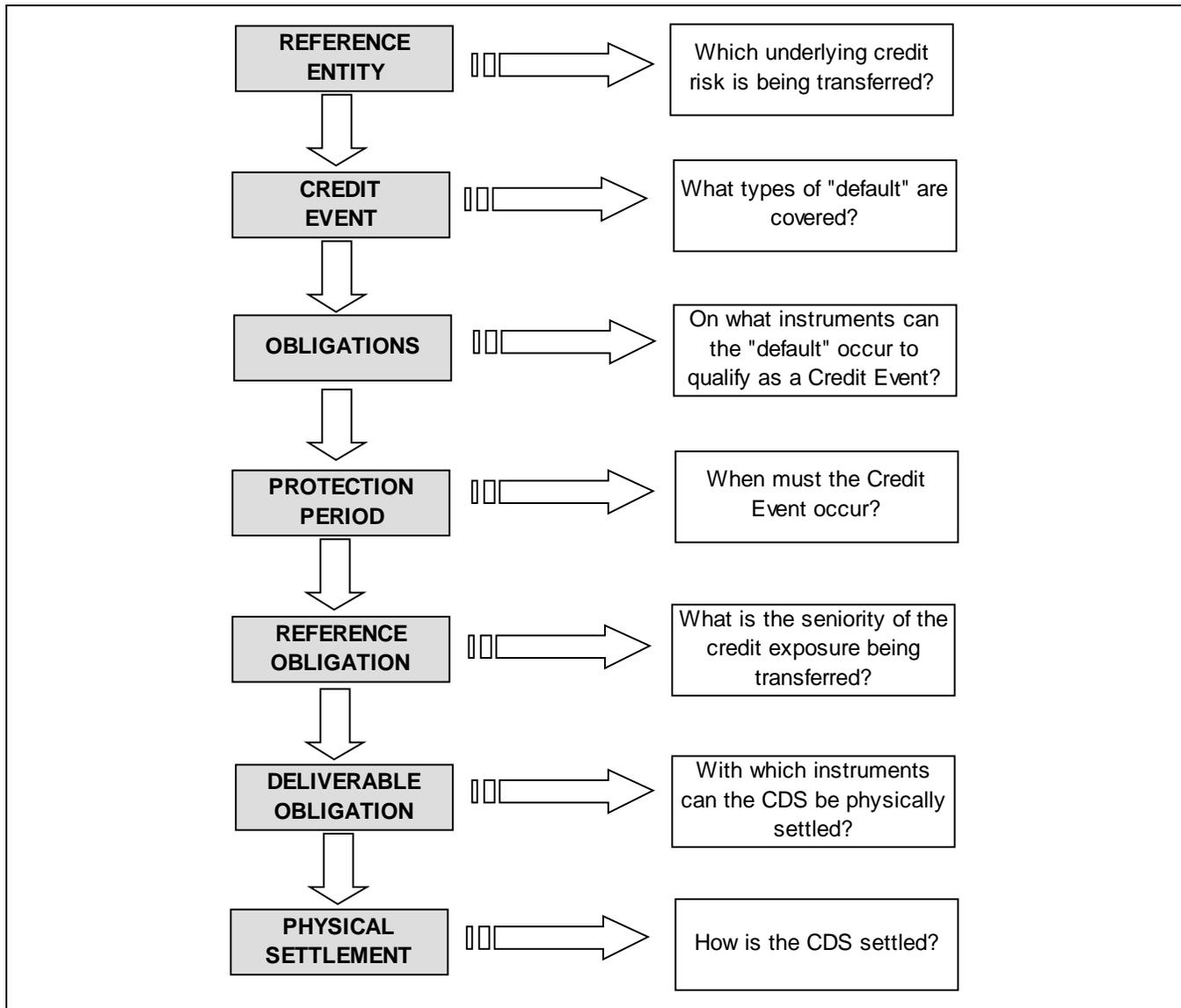
Chart 70: Profit (Loss) Analysis of an Illustrative Wings Trade for Company XYZ


Source: Merrill Lynch. Profit & Loss from Invested Amount of €2.5mn.

8. CDS Structural Roadmap

We discuss some key structural credit considerations. In such areas, law and structural credit analysis tend to overlap. A full legal analysis is beyond the scope of this chapter of a fixed income research report. We would recommend that investors take legal advice on documentation issues. That said, however, we hope that this chapter highlights some key areas for participants to consider when entering into credit default swaps.

Chart 71: CDS Structural Roadmap



Source: Merrill Lynch

Reference Entity

■ Which Default Risk is Being Transferred?

Perhaps the single most important fundamental issue with a credit default swap is defining precisely which entity's credit risk is being transferred. This sounds obvious and simple but is a vital factor in avoiding unexpected losses. Large corporate groups are often comprised of a network of subsidiaries of which various have debt in one form or another.

Defining the Reference Entity accurately is essential...but not as easy as might be expected

Sellers and Buyers of protection should be aware that the default risk of different corporate entities within the same group is not necessarily identical and the expected recovery following default is likely to be very different from entity to entity.

Even more fundamentally, protection Buyers should take care that the Reference Entity actually is likely to have some deliverable debt outstanding throughout the term of the transaction – otherwise the protection could prove worthless upon a Credit Event even though the company itself may be bankrupt.

Armstrong World Industries – US company Armstrong World Industries missed payments on its debt, which triggered credit default swaps. Its parent company Armstrong Holdings however, did not default. Many market participants had treated the parent and principal subsidiary interchangeably and had hedged positions with offsetting contracts in the other entity. The lesson here is that there may be substantial credit basis risk between different entities in the same group. Worse still, certain contracts in the market had referenced simply Armstrong without clarifying to which specific entity the contract referred.

The National Power case highlighted the need for a revised procedure for determining successors

■ Successors to the Reference Entity

A further problem is that during the life of the credit default swap contract, it is possible that through a merger or other form of corporate restructuring, the debt of a Reference Entity could become debt of one or more different entities. Such situations require a methodology for determining whether the Reference Entity should also be replaced by Successors. The test for Succession in the 1999 Definitions revolves around the succeeding company assuming “all or substantially all” of the obligations of the Reference Entity through actions such as mergers, consolidations, amalgamations or transfers.

National Power – In November 2000, National Power PLC of the UK demerged certain assets and subsidiaries into two entities: Innogy and International Power. In consideration for the transfer of assets to Innogy, shareholders were given holdings in the new entity. National Power then changed its name to International Power. Innogy also assumed certain debt obligations of National Power. This demerger prompted substantial debate as to whether Innogy had become a Successor. Given a lack of case history, whether this debt assumption amounted to “all or substantially all of the obligations” and indeed whether this question could be consistently determined under each of New York law and English law (relevant depending on the governing law of particular credit default swap contracts). It was argued that the interpretation of the “substantially all” test would likely require a significantly higher threshold under English law than New York law.

In response to the issues thrown up in the National Power case, ISDA issued a supplement to its 1999 Definitions dealing with Successors, which applied to transactions if specified (it became market custom to use this Supplement). This Supplement replaced the more subjective “substantially all” requirement definitions with set quantitative tests based on how post-restructuring debt is treated. Of course, this set of quantitative tests came too late for pre-demerger National Power credit default swaps. Given that no Credit Event has arisen on either of the entities there has been no trigger to put such contracts to the test. In practice, what has occurred is that many protection Buyers and Sellers have agreed bilaterally about how National Power’s post-demerger debt will be treated should Credit Events occur.

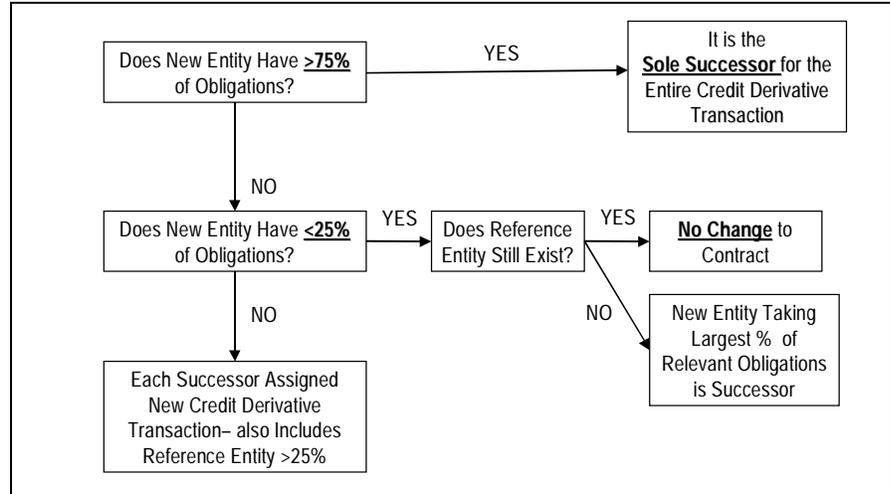
2003 Definitions – The latest definitions incorporate the Successor Supplement as the means of identifying Successor Reference Entities.

The tests a Successor for a non-Sovereign Reference Entity under the Supplement and the 2003 Definitions are summarised in Chart 72. All scenarios assume the occurrence of a Succession Event, which could be triggered by a merger,

The test for succession is based on transference of debt obligations

consolidation, amalgamation or transfer. In certain circumstances (where the two parties each end up with 25-75% of the debt or an equal proportion with no majority) they can both be Successors and the protection is divided equally between the Successor entities, the terms of which would be defined in a new credit derivative transaction.

Chart 72: Non-Sovereign Successor Summary Decision Tree



Source: Merrill Lynch

Credit Events

Credit Events are the key credit triggers in credit default swaps

■ Six potential Credit Events – but some are not used

The default swap confirmation includes details of which “Credit Events” trigger delivery under the transaction. The 2003 Definitions further clarify the six types of Credit Events that can occur with respect to “Obligations”(see below):

1. **Failure to Pay** – This requires a payment default on an Obligation by the Reference Entity and is typically subject to a materiality threshold (the Payment Requirement) of \$1mn. The Payment Requirement must be met “in accordance with the terms of such Obligations at the time of such failure” which would occur after any Grace Period Extension.
2. **Bankruptcy** – This was previously identical to the Bankruptcy Event of Default in the 1992 ISDA Master Agreement. It was, however, updated in the Supplement Relating to Successor and Credit Events which removed certain ambiguities and vagueness in the wording – see box below.
3. **Obligation Acceleration** – This refers to a situation where, for reason of default, Obligations of the Reference Entity have become due and repayable prior to maturity and have been accelerated. Since April 2002, it has been market convention for G7 corporate contracts not to use this Credit Event although it is still used in certain emerging market contracts.
4. **Obligation Default** – This would also be triggered by an event of default but requires only that an Obligation has become capable of being made due and payable prior to maturity. In practice Obligation Default is almost never included as a Credit Event in credit derivative contracts.
5. **Repudiation/Moratorium** – The 2003 Definitions made certain amendments to this Credit Event to address concerns that the clause could be triggered inappropriately. A Potential Repudiation/ Moratorium can be triggered by an authorised officer of a Reference Entity or by a Governmental Authority refusing to honour obligations or impose a moratorium which would prevent an entity from making a payment. In particular, this Credit Event will only be triggered if it is followed by an actual Failure to Pay or Restructuring

(although note that such Failure to Pay or Restructuring is not subject to any materiality threshold) within a specified time scale. Since April 2002, it has been market convention for G7 corporate contracts not to use this Credit Event although it is still used in emerging market contracts.

6. **Restructuring** – This is probably the most interesting but controversial Credit Event and is worthy of separate comment.

2003 Definitions – The Bankruptcy Credit Event previously contained language that included situations where the Reference Entity took any action in furtherance of, or indicated its consent to, Bankruptcy as defined. The 2003 Definitions require that admission of a general inability to repay debts only constitutes a Credit Event if it is part of a judicial, regulatory or administrative proceeding or filing. The previous wording provoked much debate in the recent case of Marconi.

■ Restructuring Credit Event

5 objective criteria . . .

The 2003 ISDA Definitions reiterate several tests for determining whether a “Restructuring” has occurred.

- a reduction in the rate or amount of interest payable or the amount of scheduled interest accruals;
- a reduction in the amount of principal or premium payable at maturity or at scheduled redemption dates;
- a postponement or other deferral of a date or dates for either A) the payment or accrual of interest or B) the payment of principal or premium;
- any change in the ranking in priority of payment of any Obligation, causing the subordination of such Obligation to any other Obligation; or
- any change in the currency or composition of payment of interest or principal to any currency, which is not a Permitted Currency¹⁵.

. . . plus a subjective dimension

The 2003 Definitions, however, then go on to exclude such occurrences where they do not directly or indirectly result from a deterioration in the creditworthiness or financial condition of the Reference Entity. The 2003 Definitions further add that an analysis of any case should focus on the facts and circumstances at the time of the relevant event.

Xerox Corporation – In the summer of 2002, as part of a wider agreement with its banks, Xerox extended the date for repayment of principal in respect of a major syndicated bank facility that was due for repayment in September. However, market participants have since entered a legal dispute about whether this was a result of a deterioration in creditworthiness and over what period prior to Restructuring such deterioration could reasonably have occurred.

2003 Definitions – The 2003 Definitions amend the previous definition of Restructuring to exclude any reference to Obligation Exchange. Under the 1999 Definitions this term was included to capture restructurings where the underlying terms of an Obligation weren’t actually changed but investors were subject to a “mandatory” exchange into other securities which breached one or more of the Restructuring tests.

¹⁵ Permitted Currency is defined in terms of being a G7 currency or any OECD currency that satisfies certain ratings requirements.

Argentina – Obligation Exchange requirements became the subject of legal disputes when Argentina, which was facing a tight liquidity situation, “requested” local investors to exchange \$50bn of bonds for new issues with lower coupons. In question was the meaning of “mandatory” in such circumstances.

2003 Definitions – The new definitions include four different Restructuring Credit Event options:

- Restructuring (slightly amended version of old-R).
- Modified Restructuring (Mod-R).
- Modified Modified Restructuring (Mod-Mod-R).
- No Restructuring (no-R).

A discussion of these options is included in the next section of this report.

Borrowed Money is the most frequently used Obligation Category

Obligations

The scope of the term Obligation is clearly of great importance in determining whether a Credit Event has occurred. There are six **Obligation Categories** in each of the 1999 & 2003 Definitions. The broadest of these is Payment which covers any present, future or contingent payment or repayment whether borrowed or not. Other more narrow Obligation Categories are Borrowed Money, Bond, Loan, Bond or Loan, Reference Obligations Only. **The most commonly used Obligation Category is Borrowed Money**, which includes Payments in respect of Borrowed Money (which also includes deposits and reimbursement obligations under letters of credit).

2003 Definitions – The 2003 Definitions clarify that Borrowed Money excludes undrawn revolving credit facilities. Thus for example, if an undrawn facility was to be restructured, this would not trigger a Restructuring Credit Event.

Obligation Characteristics can be specified...but frequently are not

Obligation Characteristics allow the protection Seller to further narrow down the types of Obligation that can trigger a Credit Event. If **Not Subordinated** (replacing Pari Passu Ranking from the 1999 Definitions) is selected, a default in respect of subordinated debt, for example, would not be a Credit Event in respect of senior obligations. The selection of **Specified Currency** would exclude Credit Events in others (if no currency is specified then the currencies of the G7 plus Euros are selected). Similarly **Not Domestic Currency** and **Not Domestic Issuance** and **Not Domestic Law** could reduce the impact of uniquely domestic political and legal factors on default risk. The **Not Sovereign Lender** selection excludes defaults on Obligations to governments or supranationals. The **Listed** option restricts Credit Events to Obligations that are listed or traded on an exchange.

For corporate credit default swap transactions in Europe or the US it is not the market custom to specify any Obligation Characteristics.

2003 Definitions – The 2003 definitions specify that, the Restructuring Credit Event can be triggered only on Multiple Holder Obligations (having at least four unaffiliated holders and requiring a two-thirds majority to consent to a restructuring). This effectively precludes a Restructuring Credit Event to be triggered on a bilateral loan. This feature was originally introduced in the Restructuring Supplement but in the 2003 Definitions extend it to all Restructurings.¹⁶

¹⁶ The Multiple Holder Obligation requirement can be specifically disappplied on any contracts if so desired by the counterparties.

The contract now comes into effect on the calendar day after the trade date

Note: any cash payments that are applicable to credit default swaps such as upfront fees, unwind fees or assignment fees continue to settle on the basis of T+3 Business Days or as otherwise agreed between the counterparties.

A missed payment is not a Credit Event until any Grace Period expires

Pegging the place in the capital structure

Protection Period

■ Trade Date versus Effective Date

Effective Date – It is market convention for the Effective Date (the date that protection starts) to be the calendar day following the trade date. In the unlikely event that a Credit Event occurred on the Trade Date, the protection Buyer would not be covered. This is quite a low probability occurrence for each investor – but given that multiple trades are executed daily on major credits it is likely to eventually impact some when a Credit Event occurs suddenly and unexpectedly.

Until September 2002 the Effective Date was three Business Days after the Trade Date.

This procedure is applicable on a global basis irrespective of region, sector, currency or location of participants. In particular it also applies to emerging market sovereign and corporate credits. The T+1 settlement is intended to be applicable to terminations and assignments as well as new trades.

Railtrack – On 7 October 2000, Railtrack plc was placed by the UK government into Special Railways Administration, which constituted a Bankruptcy Credit Event. This announcement date was a Saturday. Investors who bought credit default swap protection on the Wednesday, Thursday or Friday of the previous week would have not been covered for this Credit Event. Under the current conventions, however, such risks are considerably reduced.

■ Potential Failure to Pay versus Failure to Pay

Scheduled Termination Date – At this date the protection ends. However, as regards **Failure to Pay**, this is complicated by Grace Periods that may relate to the Obligation in question (if that Obligation does not contain a grace period or has a very short grace period, then ISDA assumes an automatic Grace Period of 3 Business Days).

A key point here is that many bonds or loans may contain grace periods aimed at guarding against technical defaults due to factors such as settlement errors. It is possible that the original missed payment could occur during the transaction term but the grace period ends (and acceleration occurs) after the Scheduled Termination Date. Under such circumstances the settlement would not be triggered under the transaction, unless another Obligation with a shorter grace period was already in default. In other words a Potential Failure to Pay does not become a Failure to Pay until the Grace Period has expired.

A further alternative is for a **Grace Period Extension** to be specified in the Confirmation which gives greater credit protection since it requires only that the default itself occurs before the Scheduled Termination Date and that the default is continuing at the Grace Period Extension Date. It is currently relatively rare for Grace Period Extension language to be included in corporate credit default swap documentation – although it is used in emerging markets.

Reference Obligation

The **Reference Obligation** is one particular obligation (typically a large bond issue) either issued by or guaranteed by the Reference Entity. The ranking of the Reference Obligation is determined as of the later of the Trade Date or issue date and no subsequent changes in ranking are taken into account.

The reference obligation effectively pegs the seniority of the default swap in the capital structure of the reference entity. Thus if the Reference Obligation is a senior unsecured bond then following a credit event the protection Buyer would deliver a debt obligation ranking *pari passu* with this Reference Obligation. The Buyer, however, does not have to deliver this specific obligation. The protection seller therefore is exposed to cheapest-to-deliver (CTD) risk. If certain *pari-passu*

Deliverable Obligations are trading at different market prices following a Credit Event, it is likely that the Seller will be delivered the least favourable (i.e. lowest price) alternative.

If no Reference Obligation is specified, the contract is assumed to relate to senior unsecured obligations of the Reference Entity.

Deliverable Obligations

Under physically settled credit default swaps, the Buyer of protection is entitled to deliver any qualifying obligations of the Reference Entity to the protection Seller in return for a full notional amount cash payment. As the Reference Entity may have issued a great variety of bonds or loans with very different market values, the precise details of Deliverable Obligations are extremely important in the risk equation for protection Sellers.

In addition to the Obligation Characteristics that can be specified in the Confirmation, the characteristics of Deliverable Obligations can also be specified. The list of potential **Deliverable Obligation Characteristics** is contained in Table 21.

2003 Definitions – Specify that Deliverable Obligations must satisfy the Deliverable Obligation Characteristics on the date they are delivered. For Sovereign Restructurings, however, the instrument delivered must comply with the Deliverable Obligation Characteristics immediately before a Restructuring rather than at the time of delivery.

Though transactions differ, a typical European corporate trade specifies the following characteristics.

Not Subordinated – The delivered obligation must rank pari passu or senior to the Reference Obligation (this characteristic replaces Pari Passu Ranking from the 1999 Definitions). If no Reference Obligation has been specified in the contract, the Deliverable Obligation must not be subordinated to any unsubordinated borrowed money obligation of the Reference Entity.

Specified Currency: Standard Specified Currencies – The delivered obligation must be denominated in one of the G7 currencies or Euros.

Assignable Loan – If the Buyer of protection delivers a loan, the loan must be capable of being transferred to another holder without the borrower's consent.

Consent Required Loan – If the Buyer of protection delivers a loan, the loan may require the consent of the borrower to any transfer. The additional risk element here is that subsequent transfers may be refused.

If Assignable Loan and Consent Required Loan are both specified as applicable then each Deliverable Obligation need satisfy only one of these characteristics.

Transferable – Whereas the above two characteristics apply only to loans, Transferable applies more broadly to any obligation that might be delivered. Clearly if a non-loan obligation that was delivered contained restrictions on future transfer, this would be a major risk factor for protection Sellers.

Maximum Maturity: 30 years – If a 30 year maximum maturity is specified the protection Seller is given protection from being delivered perpetual or virtually perpetual bonds which could potentially be treated less favourably in a restructuring. However, all Sellers of protection should be aware that bonds of up to 30 years in maturity are typically deliverable, even if the protection is short term.

Not Bearer – The delivered obligation must not be a bearer instrument (unless held and traded within Euroclear or another internationally recognized clearing system).

Not Contingent – This characteristic precludes the delivery of obligations in relation to which the outstanding principal balance can be reduced due to the occurrence or non-occurrence of an event or circumstance (other than payment).

Table 21: Deliverable Obligation Characteristics and Usage

Characteristic	Frequently Used ¹ ?
Not Subordinated (Pari Passu Ranking in 1999 Definitions)	✓
Standard Specified Currency	✓
Not Sovereign Lender	✗
Not Domestic Currency	✗
Not Domestic Law	✗
Listed	✗
Not Contingent	✓
Not Domestic Issuance	✗
Assignable Loan	✓
Consent Required Loan	✓
Direct Loan Participation	✗
Indirect Loan Participation	✗
Transferable	✓
Maximum Maturity	✓ (30 Years)
Accelerated or Matured	✗
Not Bearer	✓

¹ G7 Corporate Contracts.
Source: Merrill Lynch

2003 Definitions – The definition of Non Contingent has been completely rewritten from the 1999 Definitions wording and has removed references to repayment being dependent upon formulae, indices as well as a more general requirement not to be subject to any contingency. The new definition also incorporates language from the Convertible Supplement that clarifies the deliverability of (non mandatory) convertible and exchangeable bonds.

The 2003 Definitions also clarify the deliverability of accreting bonds. For such securities the nominal value of securities delivered under the credit default swap is calculated with reference to the Outstanding Principal Amount as defined in the accretion schedule rather than the full face value of the bond.

In the 1999 Definitions, one of the most controversial issues has been whether convertible or exchangeable bonds are deliverable if the Non-Contingent characteristic is included.

Railtrack – Following the Railtrack Bankruptcy Credit Event in 2000, the cheapest-to-deliver obligation was the 3.5% of 2009 exchangeable bond. Based on the 1999 Definitions, there was considerable debate as to whether convertible and exchangeable bonds complied with the Non Contingent Deliverable Obligation Characteristic. As the principal is repayable only if the bonds have not been exchanged into the underlying stock it has been argued that including convertible and exchangeable bonds are contingent upon this event not having occurred. However, most of the market took the view that, provided the bond is exchangeable or convertible at the option of the holder, the bondholder should be the beneficiary and the exchange or conversion option within its control. One further complication in the Railtrack case was the inclusion of a so called “widows and orphans” clause in the exchangeable bond which gave the trustee the right to force conversion of the bond on the holder in certain circumstances where it was viewed as being in the interests of the investor. After a protracted legal dispute, in February 2003, UK courts ruled in favour of deliverability.

Interestingly given the extent of credit derivative transactions in medium investment grade credits, when a Credit Event does occur, there can be a sudden surge in demand for the cheapest-to-deliver bond causing its market value to actually rise. This was in fact the case with the Railtrack exchangeable bond.

Physical Settlement

Settlement under credit default swaps requires certain notices to be served

Before a Credit Event can trigger settlement under a credit default swap, at least one, and more often three, notices must be served. It is worth briefly mentioning some of the features of these notices as they can have a significant impact on the risk profile of the contract.

Credit Event Notice – If a credit event occurs during the term of the transaction (i.e. prior to the Scheduled Termination Date) a Credit Event Notice may be served which describes in reasonable detail the Credit Event that has occurred. The latest this notice can be served is 14 calendar days after the Scheduled Termination Date (describing an event that occurred prior to or on the Scheduled Termination Date).

The Confirmation will also specify who is capable of serving the Credit Event Notice. There are two alternatives, either 1) Buyer, or 2) Buyer or Seller, with the latter being more common. The ability for Sellers to trigger the contract helps management of the settlement process for market players, who may have multiple contracts in place buying and selling protection on the Reference Entity. It could in theory also be used more strategically where Credit Event categories are very broad as described above to unwind an obligation on a deteriorating credit at an early stage before the obligation fully defaults and falls to a deep discount. However, we would expect such cases to be very rare.

Notice of Publicly Available Information – In addition to the Credit Event Notice, it will also usually be necessary to serve a Notice of Publicly Available Information that confirms the source of information that communicated the Credit Event. Unless the information is a public record or recognised by the Reference Entity, it is necessary to detail publication of the event included in a specified number (usually two) internationally recognised news sources. The day on which both the Credit Event Notice and if applicable the Notice of Publicly Available Information have been served is known as the **Event Determination Date**.

Assuming the contract is to be physically settled it is also necessary to serve a **Notice of Physical Settlement (NoPS)** within 30 calendar days of the Event Determination Date. This notice must detail what type of obligation the Buyer will deliver to the Seller. The Physical Settlement Period is typically set at 30 Business Days from the serving of the NoPS. The buyer must then deliver the Obligations no later than five business days from the end of this period or risk losing its protection (if the settlement fallbacks in Sections 9.9 and 9.10 are not invoked).

2003 Definitions – The NoPS has been introduced in the 2003 Definitions as a replacement for the Notice of Intended Physical Settlement (NIPS) of the 1999 Definitions. The intention here was to make such delivery binding on the protection Buyer. This impact is, however, diluted by provisions for the NoPS to be amended at any time up to the Physical Settlement Date¹⁷. After this date but before the Delivery Date, further changes can be made only to correct errors.

2003 Definitions – Introduced Alternative Settlement Procedures as a replacement for the Partial Cash Settlement procedures of 1999 Definitions. If the protection Buyer has not delivered Deliverable Obligations after five Business Days from the Physical Settlement Date, the Seller can close out the transaction by buying-in the bonds by following a set procedure over the next five Business Days. The Buyer and the Seller have the ability (for alternating time periods) to deliver / buy in obligations until the transaction is settled.

Treatment of Guarantees

2003 Definitions – One area that has received considerable focus by ISDA is guarantees – and under what circumstances guaranteed instruments are Obligations or Deliverable Obligations.

ISDA has defined two types of guarantee:

Qualifying Guarantee

Qualifying Guarantees involve the Reference Entity giving a written irrevocable guarantee of another entity's debt (but not its subordinated debt). There are a couple of exclusions:

- The guarantee cannot be structured as a surety bond, financial guarantee insurance policy, letter of credit or equivalent legal arrangement.
- Guarantees in which the payment obligations can be removed or altered due to occurrence or non-occurrence of events or circumstances are excluded.

¹⁷ This feature appears to add a further element of optionality (including possibly currency) in favour of the protection buyer.

Marconi – The Marconi group had a somewhat unusual guarantee structure. The holding company Marconi PLC provided lenders and bondholders of subsidiary Marconi Corporation PLC with a guarantee. Although the bond guarantees were stated to be “unconditional” they contained a provision that they would fall away upon the repayment of certain other guaranteed obligations. In 2002 a Bankruptcy Credit Event occurred in relation to Marconi, and the approach of market participants was to deliver loans instead of bonds, so as to avoid the risk that the guarantee structure would render the bonds undeliverable (under 1999 Definitions). The main exception to this, was where the bond in question was stated as the Reference Obligation since (in most circumstances) this is deliverable.

Qualifying Affiliate Guarantee

Qualifying Affiliate Guarantees are those Qualifying Guarantees, which are downstream from parent to subsidiary.

■ Applications

Under the 2003 Definitions, credit default swap counterparties can specify if the contract should relate to either:

- All types of Qualifying Guarantees (All Guarantees Applicable).
- Just Qualifying Affiliate Guarantees (All Guarantees Not Applicable).
- At this stage it is too soon to say which of these options will become market practice.

Non-Qualifying Affiliate Guarantees can be deliverable, but only if, at that time, such guarantee is capable of immediate demand.

The Four Restructuring Alternatives

The 2003 Definitions give counterparties four choices with regard to the Restructuring Credit Event. These are:

- **Old Restructuring (slightly amended version of old-R).**
- **Modified Restructuring (Mod-R).**
- **Modified-Modified Restructuring (Mod-Mod-R).**
- **No Restructuring (no-R).**

Table 22: Summary of Restructuring Alternatives

	Old-R	Mod-Mod-R	Mod-R	No-R
<u>Obligations</u>				
Multiple Holder Obligation requirement	Applies under 2003 (a change from 1999)	Applies	Applies	NA
<u>Deliverable Obligations</u>				
Maximum Maturity	30 year maximum is typically selected	Modified Restructuring Maturity Limitation (60 months from Restructuring Date for restructured obligations), 30 months from Restructuring Date for all other obligations)	Restructuring Maturity Limitation (30 months from Restructuring Date)	NA
Transferability of Deliverable Obligations	No restriction on transfer	Must be Conditionally Transferable	Must be Fully Transferable	NA

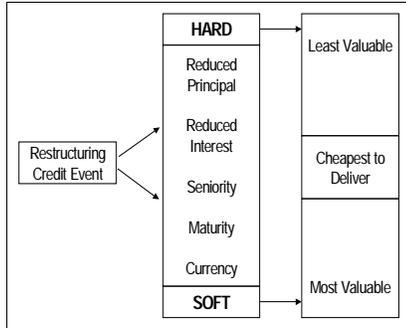
Source: Merrill Lynch

Old-R has already been described in Restructuring Credit Event on page 63 of this report. Before we discuss the alternative approaches, some background is appropriate.

■ **“Soft” and “Hard” Types of Restructuring**

The impact of restructurings can range in expected severity as shown in Chart 73. In “hard” restructuring situations, it is likely that for a given seniority, the debt of an issuer will trade at a similar cash price irrespective of maturity or currency. In a “soft” scenario though, debt may still trade on a yield basis and cash prices may not converge. The protection Buyer’s “Cheapest-to-Deliver” option is therefore typically of greater value in “soft” restructuring scenarios.

Chart 73: The Restructuring Spectrum



Source: Merrill Lynch

Conseco – The best known case study on restructuring has been Conseco. In October 2000, the company and its bankers agreed to a restructuring of its loans, which included an extension of maturity. In the bank loan market this was not seen particularly as a credit negative as it headed off a potential liquidity crisis. However, some bankers who had bought protection on Conseco gave notice of restructuring and then delivered long-dated bonds, which were trading significantly lower than the restructured bank loans. This outcome was viewed negatively by protection Sellers who were not expecting to suffer an economic loss on a “soft” Credit Event that was a result of credit deterioration but fell short of a full default or bankruptcy.

■ **Modified Restructuring**

In May 2001, ISDA issued its Restructuring Supplement (“Modified Restructuring” or “Mod-R”) to the 1999 Definitions. This Supplement, which has now been consolidated into the 2003 Definitions, has been used extensively in US markets but has been used very little in Europe. However, following the introduction of Mod-R a significant amount of business was transacted subject to this supplement before it became apparent that the new standard was failing to achieve widespread adoption in Europe. When adopted, Mod-R contains a variety of restructuring related provisions including the following:

Multiple Holder Obligations

Modified Restructuring contracts are subject to the Multiple Holder Obligation restriction. This has been extended apply to all forms of Restructuring in the 2003 Definitions. This requires that the Restructuring Credit Event can occur only with respect to an obligation that has *at least four holders* and that requires at least two thirds of holders to agree to the restructuring. Thus a restructuring of a bilateral loan would not be a Restructuring Credit Event.

2003 Definitions – Under the new definitions, the Multiple Holder Obligation requirement applies to old-R, Mod-Mod-R as well as Mod-R.¹⁸

We believe that the two-thirds agreement requirement could be problematic in Europe in particular since amendments to bond indentures typically require a quorum of 75% of bondholders and then 75% of the quorum to vote in favour of alterations. Thus restructurings could potentially be voted through by as few as 56% of bondholders.

For bonds documented under New York law, 100% approval is typically needed for fundamental restructuring changes such as reductions or postponements in interest or interest payments. Less clear to us is whether other Restructuring triggers such as subordination or currency will always require a 66 2/3% majority.

It is anticipated that ISDA will shortly publish recommended wording that can be used to amend the Multiple Holder Obligation definition such that the above types of bonds would not fail the test.

Mod R focused on limiting the Cheapest-To-Deliver option

Bilateral loans are not Obligations under Mod-R

¹⁸ The Multiple Holder Obligation can be disapplied if specified in the contract.

Complex provisions for determining what is and is not deliverable

Restructuring Maturity Limitation

These provisions set strict restrictions on Deliverable Obligations when Mod-R applies and a Restructuring Credit Event has occurred. In particular, Mod-R limits the ability of the protection Buyer to deliver long-dated instruments in settlement of the swap. Maturity of Deliverable Obligations is capped at:

- The earlier of A) 30 months following the Restructuring Date and B) the latest final maturity date of any restructured bond or loan, subject to the following limitation:
- The Restructuring Maturity Limitation Date can never be earlier than the Scheduled Termination Date of the credit default swap contract or later than 30 months after such date.

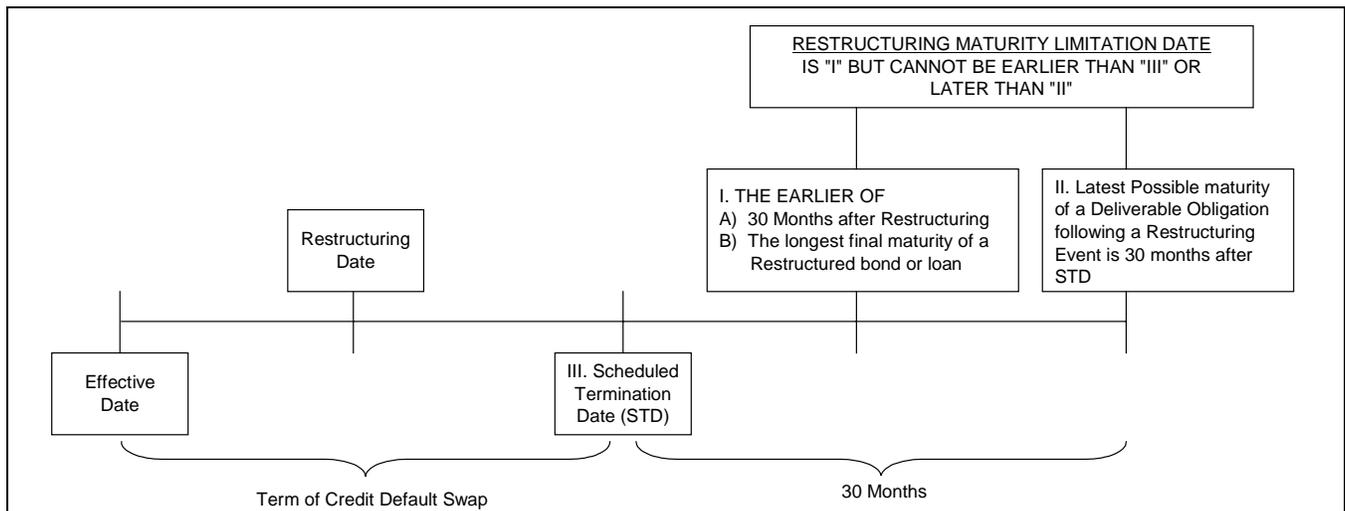
The conditionality of this definition can be quite tricky. The determination of such date is summarised in Chart .

Fully Transferable Obligation

A further provision of this clause is that following such event, *only Fully Transferable Obligations are deliverable*. Thus, loans that require the consent of the borrower for transfer to an Eligible Transferee are not deliverable. **Eligible Transferees** are defined to be those on a list of institution types, notably, banks, insurance companies, mutual funds and brokers, in each case subject to a minimum balance sheet size.

Additionally, Restructuring Maturity Limitation provisions apply only if the contract is triggered by the protection Buyer and not the protection Seller.

Chart 74: Summary of Restructuring Maturity Limitation Date under mod-R



Source: Merrill Lynch

■ **Mod-Mod-R**

As mentioned above, Mod-R never took hold in European markets. We think this was for a variety of reasons, including:

- The dominance of major banks in protection buying. As a co-ordinated force, this group favour protection-Buyer friendly and BIS friendly documentation.
- The maturity limitation requirement is viewed as too restrictive for many European corporates which are relatively new issuers in the young regional bond market. Protection Buyers worried that there may be a high chance that no bond would be deliverable following restructuring.
- Many European syndicated bank loans require borrower consent prior to being transferable to a new holder, thereby being ineligible as Fully Transferable Obligations.

Mod-Mod-R has been crafted to address at least the last two of these factors.

Refer to important disclosures at the end of this report.

Modified Restructuring Maturity Limitation

This clause differs from Mod-R in that it potentially allows obligations, which mature up to 60 months (in respect of the restructured obligation, and 30 months in respect of all other obligations) after the Restructuring date to be delivered. More precisely Deliverable Obligations cannot mature after the later of:

- the Scheduled Termination Date of the contract, and
- in the case of the restructured obligation, 60 months after the Restructuring Date and 30 months in the case of other Deliverable Obligations.

Conditionally Transferable Obligation

These provisions have been added to be less restrictive than the Fully Transferable deliverable obligation requirement.

- Consent required obligations can be considered Conditionally Transferable Obligations if such consent for novation, assignment or transfer cannot be unreasonably withheld or delayed.
- Under Mod-Mod-R the definition of Modified Eligible Transferee is narrower than the definition (under Mod-R) of Eligible Transferee, which should make qualification easier.

■ No Restructuring

One problem with Mod-R and Mod-Mod-R is that they do not address directly the “soft” features at the heart of the of the Credit Event itself (such as maturity extension). Rather they act to:

- limit the classes of Obligations on which the event can be triggered; and
- endeavour to reduce the value of the “cheapest-to-deliver option” following a Restructuring Credit Event.

Mod-R acts to limit the classes of Deliverable Obligations . . .

. . . but Xerox restructuring showed Mod-R wasn't sufficient

Xerox – Mod-R worked pretty well in the US but came under pressure when, in summer 2002, Xerox extended maturities of a syndicated bank loan. In this case the maturity limitation requirements of Mod-R did not really insulate Sellers of protection from the “cheapest-to-deliver” risk since, although not long dated, Xerox’s yen bonds were trading about 15-20 points lower than where the dollar bank loans were quoted.

It is now viewed as a risk that all forms of the Restructuring Credit Event could create a conflict of interest for bank lenders who are also long protection. For this reason parts of the US market have been strongly advocating scrapping the Restructuring Credit Event completely.

Insurance companies, which have evolved as key protection sellers in the credit default swap market, have been particularly active in the Restructuring debate.

Reflecting the problems and uncertainty that still exist, J.P. Morgan, when acting in its capacity as an end user, decided to drop the Restructuring Credit Event from its standard contracts (non-sovereign) used to hedge its own loan portfolio.

Given the dominance of banks as protection Buyers in Europe, a key factor in the wholesale adoption of no-R would be an ability to get capital relief on credit investments that have been hedged in the credit default swap market. As recently as October 2002, BIS issued technical guidance clarifying that the Restructuring Credit Event is required for capital relief¹⁹. However, we believe that recent moves towards the BIS allowing capital relief on no-R hedging against obligations over which the bank has a right of veto are a very optimistic development in this respect.

¹⁹ Quantitative Impact Study 3, Technical Guidance (QIS 3) October 2002.

9. What Price Restructuring?

In this chapter we outline a method for valuing CDS contracts with and without the Restructuring credit event.

Our Approach to the Valuation of No-R and R

■ Only Two Additional Variables Needed . . .

Two new variables are required to derive the no-R spreads . . .

Existing default swap valuation models (especially as used in pricing unwind transactions) decompose the protection premium into the probability of a credit event and expected recovery following such an event. Thus the only new elements needed to arrive at a no-R spread are:

1. the proportion of credit events that are restructurings, and
2. the expected recovery following a restructuring credit event.

■ . . . Unfortunately There is Insufficient Historical Data on Either . . .

. . . both of which are difficult to estimate

An initial problem here is a lack of historical data on credit events. In particular, since the credit derivative market is relatively young, there is not a long enough track record from which to make statistical inferences. This is especially the case in Europe which is yet to experience a major restructuring credit event.

Credit rating agency default rate data may provide a starting point. These data should essentially capture three default categories (as defined by Moody's in this case):

- any missed or delayed disbursement of interest and/or principal;
- bankruptcy or receivership; and
- distressed exchange, where either the issuer offers the debtholder a diminished financial obligation, or where the exchange has the apparent purpose of helping the borrower avoid default.

The third category overlaps with the restructuring credit event but excludes "soft" restructurings such as maturity extension.

Similarly whilst rating agency historical recovery data may provide useful data for default recoveries it will only capture those restructurings which qualify as default under their "hard" criteria. Table 23 highlights recovery and CTD data post two high profile restructurings in the US.

Table 23: Recovery Rates of "Soft" Restructurings

Credit	"Soft" Restructuring	
	Cheapest-to-Deliver	Restructured Bank Debt
Xerox	60-65	-80
Conseco	67-70	Low 90s
Senior Unsecured Bonds Recovery	Recovery Rate	Standard Deviation
Moody's (1985-2001 US Average)	50%	n/a
Moody's (1985-2001 Europe Average)	21%	n/a
S&P (1988-2001 US Average)	53%	35%
S&P (1997-2001 US Average)	44%	34%

Source: Merrill Lynch, Moody's, S&P

■ . . . and at Least One is Not Independent

In addition to these practical problems in selecting assumptions, there is also a more conceptual problem. It should not be assumed that restructuring probability is an independent variable in the valuation equation. In particular it should be remembered that banks are the dominant buyers of credit protection in the market. Indeed banks will often purchase protection as a credit hedge against loans held on

their banking books. Thus decisions on how to deal with troubled corporate relationships may involve balancing conflicting economic forces of minimizing the loss on the loan and maximizing the profit on the credit derivative. In some large banks, portfolio hedging is organizationally separated from the lending book. However, if the documentation through which protection is bought changes, we think it would be naïve to assume that banking behavior remains constant.

In particular, it would appear logical that the removal of restructuring as a credit event would encourage bankers not to agree to loan restructurings for troubled clients until a harder credit event had been triggered (a missed coupon or bankruptcy).

In summary we believe that market convention on the restructuring credit event could itself exert an influence on the relative frequency of that credit event occurring.

■ A Sample Restructuring Matrix

We discuss in detail the model and its assumptions in the pages that follow. Nonetheless, the table below illustrates a possible output that is generated by our model. In conclusion, with a view about the recovery rate post a Restructuring event, and also a view about the likelihood of Restructuring relative to 'Default' (Failure to Pay and Bankruptcy), we can calculate the *theoretical* drop in CDS premium if the Restructuring credit event is removed from a contract.

Table 24: Restructuring Matrix : Percentage Fall in Premium of a 150bps CDS (with Restructuring)

Recovery Rate Following a Restructuring	Likelihood of Restructuring Relative to 'Default'											
	1/9	1/6	1/5	1/4	1/3	1/2	1	1.25	1.5	2	3	4
5%	-14%	-19%	-22%	-26%	-32%	-41%	-59%	-64%	-68%	-74%	-81%	-85%
10%	-13%	-18%	-21%	-25%	-31%	-40%	-57%	-63%	-67%	-73%	-80%	-84%
15%	-13%	-18%	-20%	-24%	-30%	-39%	-56%	-61%	-66%	-72%	-79%	-84%
20%	-12%	-17%	-20%	-23%	-29%	-37%	-55%	-60%	-64%	-71%	-78%	-83%
25%	-11%	-16%	-19%	-22%	-28%	-36%	-53%	-59%	-63%	-69%	-77%	-82%
30%	-11%	-15%	-18%	-21%	-26%	-35%	-51%	-57%	-61%	-68%	-76%	-81%
35%	-10%	-14%	-17%	-20%	-25%	-33%	-50%	-55%	-60%	-66%	-75%	-80%
40%	-9%	-13%	-16%	-19%	-24%	-31%	-48%	-53%	-58%	-65%	-73%	-79%
45%	-9%	-13%	-15%	-18%	-22%	-30%	-46%	-51%	-56%	-63%	-72%	-77%
50%	-8%	-12%	-14%	-16%	-21%	-28%	-43%	-49%	-54%	-61%	-70%	-76%
55%	-7%	-11%	-12%	-15%	-19%	-26%	-41%	-47%	-51%	-58%	-68%	-74%
60%	-7%	-10%	-11%	-14%	-17%	-24%	-39%	-44%	-49%	-56%	-65%	-72%
65%	-6%	-9%	-10%	-12%	-16%	-22%	-36%	-41%	-46%	-53%	-63%	-69%
70%	-5%	-8%	-9%	-11%	-14%	-20%	-33%	-38%	-42%	-49%	-59%	-66%
75%	-5%	-7%	-8%	-10%	-12%	-17%	-29%	-47%	-38%	-45%	-55%	-62%
80%	-4%	-6%	-7%	-8%	-10%	-15%	-25%	-30%	-34%	-41%	-51%	-58%
85%	-3%	-5%	-5%	-7%	-8%	-12%	-21%	-25%	-29%	-35%	-45%	-52%
90%	-2%	-3%	-4%	-5%	-6%	-9%	-17%	-20%	-23%	-29%	-38%	-44%
95%	-2%	-2%	-3%	-3%	-4%	-6%	-11%	-14%	-16%	-20%	-28%	-34%
100%	-1%	-1%	-1%	-2%	-2%	-3%	-5%	-7%	-8%	-10%	-15%	-19%

Assuming a 30% recovery following a Bankruptcy or Failure to Pay credit event.
Source: Merrill Lynch

Recovery rate assumption is key driver of model output

The Restructuring Model

■ Recovery Rate Relationships & Assumptions

CDS contracts in Europe trade with the 1999 ISDA Defined Restructuring credit event (old-R) along with Bankruptcy and Failure to Pay. Valuation of a CDS contract without the Restructuring credit event is a relatively complex process. We begin by introducing the notation for recovery rates that we define below:

- *Recovery Rate with No Restructuring (R_D):* R_D is the recovery rate for the Bankruptcy and Failure to Pay credit events, i.e. Default.
- *Restructuring Recovery Rate (R_R):* R_R is the recovery rate for a Restructuring credit event (encompassing both "hard" or "soft" restructurings).
- *Blended Recovery Rate (R_B):* R_B is the weighted-average recovery rate following a credit event (Bankruptcy, Failure to Pay or Restructuring).

We use probability notation as follows:

- **P(D)** is the probability of Bankruptcy or Failure to Pay credit event, and
- **P(R)** is the probability of a Restructuring credit event.

We also define the ratio $M = P(R)/P(D)$, which is the likelihood of Restructuring relative to the other two credit events.

The four variables above: R_D, R_R, R_B and M are unknown but related by a simple equation²⁰. In Table 25 below, we make assumptions for three of the above variables (R_B, R_D and M) and derive the fourth, i.e. R_R.

Table 25: Restructuring Recovery Grid Assuming Blended Recovery of 35%

"No Restructuring" Recovery, R _D	M = P(R) / P(D) [Restructuring vs Other Credit Events]											
	1/9	1/5	1/4	1/3	1/2	1.00	1.25	1.50	1.75	2.00	3.00	4.00
5%	305%	185%	155%	125%	95%	65%	59%	55%	52%	50%	45%	43%
10%	260%	160%	135%	110%	85%	60%	55%	52%	49%	48%	43%	41%
15%	215%	135%	115%	95%	75%	55%	51%	48%	46%	45%	42%	40%
20%	170%	110%	95%	80%	65%	50%	47%	45%	44%	43%	40%	39%
25%	125%	85%	75%	65%	55%	45%	43%	42%	41%	40%	38%	38%
30%	80%	60%	55%	50%	45%	40%	39%	38%	38%	38%	37%	36%
35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%	35%
40%	-10%	10%	15%	20%	25%	30%	31%	32%	32%	33%	33%	34%
45%	-55%	-15%	-5%	5%	15%	25%	27%	28%	29%	30%	32%	33%
50%	-100%	-40%	-25%	-10%	5%	20%	23%	25%	26%	28%	30%	31%
55%	-145%	-65%	-45%	-25%	-5%	15%	19%	22%	24%	25%	28%	30%
60%	-190%	-90%	-65%	-40%	-15%	10%	15%	18%	21%	23%	27%	29%
65%	-235%	-115%	-85%	-55%	-25%	5%	11%	15%	18%	20%	25%	28%
70%	-280%	-140%	-105%	-70%	-35%	0%	7%	12%	15%	18%	23%	26%
75%	-325%	-165%	-125%	-85%	-45%	-5%	3%	8%	12%	15%	22%	25%
80%	-370%	-190%	-145%	-100%	-55%	-10%	-1%	5%	9%	13%	20%	24%
85%	-415%	-215%	-165%	-115%	-65%	-15%	-5%	2%	6%	10%	18%	23%
90%	-460%	-240%	-185%	-130%	-75%	-20%	-9%	-2%	4%	7%	17%	21%
95%	-505%	-265%	-205%	-145%	-85%	-25%	-13%	-5%	1%	5%	15%	20%
100%	-550%	-290%	-225%	-160%	-95%	-30%	-17%	-8%	-2%	2%	13%	19%

$R_B = 35\%$; $R_B = [R_D + M \times R_R] / [1 + M]$ i.e. $R_R = [(1+M) R_B - R_D] / M$
 Source: Merrill Lynch

We highlight the following observations from Table 25:

- The Blended Recovery, R_B, is fixed at 35%.
- Some cells contain negative Restructuring recovery values. These are meaningless numbers and imply that the given row and column combinations are not valid for the given assumption of R_B. We ignore these cells.

²⁰ $R_B = [R_D + M \times R_R] / [1 + M]$

- If we assume that R_R is greater than R_D we can exclude all cells below the row where $R_D = R_B$ (the three recovery rates are equal for this value, i.e., 35% in the above table).
- Though we have excluded recovery values above 100%, it is theoretically possible that debt obligations could trade above par post a very "soft" restructuring, i.e. $R_R > 100\%$.

Alternatively, we build a grid where we make assumptions for R_D (fixed at 30%), R_R and M and derive R_B (Table 26). The lighter shaded portion represents cells where R_R is less than R_D and can be ignored.

Table 26: Blended Recovery Grid Assuming "No Restructuring" Recovery of 30%

Restructuring Recovery, R_R	$M = P(R) / P(D)$											
	1/9	1/5	1/4	1/3	1/2	1.00	1.25	1.50	1.75	2.00	3.00	4.00
5%	28%	26%	25%	24%	22%	18%	16%	15%	14%	13%	11%	10%
10%	28%	27%	26%	25%	23%	20%	19%	18%	17%	17%	15%	14%
15%	29%	28%	27%	26%	25%	23%	22%	21%	20%	20%	19%	18%
20%	29%	28%	28%	28%	27%	25%	24%	24%	24%	23%	23%	22%
25%	30%	29%	29%	29%	28%	28%	27%	27%	27%	27%	26%	26%
30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%	30%
35%	31%	31%	31%	31%	32%	33%	33%	33%	33%	33%	34%	34%
40%	31%	32%	32%	33%	33%	35%	36%	36%	36%	37%	38%	38%
45%	32%	33%	33%	34%	35%	38%	38%	39%	40%	40%	41%	42%
50%	32%	33%	34%	35%	37%	40%	41%	42%	43%	43%	45%	46%
55%	33%	34%	35%	36%	38%	43%	44%	45%	46%	47%	49%	50%
60%	33%	35%	36%	38%	40%	45%	47%	48%	49%	50%	53%	54%
65%	34%	36%	37%	39%	42%	48%	49%	51%	52%	53%	56%	58%
70%	34%	37%	38%	40%	43%	50%	52%	54%	55%	57%	60%	62%
75%	35%	38%	39%	41%	45%	53%	55%	57%	59%	60%	64%	66%
80%	35%	38%	40%	43%	47%	55%	58%	60%	62%	63%	68%	70%
85%	36%	39%	41%	44%	48%	58%	61%	63%	65%	67%	71%	74%
90%	36%	40%	42%	45%	50%	60%	63%	66%	68%	70%	75%	78%
95%	37%	41%	43%	46%	52%	63%	66%	69%	71%	73%	79%	82%
100%	37%	42%	44%	48%	53%	65%	69%	72%	75%	77%	83%	86%

$R_D = 30\%$; $R_B = [R_D + M \times R_R] / [1 + M]$
 Source: Merrill Lynch

Table 27: Recovery Rate Assumptions

Recovery Rate	Assumption
Blended, R_B	35%
No Restructuring, R_D	30%
$M = P(R)/P(D)$	0.25
Restructuring, R_R	55%

Source: Merrill Lynch

Table 27 highlights assumptions that we use to illustrate our model. We assume:

- R_D of 30% and R_B of 35%: Both are lower than S&P's recovery rate average (during 1997-2001) of 44%. S&P's average has a significant standard deviation of 34%.
- $M = 0.25$, i.e. Restructuring credit event is one-fourth as likely as Non-Restructuring credit events. Implied R_R of 55% is greater than R_D .

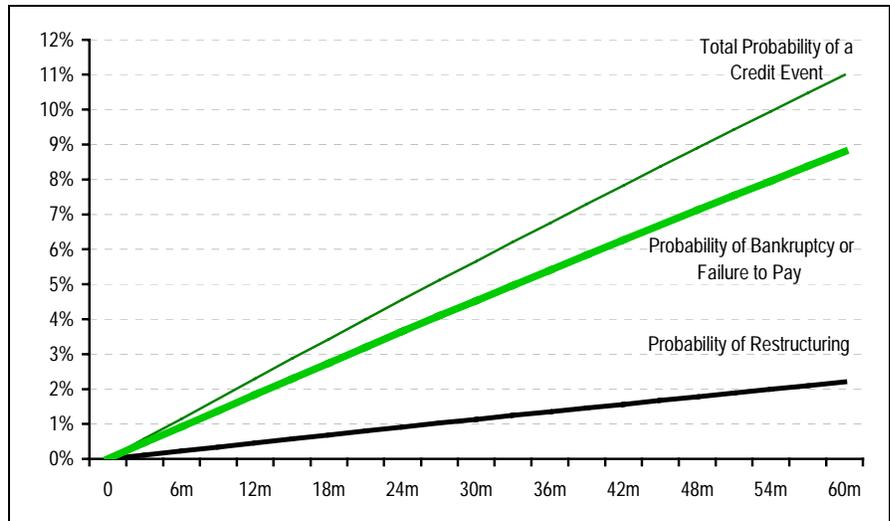
Ratio of restructuring to other credit events is difficult to predict but a firm's capital structure may provide an insight

The ratio, M , corresponds to the likelihood of Restructuring relative to the other two credit events. From a practical viewpoint it is difficult to estimate M and R_R given that Europe has yet to experience a high profile restructuring. However, in our opinion, the choice of M and R_R would depend, among other factors, on the proportion of short-term vs. long-term debt as well as the proportion of bank debt vs. bonds. Consider the following two hypothetical cases:

- **High M, High R_R :** A liquidity crisis at a viable company that has mainly *short-term debt* comprised of *bank loans* would suggest high likelihood of restructuring. If the restructuring is "soft" and involves, say, a maturity extension, the expected recovery rate post restructuring would be relatively high. E.g. $M=2$, $R_R=85\%$ (from Table 26).
- **Low M, Low R_R :** A liquidity crisis at a viable company that has mainly *long-term debt* comprised of *bonds* (and minimal bank debt) could result in the company missing a coupon payment, i.e. a greater likelihood of a Failure to Pay credit event. Any form of restructuring prior to default would most likely lead to a distressed exchange (i.e. a "hard" restructuring) with a lower expected recovery rate. E.g. $M = 1/9$, $R_R=40\%$ (from Table 26).

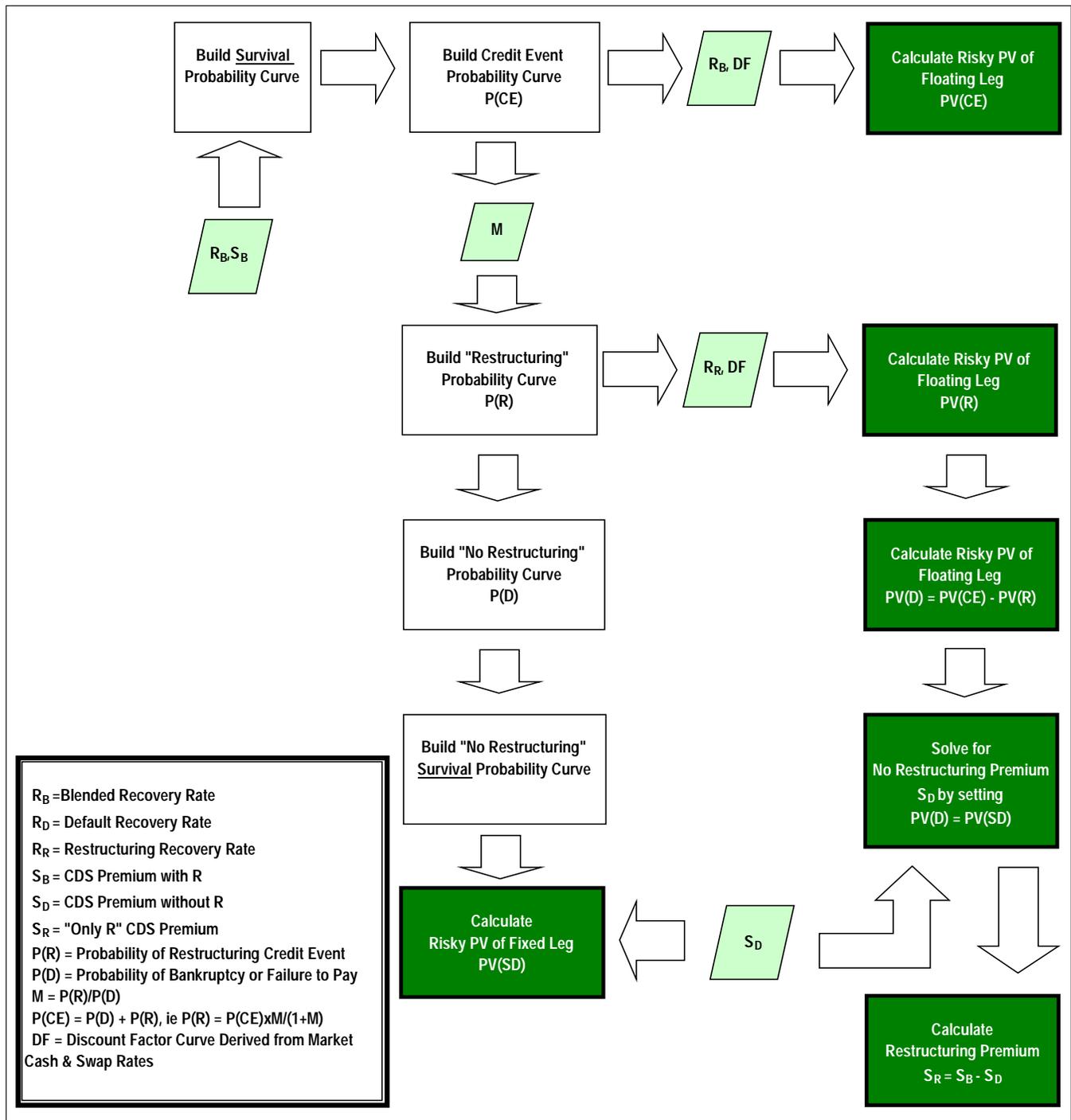
Chart 75 illustrates the different probabilities over the life of the contract given the assumptions in Table 27. Readers may not agree with these assumptions and therefore we reiterate that they serve primarily to illustrate the functionality of the model.

Chart 75: Probability of Credit Events for The Case of $M=0.25$



Source: Merrill Lynch

■ The Model Flow Chart



Source: Merrill Lynch

■ Deriving the Cost of the Restructuring Credit Event

We now work through an example applying the above flowchart methodology.

Step 1: Calculate Risky PV of Floating Leg of the CDS

Consider a CDS contract with the following features:

- Three credit events: Bankruptcy, Failure to Pay & Restructuring. We set $M=0.25$, $R_D = 30\%$ and $R_R=55\%$, i.e. implied $R_B=35\%$.
- Premium of 150bps on €10mn notional contract.

We build the following curves:

- Survival Probability Curve from Blended recovery (R_B) of 35% and 150bps CDS premium.
- Discount Factor Curve derived from market cash and swap rates.

We calculate:

- Risky PV of Floating Leg cashflows, for each quarterly date:
Notional \times (100- R_B) \times Probability of Credit Event in Quarter \times Discount Factor.
- Sum up these quarterly PV's: **€654,588**. By definition, we could also have calculated the risky PV of the Fixed Leg to get **€654,588** as well.

Table 28: Calculating the Risky PV of the Floating Leg

Coupon Dates	Discount Factor	Implied Survival Probability	Probability of Credit Event in Quarter	Payment on Credit Event	Risky PV of Floating Leg
3 months	0.992	99.42%	0.58%	€ 6,500,000	€ 37,677
6 months	0.985	98.85%	0.56%	€ 6,500,000	€ 35,982
9 months	0.978	98.27%	0.58%	€ 6,500,000	€ 36,711
12 months	0.971	97.70%	0.57%	€ 6,500,000	€ 36,225
15 months	0.963	97.12%	0.58%	€ 6,500,000	€ 36,187
18 months	0.955	96.56%	0.56%	€ 6,500,000	€ 34,529
⋮	⋮	⋮	⋮	⋮	⋮
60 months	0.821	89.01%	0.52%	€ 6,500,000	€ 27,928
Total					€ 654,588

Source: Merrill Lynch

Step 2: Calculate Risky PV due to Restructuring Only

We calculate the following curve:

- Restructuring Probability Curve using the Implied Survival Probability Curve from step 1 and the value of M . In step 1 for example, the 9 month Survival Probability is 98.27%. This implies a 1.73% probability of a credit event, and so a 0.35% $\{1.73\% \times [0.25 / (1 + 0.25)]\}$ probability of a Restructuring event.

We calculate:

- Risky PV of Floating Leg cashflows following a Restructuring credit event *only*:
Notional \times (100- R_R) \times Probability of Restructuring in Quarter \times Discount Factor.

Sum up these quarterly PV's: **€90,417**.

- Deduct the PV cost of restructuring, **€90,417**, from the **€654,588** in Step 1, to give a risky PV due to No Restructuring credit events of **€564,171**.

Table 29: Calculating the PV Due to Restructuring Only

Coupon Dates	Discount Factor	Cumulative Restructuring Probability	Probability of Restructuring in Quarter	Payment on Restructuring	Restructuring PV
3 months	0.992	0.117%	0.117%	€ 4,500,000	€ 5,217
6 months	0.985	0.229%	0.112%	€ 4,500,000	€ 4,982
9 months	0.978	0.345%	0.116%	€ 4,500,000	€ 5,083
12 months	0.971	0.460%	0.115%	€ 4,500,000	€ 5,016
15 months	0.963	0.575%	0.116%	€ 4,500,000	€ 5,011
18 months	0.955	0.687%	0.111%	€ 4,500,000	€ 4,781
⋮	⋮	⋮	⋮	⋮	⋮
60 months	0.821	2.199%	0.105%	€ 4,500,000	€ 3,867
Totals					€ 90,417

Source: Merrill Lynch

Step 3: Calculate No Restructuring Premium

We calculate a default swap premium that equates the fixed and floating legs of the No Restructuring default swap and sets the risky PV of each leg to €564,171 subject to a recovery rate (R_D) of 30%.

In this particular case, this new premium that generates the required risky PV is approximately 128bps. **So, subject to the stated recovery and restructuring assumptions, we estimate a theoretical value of 22bps for the Restructuring credit event for a default swap contract priced at 150bps (with Restructuring).**

In Table 30, we rerun the analysis using the *same assumptions* but altering only the original CDS premium. In a following section, we illustrate the results of the model for various combinations of R_D , R_R , R_B , M and CDS premiums.

Table 30: Results of the Above Analysis Changing only the Original CDS Premium

Initial CDS Premium	CDS Premium Without Restructuring
25 bps	21 bps
50 bps	43 bps
75 bps	64 bps
100 bps	85 bps
125 bps	106 bps
150 bps	128 bps
175 bps	148 bps
200 bps	169 bps
250 bps	211 bps
300 bps	252 bps
350 bps	293 bps

$M=0.25$, $R_R=55\%$, $R_D=30\%$ and $R_B=35\%$
Source: Merrill Lynch

Case Study: France Telecom

Some brokers have quoted 5yr France Telecom protection for R vs. No-R. We can use these levels to derive implied recovery rates and likelihood of restructuring relative to other credit events. Consider the following two cases.

■ **Case 1**

On 27 November 2002, France Telecom 5yr R vs. No R was quoted at 65-105bps. What did this quote mean? It implied that the broker was prepared to:

- Buy 5yr FT protection with R and sell 5yr FT protection without R paying away 105bps.
- Sell 5yr FT protection with R and buy 5yr FT protection without R picking up 65bps.

The 5yr FT protection with R was quoted at 295-305bps at that time. Therefore the implied quote for 5yr FT without R was 200-230bps.

■ **Case 2**

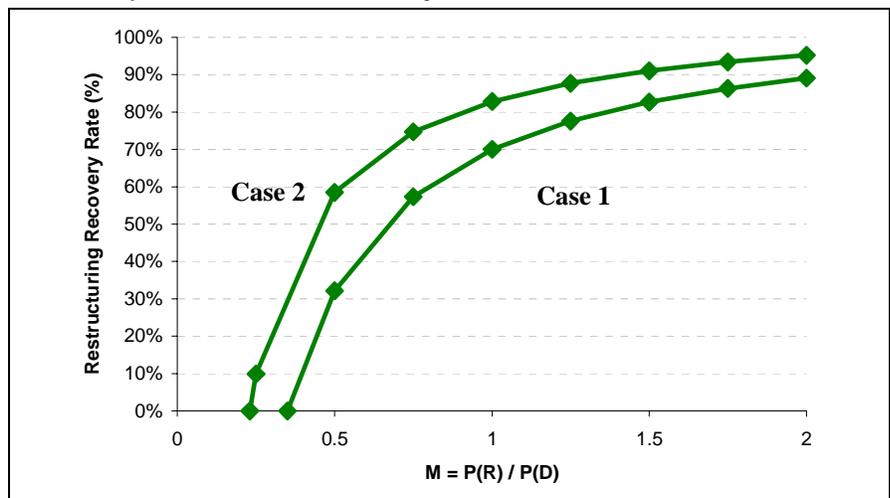
On 28 November 2002, 5yr FT R vs. No R was offered at 70bps. At this time 5yr FT protection with R was quoted at 260-280bps implying a bid of 210bps for 5yr FT protection without R.

Case 1:

Buy 5yr FT with R @305bps
 Sell 5yr FT without R @200bps
 Pay 105bps

Case 2:

Buy 5yr FT with R @280bps
 Sell 5yr FT without R @210bps.
 Pay 70bps

Chart 76: Implied R_R and M Derived from 5yr FT R vs. No R Quotes

 $R_D = 30\%$

Source: Merrill Lynch

Assuming that $R_D = 30\%$, we can plot the curves of possible R_R and M combinations for each of the above cases (Chart 76). Given these assumptions, we conclude the following:

- The market was implying lower and upper bounds for M corresponding to $R_R = 0\%$ and $R_R = 100\%$ respectively. We calculate the following boundary values for M: 0.35 and 4.36 for Case 1; 0.23 and 3.19 for Case 2.
- For a given M, Case 2 suggested a higher restructuring recovery rate, R_R , which implied a lower loss from the Restructuring credit event and therefore a lower offer.
- For a given R_R , Case 2 implied a lower likelihood of restructuring and hence we observed a lower offer of 70 vs 105bps.

Investors who believe that implied R_R values are too low for a given M (or implied M is too high for a given R_R) could "sell 5yr R vs No R" and vice versa.

Alternatively investors can pursue the following strategies:

- **Buy bond and buy protection R vs No R:** This strategy makes sense if the investor believes that the Restructuring credit event is substantially more likely than the other two credit events and is looking for protection solely from the Restructuring credit event. This is a cheaper way to buy protection.
- **Buy bond and sell protection R vs No R:** This strategy makes sense if the investor believes that the Restructuring credit event is highly unlikely and is looking to enhance yield by selling protection on only the Restructuring credit event, i.e. R vs No R.

The Restructuring Matrix

While it is not feasible to run the model for every single combination of the underlying variables, the following tables and graphs illustrates the general relationship that exists between them. The matrices give the model-implied fall in CDS premium under given assumptions about restructuring recovery and its likelihood. Again we reiterate that investors may have differing views with respect to recovery values and restructuring likelihood.

■ Varying M and CDS Premium

We run the model with the following assumptions:

- $R_D = 30\%$
- $R_R = 55\%$

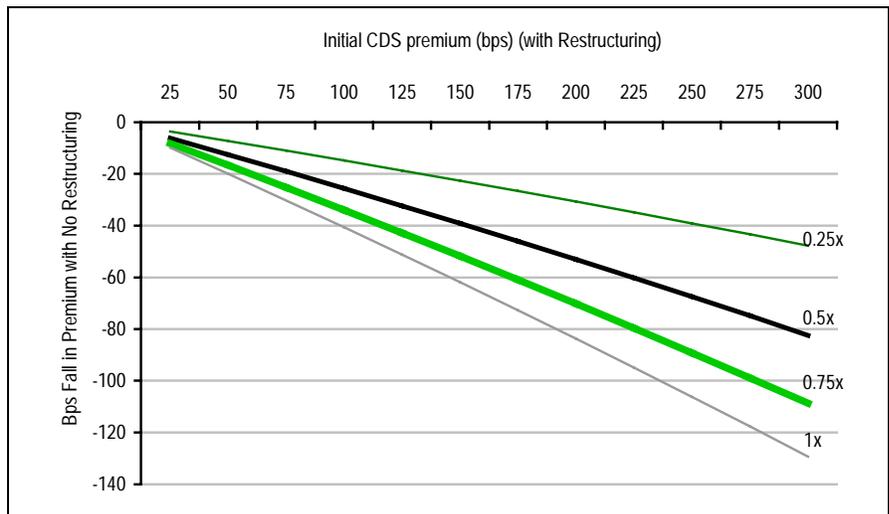
We vary M (and hence R_B varies) and initial CDS premium. Each cell in the table refers to the model-implied fall in CDS premium, in *basis points*, if the Restructuring credit event is removed.

Table 31: Model Results for Fixed R_D, R_R . Fall in basis points.

Initial CDS Premium (all Credit Events)	M = P(R) / P(D)											
	1/9	1/6	1/5	1/4	1/3	1/2	1	1.25	1.5	2	3	4
25	-2	-2	-3	-3	-4	-6	-10	-11	-12	-14	-17	-18
50	-3	-5	-6	-7	-9	-12	-20	-23	-25	-28	-33	-36
75	-5	-7	-9	-11	-14	-19	-30	-34	-37	-43	-50	-55
100	-7	-10	-12	-14	-18	-25	-40	-46	-50	-57	-67	-73
125	-9	-13	-15	-18	-23	-32	-51	-58	-63	-72	-84	-92
150	-11	-16	-18	-22	-28	-39	-62	-70	-77	-87	-102	-111
175	-13	-18	-22	-26	-33	-46	-72	-82	-90	-103	-119	-129
200	-15	-21	-25	-30	-39	-53	-84	-95	-104	-118	-137	-148
225	-17	-24	-29	-35	-44	-60	-95	-107	-118	-133	-154	-168
250	-19	-27	-32	-39	-49	-67	-106	-120	-131	-149	-172	-187
275	-21	-30	-36	-43	-55	-75	-118	-133	-146	-165	-190	-206
300	-23	-34	-40	-48	-61	-83	-130	-146	-160	-181	-208	-225

$R_D = 30\%, R_R = 55\%$
Source: Merrill Lynch

Chart 77: Basis Points Fall in CDS Premium For Different M



Source: Merrill Lynch

■ Varying M and R_R

We run the model with the following assumptions:

- $R_D = 30\%$
- Initial CDS premium = 150bps

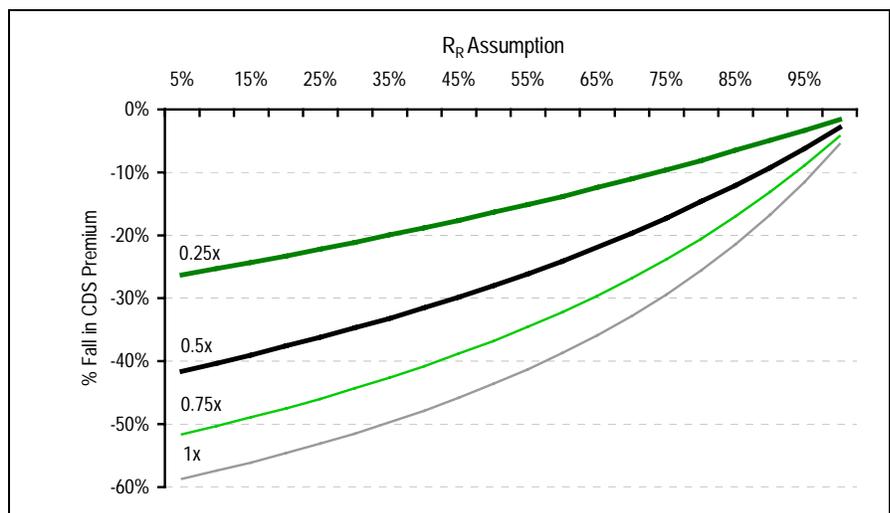
We vary M and R_R , and hence R_B varies. Each cell in the table refers to the model-implied fall in CDS premium, in *percent*, if the Restructuring credit event is removed.

Table 32: Model Results for Fixed R_D and Fixed Initial CDS premium of 150bps. Fall in Percent.

R_R	M = P(R) / P(D)											
	1/9	1/6	1/5	1/4	1/3	1/2	1	1.25	1.5	2	3	4
5%	-14%	-19%	-22%	-26%	-32%	-41%	-59%	-64%	-68%	-74%	-81%	-85%
10%	-13%	-18%	-21%	-25%	-31%	-40%	-57%	-63%	-67%	-73%	-80%	-84%
15%	-13%	-18%	-20%	-24%	-30%	-39%	-56%	-61%	-66%	-72%	-79%	-84%
20%	-12%	-17%	-20%	-23%	-29%	-37%	-55%	-60%	-64%	-71%	-78%	-83%
25%	-11%	-16%	-19%	-22%	-28%	-36%	-53%	-59%	-63%	-69%	-77%	-82%
30%	-11%	-15%	-18%	-21%	-26%	-35%	-51%	-57%	-61%	-68%	-76%	-81%
35%	-10%	-14%	-17%	-20%	-25%	-33%	-50%	-55%	-60%	-66%	-75%	-80%
40%	-9%	-13%	-16%	-19%	-24%	-31%	-48%	-53%	-58%	-65%	-73%	-79%
45%	-9%	-13%	-15%	-18%	-22%	-30%	-46%	-51%	-56%	-63%	-72%	-77%
50%	-8%	-12%	-14%	-16%	-21%	-28%	-43%	-49%	-54%	-61%	-70%	-76%
55%	-7%	-11%	-12%	-15%	-19%	-26%	-41%	-47%	-51%	-58%	-68%	-74%
60%	-7%	-10%	-11%	-14%	-17%	-24%	-39%	-44%	-49%	-56%	-65%	-72%
65%	-6%	-9%	-10%	-12%	-16%	-22%	-36%	-41%	-46%	-53%	-63%	-69%
70%	-5%	-8%	-9%	-11%	-14%	-20%	-33%	-38%	-42%	-49%	-59%	-66%
75%	-5%	-7%	-8%	-10%	-12%	-17%	-29%	-34%	-38%	-45%	-55%	-62%
80%	-4%	-6%	-7%	-8%	-10%	-15%	-25%	-30%	-34%	-41%	-51%	-58%
85%	-3%	-5%	-5%	-7%	-8%	-12%	-21%	-25%	-29%	-35%	-45%	-52%
90%	-2%	-3%	-4%	-5%	-6%	-9%	-17%	-20%	-23%	-29%	-38%	-44%
95%	-2%	-2%	-3%	-3%	-4%	-6%	-11%	-14%	-16%	-20%	-28%	-34%
100%	-1%	-1%	-1%	-2%	-2%	-3%	-5%	-7%	-8%	-10%	-15%	-19%

$R_D = 30\%$, Initial CDS Premium = 150bps
Source: Merrill Lynch

Chart 78: Percent Fall in CDS Premium For Different Values of M



Source: Merrill Lynch

10. First-to-Default Baskets

Investment Rationale

Strategies to enhance yield . . .

In the quest to increase yields on credit portfolios, there are only so many viable routes. Tactics might involve moving down the credit curve to higher yielding names, accepting less liquid bonds or investing in new forms of structured credit. Each of these responses can be valid depending on the market and the details of particular investment objectives.

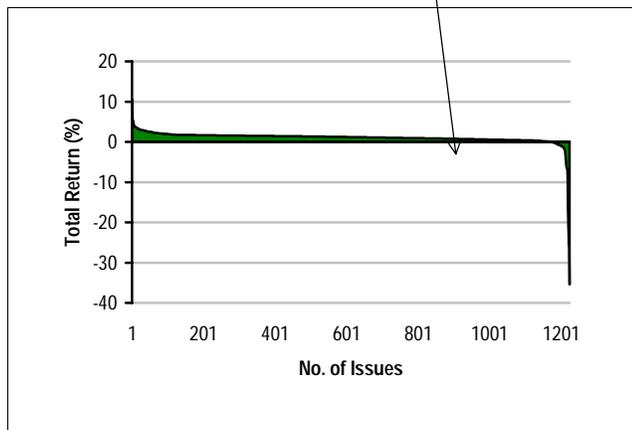
. . . in volatile credit markets

The current credit market is characterised by volatility. From a macro perspective this is reflected by swings in index spreads. Under the surface, however there are also powerful micro undercurrents. Sudden negative performance on a small number of investment grade falling angels can skew the performance of whole portfolios on the downside in some months whilst good months can be driven by the same range of names due to a powerful combination of high running yield and rebounding spreads.

Whilst the best and worst returns are quite extreme, the vast majority of bonds tend to be much more stable

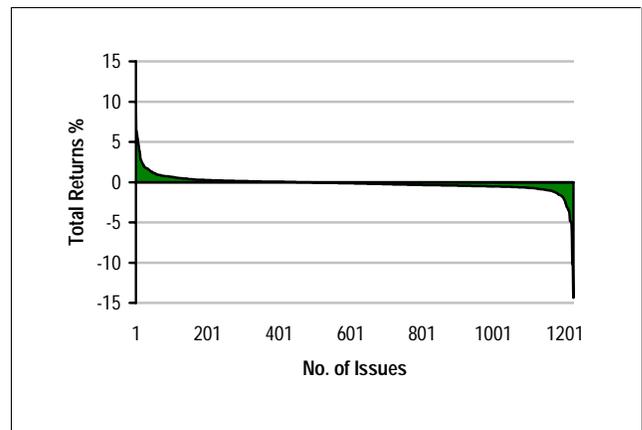
As shown in Chart 80 the returns of the best and worst performing credits in March 2003 appear to be essentially offsetting and symmetrical. Chart 79 represents the distribution of monthly returns for February 2003 which are less symmetrical. We infer that the performance of the best and worst credits in the index is relatively volatile month-on-month especially when contrasted with the vast majority of credits in the middle of the distribution.

Chart 79: European High Grade Monthly Returns in February 2003 Ranked from Best to Worst (ER00 Index)



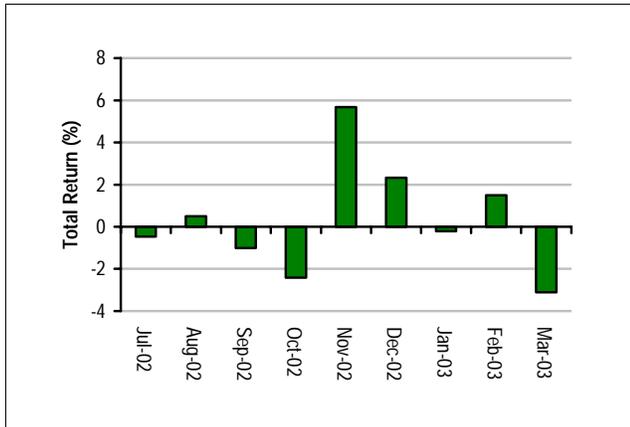
Source: Merrill Lynch Index System

Chart 80: European High Grade Monthly Returns in March 2003 Ranked from Best to Worst (ER00 Index)

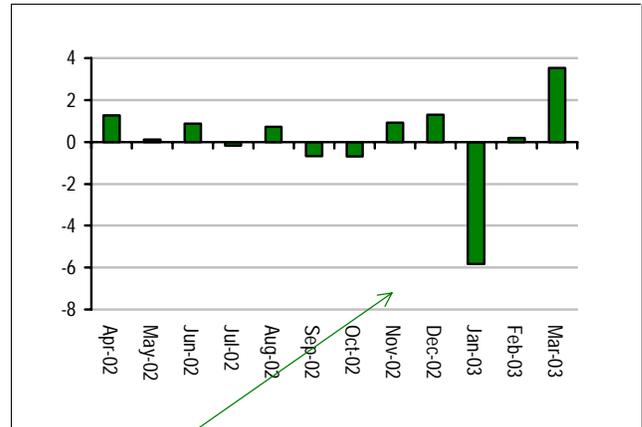


Source: Merrill Lynch Index System

What these monthly return profiles for February and March do not reveal however, is that the same credits have a tendency of cropping up on one end or the other of the return distribution each month. Chart 81 and Chart 82 illustrate this point with reference to volatile credits such as Ford and Heidelberg which have produced major positive and negative total returns in various months over the last year.

Chart 81: F 6.25% Jun-07 € Monthly Returns (%)


Source: Merrill Lynch Index System

Chart 82: HEI 6.375% Feb-07 € Monthly Returns (%)


Source: Merrill Lynch Index System

This month's fallen angel may well be next month's rebounding angel

Take aggressive trading risks?

Or take structural risk on more stable credits?

First-to-default basket swap functions like a CDS with a key difference

Sellers are attracted by the leverage

For entrepreneurial trading accounts volatile credits in such markets can offer great opportunities. This volatility of returns however does not suit all investor objectives. Many portfolios are suited better to strategies focussed on credits, which are not expected to appear in either tail of this distribution. We are currently attracted by strategies which use credit derivatives and other structured products to enhance yield on core credit exposures – thereby allowing investors to avoid taking chances on high risk/return credits.

This is the context in which we view First-to-Default Baskets (FTDBs). We see FTDBs as a means to enhance returns by focussing credit exposure and accepting a degree of credit leverage on a small basket of credits that have been carefully screened by the investor.

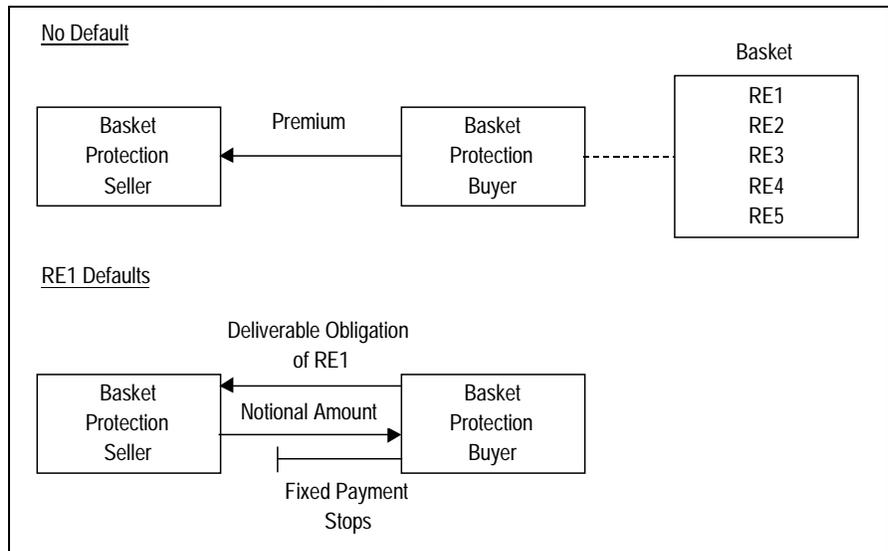
Explaining The Structure

An FTDB works in a similar manner to a CDS with a crucial difference – the protection seller of an FTDB provides protection against the first reference entity that experiences a credit event from a basket of more than one reference entity. The protection seller, therefore, assumes the "first-to-default" risk on a basket of credits.

For example, let's assume a basket of five credits with a basket notional amount of €10 million. If any one of these credits experiences a credit event, the basket default swap terminates and the protection seller pays €10 million in exchange for the notional amount of a deliverable obligation of the credit that experienced the credit event (see Chart 83).

Investors can create a simultaneous exposure to multiple credits by selling protection on an FTDB. The protection seller is motivated primarily by the leverage obtained by investing in such a structure. In the basket described above, the seller is exposed to the credit risk of five names with a total notional amount of €50 million. The seller receives a premium that is higher than any individual default swap to reflect the higher level of risk. However, in the event of default, the seller's maximum loss is limited to the notional amount for only one of the reference credits, i.e. €10 million. The investor has effectively sold five different default swaps but after the first credit event, the remaining four default swaps are knocked out.

Chart 83: First-to-Default Basket Swap



Note: RE = Reference Entity.
Source: Merrill Lynch

Lower cost method of hedging for buyers

The protection buyer views a basket swap as a lower cost method of hedging multiple credits (or, in effect, providing an equity cushion to this part of its portfolio). However, since the seller is exposed to the notional amount of only one (the first-to-default) credit, the buyer retains the residual risk of multiple defaults. This residual risk represents the imperfect hedge for the buyer. The potential cost of managing the hedge could determine the price the buyer is willing to pay for the basket.

Also available in funded form

FTDBs can also be offered to investors in the form of credit-linked notes (CLNs). CLNs are created by embedding credit derivatives in new issues from a special purpose vehicle (SPV). An FTDB CLN has an embedded FTDB swap and enables an investor to indirectly sell protection while investing in a cash instrument. We discuss CLNs in more detail in CDS Investor Strategies (Chapter 7).

Basket Pricing

■ Valuation Inputs

FTDB pricing more complicated than CDS . . .

As might be expected, pricing a basket is more complicated than pricing a single-name CDS. Any theoretical model of pricing basket swaps would include the following key inputs:

- number of reference entities;
- probability of default of reference entities and protection seller;
- default correlations between reference entities;
- default correlations between reference entities and protection seller;
- maturity of swap; and
- expected recovery value of the reference entities.

The basket premium depends not only on the probability of default of each credit in the basket but also on the default correlation between these credits.

. . . driven by default correlations

As the seller of a basket, an investor is essentially paid for a single default *plus* the increased likelihood of the occurrence of default. Given that the reference credits are typically less than perfectly correlated, the credit risk of a basket would, therefore, be greater than a single-name CDS for any of the basket constituents. The seller should be compensated for this risk with a higher yield on the basket

Basket premium greater than the worst but less than the sum

than any single-name CDS. The weaker the correlation relationship, the greater the degree of additional compensation that should be required.

The following boundary conditions should apply to the basket premium:

1. Basket premium should **exceed the single-name default premium on the weakest credit** in the basket. This compensates the seller for the increased likelihood of default relative to any single reference entity.
2. Basket premium should be **less than the sum of the premiums** available for single-name default swaps for each credit in the basket²¹. This condition should be satisfied because the buyer is not buying protection on all the names in the basket but only on the first one to default.

Unlike a single-name CDS, an FTDB cannot be replicated in the cash market making it difficult to price this instrument from arbitrage relationships between the cash and the derivative markets. The practical approach to pricing an FTDB is derived from the dynamic hedging behaviour of dealers who buy protection on FTDBs as described in the following pages.

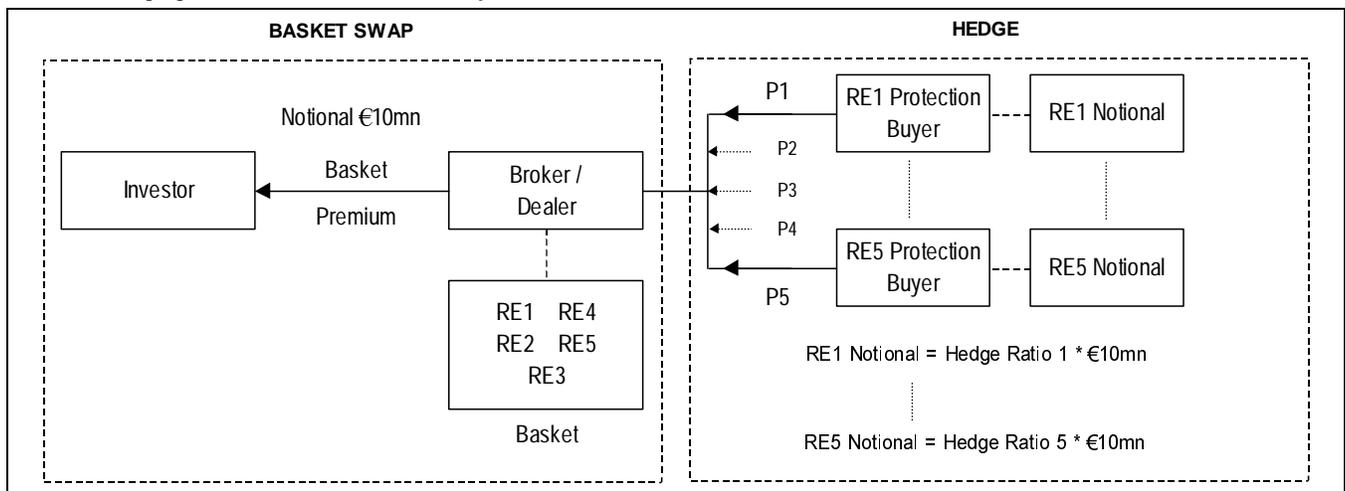
■ Dynamic Hedging of The Basket

The price of the basket is affected by the cost of managing the hedge

The hedging behaviour of a dealer provides some intuition behind the actual basket premium. **A dealer that buys protection on a basket from an investor would normally hedge this transaction by selling default protection on each individual name in the basket.** Chart 84 illustrates the hedge.

The amount of protection sold by the dealer in each name is known as the **delta** or the **hedge ratio** of that name. Among other factors, hedge ratios depend on default correlations and relative premiums of the single-name default swaps of the underlying credits. If single-name default swaps trade at similar levels, all credits would have similar hedge ratios assuming similar recovery rates.

Chart 84: Hedging a First-to-Default Basket Swap



Source: Merrill Lynch

As the underlying default premiums shift, the deltas will change and the hedges will need to be rebalanced dynamically. The efficiency with which the hedge can be managed is a key factor that determines the basket premium. For small movements in the hedge ratio, the dealer may not be able to sell or buy protection and may instead buy or sell bonds to hedge thus taking on basis risk.

The hedge is exposed to an unwind risk – greater the correlation, greater the risk

Following a credit event, the dealer will be forced to unwind the hedges on the other credits (assuming non-zero deltas for these credits). The cost of unwinding the hedge would depend on the spread movement for each of the non-defaulted credits. This, in turn, would depend on the correlation between the defaulted and the non-defaulted credits.

²¹ We assume that the reference entities are positively correlated.

The greater this correlation, the greater the expected spread widening for a non-defaulted single-name default swap. This would imply a greater cost of unwinding the hedge. The dealer would therefore maintain a lower delta i.e., sell a lower amount of protection, to minimise losses from the unwind. This would, in turn, provide a lower premium to pay for the basket protection.

On the other hand, a low correlation would imply a lower expected spread change in a non-defaulted credit in the event of default and consequently a lower cost of unwinding that hedge. The hedger could therefore maintain a higher delta to manage the hedge i.e., sell a higher amount of protection. This provides a higher premium to pay for the basket protection.

■ Negative Carry & Long Gamma Trade

Hedge is typically negative carry trade for dealer . . .

Consider the following basket example:

- Three-credit basket, each 5yr single-name default swap trades at 100bps.
- At 50% correlation, model-implied **breakeven basket premium**²² is 236bps.
- The hedge ratio for each name in the basket is 68.4%.
- The **hedge carry**²³ is therefore 205bps ($68.4\% \times 100 \times 3$).
- The hedge carry is less than the breakeven basket coupon and thus the dealer has a **negative carry** of 31bps.

For typical baskets, **the hedge is a negative carry trade for the dealer**, i.e., the breakeven basket premium is greater than the hedge carry. This is due to a positive net expected gain²⁴ following a credit default.

Basket swaps cannot be fully replicated using only single-name default swaps.

In other words, single-name default swaps cannot be used to hedge simultaneously the stochastic process of the spread movement of individual credits and the stochastic process of the actual default of any one of the credits. Dealers typically hedge only the spread process and are thus less than fully hedged. As a result, they pay a negative carry in return for a net expected gain on default. The difference also reflects the fact that the dealer is long gamma as described below.

. . . as well as a long gamma position

Gamma is defined as the rate of change of delta. As the spread of an underlying credit widens, the dealer needs to sell more protection on that credit to rebalance the hedge. Thus the hedge ratio or delta for this credit increases, i.e. gamma is positive. The dealer's hedge is a long gamma trade and dynamic hedging benefits the dealer in the following way:

- If a reference credit widens, the delta increases and the dealer sells more protection increasing the carry on the trade.
- If a reference credit tightens, the delta decreases and the dealer buys more protection thus booking gains and reducing risk.

For typical baskets, a static hedge would have a negative carry that can be recaptured in the process of dynamic hedging. From an arbitrage perspective it is intuitively satisfying to infer that if the dealer is hedging only the spread process of underlying reference credits, the hedge should have a negative carry.

²² The breakeven basket premium is one that makes the expected value of the trade zero on day one. Different market players use different mathematical models to derive this premium.

²³ Hedge carry is defined as the sum of the premiums received from selling single-name default swaps of credits in the basket.

²⁴ Net expected gain following a credit default = Expected gain on the defaulted credit *less* the expected loss on unwinding the surviving credits.

Basket premiums decline with increasing correlation

■ Default Correlation

Default correlations are key determinants of hedge ratios which determine basket premiums that dealers are willing to pay. The boundary conditions for the basket premium can be restated in terms of the default correlation as follows:

1. If the default correlation among the credits is equal to 0, the basket premium should be equal to the sum of all the single-name default premiums.
2. If the default correlation among credits is equal to 1, the basket premium should be equal to the widest single-name default premium (or the lowest quality credit).

Basket premiums should, therefore, decline with an increase in correlation. A basket of uncorrelated credits trading at similar spreads produces the largest relative increase in premium compared to the average single-name default swap premium.

Default, asset & spread correlations

Default correlations impact the likelihood of multiple defaults up to a given time horizon. In practice, there is a lack of historical data that could be used to extract default correlations. Instead, market players use the **asset correlation** to calculate default correlation.

Asset correlations can be extracted from the "ability to pay" process of a portfolio of firms. Such a process is modelled for an individual firm as its market value of assets minus liabilities. Market inputs are equity and debt data. The asset correlation derived in this manner is deterministically related to the default correlation, i.e. one can be transformed into the other.

Another approach is to apply "jump" models. In these models, a **spread correlation** is used to determine the expected spread widening (or mathematically, a jump in the annualised default rate) of the non-defaulted credits in case one credit in the basket defaults.

Sensitivity of Basket Swaps

■ Creating a Suitable Basket

A basket of credits needs to be carefully chosen to provide the desired level of leverage to the protection seller. A basket that is based on credits with a low likelihood of multiple defaults (i.e. low correlation) would provide the seller with the highest leverage and the buyer with the most effective hedge. We would also expect such a basket to be relatively high yielding.

It makes more sense to use **investment grade rather than high yield** credits in a basket. Even though the high yield credits in a basket may be uncorrelated, the higher individual probabilities of default associated with each high yield credit could lead to simultaneous multiple defaults. In the event of a single default, the non-defaulted high yield credits may have deteriorated significantly to make purchase of new protection on them extremely expensive. Investment grade credits, on the other hand, would be less likely to experience such credit deterioration. If one member of a higher quality basket defaults, it is quite likely that the others can be rehedgeed at cost-effective levels.

■ Sample Basket Analysis

Basket premiums are driven by several factors including default correlations, number of credits in basket as well as the quality of the credits. In order to examine the sensitivity of the basket premium with respect to some of these factors, we use a sample basket with the following characteristics:

- 5 reference entities, 5-year maturity.
- €10mn notional amount.
- Each single-name default swap trades at 100bps.

Higher yielding FTDBs provide greater leverage

High-yield baskets are less attractive for FTDB protection buyers

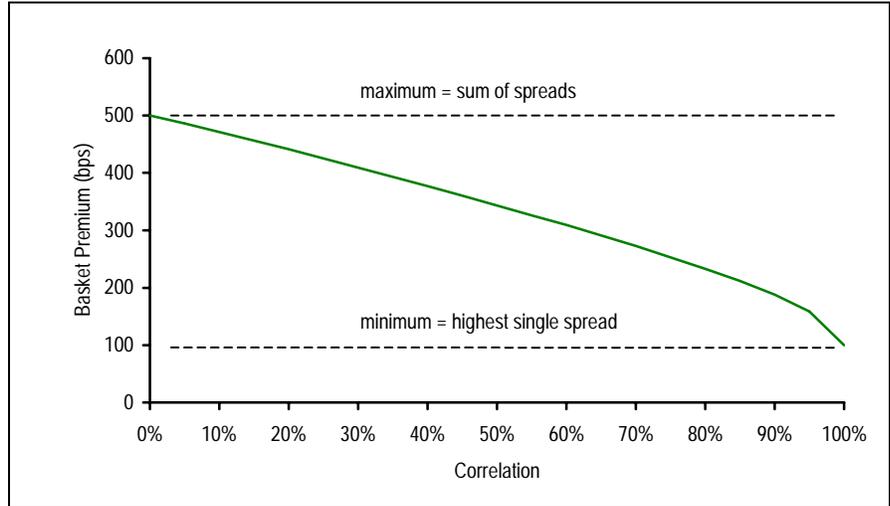
Basket premium declines with increase in correlation . . .

. . . and at an increasing rate

Correlation

As explained in the previous section, correlation drives the risk/reward tradeoff in a basket structure. The greater the correlation, the greater the probability of multiple defaults, i.e., the lower the value of protection to the buyer. Chart 85 highlights the relationship between the basket premium and correlation for our sample basket.

Chart 85: Basket Premium Declines as Correlation Increases



Source: Merrill Lynch

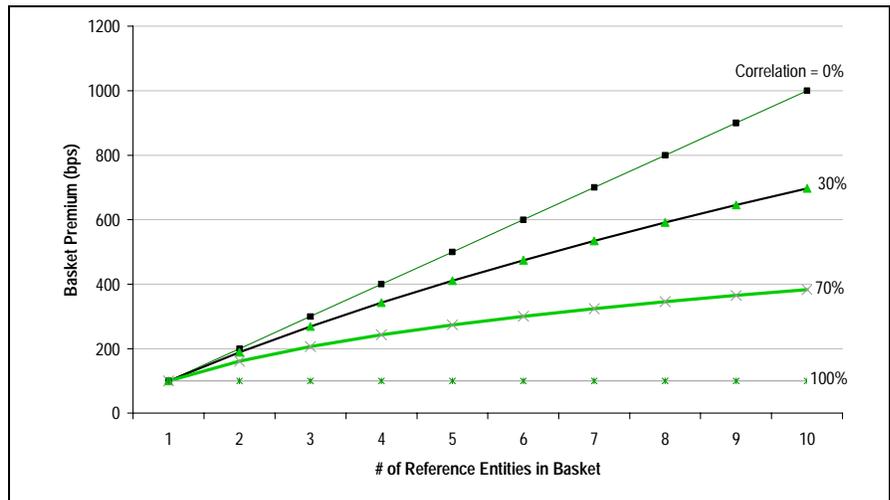
Additional REs increase the basket premium . . .

. . . but at a diminishing rate

Number of Reference Entities

Assuming constant correlation, an increase in the number of credits increases the basket premium (Chart 86). As more credits are added to the basket, the risk of the first-to-default event increases and the seller requires a greater level of compensation. However, the rate of increase in the basket premium declines with an increase in the number of reference entities. From a dealer's perspective, balanced baskets with 3-7 reference credits can be hedged most effectively. More credits would imply low deltas (and therefore low hedge notionals) resulting in lower market liquidity to set up the hedges.

Chart 86: Basket Premium Increases with Number of Reference Entities in Basket

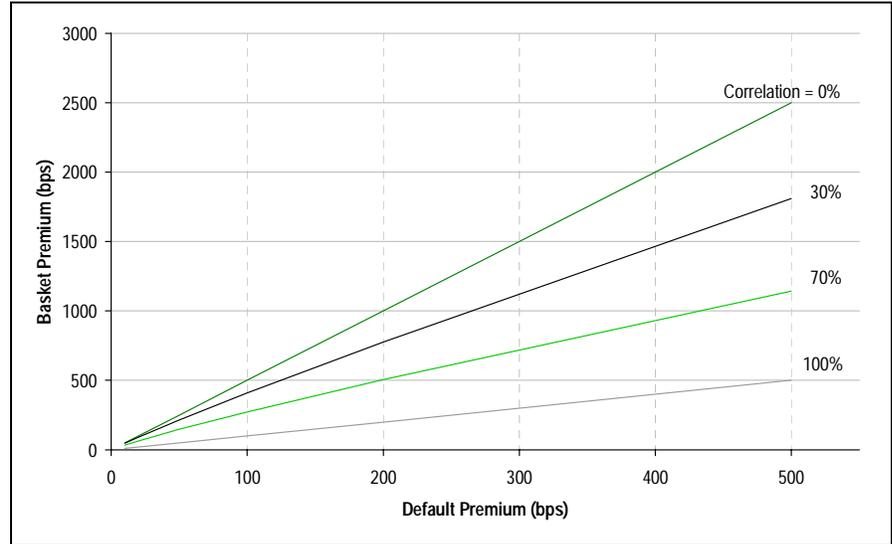


Source: Merrill Lynch

Default Premium

Chart 87 shows us the movement of basket price with a change in default premiums for all the reference entities in the basket. As the premiums increase by equal amounts for all the credits, the risk of first default of the basket increases. If basket entities are uncorrelated, we note that the price of the basket is equal to the sum of the individual default premiums.

Chart 87: Basket Premium Increases with Default Premiums



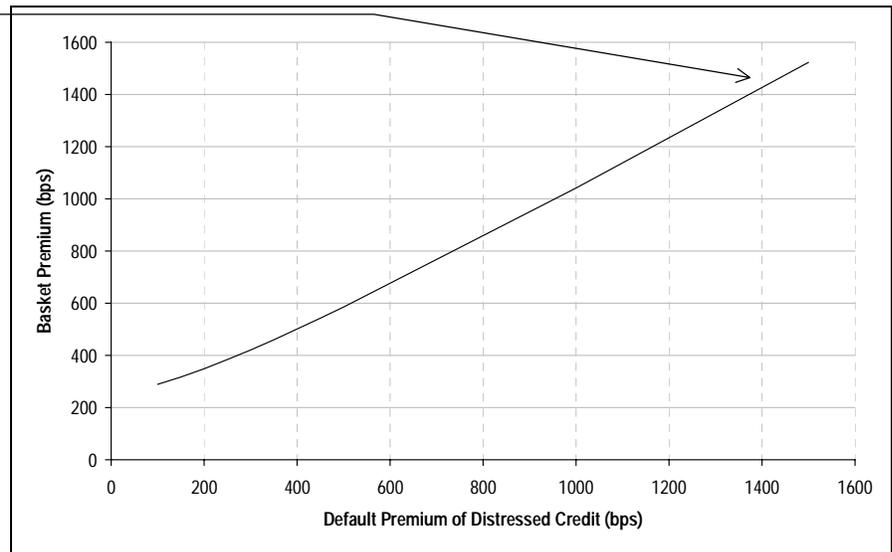
Source: Merrill Lynch

Distressed credits dictate basket pricing

Basket structures make more sense for credits that are trading at similar spreads or those that have similar credit ratings. If one of the credits is extremely weak, then it would dictate the pricing of the basket making the protection on the other credits less valuable. This is demonstrated in Chart 88 for the same basket of five credits. The chart plots the basket premium as the single-name default premium of one of the credits widens while that of the other four remain steady at 100bps.

Almost equal to the premium of the distressed credit

Chart 88: Basket Premium Approximates Premium of Highly Distressed Credit



Source: Merrill Lynch

Basket Swap Strategies

■ Investment Motivators

Basket swaps cannot be replicated in the cash market and provide some unique benefits to investors in terms of relative value and leverage.

- **Improving portfolio yields:** As credit spreads tighten, unleveraged investments in individual credits could fail to meet portfolio yield hurdles and become less attractive. In order to improve yields, portfolio managers can expand their gamut of investment opportunities by investing in lower rated, higher yielding assets. Alternatively, they can **sell protection** on a basket of approved names that meets the yield hurdle even though single-name default swaps on the reference entities may not meet the hurdle on their own.
- **Express a view on correlation:** Investors who believe that a group of credits have a higher correlation than that expressed by a basket swap on the same credits can express this opinion by **selling protection** on the basket. This trade looks more attractive as investors' opinion of correlation increases relative to that expressed in the market price of the basket.
- **Protection from a credit landmine:** Accounting and related uncertainties have increased concerns about unexpected deterioration for a particular credit. Though an investor may make the right sector allocations, sudden and sharp credit deterioration (e.g. Enron) could severely diminish portfolio returns. Investors can mitigate the effect of a credit landmine by **buying protection** on a basket swap. Though this protection would reduce overall portfolio return, investors would be protected in the current uncertain financial environment.

Investors also need to be aware of some of the limitations of basket swaps.

- **Liquidity:** Basket swaps are investor-specific and typically negotiated for baskets selected by investors for specified maturities. Investors can usually sell basket protection in maturities that correspond to the liquid single-name default swaps, usually 5 years.
- **Cheapest to deliver risk:** Protection sellers take on CTD risk following a credit event. Physical settlement of the basket swap will likely consist of the lowest priced bond ranking pari passu with the reference obligation of the entity that experienced a credit event. This risk, however, is not specific to baskets. Since baskets are special forms of credit default swaps they share similar characteristics including the CTD risk.

■ Investor Strategies

The potential benefits of basket investments can be translated into clear trading strategies for investors who wish to express particular views. We discuss some of the strategies below.

1. **Creating leveraged positions:** As discussed above, as credit spreads tighten investors can sell FTD protection on a basket of approved names to increase portfolio yield rather than moving down the credit curve and investing in high-yield credits. Though the basket may consist of approved credits, the less than perfect correlation between them increases the risk of basket default relative to each individual credit.
2. **Creating a synthetic "senior" position:** Investors can take a long position in a small portfolio of credits and buy first-to-default protection on the portfolio. The net carry from this trade is lower than that from the individual credits but the trade is less risky as a loss will only occur if there are multiple defaults. Investors take the risk that the actual correlation is higher than the expected correlation increasing the likelihood of multiple defaults.

FTDBs provide unique relative value opportunities to portfolio managers . . .

. . . but also have some inherent limitations

Basket strategies can capitalise on these views

3. **Credit convexity trade:** Investors buy FTDB protection and dynamically hedge by selling single-name default swaps on underlying credits. The investor is long gamma and has a potentially large upside. Due to the hedge the downside is limited except when actual correlation is greater than expected correlation. This trade typically has a negative carry, is non-directional and does not require price convergence or suffer during price divergence like most long/short strategies. The key risk in this trade is that FTDBs are illiquid and the best "way out" of this trade is dynamic hedging until maturity. This requires active management and a commitment to follow and participate in the CDS market.
4. **Creating a cheap senior short:** Investor sells FTDB protection and buys protection on each individual credit. The net position is similar to being short the senior tranche in this portfolio. If this position can be set up at really low rates then the investor has a small negative carry. The trade is then equivalent to buying cheap deeply out-of-the-money portfolio puts that have a big payoff when the entire market blows up and there are multiple defaults.

■ Basket Examples

Table 33: FTD Baskets

Basket 1 (High Correlation)		Basket 2 (Low Correlation)	
Credit	5yr Bid	Credit	5yr Bid
FRTEL	148	TEF	62
DT	152	DSM	40
OLIVET	150	UPMKYM	68
OOMLN	165	CRDSUI	52
Total Aggregate CDS Spread	615		222
Average CDS Spread	154		56
Max CDS spread	165		68
Min CDS spread	148		40
Indicative FTDB Spread	355		150
FTDB/Average CDS	2.3x		2.7x
FTDB/Max CDS	2.2x		2.2x
FTDB/Total CDS	58%		68%

Source: Merrill Lynch. Levels as of 11 April 2003.

We consider two baskets shown in the table above. **Basket 1** consists of European incumbent telecom credits whose single-name default swaps are trading at similar levels (**homogeneous premiums**). We expect these credits to have a relatively high default correlation.

Basket 2 consists of credits that belong to *different sectors* and we believe it is well diversified with relatively low correlation. The premiums of the single-name default swaps are also relatively homogeneous to provide an attractive pick up.

Both basket premiums are higher than the maximum single-name premium and less than the sum of all single-name premiums, i.e. they satisfy the boundary conditions.

From a relative value perspective both baskets look relatively attractive:

- Basket 1 yields 355bps which is 2.3x the average single-name premium and 2.2x the widest credit. Similarly Basket 2 generates a premium of 150bps which is 2.7x the average single-name premium and 2.2x the widest credit.
- Many of the single-name default swaps in the both baskets trade at a positive basis relative to the cash bonds. This makes the basket premium even more attractive relative to cash. However, it is important to note that a FTDB cannot be replicated in the cash market.

Investors should ensure that the credits in both baskets are attractive credits from a fundamental standpoint. We would normally tend to select credits whose ratings are supported by positive credit views by ML analysts.

Ratings Approach

Ratings agencies have developed ratings criteria for credit derivatives as well as instruments with credit derivative-like features embedded in their structure. These include n^{th} -to-default basket swaps and CLNs.

■ S&P

S&P's weakest link approach understates risk

S&P approach to rate first-to-default baskets consisting of ten names or less is effectively a weakest link approach. The basket is assigned the lowest rating of the entities in the pool, the counterparty and issuer rating (in the case of a CLN). Using this approach, the first-to-default basket swap (or first-to-default CLN) is usually assigned the rating of the lowest-rated entity in the basket as the swap counterparty and the collateral issuer would typically be better rated. S&P has indicated that this approach is under review.

The S&P view implicit in a first dollar loss / weakest link approach is that weaker credits default before stronger credits. The rating of a BBB credit encompasses the probability of default by a single-A credit as well as additional risks covered by the BBB rating. Another way of looking at it is to say the probability of default is cumulative as you go down the credit curve, and therefore the weaker credit will always default prior to the stronger one. Effectively, S&P also assumes a parallel ratings migration over time, i.e., a single-A rated credit will always be a stronger credit than a BBB rated credit.

This rating reflects an understatement of the credit risk taken by investors since the total probability of default for a basket swap is greater than the probability of default of the worst credit. The rating of a basket swap should reflect the probability of a single credit event as well the increased likelihood of the occurrence of a credit event.

■ Moody's

Moody's estimates expected loss to assign rating

Moody's has based its ratings criteria for baskets on the concept of expected loss. This implies that the rating is dependent not only on the probability of a credit event but also on the severity of loss following a credit event.

The methodology is described in detail in a report titled "Moody's Approach to Rating i^{th} -to-Default Basket Credit-Linked Notes" (17 April 2002). Essentially, Moody's examines several loss scenarios based on simulated recovery rates and simulated defaults following idealised default frequencies (adjusted for "soft" credit events). These losses are compared to promised cash flows and letter ratings are associated with the expected loss quantities.

11. Synthetic CDO Valuation

This chapter is written by David (Yong) Yan, Wenbo Zhu and Daniel Castro. For a more complete discussion on this topic see recent ML report titled "Synthetic CDO Valuation" by Yan /Zhu/Castro, dated 20 March 2003

Rationale of Synthetic CDO Investments

■ Why Invest in Synthetic CDOs?

The synthetic securitization market has been growing rapidly over the past two years. One major reason is that, in the current market, the collateral underlying traditional non-synthetic structured securitization does not always generate enough spread to pay the required yields demanded by investors. Cash CDO's also have the practical difficulty of matching cash flows, interest rates and maturities – making it difficult to match the assets to the liabilities of a CDO. Because a synthetic securitization makes significant use of credit derivatives, it is able to both: (i) generate more excess spread and often provide a more optimal risk-return profile; and (ii) place liabilities more efficiently. Synthetics also allow efficient matching of cash flows and therefore typically have bullet maturities. This chapter provides a general overview of valuation and risk analysis issues regarding synthetic securitization. We explain the rationale behind the investment in synthetic securitization and the mechanism of reduced-form valuation models. Our focus is on the three most important driving forces, as well as risk factors, regarding synthetic securitization – default probability, default correlation, and recovery rate. Investors will find the model and analysis useful for analyzing synthetic securitization, finding investment opportunities, and managing their current portfolios.

■ Credit Default Swap

Similar to investing in other structured finance securities, a thorough analysis of the underlying collateral and cash flow structure is essential for synthetic securitization investment. The credit default swap (CDS) is the building block for most synthetic securitization. As explained in What Drives The Basis? (Chapter 6) CDS spreads and comparable cash par floater spreads can, on occasion, trade at very different levels CDS spreads are more often wider than comparable cash par floater spreads. The underlying premise is that both a credit default swap and the underlying asset on the same name share similar default probabilities and loss given default. The extra spread often available in the CDS market is one of the positive features that offer better potential returns for synthetic investors.

Note, one structural difference between CDSs used in CDOs and generic contracts in the single name default swap market, is that they are cash settlements rather than physical settlements following a credit event. However, since this cash settlement relates to any qualifying deliverable obligation as opposed to the reference obligation alone, the economics should be similar to physical settlement.

■ Synthetic CDO

A synthetic CDO is an investment in which the underlying collateral is a portfolio of single-name credit default swaps. Investors purchasing one of the various risks can tailor their risk exposure to this large and diversified credit portfolio through tranches of a synthetic securitization. A typical synthetic CDO structure is shown in Chart 89 (assumed notional amount of \$1 billion).

The critical difference between this structure and a traditional CDO is that, unlike a typical CDO, a synthetic securitization does not purchase underlying assets like bonds or loans, but rather “references” them by way of credit default swaps.

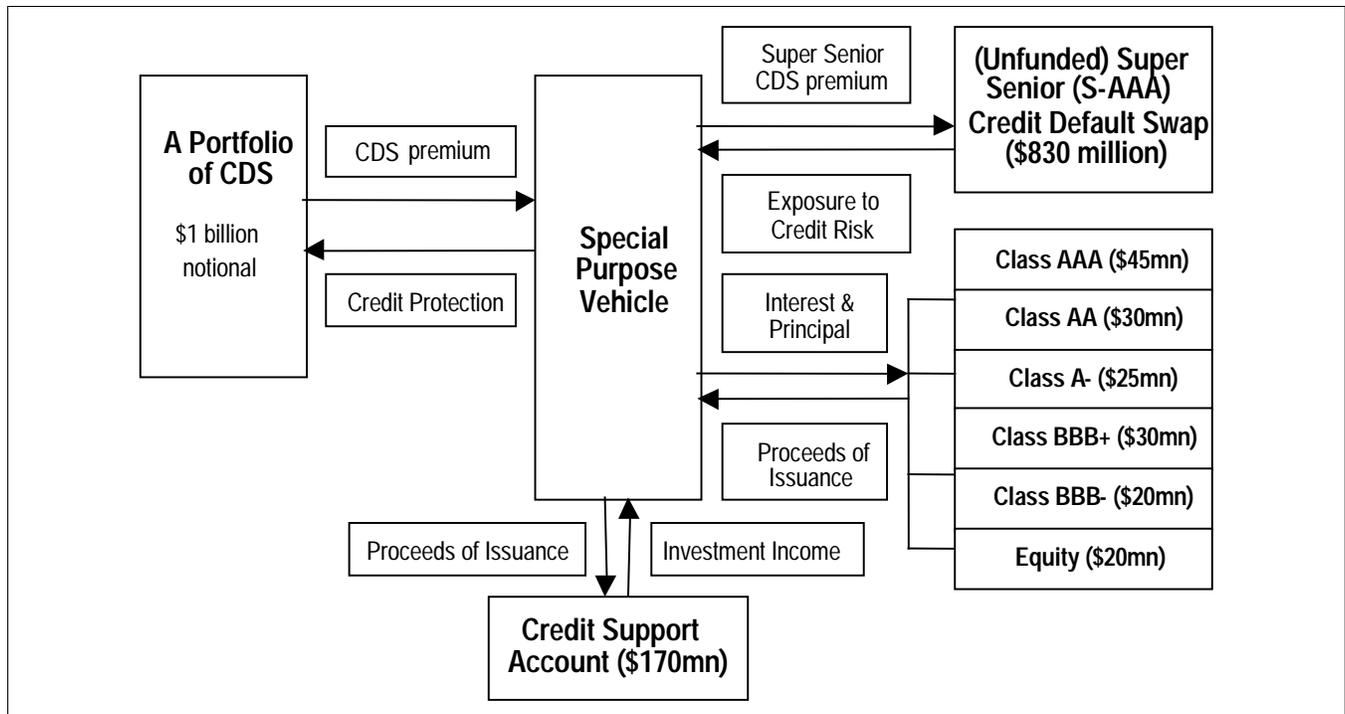
Funds collected (\$170 million) are not used to purchase collateral, but to create a credit support account, and usually invested in safe and liquid assets to absorb losses in the case of a default on any of the reference assets. These liabilities are issued in the form of multi-tranche credit linked notes (CLNs) with credit ratings from triple-A through non-rated equity. On a regular basis, the CDS premiums combined with the interest from the cash collateral account (credit support

Investors can tailor their risk exposure to a large and diversified credit portfolio through different tranches of a synthetic securitization

A synthetic CDO does not purchase the credit sensitive assets, but “references” them by way of credit default swaps

account) are paid to the investors according to a pre-defined priority of payments. Following a credit event, a trustee is expected to liquidate assets from the cash collateral account in an amount equal to the losses used to pay the protection buyers. This typically leads to a write-down of liability principal, usually bottom-up sequentially across the funded notes. For example, the first tranche to experience losses due to credit events is the equity tranche (Chart 89), then class BBB-, BBB+ and etc. Notice that in Chart 89 the structure has an “unfunded” senior tranche where investors do not put up cash, but are paid a premium to enter into a default swap with the Special Purpose Vehicle (SPV). This unfunded risk-transfer creates a more efficient capital structure.

Chart 89: Synthetic Securitization Structure



Source: Merrill Lynch

Investing in synthetic securitization (selling default protection) allows investors to achieve a higher yield than investing in cash bonds

From an investor’s standpoint, investing in a synthetic securitization (selling default protection) allows them to achieve a higher yield than investing in cash bonds, due to both the higher asset spreads paid on CDSs and the efficiency in placing senior tranches synthetically. Since we are not living in a “perfect” world, default swap spreads are generally wider than comparable cash par floater spreads. As mentioned, wider CDS spreads over the cash equivalents provide one of the benefits of investing in synthetics. In addition to this, structures with a super senior swap also provide several efficiencies. With a super senior swap, as the risk in the pool is reduced (or greater subordination is structured), the cost of this tranche can be priced at tighter and tighter spreads. This is not the case in the capital markets where further reduction in credit risk beyond a AAA level does not meet with a commensurate reduction in required credit spread. This is likely due to an investor approaching the fixed “opportunity cost” of investing cash. Including an unfunded Super Senior tranche in a deal greatly reduces the average cost of the senior liabilities and leaves either more spread or subordination for the benefit of lower-tranche investors.

Reduced-Form Model

This section focuses on the reduced-form model, a building block to the models used in providing mark-to-market valuation by Wall Street firms. Having the ability to quantify risk is essential for CDS pricing and synthetic CDO valuation.

The key parameters in valuation of synthetic CDO are default probability, default correlation, and recovery rate

The key parameters are default probability, default correlation, and recovery rate.

An investment in synthetic CDOs is essentially a contingent claim based on occurrence of credit events (default). There exist many models to determine the default probability. We can categorize them into three major approaches:

1. rating agency's approach based on historical default rates;
2. option-theoretical model (also called structural model), based on asset value and return (such as KMV and CreditMetrics); and
3. a reduced-form model based on credit spreads and risk neutral assumptions.

Unlike structural models, where fundamental factors such as the dynamics of firm value or financial status are modeled, reduced-form models focus on identifying parameters from market information and creating a replicating portfolio to mimic the pay-off of the original asset. Based on no-arbitrage condition, the value of the original asset can be derived from the replicating portfolio.

■ One-Period Contract

To illustrate, consider a credit sensitive asset A with a notional value of \$1. Let p be the probability of default over a time horizon, and q be the survival probability ($q=1-p$), θ be the recovery rate. To simplify, we assume a 3-month horizon and ignore the discount factor. The probability-weighted pay-off after 3 months is given by:

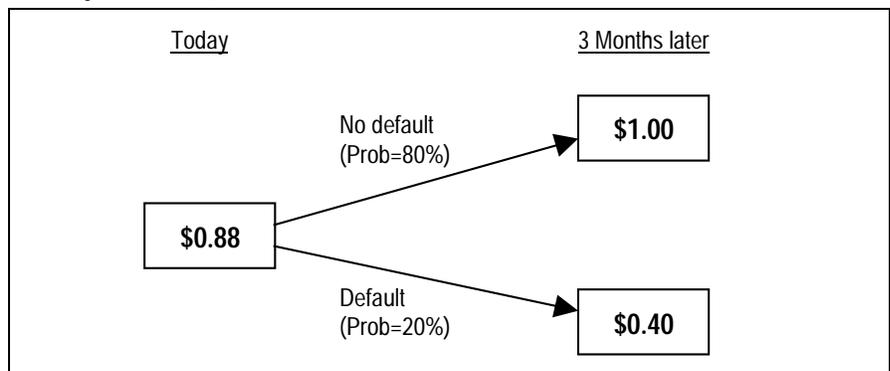
$$\text{Pay-off} = \text{notional value} \times [p \times \theta + q]$$

Assuming a recovery rate of 40% (percentage of notional) and default probability over the next 3 months of 20%, the probability-weighted pay-off is:

$$\text{Pay-off} = \$1 \times 20\% \times 40\% + \$1 \times 80\% = \$0.88.$$

Thus, the maximum price that an investor is willing to pay is \$0.88. At this point he breaks even on a probability-weighted average. Chart 90 shows the diagram of this simple credit sensitive asset.

Chart 90: Diagram of a Simple Credit Sensitive Asset (assuming no discounting and recovery rate of 40%)



Source: Merrill Lynch

Let us flip the question – If the investor is to buy insurance on the credit sensitive asset how much will he pay? (If there is a default, the insurer will make up any shortfall of \$1, i.e., pay the investor \$0.60), The answer is 12 cents or 12% of the notional. To illustrate this concept, let us assume the investor can simultaneously do two things – (1) sell the insurance and get paid \$0.12; and (2) lend \$1 to someone who promises to pay him back \$1 three months later (since there is no time value of money assumed, there is no interest on the loan). His net cash flow today is $-\$0.88 (+\$0.12 - \$1.00)$. Three months later, if there is no default, he simply paid back \$1; if there is a default, he will be paid \$1 but has to pay the insurance holder \$0.60, or a net of \$0.40.

Notice that this pay-off scenario is exactly the same as the original credit sensitive asset contract. We have just created a replicating portfolio (selling insurance and lending money) to mimic the target asset. An investor should be indifferent between these two investments. In financial terms, when an investor is indifferent between a credit sensitive asset (the original contract) and a risk-free asset (the replicating position, assuming insurer and borrower do not default), we say he is “risk-neutral”. The 12% is called the risk-neutral credit spread or credit default swap (CDS) spread in a credit default swap.

If the “market price” for the insurance is 11 cents, the investor can purchase the insurance and buy the risky asset at the same time; the net outflow is \$0.99. Three months later, no matter what happens, he will get \$1 back and thus gain an arbitrage profit of \$0.01. Everybody will go after this kind of opportunity and eventually drive the insurance price up to \$0.12. If the insurance is sold at \$0.13, the investor can sell both contracts to get \$1.01 and only need to pay back \$1 in 3 months in either scenario. Again, a guaranteed profit of \$0.01 is realized. If everybody follows the same strategy, the insurance price will have to go down to 12 cents. In finance, under certain technical conditions, no-arbitrage and risk-neutral are the same concepts.

Approximately, the expected loss and CDS spread are both equal to the default probability times one minus recovery rate

The expected loss is $\$0.12 (= 0 \times 80\% + \$0.60 \times 20\%)$. Generally, we have the following equation (loss in no-default state is always zero, so it drops out):

$$E(\text{Loss}) = p \times (1 - \theta) \quad (1)$$

As we pointed out earlier, the \$0.12 or 12% is also the risk-neutral spread with the following relationship

$$\text{CDS Spread} = p \times (1 - \theta) \quad (2)$$

The only independent check of the assumptions of any model is market data

Just as the implied volatility is derived from option prices, the default probability (p) can also be backed out from market spread (CDS spread). Because the spread is the market equilibrium price (thus no arbitrage), it is considered to be “risk-neutral” and its implied default probability and recovery are in the risk-neutral sense as well. Plus, ultimately the only independent check of the assumptions of any model is market data. So why not just start with the market information?

Appealing as it sounds, we unfortunately have only one equation (equation 2) with two unknowns – default probability (p) and recovery rate (θ). We have to strip out the recovery factor to convert the spread into probability. The most commonly used method is to use a constant recovery rate based on historical experiences.

■ Multi-period Contract

Cumulative and Conditional Default Probabilities

Let us extend our discussion into multi-period contracts. Assume the cumulative default probability over a 3-month period is 8%, and the cumulative default probability over a 6-month period is 20%. To determine the default probability from a 3 to 6 month period given no default up to 3 months, we have the following relationships:

$$20\% = 8\% + (100\% - 8\%) \times p$$

Or $p = 13.0\%$. The p here is also known as the conditional (or marginal) default probability. Given a series of cumulative default probabilities, we can bootstrap any conditional default probability within any period of time. Similar methodologies are used in deriving the period forward rate based on a term-structure of interest rates.

To generalize the above relationship, for a given time t , let the cumulative default probability from t to t_1 ($t_1 > t$) be $p(t, t_1)$, the cumulative default probability from t to t_2 ($t_2 > t_1$) be $p(t, t_2)$, and the conditional default probability from t_1 to t_2 given no default up to t_1 be $p^c(t_1, t_2 | t_1)$. We have the following relation:

$$p(t, t_2) = p(t, t_1) + (1 - p(t, t_1))p^c(t_1, t_2 | t_1) \quad (3)$$

As noted earlier, the conditional default probability is similar to the forward rate or, in this case, forward credit spread.

CDS Spread and Cumulative Default Probability

For multi-period CDS contracts, the cumulative default probability $p(t,T)$ from current time t to T with n periods is related to the CDS spread $s(\tau : t, T)$ and recovery rate θ in the following form:

$$p(t,T) = \frac{1 - \frac{1}{(1 + s(\tau : t, T))^n}}{1 - \theta} \quad (4)$$

This relationship is reduced to equation (2) for one-period contract ($n=1$ and $s \ll 1$). A numerical example is shown in Table 1, which presents three scenarios: 1) an upward sloping CDS spread curve with zero recovery rate; 2) an upward sloping CDS spread curve with 40% recovery rate; and 3) a flat CDS spread curve with 40% recovery rate.

In the case of an upward sloping spread curve with 40% recovery rate, the cumulative default probability in 3 years can be calculated using equation (4) as 2.779% ($= [1 - (1/1 + 0.562\%)^3] / (1 - 0.4)$). Furthermore, the conditional cumulative default probability is calculated using equation (3). The forward CDS spread is also calculated for a given CDS spread.

Following observations are noted from Table 34:

1. The conditional default probability can be approximated using forward credit spread when recovery rate approaches zero.
2. The CDS spread curve with upward sloping and 40% recovery rate results in a 5.313% cumulative default probability in a five-year horizon, similar to the credit quality of a company like IBM.
3. The cumulative default probabilities shown in scenario 2 are close to those of Moody's **Baa3 - Ba1** rating²⁵.
4. The cumulative default probabilities shown in scenario 3 are close to those of Moody's **Ba3** rating²⁶.

²⁵ *Default & Recovery Rates of Corporate Bond Issuers, A Statistical Review of Moody's Ratings Performance, 1920-2002*, Moody's Special Comment, February 2003.

²⁶ Same as the above footnote.

Table 34: Credit Spread Curve, Cumulative Default Probabilities and Conditional Default Probabilities**Upward Sloping Spread Curve with 0% Recovery Rate**

Year	CDS Spread	Forward CDS Spread	Conditional Default Probability	Cumulative Default Probability
1	0.346%	0.346%	0.345%	0.345%
2	0.484%	0.622%	0.618%	0.961%
3	0.562%	0.640%	0.636%	1.591%
4	0.579%	0.596%	0.592%	2.174%
5	0.650%	0.721%	0.716%	2.874%

Upward Sloping Spread Curve with 40% Recovery Rate

Year	CDS Spread	Forward CDS Spread	Conditional Default Probability	Cumulative Default Probability
1	0.346%	0.346%	0.575%	0.575%
2	0.484%	0.622%	1.033%	1.602%
3	0.562%	0.640%	1.196%	2.779%
4	0.579%	0.596%	1.055%	3.805%
5	0.650%	0.721%	1.567%	5.313%

Flat Spread Curve with 40% Recovery Rate

Year	CDS Spread	Forward CDS Spread	Conditional Default Probability	Cumulative Default Probability
1	2.70%	2.70%	4.382%	4.382%
2	2.70%	2.70%	4.462%	8.648%
3	2.70%	2.70%	4.548%	12.803%
4	2.70%	2.70%	4.639%	16.848%
5	2.70%	2.70%	4.737%	20.786%

Source: Merrill Lynch

Note: We assume risk-free rate is zero.

Default Correlation and Simulation

■ Default Correlation

Until now, we have been focusing on single-issuer's default risk. However, to evaluate a synthetic securitization we need to model the credit risk of a portfolio of assets from multiple issuers. The collateral of a synthetic securitization is a pool of credit default swaps, of which the value or loss is determined by two factors:

1. The credit quality of the collateral, in this case, the underlying assets of the credit default swap. Default probability and recovery rate are the two most important parameters to measure the credit quality.
2. The default correlation among these assets.

To put it simply, the default correlation is a measurement of the tendency of assets to default together. To price a synthetic securitization, not only do we need to understand the behavior of each single asset, but also how multiple assets default at the same time. Because defaults are rare events, empirical study on default correlation is very difficult. Some models use credit spread correlation or stock price correlation as proxy for default correlation. Fitch has recently published historical results on industry correlation matrix using asset correlation. These efforts are useful in terms of giving investors a reasonable idea of default correlation.

Another issue is how we incorporate correlation into a pricing model. The method we use is the Gaussian Copula approach. A Copula function is a function that links univariate marginal distributions to their corresponding multivariate distribution. In our analysis we use Monte Carlo simulation techniques and a generic example to illustrate how to use a reduced-form model and the Copula method to derive the loss distribution and the value of synthetic securitization.

Default correlation is extremely important for valuation of synthetic securitization

Both the timing of losses and the design of the credit enhancement in the structure can determine how these losses affect various tranches

■ Monte Carlo Simulation

The objective is to create a probability distribution of possible loss scenarios. Both the timing of losses and the design of the credit enhancement in the structure (i.e., attachment/detachment points, O/C tests, waterfall, etc.) can determine how these losses affect various tranches. The general idea of our simulation process is to use credit default swap spread curve to derive cumulative default probabilities and then generate default time based on an n-dimensional standard normal distribution with correlation coefficient matrix (known as the Copula Method²⁷). Then we can discount cash flows to calculate loss and return.

Sample Portfolio

We use a generic 5-year example that can be considered typical of most synthetic securitizations for illustration. Table 35 shows the capital structure of the transaction.

This transaction has a 5-year basket of 100 US credits with a weighted average CDS spread (WAS) of 145 basis points on the initial pricing date and an average expected recovery of 43.6%. The basket contains a \$10 million notional of each credit and thus a total notional of \$1 billion. The basket is split into 7 tranches including a super senior tranche.

Table 35: Capital Structure of a Synthetic CDO Transaction

Tranches	Cap Structure %	Notional	Start Loss	End Loss	Starting Loss (%)
S-AAA	83.00%	830,000,000	170,000,000	1,000,000,000	17.0%
AAA	4.50%	45,000,000	125,000,000	170,000,000	12.5%
AA	3.00%	30,000,000	95,000,000	125,000,000	9.5%
A-	2.50%	25,000,000	70,000,000	95,000,000	7.0%
BBB+	3.00%	30,000,000	40,000,000	70,000,000	4.0%
BBB-	2.00%	20,000,000	20,000,000	40,000,000	2.0%
First Loss	2.00%	20,000,000	0	20,000,000	0.0%
	Total	1,000,000,000			

Source: Merrill Lynch

As a quick check, the expected loss on the entire pool can be calculated using equations 1 and 4 where $s = 1.45\%$, $n = 5$, and $\theta = 43.6\%$. From equation 4 we compute the cumulative default probability over the 5-year period to be 12.31%. Then using equation 1 we compute the expected loss rate to be 6.95%. Because we ignore discounting in equation 4, the expected loss will be lower than 6.95% after taking into account discounting.

Loss Distribution

The loss distributions shown in Chart 91 to Chart 94 are at different correlation values to demonstrate the impact of correlation on the entire CDO portfolio (the impact on each tranche is discussed in the next section). The loss rate is defined as the present value of loss amount occurred over a 5-year horizon as a percentage of portfolio's notional amount.

When correlation is zero (Chart 91), i.e., all the assets are independent (not necessarily meaning that 2 assets can not default at the same time, but there is no link between their defaults), the loss distribution is close to symmetric and centered around the mean. The average loss rate is 5.11% (lower than but not too far away from 6.95%) and the standard deviation is 1.49%. The likelihood for loss above 10% (about 3 standard deviations away from the mean) is very low (about 0.19%).

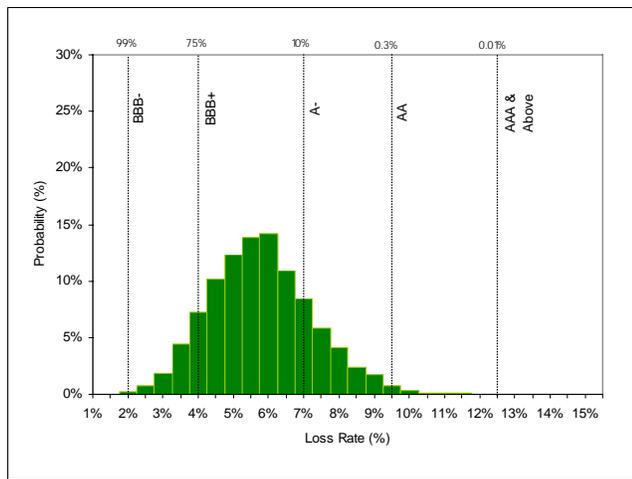
When correlation is zero, the loss distribution is close to symmetric and centered around the mean

²⁷ *On Default Correlation: A Copula Function Approach*, David Li, Working Paper, February 2000.

As the correlation increases, the tail of loss distribution gets fatter and eventually the distribution is close to binomial when correlation reaches 1

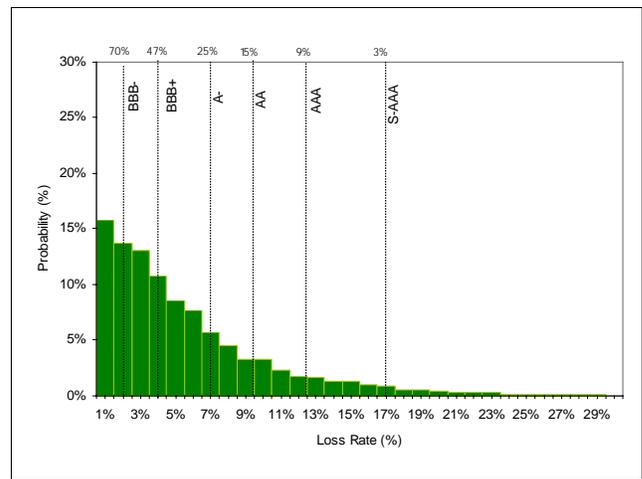
As we increase the correlation, the probability of multiple defaults and higher total losses increase. Graphically, we notice that the tail of loss distribution gets fatter and fatter. For example, the likelihood for loss above 10% increases to 13.5% when correlation is 0.25 (Chart 92) and it jumps further to 16.1% when correlation is 0.5 (Chart 93). Meanwhile, the chance of a small loss also gets bigger because the expected loss (mean) has to stay the same. Eventually, as the correlation approaches 1 (Chart 94), it is more likely that all the assets will default at the same time or none default at all and the loss distribution will approach a binomial distribution. The joint default probability is determined by the best-quality asset with the lowest default probability. Chart 94 shows the distribution when correlation is 0.98. The probability of zero loss is about 66% and also there is a good chance (probability of more than 3%) of reaching the maximum loss of about 57% (remember the average recovery rate of 43.6% is used).

Chart 91: Loss Rate Distribution and Probability of Hitting the Tranches' Attachment Point (Correlation = 0)



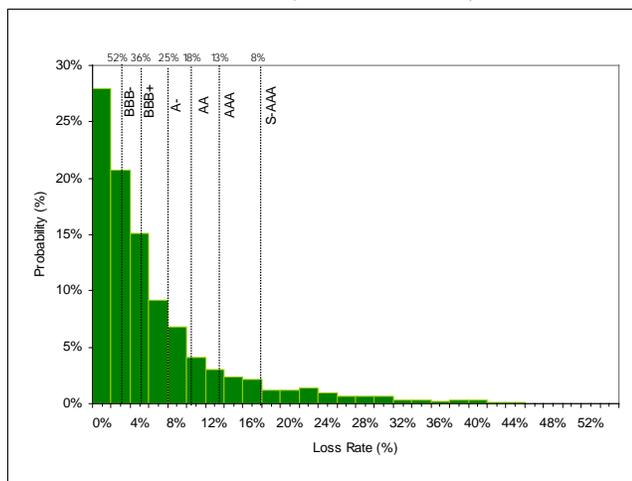
Source: Merrill Lynch

Chart 92: Loss Rate Distribution and Probability of Hitting the Tranches' Attachment Point (Correlation = 0.25)



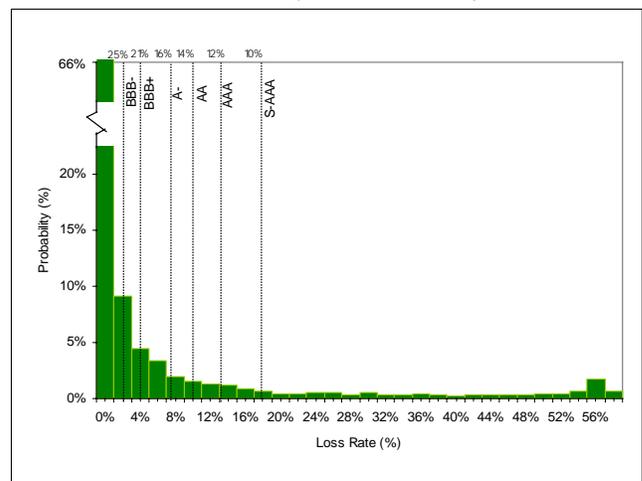
Source: Merrill Lynch

Chart 93: Loss Rate Distribution and Probability of Hitting the Tranches' Attachment Point (Correlation = 0.50)



Source: Merrill Lynch

Chart 94: Loss Rate Distribution and Probability of Hitting the Tranches' Attachment Point (Correlation = 0.98)



Source: Merrill Lynch

Tranches' Attachment Point

The starting loss rate for each tranche is set by the capital structure of the deal (Table 35). The attachment points for tranche S-AAA through BBB- are 17%, 12.5%, 9.5%, 7%, 4% and 2%, respectively. The likelihood of "hitting" these attachment points are shown on the top of Chart 91 to Chart 94.

At the zero correlation level, the BBB- tranche will start to take a loss when the loss rate exceeds 2% and the probability of the loss rate to be above 2% is 99%. In other words, the likelihood of loss on the BBB- tranche is very high. Similarly, the BBB+ tranche will not be hit until the loss rate goes above 4% and there is a 75% chance that it will occur. On the other hand, the risk for S-AAA and AAA tranches to suffer a loss is extremely slim – the probability of the loss rate beyond 12.5% is less than 0.01%.

If the correlation level goes up to 0.25 (Chart 92), the loss probability of the BBB- tranche decreases from 99% to 70%, although it is still highly likely that BBB- will experience a loss. Similarly, the probability of loss on BBB+ is lowered from 75% to 47%. In the contrary, the senior tranches experience the increase in probabilities of loss. For example, the AAA tranche has a 9% probability of loss, up from 0.3% in the zero correlation case. This pattern continues with increasing correlation (Chart 93 and Chart 94). When the correlation gets close to 1 (0.98, Chart 94), the super senior tranche S-AAA will have a 10% chance to suffer a loss!

Loss Profile and Valuation of CDO Tranches

In this section we focus on the impact of three of the most important parameters, CDS spread, recovery rate and correlation, on the loss distribution and valuation of various synthetic CDO tranches.

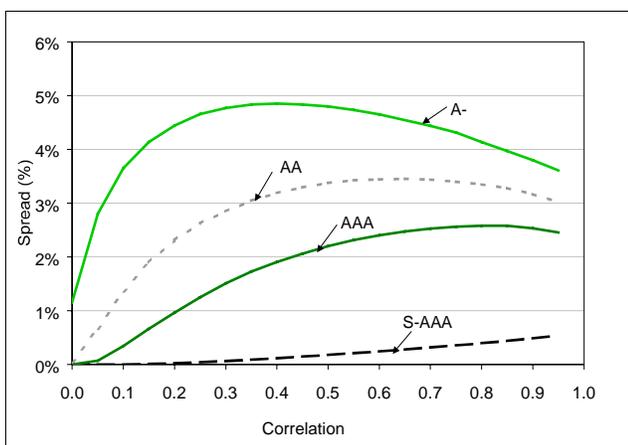
■ Default Correlation

Here we focus on the impact of correlation on the loss distribution and the spread of each tranche of a synthetic securitization. As it turns out, the result could be dramatically different for different tranches.

Break-even CDS spread is the premium paid by protection buyer at which expected present value of premium cash flows is equal to the expected present value of loss caused by defaults

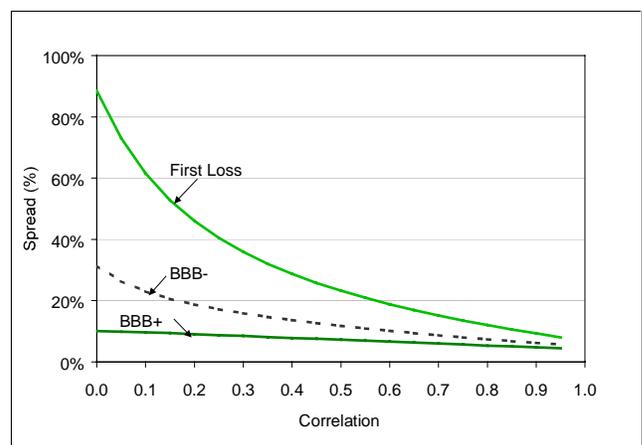
The break-even CDS spread is the premium paid by the protection buyer (received by the protection provider) at which (a) the expected present value of premium cash flows is equal to (b) the expected present value of loss amount paid by protection provider in the event of default. The detailed formulation is presented in Appendix II. The market price or CDS spread is set by the market expectation on both (a) and (b). By the same token, the break-even spread of each tranche of a synthetic securitization is the premium demanded by the investors (protection provider) so that the expected inflows (premium paid on CDSs) is equal to the expected outflows (the losses caused by defaults). We examine the impact of correlation on the valuation of each tranche through break-even spread. Chart 95 and Chart 96 show the results.

Chart 95: Break-even Spread of Synthetic Securitization Tranches vs Correlation – Senior Tranches



Source: Merrill Lynch

Chart 96: Break-even Spread of Synthetic Securitization Tranches vs Correlation – Junior Tranches



Source: Merrill Lynch

For senior tranche holder the value or price of senior tranche decreases, or spread goes up, as correlation increases

First loss or equity tranche holder likes correlation

The Super Senior Tranche

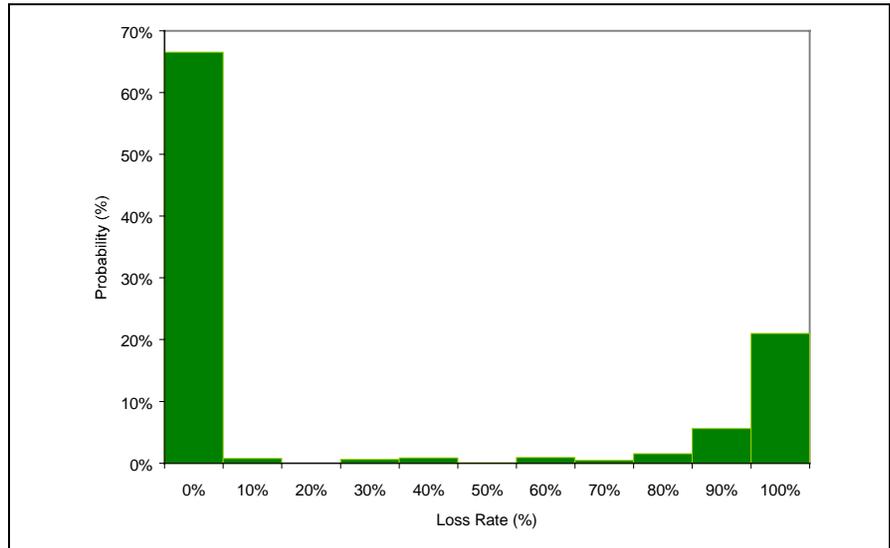
The super senior tranche (S-AAA) does not experience any losses until portfolio losses surpass \$170 million or a loss rate of 17% (Table 35). The likelihood of a large number of credit default events occurring is low if there is little correlation between credits, but increases as the correlation increases (Chart 91 to Chart 94). Therefore, the value or price of senior tranche decreases, or spread goes up, as correlation increases (Chart 95). As we discussed previously, at zero correlation the chance for the S-AAA tranche to take a loss is nearly zero. Consequently, the break-even spread for S-AAA is zero since nothing needs to be paid if no loss is expected. As the correlation among underlying credits increases, the chance of a loss for S-AAA increases accordingly and approaches 10% when correlation is 0.98 (Chart 94). Therefore, the senior tranche holders demand a premium (or spread) of approximately 60bps to break even (Chart 95). This monotonic increase in spread with correlation demonstrates that “S-AAA Dislikes Correlation.”

The First Loss Tranche

The most junior tranche can be thought of as similar to a first-to-default basket. As the correlation of credits approaches 1, the premium of first-to-default basket approaches that of the weakest credit in the underlying collateral. Conversely, as correlation approaches 0, the premium increases since the absolute level of risk increases. The joint probability of all defaults will become closer to the sum of default probabilities of all the names in the pool. Therefore, for the investor holding the first loss tranche the value of his investment increases (and spread contracts) as correlation increases (Chart 96). This monotonic decrease in spread with correlation shows that “First Loss Likes Correlation”.

As correlation approaches 1, the loss distribution of the equity tranche is binomial. Chart 97 shows the loss-or-no-loss nature of equity tranches when correlation among assets is nearly perfect (0.98). It has a 66% chance of absolutely no loss (i.e., high return). The “rest” of the distribution is “irrelevant” to equity holders since they lose everything anyway.

Chart 97: Loss Distribution of Equity Tranche (Correlation = 0.98)



Source: Merrill Lynch

The relationship between spread and correlation for mezzanine tranches is not always monotonic

The dependence of spreads on correlation for the remaining tranches has intermediate behavior. As seen in Chart 95, the relationship between spread and correlation for mezzanine tranches is not always monotonic. In particular, A-, AA and AAA tranches show a positive relationship between spread and correlation when correlation is low and a negative relationship when correlation value becomes larger.

Change in WAS will dramatically change the spread of each tranche

Increasing WAS drives up the spread of each tranche

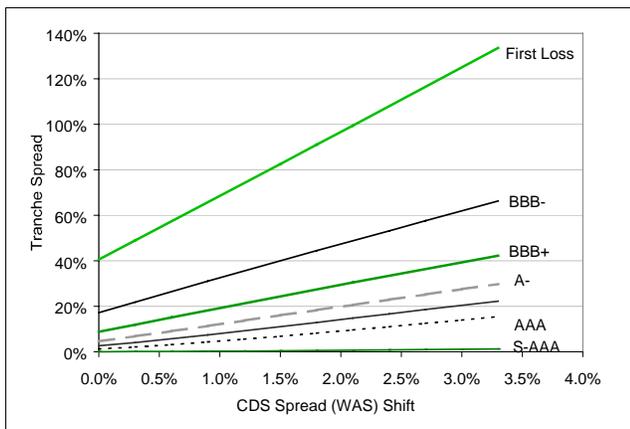
■ Credit Spread

As discussed previously, when assuming no liquidity premium and other structural issues, the CDS spread indicates the market's assessment on the credit quality, in terms of both default probability and recovery, of the underlying assets. If the recovery is assumed to be constant then increased spread means investors anticipate default to be more likely. As default probabilities and recovery rates are not directly observable, synthetic securitization investors need to monitor CDS spreads very closely. Change in WAS will dramatically change the spread of each tranche.

For our sample portfolio, the WAS is 145bps on the pricing date. If there is a parallel upward shift in WAS, the spreads of all tranches will move up since the investor (protection provider) demands more compensation as the likelihood of default on underlying CDSs and loss goes up. Assuming a constant recovery rate of 25%, Chart 98 and

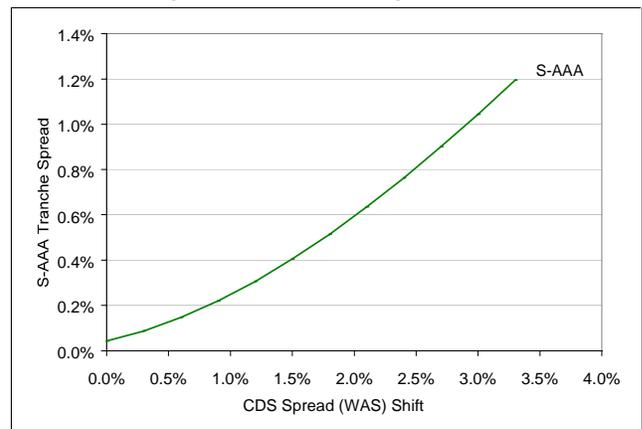
Chart 99 show the spread of various tranches as a function of the WAS shift. The 0% on the X-axis corresponds to a no-shift in WAS (or WAS=145bps) and 1% corresponds to a 100bps upward shift in WAS (or WAS=245bps).

Chart 98: CDS Spread (WAS) Shift vs Spread of Individual Tranche



Source: Merrill Lynch

Chart 99: CDS Spread (WAS) Shift vs Spread of S-AAA Tranche



Source: Merrill Lynch

However, the profiles of each tranche are not exactly the same. The spread of equity tranches moves almost linearly with the up-shift of WAS (Chart 98), while the profile is convex for the senior tranche (Chart 99), i.e., the spread of the senior tranche moves up faster with the WAS shifting up. Also, the slope of the curve is steeper for the equity tranche.

The First Loss Tranche

As the first layer to absorb loss, the equity tranche holders always take the first loss. Therefore they are more concerned or “sensitive” to the increasing chance of loss, as shown by the steeper curve (Chart 98). Yet their “sensitivity” to increasing risk (increasing spread) is rather constant since they are always the first in line to experience losses.

The Super Senior Tranche

Conversely, the super senior tranche holders will not worry about loss so long as the loss amount is below the loss protection level provided by junior tranches. Their “sensitivity” or “fear” for loss is less at the lower spread level (the curve is flatter), but increases when the spread goes up as the danger of suffering a loss becomes more relevant to them (Chart 99). The higher the chance of default, the faster the junior tranches will be consumed and thus the sooner the senior tranche is exposed to loss.

The behavior of mezzanine tranches is somewhere in between (in terms of both slope and convexity level), as shown in Chart 98.

Equity holders are more sensitive to the increasing risk, yet the sensitivity stays constant

Senior tranche holders do not worry about risk of loss covered by protection, yet their concern become increasingly greater with mounting risk of default and loss

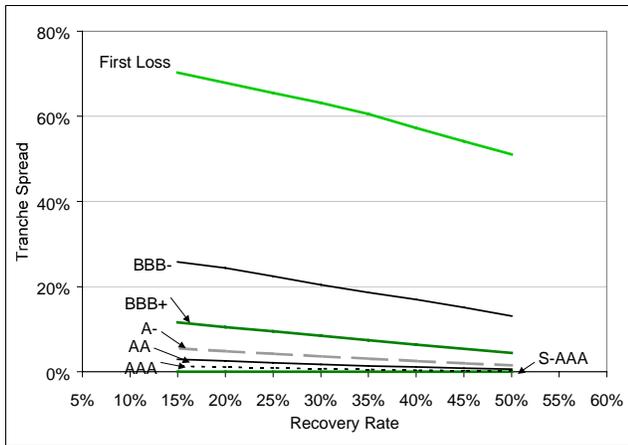
■ **Recovery Rate**

Although recovery rate does not change the “timing” of default, it does change expected loss and return

Until now we have assumed that the recovery rate is constant. However, recovery varies across different industry sectors, different periods of time, different asset types, etc. We define the recovery rate as the recovery amount in percentage of notional value. The main approaches to derive recovery rate include a) building quantitative models for recoveries and b) relying on historical recovery experiences. Credit spread is jointly determined by both default probability and recovery rate. When the macro-economic situation worsens and investors expect recovery to be lower, the credit spread and thus the spread of each tranche will go up, even assuming default probability does not change. Although recovery rate does not change the “timing” of default, it does change the expected loss and return.

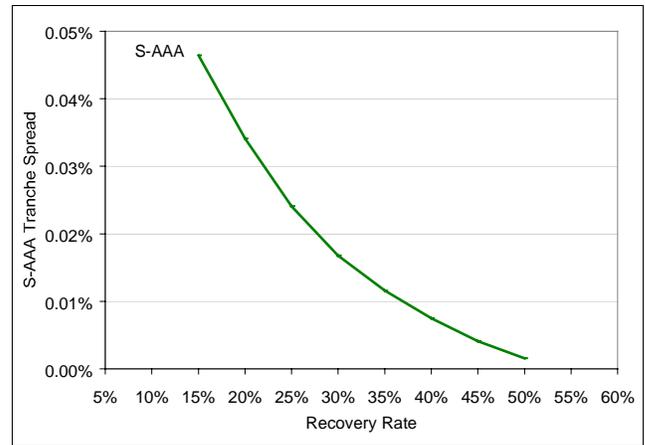
To see how a change in recovery rate affects spread of different tranches, we need to hold default probability unchanged. As a result, the CDS spread will change (equation 2). As shown in equation 4, the relationship between recovery and spread for multi-period contracts is quite complex. To simplify the matter and just make our point, we only consider a one-year period in the structure of the sample portfolio and use a constant correlation of 0.25. The tranche spreads are calculated by shifting recovery rate in 5% increments (Chart 100 and Chart 101). As recovery rate increases, the tranche spreads decline monotonically for all tranches.

Chart 100: Recovery Rate vs Individual Tranches Spreads



Source: Merrill Lynch

Chart 101: Recovery Rate vs Super Senior Tranche Spread



Source: Merrill Lynch

The recovery vs spread curve is steeper and linear for more junior tranches, while convex for more senior tranches

The impact of recovery on tranche spreads is similar to that of the CDS spread. The curves are steeper and nearly linear for junior tranches and more convex for senior tranches. The change in the recovery rate has the largest impact on the first loss tranche and least on the super senior tranche. The reasons are similar as well. Lower recovery results in higher loss to investors. Equity holders are more sensitive to loss but the sensitivity does not change over the range of recovery rates. On the other hand, senior tranche holders feel safer at higher recovery but get more and more nervous when recovery becomes lower, thus steeper spread curves in the low range of recovery rate.

Relative Value Analysis

■ **Risk-neutral vs Reality**

One of the key assumptions of a reduced-form or risk-neutral model is that the CDS spread solely reflects the credit risk taken by investors. However, in reality, there are liquidity issues, supply and demand forces, and other structural factors. Investors often ask two questions:

1. Does the default probability implied by credit spreads provide an “unbiased estimate” of future defaults?
2. How do we use the model to generate relative-value trading ideas?

Refer to important disclosures at the end of this report.

Risk-premium compensates investors for risk-aversion, mark-to-market risk, lower liquidity, and other technical and structural factors

Stating question 1 another way, “Is the credit spread on an asset the best estimate of expected loss?” As detailed earlier, the market credit spread (or CDS spread) is used to derive default probability and recovery. For a tranche of a synthetic securitization, all the assets are linked through default correlation to reach the “value” or expected loss of each tranche. But the question of whether expected losses are the only factor in determining the “appropriate” spread is the same for an individual credit as it is for a tranche of a synthetic securitization. The practical reality is that investors (and rating agencies) do not change expectation of losses in a pool commensurate with underlying changes in credit spreads. In other words, a doubling of credit spread does not necessarily mean that the market is expecting a downgrade of, say, 2 notches. Spreads reflect things other than just expected loss – liquidity, changing correlation, and other technical and structural factors. These other factors could be incorporated into something formally known as the risk premium.

Another example of the disparity in value between market levels and one’s expected losses can be illustrated by using our generic synthetic example. A diverse pool of CDS’s that is put together at the WAS of 145 would have an approximate rating of A3-Baa1 (or a Weighted Average Rating Factor, WARF, of 180-260, respectively, by Moody’s²⁸). Based on historical average default rates from 1983-2002 by Moody’s²⁹, the cumulative issuer-weighted default rate for A3-Baa1 are 0.62% and 1.80% respectively, or cumulative loss rates of 0.35% to 1.01% assuming a recovery of 43.6%. This compares to our calculation of an expected loss of 5.1% based on our model. In other words, the market is pricing this deal at a spread (145bps) much higher than what its rating suggests. If we believe the rating correctly represents the default probability and recovery rate, then either the market is over-estimating the loss (which presents us a buying opportunity) or the market is taking into consideration other factors besides default probability and recovery rate, such as liquidity.

If we incorporate an additional variable to account for “other” factors, equation 2 should be instead:

$$CDS = p \times (1 - \theta) + \delta \quad (5)$$

where δ is the risk premium.

The answer to question one above is no. First, the implied default probability is just a number based on where the market price of the CDS can be set so that supply balances with demand. It incorporates every market participant’s view on credit, but does not necessarily equal actual default probability. Second, because of the existence of a risk premium, the implied default probability contains some factors irrelevant to credit.

Does this mean that risk-neutral approach is useless? NO. In the same way that implied volatility of options is used by market participants, investors can treat implied default probability as a benchmark, against which actual probability or historical default rates can be compared. No one knows for sure what the actual default probability will be in advance. The implied default probability can at least tell us what the market thinks of the probability and where the CDS should be traded. If the market is pricing in a probability much higher (or lower) than the normal level, investors should take a close look at it because usually some investment opportunities can be found. If after all other factors irrelevant to credit, such as risk premium, are considered and there is enough reason to believe that the market is over-reacting, investors should take a long position on the credit risk, or vice versa.

Implied default probability does NOT equal actual probability. Investors can treat implied default probability as a benchmark, against which actual probability or historical default rate can be compared

²⁸ *Collateralized Debt Obligations Indices: December 2002*, Moody’s Report, February 2003.

²⁹ *Default & Recovery Rates of Corporate Bond Issuers, A Statistical Review of Moody’s Ratings Performance, 1920-2002*, Moody’s Special Comment, February 2003.

One way to obtain an indication of the risk premium inherent in spreads is to compare market-implied default probabilities with average historical defaults

Ideally we could correctly estimate δ and remove it from the market spread to get the “pure” credit spread. However, it is not easy to gauge the risk premium since it incorporates many factors. One way to obtain an indication of the risk premium inherent in spreads is to compare market-implied default probabilities with average historical defaults. Or we can construct credit curves from historical average default rates and compare the default swap spreads implied by such curve to the default swap spreads observed in the market.

■ **Default Correlation and Relative Value**

We now have a framework for assessing the risk and return for taking credit risk - allowing an investor to ask whether the risk premium is sufficient to compensate for a difference in their view of expected losses and the market’s implicit view. For a pool of credits, there is another variable to explicitly add to the assessment – correlation.

Given an investor’s view on losses (probability of loss and recovery) one can calibrate the implicit correlation in a pool of credits in a synthetic CDO by using the approach explained earlier. As with the investor’s view on an individual credit, the question is whether the possible return compensates him sufficiently for his view on correlation and that provided by the market.

Of course, if the investor wants to “capture” this risk premium, the best way is through a sufficiently diversified pool of credits. A large pool of well-diversified assets minimizes the investor’s exposure to one specific risk while enabling them to enjoy the risk premium. Default correlation is the key determinant.

As noted previously, if one’s estimate on correlation is much higher than that implicitly being priced by the market, the investor should invest in the lower or more junior tranches, i.e., sell the protection. As we mentioned before, the lower tranche holder likes correlation. Conversely, if investors believe that the assets are much more independent and the likelihood of multiple defaults will go down considerably, they will find the senior tranches increasingly attractive.

If the market-calibrated correlation is lower than their estimate, investors should go long the junior tranche, i.e., sell the protection

12. Counterparty Risk

Counterparty risk is a key feature of OTC contracts

Credit default swaps are over-the-counter (OTC) contracts between buyers and sellers of protection. Among other risks, both parties to the contract are exposed to the credit risk of the counterparty (or "counterparty risk"). This risk reflects the potential failure by the counterparty to make a payment when it is due. The extent of counterparty risk in a CDS depends on whether the investor is a protection seller or a protection buyer.

Non-payment by protection buyer . . .

Protection Seller

The only risk faced by the protection seller is that the protection buyer fails to pay the premium for whatever reason. Unlike buying a bond, selling CDS protection is an unfunded investment. Whilst the par amount (or notional amount) is exposed to a default by the reference entity, it is not at risk from a counterparty default.

Following the protection buyer's failure to make a premium payment, the seller can terminate the provision of protection and sell protection on the same credit to another counterparty. This could **expose the seller to the mark-to-market (MTM)** movement of the default swap premium. If the CDS with the original counterparty is documented under the ISDA Master Agreement, any difference between the related MTM is accounted for in the termination payment. However, the original counterparty may also fail to pay any termination payments required to be made by it under the ISDA.

. . . could expose protection seller to MTM risk

The MTM may be substantial if the default premium has tightened significantly since the seller sold the initial CDS. However, the MTM is limited by the fact that CDS premiums can never be negative. MTM risk for the protection seller would also be relatively small for low premium default swaps.

Table 36: Protection Seller's Counterparty Risk

Protection Seller	Cash Flows
Sell 5y protection	+150bps
<i>Protection buyer defaults within 5 years</i>	
Default premium (bid) at time of buyer's default	+100bps
MTM loss annuity (bps)	50bps
Notional amount	€10mn
PV01 (€) (1)	€3,000
MTM loss (€) (2)	€150,000

(1) This is an assumption. $PV01(€) = (\text{Notional Amount}/10K) \times \Sigma (\text{Survival Probability} \times \text{Risk-free Discount Factor})$

(2) $MTM \text{ Loss } (€) = \text{Loss annuity (bps)} \times PV01(€)$

Source: Merrill Lynch

Protection Buyer

Timing of default by protection seller could leave buyer with . . .

The protection buyer faces **two** key risks:

1. The reference entity defaults *and* the protection seller is unable to pay the notional amount due to the protection buyer on delivery of the appropriate obligation.
2. The reference entity does *not* default *but* the protection seller files for bankruptcy thus rendering its protection worthless.

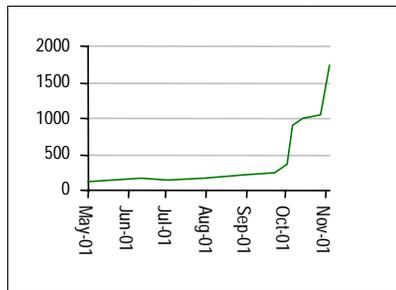
. . . defaulted asset and no protection . . .

In the *first situation*, the protection buyer would be left with a **defaulted asset and no protection**. However, the protection buyer can claim against the protection seller for any amount due from the seller that remains unpaid or unsatisfied through collateral arrangements just like any other **senior unsecured creditor** (including claims proved in any liquidation of the seller).

The *loss* experienced by the buyer would be equal to:

$$1 - (\text{recovery value of the defaulted asset} + \text{recovery from protection seller})$$

Chart 102: Enron 5y Default (bps)



Source: Merrill Lynch

... or significant MTM loss

This loss would be substantial if the defaulted asset has a small recovery value and the protection buyer is unable to recover any significant amount from the protection seller (either via collateral arrangements or through the courts).

The greater the default correlation between the reference entity and the protection seller, the greater the likelihood of both defaulting simultaneously. For example, an investor who buys protection on an Italian company such as Fiat from that company's largest Italian lender bank would be exposed to significant correlation risk.

A good example of a large counterparty defaulting has been the demise of Enron. Enron was a relatively large player in the credit derivatives market and its failure was the first big default by a counterparty. Chart 102 illustrates the widening of default premiums on Enron as it approached bankruptcy at the end of November 2001.

The *second situation* could expose the protection buyer to **significant MTM risk**. If the seller defaults but the reference entity does not, the protection buyer can terminate the existing contract and buy protection from a new counterparty. If the reference entity has deteriorated substantially since start of protection, the new default premium would be considerably larger. This would imply a relatively large negative MTM impact for the protection buyer. If the CDS with the original counterparty is documented under the ISDA Master Agreement, any difference between the related MTM is accounted for in the termination payment. However, the original counterparty may also fail to pay any termination payments required to be made by it under the ISDA.

Table 37: Protection Buyer's Counterparty Risk

Protection Buyer	Cash Flows
Buy 5y protection	+150bps
<i>Case 1: Reference entity defaults within 5 years and seller is bankrupt</i>	
Recovery value of defaulted asset	40%
Loss (%)	60%
Notional amount	€10mn
Loss (€)	€6mn
Amount recovered from collateral arrangements and/or bankruptcy court	X
Net Loss (€)	€6mn - X
<i>Case 2: Seller is bankrupt within 5 years but reference entity does not default</i>	
Default premium (offer) at time of seller's bankruptcy	+200bps
MTM loss annuity (bps)	50bps
Notional amount	€10mn
PV01 (€) (1)	€3,000
MTM loss (€) (2)	€150,000

(1) This is an assumption. $PV01(€) = (Notional\ Amount/10K) \times \Sigma (Survival\ Probability \times Risk\text{-}free\ Discount\ Factor)$

(2) $MTM\ Loss\ (€) = Loss\ annuity\ (bps) \times PV01(€)$

Source: Merrill Lynch

CLN structures reduce counterparty risk . . .

. . . since protection buyer is exposed to counterparty risk of highly rated SPV

Dynamic collateral posting could mitigate risk . . .

. . . for both the seller . . .

. . . as well as the buyer who is typically exposed to a larger counterparty risk

Transactions under ISDA Master can be netted out . . .

CLN Structure Reduces Counterparty Risk

An obvious way for protection buyers to reduce counterparty risk is via credit-linked notes (CLNs). CLNs are structures that provide fully funded exposures to credit derivatives such as single-name credit default swaps (CDS) or first-to-default basket swaps.

CLNs are cash instruments that are created by embedding credit derivatives in new issues from a special purpose vehicle (SPV). The CLN investor achieves synthetic exposure to CDS (i.e. indirectly sell protection) in a funded security form. However, the protection buyer is exposed to the credit risk of the highly rated SPV.

We discuss CLNs in more detail in CDS Investor Strategies (Chapter 7).

Risk Reduction by Collateralisation

■ Collateral Posting Arrangements . . .

If agreed by both parties, counterparty risk for protection buyers and sellers can be mitigated by the **protection seller posting collateral** or by **two-way collateral posting** arrangements. All credit default swaps are transacted under the ISDA Master Agreement. The Credit Support Annex or CSA (which supplements the ISDA Master Agreement) establishes the collateral posting arrangement.

In general, collateral posting is based on the valuation of the portfolio of transactions under the ISDA Master Agreement and not on any individual transaction. This arrangement allows for protection buyers and sellers to agree to post collateral as MTM on this portfolio increases or decreases.

The collateral posting is **dynamic in nature** and postings are typically made either daily or weekly. The counterparties may also negotiate a minimum MTM threshold above which the collateral can be called.

■ . . . Can Benefit Both Counterparties

Though collateral arrangements are primarily for the benefit of the protection buyer, two-way collateral posting can also benefit protection sellers. The MTM risk for protection sellers arises when protection is bid at *tighter levels* after the protection buyer defaults on the original CDS. However, default premiums typically tighten relatively gradually which would allow the seller to recover most of the MTM loss from the collateral following such a default.

Collateral posting is particularly useful to protection buyers who are exposed to a greater level of counterparty risk. Collateral arrangements can mitigate MTM risk for the buyer especially when the protection seller goes bankrupt *before* any significant deterioration of credit quality of the reference entity. The problem arises when the credit quality of the reference entity deteriorates rapidly *and* the protection seller goes bankrupt simultaneously. The seller might be unable to post the relatively large collateral required to cover this sudden move leaving the buyer exposed to a significantly large MTM move.

■ Netting of Transactions Under the ISDA Master Agreement

The existence of an ISDA Master Agreement allows, where jurisdiction and type of transaction permit, the netting of transactions documented under the ISDA Master as evidenced by a Confirmation³⁰. Where the ISDA Master Agreement is supplemented by a CSA, the net exposure can be collateralised on a mark to market basis under the collateral arrangement. The ISDA Master Agreement and

³⁰ A "Confirmation" is the underlying document that is executed between the parties that will evidence the particular transaction (for example, the CDS) under the ISDA Master Agreement.

... which provides substantial benefits to dealers and investors ...

all Confirmations there-under form a single agreement, which together with other features of the ISDA Master Agreement allows exposures to be netted.

As a result, different transactions documented under an ISDA Master Agreement (e.g. CDS contracts, interest rate swaps) with the same counterparty can be netted against each other. **This could substantially lower credit exposure to a particular counterparty.** In addition, if a counterparty defaults on any transaction under the ISDA Master Agreement, the ISDA Master Agreement allows the non-defaulting party to terminate all transactions under the same ISDA Master Agreement with that counterparty. It is also likely that this will cross default into any other ISDA Master Agreements between the two parties. **The netting feature is especially beneficial when complex counterparties are on the opposite side of various ISDA documented transactions like credit default swaps, interest rate swaps, currency swaps, etc.**

... jurisdiction and type of transaction permitting

The netting of exposures under an ISDA Master Agreement and CSA may not be possible in all jurisdictions and may not be possible for all transactions under the ISDA Master Agreement. For example, there are doubts as to the ability to net CDS transactions in Italy.

Obligations under ISDA Master Agreement are pari passu to senior unsecured obligations

Ranking of CDS in Capital Structure

Obligations under ISDA Master Agreement rank *pari passu* to senior unsecured obligations of the counterparty. In the event of default by the counterparty, all ISDA transactions with the counterparty may be terminated and netted out to calculate a net MTM profit or loss. Any MTM loss may be recovered from the collateral that has already been posted. If the collateral is insufficient, the remaining amount can be claimed as a senior unsecured obligation of the counterparty.

Recovery value for senior unsecured bonds average about 37% from 1982-2002

According to Moody's, the average recovery rate for senior unsecured bonds has been about 37% over the period 1982-2002. This compares to a more recent average of 34% in 2002. S&P highlights an average recovery rate of about 53% for senior unsecured debt of *US corporate issues* over the period 1988-2001. However, the average recovery rate over a more recent period (1997-2001) has been about 44%.

A more detailed discussion of average recovery rates is available in Unwinding Default Swaps (Chapter 4).

Increase in counterparty risk would tighten basis

Factors Affecting Counterparty Risk

The protection buyer is exposed to a larger counterparty risk than a protection seller in a CDS contract. An increase in counterparty risk would lower the premium that the protection buyer would be willing to pay. This would tend to tighten the basis between the default premium and the asset swap spread.

The counterparty risk faced by a protection buyer would take into account the following factors:

- Probability of default (or credit quality) of the protection seller (PS).
- Probability of default (or credit quality) of the reference entity (RE).
- Joint probability of default of PS and RE (or the correlation between the default of PS and the default of RE).
- Recovery rate of the RE.
- Recovery rate of senior unsecured obligations of the PS.
- Likelihood of PS defaulting *before* RE.

The last factor is important because if the protection seller defaults before the reference entity the protection becomes worthless at that point.

Banks and insurance companies are key players

Who Are The Counterparties?

Banks, securities firms and insurance companies are actively buying and selling protection while other market participants like corporations, hedge funds and mutual funds are beginning to take an increasing interest in the credit derivative market.

Credit derivatives like credit default swaps should facilitate the transfer of credit risk between these players to the most efficient bearer of risk. The table below highlights the changing activity levels of different types of market participants. For a more detailed discussion please see the section named "Market Participants" in Chapter 1.

Insurance companies are becoming very important protection sellers

Banks are largest buyers and sellers of protection – but market share is shrinking

Mutual & pension funds are still very small players

Table 38: Principal Buyers and Sellers of Protection – Market Share

	Protection Buyers				Protection Sellers			
	1997	1999	2001	2004 (forecast)	1997	1999	2001	2004 (forecast)
Banks	64%	63%	52%	47%	54%	47%	39%	32%
Securities Firms	18%	18%	21%	17%	22%	16%	16%	15%
Insurance Companies	5%	7%	6%	8%	10%	23%	33%	33%
Corporations	7%	6%	4%	7%	3%	3%	2%	4%
Hedge Funds	0%	3%	12%	13%	4%	5%	5%	7%
Pension Funds	1%	1%	1%	3%	2%	3%	2%	4%
Mutual Funds	1%	1%	2%	3%	4%	2%	3%	5%
Government Agencies	4%	1%	2%	2%	1%	1%	0%	0%

Source: BBA Credit Derivatives Reports 1999/2000 & 2001/2002

In a recent Fitch survey³¹, global banks and broker dealers ranked as the top credit derivative counterparties. The top three most commonly quoted counterparties (based on frequency of occurrence) were J.P. Morgan Chase, Merrill Lynch and Deutsche Bank. Fitch also observed that most financial guarantors and reinsurers are the largest sellers of protection on a net basis and cite the same banks and broker dealers above as main counterparties.

³¹ *Global Credit Derivatives: Risk Management or Risk?*, Fitch Rating, 10 March 2003.

13. Bank Capital Treatment

Existing system reflects a pre-credit derivatives world

Jargon Buster

BIS: Bank of International Settlements

Basel I: Basel Accord, July 1988

Basel II: New Basel Accord (proposed)

CAD: Capital Adequacy Directive

FSA: Financial Services Authority

QIS3: Quantitative Impact Study 3 Technical Guidance

CRW: Counterparty Risk Weight

CCF: Credit Conversion Factor

RWA: Risk Weighted Asset

PRR: Position Risk Requirement

SRR: Specific Risk Requirement

CRR: Counterparty Risk Requirement

The existing bank capital framework was established through the Basel Accord in July 1988 (Basel I), which came in force well before the credit derivative market had developed. Whereas this framework includes guidance for treatment of off-balance sheet exposures, it does not specifically deal with credit derivative transactions. As such, each central bank has had leeway to regulate the capital implications in slightly different ways. In this section we provide a brief summary of the current and proposed capital adequacy treatment.

Banking Book

The principal component of a typical banking book is the loan portfolio which faces three primary risks: (a) credit risk – the risk of non-payment by the borrower; (b) interest rate risk – the risk that the net income earned on the loan will decline as interest rates rise and push up funding costs; and (c) liquidity risk – the risk that a bank will have insufficient funds to meet undrawn loan commitments.

Basel I covers mainly credit risk and outlines how different asset classes (both on and off balance sheet) are weighted according to their "riskiness". There are four principal counterparty risk weights (CRW) outlined in Table 39, which are applied to an asset's balance sheet value, to derive the risk weighted asset (RWA). The RWA is then multiplied by the capital ratio set by a firm's regulator, the minimum permissible is 8%, to give the capital requirement.

Table 39: BIS Risk Weights

Counterparty Risk Weight (CRW)	Asset Class
0%	Sovereign (all OECD and domestic currency non-OECD)
20%	Sr debt (OECD banks / investment firms & some non-OECD banks)
50%	Loans to individuals secured by residential mortgages
100%	Corporates / non-OECD non-domestic sovereign
Credit Conversion Factor (CCF)	
0%	Commitments & undrawn facilities < 1year original maturity
50%	Commitments & undrawn facilities > 1year original maturity
100%	Written guarantee

On-Balance Sheet RWA = B/S Value x CRW

Off-Balance Sheet RWA = B/S Value x CCF x CRW

Capital Required = RWA x Capital Ratio (min 8%)

Source: BIS

Off-balance sheet items are multiplied by the appropriate credit conversion factor (CCF) outlined in Table 39, to give a balance sheet equivalent value. The credit equivalent is similarly multiplied by the relevant CRW to calculate a RWA.

The drawback of this system is that the weightings do not adequately reflect the differing default risks of the borrowers. The new proposed framework (discussed in a later section), aims to improve on this system.

■ Single Name

When **banks sell protection**, these long credit exposures are treated the same as a written guarantee on the underlying credit. Thus, if the Reference Entity is a corporate, then this will attract 100% CCF and 100% CRW.

When **banks buy protection**, regulators will typically be willing to allow a degree of capital relief if the default swap is directly offsetting an underlying long credit position. In the UK, for example, the treatment is similar to that of a guarantee. Banks can choose whether to replace the underlying corporate exposure (100% risk weighted) with that of the protection seller (20% if it is an OECD bank). However, the bank would have to establish to the regulator's satisfaction that the

Risk weightings do not reflect default risk of the borrower

Some relief can be available for banks buying protection to hedge

Refer to important disclosures at the end of this report.

terms of the default swap are indeed equivalent to a guarantee. Such treatment is clearly advantageous for capital requirements although arguably still conservative since it gives no relief for the less than unitary correlation between the default risk of the reference entity and the protection seller (i.e. loss requires that following a credit event of the Reference Entity, the default swap counterparty also fails to pay). Table 40 highlights capital requirements following the purchase of maturity-matched protection to hedge a loan on a bank's balance sheet.

Table 40: Buy Protection – Maturity Matched

Asset	Loan A	Fully Protected	Partially Protected	
		Buy Protection from OECD Bank	Buy Protection from OECD Bank	Unprotected
Amount (mn)	€100	€100	€50	€50
Term	5y	5y	5y	5y
Risk-Weight	100%	20%	20%	100%
Capital Ratio	8%	8%	8%	8%
Capital (mn)	€8.0	€1.6	€0.8	€4.0

Source: Merrill Lynch

Maturity mismatches have varying regulatory treatments

Differences between regulators tend to arise when the maturity of the default swap is different to that of the underlying credit exposure. In particular, a forward credit exposure can occur if the protection period is shorter than the underlying loan. In the US, the regulatory approach is case by case but mismatches are usually allowed provided the tenor of the default swap is relatively long. In Europe, there are differences between regulators but broadly speaking, the portion hedged by protection would attract the risk weighting of the swap counterparty (potentially 20%) and the remainder would be treated similarly to an unfunded loan commitment (50%³²) – giving a final risk weighting of 70% (20% + 50%). If the final risk weighting exceeds the original capital requirement for the underlying asset, the protection can be ignored. However, in most cases bank regulators will not allow any such relief if the residual life of the default swap is less than one year. Table 41 highlights the impact on capital requirements if a bank buys maturity-mismatched protection.

Table 41: Buy Protection – Maturity Mismatch

Asset	Loan A	Unmatched Protection	
		Buy Protection from Bank	Forward Commitment
Amount (mn)	€100	€100	€100
Term	5y	3y	2y
Risk-Weight	100%	20%	50%
Capital Ratio	8%	8%	8%
Capital (mn)	€8.0	€1.6	€4.0

Source: Merrill Lynch

■ Multiple Name (Baskets)

Regulatory treatment of FTDBs is challenging because of multiple reference entities . . .

There has been some debate about the regulatory treatment of basket structures. The challenge arises due to the fact that there is no single reference asset that forms the basis for an appropriate capital charge. An accurate assessment of risk of a basket structure would require a computational analysis of the correlation between different credits in the basket as well as the joint probabilities of default. However, the current capital rules would not be able to cater to this level of detail.

. . . and is treated conservatively by the FSA

The UK regulator, FSA, has taken an extremely conservative route. If a **bank sells FTDB protection**, the FSA requires it to hold capital against all the names in the basket. The regulator, however, adds that this is not needed if the bank can

³² Credit conversion factor of 50% on the risk weight of underlying asset (100% for corporate asset) = 50% x 100% = 50%

demonstrate a "very strong correlation" between the assets in the basket. We believe the onus would be on the firm to prove that strong correlation exists. The risk weightings are applied to the maximum payout amounts for each of the names in the basket. The total capital charge is limited to the notional amount of the basket.

When a **bank buys FTDB protection**, the protection is recognised against one asset in the basket. The bank can choose which asset in the basket attracts protection. It can also choose whether to replace the underlying corporate exposure (100% risk weighted) with that of the protection seller (20% if it is an OECD bank or investment firm).

Table 42: Buy FTDB Protection

Portfolio	Long Position					Buy 5yr Protection €10mn Notional Referencing A-E	
	Amount (€ mn)	Term	Risk-weight	Capital Ratio	Capital (€ mn)	Risk Weight	Capital (€ mn)
Loan A	10	5yr	100%	8%	0.80	20%	0.16
Loan B	10	5yr	100%	8%	0.80	100%	0.80
Loan C	10	5yr	100%	8%	0.80	100%	0.80
Loan D	10	5yr	100%	8%	0.80	100%	0.80
Loan E	10	5yr	100%	8%	0.80	100%	0.80
<i>Total</i>					<i>4.00</i>		<i>3.36</i>

Source: Merrill Lynch

Maturity mismatch treated similarly to single name default swap

Similar to a single-name default swap, if there is a maturity mismatch, protection is not recognised if the residual maturity of the protection is less than one year. If the residual maturity is one year or over, a forward credit exposure can occur if the protection period is less than the maturity of the asset that is chosen by the bank. The forward credit exposure attracts a 50% credit conversion factor against the risk weight of the underlying asset (50% x 100% = 50% for a corporate asset). The protection can be ignored if the total capital needed (including that for forward credit exposure) exceeds the original capital requirement for the unprotected asset. This treatment is broadly the same across Europe.

■ Funded Instruments (CLNs)

Risk weight for long CLN position is higher of risk weights of Reference Entity, SPV or collateral . . .

Banks that **buy CLNs** are exposed to the CDS Reference Entity, the counterparty (typically an SPV) and the collateral securities purchased with the money received from the issuance of CLNs. The purchase of a CLN is an on-balance sheet exposure. The amount of risk is limited to the funding and is recorded at the higher of the risk weights of the reference entity, the counterparty or the collateral security. This treatment is broadly the same across Europe.

Banks may hedge credit risk by **issuing CLN's**. Where banks issue the CLN directly (i.e. they directly receive full upfront cash funding), the underlying credit exposure is regarded as being cash collateralised, and so is zero risk weighted. All regulators seem to agree on this approach.

. . . but no regulatory guidance when bank buys protection from SPV that issues a CLN

However, it is common for a bank to buy unfunded protection from an SPV, which has in turn issued a funded CLN, investing the proceeds in collateral securities. There is little evidence of regulatory guidance here, and two approaches seem possible. (1) Banks could "look through" the SPV to the collateral securities and infer the risk weight of the SPV to be that of the securities. Attitudes to "look through" vary widely among regulators. (2) A bank could regard the SPV-held paper as being effectively its own collateral (only OECD Government securities would be regarded as eligible collateral). The bank would need to control the securities, and legal certainty over the right to liquidate the collateral in the event of the default of the reference asset would be required. Collateral rules are very specific to individual jurisdictions

Table 43: Issue CLNs Directly and Buy Protection

Asset	Loan A	Fully Protected	
		Buy Protection from OECD Bank	Issue CLN Referencing A (1)
Amount (mn)	€100	€50	€50
Term	5yr	5yr	5yr
Risk-Weight	100%	20%	0%
Capital Ratio	8%	8%	8%
Capital (mn)	€8.0	€0.8	€0.0

(1) Assume bank issues CLN directly.
Source: Merrill Lynch

Trading Book

Though regulations vary a little between countries, credit derivatives typically can be designated as trading book assets provided they are held with the intent to trade and can be marked to market on a consistent daily basis and there are market makers providing a degree of liquidity. Most countries have frameworks for allowing capital offsets where the derivative is held against an underlying credit position in a security (or in most cases a loan). However, in Europe (except Germany) if each leg of the transaction is to avoid a capital charge, the offset must currently be perfectly matched. The US is more flexible regarding the recognition of partial offsets. In Germany, regulators do not permit a specific risk offset between long bond and protection.

Long or short derivative positions netted against cash

All trading book credit derivative contracts create notional long (sell protection) or short (buy protection) positions in the reference asset. A long or short position in any security faces a **specific risk charge**. In the UK, long or short notional positions may be netted against other (cash or notional) positions in the same asset (same maturity, currency and pari passu ranking). Consequently, **specific risk may be reduced or eliminated altogether**.

Specific risk charge if maturity mismatch

However if a **maturity mismatch** exists between the long and short risk positions, then a "one sided" specific risk charge is taken, which effectively **ignores the benefit of the protection purchased**. Risk weights of 20% or lower (investment grade) or 100% (sub-investment grade) are then applied to the resultant net positions in each asset (see Table 44). This can be a significant problem for a broker/dealer "flow" business.

Table 44: Specific Risk Charge for Trading Book

Specific Risk Charge	Reference Entity
0.00%	All OECD Sovereign; Non-OECD Sovereign local currency < 1year
0.25%	High grade residual maturity < 6 months
1.00%	High grade, residual maturity > 6 months, < 24 months
1.60%	High grade residual maturity > 24 months
8.00%	Sub-investment grade or unrated

Source: CAD

Conservative treatment by FSA for baskets

FSA regulations for first-to-default baskets are also relatively conservative for trading book treatment. If a **bank buys FTDB protection**, it should record a short position in one reference asset of the basket. The bank can choose this asset from the basket.

If the **bank sells FTDB protection**, the bank is required to record a long position in each of the assets in the basket similar to banking book treatment (the requirement is capped at the maximum payout). The FSA may not require this if the bank can show that the assets in the basket have a "strong correlation". Once again, it is the onus of the bank to prove that strong correlation exists.

VaR models can give more favourable capital requirements

Since the implementation of the second Capital Adequacy Directive (CAD) in 1996, it has been possible for banks to use market risk capital requirements. For credit derivatives this involves a Position Risk Requirement (PRR) and a Counterparty Risk Requirement (CRR). The PRR is comprised of the **specific risk** and **general market risk** requirement. For credit derivatives, the specific risk charge is the primary charge on the trading book and can be quantified using either standard rules (as described above) or value-at-risk (VaR) models provided the bank's regulator has approved these models. VaR models are typically attractive to banks since VaR risk measures are frequently lower than the risk weightings under standard rules in the banking book or trading book. However, very few VaR models are typically approved by the regulators for calculation of specific risk.

The **counterparty risk** charge faced by credit derivative transactions held on the trading book is dependent upon the risk category of the obligor, mark-to-market of the position and an add on factor based on the type of product and the term of the transaction. However, as the BIS rules do not include a specific credit derivatives product category, each bank regulator has established its own system in its choice of add-ons for calculating the CRR.

For a standard OTC contract, the counterparty charge for a protection buyer is calculated as follows:

$$[(Notional \times PFCE) + Max (0, MTM)] \times CRW \times 8\%$$

where

PFCE = Potential future credit exposure

MTM = Mark-to-market of the contract

CRW = Counterparty risk weight (0% for sovereign, 20% OECD bank or investment firm and 50% for corporates)

The PFCE depends on whether the underlying is a qualifying debt security (QDS) – typically a high grade security – or not as well as the residual maturity of the credit derivative. Table 45 highlights the PFCE used by FSA for different combinations.

For a protection seller, the counterparty risk is typically lower than that faced by the protection buyer. The counterparty charge for protection seller is given below

$$PV (outstanding premium receivable) \times CRW \times 8\%$$

The table below highlights the SRR and CRR for different trading book positions of banks that buy protection to hedge a long bond position.

Table 45: Potential Future Credit Exposure (Add-ons)

Residual Maturity	QDS	Non-QDS
<1	0%	6%
1yr-5yr	0.5%	8%
>5yr	1.5%	10%

QDS = Qualifying Debt Security (typically high grade security)

Non-QDS = Sub-investment grade security

Source: FSA

Table 46: Capital Charge Examples for Trading Book

Trading Book Position	Investment Grade	Long Position Bond X € mn	Notional Short Position Bond X € mn	Forward Position € mn	Net Position for Specific Risk € mn	Specific Risk Requirement € mn	Counterparty Risk Requirement € mn	Total CRR + SRR € mn
Long Bond X + ...								
Buy protection of equal notional size, and equal maturity date	Y	100	-100	0	0	0.00	0.024	0.024
Buy partial protection (50% notional), and equal maturity date	Y	100	-50	0	50	0.80	0.020	0.820
Buy protection of equal notional size, earlier maturity date	Y	100	-100	100	100	1.60	0.024	1.624
Buy protection of equal notional size, and equal maturity date	N	100	-100	0	0	0.00	0.144	0.144
Buy partial protection (50% notional), equal maturity date	N	100	-50	0	50	4.00	0.080	4.080
Buy protection of equal notional size, earlier maturity date	N	100	-100	100	100	8.00	0.144	8.144

1. Standard OTC contract is purchased from bank counterparty, maturity of 1-5 years, current MTM = \$1mn in all cases

2. Specific Risk Charge = 1.6% for investment grade and 8% for sub-investment grade

3. General market risk (GMR) is ignored as it is likely to be immaterial

Source: Merrill Lynch

The New Basel Capital Accord

New Capital Accord proposed

In January 2001, the Basel Committee on Banking Supervision published New Basel Capital Accord (Basel II) consultative document that proposes a new framework to change the way regulatory capital reflects the underlying risk. It consists of three pillars. The first pillar, minimum capital requirements, expands on the requirements of the 1988 rules and allows the risk-weighting system to be based on external or internal credit ratings. The second pillar, supervisory review of capital adequacy, will seek to ensure that a bank's position is consistent with its overall risk profile and strategy. The third pillar, market discipline, will encourage high disclosure and enhance the role of market participants in encouraging banks to hold adequate capital.

Harmonisation of treatment . . .

The consultative documents also include specific proposals for the treatment of credit derivatives although the Capital Group is now moving in a different direction on the issue. A more recent publication called Quantitative Impact Study 3 Technical Guidance (QIS3) published in October 2002 provides more detail on the intended treatment for credit derivatives.

. . . expected by end 2006

The Basel Committee is working towards an implementation date of 31 December 2006, preceded by a 12 month parallel-run period. In order for Basel II to become effective in the UK, the EU needs to pass the 3rd Capital Adequacy Directive (CAD3) and the FSA then needs to issue and consult on a new Regulatory Sourcebook. The EU process may well suffer delays. However it seems likely that the FSA will implement the Basel II proposals in line with the Basel timetable, even if CAD3 is delayed.

■ **Banking Book Proposals**

BIS requires restructuring credit event for capital relief . . .

QIS3 proposes that capital relief should be available to banks when exposures are protected by credit derivatives, but only where the credit protection is direct, explicit, irrevocable and unconditional. The **credit events** must also at a minimum cover: (1) **failure to pay** the amounts due under terms of the underlying obligation that are in effect at the time of such a failure; (2) **bankruptcy**, insolvency or inability of the obligor to pay its debts as they become due; and (3) **restructuring** of the underlying obligation involving forgiveness or postponement of principal, interest or fees that results in a credit loss event. In addition, in the event of a physical settlement, it is necessary that any required consent by the protection buyer to transfer the underlying obligation to the seller may not be unreasonably withheld.

Provided these conditions are met, banks should be able recognise protection provided by sovereigns, banks, securities firms, insurance companies and corporates with credit quality of single-A- or better. These include protection provided by parent, subsidiary and affiliate companies when they have a lower risk weight than the obligor.

. . . though it may allow capital relief on no-R contracts

The BIS requirement to include restructuring in the credit events has been a major stumbling block towards the move to a no-restructuring CDS market. This requirement is arguably more problematic in Europe than in the US given the heavy involvement of banks in the market as buyers of protection in particular. However, it appears that the BIS may be showing greater flexibility on the issue of allowing capital relief on no-R CDS contracts provided the bank has the right of veto over the restructuring process.

Contingent risks noted but not modelled into the Accord

Further comments recognised the risk over-estimation problem relating to imperfectly correlated contingent default risks of the Reference Entity and the protection seller. However, given the practical difficulties in measuring and modelling such portfolio correlation benefits, no relief will be given regarding this double default effect.

External or internal ratings based

Under the new accord it was proposed that there be two approaches available to banks in calculating their capital requirements. There is the **Standardised**

Approach which weights credit quality based on external credit ratings (see Table 47) and the **Internal Ratings Based (IRB) Approach** which is based on internal credit assessment of default probability.

The credit conversion factors are the same as those that are currently employed (see Table 39) except for an increase from 0% to 20% for commitments and undrawn facilities < 1 year.

Relief also available when counterparty is a creditworthy non-bank

Table 47: Proposed Percentage Risk Weights Under the Standardised Approach

Credit Assessment	AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to BB-	B+ to B-	Below B- & Defaulted	Unrated
Sovereigns	0	20	50	100	100	150	100
Banks 1 + Investment firms	20	50	100	100	100	150	100
Banks 2 + Investment firms							
< three months	20	20	20	50	50	150	20
> three months	20	50	50	100	100	150	50
Corporates	20	50	100	100	150	150	100

Bank1: Loans slotted according to rating of sovereign (according to the place of incorporation)
 Bank 2: Loans slotted according to the banks' own rating
 All values above are percentages of the core 8% risk asset ratio
 Source: BIS

Capital relief provided on pro-rata basis

QIS3 proposes that the risk weight of the protected portion is assigned the risk weight of the protection provider. The uncovered portion of the exposure is assigned the risk weight of the underlying obligor. If the amount that is protected is less than the amount of the exposure, capital relief will be provided on a pro-rata basis. For a credit protected exposure, the risk weighted asset will be:

$$(E - G) \times r + G \times g$$

E is value of exposure (e.g. nominal amount of loan)

G is nominal amount of protection

r is risk weight of the obligor

g is the risk weight of the protection provider

QIS3 proposes conservative capital treatment for FTDBs . . .

The capital treatment proposed in QIS3 for FTDBs is relatively conservative. In this case, banks that buy protection on FTDBs may recognise capital relief for the asset in the basket with the lowest risk-weighted amount but only if the notional amount of the exposure is less than or equal to the notional amount of the FTDB.

If banks sell protection on FTDBs the risk weighting depends on external credit ratings of the basket. If the FTDB is rated by an external credit assessment institution, the risk weighting applied to securitisation tranches (see Table 48) would be used. If the basket is not rated the risk weights of the assets in baskets will be aggregated and multiplied by the nominal amount of the basket to obtain the risk weighted asset amount.

Table 48: Risk-Weight for Securitisation Tranches (Long-Term Rating)

External Credit Assessment	AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to BB-	B+ and Below or Unrated
Risk weight	20%	50%	100%	350%	Deduction

Source: BIS

. . . and second-to-default baskets (STDBs)

Banks that buy protection on second-to-default baskets will receive capital relief only if FTD protection has also been obtained or when one of the assets within the basket has already defaulted. The capital treatment for banks that sell protection on STDBs is similar to that for selling protection on FTDBs with one exception – when risk weights are aggregated the asset with the lowest risk weight can be excluded in the calculation of the risk weighted amount.

New proposals aim to lower incentive to minimise regulatory arbitrage

■ **Trading Book**

For maturity matched positions, there may be an incentive for banks to concentrate credit derivative exposures on the trading book (0% risk weight in the trading book vs. 20% the banking book for a corporate hedged by OECD bank). In a September 2001 press release, the BIS noted that one of its objectives in formulating its new policies for credit derivatives will be to minimise the possibility of regulatory arbitrage by booking transactions in the trading book to achieve a more favourable capital treatment for the same risk.

BIS has now proposed that if a bank hedges a banking book exposure by buying protection internally from the trading book, the credit risk in the trading book must be transferred outside the firm to an eligible third party for the bank to receive capital relief for the exposure in the banking book.

BIS is proposing new specific risk charges for sovereigns as shown in the table below. The specific risk charges for the other entities are proposed to remain unchanged. Under the standardised methodology, the specific risk weights are now based solely on ratings.

Table 49: Proposed Specific Risk Charges

Specific Risk Charge	Sovereign Rating	Non-sovereign	Residual Maturity
0.00%	AAA to AA-	-	-
0.25%	A+ to BBB-	High grade	< 6 months
1.00%	A+ to BBB-	High grade	> 6 months, < 24 months
1.60%	A+ to BBB-	High grade	> 24 months
8.00%	All Others	Sub-investment grade	-

Source: BIS

Three categories of specific risk offsets

The specific risk offset for long positions hedged by credit derivatives fall into *three* broad categories:

1. **100% offset:** Applies if the two legs of the hedge are "completely identical" (e.g. buy and sell protection with identical maturity, currency and reference asset) or a long position is hedged by a total return swap (or vice versa) for the same reference asset.
2. **80% offset:** Applies when the two legs always move in opposite direction such as a long position hedged by a CDS or a CLN (or vice versa) and there is an exact match in maturity, currency and reference asset.
3. **One-sided charge:** Applies if there is a maturity, currency or reference asset mismatch between the cash position and the credit derivative. However, the underlying asset should qualify as a deliverable obligation. In all these cases, the higher of the two capital requirements will apply (i.e. there is no specific risk reduction).

The reference asset requirement is a concern as it appears to ignore market convention whereby CDS's do not have precise reference assets but are referenced to a particular point in the capital hierarchy of a firm. Protection buyers who have ensured that the asset they wish to purchase protection over is included in the range of deliverable obligations may still face a one-sided charge under the current drafting.

Table 50: Proposed Specific Risk Determination for Trading Books

Example	Long Position	Short Position	Net Specific Risk Position	Notes
1	Bond 100	Bond -100	0	Identical bond
2	Bond 100	Total return swap -100	0	Identical bond / return swap reference asset
3	Bond 100	Default swap / CLN -100	20	Reference asset, currency and maturity of CDS / CLN must be identical to that of bond
4	Bond 100	Default swap / CLN -100	100	Either currency or maturity of CDS / CLN are not identical to that of bond
5	Bond 100	Default swap / CLN -100	100	Reference asset is not the same between bond and CDS/CLN, but included in range of deliverable obligations. Currency and maturity of CDS / CLN must be identical to that of bond.
6	Bond 100	Default swap / CLN -100	200	Same reference entity, but two of the following three do not match - maturity, currency, and reference asset. Treated as two different positions.

Source: Merrill Lynch

New add-on factor of 5% or 10% for counterparty risk

Basel II should have significant effects on the credit derivatives market

FTDBs and STDBs are dealt with in a similar fashion as the banking book. Banks that have sold basket protection or bought basket CLNs would be required to add the specific risk charges or use external ratings if available. In the case where the banks buy basket protection or issue basket CLNs, they would be allowed to offset specific risk for one of the underlying names, i.e. the asset with the lowest specific risk charge.

The basic formula for calculating OTC counterparty risk remains the same. However the add-on factors are now formalised as 5% or 10% depending on whether the reference asset is investment grade or junk. For investment grade assets, this is substantially higher than the current maximum add-on of 1.5% (see Table 45). Additionally the counterparty risk weights that are used to weight the credit equivalent amount now follow those of the banking book Basel proposals, i.e. dependent on ratings as well as bank/corporate category.

■ Potential Effects of Basel II on the Credit Derivatives Market

The new framework as proposed by Basel II aims to improve the way regulatory capital reflects the underlying risk. We believe that the implementation of the new proposals should also have significant effects on the credit derivatives market which we highlight below:

- The new risk weights under the standardised approach should **lower the incentive for regulatory capital arbitrage** for banks that own high quality corporate debt. Debt of corporates with ratings of AA- and above would attract similar risk weights (20%) as high quality protection sellers such as banks.
- The availability of **regulatory capital relief even when the counterparty is a creditworthy non-bank** would change the nature of attractive protection sellers. For example, assuming the standardised approach, a bank can hedge BBB rated debt (100% risk-weight) and lower its capital requirements by buying protection from a AA corporate (20% risk weight) instead of a similarly rated bank (20% risk weight).
- Current sellers of protection such as **some banks and investment firms may be less attractive counterparties** for those banks looking for capital relief. For example, if a bank has currently bought protection from an investment firm rated A+, the capital requirement would increase from 20% under current Basel rules to 50% under the standardised approach making the investment firm a less desirable counterparty.

- In addition to monitoring the credit quality of debt held in the banking book, the **credit quality of counterparties would also be need to be actively monitored** by banks. Downward ratings migration of these counterparties (banks or corporates) could lead to a significant increase in capital charge which is not the case under current rules.

In Germany, this report should be read as though Merrill Lynch has acted as a member of a consortium which has underwritten the most recent offering of securities during the last five years for companies covered in this report and holds 1% or more of the share capital of such companies.

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