ISMA CENTRE - THE BUSINESS SCHOOL
OF THE FINANCIAL MARKETS

UNIVERSITY OF READING
ENGLAND

IFID Certificate Programme

Credit Analysis and Products

Credit Derivatives

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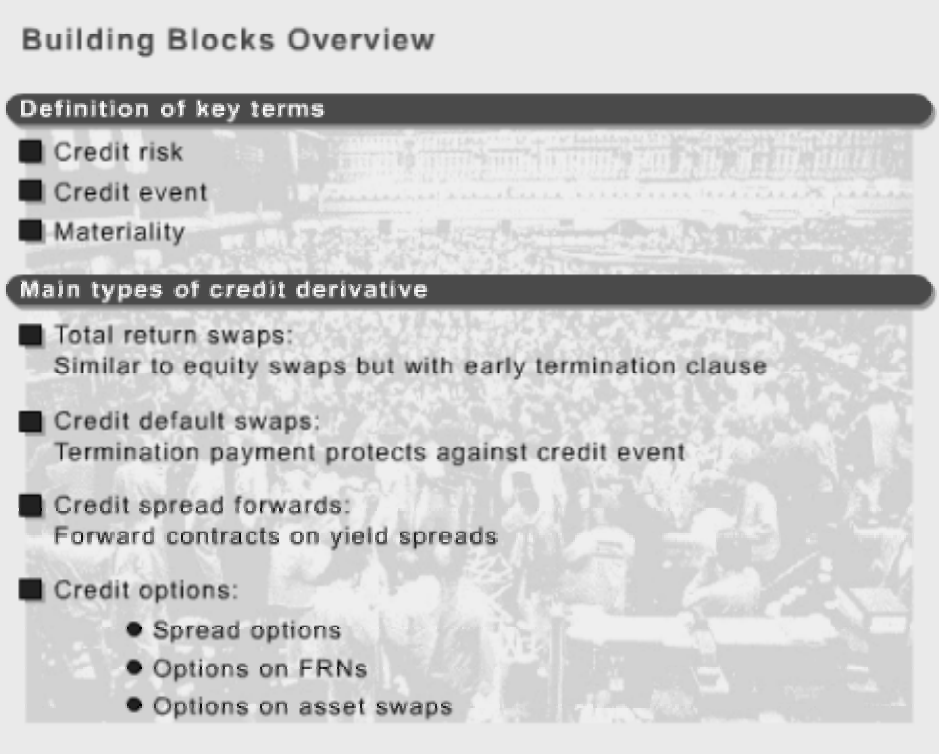
1. Overview



Here we look at a relatively new family of derivative instruments whose market has grown to an estimated total of USD 2.3 trillion in nominal amounts outstanding.

In this module, we examine the structure, pricing and applications of the basic types of credit derivative.

Learning Objectives

By the end of this module, you will be able to:

1. - Outline the structure of a typical credit default swap (CDS)
2. - Compare the relative merits of cash settlement vs. physical settlement in a CDS contract
3. - Define the key terms of a CDS contract, in particular:
   - Reference obligation(s)
   - Credit event
   - Materiality
   - Restructuring maturity limitation clause
4. - Explain how default swaps may be used in credit portfolio risk management
5. - Explain how a CDS position may be hedged with (or arbitraged by) an asset swap or an FRN on the same reference obligation

6. - Identify the key factors that cause variations between premiums quoted in the CDS market and the LIBOR spreads in the asset swap or FRN markets

7. - Outline the typical structure of a synthetic collateralised debt obligation (CDO) and the rationale for issuing this product

8. - Outline the structure and typical applications of:
   - Total return swap
   - The credit spread forward
   - Credit options

9. - Explain the implication of the early termination clause on the payoff and the pricing of total return swaps, credit spread forwards and credit options

2. Definitions

2.1. What is a Credit Derivative?

Credit derivative: a bilateral contract that transfers specific aspects of the **credit risk** on a reference debt obligation between the two parties.

Credit risk: the risk that the market value of a financial instrument will change as a result of:

- A change in the credit rating (or quality) of the instrument or its issuer
- Failure by the issuer to meet its contractual obligations (**default risk**)

Also known as: **Counterparty risk**.

Simply stated, whereas market risk is about the return on your money, credit risk is about the return of your money. Credit derivatives allow fixed income investors to:

- Lay off some (or all) of the credit risk on the assets held (the **reference obligations**) while still retaining their market risk
- Take on credit exposure to a debt issuer (the **reference name** or **reference entity**) without necessarily acquiring the issuer's obligations

With credit derivatives, investors can acquire more diversified credit exposures for their portfolios, while traditional lenders can hedge their concentration of risks on specific names or market sectors.

2.2. Credit Events

As we shall see, the payout on a credit derivative is commonly triggered by the occurrence of a **credit event** - an event that affects the credit status of the reference name.

Credit Events (2003 ISDA **Credit Derivatives Definitions)**

- **Bankruptcy** of the reference entity
- **Failure to Pay** (failure by the reference name to meet its payment obligations when due)
- **Obligation Default**
- Obligation Acceleration (the accelerated repayment of an issuer's obligation)
- **Repudiation** or **Moratorium** (for sovereign entities)
- Restructuring of the issuer's debt with materially adverse consequences

Which of these triggers are included in the contract is a matter of negotiation between the two parties to the credit derivative transaction. As in any OTC contract, the two parties may choose to include other event triggers that are not listed in the standard ISDA documentation[1].

[1] For an example of this, see the contingent CDS in section *Credit Default Swap*, below.

2.3. Materiality

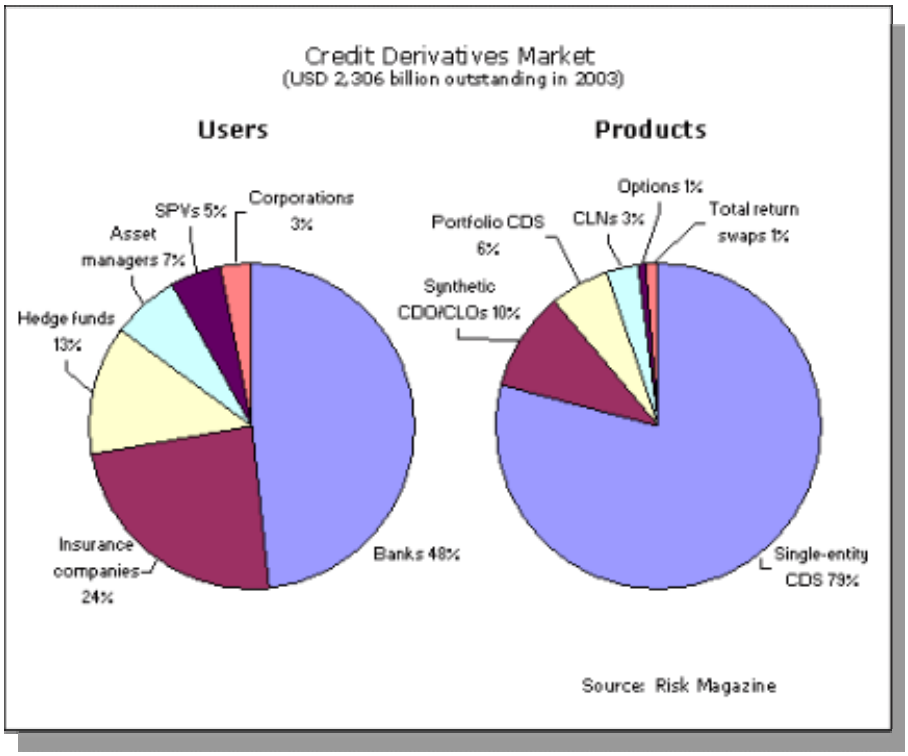
Materiality requires that a credit event must be associated with a significant change in the status of the reference entity or its reference obligation.

This is an important element in the definition of a credit event. It is designed to prevent either of the parties to a credit derivative transaction from declaring a credit event on account of a small or technical payment failure by the reference entity or its paying agent, or on account of adverse movements in bond prices in general.

We shall see how this concept is implemented in the definition of Failure to Pay, Default and Restructuring in section *Credit Default Swap* and also in the definition of the **early termination clause** in section *Other Structures*, below.

3. Market Users & Products

This has been one of the fastest-growing market sectors in recent years, with total amounts outstanding expanding by more than 50% per annum since in 2001. The charts below show who are the main users of this market and its main products. Click on the drop-down menu below for more details about this chart.



Guide to the charts

Market users

- **Banks** are have been and still are the largest users, although their percentage participation in this market has diminished in the past two years.
    - Some banks use credit derivatives to reduce some of the concentration of credit risk in their loan portfolios towards their most important business clients
    - Other banks use credit derivatives to acquire credit exposure to specific corporate names with whom they don't have a business relationship
- **Insurance companies** and **asset managers**: these institutional investors have become increasingly active users of credit derivatives as a way of decreasing or increasing their concentration of credit risk towards specific names as business conditions change
- **Hedge funds** have become a distinct presence in this market.
    - Some hedge funds use this market as a way of building speculative positions on specific reference names, for example ahead of a possible merger or corporate restructuring – the so-called **corporate action** arbitrageurs
    - Other hedge funds spread-trade credit derivatives against the underlying asset swaps, the reference bonds and even the equity of the reference names – the so-called **credit** and **capital structure** arbitrageurs
- A few **corporate bond issuers** have started using credit derivatives as a way of hedging their future costs of funding in rapidly changing market conditions

The products

- **Single-entity credit default swap** (CDS). The CDS gives someone exposure to pure credit default in exchange for a fixed premium and is by far the most fundamental building block of the credit derivatives market. Therefore, we begin this module with an analysis of its structure, its relationship to the underlying reference bond and its pricing.
- **Portfolio CDS**. These are CDSs whose payoffs depend on the joint performance of two or more out of a list of reference entities, instead of on just one, and for this reason they are known as **correlation products**
- **Synthetic CDOs, CLOs** and **CLNs**. These are in fact mostly funded versions of the CDS product (single-entity or portfolio variety). As with ordinary CDOs and CLOs, the investor in each tranche earns a return on capital proportional to the amount of credit exposure she takes to the underlying pool of credits, except that here instead of a pool of loans the exposures are acquired synthetically by means of a pool of credit derivatives (mostly CDSs)
- **Total return swap** (TRS). In a TRS one party receives the total return (coupons plus capital gain/loss) on a reference bond in exchange for a LIBOR-based payment. This structure is very similar to an equity swap except that the underlying is a bond or portfolio of bonds rather, than stocks.
- **Credit options**. Credit options include a wide variety of products – for example, options on FRNs, on asset swaps and on CDSs. Some of these (e.g. option on FRNs) have been around for many years but as the chart suggests, this section of the market is still the domain of a few specialists, so we shall not dedicate a lot of space to it in this programme.

4. Credit Default Swap

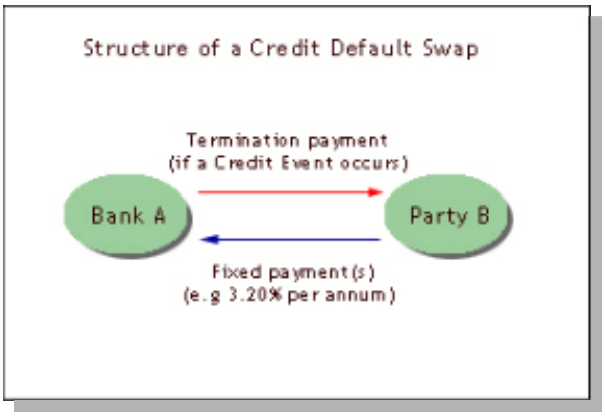
As the chart on the previous section shows, the credit default swap (CDS) is by far the most common credit derivative and most of this module will focus on this product alone.

In a CDS:

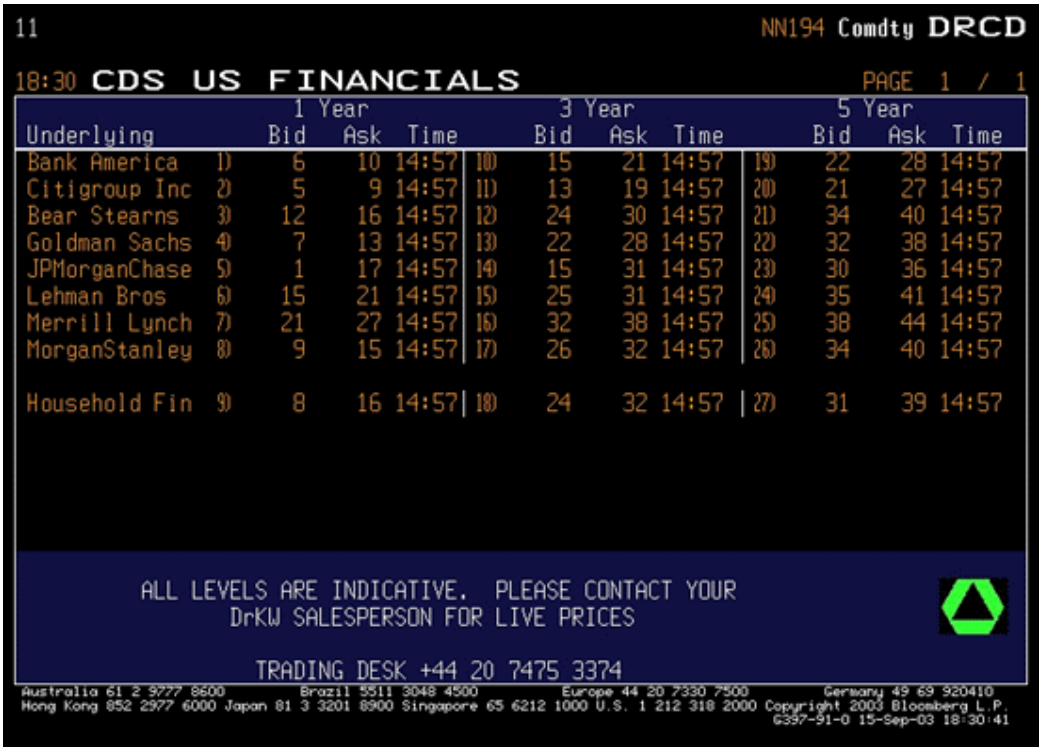
- One party (the **protection buyer**) pays a fixed amount (or **premium**) either in one lump sum or at regular intervals
- The other party (the **protection seller**) makes a **termination payment** only if a credit event is triggered by the reference name

Also known as: **Credit swap**, **Credit event triggered swap**, **Default put option**.

The CDS allows the protection buyer, for a premium fee, to transfer the credit risk on the reference entity to the protection seller. The fixed premium is quoted in basis points per annum and the corresponding cash amount is calculated by multiplying this premium (or **fixed** rate) by the contract's notional amount.



CDS market prices
Sample screen from the Bloomberg system showing market prices for CDS contracts on US financial names.



CDS prices are quoted in basis points per annum and notice here the positive slope of the **CDS premium curve**: longer term contracts are more expensive than shorter term ones.

4.1. Termination Payment

The termination payment may be:

- **Physically settled** - the protection buyer hands over the agreed Calculation Amount of a Deliverable Obligation and receives its Reference Price (typically par) in cash. In some cases the protection buyer may not be able to deliver the asset (e.g. if it is a non-transferrable loan), so a list of deliverable assets may be specified which includes other obligations of the reference entity with similar credit seniority.

- **Cash-settled** - the protection buyer receives a cash payment proportional to the loss severity on the reference asset (i.e. Reference Price - Recovery Value).

Termination payment in a cash-settled CDS

Termination payment = Notional amount x (Reference Price - Recovery Value)

Where:

Recovery Value = Estimated market price of the reference obligation when a credit event has been declared

Reference Price = Any one of the following:

- Par
- The market price of the reference obligation at the start of the swap
- Some agreed percentage of par, say 98.50% (so amount paid is subject to a **deductible** or **payment threshold** of 1.50% in the event of a claim)

One common problem with cash settlement is that there may not be enough market liquidity in the reference obligation to accurately assess its recovery value in the midst of a credit event and this is why most CDS contracts nowadays are physically settled.

Some CDS contracts that are cash-settled specify a fixed termination cash amount, irrespective of the asset's recovery value. In this case, the settlement amount is expressed as a fixed percentage of the notional amount (e.g. 50%) and is known as a **digital** or **binary settlement** because of its similarity with the payout on a binary option (see Introduction to Exotic Options – Binary Options).

4.2. Term Sheet

The term sheet below illustrates the typical terms included in a CDS contract. Click on the highlighted items for a description of what the terms mean.

Date: 1 July 2004
From: Bank A
To: Party B Inc.
Our Ref: CDS 0471-2

This is to confirm the terms and conditions of the Credit Default Swap transaction entered into between us on 1 July 2004, pursuant to the ISDA Master Agreement between us dated 10 November 2002.

The definitions and provisions contained in the 2003 ISDA Credit Derivatives Definitions, as published by ISDA, are incorporated into this confirmation.

1. General terms

Effective Date:	5 July 2004
Scheduled Termination date:	5 July 2007
Floating Rate Payer:	Bank A
Fixed Rate Payer:	Party B Inc.
Reference Entity:	Citigroup Inc
Reference Obligation:	Citigroup 3½% Eurobond maturing 1 Feb 2008
Reference Price:	100.00

2. Fixed payments

Calculation Amount:	USD 15,000,000
Period Dates:	Each 5 July and 5 January at the end of each Period, subject to the Modified Following Banking Day convention, and finally the Termination Date
Fixed Rate:	0.19%
Day Count Fraction:	30E/360

3. Floating payment

Calculation Amount: USD 15,000,000

Conditions to Settlement:
- Credit Event Notice
- Notifying Party: buyer or seller

Credit Events: The following credit events shall apply to this transaction:

- Bankruptcy
- Failure to pay
  - Grace Period: 2 weeks
  - Payment Requirement: USD 1,000,000
- Obligation Default
- Obligation Acceleration
- Restructuring
  - Default Requirement: USD 10,000,000

Obligations Category: Borrowed Money

4. Settlement terms

Settlement Method:	Physical Settlement
Settlement Period:	Not to exceed 30 Business Days
Deliverable Obligations:	• Exclude Accrued Interest • Obligation Category: Bond or Loan • Characteristics: - Not Subordinated - Not Contingent - Assignable Loan - Maximum Maturity: 10 years

Please confirm your agreement to be bound by the terms of the foregoing.

For Party A Bank,
John Smith
Settlements Manager

Points to note:

- Here the **buyer** of credit protection (or **fixed rate payer**) is Bank B
- A specific **reference obligation** is mentioned, but:
    - A credit event may be triggered by failure to pay, default or restructuring on **any borrowed money**
    - The contract may be physically settled by the delivery of any of the reference entity's **bond or loan** that meets the characteristics specified
- Payment against physical delivery will be at par (the **reference price**) excluding any interest accrued on the obligation being delivered. In other words, the protection buyer loses out the interest accrued on any underlying debt instrument up to the date when the credit event occurs.
- The **maximum maturity** clause is designed to limit the ability of a protection buyer to deliver very long-dated (i.e. price sensitive) assets in a 'technical' credit event. This clause has become standard in credit derivative documentation after the so-called CONSECO affair[2] in the US in 2001, when a debt restructuring by financial group CONSECO triggered off claims on CDS contracts referenced on it.

  In a real credit event (e.g. bankruptcy) the bond's maturity should no longer have an impact on its price: all bonds with the same seniority, no matter what their maturities, become immediately payable and therefore all trade at the same recovery value.

[2] The trigger was a wholly voluntary restructuring between CONSECO and its creditors on part of CONSECO's debt. This had only a minor ripple on the price of the issuer's other obligations except on its long dated bonds, because they are a more price sensitive. Protection buyers profited from this by delivering very long-dated bonds that were trading well below par on their CDS settlement.

- This sample term sheet has been drawn up using the 2003 ISDA Credit Derivatives Definitions. This is the latest master document published by ISDA which defines all the standard terms used in this market and has clarified many of the ambiguities that were present in earlier legal documentation.

  Legal risk has been a significant feature of the credit derivatives market and it is quite common nowadays for CDSs written on the same reference entity to be transacted at different prices, depending on which ISDA master documentation is used – the 1999 or the 2003!

4.3. Applications

Credit Risk Diversification

Like the TR swap, the CDS allows an investor to lay off some of the risks associated with an asset. Commercial banks and fund managers are often obliged to hold in their asset portfolios loans to corporate entities with which they have long-term relationships. Moreover, many loan assets held by commercial banks are non-transferable. Buying protection through the CDS (as Party B does in the figure on page 1) allows the lenders to reduce their credit exposure to key clients discreetly, without having to sell or assign the underlying loans.

Synthetic Securitisation

In this context, the CDS may be an alternative to securitisation (see Asset-backed Securities - Structure). Banks which are able to tap sub-LIBOR sources of unsecured funding and seeking to reduce their regulatory capital requirements may find the cost of funding achieved by securitisation unattractive, since the asset-backed securities are typically sold at spreads over LIBOR.

By purchasing default protection through a CDS, these banks may obtain the regulatory capital relief of a traditional securitisation while preserving their competitive funding advantage. Synthetic securitisations reduce the legal, systems and ratings costs associated with a traditional securitisation.

Buying Synthetic Default Risk

Conversely, investors wishing to take on credit exposures to given names, but lacking the funding base or the ability to acquire the necessary assets, are natural protection sellers. This might be the motivation behind Bank A in the figure on the *Credit Default Swaps* page.

4.4. Structural Variations

As with any OTC contract, all the terms in a CDS are negotiable. Here are two variations that have been designed to meet the specific requirements of certain credit risk managers:

- **Contingent CDS** - in this contract *two* events are required to trigger the termination payment:

  - A credit event involving the reference name
  - Another specified event, which could be a credit event involving a different reference name, an equity price threshold or a specified movement in interest rates

  The addition of a second event reduces the probability of early termination, so it reduces the cost of credit protection

- **Dynamic CDS** - very often the size of a bank's exposure to a reference name varies with the probability of default. For example, the counterparty to an interest rate swap may become a weaker credit as the mark-to-market value of the swap moves against it. In a dynamic CDS the notional on the CDS would be linked to the mark-to-market value of a reference interest rate swap at the time of the credit event.

5. CDS Pricing

5.1. Is it a Swap?

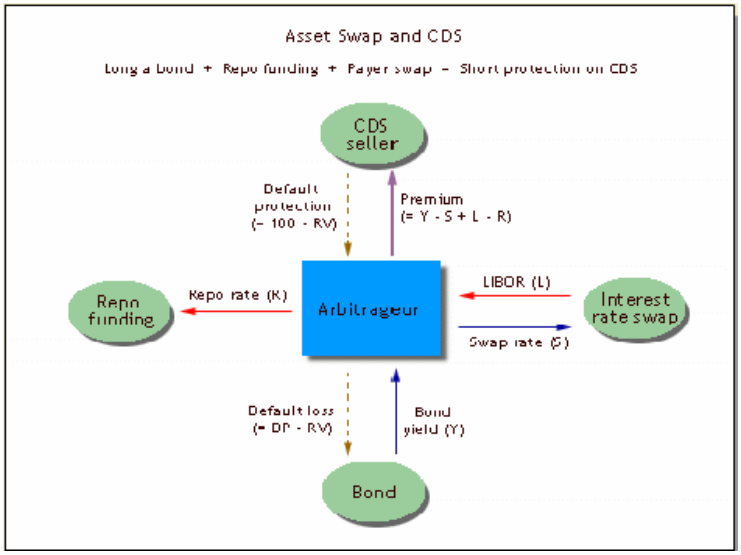
The CDS is a synthetic (unfunded) asset swap position.

Formally, the CDS is described as a swap because its payoff profile may be more or less replicated with an asset swap (ASW) funded in the repo market.

Bond on reference entity
+ Payer interest rate swap
= ASW

ASW
+ Bond funding on repo
= CDS

As the figure below shows, an ASW in which the bond is funded on repo creates a position that is effectively short CDS credit protection.



Symbols used in the figure

Y = Yield to maturity on reference bond
S = Market rate for swap of same maturity as the bond
R = Term repo rate for maturity of CDS
DP = Bond dirty price
RV = Recovery value of bond in a credit event

Put in a slightly different way, a corporate bond or loan carries 3 types of risk – market risk, funding risk and credit risk – and in an ASW-CDS arbitrage:

- The fixed leg of the payer swap covers the market risk on the reference bond
- The floating leg covers its funding risk
- The CDS covers its credit risk

Using this so-called **valuation by proxy** approach to pricing the CDS, we obtain the premium price on the CDS as the residual yield on the reference bond after taking out the cost of hedging its market risk and its funding risk.

? What is the breakeven CDS premium payable on the ASW-CDS arbitrage?

As we saw in module Interest Rate Swaps – Asset Swaps, the return on an ASW is approximately LIBOR plus the difference between the yield on the underlying bond (Y) and the market swap rate for the same maturity (S).

Yield on asset swap **≈ L IBOR + (Bond yield - Swap rate)**
≈ L + (Y – S)

Therefore:
CDS premium ≈ Yield on asset swap – Cost of funding it
≈ L + (Y – S) – R
≈ (L – R) + (Y – S)

We analyse the relationship between the CDS premium and the ASW spread in more detail in the *Exercise* that follows this section.

5.2. Is it an Option?

Defining the CDS just as a synthetic asset swap glosses over the fact that, fundamentally, as we said in the introductory module to Credit Analysis, the yield spread on a corporate bond is a premium that the debt-holder receives for selling a put option on the assets of the company.

As with all options, the premium on a the CDS should therefore reflect the present value (PV) of its expected future cash flow - in this case the Termination Payment.

CDS premium **≈ PV (Expected future termination payment)**
≈ PV [(100 - RV) x P]

Where:
RV = Expected recovery value
P = Default probability

In module Credit Ratings – Default and Yield Spreads we outlined one way in which we could derive a CDS premium from the default probabilities implied in observed bond credit spreads and recovery values.

An alternative approach to probabilistic valuation is to estimate the default probabilities implied in the observed CDS market rates for different maturities – the **CDS curve**. This approach is typically used by banks when marking to market existing CDS trading positions.

Probabilistic calculations of CDS prices from observed yield spreads lies outside the scope of the IFID Certificate syllabus.

5.3. Pricing in Practice

Most CDS traders base their pricing decisions on simple comparisons with rates observed in related credit markets, including:

- Rates quoted by other market makers for CDSs on similar reference entities
- Spreads over LIBOR on the reference obligation in the asset swap market
- Commitment fees for un-drawn bank credit lines to the reference entity

As with all derivatives, the rate quoted on a CDS must reflect the method by which the trader is most likely to hedge its risks. As far as possible, credit derivative traders try to run their books on a matched basis - i.e. by selling or buying equivalent contracts so as to offset their exposures. When this is not possible, they **warehouse** their positions with offsetting asset swap positions on the reference asset itself. As we saw above, the buyer of protection on a CDS could hold a long position in the asset swap and the seller of protection could short the asset swap.

A significant amount of documentation risk is also priced into many transactions because:

- The definition of what constitutes a credit event may differ from contract to contract (and may also differ from the definition of default in the loan documentation governing the reference obligation itself)

- The settlement terms may differ from contract to contract: some are cash-settled while others are physically settled, and some contracts cover wider categories of obligation than others

These ambiguities imply that there may be significant **basis risk** between the performance of a specific CDS contract and the price behaviour of the instruments which the trader may use to hedge it. In the *Exercise* below we shall explore some of the factors that drive the basis risk between the CDS and the underlying asset swap.

6. Exercise

Theoretically, the CDS premium should reflect the LIBOR spread on an equivalent ASW.

In practice CDS premiums can deviate from asset swap spreads because legally and in terms of their balance sheet impact the two instruments are clearly not identical. These differences give rise to a **default swap basis** between CDS premiums and ASW spreads, which many institutions (especially hedge funds) nowadays actively trade.

Default swap basis = CDS premium – ASW spread

Below is a list of the key factors that analysts have identified as possible reasons why the default swap basis may not be zero (in addition to temporary supply/demand imbalances in either market).

1. Repo cost of funding the ASW < LIBOR

As we illustrated in the previous section, investors in asset swapped bonds may fund themselves at the repo rate, which is typically below LIBOR. This is especially so for investors who hedge against credit risk by shorting the reference securities on an ASW, rather than buying protection via a CDS, if the securities in question are trading on special.

2. Dirty price of reference asset > 100

In a credit event, most standard CDS contracts pay out par against delivery of the defaulted security but for the ASW investor, the risk on a bond is its dirty price[3], not par. Therefore, an investor buying standard CDS protection on a bond that trades above par needs to enter into a CDS contract for a larger notional amount than the face value of the reference bond.

3. Protection buyer must pay premium accrued on CDS up to the date of credit default

Most standard CDS contracts require the protection buyer to pay the accrued CDS premium right up to the credit event, whereas the investor in a defaulting bond typically loses out any accrued interest on the bond, as issuers in a corporate liquidation case rarely compensate investors for any coupons owed.

4. ASW spread may be negative but CDS premium >= 0

Given that the interest rate swap market is dominated by A or AA rated banks, the swap curve typically trades at a comparable spread over treasuries. Therefore, an ASW on a reference bond with a rating of AA or better can easily yield a spread below LIBOR, but of course no CDS protection seller will be willing to receive a negative premium (i.e. pay the premium) in order to protect the buyer against credit risk – no matter how highly rated the reference name is!

5. The buyer of protection on a CDS typically owns a delivery option

In a physically settled CDS (the majority of contracts) the protection buyer typically has a range of possible bonds and/or loans that are deliverable against a payment of par, whereas this option is not present in an asset swap which is normally structured on a specific security.

The protection buyer therefore has an incentive to deliver to the protection seller those deliverable obligations of the reference entity that trade at the lowest possible market price following a credit event, and this exposes the seller to an additional risk.

[3] Labelled **DP** in the figure on the previous section.

This risk was starkly illustrated in 2001 in the so-called **Conseco affair**, in which the US insurer Conseco successfully negotiated the restructuring of part of its debt, giving the affected creditors adequate compensation for the new terms, but the event had a negative market impact on the rest of Conseco's debt (which was not restructured) and this triggered substantial claims against CDS contracts written by third parties on all of Conseco's debt.

To avoid a repetition of the Conseco affair the new ISDA documentation has significantly tightened the definition of a credit event so as to mirror as closely as possible a real event of default on a bond or a loan. In particular, the new documentation has removed corporate debt restructuring agreements from the list of possible credit event triggers.

Nevertheless, the delivery option on the CDS is still considered to offer the protection seller an additional credit risk to the CDS protection seller which is not present in the equivalent ASW.

6. The protection seller in a CDS has less counterparty risk than the investor in an ASW

The protection seller in a CDS receives regular cash premium payments from the buyer on the understanding that it may have to make a possible counter-payment in the future if a credit event is triggered, so there is no question that in a standard CDS contract only the protection buyer has counterparty risk and the seller has none.

The investor in an ASW, on the other hand, has some counterparty risk on the interest rate swap that overlays the reference bond and also some on the repo transaction that funds the bond position. Although, both of these are normally considered to be minimal risks, nevertheless there are more risks here than for the protection seller in the CDS.

7. Profit on ASW position may be realised with more certainty than on equivalent CDS position

An investor in an ASW can realise her profit from a tightening of the bond's yield spread over swaps by liquidating the position immediately – i.e. selling the underlying bond and reversing the interest rate swap (IRS) with an equivalent contract for its residual maturity.

Someone holding an equivalent position in a CDS will typically lock in the profit from a tightening of the CDS premium by entering into an offsetting CDS for the residual maturity, in which they pay the lower premium.

In both cases, any profits on the IRS position or on the CDS position will be calculated as the net present value (NPV) of offsetting cash flows and will be realised as those cash flows are settled through the remaining life of the contracts.

But the big difference between the profits locked on an IRS position and those locked on a CDS position is that, whereas the risk of default on the IRS positions is normally regarded as being very small, the credit risk on the CDS positions is much larger and in a credit event both offsetting CDS contracts are immediately terminated, so the investor foregoes the net profit locked in on the remaining premium payments.

a) Explain the impact of each of the factors above on the default swap basis, other things being equal, by entering either 'Y' or 'N' in the appropriate column on the table below next to each factor. Where you feel that the impact of a given factor may be ambiguous, enter 'Y' in both columns.

Key basis risk factor	Default swap basis > 0	Default swap basis < 0
1.		
2.		
3.		
4.		
5.		
6.		
7.		

7. Synthetic CDOs

Synthetic CDO: a collateralised debt obligation that is backed by a risk-free investment overlaid with the sale of credit default swaps, to give investors the desired credit exposure.

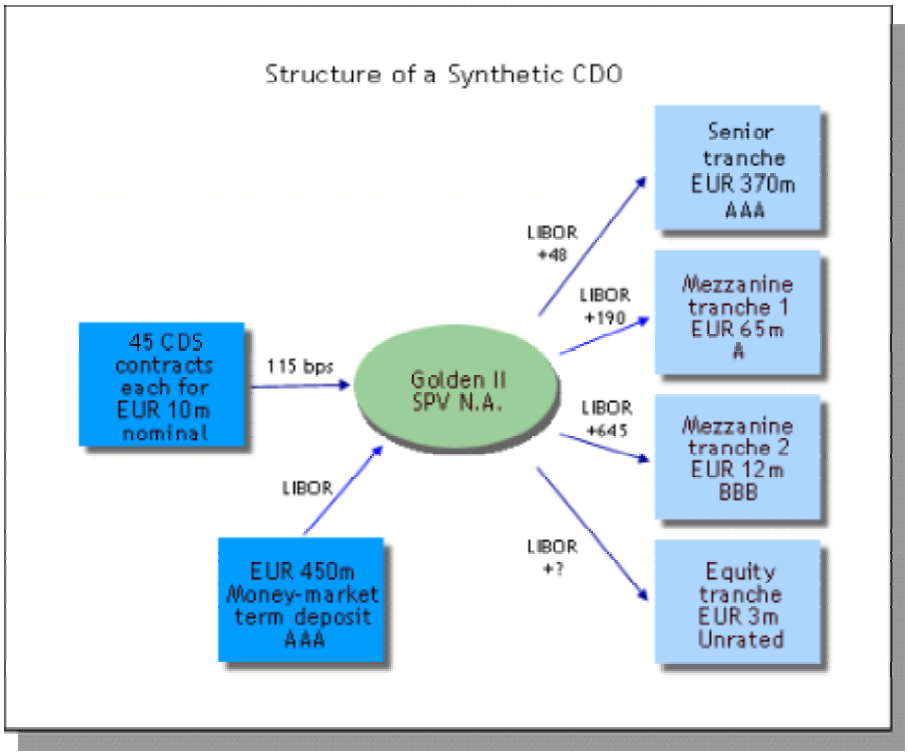
Also known as: **Collateralised synthetic obligation** (CSO), **Credit-linked note** (CLN)

This product has gained a lot of interest in recent years and now accounts for a significant percentage of the total credit derivatives market (see section *Market Users & Products*), so it is worth outlining the factors driving this sector.

As with the conventional CDO that we saw in module Asset-backed Securities – Collateralised Debt Obligations, this one is also typically issued by a special purpose vehicle (SPV) which uses the issue proceeds to buy collateral.

Example

The figure below gives you an example of how it works.



The tranches in this CDO issue are almost identical to the ones in the example discussed in module Asset-backed Securities – Collateralised Debt Obligations, except that here instead of buying a pool of underlying corporate loans, the SPV does the following:

- Places the investors' money in a AAA-rated asset earning LIBOR flat
- Sells credit protection on a portfolio of 45 CDS contracts, each one written on a different reference name, paying an average premium of 155 basis points

As in the conventional CDO, the premium on the CDS is allocated to the different tranches in proportion to the credit risk that each tranche will take.

If a credit event occurs on any of the CDSs, the SPV settles the termination payment out of the investors' funds that have been placed on deposit and reducing this amount from the principal that is repayable on one of the tranches, starting from the equity tranche. In other words, instead of being repaid their principal in cash, the holders of the equity tranche may well end up being 'repaid' in bonds issued by a reference name in default!

One reason for the growth in synthetic CDOs is the way that they allow issuers to create credit exposures tailored to specific clients, but another important reason is because the synthetic CDO removes counterparty risk for the protection buyer.

This synthetic CDO is a funded credit default swap.

For example, in our example above the bank that buys the CDS portfolio from the SPV can also manage the SPV's risk-free deposit which will be used as termination payment in a credit event.

7.1. Basket Default Swaps

One of the interesting variations on the synthetic CDO theme is the use of a single CDS contract written on a portfolio of reference names (typically 5-10 names), instead of a portfolio of CDSs, each of which is written on a single name. In other words, some synthetic notes use **basket default swaps** rather than **single-name default swaps**.

Basket CDSs open up the possibility of different types of contingent payout; for example:

- A **first-to-default** (**FTD**) CDS makes its termination payment if there is a credit event on any one of the reference names listed in the basket
- A **second-to-default** (**STD**) CDS makes its termination payment only if there are credit events on two of the reference names listed in the basket
- …and so on

As with conventional CDOs, default correlations between the different names referenced in the synthetic CDO will have an impact on the structure's credit risk and therefore on its credit rating and the pricing of each tranche (see module Asset-backed Securities – Collateralised Debt Obligations).

Exercise

Which of the following statements do you think is/are true, all other things being equal?

a)

- ☐ Premium on a FTD CDS **≥** premium on any CDS written on any single name in that basket
- ☐ Premium on a FTD CDS **≤** sum of premiums on portfolio of single-named CDSs
- ☐ The higher the default correlation between the different reference names, the lower is the premium on a FTD CDS
- ☐ Premium on a STD CDS **≤** premium on a FTD CDS
- ☐ The higher the default correlation between the different reference names, the higher is the premium on a STD CDS

8. Other Structures

So far in this module we have focused mainly on the CDS product, as this represents by far the bulk of the credit derivatives market. In this final section we describe briefly some of the other credit derivative structures that are increasingly being traded:

- Total return swaps
- Credit spread forwards
- Credit options

In each case we explain the typical structure and applications of the product and give a brief indication of the approaches taken to pricing them, although pricing of credit options lies outside the scope of the IFID Certificate syllabus.

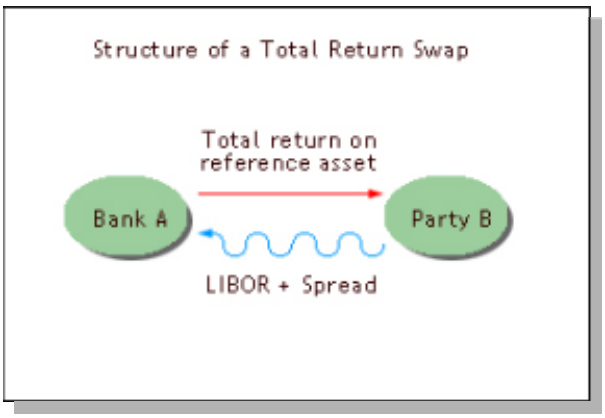
8.1. Total Return Swap

In a total return swap (TR swap):

- One party pays the total return (coupons plus capital gain/loss) calculated on a notional amount (or **calculation amount**) invested in a specified reference asset - typically a bond or a loan

- In exchange, the counterparty pays LIBOR plus a fixed spread, calculated on the same notional amount

This is one of the earliest types of credit derivative and in many respects it is very similar to an equity swap (see Equity Swaps - Contract Structure), where one party pays the total return on an equity against a LIBOR-based rate. Below is a representation of the cash flows in a typical TR swap.

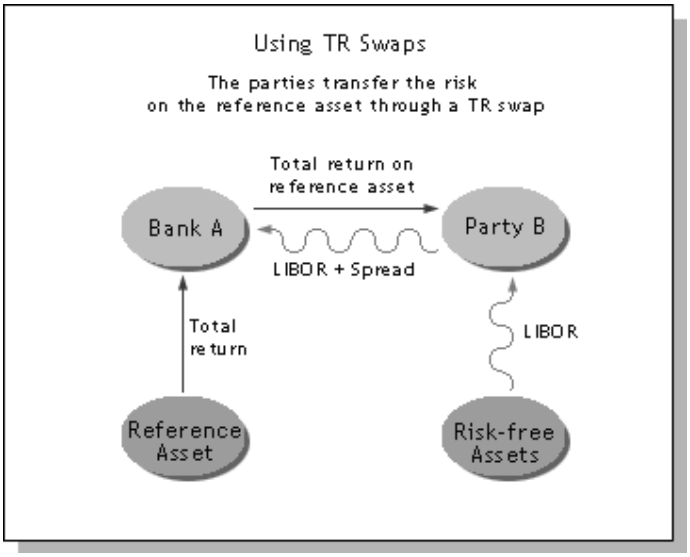


Applications

Like other types of swaps, TR swaps are commonly used:

- To gain synthetic exposure to an asset in situations where it is either legally impossible or uneconomic for the total return receiver to acquire the asset itself (Party B)

- To hedge an existing exposure to a reference name without physically having to dispose of the reference asset (Bank A)



Pricing

A TR swap that *does not* include an **early termination clause** is relatively easy to hedge and hence to price. As you can see from the diagramme above, the total return payer (Bank A in this example) can hedge its exposure on this swap by acquiring the reference asset itself[4].

The spread over LIBOR received on the swap is set so as to leave the total return payer a net profit margin, after taking into account:

- The cost of funding the hedging position in the reference asset
- The use of the bank's regulatory capital
- Any legal documentation risks associated with the contract (as discussed in section *Credit Default Swap*)

Pricing the early termination clause:
For TR swaps that include an early termination clause, the total return payer must charge an additional spread over LIBOR for retaining the default risk on the reference asset. But notice the following:

Long a TR swap with no early termination clause
+ Long protection on a CDS

= Long a TR swap with protection from default risk

If we know how to price each of these components separately, then we also know how to price a TR swap with early termination!
Conversely, an entity receiving the total return could hedge its exposure to the swap by carrying a short position in the reference asset. The spread over LIBOR paid to the swap counterparty must take into account the interest that could be earned on the proceeds of the short sale, net of borrowing fees, as well as any residual credit and legal risks.

[4] In a synthetic CDO the notional amount on the embedded CDS does not have to be the same as the principal on the issued tranches. Of course, a larger notional on the CDS creates potentially leveraged losses for the investors, if a credit event occurs, which could exceed the value of the collateral held by the SPV. Therefore, synthetic CDOs tend to be cash settled and subject to a maximum loss of 100% of the value of the tranches. In exchange for these potentially larger capital losses, all tranches in a leveraged synthetic CDO of course earn correspondingly higher yields.

In this situation there would be an additional hedging risk: the short position in the underlying asset would have to be kept for the duration of the contract, which could span many months or years, whereas the assets will in all likelihood be repoed in over a series of shorter rollovers. Since the repo rate is renegotiated at each rollover, there is always the risk that the party that is short the underlying assets may be squeezed by the securities lender.

Sample term sheet
Illustrating the typical terms that are found in TR swap contract.

Date: 1 July 2002
To: Party B Inc.
From: Bank A
Our Ref: TRS 9971-1

We are pleased to confirm our mutually binding agreement to enter into a Total Return Swap Transaction with you in accordance to our telephone agreement with [Mr Swapper] on 1 July 2002, pursuant to the ISDA Master Agreement between us dated 10 November 1998.

Effective date:	8 July 2002
Termination date:	8 July 2005
Notional amount:	USD 50 million
Early termination:	Credit Event for Reference Name, or at Party B's option at any Party A Calculation Date with 7 Business Days' notice.
Materiality:	Price is 90% of Initial Asset Price, or less, subject to adjustment for the movement in a comparable US Treasury security
Bank A pays:	Total return on the Reference Asset with first and last period coupon time apportioned
Reference asset:	Argentina 12½% USD Eurobond maturing 20 October 2014, rated Baa/BBB sovereign
Initial asset price:	98.50%
Reference asset accrued interest calculation:	Annual, 30/360
Party B pays:	USD 6 month LIBOR + 3.20%
First LIBOR fixing:	5.53 percent per annum
Day count:	Actual/360
Reset dates:	Two London business days prior to the First day of each Party A Calculation Period, based on the rate published by the British Bankers Association ("BBAIRS").
Payment Dates:	Each party pays on its own Period End Dates

Party A Calculation Periods for Payments

First period:	Effective Date to but excluding 8 July 2000 (the "Period End")
Later period dates:	Each 8 July after the First Period End Date, subject to the Modified Following Banking Day convention, and finally the Termination Date

Party B Calculation Periods for Payments

First period:	Effective Date to but excluding 8 January 2000 (the "Period End Date")
Later period dates:	Each 8 July and 8 January after the First Period End Date, subject to the Modified Following Banking Day convention, and finally the Termination Date

Please confirm to us that the terms set forth herein accurately reflect our transaction.

For Party A Bank,

John Smith
Settlements Manager

8.2. Credit Spreads Forward

A credit spread forward is a financial bet on the yield spread of a reference bond being different from a specified reference level at a given future date.

For the buyer of a credit spread forward, the payout at maturity is calculated as follows:

Maturity payout = Leverage factor x (Yield spread - Reference spread)

The buyer receives a cash payment if the yield spread on the reference bond is wider than the agreed reference spread, and conversely makes a payment if the yield spread is narrower. Obviously, for the seller the payout is exactly the opposite.

The leverage factor typically reflects the basis point value of the reference bond (and the reference Treasury) at the maturity of the contract, but it may be any arbitrary value. Obviously, the higher the leverage factor the greater is the investor's potential gain or loss from the contract.

Applications

Any forward contract allows you to profit from a view that the future price of the underlying instrument will be different from its current forward price. With a credit spread forward, the underlying is the forward yield spread on the reference asset, rather than its price, and the speculator can profit if the credit quality of the reference name turns out to be different from that which is implied in its forward yield spread.

As with any forward or futures contract, this product may be used either for speculation or to hedge existing exposures.

An investor holding a corporate bond may hedge against the risk of a credit rating downgrade by buying a credit spread forward on that bond.

The gains made on the forward contract, if the yield spread on the bond widens, will compensate the investor for the consequent loss in the market price of the underlying bond.

Of course, the credit spread forward only hedges the credit risk on the reference bond; to hedge the market risk on the bond as well, the investor could use one of the following strategies:

Strategy	Reference
Short treasury bonds	Bond Market Risk - Trading Applications
Short bond futures	Bond Futures - Hedging
Enter into a payer swap	Interest Rate Swaps - Exercise 2
Short equivalent strip of futures	Interest Rate Swaps - Warehousing

Pricing

The reference spread is typically set at the **forward yield spread** on the reference asset.

Forward yield spread
= Yield on the reference bond implied in its forward price
- Forward yield on a Treasury bond with comparable maturity

One way to derive the forward yield spread on the reference bond is to:

1. Calculate the forward price of the reference bond and of the Treasury bond using the cash-and-carry formula developed in Bond Futures - Pricing

2. Using a standard bond pricing model, derive the yields implied in these two forward prices: the forward yield spread is the difference between the two calculated forward yields

As with total return swaps, the credit spread forward contract may include an early termination clause that makes the contract null-and-void if a credit event take place, but the clause can be priced separately.
In this approach the forward price of the reference bond is determined purely by reference its net cost of carry. An alternative method would be to estimate its future value, given a set of default probabilities and loan recovery rates, as we illustrate in section *CDS Pricing*.

In theory both methods should result in the same forward price, since the bond's current price (hence its net carry) reflects its expected future cash flows. In practice this is unlikely to be the case, given the uncertainties in estimating default probabilities and recovery rates. Most practitioners estimate forward yield spreads based on net carry costs, although for long-dated contracts there are some who attempt to estimate forward prices using probabilistic models.

8.3. Credit Options

Credit options represent a small (though growing) part of the credit derivatives market and in this section we summarise the main types that are traded.

Option on a yield spread over treasuries

In a **spread option**, the call buyer benefits if, on exercise, the yield spread on the reference security over Treasuries turns out to be wider than the strike; the put buyer benefits if the yield spread is narrower than the strike[5].

The payout formula is similar to that of a credit spread forward, except that it is now subject to a minimum of zero:

Call payout = MAX { Leverage x (Yield spread - Reference spread), 0}
Put payout = MAX { Leverage x (Reference spread - Yield spread), 0}

[5] Notice that the buyer of a call on a bond's yield spread effectively has the right to put the bond in question at a given price relative to the price of the reference treasury. This product is an example of an **exchange option**, which we discussed in module Introduction to Exotic Options - Pricing: the option to exchange one asset for another at a given exchange rate (which in this case is specified as a yield spread rather than a price ratio).

As with any exchange option, its price is a function of the volatilities of the two underlying components, as well as the correlation between them.

The higher the correlation between the yields on the two bonds, the *lower* is the price of the spread option.

High correlation means there is a low probability that the two yields will diverge significantly, so the volatility of the yield spread is low and so is the price of the spread option.

In a spread option the put buyer and the call seller are the parties taking on the credit risk on the reference name.

Both of these parties will win if the credit spread of the reference entity widens.

Option on an FRN

In many ways a credit option on an FRN is just a bond option. What makes it a credit derivative is the fact that the underlying is primarily a credit risk product[6]:

- The FRN price is not very sensitive to changes in market yields (because the coupons are reset periodically in line with the market)
- But it is very sensitive to changes in the credit quality of the issuer

Pricing an option on an FRN may be done:

- On a price basis, using the volatility of the FRN's price
- On a rate basis, using the volatility of the note's discount margin

Pricing the FRN option on a discount rate basis makes the contract economically similar to an option on a CDS and allows us to make direct pricing comparison between the two instruments.

In section *CDS Pricing* above we showed how the CDS is effectively a synthetic asset swap position and in module Interest Rate Swaps – Asset Swaps we showed how the asset swap is itself a synthetic FRN.

Option on a CDS

The buyer of a call has the right to pay a given fixed rate (the strike) on a specified CDS written on a reference entity; the put buyer has the right to receive the fixed rate[7].

Credit options may be European, Bermudan or American in style and their expiry payout may be either binary[8] or conventional (spot – strike).

As with total return swaps, the credit spread forward contract may include an early termination clause that makes the contract null-and-void if a credit event take place, but that clause can be priced separately.

Applications

The most commonly-traded credit options are calls on yield spreads. Many yield-seeking investors prefer to earn additional income by writing OTM options on relatively high credit quality assets, rather than taking lower-quality securities into their portfolios.

Buyers, on the other hand, are typically fund managers seeking to insure their portfolios in the event of a general 'flight to quality', where they might become forced sellers of the underlying corporate credits in a distressed market. The motivation is portfolio insurance (see Options Strategies - Portfolio Insurance), except that the emphasis here is primarily on protection against credit risk, rather than market risk.

[6] We discussed this point in module Bond Pricing and Risks – FRN Discount Margin.
[7] The **underlying** in a CDS option is the forward CDS premium implied in the CDS premium curve observed in the market. See the sample CDS market price screen shown in section *Credit Default Swap*, above.
[8] See module Introduction to Exotic Options – Binary Options.