FIXED INCOME PRODUCTS AND MARKETS

III – Fixed Income Derivatives and Models

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III – Fixed Income Derivatives and Models

1. Swaps, Fra's and Short Term Interest Rate Futures
2. Bond Futures
3. Credit Spread Dynamics
4. Bonds with embedded options and Bond Options
5. Futures Options, Caps, Floors and Swaptions
6. Exotic Options and Credit Derivatives

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6.1 Interest-Rate Exotic Options

- Interest-rate exotic options usually are
  - *Path-dependent*
  - *Correlation-dependent*
  - *Time-dependent*

- Path-dependent options

option payoffs are a function of the path that interest rates follow over the option life

- Correlation-dependent options

option payoffs are based on the relationship between several interest rates

- Time-dependent options

the buyer has the right to choose an option characteristic as a function of time

Barrier Caps and Floors

- ***Up-and-in barrier cap***: this cap is activated when the reference rate reaches or goes above the barrier during a certain period of time (American style) or is equal or above the barrier at expiry (European style)

- ***Up-and-out barrier cap***: cap is desactivated when the reference rate reaches or goes above the barrier during a certain period of time (American style) or is equal or above the barrier at expiry (European style)

- ***Down-and-in barrier floor***: this floor is activated when the reference rate reaches or falls below the barrier (American style) or is equal or below the barrier at expiry (European style)

- ***Down-and-out barrier floor***: this floor is desactivated when the reference rate reaches or falls below the barrier (American style) or is equal or below the barrier at expiry (European style)

Note that the barrier level is higher (lower) than the strike price for the caps (floors)

Bounded Caps e *Floors*

Bounded Caps e *Floors* (B-Caps e B-Floors) – are caps and floors whose payout is limited to a particular amount of money

Cancelable Swaps

A callable (putable) swap is a structure where the fixed-rate payer (receiver) of a swap buys a receiver (payer) swaption, so that it has the right to cancel the swap at maturity (European style) or at some specified dates during the swap life (Bermudan style)

Captions e *Floortions*

Caption – is an option that gives the buyer the right to buy or sell a cap at the maturity date and for a specified premium

Floortion – is an option that gives the buyer the right to buy or sell a floor at the maturity date and for a specified premium

Contingent Premium Caps e Floors

A contingent premium cap (floor) is a standard cap (floor) where the buyer pays a smaller premium than for a cap (floor), but may have to pay an additional premium if the reference rate goes above (below) a specified contingent level on any one reset date

Extendible Swaps

An extendible swap is a plain-vanilla swap where one party has the right at a determined date, or at several future dates, to extend the swap maturity for a specified period

Incremental Fixed Swap

It's a swap the fixed part can be transformed into a combination of fixed and variable part, depending on the value assumed by the floating rate. When the floating rate decreases , the proportion of the variable component also decreases

Choosercaps and Flexicaps-and-Floors

Choosercaps (floors) and flexicaps (floors) offer the buyer a maximum (minimum) interest rate for a limited number n of caplets (floorlets) and not for all the caplets (floorlets) that constitute the cap (floor)

With a flexicap (floor), the guaranteed maximum (minimum) rate applies to the first n number of fixings that are greater than the strike rate (after which no more protection)

With a choosercap (floor), the buyer decides to exercise n caplets (floorlets) in the money amongst all the caplets (floorlets) in the money

6.2 Credit Derivatives

Credit derivatives can be defined as arrangements that allow one party (protection buyer or originator) to transfer credit risk of a reference asset, which it may or may not own, to one or more other parties (the protection sellers)

Tipology

1. Credit Default Derivatives (designed as hedging vehicles for default risk)
   - Credit Default Swap (CDS)
   - Credit Linked Notes (CLN)
2. Credit Spread Derivatives (based on differences in creditworthiness)
   - Credit Spread Forward
   - Credit Spread Options
3. Products that synthetically replicate the performance of the underlying
   - Total Return Swap

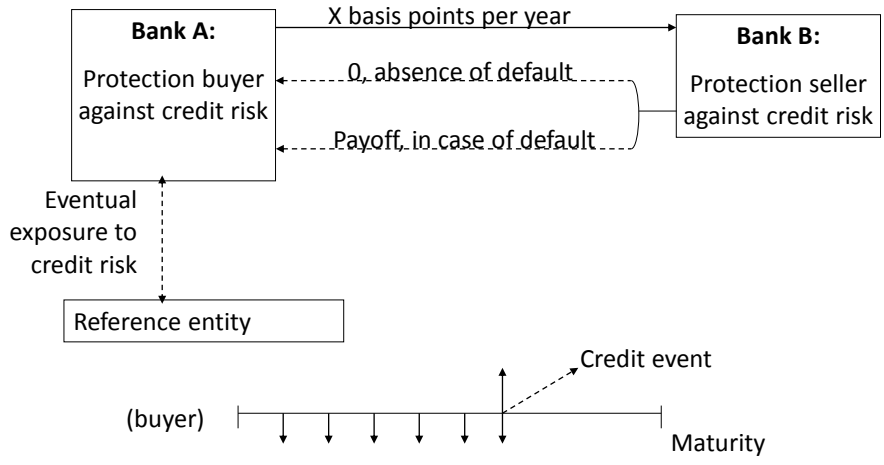
Credit Default Swap (CDS)

Allows to transfer synthetically the credit risk of a reference entity

The CDS buyer (the protection buyer) pays a periodic premium to the CDS seller (the protection seller), in return the CDS seller will make a payment to the CDS buyer upon the happening of a specified credit event

Building block of the credit derivarives market

Credit Default Swap (CDS)



Credit Default Swap (CDS) – contract elements

- Reference Entity – Exact name of the entity agaisnt which we want to hedge or assume the credit risk
- Obligations – Definition of the obligations over which we can observe a credit event. ISDA* definitions
  - *Payment* – covers all payments (present and futures) of the RE
  - *Borrowed Money – financial debt of the RE*
  - *Bond or Loan*
  - *Bond Only*; - *Loan Only*; - *Reference Obigation Only*
- Credit Events – Credit event definitions - ISDA*:
  - Bankruptcy
  - Failure to pay
  - Restructuring
  - Obligation acceleration
  - Repudiation/Moratorium (for sovereign risk)

*International Swaps and Derivatives Association

Credit Default Swap (CDS) – contract elements

- Settlement

  - Physical

  The buyer delivers to the seller the bond of the RE (*Deliverable Obligations*) in return e receives the notional value

  - Cash

  The seller pays to the buyer par value (100%) less the post-default bond observed value

  - Fixed pay-out

  The seller pays a pre-determined fraction of par value

Credit Default Swap (CDS) – pricing

$$PV\left(\text{premiums}\right) = \sum_{j=1}^{n} Z\left(0,T_j\right)\left(1 - Q\left(0,T_j\right)\right)\delta_j S_n$$

$$PV\left(\text{protection}\right) = \sum_{j=1}^{n} Z\left(0,T_j\right)\left(Q\left(0,T_j\right) - Q\left(0,T_{j-1}\right)\right)\left(1 - X\right)$$

$Z\left(0,T_j\right)$ - Discount factor (risk-free)

$1 - Q\left(0,T_j\right)$ - Survival probability until T_j, for the reference entity

δ_j - Premium fraction received at date T_j

$\left(Q\left(0,T_j\right) - Q\left(0,T_{j-1}\right)\right)$ - Default probability between T_{j-1} e T_j

X - Recovery rate

S_n - Premium of CDS with maturity at T_n

Note: accrued premium is not considered

Credit Default Swap (CDS) – pricing

CDS value for the protection buyer:

$$V^{CDS}(0,T_n) = PV(\text{protection}) - PV(\text{premiums})$$

$$= \sum_{j=1}^{n} Z(0,T_j)\left(Q(0,T_j) - Q(0,T_{j-1})\right)(1-X)$$

$$-\sum_{j=1}^{n} Z(0,T_j)\left(1-Q(0,T_j)\right)\delta_j S_n$$

The premium, S_n, is established so as to make the CDS value equal zero:

$$S_n = \frac{\sum_{j=1}^{n} Z(0,T_j)\left(Q(0,T_j) - Q(0,T_{j-1})\right)(1-X)}{\sum_{j=1}^{n} Z(0,T_j)\left(1-Q(0,T_j)\right)\delta_j}$$

Credit Default Swap (CDS) – pricing

Example:

Maturity: 1 year

Quarterly payments (δ_j = 0,25)

Recovery rate: 40% (X =0,4)

T_j (years)	$Z(0,T_j)$	$1-Q(0,T_j)$	$Q(0,T_j)-Q(0,T_{j-1})$	(1-X)	CF act *Prob	(0,25)*(2)*(3)
0,25	0,99628	0,99253	0,00747	0,6	0,004466	0,247209
0,5	0,99161	0,98511	0,00742	0,6	0,004412	0,244212
0,75	0,98671	0,97775	0,00736	0,6	0,004358	0,241189
1	0,98039	0,97045	0,00731	0,6	0,004297	0,237854
					0,017534	**0,970464**

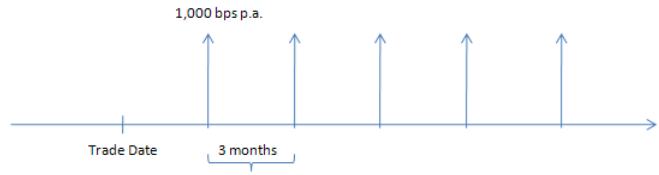
$$S = \frac{0,017534}{0,970464} = 0,01807$$

S = 181 bp

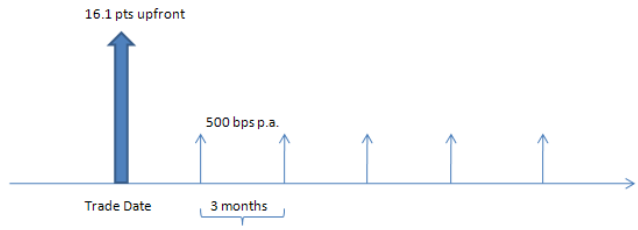
Credit Default Swap (CDS) – pricing

Running CDS Spread vs Upfront CDS with fixed Running Spread

CDS with Running Spread



CDS with Upfront Fee + Running Spread



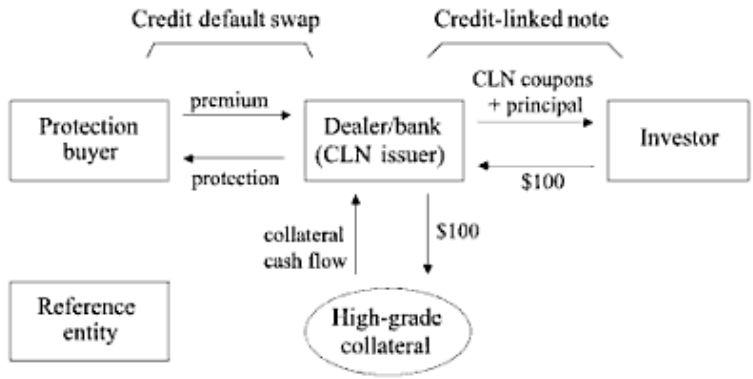
Credit Linked Notes (CLN)

Corresponds to the CDS financed version

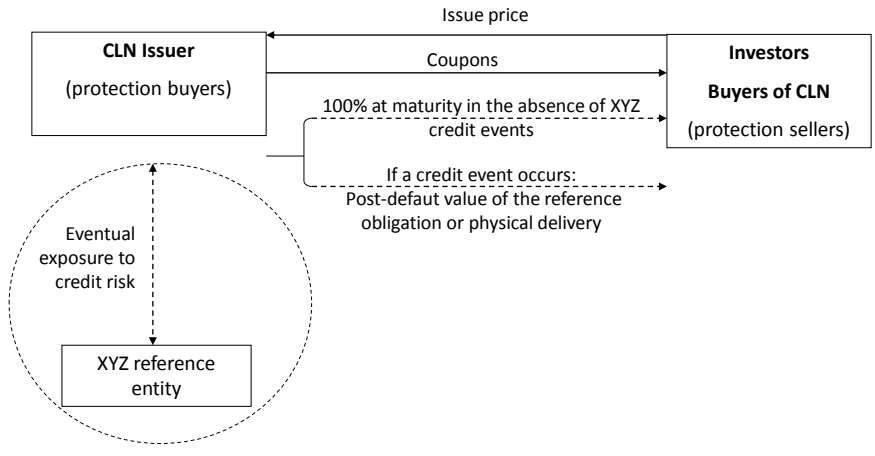
It's a bond whose coupon and notional redemption payments are conditional to the absence of credit events

Allows the buyer to take a bond position of the reference entity

Credit Linked Notes (CLN)



Credit Linked Notes (CLN)



Total Return Swap (TRS)

Allows to transfer the full economic result of financial security for a given period of time