Chapter 2

Credit Derivatives: Overview and Hedge-Based Pricing

- Derivatives used to transfer, manage or hedge credit risk (as opposed to market risk).
- Payoff is triggered by a credit event wrt a reference asset.

Asset Swaps

- Combination of a defaultable bond (the asset) and interest rate swap that swaps the coupon of the bond for Libor + spread.
- The spread (denoted by s^A) is chosen so that the package is worth 1 at inception.

Total Return Swaps

- Two counterparties exchange the total return of the defaultable bond for a floating payment.
- So, as before, coupons are exchanged but now also capital appreciation is .
- The spread, in this case, is denoted by s^{TRS}.
- They are among the most popular of the credit derivatives.

Credit Default Swaps

- Focuses on default event.
- The buyer pays a fee for default protection.

- If $s(t)$ is the swap rate for a swap starting at T_n and ending at T_N then:

$$s(t) = \frac{B(t, T_n) - B(t, T_N)}{A(t, T_n, T_N)}$$

- This follows from the fact that adding a payment of 1 at time T_N to the floating side would make it into a floating bond and therefore worth 1 . So the value of the floating side of the swap should be 1 minus the present value of 1 at time T_N which is the value of a zero-coupon bond $(B(t, T_N)$.

Repo

- A owns the defaultable bond $\bar{C}$.
- B buys the bond for $\bar{C}(0)$.
- B agrees to sell the bond back to A at time T for the fwd price K.
- Then $K = (1 + Tr^{repo})\bar{C}(0)$.

- s^A is chosen so that.

$$\bar{C}(0) + A(0)s(0) + A(0)s^A(0) - A(0)\bar{c} = 1$$

but
$(1 - A(0)s(0)) = B(0, T_N)$ and then $1 - A(0)s(0) + A(0)\bar{c}$ is the value of a default-free bond with coupon $= \bar{c}$ which we denote by $C(0)$..
Then

$$s^A(0) = \frac{1}{A(0)}(C(0) - \bar{C}(0))$$

Credit Default Swaps

- CDS plus a defaultable bond should trade close to a default free bond.
- Let's consider some cash-and-carry strategies:

Cash-and-carry with fixed-coupon bonds

- Portfolio I:
  Defaultable bond $\bar{C}$ with $\bar{c}$, expiring at T_N.
  One CDS with spread $\bar{s}$.
  Unwound after default.

- Portfolio II:
  Default-free bond C, coupon $\bar{c} - \bar{s}$.
  Sell bond after default.

Credit Default Swaps III

Cash-and-carry with fixed-coupon bonds

- Payoffs coincide before default.
- Unfortunately in default the payoffs do not coincide.
- The default-free bond is worth $C(\tau)$ whereas the defaulted one can be put at par.

Credit Default Swaps IV

Cash-and-carry with par floaters

- Consider a default-free bond paying L_{i-1} at T_i and a defaultable bond paying $L_{i-1} + s^{par}$.
  s^{par} chosen so that at onset the value is 1.
  Now:
- Portfolio I:
  Defaultable par floater bond $\bar{C}'$.
  One CDS with spread $\bar{s}$.
  Unwound after default.
- Portfolio II:
  Default-free bond C', coupon $c_i = L_{i-1}$.
  Sell bond after default.

Credit Default Swaps V

Cash-and-carry with par floaters

- At onset both portfolios are worth the same.
- In default they differ by the accrued interest on the default free bond.
- Can minimize this by increasing the protection taken by the CDS.
- This means that $\bar{s} = s^{par}$.

Credit Default Swaps VI

Cash-and-carry with asset swap packages.

- The problem with the previous strategy is that in most cases defaultable par floaters do not exist.
- Use an asset swap package instead.
- It is priced at par in the beginning and before default it pays a coupon of Libor plus a spread. So, it is similar to a defaultable par floater.
- However, at default the value of the par floater is the recovery rate but the value of the aset swap package is the recovery rate plus the market value of the interest rate swap.
- But, the interest rate swap value depends on the term structure of the default-free term structure of interest rates (and the initial value of the swap).
- This means that $\bar{s} \sim s^A$.

Credit Default Swaps VII

Fallen angels and distressed debt.

- Special case: bonds issued by companies that have been downgraded after having issued a bond with coupon $\bar{c}$.
- Suppose that the company raises the coupon to $\bar{c} + x$ so the bond trades at par.
- Then in the asset swap we swap $\bar{c}' = \bar{c} + x$ for Libor $+s^{A'}$.
- So $s^{A'} = \bar{c} + x - s$, where s is the swap rate.
- By the previous result $\bar{s} \sim s^{A'}$.
- Then

$$\bar{s} - s^A \sim s^{A'} - s^A = \frac{1}{A(0)}[(C' - C) - (\bar{C}' - \bar{C})] > 0$$

- Therefore $\bar{s} > s^A$ if $\bar{C}(0) < 1$.

Credit Default Swaps VIII

Trading the basis.

- So, for for defaultable bonds that trade close to par the CDS spread and the asset swap spread are very close.
- However, they often differ..
- The reason is that, in many cases, we can't short asset swaps.
- So, we can buy the CDS and buy the asset swap (pay the offer in both, but notice that for asset swaps the offer is lower than the bid, since it is the amount that we **get** paid).
- But selling both can't be done so $\bar{s}^{bid} \leq s^{Abid}$ can be violated.
- So the basis is defined as

$$\text{Basis} = \text{CDS bid} - \text{Asset swap bid}$$

Credit Default Swaps IX

Problems with cash-and-carry arbitrage.

- Might not be able to short defaultable bonds.
- The defaultable bond may not match the CDS's maturity or its coupon payment dates may not match the CDS fee payment dates.
- Default-free bond may not be available in the market.
- Etc.

Exotic Credit Derivatives

Default Digital Swap.

- It pays a fixed amount regardless of the recovery.
- Combined with a CDS, it can be used to trade expected recovery rates:
  - Long CDS with notional of 1. Fee: $\bar{s}$, payoff in default: $1-$ recovery.
  - Short a DDS with notional $\frac{\bar{s}}{\bar{s}^{DDS}}$. Fee: $\frac{\bar{s}}{\bar{s}^{DDS}}$ x $\bar{s}^{DDS} = \bar{s}$, payoff in default: $\frac{\bar{s}}{\bar{s}^{DDS}}$
  - Then implied recovery $= 1 - \frac{\bar{s}}{\bar{s}^{DDS}}$
- DDS don't trade very often since there is not cash-and-carry argument that relates them with the underlying cash bond market.

Default Correlation Products

Loads of the products in the market involve multiple names.

- First-to-default
- As long as the prob of multiple defaults is small the whole basket is well protected by an FtD.
- Portfolio can't be too big, just a handful of names.
- Also second-to-default etc.
- First loss layers: Deals with the case of big portfolios.
- It uses a loss function which is the aggregated loss up to an upper bound.

Default Correlation Products II

- Collateralised debt obligations.
- Given a portfolio of defaultable bonds or loans define tranches and sell the pieces.
- Similar to MBS.