Portfolio Management

Session 8

Cesario MATEUS
www.cesariomateus.com
c.mateus@greenwich.ac.uk

Credit Derivatives in Bond Portfolio Management

Derivatives: Financial instruments designed efficiently to transfer some form of risk between two parties.

In the Fixed-Income market, derivatives include interest rate derivatives (which transfer interest rate risk) and credit derivatives (which transfer credit risk).

Credit derivatives: Portfolio manager can either acquire or reduce credit risk exposure.

Credit derivatives can be classified as follows:

- Total return swaps
- Credit default products
- Credit spread option

Market participants

End-buyers of protection, end-sellers of protection and Intermediaries

End-buyers of protection: entities that seek to hedge credit risk taken in other parts of their business. Predominate entity commercial banks for their loan portfolio. However, there are also insurance companies, pension funds and mutual funds who seek to diversify their current portfolio and can do so more efficiently with credit derivatives.

End-sellers of protection: entities that seek to diversify their current portfolio and can do so more efficiently with credit derivatives. Entity that provides protection in seeking exposure to a specific credit or a basket of credits.

Intermediaries: include investment arms of commercial banks. Key role: provide liquidity to end-users. They trade by their own account looking for arbitrage opportunities and other profitable opportunities.

Why Credit Risk is Important?

A fixed-income instrument represents a basket of risks:
There is: a) interest rate risk (as measured by duration and convexity), b) call risk, and c) credit risk.

Credit risk, includes the risk of defaults, downgrades and widening credit spreads.

The total return from a fixed-income instrument is the compensation for assuming all of these risks.

Depending upon the rating on the underlying debt instrument, the return from credit risk can be a significant part of a bond's total return.

Types of Credit Risk

Default Risk

Risk that the issuer default on its obligations.

Most investors consider the sovereign debt of the G7 countries to be default free.

Sovereign debt default risk is associated mainly with emerging economies.

Credit derivatives therefore appeal to portfolio managers who invest in corporate bonds – particularly, high-yield corporate bonds – and sovereign bonds.

Credit Risk Spread

Risk that the interest rate spread for a risky bond over a riskless bond will increase after the risky bond has been purchased.

Example: in the USA, US Treasury securities are generally considered to be without credit risk (default free). Therefore, corporate bonds, agency debentures and the debt of foreign governments are typically priced at a spread to comparable US treasury securities.

October 1997, rapid decline in Asian market spilled over into the US stock markets, causing a significant decline in financial stocks.

Flight to safety of investment capital resulted in a significant increase in credit spreads of corporate bonds to US Treasuries.

Example

June, 30, 1997, corporate bonds rated BB by Standard & Poor's were trading at an average spread over US Treasuries of 215 basis points.

October, 31, 1997, the spread has increased to 319 basis points.

For a $1000 market value BB-rated corporate bond with a duration of 5, resulted in a loss of value of about $52.50 per bond.

Spread duration: approximate percentage change in the bond's price for a 100 basis point increase in the credit spread (holding the treasury rate constant).
A spread duration of 3 means that for a 100 basis point increase in the credit spread, the bond's price will decline approximately 3%.

Downgrade Risk

Occurs when a nationally recognized statistical rating organization such Standard & Poor's, Moody's Investor Services or Fitch ratings reduces its outstanding credit rating for an issuer based on an evaluation of that issuer's current earning power versus its capacity to pay its fixed income obligations as they become due.

Reasons for selling Credit Protection

Market participant can sell contingent or insurance-type protection. Can be due he believes that credit performance will be such that it will be unnecessary to make an insurance payment to a counterparty (party buying credit protection), or, he may want to take the opposite view of a credit protection buyer and in fact benefit from an improvement in a credit.

Why are portfolio managers willing to assume credit risk?

1) Credit upgrades versus credit downgrades. One factor affecting credit rating upgrades is a strong stock market which encourages public offerings of stock by credit risky companies. Often, large portion of these equity financings are used to reduce outstanding costly debt, resulting in improved balance sheets and credit ratings for the issuer.
2) Expectation of other credit events which have a positive effect on credit risky bonds. Ex. Mergers and acquisitions, have been historically a frequent occurrence in the high-yield corporate bond market. Even though a credit risky issuer may have a low debt rating it may have valuable technology worth acquiring.
3) With a growing economy, banks may be willing to provide term loans to high-yield companies at more attractive rates than the bond market. Advantageous to redeem their high-yield bonds and replace with lower cost term loan. The resulting premium for redemption of high-yield bonds is a positive credit event which improve portfolio returns.

Total Return Swap

Swap in which one party makes periodic floating payments to a counterparty in exchange for the total return realized on an individual reference obligation or a basket of reference obligations.

Example:

Portfolio manager believes that the fortunes of XYZ Corporation will improve next year, and that the company's credit spread to US Treasury securities will decline. The company has issued a 10-year bond at par with a coupon rate of 8.5% and therefore the yield is 8.5%. Suppose at the time of issuance, the 10-year Treasury yield is 5.5%. This means that the credit spread is 300 basis points and the portfolio manager believes it will decrease over the year to less this amount.

Enter into a total return swap that matures in one year as a total return receiver with the reference obligation being the 10-year 8.5% XYZ Corporation bond issue.

Suppose:

1) The swap calls for an exchange of payments semiannually and,
2) The terms of the swap are such that the total return receiver pays the 6-month Treasury rate plus 140 basis points in order to receive the total return on the reference obligation. The notional amount for the contract is $10 million.

Assume that over the one year, the following occurs:

- The 6-month Treasury yield is 4.6% initially;
- The 6-month Treasury rate for computing the second semiannual payment is 5.6%;
- At the end of one year the 9-year Treasury rate is 7%;
- At the end of one year the credit spread for the reference obligation is 200 basis points.

Payments made by the portfolio manager:

First swap payment paid: \$10 million × 3% [(4.6% + 140 bp)/2]	\$300,000
First swap payment paid: \$10 million × 3% [(5.6% + 140 bp)/2]	\$350,000
Total payments	\$650,000

Payments received by the portfolio manager

Coupon payment (8.5% × \$ 1 million)	\$850,000
Capital Loss (9 years maturity, 9-year Treasury rate 7%, credit spread 200 bp, reference obligation yield 9%, (price of an 8.5%, 9-year bond selling to yield 9% is 96.96)	\$304,000
Swap payment	\$546,000

Portfolio manager must make a payment of \$104,000

Even portfolio manager's expectations were realized (decline in the credit spread), the portfolio manager had to make a net outlay.

One disadvantage of a total return swap: the return of the investor is dependent on both credit risk (declining or increasing credit spreads) and market risk (declining or increasing market rates).

To remedy this problem, a total return receiver can customize the total return swap transaction.

Example: could negotiate to receive the coupon income on the reference obligation plus any change in value due to changes in the credit spread. In our example, in addition to the coupon income, the portfolio manager would receive the difference between the present value of the reference obligation at a current spread of 200 basis points and the present value of the reference obligation at a credit spread of 300 basis points.

Benefits of Total Return Swaps

Advantages of total return swaps as opposed to purchasing reference obligations.

1) Total return receiver does not have to finance the purchase of the reference obligations. He pays a fee to the total return payer in return for receiving the total return on the reference obligations.

2) The total receiver can achieve the same economic exposure to a diversified basket of assets in one swap transaction that would otherwise take several cash market transactions to achieve.

3) Investor who wants to short the corporate bond of one or more issuers will find it difficult to do so in the corporate bond market. An investor can do so efficiently by using a total return swap. Investor will pay the total return and receive floating payment.

Credit Default Products (Credit Default Swaps and Default Options on a Credit Risky Asset)

Credit Default Swaps: Primary purpose is to hedge the credit exposure to a particular asset or issuer. Operate much like a standby letter of credit or insurance policy.

In a single-name CDS, the protection buyer pays a fee to the protection seller in return for the right to receive a payment conditional upon an occurrence of a credit event by the reference obligation or the reference entity.

Payments made by the protection buyer are called the premium leg; the contingent payment that might have to be made by the protection seller is called protection leg.

Settlement Methods

In the interdealer market, single-name credit default swaps are typically settled physically. Means that if a credit event as defined by the documentation occurs, the reference obligation is delivered by the protection buyer to the protection seller in exchange for a cash payment.

When a credit default swaps is cash settled, there is a netting of payment obligations with the same counterparty.

If no credit event has occurred by the maturity of the swap, both sides terminate the swap agreement and no further obligations are incurred.

Illustration of a Standard Single-Name Credit Default Swap

Reference entity: Corporation
5 year schedule term (typical tenor in the interdealer market)
Swap premium (payment made by the protection buyer to the protection seller): 410 basis points

If the credit event occurs, the protection seller pays the protection buyer the notional amount of the contract ($10 million).
Note: The notional amount is not the par value of the reference obligation.
Example: Suppose that a bond issue is trading at 80 (par value being 100). If a portfolio manager owns $12.5 million par value of the bond issue and wants to protect the current market value of $10 million (=80% of $12.5 million), then the portfolio manager will want a $10 million notional amount. If a credit event occurs, the portfolio manager will deliver $12.5 million par value of the bond and receive a cash payment of $10 million.

A standard contract for a single-name credit default swap in the interdealer market calls for a quarterly payment of the swap premium.

The day count convention used for credit default swaps is actual/360.

$$\text{Quarterly swap premium payment} = \text{notional amount} \times \text{swap premium (in decimal)} \times \frac{\text{actual number of days in quarter}}{360}$$

Example: Notional amount $10 million and there are 92 days in a quarter, then if the swap rate is 410 bp (0.0410), the quarterly swap premium payment made by the protection buyer would be:

$$\$10{,}000{,}000 \times 0.0410 \times \frac{92}{360} = \$104{,}777.80$$

Default Options on a Credit Risky Asset

A Default Option on a credit risky asset is another form of credit default products.

In a binary credit option the option seller will pay out a fixed sum if and when a default event occurs with respect to a reference obligation or reference entity. Represents two states of the world: default and no default.

At maturity of the option, if the reference obligation or reference entity has defaulted, the option holder receives a predetermined payout. If there is no default at maturity of the option, the option buyer receives nothing.

A binary credit option could also be triggered by a rating downgrade, both by a put and a call.

Example: binary credit put option

Assume that the portfolio manager purchased at par $1 million of Company X bonds, currently rated AA. The portfolio manager purchases a put option where he can sell the bonds at par value to the put option seller should the credit rating for Company X fall below investment grade (below BBB). The payoff to this binary put option can be described as:

$$Payoff = \begin{cases} \$1{,}000{,}000 - \text{market valeu of bonds, if the credit rating} \\ \qquad\qquad\qquad\qquad \text{of Company X falls below a BBB rating} \\ \qquad\qquad \text{or} \\ \$0 \qquad\qquad - \text{if the credit rating of Company X remains investment grade} \end{cases}$$

Portfolio manager receives a payout on the credit put option only in one state of the world: Company X is downgraded to below investment grade

Example: binary credit call option

Whenever Company X is downgraded, the portfolio manager gets to call for a payment that will compensate her for the greater credit risk associated with her bond holdings.

This is like receiving additional coupon income to reflect the higher credit risk associated with company X's bonds.

Portfolio manager gets to call for an additional 25 basis points of income should Company X be downgraded one credit rating, 50 basis points of income should Company X be downgraded two steps and so forth.

The pay out of this credit call option may be described as:

$$Payoff = \begin{cases} \$2{,}500 \text{ - if the credit rating of Company X declines by one credit rating} \\ \text{or} \\ \$5{,}000 \text{ - if the credit rating of Company X declines by one credit rating} \\ \text{or} \\ \$0 \quad \text{ - if the credit rating of Company X is not downgraded} \end{cases}$$

Where $\$2{,}500 = 0.25\% \times \$1{,}000{,}000$

and $\$5{,}000 = 0.25\% \times \$1{,}000{,}000$

The payout to the binary credit call option is not a function of the bond's market value

Credit Spread Products

Credit Spread Options: is an option whose value/payoff depends on the change in credit spreads for a reference obligation.

The underlying can be: a reference obligation with a fixed credit spread or the level of the credit spread for a reference obligation.

Underlying is a reference obligation with a fixed credit spread

When the underlying is a reference obligation with a fixed credit spread.

The credit spread is defined as follows:
Credit spread *put* option: An option that grants the option buyer the right, but not the obligation, to sell a reference obligation at a price that is determined by a strike credit spread over a referenced benchmark at the exercise date.
Credit spread *call* option: An option that grants the buyer the right, but not the obligation, to buy a reference obligation at a price that is determined by a strike credit spread over the referenced benchmark at the exercise date.

A credit spread option can have any exercise style: only at the exercise date (European), at any time prior to the exercise date (American), or only on specified dates by the exercise date (Bermudean).

The price of the reference obligation (i.e. the credit risky bond) is determined by specifying a strike credit spread over the referenced benchmark, typically a default-free government security.

Example:

- Reference obligation is an 8% 10-year credit-risky bond selling to yield 8%.

- The price of this bond is 100.

- Referenced benchmark is a same maturity US treasury bond that is selling to yield 6%.

- Current credit spread is 200 basis points.

• A strike credit spread of 300 basis points is specified and that the option expires in six-months.

• At the end of six-months, the 9.5-year treasury rate is 6.5%.

• Since the strike credit spread is 300 basis points, then the yield used to compute the strike price for reference obligation is 9.5% (the Treasury rate of 6.5% plus the strike credit spread of 300 basis points).

•The price of a 9.5 – year 8% coupon bond selling to yield 9.5% is $90.75 per $100 par value.

• Payoff at the expiration: Depends on the market price for the reference obligation.

• Suppose that at the end of six months, the reference obligation is trading at 82.59 (yield of 11%) and therefore a credit spread of a 450 basis points over the 9.5-year Treasury yield of 6.5%.

• For a credit spread put option, the buyer can sell the reference obligation (selling at 82.59) for the strike price of 90.75. the payoff from exercising is 8.16 (reduced by the cost of the option).

• For a credit call option, the buyer will not exercise the option and will allow it to expire worthless (loss equal to the cost of the option).

Problem with using a credit spread option which the underlying is a reference obligation with a fixed credit spread

The payoff is dependent upon the value of the reference obligation's price, which is affected by both the change in the level of the interest rates (as measured by the referenced benchmark) and the change in the credit spread.

Example:

- 9.5%-year treasury at the exercise date is 4.5% (instead of 6.5%).
- credit spread increases to 450 basis points.

- Reference obligation is trading at 9% (4.5% plus 450 basis points)

- Since it is an 8% coupon bond with 9.5-years to maturity selling at 9%, the price is 93.70.

• the credit spread put option would have a payoff of $965 because the price of the reference obligation is 93.70 and the strike price 103.35.

There is no protection against credit spread risk because interest rates for the referenced benchmark fell enough to offset the increase in the credit spread.

Type of Option	Positive Payoff if at expiration
Put	Credit spread at expiration > strike credit spread
Call	Credit spread at expiration < strike credit spread

Consequently, to protect against credit spread risk, and investor can buy a credit spread *put* option where the underlying is a reference obligation with a fixed credit spread

Underlying is a credit spread on a reference obligation

When the underlying for a credit spread option is the credit spread for a reference obligation over a referenced benchmark, then the payoff of a call and put option if exercise are as follows:

Credit Spread Call Option

Payoff = (credit spread at exercise - strike credit spread) × notional amount × risk factor

Credit Spread Put Option:

Payoff = (credit spread at exercise - strike credit spread) × notional amount × risk factor

Strike Credit Spread (in decimal form): fixed at the outset of the option
The Credit Spread at Exercise (in decimal form): is the credit spread over a referenced benchmark at the exercise date
Risk Factor: is based on the interest rate sensitivity of the debt instrument.

Notice

• When the underlying for the credit spread option is the credit spread for a reference obligation over a referenced benchmark, a credit spread *call* option is used to protect against an increase in the credit spread.

• When the underlying for the credit spread option is the reference obligation, a credit spread *put* option is used to protect against an increase in the credit spread.

•The risk factor is determined by the sensitivity of the reference obligation changes in the credit spread. Can be computed as:

- percentage change in the price of the reference obligation to a 100 basis point change in interest rates.

(since the percentage change will differ depending on whether we are looking at an increase or decrease in the credit spread, the change used will be dictated by the circumstances)

Risk Factor = percentage price change for a 1 basis point change in rates $\times$ 10,000

By including the risk factor, this form of credit spread option overcomes the problem identified with the credit spread option in which the underlying is a reference obligation: the payoff depends in both changes in the level of interest rates and the credit spread.

Fluctuations in the level of the referenced benchmark's interest rates will not affect the value of the options.

Example

Consider BB rated, 7.75 XYZ bond due in 2012. In September 1992 this bond was trading at a price of $104.77 with a yield to maturity around 7.08%. The risk factor is determined using the percentage change in price for an 100 basis point *increase* in interest rates. For the XYZ bond, there would be a percentage price change of 6.65% for a 100 basis point increase in rates.

$$\text{Risk Factor} = 0.000665 \times 10{,}000 = 6.65$$

At the time that this bond was offering a yield of 7.08%, the 10-yaer treasury note was yielding about 5.3% for a credit spread of 178 basis point. At the time it was a very narrow spread considering XYZ BB credit rating. Perhaps the market was implying that the credit risk of XYZ was closer to BBB than BB or alternatively the market overvalued the bond.

If a portfolio manager believed that the bond was overvalued, he could purchase a credit spread option strike at 178 basis points. This is the same as the portfolio manager expressing a view that the price of the reference obligation is inflated at the prevailing credit spread, and expecting the credit spread to expand out to more normal levels.

Suppose that the manager believes that the credit spread for this bond will increase to 250 basis points in one year.

The portfolio manager can purchase $20 million notional at-the-money call option on the credit spread between the debt of XYZ and US Treasury.

One year option, with a premium of 125 basis points and the risk factor is 6.65.

At the maturity of the option, if the credit spread is 250 basis points (credit spread at expiration) the portfolio manager will receive:

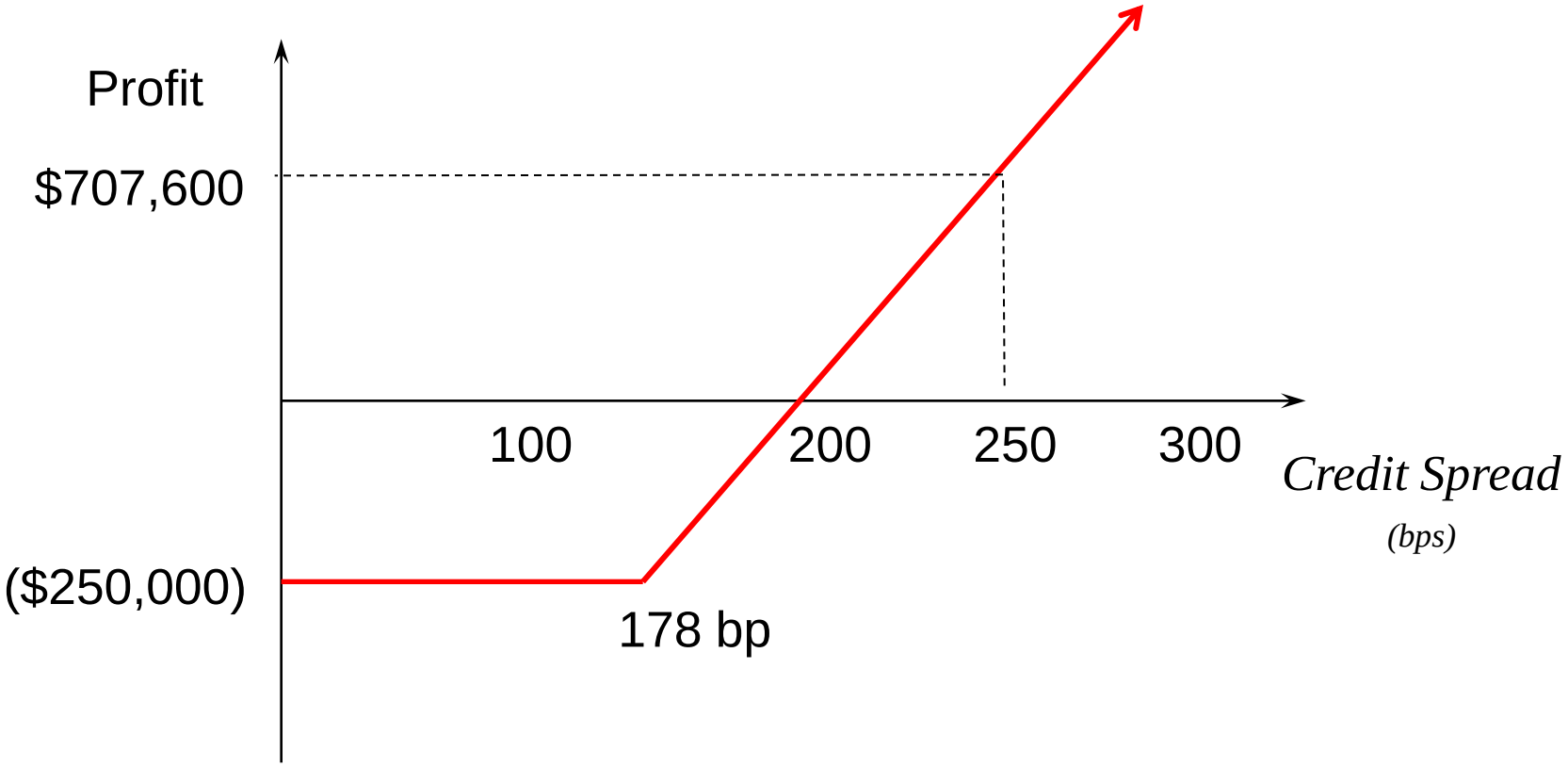
$$\text{Payoff} = (0.025 - 0.0178) \times \$20{,}000{,}000 \times 6.65 = \$957{,}600$$

The amount earned by the portfolio manager is the amount received less the cost of the option.

Since the option cost is 125 basis points for a notional amount of $20 million, the option cost is $250,000.

The portfolio manager's profit is $707,600

$$(= \$957{,}600 - \$250{,}000)$$


Profit
$707,600
($250,000)
100
200
250
300
Credit Spread
(bps)
178 bp

Credit Spread Forwards

Requires an exchange of payments at the settlement date based on a credit spread.

The payoff depends on the credit spread at the settlement date of the contract.

The payoff is positive (i.e. the party receives cash) if the credit spread moves in favor of the party at the settlement date, and the party makes a payment if the credit spread moves against.

Suppose that a manager has a view that the credit spread will increase, to more than the current 250 basis points in one year for a credit-risky bond.

The payoff function for this credit spread forward contract would be:

$$\text{Credit Spread at Setlement date} - 250) \times \text{notional amount} \times \text{risk factor}$$

Assuming that the notional is $10 million and the risk factor is 5, then if the credit spread at the settlement date is 325 basis points, then the amount that will be received by the portfolio manager is:

$$(00.0325 - 0.025) \times \$10,000,000 \times 5 = \$375,000$$

Instead if the credit spread at the settlement date decreased to 190 basis points, then the portfolio manager would have to pay $300,000:

$$(0.019 - 0.025) \times \$10,000,000 \times 5 = \$300,000$$

In general:

Payoff if the portfolio manager takes a position in a credit spread to benefit from an increase in the credit spread:

(Credit Spread at Settlement date - Contracted Credit Spread) × Notional amount × Risk factor

Payoff if the portfolio manager takes a position in a credit spread to benefit from an decrease in the credit spread:

(Contracted Credit Spread - Credit Spread at Settlement date) × Notional amount × Risk factor