

Portfolio Management

2010-2011

Question 1

A portfolio manager purchases a binary credit put option on a bond of Company X. The option pays out only if the credit rating of Company X declines below investment grade. At the maturity of the option at time T , the payout to the option buyer per \$1,000 par value is expressed as:

$$Payout = \begin{cases} \$1,000 - \text{Value of the bond at time } T & \text{;if the credit rating is below BBB} \\ \$0 & \text{;if the credit rating is BBB or higher} \end{cases}$$

- a. Suppose that at maturity of the option, the credit rating of Company X is BBB and its bonds are worth \$950 per bond. What is the payout on this binary credit put option?
- b. Suppose that at the maturity of the option, the credit rating of the Company X is BB and its bonds are worth \$920 per bond. What is the payout on this binary credit put option?
- c. Suppose that at the maturity of the option, the credit rating of Company X is BB+ and its bonds are worth \$1,010 per bond. What is the payout on this binary credit put option?

Question 2

Mr. X of Covered Insurance Inc. manages the insurance company's asset portfolio. He is concerned about a large position in one credit – bond MMM, a high-yield corporate bond issue. For certain reasons, this position cannot be disposed of for another six months. More specifically, he was not concerned with the bankruptcy of the credit but with a rating downgrade that could lead to a widening of the credit spread.

After reading an article on credit derivatives, Mr. X. decides to meet with credit derivative specialists of three dealer firms. Here were their recommendations:

- Dealer A recommended a 6-month total return swap in which the reference obligation is the bond issue of MMM held by Covered Insurance Inc. and the notional amount is the market value of the bond. Covered Insurance Inc. would be the total return receiver and Dealer A would be total return payer.
- Dealer B recommended the purchase of a 6-month credit spread put option.

- Dealer C recommended the purchase of a 6-month credit spread call option.
 - a. Evaluate the recommendation of Dealer A and make a recommendation to Mr. X about the proposed trade.
 - b. Mr. X is confused by the recommendations of Dealer B and Dealer C. Both are recommending the purchase of a put and the other a call. Explain to Mr. X the source of confusion.
 - c. Of the three proposals which would you recommend to Mr. X?

Question 3

What is the purpose of the “risk factor” in credit derivatives where the payout is based on a change in the credit spread?

Question 4

Suppose the 10-year bond of XYZ.com was trading to yield 8.2%. The 10-year Treasury bond was yielding 6.2% at the time for a credit spread of 200 basis points.

- a) Suppose that a portfolio manager felt that the issue was overvalued and that the credit spread would be at least 300 basis points one year from now and could purchase a credit spread option where the underlying is a credit spread strike of 200 basis points. What type of credit spread option would the portfolio manager purchase, a put or a call?
- b) Suppose the risk factor for the XYZ.com bond was 6. Assuming that the manager purchased the option in part (a) with a strike credit spread of 200 basis points, ignoring the cost of the option what is the payoff for this option assuming a notional amount of \$10 million?
- c) Suppose that the premium paid for the credit spread option in part (a) is \$120,000 and that the manager’s expectations are realized and the credit spread in one year is 300 basis points. What is the profit from the purchase of this credit spread option?

Question 5

On January, 1, a portfolio manager purchases a 5-year bond from Company Y with a par value of \$1,000. The bonds are issued at par on January, 1 at a credit spread of 200 basis points over a

comparable 5-year U.S. Treasury note rate of 6.5%. The first semiannual coupon payment is due on July, 1.

On January 31, the portfolio manager purchases a credit spread put option on the bond at a strike credit spread of 250 basis points over the 5-year U.S. Treasury note rate. The option matures on July, 1 and costs the portfolio manager \$10. On July 1, the credit quality of Company Y has deteriorated and its bonds now trade at a credit spread of 300 basis points over the 5-year U.S. Treasury note rate. On July, 1 the yield on a 5-year U.S. Treasury note remains unchanged at 6.5%.

- a) What is the strike price for this credit spread put option?
- b) What is the payoff for the option by exercising on July 1?
- c) What is the profit from the purchase of this option?

Question 6

A high-yield portfolio manager wants to protect her portfolio from macroeconomic shocks that might increase credit spreads. Her portfolio market value is \$500 million, and has an average credit spread to the 5-year U.S Treasury note of 250 basis points. The risk factor of her portfolio is 3.25.

On July 1, she purchases a credit spread forward contract to protect against declines in the value of her total portfolio. The credit forward contract has a contracted credit spread of 300 basis points relative to the 5-year Treasury rate and matures on December 31. In November, a large US company defaults on its outstanding bonds, and credit spreads increase across the credit spectrum. On December 31, the average credit spread on the manager's portfolio is 350 basis points.

What is the payoff to the credit spread forward contract?

Solutions

Question 1

- a. The value of the binary credit put option is \$0 because the credit rating of Company X is not below BBB.
- b. Because the issue is rated BB, the binary credit put option expires in the money. The payoff is 480 (\$1,000-\$520).
- c. While this binary credit put option has a credit rating below BBB, its price is above par. Thus, the payoff would indicate a negative value of \$10. However, because the option has a negative value, the option buyer will not exercise. Therefore, the payoff from the option is zero.

Question 2

- a. The trade recommendation suggested by dealer A does not make any sense. The total return swap and the position that the insurer should take in the trade suggested by Dealer A (receiving the total return) would double the credit risk exposure and interest rate risk exposure, not reduce credit spread risk.
- b. The confusion here is that credit spread options can be written where the underlying is a credit risky bond with a fixed credit spread or where the underlying is a credit spread. When the underlying is a credit risky bond with a fixed credit spread, a put option provides protection against an increase in the credit spread. When the underlying is a credit spread, a call option provides this protection. Hence, Dealer B and Dealer C could both be correct, it is just they were referring to a different type of credit spread option.
- c. The total return swap can be ruled out for the reason given in part (a). Both types of credit spread options would accomplish the objective sought by Mr. X. Of the two types of credit risk options, the one in which the underlying is a credit spread should be preferred since the other assumes that market risk (i.e. interest rate risk) will not matter over the next six months.

Question 3

The payout on a credit derivative in which the underlying is a credit spread should be based only on a change in the credit spread and not a change in the general level of interest rates. The risk factor is derived from the price sensitivity of a security to changes in interest rates. When the

change in the credit spread is multiplied by the risk factor and the notional amount, the result is the change in value attributable to only a change in the credit spread.

Question 4

a) Since the manager expects the credit spread to widen, the manager will benefit by purchasing a credit spread call option.

b) The payoff for the credit spread call option is as follows:

- If the credit spread at expiration is 200 basis points or less the payoff is zero
- If the credit spread at expiration is greater than 200 basis points the payoff is

$$(\text{credit spread at expiration} - 0.020) \times \$10,000,000 \times 6$$

c) Because the option cost is \$120,000, the profit for the credit spread call is

$$(\text{credit spread at expiration} - 0.020) \times \$10,000,000 \times 6 - \$120,000$$

If the credit spread is 300 basis points (that is, 0.030), the profit is:

$$(0.030 - 0.020) \times \$10,000,000 \times 6 - \$120,000 = \$480,000$$

Question 5

Before looking at the precise answers for parts (a) through (c), consider the difference between the credit spread call option in question 4 compared to the credit spread put option in this question. In question 4, the credit spread call option was written on the credit spread. As the credit spread widened, the credit option came into the money.

Conversely, in this question, the credit spread put option is written on the underlying asset. As the credit spread widens, the value of the underlying asset declines, and the credit spread put option will come into the money. In this question, the credit spread is used to determine the strike price for the put option on the underlying asset.

The key point of the previous and this question is to demonstrate that an investor can use both a credit call option and a credit put option to profit from widening credit spreads. The distinction is

that the credit spread call option must be written on the credit spread, while the credit put option must be written on the underlying asset.

a) The strike price is the present value of the future cash flow. The discount rate for computing the present value is the 5-year Treasury rate of 6.5% plus then credit spread of 250 basis points. So, the annual discount rate is 9% and the semiannual discount rate is therefore 4.5%.

The coupon rate for the bond is 200 basis points over 6.5% or 8.5%. the semiannual coupon payment is \$42.50.

The first coupon payment of \$42.50 is not discounted because it is paid in the same day that the option matures, July 1. (That is, when evaluating as of July, 1, it is not a future cash flow). Since the bond is a 5-year bond, there are 10 coupon payments. However, there are nine remaining after July, 1. The nine future coupon payments of \$42.50 per \$1,000 of par value are discounted at 4.5%. It can be shown that the present value of the nine future coupon payments is \$308.92.

The present value of the maturity value of \$1,000 nine periods from now when discounted at 4.5% is \$672.90 [= \$1,000/(1.045)⁹].

Therefore the strike price is:

Strike price = current coupon + PV of future coupons + PV of maturity value

$\$42.50 + \$308.92 + \$672.90 = \$1,024.32$

b) The payout is equal to:

Strike price – bond's value on July 1

The bond's value on July 1 must be determined. It is assumed in the question that on July 1 the credit spread is 300 basis points and the 5-year US Treasury note rate is unchanged at 6.5%. the discount rate is 9.5% and the semiannual discount rate is 4.75%.

The semiannual coupon payment is \$42.50. Again, as of July 1, the first coupon is not discounted because it is paid on the same date when the option matures. Since the bond is initially a 5-year bond, on July 1 there are 9 remaining coupon payments of \$42.50. The present value of the 9 remaining coupon payments when discounted at 4.75% (the semiannual discount rate on July 1) is \$305.47.

The present value of the \$1,000 maturity value discounted at 4.75% nine periods from now is
 $\$1,000/(1.0475)^9 = \658.59

The value of the bond as of July 1 is therefore equal to:

$$\begin{aligned} &= \text{current coupon} + \text{PV of future coupons} + \text{PV of maturity value} \\ &= \$42.50 + \$305.47 + \$658.59 = \$1,006.56 \end{aligned}$$

The payout is:

$$\$1,024.32 - \$1,006.56 = \mathbf{\$17.76}$$

c) The profit is equal to;

Strike price – bond's value – cost of option

Since the cost of the option is \$10, the profit is

$$\$1,024.32 - \$1,006.56 - \$10 = \mathbf{\$7.76}$$

Question 6

The payoff for the credit spread forward contract is;

$$\text{Payoff} = [\text{credit spread at maturity} - \text{contracted credit spread}] \times \text{risk factor} \times \text{notional amount}$$

The following is known

Credit spread at maturity of the forward (December 31) = 3.5%

Contracted credit spread = 3%

Risk factor = 3.25

Notional amount = \$500,000,000

Therefore,

$$\text{Payoff} = [0.035 - 0.03] \times 3.25 \times \$500,000,000 = \mathbf{\$8,125,000}$$