

Corporate Finance, Module 23: "Advanced Option Valuation"

*Practice Problems*

(The attached PDF file has better formatting.)

{This posting contains more information than is needed for the corporate finance on-line course.}

Exercise 23.1: Bond Default Risk

A firm issues two-year bonds with a face value of \$1,000 and 8% coupons. There is a 5% chance that the firm will go out of business in the upcoming year and default on the bonds. If the firm makes it through this year, there is a 10% chance that it will go out of business in the second year and default on the bonds. If it survives for two years, the chance of default falls to zero. Assume that the risk of default is wholly diversifiable. The current risk-free rate of return is 6%. What would you be willing to pay for one bond?

Solution 23.1:

Since the risk of default is wholly diversifiable, the cost of capital is 6%, not 8%. The expected cash inflows from the bond are

- ! 5% probability: zero
- ! 95% probability × 10% probability: 9.5% probability: \$80 in one year
- ! 1 – 5% – 9.5% = 85.5% probability: \$80 in one year and \$1,080 in two years

Net present value of bond =

$$5\% \times \$0 + 9.5\% \times \$80 / 1.06 + 85.5\% \times (\$80 / 1.06 + \$1,080 / 1.06^2) = \$893.52.$$

### Exercise 23.2: Risky Assets

Which of the following are examples of options to exchange one risky asset for another?

- a. A firm invests in computer-controlled machinery that allows it to vary product mix as demand changes.
- b. A utility installs equipment that allows it to burn a mixture of natural gas and coal.
- c. A computer chip manufacturer establishes manufacturing plants in several different countries.

Solution 23.2:

Scenarios A and B are clearly options to exchange one risky asset for another, since the firm varies the product mix or the utility varies the source of energy as the prices of each change. Scenario C is unclear. If the computer chip manufacturer can not vary the use of the different facilities as labor costs change, it has no option; if it can lay off workers (without suffering severance costs and continuing overhead expenses), it has an option.

### Exercise 23.3: Real Options

Which of the following are true?

1. The value of flexibility in manufacturing and service processes can be modeled using option pricing theory.
2. The stock of a bankrupt company can be viewed as a put option.
3. As the stock price rises, the value of a put option falls.

Solution 23.3:

Statement 1 is true; this is the option to exchange one risky asset for another.

Statement 2 is false. The stock of a corporation – before bankruptcy – can be viewed as a put option held by the shareholders. After bankruptcy, the put option is exercised and the stock is exchanged for the exercise price, which is the par value of the debt.

Statement 3: True. The put option allows the investor to exchange the stock for the exercise price, so as the stock price rises and the exercise price remains fixed, the value of the put option falls.