Chapter 13: Risk Analysis, pages 457 - 460

7. Another way managers can introduce risk into the valuation model is to adjust the discount rate. To do this, managers should construct indifference curves between expected rate of return and risk, based on their utility functions. Using such indifference curves, managers can estimate the risk premium (if any) that is appropriate.

PROBLEMS

1. The president of the Martin Company is considering two alternative investments, *X* and *Y*. If each investment is carried out, there are four possible outcomes. The present value of net profit and probability of each outcome follow:

Outcome	Investment *X* Net Present Value	Probability	Outcome	Investment *Y* Net Present Value	Probability
1	$20 million	0.2	*A*	$12 million	0.1
2	8 million	0.3	*B*	9 million	0.3
3	10 million	0.4	*C*	6 million	0.1
4	3 million	0.1	*D*	11 million	0.5

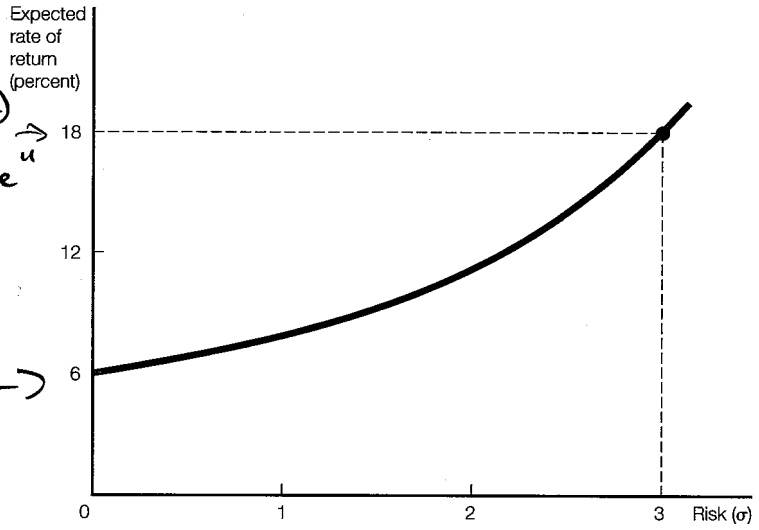
a. What are the expected present value, standard deviation, and coefficient of variation of investment *X*?
b. What are the expected present value, standard deviation, and coefficient of variation of investment *Y*?
c. Which investment is riskier?
d. The president of the Martin Company has the utility function

$$U = 10 + 5P - 0.01P^2$$

where U is utility and P is net present value. Which investment should she choose?

2. William J. Bryan is the general manager of an electrical equipment plant. He must decide whether to install a number of assembly robots in his plant. This investment would be risky because both management and the workforce have no real experience with the introduction or operation of such robots. His indifference curve between expected rate of return and risk is as shown in the figure.

a. If the riskiness (σ) of this investment equals 3, what risk premium does he require?
b. What is the riskless rate of return?
c. What is the risk-adjusted discount rate?
d. In calculating the present value of future profit from this investment, what interest rate should be used?



3. The Zodiac Company is considering the development of a new type of plastic. Whether the plastic will be successful depends on the outcome of a research project being carried out at a major university. Zodiac's executives have no reliable means of estimating the university research team's probability of success. Zodiac's gains (or losses), depending on the outcome of the university research project, are as follows:

Action	Outcome of University Research Project: Success	Failure
Zodiac develops plastic	$50 million	−$8 million
Zodiac does not develop plastic	0	0

On the basis of the information given, can you calculate the expected value of perfect information? Why or why not?

4. The Electro Corporation, which manufactures television sets, has a fixed cost of $1 million per year. The gross profit from each TV set sold—that is, the price less the average variable cost—is $20. The expected value of the number of sets the company sells per year is 100,000. The standard deviation of the number of sets sold per year is 10,000.
   a. What is the expected value of the firm's annual profit?
   b. What is the standard deviation of the firm's annual profit?
   c. What is the coefficient of variation of the firm's annual profit?

5. Richard Miller, a Wall Street trader, says he is risk-neutral. Suppose we let 0 be the utility he attaches to $100,000 and 1 be the utility he attaches to $200,000.

If what he says is true, what is the utility he attaches to (a) \$400,000? (b) \$40,000? (c) −\$20,000?

6. The chief executive officer of a publishing company says she is indifferent between the certainty of receiving \$7,500 and a gamble where there is a 0.5 chance of receiving \$5,000 and a 0.5 chance of receiving \$10,000. Also, she says she is indifferent between the certainty of receiving \$10,000 and a gamble where there is a 0.5 chance of receiving \$7,500 and a 0.5 chance of receiving \$12,500.
   a. Draw (on a piece of graph paper) four points on the utility function of this publishing executive.
   b. Does she seem to be a risk averter, a risk lover, or risk-neutral? Explain.

7. The Oahu Trading Company is considering the purchase of a small firm that produces clocks. Oahu's management feels there is a 50–50 chance, if Oahu buys the firm, that it can mold the firm into an effective producer of washing machine parts. If the firm can be transformed in this way, Oahu believes that it will make \$500,000 if it buys the firm; if it cannot be transformed in this way, Oahu believes that it will lose \$400,000.
   a. Construct a decision tree to represent Oahu's problem.
   b. What are the decision forks? (Are there more than one?)
   c. What are the chance forks? (Are there more than one?)
   d. Use the decision tree to solve Oahu's problem. In other words, assuming that the firm wants to maximize the expected profit, should Oahu buy the firm?
   e. Before Oahu makes a decision concerning the purchase of the firm, Oahu's president learns that if the clock producer cannot be made into an effective producer of washing machine parts, there is a 0.2 probability that it can be resold to a Saudi Arabian syndicate at a profit of \$100,000. (If the firm cannot be resold, Oahu will lose \$400,000.)
      (1) Does this information alter the decision tree?
      (2) Can you think of three mutually exclusive outcomes if Oahu buys the firm?
      (3) What is the probability of each of these outcomes?
      (4) What is the monetary value to Oahu of each of these outcomes?
   f. Use your results in part (e) to solve Oahu's problem under this new set of conditions. In other words, on the basis of this new information, should Oahu buy the firm?
   g. Oahu's executive vice president discovers an error in the estimate of how much Oahu will gain if it buys the clock manufacturer and turns it into an effective producer of washing machine parts.
      (1) Under the circumstances in part (d), how big would this error have to be to reverse the indicated decision?
      (2) Under the circumstances in part (e), how big would the error have to be to reverse the indicated decision?

8. The National Aeronautics and Space Administration (NASA) estimated the probability of a crash of the space shuttle to be 1 in 100,000, whereas the probability was in fact closer to about 0.01–0.02. If a decision tree had been used to determine whether to attempt a launch of the shuttle, what difference, if any, would this have made?

9. The *East Chester Tribune* must decide whether to publish a Sunday edition. The publisher thinks the probability is 0.6 that a Sunday edition would be a success and 0.4 that it would be a failure. If it is a success, she will gain $100,000. If it is a failure, she will lose $80,000.
   a. Construct a decision tree corresponding to the problem, and use backward induction to solve the problem. (Assume that the publisher is risk-neutral.)
   b. List all forks in the decision tree you constructed; then indicate whether each is a decision fork or a chance fork and state why.

10. Roy Lamb has an option on a particular piece of land, and he must decide whether to drill on the land before the expiration of the option or give up his rights. If he drills, he believes that the cost will be $200,000. If he finds oil, he expects to receive $1 million; if he does not find oil, he expects to receive nothing.
   a. Construct a decision tree to represent Lamb's decision.
   b. Can you tell whether he should drill on the basis of the available information? Why or why not?
      Lamb believes that the probability of finding oil if he drills on this piece of land is 0.25, and the probability of not finding oil if he drills there is 0.75.
   c. Can you tell whether he should drill on the basis of the available information? Why or why not?
   d. Suppose Lamb can be demonstrated to be a risk lover. Should he drill? Why or why not?
   e. Suppose Lamb is risk-neutral. Should he drill?