

# STUDY SESSION

# 2

## Quantitative Methods

### Basic Concepts

**T**his study session introduces quantitative concepts and techniques used in financial analysis and investment decision making. The time value of money and discounted cash flow analysis form the basis for cash flow and security valuation. Descriptive statistics used for conveying important data attributes such as central tendency, location, and dispersion are presented. Characteristics of return distributions such as symmetry, skewness, and kurtosis are also introduced. Finally, all investment forecasts and decisions involve uncertainty: Therefore, probability theory and its application quantifying risk in investment decision making is considered.

#### READING ASSIGNMENTS

- |                  |                                                                                                                                                               |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Reading 6</b> | The Time Value of Money<br>by Richard A. DeFusco, CFA PhD, Dennis W. McLeavey, CFA, Jerald E. Pinto, PhD, CFA, and David E. Runkle, PhD, CFA                  |
| <b>Reading 7</b> | Discounted Cash Flow Applications<br>by Richard A. DeFusco, CFA, PhD, Dennis W. McLeavey, CFA, Jerald E. Pinto, PhD, CFA, and David E. Runkle, PhD, CFA       |
| <b>Reading 8</b> | Statistical Concepts and Market Returns<br>by Richard A. DeFusco, CFA, PhD, Dennis W. McLeavey, CFA, Jerald E. Pinto, PhD, CFA, and David E. Runkle, PhD, CFA |
| <b>Reading 9</b> | Probability Concepts<br>by Richard A. DeFusco, CFA, PhD, Dennis W. McLeavey, CFA, Jerald E. Pinto, PhD, CFA, and David E. Runkle, PhD, CFA                    |

**LEARNING OUTCOMES****READING 6. THE TIME VALUE OF MONEY**

The candidate should be able to:

- a** interpret interest rates as required rates of return, discount rates, or opportunity costs;
- b** explain an interest rate as the sum of a real risk-free rate and premiums that compensate investors for bearing distinct types of risk;
- c** calculate and interpret the effective annual rate, given the stated annual interest rate and the frequency of compounding;
- d** solve time value of money problems for different frequencies of compounding;
- e** calculate and interpret the future value (FV) and present value (PV) of a single sum of money, an ordinary annuity, an annuity due, a perpetuity (PV only), and a series of unequal cash flows;
- f** demonstrate the use of a time line in modeling and solving time value of money problems.

**READING 7. DISCOUNTED CASH FLOW APPLICATIONS**

The candidate should be able to:

- a** calculate and interpret the net present value (NPV) and the internal rate of return (IRR) of an investment;
- b** contrast the NPV rule to the IRR rule, and identify problems associated with the IRR rule;
- c** calculate and interpret a holding period return (total return);
- d** calculate and compare the money-weighted and time-weighted rates of return of a portfolio and evaluate the performance of portfolios based on these measures;
- e** calculate and interpret the bank discount yield, holding period yield, effective annual yield, and money market yield for US Treasury bills and other money market instruments;
- f** convert among holding period yields, money market yields, effective annual yields, and bond equivalent yields.

**READING 8. STATISTICAL CONCEPTS AND MARKET RETURNS**

The candidate should be able to:

- a** distinguish between descriptive statistics and inferential statistics, between a population and a sample, and among the types of measurement scales;
- b** define a parameter, a sample statistic, and a frequency distribution;
- c** calculate and interpret relative frequencies and cumulative relative frequencies, given a frequency distribution;
- d** describe the properties of a data set presented as a histogram or a frequency polygon;
- e** calculate and interpret measures of central tendency, including the population mean, sample mean, arithmetic mean, weighted average or mean, geometric mean, harmonic mean, median, and mode;

- f** calculate and interpret quartiles, quintiles, deciles, and percentiles;
- g** calculate and interpret 1) a range and a mean absolute deviation and 2) the variance and standard deviation of a population and of a sample;
- h** calculate and interpret the proportion of observations falling within a specified number of standard deviations of the mean using Chebyshev's inequality;
- i** calculate and interpret the coefficient of variation and the Sharpe ratio;
- j** explain skewness and the meaning of a positively or negatively skewed return distribution;
- k** describe the relative locations of the mean, median, and mode for a unimodal, nonsymmetrical distribution;
- l** explain measures of sample skewness and kurtosis;
- m** compare the use of arithmetic and geometric means when analyzing investment returns.

## READING 9. PROBABILITY CONCEPTS

The candidate should be able to:

- a** define a random variable, an outcome, an event, mutually exclusive events, and exhaustive events;
- b** state the two defining properties of probability and distinguish among empirical, subjective, and a priori probabilities;
- c** state the probability of an event in terms of odds for and against the event;
- d** distinguish between unconditional and conditional probabilities;
- e** explain the multiplication, addition, and total probability rules;
- f** calculate and interpret 1) the joint probability of two events, 2) the probability that at least one of two events will occur, given the probability of each and the joint probability of the two events, and 3) a joint probability of any number of independent events;
- g** distinguish between dependent and independent events;
- h** calculate and interpret an unconditional probability using the total probability rule;
- i** explain the use of conditional expectation in investment applications;
- j** explain the use of a tree diagram to represent an investment problem;
- k** calculate and interpret covariance and correlation;
- l** calculate and interpret the expected value, variance, and standard deviation of a random variable and of returns on a portfolio;
- m** calculate and interpret covariance given a joint probability function;
- n** calculate and interpret an updated probability using Bayes' formula;
- o** identify the most appropriate method to solve a particular counting problem and solve counting problems using factorial, combination, and permutation concepts.