STUDY SESSION

3

Quantitative Methods for Valuation

This study session introduces correlation analysis, linear regression with one and multiple independent variables, and time-series analysis as tools for identifying relationships among variables. The fundamental elements of all three are covered beginning with correlation analysis. Regression, using one or more (independent) variables to explain or predict the value of another (dependent) variable, is explored next. Time-series analysis, in which the dependent variable's past values are included as independent variables, follows. The session concludes with coverage of probability-based techniques for assessing risk, with a focus on simulation models.

READING ASSIGNMENTS

Reading 9	Correlation and Regression by Richard A. DeFusco, PhD, CFA, Dennis W. McLeavey, CFA, Jerald E. Pinto, PhD, CFA, and David E. Runkle, PhD, CFA
Reading 10	Multiple Regression and Issues in Regression Analysis by Richard A. DeFusco, PhD, CFA, Dennis W. McLeavey, CFA, Jerald E. Pinto, PhD, CFA, and David E. Runkle, PhD, CFA
Reading 11	Time-Series Analysis by Richard A. DeFusco, PhD, CFA, Dennis W. McLeavey, CFA, Jerald E. Pinto, PhD, CFA, and David E. Runkle, PhD, CFA
Reading 12	Excerpt from "Probabilistic Approaches: Scenario Analysis, Decision Trees, and Simulations" by Aswath Damodaran

LEARNING OUTCOMES

READING 9. CORRELATION AND REGRESSION

The candidate should be able to:

a calculate and interpret a sample covariance and a sample correlation coefficient and interpret a scatter plot;

b describe limitations to correlation analysis;

c formulate a test of the hypothesis that the population correlation coefficient equals zero and determine whether the hypothesis is rejected at a given level of significance;

d distinguish between the dependent and independent variables in a linear regression;

e explain the assumptions underlying linear regression and interpret regression coefficients;

f calculate and interpret the standard error of estimate, the coefficient of determination, and a confidence interval for a regression coefficient;

g formulate a null and alternative hypothesis about a population value of a regression coefficient and determine the appropriate test statistic and whether the null hypothesis is rejected at a given level of significance;

h calculate the predicted value for the dependent variable, given an estimated regression model and a value for the independent variable;

i calculate and interpret a confidence interval for the predicted value of the dependent variable;

j describe the use of analysis of variance (ANOVA) in regression analysis, interpret ANOVA results, and calculate and interpret the *F*-statistic;

k describe limitations of regression analysis.

READING 10. MULTIPLE REGRESSION AND ISSUES IN REGRESSION ANALYSIS

The candidate should be able to:

a formulate a multiple regression equation to describe the relation between a dependent variable and several independent variables and determine the statistical significance of each independent variable;

b interpret estimated regression coefficients and their *p*-values;

c formulate a null and an alternative hypothesis about the population value of a regression coefficient, calculate the value of the test statistic, and determine whether to reject the null hypothesis at a given level of significance;

d interpret the results of hypothesis tests of regression coefficients;

e calculate and interpret 1) a confidence interval for the population value of a regression coefficient and 2) a predicted value for the dependent variable, given an estimated regression model and assumed values for the independent variables;

f explain the assumptions of a multiple regression model;

g calculate and interpret the *F*-statistic, and describe how it is used in regression analysis;

h distinguish between and interpret the R^2 and adjusted R^2 in multiple regression;

i evaluate how well a regression model explains the dependent variable by analyzing the output of the regression equation and an ANOVA table;

j formulate a multiple regression equation by using dummy variables to represent qualitative factors and interpret the coefficients and regression results;

k explain the types of heteroskedasticity and how heteroskedasticity and serial correlation affect statistical inference;

l describe multicollinearity and explain its causes and effects in regression analysis;

m describe how model misspecification affects the results of a regression analysis and describe how to avoid common forms of misspecification;

n describe models with qualitative dependent variables;

o evaluate and interpret a multiple regression model and its results.

READING 11. TIME-SERIES ANALYSIS

The candidate should be able to:

a calculate and evaluate the predicted trend value for a time series, modeled as either a linear trend or a log-linear trend, given the estimated trend coefficients;

b describe factors that determine whether a linear or a log-linear trend should be used with a particular time series and evaluate limitations of trend models;

c explain the requirement for a time series to be covariance stationary and describe the significance of a series that is not stationary;

d describe the structure of an autoregressive (AR) model of order p and calculate one- and two-period-ahead forecasts given the estimated coefficients;

e explain how autocorrelations of the residuals can be used to test whether the autoregressive model fits the time series;

f explain mean reversion and calculate a mean-reverting level;

g contrast in-sample and out-of-sample forecasts and compare the forecasting accuracy of different time-series models based on the root mean squared error criterion;

h explain the instability of coefficients of time-series models;

i describe characteristics of random walk processes and contrast them to covariance stationary processes;

j describe implications of unit roots for time-series analysis, explain when unit roots are likely to occur and how to test for them, and demonstrate how a time series with a unit root can be transformed so it can be analyzed with an AR model;

k describe the steps of the unit root test for nonstationarity and explain the relation of the test to autoregressive time-series models;

l explain how to test and correct for seasonality in a time-series model and calculate and interpret a forecasted value using an AR model with a seasonal lag;

m explain autoregressive conditional heteroskedasticity (ARCH) and describe how ARCH models can be applied to predict the variance of a time series;

n explain how time-series variables should be analyzed for nonstationarity and/or cointegration before use in a linear regression;

o determine an appropriate time-series model to analyze a given investment problem and justify that choice.

READING 12. EXCERPT FROM "PROBABILISTIC APPROACHES: SCENARIO ANALYSIS, DECISION TREES, AND SIMULATIONS"

The candidate should be able to:

a describe steps in running a simulation;

b explain three ways to define the probability distributions for a simulation's variables;

c describe how to treat correlation across variables in a simulation;

d describe advantages of using simulations in decision making;

e describe some common constraints introduced into simulations;

f describe issues in using simulations in risk assessment;

g compare scenario analysis, decision trees, and simulations.