Edge FIT - Formula Sheet
December 2019 CFA LI Exam

STUDY SESSION 1 - Ethics

The Code of Ethics

Members and candidates must:

- Act with integrity, competence, diligence, and respect and in an ethical manner with the public, clients, prospective clients, employers, employees, colleagues in the investment profession, and other participants in the global capital markets.
- Place the integrity of the investment profession and interests of clients above their own personal interests.
- Use reasonable care and exercise independent professional judgment when conducting investment analysis, making investment recommendations, taking investment actions, and engaging in other professional activities.
- Practice and encourage others to practice in a professional and ethical manner that will reflect credit on themselves and the profession.
- Promote the integrity and viability of the global capital markets for the ultimate benefit of society.
- Maintain and improve their professional competence and strive to maintain and improve the competence of other investment professionals.

The Standards of Professional Conduct

I. Professionalism
- A. Knowledge of the Law
- B. Independence and Objectivity
- C. Misrepresentation
- D. Misconduct

II. Integrity of Capital Markets
- A. Material Non-public Information
- B. Market Manipulation

III. Duties to Clients
- A. Loyalty, Prudence, and Care
- B. Fair Dealing
- C. Suitability
- D. Performance Presentation
- E. Preservation of Confidentiality

IV. Duties to Employers
- A. Loyalty
- B. Additional Compensation Arrangements
- C. Responsibility of Supervisors

V. Investment Analysis, Recommendations, & Actions
- A. Diligence and Reasonable Basis
- B. Communication with Clients and Prospective Clients
- C. Record Retention

VI. Conflicts of Interest
- A. Disclosure of Conflicts
- B. Priority of Transactions
- C. Referral Fees

VII. Responsibilities as a CFA Institute Member or CFA Candidate
- A. Conduct as Participants in CFA Institute Programs
- B. Reference to CFA Institute, the CFA Designation, and the CFA Program

Global Investment Performance Standards (GIPS®)

Nine major sections of the GIPS standards:

0. Fundamentals of Compliance
1. Input Data
2. Calculation Methodology
3. Composite Construction
4. Disclosure
5. Presentation and Reporting
6. Real Estate
7. Private Equity
8. Wrap/Separately Managed Account (SMA) Portfolio.

STUDY SESSIONS 2 & 3 - Quantitative Methods

Time Value of Money

1. Effective Annual Rate

$EAR = (1 + \text{periodic rate})^m - 1$ Where:

Periodic rate = stated annual rate divided by the number of compounding periods
m = number of compounding periods per annum

2. Future Value of a Single Sum

$FV_N = PV(1 + r)^N$ Where:

FV_N = The future value of the amount invested
PV = The amount invested today
r = The annual interest rate on the investment
N = The period of the investment

3. Present Value of a Single Sum

$$PV = \frac{FV_N}{(1 + r)^N}$$

4. Annuities

Ordinary Annuity: Cash flow at end-of-time period
Annuity Due: Cash flow at the beginning-of-time period

5. Perpetuity - Present Value

$$PV = \frac{A}{r}$$ Where:

A = The Annuity; r = The annual interest rate on the annuity

Discounted Cash Flow Applications

6. Net Present Value (NPV)

$$NPV = CF_0 + \frac{CF_1}{(1+k)^1} + \frac{CF_2}{(1+k)^2} + \frac{CF_n}{(1+k)^n}$$

Thus $NPV = \sum_{t=0}^{n} \frac{CF_t}{(1+k)^t}$

7. Internal Rate of Return (IRR)

The discount rate that equates the present value of projects' cash inflows to the present value of its cash outflows

8. Money-Weighted Rate of Return

This involves calculating the internal rate of return of the investment.

9. Time Weighted Return

Take the geometric mean of the annual returns to find the annualized time-weighted rate of return.

10. Bank Discount Yield

$$r = \frac{D}{F} \times \frac{360}{t}$$ Where:

r = The annualized yield on a bank discount basis
D = The dollar discount, which is
= Face value of bill (F) – its purchase price
F = The face value of the bill
t = The number of days remaining to maturity (actual).

11. Effective Annual Yield

$$EAY = (1 + HPY)^{\frac{365}{t}} - 1$$

where: HPY= Holding period yield

12. Holding Period Yield

$$HPY = \frac{P_1 - P_0 + D_0}{P_0}$$ Where:

P_0 = The initial purchase price of the instrument
P_1 = The price received for the instrument at maturity
D_0 = The cash distribution paid by the instrument (for example, dividends).

13. Money Market Yield *(also known as CD equivalent yield)*

$$r_{MM} = \frac{360 \times r_{BD}}{360 - (t \times r_{BD})}$$ Where:

r_{BD} = Bond discount yield

Statistical Concepts and Market Returns

Measures of Central Tendency

14. Mean

= The average of a list of numbers

$$= \frac{\text{Sum of the Data Set}}{\text{Number of Observations}}$$

15. Arithmetic Mean (A-Mean)

$$= \frac{\text{Sum of the Data Set}}{\text{Number of Observations}}$$

16. Geometric Mean (G-Mean)

$$= \sqrt[n]{(X_1 + 1)(X_n + 1)} - 1$$

17. Harmonic Mean (H-Mean)

$$= \frac{N}{\frac{1}{X_1} + \frac{1}{X_2} + \frac{1}{X_3}}$$

18. Weighted Mean (W-Mean)

$$= \frac{W_1X_1 + W_2X_2 + W_nX_n}{(W_1 + W_2 + W_n)}$$

19. Median

The mid-point of all the observations; ie: The value that stands in the middle of the data set

20. Mode

The most frequent value of all the observations; ie: The value that occurs most frquently in the data set.

Measures of Dispersion

21. Range

Largest value – Smallest value

22. MAD

$$MAD = \frac{(X_1 - \bar{X}) + (X_2 - \bar{X}) + (X_n - \bar{X})}{n}$$

Where: X = Observation; $\bar{X}$ = Mean

23. Variance

$$\sigma^2 \text{ (population)} = \frac{(X_1 - \mu)^2 + (X_2 - \mu)^2 + (X_3 - \mu)^2}{N}$$

$$S^2 \text{ (sample)} = \frac{(X_1 - \bar{X})^2 + (X_2 - \bar{X})^2 + (X_3 - \bar{X})^2}{n - 1}$$

Where: μ = population mean; N = population size
$\bar{X}$ = sample mean; n = sample size

24. Standard Deviation

$\sigma = \sqrt{\sigma^2}$ $S = \sqrt{S^2}$ where:

σ = population standard deviation; S = sample standard deviation

25. Chebyshev's Inequality

$$1 - \frac{1}{k^2}$$

k = number of standard deviations from the mean.

26. Coefficient of Variation

$$CV = \frac{\text{Standard Deviation}}{\text{Mean}}$$

27. Sharpe Ratio

$$SR = \frac{\text{Portfolio mean return} - \text{Risk free Return}}{\text{Standard Deviation}}$$

Measures of Kurtosis

The measure of 'peakedness' of a distribution.

28. Leptokurtic

A peaked distribution is referred to as leptokurtic. This type of distribution has most of its values clustered closely around the mean.

29. Platykurtic

A flat or non-peaked distribution. This type of distribution is very flat and has large dispersion statistics.

30. Mesokurtic

The middle-of-the-road distribution. A normal distribution with a kurtosis measure of 3.

Measures of Skewness

A distribution is skewed if it is not symmetrical.

31. Positively Skewed (skewed to the right)

A distribution with a long tail on the right hand side, as a result of large outliers relative to the rest of the data.

32. Negatively Skewed (skewed to the left)

A distribution with a long tail on the left hand side, as a result of small outliers relative to the rest of the data.

Probability Concepts

33. Probability Rule: P(A)

$$\frac{\text{\# of ways event A can happen}}{\text{\# of items in sample space for event A}}$$

34. Odds Rule

$$\text{Odds} = \frac{\text{Probability}}{1 - \text{Probability}}$$

35. Multiplication Rule

$P(AB) = P(A|B) \times P(B)$ **OR** $P(AB) = P(B|A) \times P(A)$

The '|' means given that.

36. Addition Rule

$P(A \text{ or } B) = P(A) + P(B) - P(AB)$

37. Complement Rule

(for an event A) = P(A) + P(A^c) = 1 (where A^c is the event that is not A)

38. Total Probability Rule (Multiplication rule + Multiplication rule)

P(A) = P(A∩B) + P(A∩B^c) (∩ means "intersection")

39. Independent Rule

P(A and B) = P(A) x P(B)

40. Covariance

$Cov(R_i,R_j) = E\{[R_i - E(R_i)] \times [R_j - E(R_j)]\}$

41. Correlation

$$\rho_{i,j} = \frac{Cov(R_i,R_j)}{\sigma(R_i)\,\sigma(R_j)}$$

42. Bayes Theorem

P (event|new information) =

$$\frac{\text{(new information | event)}}{\text{P (new information)}} \times \text{P(prior probability of event)}$$

43. Multinomial Formula (General formula for labeling problem)

$$\frac{n!}{n_1!\,n_2!\,....n_k!}$$

44. Combination Formula (Binomial Formula)

$$^nC_r = \frac{n!}{(n-r)!r!}$$ Where:

n = total no. of objects r = no. of objects selected

45. Permutation

$$^nP_r = \frac{n!}{(n-r)!}$$

Common Probability Distributions

46. Tracking Error

The difference between the total return on a portfolio and the total return on a comparable portfolio used as a benchmark.

47. Continuous Uniform Distribution

A special type of continuous distribution, defined by the probability density function:

$$f(x) = \frac{1}{b-a}$$

48. Z-Score

Z = (observation – population mean) / population standard deviation

$Z = (X - \mu) / \sigma$

49. Shortfall Risk, Calculate the Safety-First Ratio

$$SFRatio = \frac{(E[R_p] - R_L}{\sigma p}$$ Where:

$E[R_p]$ = Portfolio return
R_L = Minimum return the investor will be satisfied with
σp = Standard deviation of the portfolio

50. Discretely Compounded Rate of Return

$$R = \frac{S_1}{S_0}$$ Where:

S_1 = closing price of the asset; S_0 = beginning price of the asset

51. Continuously Compounded Rate of Return

$$\ln(1+r) = \ln\left(\frac{S_1}{S_0}\right)$$

Sampling and Estimation

52. Sampling Error

Sample mean – population mean = $\bar{X} - \mu$

53. Standard Error of the Sample Mean

$$= \frac{\sigma}{\sqrt{n}}$$

54. Students T-Distribution

$$\mu = \bar{X} \pm (\text{Z-Score} \times \frac{\sigma}{\sqrt{n}})$$

55. Confidence Interval

Point estimate - Reliability factor * standard error

$$= \bar{X} \pm (\text{Z-Score} \times \frac{\sigma}{\sqrt{n}})$$ Where:

Reliability factor comes from a z-table

Standard error = $\frac{\sigma}{\sqrt{n}}$ (known variance) OR

$\frac{s}{\sqrt{n}}$ (unknown variance)

56. z - Ratio

$$z = \frac{\bar{X} - \mu}{\sigma / \sqrt{n}}$$

57. t - Ratio

$$t = \frac{\bar{X} - \mu}{s / \sqrt{n}}$$

58. Using the Z - Table

Confidence Interval	Level of Significance	Two-Tails (Normal Distribution)		
		Adjusted Level of Significance	Adjusted Confidence Interval	Reliability Factor (z-table)
90%	10%	$\frac{0.10}{2}$ = 0.05	1 - 0.05 = 0.950	1.645
95%	5%	$\frac{0.05}{2}$ = 0.025	1 - 0.025 = 0.975	1.96
99%	1%	$\frac{0.01}{2}$ = 0.005	1 - 0.005 = 0.995	2.576

Hypothesis Testing

59. The Test Statistic

$$= \frac{\text{Sample statistic} - \text{Population value of the statistic under } H_0}{\text{Standard error of the sample statistic}}$$

60. Type I and a Type II Errors

- **Type I error** - Rejecting the null hypothesis when it is in fact true. The probability of this error is denoted α
- **Type II error** – Not rejecting the null hypothesis when it is false. The probability of this error is denoted β.
- **The power of the test** – The probability of correctly rejecting the null hypothesis. It is denoted 1-β and is the converse of the probability of a type II error.

61. Pooled Variance

$$t = \frac{(\bar{X}_1 - \bar{X}_2) - (u_1 - u_2)}{\sqrt{\frac{s_p^2}{n_1} + \frac{s_p^2}{n_2}}}$$

62. Test Statistic for a Test of Mean Differences

(normally distributed populations, unknown population variances)

$$t = \frac{(\bar{d} - \mu_{d0})}{(s - \frac{\bar{d}}{\sqrt{n}})}$$ where: $\bar{d}$ = sample mean difference

63. F - Test

$$F = \frac{S_1^2}{S_2^2}$$

64. Chi Square Test

$$\chi 2 = (n-1)^* \frac{S^2}{\sigma_0^2}$$

Technical Analysis

65. Relative-Strength Ratio

$$= \frac{\text{Stock Price}}{\text{Value of the Series (eg: S\&P 500)}}$$

OR

$$= \frac{\text{Price of Asset}}{\text{Price of Benchmark Asset}}$$

66. Short Sales by Specialists Ratio

$$= \frac{\text{Specialist's Short Sales}}{\text{Total Short Sales on the NYSE}}$$

67. Price Target for the:

Head and Shoulders = Neckline – (Head – Neckline)

Inverse Head and Shoulders = Neckline + (Neckline– Head)

68. Put/Call Ratio

$$= \frac{\text{Number of Puts}}{\text{Number of Calls}}$$

STUDY SESSIONS 4 & 5 - Economics

Topics in Demand and Supply Analysis

69. Slope of the Demand Curve

$$= \frac{\Delta \text{ in Price}}{\Delta \text{ in Quantity Demanded}}$$

70. Slope of the Supply Curve

$$= \frac{\Delta \text{ in Price}}{\Delta \text{ in Quantity Supply}}$$

71. Total Revenue

Total quantity sold × Price per unit = P x Q

72. Producer Surplus

Total revenue received from selling a given amount of a good – Total variable cost of producing that amount

Area (for calculating Producer Surplus)
= ½ (Base × Height)
= ½ {(Q_0) × (P_0 – intercept point on y-axis**)}

**where supply curve intersects y-axis

73. Total Surplus

Consumer surplus + Producer surplus

74. Total Surplus

Total value – Total variable cost

75. Society Welfare

Consumer surplus + Producer surplus

76. Own-Price Elasticity of Demand:

$$E^d_{px} = \frac{\%\,\Delta \text{ Quantity Demanded}}{\%\,\Delta \text{ Price}} = \frac{\%\,\Delta Q^d_x}{\%\,\Delta P_x}$$

$$= \frac{\frac{\Delta Q^d_x}{Q^d_x}}{\frac{\Delta P_x}{P_x}} = \left(\frac{\Delta Q^d_x}{\Delta P_x}\right)\left(\frac{\Delta P_x}{\Delta Q^d_x}\right) = \frac{\frac{Q_1 - Q_2}{Q_1 + Q_2}}{\frac{P_1 - P_2}{P_1 + P_2}}$$

77. Income Elasticity of Demand

$$E^d_{PI} = \frac{\%\Delta \text{ Quantity Demanded}}{\%\,\Delta \text{ Income}} = \frac{\%\Delta Q^d_x}{\%\,\Delta I}$$

78. Cross-Price Elasticity

$$E^d_{Py} = \frac{\%\Delta Q^d_x}{\%\Delta P_y}$$

79. Marginal Utility

$$MU = \frac{\Delta \text{ Total Utility}}{\Delta \text{ Quantity Consumed}}$$

80. Equation of Budget Constraint Line

$(P_x \times Q_x) + (P_y \times Q_y)$

81. Slope of Budget Constraint Line

$$\frac{\Delta Q_y}{\Delta Q_x} = \frac{P_x}{P_y}$$

82. Marginal Rate of Substitution

$$\frac{\Delta Q_y}{\Delta Q_x} = \frac{\text{Marginal Utility of Good Y}}{\text{Marginal Utility of Good X}}$$

83. Economic Profit

= Total Revenue – Explicit Costs – Implicit Costs
OR
= Accounting Profit – Implicit Costs
OR
= Total Revenue – Total Economic Costs

84. Economic Costs

Explicit costs + Implicit costs

85. Normal Profit

Accounting Profit – Economic Profit

86. Accounting Profit

Economic Profit + Normal Profit

87. Economic Rent

(New "Higher" Price after ↑ in Demand – Previous Price before ↑ in Demand) × Q_s before ↑ in Demand

88. Average Revenue

$$AR = \frac{\text{Total Revenue}}{\text{Output}}$$

89. Marginal Revenue

$$MR = \frac{\Delta \text{ Total Revenue}}{\Delta \text{ Output}}$$

MR = AR = P = Demand (in perfect competition)

$$MR = Px\left(1 - \frac{1}{\text{Price Elasticity of Demand}}\right)$$

90. Total Cost and Total Variable Cost

TC = Total Fixed Costs + Total Variable Cost
TVC = Variable Cost per unit × Quantity Produced

91. Average Total Cost

$$ATC = \frac{\text{Total Cost}}{\text{Output}}$$

ATC = Avg. Fixed Cost + Avg. Variable Cost

92. Marginal Cost

$$MC = \frac{\Delta \text{ Total Cost}}{\Delta \text{ Output}}$$

93. Marginal Variable Cost

$$MVC = \frac{\Delta \text{ Total Variable Cost}}{\Delta \text{ Output}}$$

94. Profit-Maximizing Rule

MC = P = MR

95. Average Product

$$MP = \frac{\text{Total Product}}{\text{Quantity of Labor}}$$

96. Marginal Product

$$MP = \frac{\Delta \text{ Total Product}}{\Delta \text{ Quanity}}$$

97. Increasing Profit

- Profit can be increased by increasing output when MR> MC
- Profit can be increased by decreasing output when MR< MC

98. Marginal Product of Labor

$$MP_L = \frac{\Delta \text{ Output}}{\Delta \text{ Labor}}$$

99. Value of Marginal Product (VMP)

VMP = MP x P

100. Break-even Price

P = ATC → Output level where Price = Average Revenue = Marginal Revenue = Average Total Cost → where, Total Revenue = Total Cost.

101. Concentration Ratio

$$CR = \frac{\text{Sum of Sales of the Largest 10 Firms}}{\text{Total Market Sales}}$$

102. Herfindahl-Hirshman Index

HHI = Sum of the squares of the market shares of the top N companies in an industry

Aggregate Output, Prices, and Economic Growth

103. Nominal GDP_t

Prices in year t × Quantity produced in year t

104. Real GDP_t

Prices in the base year × Quantity produced in year t

105. Implicit Price Deflator for GDP or GDP Deflator and Real GDP

$$\text{GDP deflator} = \frac{\text{Nominal GDP}}{\text{Real GDP}} \times 100$$

Real GDP current year

$$= \text{Nominal GDP current year} \times \frac{\text{GDP Deflator (Base Year)}}{\text{GDP Deflator (Current Year)}}$$

$$\text{Real GDP} = \frac{\text{Nominal GDP}}{\left(\frac{\text{GDP Deflator}}{100}\right)}$$

106. Gross Domestic Product

Expenditure Approach

Total Spending = C + I + G + (X – M) + ε

GDP =
Consumer spending on goods and services
+ Business gross fixed investment
+ Change in inventories
+ Government spending on goods and services
+ Government gross fixed investment
+ Exports
– Imports
+ Statistical discrepancy

Where:

C = Consumer spending on goods and services
I = Investments; G = Government spending
X = Exports; M = Imports; (X - M) = Net Exports
ε = Statistical Discrepancy

Resource Cost - Income Approach

GNP = GNI + indirect business taxes + depreciation
GDP = GNP + net income of foreigners

GDP = National income + Capital consumption allowance + Statistical discrepancy

107. Investment

(G – T) – (S – I) – (X –M)

Investment = Y – C – G
Savings = Y – C – G
Savings = Private Saving + Public Saving
= (Y – C – T) + (T – G)

Where:

G = Government spending; T = Taxes
(G - T) = Financing government deficits
S = Savings; I = Investments; X = Exports; M = Imports;
(X - M) = Net Exports

108. National Income

National income =
Compensation of employees
+ Corporate and government enterprise profits before taxes
+ Interest income
+ Unincorporated business net income (proprietor's income)
+ Rent
+ Indirect business taxes less subsidies

NI = GNP – depreciation – indirect business taxes + business subsidies

109. Price Index

PI = National income – Indirect business taxes – Corp income taxes – Undistributed Corp profits + Transfer payments

110. Trade Balance

Exports – Imports

111. Fiscal Balance

Government Expenditure – Taxes =
(Savings – Investment) – Trade Balance

112. Production Function

$Y = AF(L,K)$ Where:

Y = Total Output; A = Constant reflecting overall Productivity
F = Function relating to Output and Inputs used
L = Quantity of Labor used; K = Quantity of Capital used

113. Labor Productivity

$$\frac{\text{Real GDP}}{\text{Aggregate Hours}}$$

$$\frac{Y}{L} = AF\left(1, \frac{K}{L}\right)$$ Where:

$\frac{Y}{L}$ = Output per Worker; $\frac{K}{L}$ = Capital per Worker

114. Potential GDP

Aggregate hours worked × Labor productivity

115. Potential Growth Rate

(Long-term growth rate of labor force)
+ (Long-term labor productivity growth rate)

116. IS Curve

Aggregate Expenditure = AE = C + I + G + (X – M)

117. LM Curve

$$\frac{M^D}{P} = K(Y) + L(r)$$ Where: K = Capital; L = Labor

Understanding Business Cycles

118. The Labor Force Participation Rate

$$\frac{\text{Labor Force (Civilian Labor Force)}}{\text{Adult Population over Age 16}} \times 100$$

119. The Rate of Unemployment

$$\frac{\text{Number of People Unemployed}}{\text{Number of People in Labor Force}} \times 100$$

120. Inflation Rate

$$\frac{\text{Price Index (this year) - Price Index (last year)}}{\text{Price Index (last year)}} \times 100$$

121. Unit Labor Cost

$$ULC = \frac{W}{O}$$ Where:

ULC = unit labor costs
O = output per hour per worker
W = total labor compensation per hour per worker

122. Fisher Index

$$\sqrt{IL \times I_p}$$

Where: IL = Laspeyers Index; Ip = Paasche Index

Monetary and Fiscal Policy

123. Narrow Money

M1= currency held outside banks + checking accounts + traveller's check

124. Broad Money

M2 = M1 + time deposits + saving deposits

125. Quantity Theory of Money

MV = PY Where:

M = money supply ; P = price level
Y = real income/expenditure; V = velocity of money

126. Money Creation

$$\text{Money created} = \frac{\text{New Reserves}}{\text{Reserve Requirement}}$$

127. Money Multiplier

$$MM = \frac{1}{\text{Reserve Ratio}}$$

128. The Fisher Effect

Nominal interest rate =
Equilibrium real interest rate + Expected inflation

129. Budget Surplus OR Deficit

G – T + B = Budget deficit/surplus Where:

G = government spending; T = Taxes; B = transfer benefits

130. Marginal Propensity to Consume

$$MPC = \frac{\Delta \text{ Consumption}}{\Delta \text{ Income}}$$

MPC (with taxes) = MPC × (1 - t)

131. Marginal Propensity to Save

$$MPS = \frac{\Delta \text{ Savings}}{\Delta \text{ Income}} = 1 - MPC$$

132. Multiplier

$$k = \frac{1}{1 - C}$$ Where: $0 < c < 1$

133. Fiscal Multiplier

$$\frac{1}{[1 - c\,(1-t)]}$$ Where: $0 < c(1 - t) < 1$

International Trade and Capital Flows

134. Terms of Trade

$$\frac{\text{Price of Exports}}{\text{Price of Imports}}$$

135. Balance of Payments

Current account balance + Capital account balance + Official reserve account = 0

136. Closed Economy

$Y = C + I + G$

137. Open Economy

$Y = C + I + G + X - M$

Currency Exchange Rates

138. Real Exchange Rate

$$\text{Real exchange rate}_{d/f} = \frac{(S^{f}_{d} - P_f)}{P_d} = S^{f}_{d} \times \frac{P_f}{P_d}$$

Where:

S^{f}_{d} = spot exchange rate (quoted in terms of the number of units of domestic currency per one unit of foreign currency)
P_f = foreign price level quoted in terms of the foreign currency

139. Percentage Spread

$$\frac{\text{Ask Price - Bid Price}}{\text{Ask Price}} \times 100$$

140. Forward Rates

$$r_{domestic} - r_{foreign} = \frac{\text{Forward Rate - Spot Rate}}{\text{Spot Rate}}$$

$$\text{Forward price} = \frac{\text{Spot DC}}{\text{Spot FC}} \times \frac{1 + r_{domestic}}{1 + r_{foreign}}$$

141. Interest Rate Parity

$$(1 + r_d) = \frac{(1 + r_f)\ (\text{Forward Rate})}{\text{Spot Rate}}$$

142. Forward Premium

$$\frac{\text{Forward Rate - Spot Rate}}{\text{Spot Rate}} \times \frac{360}{\text{Forward Number of Days}}$$

143. Trade Balance

$X - M = (S - I) + (T - G)$ Where:

(X-M) = Net Exports;
(S-I) = Net Private Savings;
(T-G) = Net Public Savings

144. Marshall–Lerner Condition

$\omega_x \varepsilon_x + \omega_M(\varepsilon_M - 1) > 0$ Where:

ω_x and ω_M = the shares of exports and imports, respectively, in total trade (i.e., imports + exports)

ε_x and ε_M = the price elasticities of foreign demand for domestic country exports and domestic country demand for imports, respectively.

STUDY SESSIONS 6, 7, 8 & 9
Financial Reporting & Analysis

Financial Statement Analysis: An Introduction

145. Financial Position

Assets = Equity + Liabilities

146. Gross Profit

GP = Revenue – Cost of sales

147. Operating Profit or EBIT

EBIT = Gross profit – Operating costs + Other operating income

148. Profit Before Tax

PBT = EBIT – Interest expense

149. Profit After Tax

PAT = Profit before tax – Income tax expense

150. Deriving Owners Equity

Owner's Equity = Contributed Capital + Retained Earnings

Closing R.E = Opening R.E + Net income – Dividends

Equity = Assets - Liabilities

Assets = Liabilities + Contributed Capital + Opening R.E + Revenue – Expenses – Dividends

Understanding Income Statements

151. Net Income

Net income = revenue + other income + gains – expenses – other expenses – losses

152. Revenue Recognized on Prorated Basis

$$= \frac{\text{Total Amount of Cost}}{\text{Time Period of Contract}}$$

153. Revenue Recognized under Percentage-of Completion Method

= % of Total cost spent by the firm × Total Contract Revenue

154. Revenue Recognized under Installment Method

$$= \frac{\text{Profit}}{\text{Sales}} \times \text{Cash receipt}$$

155. Inventory Methods

Method	COGS =	Ending Inventory =	COGS =	Ending Inventory =
			When prices are rising, relative to other 2 methods	
FIFO	First Purchases	Most recent purchases	Lowest	Highest
LIFO	Last Purchases	Oldest purchases	Highest	Lowest
Weighted Average	Average Purchases	Average of items purchased	Middle	Middle

156. Straight Line Depreciation Expense

$$= \frac{\text{Cost - Residual Value}}{\text{Estimated Useful Life}}$$

157. Production Method

$$= \frac{\text{Cost - Residual Value}}{\text{Estimated Useful Life}}$$

158. Annual Depreciation Expense (Declining Balance Method)

$$DB = \frac{100\%}{\text{Useful Life}} \times \text{Acceleration factor (say 200\% or 2)} \times \text{Net Book Value}$$

159. Earnings Per Share (EPS)

$$= \frac{\text{Net Income - Preferred Dividends}}{\text{Weighted Average Number of Shares Outstanding}}$$

Understanding Balance Sheets

160. Vertical Common-Size Balance-Sheet

$$= \frac{\text{Balance Sheet Amount}}{\text{Total Assets}}$$

Liquidity Ratios

161. Current Ratio

$$= \frac{\text{Current Assets}}{\text{Current Liabilities}}$$

162. Quick Ratio

$$= \frac{\text{Cash + Marketable Securities + Receivables}}{\text{Current Liabilities}}$$

163. Cash Ratio

$$= \frac{\text{Cash + Marketable Securities}}{\text{Current Liabilities}}$$

Solvency Ratios

164. Debt-Equity ratio

$$= \frac{\text{Total Long-term Debt}}{\text{Total Equity}}$$

165. Total Debt to Equity Ratio

$$= \frac{\text{Total Debt}}{\text{Total Equity}}$$

166. Debt Ratio

$$= \frac{\text{Total Debt}}{\text{Total Assets}}$$

167. Financial Leverage Ratio

$$= \frac{\text{Total Assets}}{\text{Total Equity}}$$

Understanding Cash Flow Statements

168. Free Cash Flow to the Firm

FCFF = NI + NCC + Int(1 – tax rate) – FCInv –WCInv

Where:
NI - Net income attributable to common shareholders
NCC - Net non-cash charges
Int(1-tax rate) - Interest expense X (1 – tax rate)
FCInv - Investment in fixed capital
WCInv - Investment in working capital

FCFF = CFO + Int(1 – tax rate) – FCInv

Where:
CFO – Cash flows from operations
WCInv - Investment in working capital

169. Free Cash Flow to Equity Holders

FCFE = NI + NCC – FCInv - WCInv + Net borrowing
OR
FCFE = FCFF - Int(1 – tax rate) + Net borrowing
OR
FCFE = CFO - FCInv + Net borrowing

Performance Ratios

170. Cash Flow/Revenue Ratio

$$= \frac{\text{CFO}}{\text{Total Revenue}}$$

171. Cash Return on Assets Ratio

$$= \frac{\text{CFO}}{\text{Average Total Assets}}$$

172. Cash Return on Equity

$$= \frac{\text{CFO}}{\text{Average Total Equity}}$$

173. Cash to Income Ratio

$$= \frac{\text{CFO}}{\text{Operating Income}}$$

174. Cash Flow Per Share

$$= \frac{\text{CFO-Preference Shares}}{\text{Weighted Average Number of Common Shares}}$$

Coverage Ratios

175. Debt Coverage Ratio

$$= \frac{\text{CFO}}{\text{Total Debt}}$$

176. Interest Coverage Ratio

$$= \frac{\text{CFO + Interest Paid + Taxes Paid}}{\text{Interest Paid}}$$

177. The Reinvestment Ratio

$$= \frac{\text{CFO}}{\text{Cash Paid for Long-Term Assets}}$$

178. The Debt Payment Ratio

$$= \frac{\text{CFO}}{\text{Cash Paid for Long-Term Debt Repayment}}$$

179. The Dividend Payment Ratio

$$= \frac{\text{CFO}}{\text{Dividends Paid}}$$

180. The Investing and Financing Ratio

$$= \frac{\text{CFO}}{\text{Cash Outflow from Investing and Financing Activities}}$$

Activity Ratios

181. Receivables Turnover

$$= \frac{\text{Net Annual Sales}}{\text{Average Receivables}}$$

182. Average Receivable Collection Period

$$= \frac{365}{\text{Average Receivables Turnover}}$$

183. Inventory Turnover

$$= \frac{\text{Cost of Goods Sold}}{\text{Average Inventory}}$$

184. Average Inventory Processing Period

$$= \frac{365}{\text{Average Inventory Turnover}}$$

185. Payables Turnover

$$= \frac{\text{Purchases}}{\text{Average Payables}}$$

186. Payables Days

$$= \frac{365}{\text{Payables Turnover}}$$

Profitability Ratios

187. Gross Profit Margin

$$= \frac{\text{Gross Profit}}{\text{Net Sales}}$$

188. Operating Margin

$$= \frac{\text{Operating Profit (EBIT)}}{\text{Net Sales}}$$

189. Pretax Margin

$$= \frac{\text{EBT}}{\text{Net Sales}}$$

190. Return on Assets (ROA)

$$= \frac{\text{Net Income}}{\text{Average Total Assets}}$$

191. Operating Return on Assets

$$= \frac{\text{EBIT}}{\text{Average Total Assets}}$$

192. Return on Total Capital (ROTC)

$$= \frac{\text{EBIT}}{\text{Average Total Capital}}$$

193. Return on Equity (ROE)

$$= \frac{\text{Net Income}}{\text{Average Total Equity}}$$

194. Return on Owner's Equity

$$= \frac{\text{Net Income - Preferred Dividend}}{\text{Average Common Equity}}$$

Valuation ratios - Equity ratios

195. Price-Earnings Ratio

$$\text{P/E} = \frac{\text{Price per Share}}{\text{Earnings per Share}}$$

196. Price to Cash Flow

$$\text{P/CF} = \frac{\text{Price per Share}}{\text{Cash Flow per Share}}$$

197. Price to Sales

$$\text{P/S} = \frac{\text{Price per Share}}{\text{Sales per Share}}$$

198. Price to Book Value

$$\text{P/BV} = \frac{\text{Price per Share}}{\text{Book Value per Share}}$$

199. Dividends per Share

$$\text{DPS} = \frac{\text{Common Dividend Declared}}{\text{Weighted Average Number of Shares}}$$

200. Dividend Payout Ratio

$$= \frac{\text{Common Dividend Declared}}{\text{Net Income Attributable to Ordinary Shareholders}}$$

201. Retention Rate

$$= \frac{\text{NI for Ordinary Shareholders - Common Divdends Declared}}{\text{NI Attributable to Ordinary Shareholders}}$$

Where: NI= Net income

202. Sustainable Growth Rate

SGR = Retention rate X ROE

Business Risk

203. Coefficient of Variation of Sales

$$= \frac{\text{Standard Deviation of Sales}}{\text{Mean Sales}}$$

204. Coefficient of Variation of Operating Income

$$= \frac{\text{Standard Deviation of Operating Income}}{\text{Mean Operating Income}}$$

205. Coefficient of Variation of Net Income

$$= \frac{\text{Standard Deviation of Net Income}}{\text{Mean Net Income}}$$

Dupont Analysis

206. Return on Equity (ROE)

$$\text{ROE} = \frac{\text{Net Income}}{\text{Average Total Equity}}$$

ROE = Net profit margin X Total asset turnover X Financial leverage

$$= \frac{\text{Net Income}}{\text{Net Sales}} \times \frac{\text{Net Sales}}{\text{Total Avg Assets}} \times \frac{\text{Total Avg Assets}}{\text{Total Avg Equity}}$$

Extended ROE

ROE = Tax burden X Interest burden X EBIT margin X Total asset turnover X Financial leverage

$$= \frac{\text{NI}}{\text{EBT}} \times \frac{\text{EBT}}{\text{EBIT}} \times \frac{\text{EBIT}}{\text{Net Sales}} \times \frac{\text{Net Sales}}{\text{TAA}} \times \frac{\text{TAA}}{\text{Total Avg Equity}}$$

Where: NI = Net Income; TAA= Total Average Assets

Segment Ratios

207. Segment Margin

$$= \frac{\text{Segment Net Profit}}{\text{Segment Revenue}}$$

208. Segment Turnover

$$= \frac{\text{Segment Revenue}}{\text{Segment Assets}}$$

209 Segment ROA

$$= \frac{\text{Segment Net Profit}}{\text{Segment Assets}}$$

210. Segment Debt Ratio

$$= \frac{\text{Segment Liabilities}}{\text{Segment Assets}}$$

Inventories

211. Ending Inventory Balance

= beginning inventory balance + purchases – cost of goods sold

212. Cost of Goods Sold

= beginning inventory balance + purchases – ending inventory

213. Inventory Amount Net of Valuation Allowance

= Carrying amount of Inventory – Write downs

Long-Lived Assets

214. Carrying Amount under Cost Model

= Historical Cost – Accumulated Dep or Amortization

215. Carrying Amount under Revaluation Model

= Fair value at the date of revaluation – Any subsequent Accumulated Dep or Amortization

216. Impairment Loss (US GAAP)

= Asset's Fair Value – Carrying Amount

If :
Carrying amount > Undiscounted Expected Future Cash Flows

217. Impairment Loss (IFRS)

= Recoverable Amount – Net Carrying Amount

Where:
Recoverable amount
= Max [(Fair value – Costs to sell); Value in Use)]

Value in use
= PV of Expected Future CFs

Income Taxes

218. Tax Base of a Liability

= Carrying amount of the liability – Amounts that will be deductible for tax purposes in the future

219. Deferred Tax

Deferred tax assets
When taxable income is > accounting income, deferred tax assets are created.

Deferred tax liabilities
When taxable income is < accounting income, deferred tax liabilities are created.

CA = Carrying amount; TB = Tax base

CA Asset > TB Asset = Deferred tax Liability
CA Asset < TB Asset = Deferred tax Asset
CA Liability > TB Liability = Deferred tax Asset
CA Liability < TB Liability = Deferred tax Liability

220. Effective Tax Rate

$$= \frac{\text{Income Tax Expense}}{\text{Pre-Tax Income}}$$

Non-current Liabilities

Leverage Ratios

221. Debt to Assets Ratio

$$= \frac{\text{Total Debts}}{\text{Total Assets}}$$

222. Debt/Total Capital Ratio

$$= \frac{\text{Total Long-Term Debt}}{\text{Total Long-Term Capital}}$$

223. Debt-Equity Ratio

$$= \frac{\text{Total Debt}}{\text{Total Shareholders Equity}}$$

224. Financial Leverage Ratio

$$= \frac{\text{Total Average Assets}}{\text{Total Average Equity}}$$

Financial Reporting Quality

Financial Statement Analysis: Applications

225. Inventory Value Adjusted to FIFO Basis

= End Inventory value under LIFO + End LIFO reserve

226. COGS adjusted to a FIFO Basis

= COGS under LIFO – (End LIFO reserve – Beg LIFO reserve)

227. Interest Expense

= Interest × PV of the lease payments

STUDY SESSIONS 10 & 11 - Corporate Finance

Corporate Governance and ESG: An Introduction

Environmental (E) issues related to business operations.
Social (S) issues relates to businesses operations.
Governance (G) issues related to business operations.

228. Internal Rate of Return (IRR)

$$NPV = CF_0 + \frac{CF_1}{(1+IRR)^1} + \frac{CF_2}{(1+IRR)^2} + \frac{CF_n}{(1+IRR)^n}$$

229. Profitability Index (PI)

$$PI = \frac{\text{Present Value of Future Cash Flows (PVCF)}}{\text{Initial Investment}}$$

Cost of Capital

230. Cost of Debt

$= k_d(1 - T)$ Where:

k_d = the cost of debt
T = Tax Rate

231. Weighted Average Cost of Capital

$WACC = w_d\, k_d\, (1 - T) + w_{ps}\, k_{ps} + w_e\, k_e$

Where:

K_e = the cost of equity
w_d = the weight for debt
w_{ps} = the weight for preferred stock
w_e = the weight for common stock

232. Cost of Preferred Stock

$$k_{ps} = \frac{D_{ps}}{P_n}$$ Where:

D_{ps} = The preferred dividend i.e. the dividend that will be paid to the new preferential shareholders.

P_n = The net issuing price i.e. the price of the preferred shares the company receives after deducting the flotation costs of the shares, as well as any discount given.

233. Cost of Retained Earnings

$$k_e = \frac{D_1}{P_0} + g$$ Where:

D_1 = Dividend next year on the market index
P_0 = Price
g = Long-term earnings growth rate

234. Capital Asset Pricing Model (CAPM) Model

$K_e = R_f + ß(R_m - R_f)$ Where:

K_e = The return required by equity holders (cost of equity)
R_f = The risk free rate.
ß = The beta of the share.
R_m = Return on the market portfolio

235. Discounted Cash Flow (DCF) Model

$$K_e = \frac{D_1}{P_0 + g}$$

236. Growth Rate

g = (Retention rate)(ROE) = (1 – Payout ratio)(ROE)

237. Calculation of Beta

Asset Beta of a publicly traded firm: Unlevered β

$$\beta_{ASSET} = \beta_{EQUITY}\left[\frac{1}{1 + (1\text{-}t)\frac{D}{E}}\right]$$

Where:

$\frac{D}{E}$ = the Debt to Equity ratio; t = marginal tax rate

Equity Beta of the project: Levered β

$$\beta_{PROJECT} = \beta_{ASSET}\left(1 + (1\text{-}t)\frac{D}{E}\right)$$

238. CAPM and Country Spread

CAPM taking into account country risk
$= K_{ce} = R_f + \beta[R_{market} - R_f + CRP]$

Where:

CRP = Sovereign Yield Spread

$$X \frac{\sigma \text{ of the developing country's EQUITY MARKET}}{\sigma \text{ of the Sovereign BOND MARKET in Developed Market}}$$

Measures of Leverage

239. Degree of Operating Leverage

$$DOL = \frac{\text{Percentage Change in EBIT}}{\text{Percentage Change in Sales}}$$

$$= \frac{\frac{\Delta EBIT}{EBIT}}{\frac{\Delta Q}{Q}}$$

$$= \frac{Q(P-V)}{Q(P-V) - F'}$$

Where:
Q = Initial units of output
P = Average price per unit
V = Variable cost per unit
F = Fixed costs

In sales terms:

$$DOL_s = \frac{S - VC}{S - VC - F}$$

Where:
S = Initial sales in dollars
VC = Total variable costs

240. Degree of Financial Leverage

$$DFL = \frac{\text{Percentage Change in EPS}}{\text{Percentage Change in EBIT}}$$

$$DFL = \frac{EBIT}{(EBIT - 1)}$$

241. Degree of Total Leverage

DTL = (DOL) x (DFL)

Alternatively:

$$DTL = \frac{Q\,(P - V)}{Q\,(P - V) - F - I}$$

In sales terms:

$$DTL = \frac{S - VC}{S - VC - F - I}$$

242. Breakeven Point

Sales = Costs or PQ = VQ + F Where:

P = Average sale price per unit output
Q = Quantity of goods output
V = Variable cost per unit
F = Fixed costs

Therefore, breakeven = PQ – VQ – F = 0

243. Breakeven Quantity of Sales

$$Q_{BE} = \frac{F + FC}{P - V}$$ Where:

F = Fixed costs; FC = Fixed Financing Costs
P = Selling price per Unit;V = Variable cost per unit

244. Operating Breakeven Quantity of Sales

$$Q_{BE} = \frac{F}{P - V}$$ Where:

F = Fixed costs; P = Selling price per unit;
V = Variable cost per unit

Working Capital Management

245. Operating Cycle

= No. of days of inventory
+ No. of days of receivables

246. Net Operating Cycle

= No. of days of inventory
+ No. of days of receivables
– No. of days payables

STUDY SESSION 12 & 13 - Portfolio Management

Risk Management: An Introduction

Portfolio Management: An Overview

247. Diversification Ratio

$$\frac{\sigma \text{ of Returns for all the Stocks in the Portfolio}}{\sigma \text{ of Return for an Individual Stock in the Portfolio}}$$

where:
σ = standard deviation

248. Net Asset Value per Share

$$= \frac{\text{Total Market Value of Fund Portfolio - Fund Expenses}}{\text{Total Fund Shares Outstanding}}$$

249. Covariance

Covariance =
Correlation coefficient × (Standard deviation a) × (Standard deviation b)

$Cov_{ab} = E[R_a - E(R_a)][R_b - E(R_b)]$

$Cov_{a,b} = r_{(a,b)}(\sigma_1)(\sigma_2)$

250. Correlation Coefficient

$$= \frac{\text{Covariance}}{\text{Standard Deviation a X Standard Deviation b}}$$

$$= \frac{\text{Covariance}}{\sqrt{\text{Variance a X Variance b}}}$$

251. Standard Deviation of a Portfolio

$$\sigma_{port} = \sqrt{w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2r_{1,2}\sigma_1\sigma_2}$$

Where:
w = Weighting of each asset
σ = Individual standard deviations
r = Correlation coefficient

Portfolio Risk and Return: Part II

252. Expected Standard Deviation of the Portfolio with a Risk-free Asset in the Portfolio

$$E(\sigma_{port}) = \sqrt{(1 - w_{RF})\sigma_i}$$

253 Capital Allocation Line (CAL)

$$E(R_p) = R_f + \frac{[E(r_i)\text{-}r_f]}{\sigma_i} \times \sigma_p$$

g = (Retention rate)(ROE) = (1 – Payout ratio)(ROE)

254. The Capital Market Line (CML)

$$E(Rp) = Rf + (E(Rm)\text{-}Rf)\frac{\sigma_p}{\sigma_M}$$

255. Calculation of Beta

$$\text{Beta} = \frac{Cov_{i,m}}{\sigma^2_m}$$

OR

$$\text{Beta} = \frac{\sigma_{market}\,\sigma_{Stock}\,P_{market,\,Stock}}{\sigma^2_{market}}$$

OR

$$\text{Beta} = \left(\frac{\sigma_{Stock}}{\sigma_{market}}\right)(P_{market,\,Stock})$$

256. The Security Market Line (SML)

CAPM = E(r) = Rf + ß(Rm - Rf) Where:

E(r) = The return required by equity holders
Rf = The risk free rate
ß = The beta of the share
Rm = Return on the market portfolio

257. The M-Squared Measure

$= (R_p - R_f)\frac{\sigma_m}{\sigma_p} - (R_m - R_f)$

258. Treynor Measure

$= \frac{R_p - R_f}{ß_p}$

259. Jensen's Alpha

$\alpha_p = R_p - [R_f + ß_p (R_m - R_f)]$

STUDY SESSIONS 14 & 15 - Equities

Market Organization and Structure

260. The Leverage Ratio

$= \frac{1}{\text{Margin \%}}$

261. ROE (based on leverage alone)

= Leverage (in times) × stock price return (in %)

262. Return on Investment

$= \frac{\text{Market Value - Loan - Costs}}{\text{Initial Equity Investment}} - 1$

263. Margin Call

$\text{Long} = \frac{\text{(Original Price) (1 - Initial Margin \%)}}{\text{(1 - Maintenance Margin \%)}}$

$\text{Short} = \frac{\text{(Original Price) (1 + Initial Margin \%)}}{\text{(1 + Maintenance Margin \%)}}$

264. Initial Margin Percentage

$= \frac{\text{Initial Margin}}{\text{Value of Equity}}$

Security Market Indices

265. Total Return

$R_p = (1 + R_{S1})(1 + R_{S1})(1 + R_n) - 1$ Where:

R_p = return on the portfolio for the period being measured
R_{S1} = return for period 1
n = total number of periods being measured
R_n = return for sub-period n

266. Price-Weighted Series

$\frac{\text{Sum of the Market Prices of the Stocks making up the Index}}{\text{Number of Stocks in the Index}}$

267. Price-Weighted Series with a Stock Split

$\frac{\text{Sum of the Market Prices of the Stocks making up the Index}}{\text{The Adjusted Divisor}}$

268. Market Capitalization-Weighted Series

Market value = Number of shares outstanding
x Current market price

$\text{Index} = \frac{\text{Sum of (\# of Shares x Current Market Price)}}{\text{Sum of (Shares x Market Price) on the day the Index started}}$

x Beginning Index Value

The New Index Value = Beginning index value

269. Equal-Weighted Series

Arithmetic average =
$\frac{\sum \text{Current Share Prices relative to the Initial Share Price}}{\text{Number of Shares in the Index}}$

Geometric average = [The Multiplication of each of the Current Share Prices divided by the Initial Share Price] x

$\left[\frac{1}{\text{Number of Shares in the Index}}\right]$

Market Efficiency

270. Abnormal Returns

Abnormal return = Return(Actual) – [Return(Market) x (Beta)]

Overview of Equity Securities

271 Return on Equity (ROE)

$\text{ROE} = \frac{\text{Net Income}}{\text{Average Total Equity}}$

Introduction to Industry and Company Analysis

Equity Valuation: Concepts and Basic Tools

272. The Gordon Growth Model Equation

$V_0 = \frac{D}{r}$ Where:

V_0 = value of the stock today
D_1 = expected dividend per share at the end of time period 1
r = required rate of return on the stock
g = expected constant growth rate in dividends

273. The Dividend Discount Model (DDM)

Single holding period

$V_0 = \frac{D_1}{(1+r)^1} + \frac{P_1}{(1+r)^1}$

Multiple holding periods

$V_0 = \frac{D_1}{(1+r)^1} + \frac{D_2}{(1+r)^2} + \frac{P_2}{(1+r)^2}$

274. Two-Stage Dividend Discount Model

$V_0 = \frac{D_t}{(1+r)^t} + \frac{V_n}{(1+r)^n}$ Where:

V_0 = The value of the stock today
D_t = $D_0(1 + g_s)^t$
D_0 = Current dividend
g_s = The extraordinary short-term dividend growth rate
t = The short-term growth period
r = The required rate of return on the stock
V_n = $D_0(1 + g_s)^n(1 + g_l) / (r - g_l)$
n = After time period n, dividend growth rate returns to normal
g_l = Normal long-term dividend growth rate

275. Enterprise Value

EV= MV of stock + MV of debt – Cash and cash Equivalents

276. Justified P/E ratio

Trailing PE ratio		
Ratio:	Gordon's Growth	Gordon's Growth
$\frac{P_0}{E_0}$	$\frac{\frac{D_0(1+g)}{E_0}}{r-g}$	$\frac{(1-b)(1+g)}{r-g}$
Leading PE ratio		
Ratio:	Gordon's Growth	Gordon's Growth
$\frac{P_0}{E_1}$	$\frac{\frac{D_0(1+g)}{E_1}}{r-g}$	$\frac{(1-b)}{r-g}$

Where:
b= The retention rate; 1 – b = The dividend payout ratio

STUDY SESSIONS 16 & 17 - Fixed Income

Fixed-Income Securities: Defining Elements

277. Taxation

After-tax Yield =
Pre-tax Yield x (1 – Marginal Income Tax Rate).

$\text{Taxable-equivalent Yield} = \frac{\text{Tax Exempt Yield}}{\text{1 - Marginal Tax Rate}}$

Introduction to Fixed-Income Valuation

278. The Formula for Present Value$_t$

$= \frac{\text{Expected Cash Flow in Period}_t}{(1+i)^t}$

Yield Measures for Fixed Rate Bonds

279. Converting from a Yield on an Annual Basis to a Bond-Equivalent Yield

= 2[(1 + yield on annual pay bond) - 1]

280. Converting from a Bond-Equivalent Yield to a Yield on an Annual Basis

$= \left[\left(1 + \frac{\text{Yield on a Bond Equivalent Basis}}{2}\right)^2 - 1\right]$

281. Current Yield

$= \frac{\text{Annual Dollar Coupon Interest}}{\text{Price of the Bond}}$

282. Forward Rates

Forward rate = $f = \frac{(1+Z_2)^2}{(1+Z_1)} - 1$ Where:

f = forward rate
(one-year forward rate, starting in 1 year from now)
Z_1 = spot rate for period 1
Z_2 = spot rate for period 2

283. Computing Spot Rates Given Forward Rates and Vice-versa

$X(1+Z_1)(1+f_1)(1+f_2)(1+f_3)(1+f_4)(1+f_5)$

Where:

X = value of the investment
Z_1 = spot rate for period 1
f_T = forward rates

284. Valuation Using Forward Rates

$= \frac{1}{(1+Z_1)(1+1f_1)(1+1f_2)(1+1f_3)\ldots(1+1f_{T-1})}$

Where:

Z_1 = spot rate for period 1
f_T = forward rates

285. Absolute Yield Spread

= Yield on bond X – Yield on bond Y

286. Relative Yield Spread

$= \frac{\text{Yield on bond X – Yield on bond Y}}{\text{Yield on bond Y}}$

287. OAS

= Z-spread – Option value (bps per year)

288. G-Spread

= Yield-to-maturity on Corporate bond – Yield-to-maturity on a government bond

289. Interpolated Spread

= I–spread
= YTM of the bond – Linearly interpolated yield to the same maturity on an appropriate reference curve

Introduction to Asset-Backed Securities

290. Debt to Service Coverage Ratio

$= \frac{\text{New Operating Income}}{\text{Debt Service}}$

291. Loan to Value Ratio

$= \frac{\text{Current Mortgage Value}}{\text{Current Property Value}}$

Understanding Fixed-Income Risk and Return

292. Modified Duration

$$MD = \frac{V_- - V_+}{2(V_0)(\Delta_y)}$$ Where:

V_- = price if yields decline by Δ_y
V_+ = price if yields increase by Δ_y
V_0 = initial price
Δ_y= change in the yield

293. Effective Duration

$$= \frac{V_- - V_+}{2(V_0)(\Delta_{curve})}$$ Where:

V_- = price if yields decline by Δ_y
V_+ = price if yields increase by Δ_y
V_0 = initial price
Δ_{curve} = change in the curve

294. Macaulay Duration

$$\text{Macaulay duration} = \left(\frac{1+r}{r} - \frac{1+r+[N \times (c-r)]}{C \times \{(1+r)^N - 1}\right) - \frac{t}{T}$$

Where:
c = coupon rate per period
r = yield to maturity
t = time period in days since last payment
T = time period in days for each coupon period
N = number of periods until maturity

To go from modified to Macaulay:

$$\text{Modified duration} = \frac{\text{Macaulay}}{(1 + \text{Yield to Maturity})}$$

295. Calculating Approx. Price Changes Using Duration

Approximate % price change = - duration X Δ_{y^*} X 100

296. Portfolio Duration

$= w_1D_1 + w_2D_2 + \ldots\ldots + w_kD_k$ Where:

w = market value of the bond / of the portfolio
D = duration of the bond
K = number of bonds in the portfolio

297. Approximate Convexity

$$C = \frac{V_+ + V_- - 2V_0}{V_0(\Delta_y)^2}$$ Where:

V_- = price if yields decline by Δ_y
V_+ = price if yields increase by Δ_y
V_0 = initial price
Δ_y= change in the yield

298. Effective Convexity

$$C = \frac{V_+ + V_- - 2V_0}{V_0(\Delta_{curve})^2}$$

299. Calculating Approximate Price Changes Using Convexity

$C \times (\Delta_{y^*})^2 \times 100$ Where: Δ_{y^*} = the change in yield

300. Total Expected Change in the Price of a Bond

Change in the price of the bond
$= -$ modified duration $(\Delta_y) + \frac{1}{2}$ (Convexity) $(\Delta_y)^2$

301. Present Value of a Basis Point

$$PVBP = \frac{PV_- - PV_+}{2}$$

302. Basis Point Value

BPV = Money duration × 0.0001 (1bp)

303. Duration Gap

Bond's Macaulay Duration – Investment Horizon

Fundamentals of Credit Analysis

304. Expected Loss

= Default Probability × Loss Severity given Default

STUDY SESSION 18 - Derivatives

Derivative Markets and Instruments

305. Value of a Contract

Value of the contract to the 'Long' at expiration
$= S_T - F0(T)$

Value of the contract to the 'Short' at expiration
$= F0(T) - S_T$

Where:
S_T = value of the underlying at time T
F0(T) = future prices determined at initiation, applying to contract expiring at time T

306. Margin % in Stock Market

$$= \frac{\text{MV of Stock} - \text{MV of Debt}}{\text{MV of Stock}}$$

307. Margin Call

Long position: Price ↓ that would trigger a margin call
= Initial Margin req – Maintenance Margin req

Short position: Price↑ that would trigger a margin call
= Initial Margin req – Maintenance Margin req

308. TED Spread

= LIBOR – T-Bill rate

309. Payoff at Expiration (for Option Buyer)

Value of Call option = C_T = Max (0, ST - X)
C_T = Max (underlying price - strike price, 0)

Profit from Call option = Max (0, ST - X) – C0
= Payoff - Cost of Option

Value of Put option = P_T = Max (0, X- ST)
P_T = Max (strike price - underlying price, 0)

Profit from Put option = Max (0, X- ST) – P0
= Payoff - Cost of Option

310. Payoff at Expiration (for Option Seller)

Profit from Call option = – Max (0, ST - X) + C0
Profit from Put option = – Max (0, X- ST) + P0

311. To Eliminate Arbitrage Opportunity

Forward Price should be = Spot Price × $(1 + i\%)^t$

312. Present Value of an Asset

$$S_0 = \frac{E(S_T)}{(1 + Rf + \text{Risk Premium})} + PV(\text{benefits} - \text{costs of holding the asset for time period T})$$

Where:
$E(S_T)$ = expected price/value of the asset at time period T.
T = the expected holding period.

Forwards

Pricing and Valuation of a Forward Contract:

T_0 = Today
T = Expiration Date
t = Any time in between T_0 and T

S_0 = The Spot Price at T_0
S_T = The Spot Price at T
S_t = The Spot Price at time period t

F(0,T) = The forward contract price; the notation means the price of the forward contract initiated at T_0 (now) and expiring in time T (expiration date)

$V_0(0,T)$ = The **value** of the forward contract today
= 0 (else arbitrage opportunities)

$V_t(0,T)$ = The **value** of the forward contract at time t
$= S_t - F_0(T) / (1 + r)^{(T-t)}$

$V_T(0,T)$ = The **value** of the forward contract at expiry
$= S_T - F_0(T)$ for the long, and
$= -[S_T - F_0(T)]$ for the short.

Remember that $F_0(T) = S_0(1 + r)^T$,
or if there are carry benefits and costs,
S_0 will be replaced by $[S_0$ - (benefits - costs)

313. Price of a Forward Contract

$F(0,T) = S_0(1 + r)^T$

314. Value of a Forward Contract Today

$V_0(0,T) = 0$

315. Value of a Forward Contract at Time Period t

$$V_t(0,T) = S_t - \frac{F(0,)}{(1 + r)^{T-t}}$$

316. Value of a Forward Contract at Expiry

$V_T(0,T) = S_T - F(0,T)$

317. The Price of a Forward Contract that only had Benefits Attached to it would be:

$F(0,T) = [S_0 + PV_0(\text{costs}) - PV_0(\text{benefits})](1 + r)^T$

Swaps

318. Pricing and Valuation of Swaps

$$FS(0, n, m) = \frac{1.0 - B_0(h_n)}{\sum B_0(h_j)}$$ Where:

FS(0, n , m) = Fixed payment amount that corresponds to $1 of principal
$B_0(h_n)$ = Present value factor for the final $1 of principal

319. Option Payoff Values

At expiry the **call** option is worth the greater of:

i. Zero, Or
ii. The difference between the underlying price and the exercise price
iii. $c_T = Max(0, S_T - X)$

At expiry the **put** option is worth the greater of:

i. Zero, Or
ii. The difference between the exercise price and the underlying price
iii. $p_T = Max(0, X - S_T)$

320. Put-Call Parity

$$c_0 + \frac{X}{(1 + r)^T} = p_0 + S_0$$ Where:

c_0 = cost of the call;
$X/(1+r)^T$ = present value of the purchase of the underlying bond
p_0 = cost of the put
S_0 = underlying asset

STUDY SESSION 19 - Alternative Investments

321. Total Hedge Fund Fee

= Management fee (normally 2%) + Incentive fee (normally 20%)

The Management fee is paid regardless of results. The incentive fee is based on the results.

322. Roll Yield

The futures price = Spot Price $(1 + \text{Risk-free rate})^{\text{Time}}$ + storage costs - convenience yield

Storage costs + Convenience yield = Costs of carry.

323. The Difference in Yield between Spot and Future Prices

Roll yield = negative for a market in contango.
If the costs + interest is greater than the benefits, this will mean that the future prices > the spot prices = **contango**.

Roll yield = positive for a market in backwardation.
If the benefits exceed the cost + interest, then the future prices < the spot prices = **backwardation**.