ETHICAL AND PROFESSIONAL STANDARDS

ETHICS IN THE INVESTMENT PROFESSION

- Challenges to ethical behavior: overconfidence bias, situational influences, focusing on the immediate rather than long-term outcomes/consequences.
- General ethical decision-making framework: identify, consider, decide and act, reflect.
- CFA Institute Professional Conduct Program sanctions: public censure, suspension of membership and use of the CFA designation, and revocation of the CFA charter (but no monetary fine).

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 Nonpublic 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. Responsibilities of Supervisors

V. Investment Analysis, Recommendations, and 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®)

- Compliance by investment management firms with GIPS is **voluntary**.
- Comply with **all** requirements of GIPS on a firm-wide basis in order to claim compliance.
- Third-party verification of GIPS compliance is **optional**.
- Present a minimum of five years of GIPS-compliant historical performance when first claiming compliance, or since inception of the firm or composite if less than five years, then add one year of compliant performance each subsequent year so that the firm eventually presents a (minimum) performance record for 10 years.
- Nine major sections: Fundamentals of Compliance; Input data; Calculation Methodology; Composite Construction; Disclosures; Presentation and Reporting; Real Estate; Private Equity; and Wrap Fee/Separately Managed Account (SMA) Portfolios.

QUANTITATIVE METHODS

TIME VALUE OF MONEY

- Present value (PV) and future value (FV) of a single cash flow

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

- PV and FV of ordinary annuity and annuity due

$$PV_{\text{Annuity Due}} = PV_{\text{Ordinary Annuity}} \times (1+r)$$
$$FV_{\text{Annuity Due}} = FV_{\text{Ordinary Annuity}} \times (1+r)$$

- PV of a perpetuity

$$PV_{\text{Perpetuity}} = \frac{PMT}{I/Y}$$

STATISTICAL CONCEPTS

- Data scales: **N**ominal (lowest), **O**rdinal, **I**nterval, **R**atio (highest)
- Arithmetic mean: simple average
- Geometric mean return: used to average rates of change (or gr wth) over time

$$R_G = \left[\sqrt[n]{(1+R_1)\times(1+R_2)\times\ldots\times(1+R_n)}\right] - 1$$

- Harmonic mean: used to determine the average cost of shares purchased over time

$$\text{Harmonic mean: } \overline{X}_H = \frac{N}{\sum_{i=1}^{N}\frac{1}{X_i}}$$

- Variance: average of the squared deviations around the mean

$$\sigma^2 = \frac{\sum_{i=1}^{n}(X_i-\mu)^2}{n}$$

$$s^2 = \frac{\sum_{i=1}^{n}(X_i-\overline{X})^2}{n-1}$$

- Standard deviation: positive square root of the variance
- Coefficient of variation: used to compare relative dispersions of data sets (lower is better)

$$\text{Coefficient of variation} = \frac{s}{\overline{X}}$$

- Sharpe ratio: used to measure excess return per unit of risk (higher is better)

$$\text{Sharpe ratio} = \frac{\overline{r}_p - r_f}{s_p}$$

- Positive skew: mode < median < mean
- Kurtosis: leptokurtic (positive excess kurtosis), platykurtic (negative excess kurtosis), mesokurtic (same kurtosis as normal distribution; i.e. zero excess kurtosis)

PROBABILITY CONCEPTS

- Expected value and variance of a random variable (X) using probabilities

$$E(X) = P(X_1)X_1 + P(X_2)X_2 + \ldots P(X_n)X_n$$

$$\sigma^2(X) = \sum_{i=1}^{n} P(X_i)\,[X_i - E(X)]^2$$

- Covariance and correlation of returns

$$\text{Corr}(R_A,R_B) = \rho(R_A,R_B) = \frac{\text{Cov}(R_A,R_B)}{(\sigma_A)(\sigma_B)}$$

- Expected return on a portfolio

$$E(R_p) = \sum_{i=1}^{N} w_i E(R_i) = w_1E(R_1) + w_2E(R_2) + \cdots + w_NE(R_N)$$

- Variance of a 2-asset portfolio

$$\text{Var}(R_p) = w_A^2\sigma^2(R_A) + w_B^2\sigma^2(R_B) + 2w_Aw_B\rho(R_A,R_B)\sigma(R_A)\sigma(R_B)$$

BINOMIAL DISTRIBUTION

- Probability of *x* successes in *n* trials (where the probability of success, *p*, is equal for all trials) is given by:

$$P(X=x) = {}_nC_x(p)^x(1-p)^{n-x}$$

- Expected value and variance of a binomial random variable

$$E(x) = n \times p$$

$$\sigma^2 = n \times p \times (1-p)$$

NORMAL DISTRIBUTION

- 50% of all observations lie in the interval $\mu \pm (2/3)\sigma$
- 68% of all observations lie in the interval $\mu \pm 1\sigma$
- 90% of all observations lie in the interval $\mu \pm 1.65\sigma$
- 95% of all observations lie in the interval $\mu \pm 1.96\sigma$
- 99% of all observations lie in the interval $\mu \pm 2.58\sigma$
- A z-score is used to standardize a given observation of a normally distributed random variable

$$z = (\text{observed value} - \text{population mean})/\text{standard deviation} = (x-\mu)/\sigma$$

- Roy's safety-first criterion: used to compare shortfall risk of portfolios (higher SF ratio indicates lower shortfall risk)

$$\text{Shortfall ratio (SF Ratio)} = \frac{E(R_P) - R_T}{\sigma_P}$$

SAMPLING THEORY

- **Central limit theorem:** Given a population with any probability distribution, with mean, μ, and variance, σ^2, the sampling distribution of the sample mean *x*, computed from sample size *n* will approximately be normal with mean, μ (the population mean), and variance, σ^2/n, when the sample size is greater than or equal to 30.
- The standard deviation of the distribution of sample means is known as the standard error of sample mean.
- When the population variance is known, the standard error of sample mean is calculated as

$$\sigma_{\overline{x}} = \sigma/\sqrt{n}$$

- When the population variance is not known, the standard error of sample mean is calculated as

$$s_{\overline{x}} = \frac{s}{\sqrt{n}}$$

- Confidence interval for unknown population parameter based on z-statistic

$$\overline{x} \pm z_{\alpha/2}\frac{\sigma}{\sqrt{n}}$$

- Confidence interval for unknown population parameter based on t-statistic

$$\overline{x} \pm t_{\alpha/2}\frac{s}{\sqrt{n}}$$

- When to use z-statistic or t-statistic

When Sampling from a:	Small Sample n < 30	Large Sample n > 30
Normal distribution with known variance	z-statistic	z-statistic
Normal distribution with unknown variance	t-statistic	t-statistic*
Non-normal distribution with known variance	not available	z-statistic
Non-normal distribution with unknown variance	not available	t-statistic*

** Use of z-statistic is also acceptable*

HYPOTHESIS TESTING

- One-tailed versus two-tailed tests

Type of test	Null hypothesis	Alternate hypothesis	Reject null if	Fail to reject null if	P value represents
One tailed (upper tail) test	$H_0 : \mu \leq \mu_0$	$H_a : \mu > \mu_0$	Test statistic > critical value	Test statistic ≤ critical value	Probability that lies above the computed test statistic
One tailed (lower tail) test	$H_0 : \mu \geq \mu_0$	$H_a : \mu < \mu_0$	Test statistic < critical value	Test statistic ≥ critical value	Probability that lies below the computed test statistic
Two tailed	$H_0 : \mu = \mu_0$	$H_a : \mu \neq \mu_0$	Test statistic < lower critical value Test statistic > upper critical value	Lower critical value ≤ test statistic ≤ upper critical value	Probability that lies above the positive value of the computed test statistic plus the probability that lies below the negative value of the computed test statistic

- Type I versus Type II e rors

Decision	H_0 is True	H_0 is False
Do not reject H_0	Correct decision	Incorrect decision **Type II error**
Reject H_0	Incorrect decision **Type I error** Significance level = P(Type I error)	Correct decision Power of the test = 1 – P(Type II error)

- Hypothesis test concerning the mean of a single population

$$\text{t-stat} = \frac{\bar{x} - \mu_0}{s/\sqrt{n}}$$

- Hypothesis test concerning the variance of a normally distributed population

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

- Hypothesis test related to the equality of the variance of two populations

$$F = \frac{s_1^2}{s_2^2}$$

ECONOMICS

DEMAND ELASTICITIES

- Own-price elasticity of demand is calculated as:

$$ED_{Px} = \frac{\%\Delta QD_x}{\%\Delta P_x}$$

  - If the absolute value of price elasticity of demand equals 1, demand is said to be unit elastic.
  - If the absolute value of price elasticity of demand lies between 0 and 1, demand is said to be relatively inelastic.
  - If the absolute value of price elasticity of demand is greater than 1, demand is said to be relatively elastic.
- Income elasticity of demand is calculated as:

$$E_I = \frac{\text{\% change in quantity demanded}}{\text{\% change in income}}$$

  - Positive for a normal good.
  - Negative for an inferior good.
- Cross-price elasticity of demand is calculated as:

$$E_C = \frac{\text{\% change in quantity demanded}}{\text{\% change in price of substitute or complement}}$$

  - Positive for substitutes.
  - Negative for complements.
- Normal good: substitution and income effects reinforce one another.
- Inferior good: income effect partially mitigates the substitution effect.
- Giffen good: inferior good where the income effect outweighs the substitution effect, making the demand curve upward sloping.
- Veblen good: status good with upward sloping demand curve.

PROFIT MAXIMIZATION, BREAKEVEN AND SHUTDOWN ANALYSIS

- Profits are maximized when the difference between total revenue (TR) and total cost (TC) is at its highest. The level of output at which this occurs is the point where:
  - Marginal revenue (MR) equals marginal cost (MC); and
  - MC is not falling
- Breakeven occurs when TR = TC, and price (or average revenue) equals average total cost (ATC) at the breakeven quantity of production. The firm is earning normal profit.
- Short run and long run operating decisions

Revenue/ Cost Relationship	Short-run Decision	Long-run Decision
TR = TC	Continue operating	Continue operating
TR > TVC, but < TC	Continue operating	Exit market
TR < TVC	Shut down production	Exit market

MARKET STRUCTURES

- Perfect competition
  - Minimal barriers to entry, sellers have no pricing power.
  - Demand curve faced by an individual firm is perfectly elastic (horizontal).
  - Average revenue (AR) = Price (P) = MR.
  - In the long run, all firms in perfect competition will make normal profits.
- Monopoly
  - High barriers to entry, single seller has considerable pricing power.
  - Product is differentiated through non-price strategies.
  - Demand curve faced by the monopoly is the industry demand curve (downward sloping).
  - An unregulated monopoly can earn economic profits in the long run.
- Monopolistic competition
  - Low barriers to entry, sellers have some degree of pricing power.
  - Product is differentiated through advertising and other non-price strategies.
  - Demand curve faced by each firm is downward sloping.
  - In the long run all firms will make normal profits.
- Oligopoly
  - High costs of entry, sellers enjoy substantial pricing power.
  - Product is differentiated on quality, features, marketing and other non-price strategies.
  - Pricing strategies: pricing interdependence (kinked demand curve), Cournot assumption, game theory (Nash equilibrium), Stackelberg model (dominant firm).
- Firms always maximize profits at the output level where MR = MC
- Identification of market structure
  - N-firm concentration ratio.
  - HHI (add up the squares of the market shares of each of the largest *N* companies in the market).

AGGREGATE SUPPLY AND DEMAND

- Components of GDP
  - Expenditure approach

$$GDP = C + I + G + (X - M)$$

- Income approach

$$GDP = \text{National income} + \text{Capital consumption allowance} + \text{Statistical discrepancy}$$

- Equality of Expenditure and Income

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

- To finance a fiscal deficit (G – T > 0), the private sector must save more than it invests (S > I) and/or imports must exceed exports (M > X).
- Factors causing a shift in aggregate demand (AD)

An Increase in the Following Factors	Shifts the AD Curve:	Reason
Stock prices	Rightward: Increase in AD	Higher consumption
Housing prices	Rightward: Increase in AD	Higher consumption
Consumer confidence	Rightward: Increase in AD	Higher consumption
Business confidence	Rightward: Increase in AD	Higher investment
Capacity utilization	Rightward: Increase in AD	Higher investment
Government spending	Rightward: Increase in AD	Government spending a component of AD
Taxes	Leftward: Decrease in AD	Lower consumption and investment
Bank reserves	Rightward: Increase in AD	Lower interest rate, higher investment and possibly higher consumption
Exchange rate (foreign currency per unit domestic currency)	Leftward: Decrease in AD	Lower exports and higher imports
Global growth	Rightward: Increase in AD	Higher exports

- Factors causing a shift in aggregate supply (AS)

An Increase in	Shifts SRAS:	Shifts LRAS:	Reason
Supply of labor	Rightward	Rightward	Increases resource base
Supply of natural resources	Rightward	Rightward	Increases resource base
Supply of human capital	Rightward	Rightward	Increases resource base
Supply of physical capital	Rightward	Rightward	Increases resource base
Productivity and technology	Rightward	Rightward	Improves efficiency of inputs
Nominal wages	Leftward	No impact	Increases labor cost
Input prices (e.g., energy)	Leftward	No impact	Increases cost of production
Expectation of future prices	Rightward	No impact	Anticipation of higher costs and/or perception of improved pricing power
Business taxes	Leftward	No impact	Increases cost of production
Subsidy	Rightward	No impact	Lowers cost of production
Exchange rate	Rightward	No impact	Lowers cost of production

- Impact of changes in AD and AS

	Real GDP	Unemployment Rate	Aggregate Level of Prices
An increase in AD	Increases	Falls	Increases
A decrease in AD	Falls	Increases	Falls
An increase in AS	Increases	Falls	Falls
A decrease in AS	Falls	Increases	Increases

- Effect of combined changes in AD and AS

Change in AS	Change in AD	Effect on Real GDP	Effect on Aggregate Price Level
Increase	Increase	Increase	Uncertain
Decrease	Decrease	Decrease	Uncertain
Increase	Decrease	Uncertain	Decrease
Decrease	Increase	Uncertain	Increase

BUSINESS CYCLES

- Phases: trough, expansion, peak, contraction (or recession)
- Theories
  - Neoclassical (Say's Law).
  - Austrian (misguided government intervention).
  - Keynesian (advocates government intervention during a recession).
  - Monetarist (steady growth rate of money supply).
  - New Classical (business cycles have real causes, no government intervention).
  - Neo-Keynesian (prices and wages are downward sticky, government intervention is useful in eliminating unemployment and restoring macroeconomic equilibrium).
  - Unemployment: natural rate vs frictional vs structural vs cyclical.
  - Prices indices: using a fixed basket of goods and services to measure the cost of living results in an upward bias in the computed inflation rate due to substitution bias, quality bias and new product bias.
- Economic indicators
  - Leading (used to predict economy's future state).
  - Coincident (used to identify current state of the economy).