

LEVEL I SCHWESER'S QuickSheet

CRITICAL CONCEPTS FOR THE 2025 CFA® EXAM

ETHICAL AND PROFESSIONAL STANDARDS

I Professionalism

- I(A) Knowledge of the Law.
- I(B) Independence and Objectivity.
- I(C) Misrepresentation.
- I(D) Misconduct.
- I(E) Competence.

II Integrity of Capital Markets

- II(A) Material Nonpublic Information.
- II(B) Market Manipulation.

III Duties to Clients

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

IV Duties to Employers

- IV(A) Loyalty.
- IV(B) Additional Compensation Arrangements.
- IV(C) Responsibilities of Supervisors.

V Investment Analysis, Recommendations, and Actions

- V(A) Diligence and Reasonable Basis.
- V(B) Communication with Clients and Prospective Clients.
- V(C) Record Retention.

VI Conflicts of Interest

- VI(A) Avoid or Disclose Conflicts.
- VI(B) Priority of Transactions.
- VI(C) Referral Fees.

VII Responsibilities as a CFA Institute Member or CFA Candidate

- VII(A) Conduct as Participants in CFA Institute Programs.
- VII(B) Reference to CFA Institute, the CFA Designation, and the CFA Program.

Global Investment Performance Standards

Definition of firm: Corporation, subsidiary, or division held out to clients as a business entity. All fee-paying discretionary portfolios must be included in at least one composite.

Verification: Optional, but if chosen it must be carried out by an independent third party.

GIPS standards for firms:

1. Fundamentals of Compliance
2. Input Data and Calculation Methodology
3. Composite and Pooled Fund Maintenance
4. Composite Time-Weighted Return Report
5. Composite Money-Weighted Return Report
6. Pooled Fund Time-Weighted Return Report
7. Pooled Fund Money-Weighted Return Report
8. GIPS Advertising Guidelines

QUANTITATIVE METHODS

Holding Period Return (HPR)

$$R_t = \frac{P_t - P_{t-1} + D_t}{P_{t-1}} \text{ or } \frac{P_t + D_t}{P_{t-1}} - 1$$

Annualized Return

$$(1 + \text{HPR})^{365/\text{days}} - 1$$

Continuously Compounded Return

$$R_{CC} = \ln(1 + \text{HPR})$$

Means

Arithmetic mean: sum of all observation values in sample/population, divided by # of observations.

Geometric mean: used when calculating investment returns over multiple periods or to measure compound growth rates.

Geometric mean return:

$$\bar{R}_G = [(1 + R_1) \times \dots \times (1 + R_N)]^{1/N} - 1$$

$$\text{Harmonic mean} = \frac{N}{\sum_{i=1}^N \left(\frac{1}{X_i} \right)}$$

Trimmed mean (x%): Exclude highest and lowest x/2 percent of observations.

Winsorized mean (x%): Substitute values for highest and lowest x/2 percent of observations.

Variance and Standard Deviation

Variance: average of squared deviations from mean.

$$\text{sample variance} = s^2 = \frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}$$

Standard deviation: square root of variance.

Target Downside Deviation

$$S_{\text{target}} = \sqrt{\frac{\sum_{\text{all } X_i < \text{target}} \frac{(X_i - \text{target})^2}{n - 1}}$$

Coefficient of Variation

Coefficient of variation (CV): expresses how much dispersion exists relative to mean of a distribution; allows for direct comparison of dispersion across different data sets. CV is calculated by dividing standard deviation of a distribution by the mean or expected value of the distribution:

$$CV = \frac{s}{\bar{x}}$$

Bayes' Formula

$$P(A | B) = \frac{P(B | A)}{P(B)} \times P(A)$$

Expected Return/Standard Deviation

Expected return: $E(X) = \sum P(x_i) x_n$

$$E(X) = P(x_1)x_1 + P(x_2)x_2 + \dots + P(x_n)x_n$$

Probabilistic variance:

$$\begin{aligned} \sigma^2(X) &= \sum P(x_i)[x_i - E(X)]^2 \\ &= P(x_1)[x_1 - E(X)]^2 + P(x_2)[x_2 - E(X)]^2 \\ &\quad + \dots + P(x_n)[x_n - E(X)]^2 \end{aligned}$$

Standard deviation: take square root of variance.

Correlation and Covariance

Correlation: covariance divided by product of the two standard deviations.

$$\text{corr}(R_i, R_j) = \frac{\text{COV}(R_i, R_j)}{\sigma(R_i)\sigma(R_j)}$$

Expected return, variance of 2-stock portfolio:

$$\begin{aligned} E(R_p) &= w_A E(R_A) + w_B E(R_B) \\ \text{var}(R_p) &= w_A^2 \sigma^2(R_A) + w_B^2 \sigma^2(R_B) \\ &\quad + 2w_A w_B \sigma(R_A)\sigma(R_B)\rho(R_A, R_B) \end{aligned}$$

Roy's Safety-First Ratio

$$\frac{\bar{r}_p - r_{\text{target}}}{\sigma_p}$$

Normal Distributions

Normal distribution is completely described by its mean and variance.

68% of observations fall within $\pm 1\sigma$.

90% fall within $\pm 1.65\sigma$.

95% fall within $\pm 1.96\sigma$.

99% fall within $\pm 2.58\sigma$.

Computing Z-Scores

Z-score: "standardizes" observation from normal distribution; represents # of standard deviations a given observation is from population mean.

$$z = \frac{\text{observation} - \text{population mean}}{\text{standard deviation}} = \frac{x - \mu}{\sigma}$$

Central Limit Theorem

Central limit theorem: when selecting simple random samples of size n from *population* with mean μ and finite variance σ^2 , the sampling distribution of sample mean approaches normal probability distribution with mean μ and variance equal to σ^2/n as the sample size becomes large.

Standard Error

Standard error of the sample mean is the standard deviation of distribution of the sample means.

$$\text{known population variance: } \sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

$$\text{unknown population variance: } s_{\bar{x}} = \frac{s}{\sqrt{n}}$$

Resampling Techniques

Jackknife: Calculate multiple sample means, each with one observation removed, then calculate standard deviation of the sample means

Bootstrap: Draw repeated samples of size n from the full dataset, replacing the sampled observations each time, then calculate the standard deviation of the sample means

Null and Alternative Hypotheses

Null hypothesis (H_0): hypothesis that contains the equal sign ($=, \leq, \geq$).

Alternative hypothesis (H_A): concluded if there is sufficient evidence to reject the null hypothesis.

Type I and Type II Errors

- **Type I error:** rejection of null hypothesis when it is actually true.
- **Type II error:** failure to reject null hypothesis when it is actually false.

Hypothesis Tests

Test of:	Stat	d.f.
Mean	t or z	n - 1
Difference in means	t	$n_1 + n_2 - 2$
Mean differences	t	n - 1
Variance	χ^2	n - 1
Equal variances	F	$n_1 - 1, n_2 - 1$
Correlation	t	n - 2
Independence	χ^2	$(r - 1)(c - 1)$
Regression slope:		
Significance Value	F t	1, n - 2 n - 2

Linear Regression

$$Y_i = b_0 + b_1 X_i + \varepsilon_i$$

where:

- Y = dependent variable
- X = independent variable
- b_0 = intercept term
- b_1 = slope term
- ε_i = error term (residual)

Estimated intercept and slope terms:

$$\hat{b}_0 = \bar{Y} - \hat{b}_1 \bar{X}$$

$$\hat{b}_1 = \frac{\text{Cov}_{XY}}{\sigma_X^2}$$

Analysis of Variance (ANOVA)

Total sum of squares (SST) = sum of squared differences between actual Y-values and the mean of Y

Sum of squares regression (SSR) = sum of squared distances between predicted Y-values and the mean of Y

Sum of squared errors (SSE) = sum of squared distances between actual and predicted Y-values

Coefficient of Determination

$R^2 = \text{SSR}/\text{SST}$ = percentage of variation in the dependent variable explained by variation in the independent variable

ECONOMICS

Breakeven and Shutdown

Breakeven: total revenue = total cost.

Operate in short run if total revenue is greater than total variable cost but less than total cost.

Shut down in short run if total revenue is less than total variable cost.

Market Structures

Perfect competition: Many firms with no pricing power; very low or no barriers to entry; homogeneous product.

Monopolistic competition: Many firms; some pricing power; low barriers to entry; differentiated products; large advertising expense.

Oligopoly: Few firms that may have significant pricing power; high barriers to entry; products may be homogeneous or differentiated.

Monopoly: Single firm with significant pricing power; high barriers to entry; advertising used to compete with substitute products.

In *all* market structures, profit is maximized at the output quantity for which marginal revenue = marginal cost.

Savings, Investment, Fiscal Balance, and Trade Balance

Fiscal budget deficit ($G - T$) = excess of saving over domestic investment ($S - I$) – trade balance ($X - M$)

Business Cycle Phases

Expansion; peak; contraction; trough.

Economic Indicators

Leading: Turning points occur ahead of peaks and troughs

Coincident: Turning points coincide with peaks and troughs

Lagging: Turning points follow peaks and troughs

Expansionary and Contractionary Policy

Monetary policy is expansionary when the policy rate is less than the neutral interest rate (real trend rate of economic growth + inflation target) and

contractionary when the policy rate is greater than the neutral interest rate.

Fiscal policy is expansionary when a budget deficit is increasing or surplus is decreasing, and contractionary when a budget deficit is decreasing or surplus is increasing.

Balance of Payments

Current account: merchandise and services; income receipts; unilateral transfers.

Capital account: capital transfers; sales/purchases of nonfinancial assets.

Financial account: government-owned assets abroad; foreign-owned assets in the country.

Regional Trading Agreements

Free trade area: Removes barriers to goods and services trade among members.

Customs union: Members also adopt common trade policies with non-members.

Common market: Members also remove barriers to labor and capital movements among members.

Economic union: Members also establish common institutions and economic policy.

Monetary union: Members also adopt a common currency.

Foreign Exchange Rates

For the exam, FX rates are expressed as *price currency / base currency* and interpreted as the number of units of the price currency for each unit of the base currency.

Real Exchange Rate

$$\text{nominal FX rate} \times \left(\frac{\text{base currency CPI}}{\text{price currency CPI}} \right)$$

No-Arbitrage Forward Exchange Rate

$$\frac{\text{forward}}{\text{spot}} = \frac{1 + \text{price currency interest rate}}{1 + \text{base currency interest rate}}$$

Exchange Rate Regimes

Formal dollarization: country adopts foreign currency.

Monetary union: members adopt common currency.

Fixed peg: $\pm 1\%$ margin versus foreign currency or basket of currencies.

Target zone: Wider margin than fixed peg.

Crawling peg: Pegged exchange rate adjusted periodically.

Crawling bands: Width of margin increases over time.

Managed floating: Monetary authority acts to influence exchange rate but does not set a target.

Independently floating: Exchange rate is market-determined.

FINANCIAL STATEMENT ANALYSIS

Financial Statement Analysis Framework

1. State the objective and context
2. Gather data
3. Process the data
4. Analyze and interpret the data
5. Report conclusions or recommendations
6. Update the analysis

Auditor Opinions

Unqualified (unmodified, clean): Reasonable assurance that financial statements are free from material omissions and errors.

Qualified: Exceptions to accounting principles.

Adverse: Statements are not presented fairly or do not conform with accounting standards.

Disclaimer of opinion: Auditor is unable to express an opinion.

Revenue Recognition

Five-step revenue recognition model:

1. Identify contracts
2. Identify performance obligations
3. Determine transaction price
4. Allocate price to obligations
5. Recognize when (as) obligations are satisfied

Basic and Diluted EPS

Basic EPS calculation **does not** consider effects of any dilutive securities in computation of EPS:

$$\text{basic EPS} = \frac{\text{net income} - \text{preferred dividends}}{\text{wtd. avg. no. of common shs. outstanding}}$$

$$\text{diluted EPS} = \frac{\text{adj. income avail. for common shares}}{\text{wtd. avg. common shares plus potential common shares outstanding}}$$

Therefore, diluted EPS is:

$$\left[\frac{\text{net income} - \text{pfd div}}{\text{wtd avg sh s}} + \frac{\text{convertible preferred dividends}}{\text{shares from conv. pfd. sh's}} + \frac{\text{convertible debt interest}}{\text{sh's from conv. debt}} + \frac{\text{convertible stock options}}{\text{shares issuable from stock options}} \right] (1 - t)$$

Marketable Security Classifications

Held-for-trading: fair value on balance sheet; dividends, interest, realized and unrealized G/L recognized on income statement.

Available-for-sale: fair value on balance sheet; dividends, interest, realized G/L recognized on income statement; unrealized G/L is other comprehensive income.

Held-to-maturity: amortized cost on balance sheet; interest, realized G/L recognized on income statement.

Cash Flows From Operations (CFO)

Direct method: start with cash collections (cash equivalent of sales); cash inputs (cash equivalent of cost of goods sold); cash operating expenses; cash interest expense; cash taxes.

Indirect method: start with net income, subtracting back gains and adding back losses resulting from financing or investment cash flows, adding back all noncash charges, and adding and subtracting asset and liability accounts that result from operations.

Free Cash Flow

Free cash flow (FCF) measures cash available for discretionary purposes and is equal to operating cash flow less net capital expenditures.

Critical Ratios

Common-size financial statement analysis:

- Common-size *balance sheet* expresses all balance sheet accounts as a percentage of total assets.
- Common-size *income statement* expresses all income statement items as a percentage of sales.
- Common-size *cash flow statement* expresses each line item as a percentage of total cash inflows (outflows), or as a percentage of net revenue.

Horizontal common-size financial statement analysis: expresses each line item relative to its value in a common base period.

Liquidity ratios:

$$\text{current ratio} = \frac{\text{current assets}}{\text{current liabilities}}$$

$$\text{quick ratio} = \frac{\text{cash} + \text{marketable securities} + \text{receivables}}{\text{current liabilities}}$$

$$\text{cash ratio} = \frac{\text{cash} + \text{marketable securities}}{\text{current liabilities}}$$

$$\text{defensive interval} = \frac{\text{cash} + \text{mkt. sec.} + \text{receivables}}{\text{daily cash expenditures}}$$

Receivables, inventory, payables turnover, and days' supply ratios—all of which are used in the cash conversion cycle:

$$\text{receivables turnover} = \frac{\text{annual sales}}{\text{average receivables}}$$

$$\text{inventory turnover} = \frac{\text{cost of goods sold}}{\text{average inventory}}$$

$$\text{payables turnover ratio} = \frac{\text{cost of goods sold}}{\text{average trade payables}}$$

$$\text{days of sales outstanding} = \frac{365}{\text{receivables turnover}}$$

$$\text{days of inventory on hand} = \frac{365}{\text{inventory turnover}}$$

$$\text{number of days of payables} = \frac{365}{\text{payables turnover ratio}}$$

$$\text{cash conversion cycle} = \left(\frac{\text{days of inventory}}{\text{on hand}} \right) + \left(\frac{\text{days of sales}}{\text{outstanding}} \right) - \left(\frac{\text{number of days}}{\text{of payables}} \right)$$

Total asset, fixed-asset, and working capital turnover ratios:

$$\text{total asset turnover} = \frac{\text{revenue}}{\text{average total assets}}$$

$$\text{fixed asset turnover} = \frac{\text{revenue}}{\text{average fixed assets}}$$

$$\text{working capital turnover} = \frac{\text{revenue}}{\text{average working capital}}$$

Gross, operating, and net profit margins:

$$\text{gross profit margin} = \frac{\text{gross profit}}{\text{revenue}}$$

$$\text{operating profit margin} = \frac{\text{operating profit}}{\text{revenue}} = \frac{\text{EBIT}}{\text{net sales}}$$

$$\text{net profit margin} = \frac{\text{net income}}{\text{revenue}}$$

Return on assets [return on total capital (ROTC)]:

$$\text{return on assets (total capital)} = \frac{\text{EBIT}}{\text{average total capital}}$$

Debt to equity ratio and total debt ratio:

$$\text{debt-to-equity ratio} = \frac{\text{total debt}}{\text{total equity}}$$

$$\text{total-debt-ratio} = \frac{\text{total debt}}{\text{total assets}}$$

Interest coverage and fixed charge coverage:

$$\text{interest coverage} = \frac{\text{EBIT}}{\text{interest}}$$

$$\text{fixed charge coverage} = \frac{\text{EBIT} + \text{lease payments}}{\text{interest} + \text{lease payments}}$$

Growth rate: g = RR × ROE

$$\text{retention rate} = 1 - \frac{\text{dividends declared}}{\text{operating income after taxes}}$$

Liquidity ratios indicate company's ability to pay its short-term liabilities.

Operating performance ratios indicate how well management operates the business.

DuPont Analysis

Traditional DuPont equation:

$$\text{return on equity} = \left(\frac{\text{net income}}{\text{sales}} \right) \left(\frac{\text{sales}}{\text{assets}} \right) \left(\frac{\text{assets}}{\text{equity}} \right)$$

You may also see it presented as:

$$\text{return on equity} = \left(\frac{\text{net profit}}{\text{margin}} \right) \left(\frac{\text{asset}}{\text{turnover}} \right) \left(\frac{\text{equity}}{\text{multiplier}} \right)$$

Extended DuPont equation further decomposes net profit margin:

$$\text{ROE} = \left(\frac{\text{net income}}{\text{EBT}} \right) \times \left(\frac{\text{EBT}}{\text{EBIT}} \right) \times \left(\frac{\text{EBIT}}{\text{revenue}} \right) \times \left(\frac{\text{revenue}}{\text{avg. total assets}} \right) \times \left(\frac{\text{avg. total assets}}{\text{avg. equity}} \right)$$

You may also see it presented as:

$$\text{ROE} = \text{tax burden} \times \text{interest burden} \times \text{EBIT margin} \times \text{asset turnover} \times \text{leverage}$$

Inventory Accounting

In periods of rising prices and stable or increasing inventory quantities:

LIFO results in:

Higher COGS
Lower gross profit
Lower inventory balances

FIFO results in:

Lower COGS
Higher gross profit
Higher inventory balances

Long-Lived Assets Capitalizing vs. Expensing

Capitalizing: lowers income variability and increases near-term profits. Increase assets, equity.

Expensing: opposite effect.

Revaluation of Long-Lived Assets

IFRS: revaluation gain recognized in net income only to the extent it reverses previously recognized impairment loss; further gains recognized in equity as revaluation surplus. (For *investment property*, all gains and losses from marking to fair value are recognized as income.)

U.S. GAAP: revaluation is not permitted.

Deferred Taxes

- Created when taxable income (on tax return) ≠ pretax income (on financial statements) due to temporary differences.
- Deferred tax liabilities* are created when taxable income < pretax income. Treat DTL as equity if not expected to reverse.
- Deferred tax assets* are created when taxable income > pretax income. Must recognize *valuation allowance* if more likely than not that DTA will not be realized.

Leases

Lessee reporting: Under IFRS, lessee recognizes right-of-use asset (amortized straight-line) and liability equal to PV of lease payments. Interest portion of each payment is interest expense, principal portion decreases liability.

U.S. GAAP is same except that right-of-use asset is amortized to match the lease liability, and for an operating lease, entire lease payment is an expense.

Lessor reporting, finance lease: Remove asset from balance sheet, recognize lease receivable asset, report interest income.

Lessor reporting, operating lease: Keep asset on balance sheet, report lease payments as income, record depreciation expense.

Pensions

Defined contribution: employer contribution expensed in period incurred.

Defined benefit: overfunded plan recognized as net pension asset, underfunded plan recognized as net pension liability.

Share-Based Compensation

For stock grants, performance shares, and employee stock options, the estimated fair value at the grant date is expensed over the vesting period.

Sales-Based Pro Forma Model

1. Estimate revenue growth
2. Estimate cost of sales
3. Estimate SG&A expenses
4. Estimate financing costs
5. Estimate taxes
6. Model working capital accounts
7. Estimate PP&E, capital spending
8. Construct pro forma statements

CORPORATE ISSUERS

Corporate Governance

Stakeholder groups: Shareholders, board of directors, senior managers, employees, creditors, suppliers.

Key board committees: Audit, nominating/governance, compensation/remuneration.

Types of Capital Investment Projects

Going concern: Maintain the business or reduce costs.

Regulatory/compliance: Required to meet concerns such as safety or environment.

Expansion: Grow the existing business

Other: Includes projects outside the existing business.

Capital Allocation

Administrative steps:

1. Generate ideas
2. Analyze project proposals
3. Create firm-wide capital budget
4. Monitor decisions and conduct post-audit

$$\text{NPV} = \text{CF}_0 + \frac{\text{CF}_1}{(1+k)^1} + \frac{\text{CF}_2}{(1+k)^2} + \dots + \frac{\text{CF}_n}{(1+k)^n}$$

IRR: discount rate that makes NPV equal to zero.

Return on Invested Capital (ROIC)

$$\text{ROIC} = \frac{\text{net operating profit after tax}}{\text{average book value of invested capital}}$$

Real Options

Timing: Delay investment

Abandonment: Exit project

Expansion: Follow-on investment

Flexibility: Change price or inputs

Fundamental: Payoff depends on price of underlying asset

Weighted Average Cost of Capital

$$\text{WACC} = (w_d)[k_d(1-t)] + (w_{ps})(k_{ps}) + (w_{ce})(k_s)$$

Capital Structure Theories

Modigliani-Miller (MM) with no taxes: Capital structure is irrelevant.

MM with taxes but no costs of financial distress:

100% debt maximizes firm value.

Static tradeoff theory: Firm value initially increases with debt financing, but decreases when costs of financial distress outweigh tax benefits of additional debt.

Pecking order theory: Managers prefer internal capital, then debt, then external equity.

PORTFOLIO MANAGEMENT

Investment Policy Statement

Investment objectives:

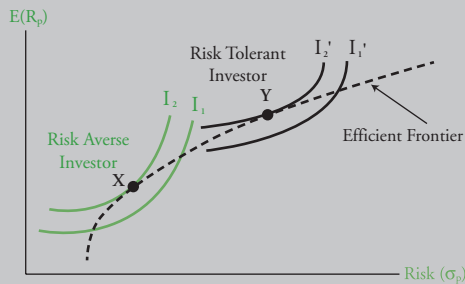
- Return objectives.
- Risk tolerance.

Constraints:

- Liquidity needs.
- Time horizon.
- Tax concerns.
- Legal and regulatory factors.
- Unique circumstances.

Combining Preferences with the Optimal Set of Portfolios

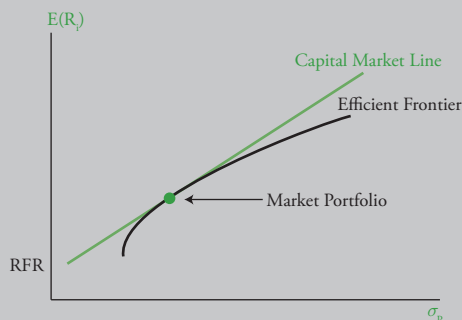
Markowitz efficient frontier is the set of portfolios that have highest return for given level of risk.



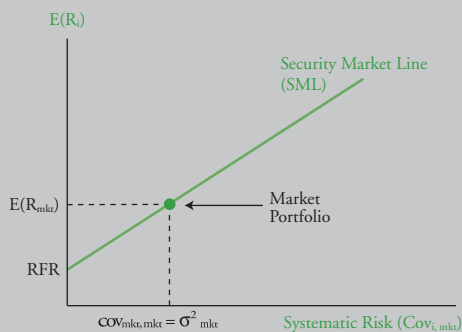
Security Market Line (SML)

Investors should only be compensated for risk relative to market. *Unsystematic risk* is diversified away; investors are compensated for *systematic risk*. The equation of the SML is the CAPM, which is a return/systematic risk equilibrium relationship.

total risk = systematic + unsystematic risk



$$\text{CAPM: } E(R_i) = \text{RFR} + \beta_i [E(R_{\text{mkt}}) - \text{RFR}]$$

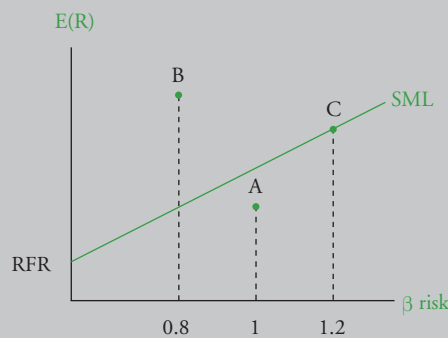


The SML and Equilibrium

Identifying mispriced stocks:

Consider three stocks (A, B, C) and SML. Estimated stock returns should plot on SML.

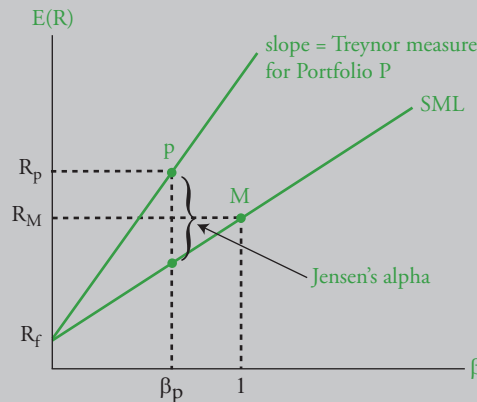
- A return plot over the line is *underpriced*.
- A return plot under the line is *overpriced*.



Risk-Adjusted Returns

Sharpe ratio and *M-squared* measure excess return per unit of *total risk*.

Treynor measure and Jensen's alpha measure excess return per unit of *systematic risk*.



Behavioral Biases

Cognitive errors, belief perseverance: Conservatism, confirmation, representativeness, control, hindsight

Cognitive errors, information processing: Anchoring and adjustment, mental accounting, framing, availability

Emotional biases: Loss aversion, overconfidence, self-control, status quo, endowment, regret aversion

EQUITY INVESTMENTS

Well-Functioning Security Markets

- Operational efficiency (lowest possible transactions costs).
- Informational efficiency (prices rapidly adjust to new information).

Margin Purchases

For margin transactions:

- Leverage factor = 1/margin percentage.
- Levered return = HPR × leverage factor.

Margin Call Price

$$\frac{P_0(1 - \text{initial margin \%})}{1 - \text{maintenance margin \%}}$$

Computing Index Prices

$$\text{Price-weighted Index} = \frac{\sum \text{stock prices}}{\text{adjusted divisor}}$$

Value-weighted Index

$$= \frac{\sum (\text{current prices})(\# \text{ shares})}{\sum (\text{base year prices})(\# \text{ base year shares})} \times \text{base value}$$

Types of Orders

Execution instructions: how to trade; e.g., market orders, limit orders.

Validity instructions: when to execute; e.g., stop orders, day orders, fill-or-kill orders.

Clearing instructions: how to clear and settle; for sell orders, specify short sale or sale of owned security.

Market Structures

Quote-driven markets: investors trade with dealers.

Order-driven markets: buyers and sellers matched by rules.

Brokered markets: brokers find counterparties.

Forms of EMH

- *Weak form.* Current stock prices *fully reflect available security market info*. Volume information/past price do not relate to future direction of security prices. Investor *cannot* achieve excess returns using tech analysis.
- *Semi-strong form.* Security prices instantly adjust to new *public information*. Investor *cannot* achieve excess returns using fundamental analysis.
- *Strong form.* Stock prices *fully reflect all information from public and private sources*. Assumes *perfect markets* in which all information is cost free and available to everyone at the same time. Even with inside info, investor cannot achieve excess returns.

Industry and Competitive Analysis

1. Define the industry
2. Survey industry size, growth, profitability
3. Analyze industry structure (Porter)
4. Examine external influences (PESTLE)
5. Analyze companies' strategies

Five Competitive Forces

1. Rivalry among existing competitors.
2. Threat of entry.
3. Threat of substitutes.
4. Power of buyers.
5. Power of suppliers.

PESTLE Analysis

External forces affecting companies and industries:

- Political
- Economic
- Social
- Technological
- Legal
- Environmental

Competitive Strategies

- Cost leadership
- Product or service differentiation
- Focus (niche market)

One-Period Valuation Model

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

Be sure to use *expected* dividend D_1 in calculation.

Infinite Period Dividend Discount Models

Supernormal growth model (multi-stage) DDM:

$$V_0 = \frac{D_1}{(1 + k_e)} + \dots + \frac{D_n}{(1 + k_e)^n} + \frac{P_n}{(1 + k_e)^n}$$

$$\text{where: } P_n = \frac{D_{n+1}}{(k_e - g_c)}$$

Constant growth model:

$$V_0 = \frac{D_0(1 + g_c)}{k_e - g_c} = \frac{D_1}{k_e - g_c}$$

Critical relationship between k_e and g_c :

- As difference between k_e and g_c *widens*, value of stock *falls*.
- As difference *narrows*, value of stock *rises*.
- Small changes in difference between k_e and g_c cause large changes in stock's value.

Critical *assumptions* of infinite period DDM:

- Stock pays dividends; constant growth rate.
- Constant growth rate, g_c , never changes.
- k_e must be greater than g_c (or math will not work).

Earnings Multiplier Model

$$\frac{P_0}{E_1} = \frac{D_1/E_1}{k - g} = \frac{\text{payout ratio}}{k - g}$$

Price Multiples

$$\text{leading P/E} = \frac{\text{price per share}}{\text{forecast EPS next 12 mo.}}$$

$$\text{trailing P/E} = \frac{\text{price per share}}{\text{EPS previous 12 mo.}}$$

$$P/B = \frac{\text{price per share}}{\text{book value per share}}$$

$$P/S = \frac{\text{price per share}}{\text{sales per share}}$$

$$P/CF = \frac{\text{price per share}}{\text{cash flow per share}}$$

FIXED INCOME

Price, Yield, Coupon Relationships

Bond prices and yields are inversely related.

Increase in yield decreases price; decrease in yield increases price.

Coupon < yield: Discount to par value.

Coupon > yield: Premium to par value.

Constant-yield price trajectory: Price approaches par as bond nears maturity from amortization of discounts and premiums. Capital gains and losses are calculated relative to this trajectory.

Other things equal, a *lower coupon rate* and a *longer maturity* make a bond price more sensitive to changes in yield.

Basic Features of Bonds

Issuer: Sovereign governments, corporations, local governments, agencies, supranational entities, special purpose entities.

Maturity: Money market (one year or less); capital market (greater than one year).

Par value: Bond's principal value (face value).

Coupon: Annual percent of par; fixed or floating.

Divide by *periodicity* to get periodic rate.

Seniority: Senior > junior (subordinated).

Contingency provisions: Callable, putable, convertible.

Cash Flow Structures

Bullet: All principal repaid at maturity.

Fully amortizing: Equal periodic payments include both interest and principal.

Partially amortizing: Periodic payments include interest and principal, balloon payment at maturity repays remaining principal.

Sinking fund: Schedule for early redemption.

Floating-rate: Coupon payments based on reference rate plus margin.

Index-linked: Interest-indexed (coupon rate adjusted) or capital-indexed (principal adjusted).

Embedded Options

Callable: Issuer may repay principal early. Increases yield and decreases duration.

Putable: Bondholder may sell bond back to issuer. Decreases yield and duration.

Convertible: Bondholder may exchange bond for issuer's common stock.

Warrants: Bondholder may buy issuer's common stock at exercise price. Warrants are typically detachable from the bond.

Bond Markets

Domestic bonds: Domestic issuer and currency.

Foreign bonds: Foreign issuer, domestic currency.

Eurobond market is outside any one country, with bonds denominated in currencies other than those of countries in which bonds are sold.

Global bonds trade in both a national bond market and the eurobond market.

Bond Issuance

Underwritten offering: Investment banks buy entire issue, sell to public.

Best efforts offering: Investment banks act as brokers.

Shelf registration: Register entire issue with regulators but sell over a period of time.

Repurchase Agreements

Short-term borrowing with a fixed income security as collateral.

Repo rate: Annualized percent difference between sale and repurchase prices.

Initial margin: Extra collateral above loan amount.

$$\text{Haircut} = 1 - \frac{1}{\text{initial margin}}$$

Bond Pricing

Full price = PV on last coupon date ×

$$\left(1 + \frac{\text{YTM}}{\text{periods per year}} \right)^{\frac{\text{days since last coupon}}{\text{days in coupon period}}}$$

$$\text{Accrued interest} = \text{coupon payment} \times \frac{\text{days from last coupon to settlement}}{\text{days in coupon period}}$$

Flat price = full price – accrued interest

Bonds are quoted at their flat prices.

Matrix pricing: For illiquid bonds, use yields of bonds with same credit quality to estimate yield; adjust for maturity differences with linear interpolation.

Yield Measures

Effective yield depends on periodicity. YTM = effective yield for annual-pay bonds.

Semiannual bond basis: YTM = 2 × semiannual discount rate.

Current yield = annual coupon / price.

Simple yield = current yield ± amortization.

Yield to call is based on call date and call price.

Yield to worst is lowest of a bond's YTCs or YTM.

Yield Spreads

G-spread: Basis points above government yield.

I-spread: Basis points above swap rate.

Z-spread: Accounts for shape of yield curve.

Option-adjusted spread: Adjusts Z-spread to remove effects of embedded options.

Floating-Rate Notes

Quoted margin: Fixed margin above the MRR.

Required margin or discount margin: Margin above the MRR that would price the note at par. Decrease in credit quality causes the required margin to be greater than the quoted margin.

Money market yields may be on a discount or add-on basis and may use a 360- or 365-day year. *Bond-equivalent yield* is an annualized add-on yield based on a 365-day year.

Forward and Spot Rates

Forward rate is a rate for a loan that begins at a future date. "1y3y" = 3-year forward rate 1 year from today.

Example of spot-forward relationship:

$$(1 + S_2)^2 = (1 + S_1)(1 + 1y1y)$$

Interest Rate Risk

Interest rate risk has two components: *reinvestment risk* and *market price risk* from YTM changes. These risks have opposing effects on an investor's horizon yield.

- Bond investors with short horizons are more concerned with market price risk.
- Bond investors with long horizons are more concerned with reinvestment risk.
- The horizon at which market price risk and reinvestment risk just offset is a bond's *Macaulay duration*. This is the weighted average of times until a bond's cash flows are scheduled to be paid. *Modified duration* is the approximate change in a bond's price given a 1% change in its YTM:

$$= \frac{\text{Macaulay duration}}{(1 + r)} \approx \frac{(V_-) - (V_+)}{2V_0(\Delta y)}$$

Price change estimates based on duration only are improved by adjusting for *convexity*:

$$\% \Delta \text{price} = -\text{duration}(\Delta y) + \frac{1}{2} \text{convexity}(\Delta y)^2$$

Approximate convexity:

$$\frac{V_- + V_+ - 2V_0}{(\Delta \text{YTM})^2 V_0}$$

Effective duration is required if a bond has embedded options:

$$\frac{(V_-) - (V_+)}{2V_0(\Delta \text{curve})}$$

Credit Risk and Analysis

Bottom-up credit analysis factors:

- Capacity
- Capital
- Collateral
- Covenants
- Character

Top-down credit analysis factors:

- Conditions
- Country
- Currency

Expected loss = probability of default × loss given default

Credit ratings:

Investment grade: Baa3/BBB– or above

Non-investment grade: Ba1/BB+ or below

Corporate family rating (CFR): issuer rating.

Corporate credit rating (CCR): security rating.

Secured bonds are backed by specific collateral and senior to unsecured bonds.

Unsecured bonds are general claims to issuer's cash flows and assets.

Asset-Backed Securities

Residential MBS: home mortgages are collateral.

Agency RMBS include only conforming loans;

nonagency RMBS may include nonconforming loans and need credit enhancement.

Internal credit enhancement: Excess spread, overcollateralization, waterfall structure.

Prepayment risk: contraction risk from faster prepayments; extension risk from slower prepayments.

CMOs: pass-through MBS are collateral. May have sequential-pay or PAC/support structure.

Commercial MBS: non-recourse mortgages on commercial properties are collateral.

Credit card ABS: credit card receivables are collateral.

CDOs: Bonds, bank loans are collateral; employ a collateral manager.

DERIVATIVES

Arbitrage and Replication

- *Law of one price:* two assets with identical cash flows in the future, regardless of future events, should have the same price.
- Two assets with uncertain returns can be combined in a portfolio that will have a certain payoff. If a portfolio has a certain payoff, the portfolio should yield the risk-free rate. For this reason, derivatives values are based on risk-neutral pricing.

Derivatives Values vs. Prices

The price of a forward, futures, or swap contract is the forward price stated in the contract and is set such that the contract has a *value* of zero at initiation. Value may change during the contract's life with opposite gains/losses to the long and short.

Forward Contract Value

At time t :

$$V_t(T) = [S_t + PV_t(\text{costs}) - PV_t(\text{benefits})] - F_0(T)(1 + Rf)^{-(T-t)}$$

Futures vs. Forwards

Futures are standardized, exchange-traded forward contracts that require daily cash settlement of mark-to-market gains and losses.

Forward Rate Agreements (FRA)

Can be viewed as a forward contract to borrow/lend money at a certain rate at some future date.

Interest Rate Swaps

May be replicated by a series of FRAs with present values at swap initiation that sum to zero.

Options

- Buyer of a call option—long asset exposure.
- Writer (seller) of a call option—short asset exposure.
- Buyer of a put option—short asset exposure.
- Writer (seller) of a put option—long asset exposure.

$$\text{intrinsic value of a call option} = \text{Max}[0, S - X]$$

$$\text{intrinsic value of a put option} = \text{Max}[0, X - S]$$

American vs. European Options

American options allow the owner to exercise the option any time before or at expiration. *European options* can be exercised *only* at expiration.

Factors that Affect Option Values

Increase in:	Calls	Puts
Asset price	Increase	Decrease
Exercise price	Decrease	Increase
Risk-free rate	Increase	Decrease
Volatility	Increase	Increase
Time to expiration	Increase	Increase*
Holding costs	Increase	Decrease
Holding benefits	Decrease	Increase

*Except some deep-in-the-money European puts.

Put-Call Parity

The put-call parity relationship for European options at time t :

$$c + X(1 + Rf)^{-T} = S + p$$

Each security in the put-call parity relationship can be expressed as:

$$S = c - p + X(1 + Rf)^{-T}$$

$$p = c - S + X(1 + Rf)^{-T}$$

$$c = S + p - X(1 + Rf)^{-T}$$

$$X(1 + Rf)^{-T} = S + p - c$$

Put-Call Forward Parity

The present value of the forward price of the underlying asset, $F_0(T)(1 + Rf)^{-T}$, can be substituted for S in any of the put-call parity relationships at time 0.

ALTERNATIVE INVESTMENTS

Alternative Investment Life Cycle

Capital commitment phase: Managers identify investments and make capital calls from partners.

Capital deployment phase: Managers fund and involve themselves in projects.

Capital distribution phase: Successful investments generate income and cash flows.

Fair Value Hierarchy

Level 1: Active market, quoted prices readily available.

Level 2: Can be valued based on observable inputs or with models.

Level 3: Require unobservable inputs to establish a fair value; few or no market transactions.

Redemption Restrictions

Lockup period: Time after initial investment during which limited partners cannot request redemptions or incur significant penalties.

Notice period: Time within which a fund must fulfill a redemption (typically 30–90 days).

Gate: Temporary restriction of redemptions.

Fee Structures

- *Management fee and performance fee*, for example “2 and 20”: 2% management fee plus 20% performance fee. Management fee is typically a percentage of assets under management for hedge funds, percentage of committed capital for private equity.
- *Hard hurdle rate:* incentive fee only on return above hurdle rate.
- *Soft hurdle rate:* incentive fee on whole return, but only paid if return is greater than hurdle rate.
- *High water mark:* no incentive fee until value exceeds previous high.
- *Clawback provision:* limited partners can recover performance fees if earlier gains are reversed
- *Deal-by-deal (American) waterfall:* profits distributed as each investment is sold.
- *Whole-of-fund (European) waterfall:* limited partners receive all distributions until they have recovered their initial investment plus the hurdle rate.

Hedge Funds

Event-driven strategies: merger arbitrage; distressed/restructuring; activist shareholder; special situations.

Relative value strategies: convertible arbitrage; specific fixed income; general fixed income; multi-strategy.

Equity strategies: market neutral; fundamental growth; fundamental value; fundamental long/short; short bias.

Opportunistic strategies: Macro; managed futures.

Private Capital

Leveraged buyouts: management buyouts (existing managers), management buy-ins (new managers)

Venture capital stages of development:

- Formative stage: angel investing, seed stage, early stage.
 - Later stage: expand production, increase sales.
 - Mezzanine stage: prepare for IPO.
- Exit strategies:* trade sale; IPO; recapitalization; secondary sale; write-off.

Real Estate

Includes residential property; commercial property; real estate investment trusts (REITs); whole loans; construction loans.

Commodities

Contango: futures price > spot price.

Backwardation: futures price < spot price.

$$\text{futures price} \approx \text{spot price}(1 + R_f) + \text{storage costs} - \text{convenience yield}$$

Infrastructure

Long-lived assets for public use, including transportation, utility, communications, social.

Greenfield: Invest in new infrastructure assets, often on a “Build-Operate-Transfer” basis.

Brownfield: Develop existing infrastructure assets.

Second-stage: Invest in infrastructure assets that do not need further development.

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