

CRITICAL CONCEPTS FOR EXAM SUCCESS

ETHICAL AND PROFESSIONAL STANDARDS

I Professionalism

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

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 Action

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

VI Conflicts of Interest

- VI (A) Disclosure of Conflicts
- VI (B) Priority of Transactions
- VI (C) Referral Fees

VII Responsibilities as a CFA Institute Member or CFA Candidate

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

QUANTITATIVE METHODS

Simple Linear Regression

Correlation:

$$r_{XY} = \frac{\text{COV}_{XY}}{(s_X)(s_Y)}$$

t-test for r (n-2 df):

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

Estimated slope coefficient: $\frac{\text{COV}_{xy}}{\sigma_x^2}$

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

Confidence interval for predicted Y-value:

$$\hat{Y} \pm t_c \times \text{SE of forecast}$$

Multiple Regression

$$Y_i = b_0 + (b_1 \times X_{1i}) + (b_2 \times X_{2i}) + (b_3 \times X_{3i}) + \varepsilon_i$$

- Test statistical significance of b; $H_0: b = 0$

$$t = \frac{\hat{b}_j}{s_{\hat{b}_j}}, n - k - 1 \text{ df}$$

Reject if $|t| > \text{critical } t$ or p-value $< \alpha$

- Confidence Interval: $\hat{b}_j \pm (t_c \times s_{\hat{b}_j})$

• SST = RSS + SSE.

• MSR = RSS/k.

• MSE = SSE/(n - k - 1).

• Test statistical significance of regression:

F = MSR/MSE with k and n - k - 1 df (1-tail).

• Standard error of estimate (SEE = $\sqrt{\text{MSE}}$).

Smaller SEE means better fit.

• Coefficient of determination ($R^2 = \text{RSS}/\text{SST}$).

% of variability of Y explained by X's; higher R^2 means better fit.

Regression Analysis - Problems

- Heteroskedasticity. Non-constant error variance. Detect with Breusch-Pagan test. Correct with white-corrected standard errors.
- Autocorrelation. Correlation among error terms. Detect with Durbin-Watson test; positive autocorrelation if $DW < d_l$. Correct by adjusting std. errs. using Hanson method.
- Multicollinearity. High correlation among X's. Detect if F-test significant, t-tests insignificant. Correct by dropping X variables.

Model Misspecification

- Omitting a variable.
- Variable should be transformed.
- Incorrectly pooling data.
- Using lagged dependent vbl. as independent vbl.

- Forecasting the past.

- Measuring independent variables with error.

Effects of Misspecification

Regression coefficients are biased and inconsistent, lack of confidence in hypothesis tests of the coefficients or in the model predictions.

Linear trend model: $y_t = b_0 + b_1t + \varepsilon_t$

Log-linear trend model: $\ln(y_t) = b_0 + b_1t + \varepsilon_t$.

Covariance stationary: Mean and var. don't change over time. To determine if a time series is covariance stationary, (1) plot data, (2) run an AR model & test correlations, and/or (3) perform Dickey Fuller test.

Unit root: Coefficient on lagged dep. vbl = 1. Series with unit root is not covariance stationary. 1st differencing will often eliminate the unit root.

Autoregressive (AR) model:

Specified correctly if autocorrelation of residuals not significant.

$$x_t = b_0 + b_1x_{t-1} + b_2x_{t-2} + \dots + b_px_{t-p} + \varepsilon_t$$

Mean reverting level for AR(1):

$$\frac{b_0}{(1 - b_1)}$$

RMSE: square root of avg squared error.

Random walk time series:

$$x_t = x_{t-1} + \varepsilon_t$$

Seasonality: Indicated by statistically signif. lagged err. term. Correct by adding lagged term.

ARCH: Detected by estimating:

$$\hat{\varepsilon}_t^2 = a_0 + a_1\hat{\varepsilon}_{t-1}^2 + \mu_t$$

Variance of ARCH series:

$$\hat{\sigma}_{t+1}^2 = \hat{a}_0 + \hat{a}_1\hat{\varepsilon}_t^2$$

- Technology changes \Rightarrow increased saving and inv. \Rightarrow capital/labor hour \uparrow and real return \downarrow .
- Economic growth stops when real return = target return.
- Pop. growth independent of economic growth.

New Growth Theory

- Economic growth continues indefinitely as technology advances.
- \downarrow real rate \Rightarrow incentive to discover new products and methods.
- Discovery \Rightarrow real return $>$ target return.

Balance of Payments: current acct + capital acct + official reserve account = 0.

Foreign Exchange

Direct quotes: domestic currency (DC) per foreign currency (DC/FC).

Bid-ask spread stated as percent of asking price:

$$\% \text{ spread} = \frac{\text{ask price} - \text{bid price}}{\text{ask price}} (100)$$

Foreign currency is at forward *discount (premium)* if F is below (above) S, using *direct* quotes:

$$\left(\begin{array}{c} \text{forward} \\ \text{prem or disc} \end{array} \right) = \left(\frac{F - S}{S} \right) \left(\frac{360}{\# \text{ of forward contract days}} \right)$$

Currency appreciates/depreciates due to:

- Relative income growth rates.
- Relative rates of inflation.
- Changes in real interest rates.

Unanticipated shift to exp. monetary policy: higher income, accelerated infl, lower real interest rates; leads to currency depr, current acct surplus, & financial acct deficit.

Unanticipated shift to exp. fiscal policy: currency appr, current acct deficit, & financial account surplus.

Purchasing Power Parity

Law of one price: a single, clearly comparable good should have same real price in all countries.

Relative PPP: Countries with high inflation rates should see their currencies depreciate.

$$\frac{E(S_1)}{S_0} = \frac{1 + i_{FC}}{1 + i_{DC}}, S \text{ in FC/DC}$$

International Fisher Relation

Assumes real interest rates are equal across borders, so interest differential equals expected inflation diff:

$$\frac{1 + r_{FC}}{1 + r_{DC}} = \frac{1 + E(i_{FC})}{1 + E(i_{DC})}$$

$$r_{FC} - r_{DC} \approx E(i_{FC}) - E(i_{DC})$$

Uncovered Interest Rate Parity

Countries with high nominal interest rates should see their currencies depreciate:

ECONOMICS

Properties of Productivity Curves

- Growth in capital/labor hour causes movements along curve.
- Technological change causes shift in curve.

One Third Rule

- At given technology level, 1% \uparrow in capital/labor hour \Rightarrow 1/3% \uparrow in real GDP per labor hour.

Classical Growth Theory

- Real GDP growth temporary (real GDP/person \uparrow above subsistence level.)
- Population explodes.
- Real GDP/person \downarrow to subsistence level.

Neoclassical Growth Theory

- No technological change \Rightarrow no real GDP growth.

$$\frac{E(S_1)}{S_0} = \frac{1+r_{FC}}{1+r_{DC}}, S \text{ in FC/DC}$$

$$\% \Delta S \approx r_{FC} - r_{DC}$$

Interest Rate Parity

Countries with high nominal interest rates will have their currencies sell at forward discount to prevent arbitrage.

$$\frac{F}{S_0} = \frac{1+r_{FC}}{1+r_{DC}}, S \text{ and } F \text{ in FC/DC}$$

$$\frac{F-S_0}{S_0} \approx r_{FC} - r_{DC}$$

Asset Market Approach

Money supply increase will cause:

- Short-run DC depreciation from inflation increase and real rate decrease.
- Long-run DC appreciation to PPP level.
- Overall, DC depreciates from initial

level to PPP level.

Currency Arbitrage

"Up the bid and down the ask"

Measuring Economic Activity

GDP

+ net property income from abroad

GNI

- depreciation

NNI

GDP at market prices

- indirect taxes

+ subsidies

GDP at factor prices

CORPORATE FINANCE**Capital Budgeting Expansion**

- Initial outlay = FCInv + WCInv
- $CF = (S - C - D)(1 - T) + D = (S - C)(1 - T) + DT$
- $TNOCF = Sal_T + NWCInv - T(Sal_T - B_T)$

Capital Budgeting Replacement

- Same as expansion, except current after-tax salvage of old assets reduces initial outlay.
- Incremental dep. is Δ in dep.

Projects with Unequal Lives

- Least common multiple of lives.
- Equivalent annual annuity (EAA): annuity equal to PV of project CFs

Effects of Inflation

- Discount nominal (real) cash flows at nominal (real) rate; unexpected changes in inflation affect project profitability; reduces the real tax savings from depreciation; decreases value of fixed payments to bondholders; affects costs and revenues differently.

Capital Rationing

- If +NPV projects > capital, choose combination with highest NPV

Real Options

- Timing, abandonment, expansion, flexibility, fundamental options.

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FINANCIAL STATEMENT ANALYSIS**Marketable Securities Classification**

- Held-to-maturity at cost on B/S; interest and realized gains/losses on I/S.
- Available-for-sale at FMV with unrealized gains/losses in equity on B/S; dividends, interest, realized gain/losses on I/S.
- Trading securities at FMV; dividends, interest, realized and unrealized gains/losses on I/S.

Account for Intercorporate Investments

- Cost/market: < 20%; no influence.
- Equity: 20 to 50%; significant influence.
- Consolidation: > 50%; control.
- IFRS permits proportionate consolidation for JV.

Financial Effect of Choice of Method

Equity, consolidation & proportionate consolidation:

- All three methods report same net income.
- All three methods report same ROE.
- Assets, liabilities, sales are highest under consolidation; lowest under equity method; proportionate consolidation in between.

Pension Accounting

- PBO components: service cost, interest cost, actuarial gains/losses, benefits paid.
- Funded status = FMV of plan assets - PBO
- Pension expense components: service cost, interest cost, expected return on plan assets, prior service cost, net actuarial gain/loss.
- Aggressive assumptions/low earnings quality: high discount rate, low compensation growth rate, high expected return.
- Under the old stds adjust BS to reflect funded status: 1) increase in pension liability or decrease in asset will be offset with decrease in equity and deferred taxes; 2) decrease in pension liability or increase in asset will be offset with increase in equity and deferred taxes. U.S. GAAP stds Δ for FYs after 12/06. Funded status reported on BS. Offsetting entries to Sh. Equity & deferred tax liab.
- Min. liab. if ABO > fair value of plan assets
- Expected return on plan assets = beg. market-related value \times expected return (%)
- Actual return on plan assets = beg. fair value \times actual return (%)
- Adjusted pension expense = service cost + interest cost - actual return on plan assets

IFRS similar to the new U.S. stds, except

- IFRS - BS pension liab reflects funded status adj. for unrecognized items.

- IFRS - actuarial gains and losses amtzd over employee's service life, not life expectancy.
- IFRS - prior service costs for retired participants and current employees vested expensed in period incurred.
- IFRS - does not require a minimum liability.

Stock-based compensation Under new stds, report expense on IS, \downarrow reported earnings. In general, U.S. stds more flexible than intl stds.

Business Combinations

- Purchase method required under U.S. GAAP and IFRS.
- Goodwill not amortized, subject to annual impairment test.

Purchase Method Attributes

- Acquirer assumes assets/liabilities of acquired company.
- Excess FMV of acquired net assets allocated first to intangible assets, then goodwill.
- Prior operating results not restated.

Pooling Method Attributes

- Company f/s combined at book value.
- Prior operating results restated.

Impact of Purchase vs Pooling

- Asset and equity higher, net income lower under purchase method.
- Profit margin, ROA, ROE lower under purchase method.

Entity is a VIE if any of

- Insufficient at-risk equity investment.
- S/h lack decision-making rights.
- S/h do not absorb losses.
- S/h do not receive residual benefits.

The primary beneficiary consolidates the VIE.

Multinational Operations: Choice of Method

For self-contained sub, local currency is functional currency; use all-current method:

- Assets/liabilities at current rate.
- Common stock at historical rate.
- Income statement at average rate.
- Exposure = shareholders' equity

For integrated sub or sub in inflationary environment, parent currency is functional currency; use temporal method:

- Monetary assets/liabilities at current rate.
- Nonmonetary assets at historical rate.
- Sales, SGA at average rate.
- COGS, depreciation at historical rate.
- Exposure = (Cash + A/R) - (A/P + current and LT debt)

Calculating Translation Gain/Loss

- Flow effect = Δ exposure \times (ending rate - average rate)
- Holding effect = beg. exposure \times (ending rate - beg. rate)
- Translation gain/loss = flow effect + holding effect

Original F/S versus All-Current

- Pure BS and IS ratios unchanged.
- If LC depreciating, translated mixed ratios will be larger.
- If LC appreciating, translated mixed ratios will be smaller.

Temporal versus All-current

- If LC appreciating, asset turnover, gross PM, interest coverage, leverage higher under temporal.
- If LC depreciating, asset turnover, gross PM, interest coverage, leverage lower under temporal.

Cash Flow Shenanigans

- Stretching AP by delaying payment not sustainable, ID by \uparrow in # days payable.
- Alter timing - finance payables thru 3rd party & securitizing AR.
- Increase tax benefits from employee stock options - sustainable?
- Reclassify net cash outflow to repurchase stock from CFF to CFO.

Low earnings quality result of:

- Acctng principles that misrepresent economics of the transactions.
- Structuring transactions for desired outcome.
- Using aggressive/unrealistic est. & assumptions.
- Exploiting acctng principle intent.

Fraud Triangle: Incentive/pressure, opportunity, and attitudes/rationalization

Earnings growth: Not sustainable w/o LR CFO growth.

Fair value hedge: gain/loss from deriv & hedged BS item reported in IS.

Cash flow hedge: gain/loss from deriv bypass IS - reported in Sh. Equity.

Net investment hedge of a foreign sub: gain/loss recog. in equity along w/ trans. gain/loss.

Economic and Accounting Income

- Econ inc = AT CF + Δ in project's MV.
- Econ dep based on Δ in investment's MV.
- Econ inc calculated before interest expense (cost of cap reflected in discount rate)
- Acc inc = project rev - costs
- Acc dep based on original investment cost
- Interest (financing costs) deducted before calculating accounting income.

Valuation Models

- Econ profit = NOPAT - \$WACC; discounted at WACC.
- Residual income: = NI - equity charge; discounted at required return on equity.
- Claims valuation separates CFs based on equity claims (discounted at cost of equity) and debt holders (discounted at cost of debt).

Operating Leverage

Operating leverage: variable/fixed cost tradeoff.

$$DOL = \frac{\% \Delta \text{ EBIT}}{\% \Delta \text{ Sales}}$$

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

$$DOL_{Sales} = \frac{S - VC}{S - VC - F}$$

Financial Leverage

Refers to use of fixed-income securities (debt and preferred stock).

$$DFL = \frac{\% \Delta \text{ EPS}}{\% \Delta \text{ EBIT}} = \frac{\text{EBIT}}{\text{EBIT} - \text{interest}}$$

$$\% \Delta \text{ EPS} = (DFL)(\% \Delta \text{ EBIT})$$

Total Leverage

Measures effect on EPS of given change in sales.

$$DTL = (DOL)(DFL)$$

Breakeven:

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

MM Prop I (No taxes): Capital structure irrelevant (no taxes, trans. or bankruptcy costs)

MM Prop II (No Taxes): incr. use of cheaper debt incr. cost of equity, no chg in WACC.

MM Proposition I (With Taxes): tax shield adds

value, Value maximized at 100% debt.

MM Proposition II (With Taxes): tax shield adds value, WACC minimized at 100% debt.

Corporate Governance Objectives

- Mitigate conflicts of interest between 1) managers and shareholders, and 2) directors and shareholders.
- Ensure assets used to benefit investors and stakeholders.

EPS After a Share Repurchase

$$EPS = \frac{\text{total earnings} - \text{after tax cost of funds}}{\text{shares outstanding after buyback}}$$

If after-tax cost of debt is *less* than earnings yield, a share repurchase will *increase* EPS. If after-tax cost of debt is *greater* than earnings yield, a share repurchase will *decrease* EPS.

BV per Share After a Share Repurchase

If the share price is *greater* than the original BVPS, a share repurchase will *decrease* BVPS. If the share price is *less* than the original BVPS, a share repurchase will *increase* BVPS.

Effective Tax Rate on Dividends

double taxation or split rate systems:

eff. rate = corp rate + (1 - corp rate)(indiv rate)

imputation system: effective tax rate is the shareholder's individual tax rate.

Signaling Effects of Dividend Changes

Initiation: ambiguous signal.

Increase: positive signal.

Decrease: negative signal unless management sees many profitable investment opportunities.

Share Repurchases

- Share repurchase is equivalent to cash dividend, assuming equal tax treatment.
- Unexpected share repurchase is good news.
- Rationale for: 1) prevent EPS dilution; 2) supplement a regular dividend; 3) good investment for company; 4) positive signal to investors; 5) change capital structure

Dividend Policy Approaches

- Residual dividend: dividends based on earnings less funds retained to finance capital budget.
- Longer-term residual dividend: forecast capital budget, smooth dividend payout.

• Dividend stability: dividend growth aligned with sustainable growth rate.

• Target payout ratio: long-term payout ratio target.

Merger Types: Horizontal, vertical, conglomerate

Merger Motivations: Achieve synergies, more rapid growth, incr. mkt power, gain access to unique capabilities, diversify, mgr personal benefits, tax benefits, unlock hidden value, achieving intl goals, & bootstrapping earnings.

Pre-offer defense mechanisms: poison pills & puts, reincorp. in a state w/ restrictive takeover laws, staggered board elections, restrict. voting rights, supermajority voting, fair price amendments, and golden parachutes.

Post-offer defense mechanisms: litigation, greenmail, share repurch, leveraged recap, the "crown jewel," "Pac man," & "just say no" defenses, and white knight/white squire.

The Herfindahl-Hirschman Index (HHI): mkt power = sum of squared mkt shares for all industry firms. High or \uparrow HHI mean regulators more likely to challenge a merger.

Methods to Determine Target Value

DCF method - target proforma FCF discounted at adj. WACC

Comparable company analysis- target value from relative valuation metrics on similar firms + takeover premium.

Comparable transaction analysis: target value from takeover transaction; takeover premium incl.

Merger Valuations

Combined firm:

$$V_{AT} = V_A + V_T + S - C$$

Takeover premium (to Target):

$$\text{Gain}_T = TP = P_T - V_T$$

Synergies (to acquirer):

$$\text{Gain}_A = S - TP = S - (P_T - V_T)$$

Merger Risk & Reward

Cash offer - acquirer assumes risk & receives reward.

Stock offer - some of risks & rewards shift to target. If higher confidence in synergies; acquirer prefers cash & target prefers stock.

Forms of divestitures: equity carve-outs, spin-offs, split-offs, and liquidations.

EQUITY INVESTMENTS**Alpha**

ex ante α = expected return - required return from CAPM or APT

ex post α = historical holding period return - historical return on similar assets

Franchise Value and Growth Process

Tangible P/E = 1/r

Franchise P/E = franchise factor x growth factor = FF x GF

- If ROE > r, firm has sustainable competitive advantage, franchise factor > 0.
- If FF > 0, higher retention ratio implies higher GF, higher franchise P/E.

Inflation Effects on Valuation

- Higher flow-through rate implies higher P/E, all else equal.
- If inflation flow-through < 100%, higher inflation implies lower P/E, all else equal.

Porter's Five Forces

1. Entry barriers (or threat of new entrants): function of economies of scale, product differentials, brand identity, capital requirements,

access to distribution channels, government policy, cost advantages.

2. Threat of substitutes: function of relative price performance of substitutes, buyer propensity to substitute, switching cost.
3. Bargaining power of buyers: function of bargaining leverage/price sensitivity.
4. Bargaining power of suppliers: determined by differentiation of inputs, presence of substitute inputs, supplier concentration, importance of volume to supplier, threat of forward integration.
5. Rivalry among existing competitors: function of industry growth, fixed costs, value added, product differences, brand identity, diversity of competitors, exit barriers, informational complexity.

Generic Competitive Strategies

- Cost leadership. Try to be low-cost producer.
- Differentiation. Try to set products apart from competitor's products.
- Cost focus. Cost leader in industry segment.
- Differentiation focus. Differentiate in industry segment.

Industry Analysis

- Industry life cycle: Pioneer \rightarrow Growth \rightarrow Mature \rightarrow Decline

- External factors: Technology, government, social change, demography, foreign influences.

Nominal versus Real - Distinction Matters

- Income taxes: forecast nominal earnings before taxes.
- Real cash flow from WC \neq Δ real WC; convert nominal WC to real CF.
- Forecast real capex, dep, and EBITDA.

Arguments for Adj. CF vs Discount Rate

- Country risks are diversifiable.
- Companies respond differently to country risk.
- Country risk is one-sided risk.
- Identifying cash flow effects aids in risk management.

Estimating WACC in Emerging Markets

- R_f = 10-year U.S. gov. bond yield + inflation differential (local - US).
- Beta = industry beta from globally-diversified market index.
- Long-term global MRP \approx 4.5% to 5.5%.
- Pre-tax cost of debt = local r_f + credit spread on similarly-rated U.S. corporate debt.
- Marginal tax rate \Rightarrow reflect local taxes applied to interest expense on debt.

- Capital structure weights approximated by industry average weights.

Growth Duration Model

- Implied growth duration > forecast from fundamentals ⇒ overpriced stock
- Implied growth duration < forecast from fundamentals ⇒ underpriced stock

Discounted Cash Flow (DCF) Methods

Use dividend discount models (DDM) when:

- Firm has dividend history.
- Dividend policy related to earnings.
- Minority shareholder perspective.

Use free cash flow (FCF) models when:

- Firm lacks stable dividend policy.
- Dividend policy not related to earnings.
- FCF is related to profitability.
- Controlling shareholder perspective.

Use residual income (RI) when:

- Firm lacks dividend history.
- Expected FCF is negative.

Three ways to determine cost of equity:

- CAPM $[r = r_f + \beta(r_m - r_f)]$
- Multi-factor APT.
- Add equity risk premium to firm's LT bond yield.

Gordon Growth Model (GGM)

Assumes perpetual dividend growth rate

$$V_0 = \frac{D_1}{r - g}$$

Most appropriate for mature, stable firms.

Limitations are:

- Very sensitive to estimates of r and g .
- Difficult with non-dividend stocks.
- Difficult with unpredictable growth patterns (use multi-stage model).

Present Value of Growth Opportunities

$$V_0 = \frac{E_1}{r} + PVGO$$

Two-Stage Growth Model

Step 1: Calculate dividends in high-growth period.

Step 2: Use GGM for terminal value at end of high-growth period.

Step 3: Discount interim dividends and terminal value to time zero to find stock value.

H-Model

$$V_0 = \frac{[D_0 \times (1 + g_L)]}{r - g_L} + \frac{[D_0 \times H \times (g_S - g_L)]}{r - g_L}$$

$$H = \frac{t}{2}$$

Solving for Required Return

For Gordon (or stable growth) model, solving for return yields:

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

Free Cash Flow to Firm (FCFF)

Assuming DEP is only NCC:

- $FCFF = NI + Dep + [Int \times (1 - \text{tax rate})] - FCInv - WCInv$
- $FCFF = [EBIT \times (1 - \text{tax rate})] + Dep - FCInv - WCInv$
- $FCFF = [EBITDA \times (1 - \text{tax rate})] + (Dep \times \text{tax rate}) - FCInv - WCInv$
- $FCFF = CFO + [Int \times (1 - \text{tax rate})] - FCInv$

Free Cash Flow to Equity (FCFE)

- $FCFE = FCFF - [Int \times (1 - \text{tax rate})] + \text{Net borrowing}$
- $FCFE = NI + Dep - FCInv - WCInv + \text{Net borrowing}$

- $FCFE = NI - [(1 - DR) \times (FCInv - Dep)] - [(1 - DR) \times WCInv]$. (Used to fcst.)

Single-Stage FCFF/FCFE Models

- For FCFF valuation: $V_0 = \frac{FCFF_1}{WACC - g}$
- For FCFE valuation: $V_0 = \frac{FCFE_1}{r - g}$

Two-Stage FCFF/FCFE Models

Step 1: Calculate FCF in high-growth period.

Step 2: Use single-stage FCF model for terminal value at end of high-growth period.

Step 3: Discount interim FCF and terminal value to time zero to find stock value; use WACC for FCFF, r for FCFE.

Price to Earnings (P/E) Ratio

Problems with P/E:

- If earnings < 0, P/E meaningless.
- Volatile, transitory portion of earnings makes interpretation difficult.
- Management discretion over accounting choices affects reported earnings.

Justified P/E

$$\text{leading P/E} = \frac{1 - b}{r - g}$$

$$\text{trailing P/E} = \frac{(1 - b)(1 + g)}{r - g}$$

Normalization Methods:

- Historical average EPS.
- Average ROE.

Price to Book (P/B) Ratio

Advantages:

- BV almost always > 0.
- BV more stable than EPS.
- Measures NAV of financial institutions.

Disadvantages:

- Size differences cause misleading comparisons.
- Influenced by accounting choices.
- $BV \neq MV$ due to inflation/technology.

$$\text{justified P/B} = \frac{ROE - g}{r - g}$$

Price to Sales (P/S) Ratio

Advantages:

- Meaningful even for distressed firms.
- Sales revenue not easily manipulated.
- Not as volatile as P/E ratios.
- Useful in valuing mature, cyclical, and start-up firms.

Disadvantages:

- High sales do not imply high profits and cash flows.
- Does not capture cost structure differences.
- Revenue recognition practices still distort sales.

$$\text{justified P/S} = \frac{PM_0 \times (1 - b)(1 + g)}{r - g}$$

Price to Cash Flow Ratios

Advantages:

- Cash flow harder to manipulate than EPS.
- More stable than P/E.
- Mitigates earnings quality concerns.

Disadvantages:

- Difficult to estimate true CFO.
- FCFE better but more volatile.

Method of Comparables

- Firm multiple > benchmark implies overvalued.
- Firm multiple < benchmark implies undervalued.
- Fundamentals that affect multiple should be similar between firm and benchmark.

Residual Income Models

- $RI = E_t - (r \times B_{t-1}) = (ROE - r) \times B_{t-1}$
- Single stage RI model:

$$V_0 = B_0 + \left[\frac{(ROE - r) \times B_0}{r - g} \right]$$

- Multistage RI valuation: $V_0 = B_0 + (\text{PV of interim high-growth RI}) + (\text{PV of continuing RI})$

Economic Value Added*

- $EVA = NOPAT - \$WACC$; $NOPAT = EBIT(1 - \tau)$
- $\$WACC = WACC \times \text{Invested capital}$; Invested capital = $NWC + \text{Net PP\&E}$
- Ways to increase EVA: Increase revenues, reduce expenses, less invested capital, fund +NPV projects, reduce WACC.

Real Estate (RE) Investment Analysis

- $CFAT = NOI - \text{debt service} - \text{taxes payable}$.
- $ERAT = \text{net selling price} - \text{mortgage balance} - \text{taxes}$.

Recaptured depreciation: depr. taken in anticipation of ↓ in asset's value that did not materialize.

Types of Real Estate Investments

Raw land - passive and illiquid; for speculators and developers.

Apartments & office buildings - active, moderately liquid; tax-shelters for high-income investors; *Warehouses* - passive, moderately liquid; for passive investors & those seeking tax shelter.

Shopping centers - moderately active, low-liquidity; for wealthy investors.

Hotels and motels - active, moderately liquid; for those seeking tax shelter.

Income Property Analysis: Cap Rate

Market extraction

$$R_0(\text{ME}) = \frac{NOI}{MV}$$

Use when income data is available.

Valuing Income Properties

Direct income capitalization technique:

$$MV_0 = \frac{NOI_1}{r - g} = \frac{NOI_1}{R}$$

Gross income multiplier technique

$MV = \text{gross income} \times \text{income multiplier}$.

$$\text{Gross income multiplier (M)} = \frac{\text{sales price}}{\text{gross income}}$$

Hedge Funds

Performance measurement difficult due to diff in leverage, short positions, Δ in style, & port. TO. *Exposed to* investment, fraud and operational risk. *Investment risks* - ltd information available; credit spread Δ, equity mkt risk, style drift, & leverage. *Use downside measure of risk*, such as maximum drawdown and/or value at risk (VaR).

FIXED INCOME**Credit Analysis.**

High-yield debt

- Issuer has senior, short-term, floating bank debt.
- Analyze corporate structure, debt structure.

Asset-backed debt

- Quality of collateral.
- Servicer quality.
- Cash flow stress and payment structure.
- Legal structure.

Municipal bonds

- Tax-backed municipal bond analysis involves: issuer's debt structure, budgetary policy, local tax and intergovernmental revenue availability, and

issuer's socioeconomic environment.

- Municipal bond credit analysis: limits of the basic security, flow of funds structure, rate covenants, and additional bonds tests.

Sovereign debt

- Local vs. foreign currency rating.
- Economic risk: ability to pay.
- Political risk: willingness to pay.

Theories of the Term Structure

Pure (unbiased) expectations. Forward rates (F) function of expected future spot rates E(S).

- If up sloping, ST spot rates rise.
- If down sloping, ST rate spot rates fall.
- If flat, ST spot rates constant.

Liquidity theory: F rates reflect expectations of E(S) plus liquidity premium.

Preferred habitat theory: Imbalance between fund supply/demand at maturity range induces lenders to shift from preferred habitats to one with opposite imbalance.

Key Rate Duration

- %Δvalue from 100 bps Δ in key rate.
- Have several key rates (5-yr, 10-yr).
- Estimate effect of non-parallel yield curve shift on bond portfolio value.

Valuing Option Free Bonds

To value option free bond with the binomial tree, start at end and discount back through the tree (backwards induction method).

Value 2-year, option-free bond:

Step 1: Find the time one up-node value:

$$\text{nodal value}_{1,U} = \frac{1}{2} \left[\left(\frac{\text{nodal value}_{2,U,U}}{1+i_{1,U}} \right) + \left(\frac{\text{nodal value}_{2,U,D}}{1+i_{1,U}} \right) \right]$$

Step 2: Find time one down-node value

Step 3: Find time zero value:

$$\text{nodal value}_0 = \frac{1}{2} \left[\left(\frac{\text{nodal value}_{1,U}}{1+i_0} \right) + \left(\frac{\text{nodal value}_{1,D}}{1+i_0} \right) \right]$$

Value Bond with Embedded Option

For bonds with embedded options, assess whether option will be exercised at each node. New Step 3 is:

Step 3: (callable bond). Find time 0 value assuming year 1 down-node calculated value > than call price:

$$\text{nodal value}_0 = \frac{1}{2} \left[\left(\frac{\text{nodal value}_{1,U}}{1+i_0} \right) + \left(\frac{\text{call value}}{1+i_0} \right) \right]$$

Call = noncallable bond - callable bond

Put = puttable bond - nonputtable bond

Option Adjusted Spread

- "Option-removed spread."
- Compensation for liquidity and credit risk relative to benchmark.
- Spread that forces model price = market price.
- Nominal spread = OAS + option cost.

Relative Valuation Analysis

If benchmark is Treasuries or higher-rated bond sector:

- Bond is undervalued if OAS > required OAS.
- Bond is overvalued if OAS < required OAS.

If benchmark is issuer-specific:

- Bond is undervalued if OAS > 0.
- Bond is overvalued if OAS < 0.

Convertible Bonds

- Conversion value = stock price x conversion ratio.
- Minimum value = max(straight value, conversion value).
- Market conversion premium = conversion price - market price.

- Callable convertible bond = straight bond + call on stock - call on bond.

MBS Prepayment Risk

Prepayment Speed Factors

- Spread of current vs. original mortgage rates.
- Mortgage rate path (refinancing burnout).
- Housing turnover.
- Loan seasoning and property location.

Contraction risk occurs as rates fall, prepayments rise, average life falls.

Extension risk occurs as rates rise, prepayments fall (slow), average life rises.

CMO Prepayment Risk

- PAC I tranches: low contraction and extension risk (due to PAC collar).
- PAC II tranches: somewhat higher contraction and extension risk.
- Support tranches: higher contraction and extension risk.
- IO strips: value positively related to interest rates at low current rates.
- PO strips: negative convexity at low rates, high interest rate sensitivity.

Commercial MBS

- Non-recourse, so focus on property credit risk.
- Loan-level call protection: prepayment lockout; defeasance; prepayment penalty; yield maintenance charge.
- Pool-level call protection: senior and subordinated tranches.

ABS Credit Enhancement

- External: corporate guarantees, letters of credit, bond insurance.
- Internal: reserve funds, overcollateralization, senior/sub structure.

ABS Prepayment Risk

- Closed-end HEL: prepayments also affected by borrower credit traits.
- Manufactured housing loan: low prepayment risk; small balances, high depreciation, low borrower credit ratings.
- Auto loan: low prepayment risk; small balances, high depreciation.
- Student loan: prepayments from default, loan consolidation.
- Credit card receivable: low prepayment risk; lockout period, no prepayment on credit cards.

Collateralized Debt Obligation (CDO)

- Backed by: speculative grade corporate bonds, MBS/ABS, emerging market bonds, bank commercial loans, special situation/distressed debt.
- Structure: Senior tranche(s), mezzanine tranches, equity tranche.
- Arbitrage-driven cash CDO: use interest rate swap.
- Cash flow CDO: actively managed, no short-term trading.
- Synthetic CDO: Bondholders take on economic risks of assets but not legal ownership of them; link contingent payments to reference asset (e.g., a bond index).
- Advantages of synthetic CDO: no funding, shorter ramp-up period, acquire exposure more cheaply through credit-default swap.

MBS/ABS Spread Analysis

- Plain-vanilla corporate: Use Z-spread.
- Callable corporate: Use OAS (binomial model).
- MBS: Use OAS (Monte Carlo model).
- Credit card/auto ABS: Use Z-spread.
- High-quality home equity ABS: Use OAS (Monte Carlo model).

DERIVATIVES

Forwards- No Arbitrage Pricing

$$FP = S_0 \times (1 + R_f)^T$$

$$V_{\text{long}} = S_t - \left[\frac{FP}{(1 + R_f)^{T-t}} \right]$$

Equity Forward

$$FP(\text{equity}) = (S_0 - PVD) \times (1 + R_f)^T$$

$$V_{\text{long}} = [S_t - PVD_t] - \left[\frac{FP}{(1 + R_f)^{T-t}} \right]$$

Forward on Fixed Income Securities

$$FP(\text{fixed income}) = (S_0 - PVC) \times (1 + R_f)^T$$

$$V_{\text{long}} = [S_t - PVC] - \left[\frac{FP}{(1 + R_f)^{T-t}} \right]$$

Forward Rate Agreements (FRA)

- FRA is forward contract on interest rate; long wins when rates increase, loses when rates decrease.
- FRA "price" is implied forward interest rate for period beginning when FRA expires to underlying "loan" maturity.
- FRA value at maturity is interest savings at maturity of "loan" discounted back to FRA expiration at current LIBOR.
- FRA value prior to maturity is interest savings estimated by implied forward rate discounted back to valuation date at current LIBOR.

Currency Forward (Interest Rate Parity)

$$FP(\text{currency}) = S_0 \times \frac{(1 + R_{DC})^T}{(1 + R_{FC})^T}$$

F and S in DC/FC

$$V_{\text{long}} = \left[\frac{S_t}{(1 + R_{FC})^{T-t}} \right] - \left[\frac{FP}{(1 + R_{DC})^{T-t}} \right]$$

Futures Price

$$FP = S_0 \times (1 + R_f)^T$$

- Futures > forward when rates and asset values positively correlated.
- Futures < forward when rates and asset values negatively correlated.

Futures Arbitrage

Cash and carry: Borrow, buy spot, sell futures today; deliver asset, repay loan at end.
Reverse cash and carry: Short spot, invest, buy futures today; collect loan, buy asset under futures contract, deliver to cover short sale.

Costs and Non-monetary Benefits

- Holding costs increase futures price; non-monetary benefits reduce futures price.
- Backwardation: Futures price < spot price.
- Contango: Futures price > spot price.
- Normal backwardation: Futures price < expected spot price.
- Normal contango: Futures price > expected spot price.

Treasury Bond Futures

$$FP = \left[\text{bond price} \times (1 + R_f)^T - FVC \right] \times \frac{1}{CF}$$

Equity Futures

$$FP(\text{stock}) = S_0 \times (1 + R_f)^T - FVD$$

$$FP(\text{index}) = S_0 \times e^{(R-\delta)T}$$

Eurodollar Futures

- Priced as discount yield; LIBOR-based deposits priced as add-on yield \Rightarrow deposit value not perfectly hedged by Eurodollar contract.
- Can't price Eurodollar futures using no-arb framework.

Put-Call Parity

Call + RF Bond = Put + Underlying

$$C_0 + \frac{X}{(1+r)^T} = P_0 + S_0$$

Caps and Floors

- Cap = portfolio of calls on LIBOR.
- Floor = portfolio of puts on LIBOR.
- Collar = buy cap and sell floor, or sell cap and buy floor.

Binomial Option Pricing Model

- Step 1: Calculate option payoffs at end in all states.
Step 2: Calculate expected value using probabilities.

$$\pi_{up} = \frac{1 + R - D}{U - D}$$

Step 3: Discount to today at risk-free rate.

BSM Assumptions & Limitations

- Assumptions: Price of underlying follows lognormal distribution; (continuous) risk-free rate constant and known; σ of underlying asset constant and known; frictionless markets; underlying asset has no CF; European options.
- Limitations: Not useful for pricing options on bond prices/interest rates; σ must be estimated; σ not constant over time; frictionless markets assumption not realistic.

Effect of Each Variable on a Call Option:

- Asset price – positively related.
- Volatility of asset price – positively related.
- Risk free rate – positively related.
- Time to expiration – value \rightarrow \$0 as call \rightarrow maturity.
- Exercise price – negatively related.

Delta

Estimates the change in value of option for a one-unit change in stock price.

- Call delta between 0 and 1; increases as stock price increases.
- Call delta close to 0 for far out-of-the-money calls; close to 1 for far in-the-money calls.
- Put delta between -1 and 0; increases from -1 to 0 as stock price increases.
- Put delta = call delta - 1 (all else equal).
- Delta close to 0 for far out-of-the-money puts; close to -1 for far in-the-money puts.

Delta Neutral Hedging

$$\# \text{ calls for delta hedge} = \frac{\# \text{ shares of stock}}{\text{delta of call option}}$$

Delta-neutral position only holds for very small changes in value of underlying stock. Delta-neutral portfolio must be frequently (continuously) rebalanced to maintain hedge; called a dynamic hedge.

Gamma

Measures rate of change in delta as underlying stock price changes; largest when option is at-the-money.

Currency Swaps

Parties swap payments in two currencies at fixed or floating rates.

Interest Rate Swaps

Plain vanilla interest rate swap: trading fixed interest rate payments for floating rate payments.

Equity Swaps

Return on stock, portfolio, or stock index is paid each period by one party in return for a fixed payment. Return can be capital appreciation or total return including dividends on the stock or portfolio.

Swap Pricing and Valuation

- Swap rate is set so PV of floating rate payments = PV of fixed rate payments; swap value is zero to both parties:

$$C_N = \frac{1 - Z_N}{Z_1 + Z_2 + \dots + Z_N}$$

$$Z_n = \text{PV of \$1 on } n^{\text{th}} \text{ date}$$

- Value to fixed-pay side = PV of floating - PV of fixed; value increases when rates increase.
- Value to floating-pay side = PV of fixed - PV of floating; value increases when rates decrease.

Credit Derivatives

Credit default swap – compensates buyer when credit event occurs on referenced bond/loan. Pricing depends on credit risk of refer. oblig, not int rate risk.

Strategies: basis, curve, index, options, capital structure, and correlation trades.

PORTFOLIO MANAGEMENT

Minimum-variance frontier (MVF): set of port. w/ lowest var at each level of exp. return.

Efficient frontier: Positively sloped portion of MVF. If a risk-free investment is part of the investment opportunity set, the efficient frontier is a straight line called the CAL.

CAL: Eff. front. with R_f becomes straight line.

$$E(R_C) = R_f + \left[\frac{E(R_T) - R_f}{\sigma_T} \right] \sigma_C$$

CML

$$E(R_C) = R_f + \left[\frac{E(R_M) - R_f}{\sigma_M} \right] \sigma_C$$

Market price of risk = Sharpe ratio of mkt port = slope of CML = mkt risk premium per unit of mkt risk.

CAPM: $E(R_i) = R_f + \beta_i [E(R_M) - R_f]$

$$\beta_i = \frac{\text{Cov}_{iM}}{\sigma_M^2} = \frac{\rho_{iM} \sigma_i \sigma_M}{\sigma_M^2} = \rho_{iM} \left(\frac{\sigma_i}{\sigma_M} \right)$$

Market model: $R_i = a_i + b_i R_M + \varepsilon_i$

Multifactor model: extension of a 1-factor mkt model. 3 Types: Macroeconomic factor, fundamental factor, and statistical factor.

APT

$$E(R_p) = R_f + b_{p1} \mu_1 + b_{p2} \mu_2 + \dots + b_{pk} \mu_k$$

Active return: $(R_p - R_B)$

Active risk: std dev of active return over time

Active risk squared: active risk + active specific risk

Information Ratio

$$IR = \frac{\bar{R}_P - \bar{R}_B}{\sigma(R_P - R_B)}$$

Factor portfolio has sensitivity of one to particular factor & zero to all other factors.

Tracking portfolio – port w/ specific set of factor sensitivities

If CAPM Assumptions Don't Hold

Mkt port might lie below eff frontier; relationship btw exp return & β may not be linear; less risk-averse investor may hold diff risky port than more risk-averse investors; CAPM risk-adj may not be appropriate.

Foreign Currency Risk Premium (FCRP)

Expected foreign currency appreciation less interest rate differential:

$$FCRP = E(\% \Delta S) - (r_{DC} - r_{FC}), S \text{ in DC/FC}$$

International CAPM

DC return = FC interest rate + FC appreciation = DC interest rate + FCRP

$$E(R) = R_f + (\beta_G \times MRP_G) + (\gamma_1 \times FCRP_1) + (\gamma_2 \times FCRP_2)$$

$$\gamma = \gamma(LC) + 1$$

Currency Exposure

- Exporters are hurt and importers are helped by domestic currency appreciation.
- Traditional model predicts domestic currency depreciation will improve competitiveness and increase equity prices (negative currency exposure).
- Money demand model predicts positive currency exposure: decreased LR economic activity causes currency depreciation and lower equity prices.

Treynor Black Model

1. Develop cap mkt expectations for passively mnged mkt index port (M).
2. ID ltd. # of mispriced securities, (large +/- alphas); use CAPM $\alpha_i = \text{fcst return for stock } i - \{R_f + \beta_i [E(R_M) - R_f]\}$
3. Determine weighting (w) across mispriced sec. to form actively mnged port (A). Weight (w) large for high α , low unsyst. risk.

$$w_1 = \frac{\alpha_1}{\sigma^2(\varepsilon_1)} \bigg/ \left(\frac{\alpha_1}{\sigma^2(\varepsilon_1)} + \frac{\alpha_2}{\sigma^2(\varepsilon_2)} \right)$$

$$w_2 = 1 - w_1$$

$$\sigma^2(\varepsilon_i) = \text{analyst's predicted unsyst risk}$$

4. Determine w to A & M to form optimal portfolio P; using Sharpe ratio (P has highest sharpe ratio)

$$\frac{E(R_P) - R_f}{\sigma_P}$$

5. Determine the approp. allocation to R_f & P that satisfies investor risk aversion.

Portfolio Management Planning Process

- Analyze risk and return objectives.
- Analyze constraints: liquidity, time horizon, legal and regulatory, taxes, unique circumstances.
- Develop IPS: client description, purpose, duties, objectives and constraints, performance review schedule, modification policy, rebalancing guidelines.
- Determine investment strategy: passive, active, semi-active.
- Select strategic asset allocation: asset class weightings based on capital market expectations.

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