

Ethics	Quant	Econ	FSA	Corp. Iss.	Equity	Fixed Inc.	Deriv.	Alt. Inv.	Port. Mgmt
15–20%	6–9%	6–9%	11–14%	6–9%	11–14%	11–14%	5–8%	7–10%	8–12%

ETHICAL AND PROFESSIONAL STANDARDS

Code of Ethics — the six obligations

Act with integrity, competence, diligence and respect toward the public, clients, employers, colleagues and other market participants. Put the integrity of the profession and clients' interests ahead of your own. Use reasonable care and independent professional judgement. Practise and encourage others to practise ethically. Support the rules that govern capital markets. Maintain and improve professional competence.

Ethical decision-making framework

1. *Identify*: duties owed, relevant facts, conflicts, applicable principles.
2. *Consider*: situational influences, alternative actions, additional guidance.
3. *Act* on the decision.
4. *Reflect*: did the outcome match the intent?

I — Professionalism

I(A) Knowledge of the Law. Follow the strictest of local law, the Code and Standards. Dissociate from ongoing violations; reporting is encouraged but not required.

I(B) Independence and Objectivity. Refuse gifts, benefits or pressure that could compromise judgement. Modest token gifts from clients are acceptable with employer disclosure.

I(C) Misrepresentation. No untrue statements about qualifications, services or performance. Plagiarism is a violation; attribute all borrowed work.

I(D) Misconduct. No dishonesty, fraud or deceit; nothing reflecting badly on professional reputation or integrity.

I(E) Competence. Have and maintain the skills needed to competently discharge your responsibilities.

II — Integrity of Capital Markets

II(A) Material Nonpublic Information. Do not act or cause others to act on it. *Material* = would affect price or a reasonable investor's decision. Use mosaic theory; erect information barriers.

II(B) Market Manipulation. No transaction-based manipulation (artificial volume/price) or information-based manipulation (spreading false data).

III — Duties to Clients

III(A) Loyalty, Prudence, and Care. Client interests before employer's or your own; identify the actual client; act with the care of a prudent professional.

III(B) Fair Dealing. Treat all clients fairly in recommendations and trade allocation; disseminate changes simultaneously; prorate partial fills.

III(C) Suitability. With an advisory relationship, obtain and update an IPS and judge suitability in a portfolio context. With a stated mandate, follow the mandate.

III(D) Performance Presentation. Fair, accurate, complete; disclose whether results are simulated, gross or net.

III(E) Preservation of Confidentiality. Keep client information confidential unless disclosure is legally required, the activity is illegal, or the client permits it. Applies to former clients too.

IV — Duties to Employers

IV(A) Loyalty. No harm to the employer; no misappropriation of property or client lists. Preparation to leave is acceptable; competing before resigning is not. Independent practice requires written consent.

IV(B) Additional Compensation Arrangements. No outside compensation that competes with the employer's interest without written consent from all parties.

IV(C) Responsibilities of Supervisors. Make reasonable efforts to detect and prevent violations; ensure adequate compliance systems exist or decline supervisory responsibility.

V — Investment Analysis, Recommendations, Actions

V(A) Diligence and Reasonable Basis. Adequate research supporting each recommendation; check third-party research quality.

V(B) Communication with Clients. Distinguish fact from opinion; disclose the investment process, its basic format and general principles, plus significant limitations and risks.

V(C) Record Retention. Keep records supporting analysis. Absent a regulatory requirement, **7 years** is recommended. Records belong to the employer.

VI — Conflicts of Interest

VI(A) Avoid or Disclose Conflicts. Avoid conflicts where possible; otherwise disclose them fully, fairly and in plain language.

VI(B) Priority of Transactions. Client transactions before employer's, both before personal ("beneficial ownership") accounts.

VI(C) Referral Fees. Disclose any consideration paid or received

for referrals, before the client engages.

VII — Responsibilities as a Member/Candidate

VII(A) Conduct as Participants in CFA Institute Programs. Protect exam integrity; do not reveal exam content.

VII(B) Reference to CFA Institute, the Designation, the Program. No exaggeration of what membership or the charter implies; no partial designations. Correct usage: "CFA" as an adjective, never a noun; "Level I candidate in the CFA Program".

Exam habit: for every ethics vignette ask (1) which *specific* sub-standard is engaged, (2) was there *disclosure and consent*, (3) was the action *reasonable* for a professional. Most answers hinge on disclosure.

GIPS — Global Investment Performance Standards

Firm: a distinct business entity held out to clients — corporation, subsidiary or division. The firm, not a composite, claims compliance, and compliance is *firm-wide*; partial compliance may not be claimed.

Fundamental rule: every fee-paying discretionary portfolio must appear in at least one composite (grouped by strategy or objective).

Verification: voluntary, performed by an independent third party, applied to the whole firm, and it cannot be claimed for a single composite.

History: present a minimum of 5 years of compliant performance (or since inception), then build to 10 years.

The 8 sections of the 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

Separate sets exist for asset owners and for verifiers. Money-weighted returns may be reported when the manager controls the timing of external cash flows (e.g. closed-end private capital vehicles).

QUANTITATIVE METHODS

Rates of Return

Holding period return:

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

Annualized (from a d -day HPR): $(1 + \text{HPR})^{365/d} - 1$
Continuously compounded: $R_{cc} = \ln(1 + \text{HPR})$, so $\text{HPR} = e^{R_{cc}} - 1$

Multi-period linking: $(1 + R_1)(1 + R_2) \cdots (1 + R_n) - 1$

Time Value of Money

$$\text{FV}_N = \text{PV}(1 + I/Y)^N \quad \text{PV} = \frac{\text{FV}_N}{(1 + I/Y)^N}$$

With m compounding periods per year, use the periodic rate I/m over mN periods. Continuous compounding: $\text{FV} = \text{PV} e^{rN}$.

$$\text{effective annual rate} = \left(1 + \frac{\text{stated rate}}{m}\right)^m - 1$$

Ordinary annuity pays at the *end* of each period; an **annuity due** pays at the beginning, so its value is the ordinary annuity $\times (1 + I/Y)$.

$$\text{PV}_{\text{perpetuity}} = \frac{\text{PMT}}{I/Y} \quad \text{PV}_{\text{growing}} = \frac{\text{CF}_1}{r - g}$$

Cash flow additivity: amounts indexed to the same date may simply be added. Draw a timeline for any uneven series, discount each flow separately, then sum.

Measures of Central Tendency

Arithmetic mean: sum of observations divided by their number. Best for a single-period expected value.

Geometric mean return — the compound rate actually earned:

$$\bar{R}_G = \left[\prod_{i=1}^N (1 + R_i) \right]^{1/N} - 1$$

Harmonic mean — used for average cost per unit (e.g. dollar-cost averaging):

$$\bar{X}_H = \frac{N}{\sum_{i=1}^N (1/X_i)}$$

Relationship: $\bar{X}_{AM} \geq \bar{X}_{GM} \geq \bar{X}_{HM}$, with equality only when all observations are identical. The gap widens as dispersion rises.

Weighted mean: $\sum w_i X_i$ — the portfolio return formula.

Trimmed mean ($x\%$): drop the top and bottom $x/2\%$ of observations.

Winsorized mean ($x\%$): replace, rather than drop, the top and bottom $x/2\%$ with the nearest retained value.

Mode: most frequent value; a distribution may be uni-, bi- or multimodal.

Dispersion

Mean absolute deviation: $\text{MAD} = \frac{\sum |X_i - \bar{X}|}{n}$

$$s^2 = \frac{\sum_{i=1}^n (X_i - \bar{X})^2}{n-1} \quad \sigma^2 = \frac{\sum_{i=1}^N (X_i - \mu)^2}{N}$$

Standard deviation is the square root of variance. Sample variance uses $n - 1$ (degrees of freedom) so the estimator is unbiased.

Target Downside Deviation

Penalises only outcomes below a chosen target B :

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

The denominator keeps all $n - 1$ observations even though the numerator counts only shortfalls.

Coefficient of Variation

$$\text{CV} = \frac{s}{\bar{X}}$$

Risk per unit of return; being unit-free it allows dispersion to be compared across data sets. **Lower is better.**

Shape of a Distribution

Skewness. Right (positive) skew: mean $>$ median $>$ mode, long right tail. Left (negative) skew: mean $<$ median $<$ mode. Symmetric: all three equal, skew = 0.

Kurtosis measures tail weight. Excess kurtosis = kurtosis $- 3$. Leptokurtic (> 0) means fat tails and more extreme outcomes than normal — typical of asset returns; platykurtic (< 0) means thin tails; mesokurtic ($= 0$) matches the normal.

Quantiles

Position of the y -th percentile in n ordered observations:

$$L_y = (n + 1) \frac{y}{100}$$

Interpolate between adjacent observations when L_y is not an integer. Quartiles cut into 4, quintiles 5, deciles 10, percentiles 100. Interquartile range = $Q_3 - Q_1$; a box-and-whisker plot displays it.

Probability Rules

Multiplication (joint): $P(AB) = P(A | B) P(B)$

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

Independence: $P(A | B) = P(A)$, hence $P(AB) = P(A)P(B)$

Total probability: $P(A) = \sum P(A | S_i) P(S_i)$ over mutually exclusive, exhaustive scenarios.

Odds for $E = P(E)/[1 - P(E)]$.

Bayes' Formula

Updates a prior belief for new information:

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

Counting

Factorial $n!$ orders n items. Labelling into k groups: $\frac{n!}{n_1! n_2! \cdots n_k!}$. Permutations (order matters) $\frac{n!}{(n-r)!}$;

combinations (order irrelevant) $\binom{n}{r} = \frac{n!}{(n-r)! r!}$.

Expected Value and Variance

$$E(X) = \sum P(x_i) x_i$$

$$\sigma^2(X) = \sum P(x_i) [x_i - E(X)]^2$$

Standard deviation is the square root. Conditional expected values use $P(x_i | S)$ — the basis of a probability tree.

Covariance and Correlation

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

$$\rho(R_i, R_j) = \frac{\text{Cov}(R_i, R_j)}{\sigma(R_i) \sigma(R_j)}$$

Correlation is bounded by -1 and $+1$ and is unit-free. It captures *linear* association only, is not causation, and is badly distorted by outliers and by spurious relationships.

Two-Asset Portfolio

$$E(R_p) = w_A E(R_A) + w_B E(R_B)$$

$$\sigma_p^2 = w_A^2 \sigma_A^2 + w_B^2 \sigma_B^2 + 2w_A w_B \sigma_A \sigma_B \rho_{AB}$$

Diversification benefit grows as ρ_{AB} falls. At $\rho = +1$ risk is a simple weighted average; at $\rho = -1$ a zero-variance portfolio is possible.

Roy's Safety-First Criterion

Choose the portfolio with the largest ratio — it minimises the probability of returning less than the threshold R_L :

$$\text{SFRatio} = \frac{E(R_p) - R_L}{\sigma_p}$$

If $R_L = R_f$ this is the Sharpe ratio. Shortfall probability $= N(-\text{SFRatio})$.

Common Distributions

Discrete uniform: equal probability on each of n outcomes.

Binomial: n independent Bernoulli trials with constant p .

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

$E(X) = np$; $\text{var}(X) = np(1 - p)$.
Continuous uniform: $P(x_1 \leq X \leq x_2) = (x_2 - x_1)/(b - a)$.

Normal: symmetric, fully described by μ and σ^2 ; any linear combination of normals is normal; skew = 0, excess kurtosis = 0.

Lognormal: $\ln X$ is normal; bounded below by zero and right-skewed, so it suits asset prices.

Student's t : symmetric, fatter tails, defined by degrees of freedom; approaches the normal as d.f. rises.

Chi-square: asymmetric, bounded below by zero — tests of a single variance.

F : ratio of two chi-square variables — tests of equality of variances and joint significance in regression.

Normal Distribution Confidence Intervals

- $\mu \pm 1.00\sigma$ captures $\approx 68\%$
- $\mu \pm 1.65\sigma$ captures 90%
- $\mu \pm 1.96\sigma$ captures 95%
- $\mu \pm 2.58\sigma$ captures 99%

Standardising: the z -Score

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

A z -score states how many standard deviations an observation sits from the mean; the standard normal has $\mu = 0$, $\sigma = 1$.

Sampling and Estimation

Central limit theorem: for simple random samples of size n drawn from any population with mean μ and finite variance σ^2 , the distribution of the sample mean approaches normal with mean μ and variance σ^2/n as n becomes large (rule of thumb $n \geq 30$).

Standard error of the sample mean:

$$\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}} \quad (\sigma \text{ known}); \quad s_{\bar{X}} = \frac{s}{\sqrt{n}} \quad (\sigma \text{ unknown})$$

Confidence interval: $\bar{X} \pm (\text{reliability factor}) \times (\text{standard error})$.
Sampling error = sample statistic – population parameter.
Biases: data-snooping, sample selection, survivorship, look-ahead, time-period bias.

Resampling

Jackknife: recompute the mean n times, each time leaving one observation out, then take the standard deviation of those means. Removes bias, deterministic.

Bootstrap: draw many samples of size n *with replacement* from the observed data, compute the statistic for each, and use the dispersion of those estimates as the standard error. Works for statistics with no closed-form standard error.

Hypothesis Testing

H_0 always contains the equality ($=$, $\leq$, $\geq$) and is the statement being tested; H_a is what you conclude if H_0 is rejected. Reject when the test statistic falls beyond the critical value, or when the p -value $<$ the significance level α .

- *Type I error*: rejecting a true H_0 . Probability = α , the significance level.
- *Type II error*: failing to reject a false H_0 . Probability = β .
- *Power* of a test = $1 - \beta$. For fixed n , cutting α raises β ; only a larger sample improves both.
- p -value = smallest α at which H_0 can be rejected.

Which Test Statistic?

Test of	Stat	d.f.
Single mean	t or z	$n - 1$
Difference in means (indep.)	t	$n_1 + n_2 - 2$
Mean of paired differences	t	$n - 1$
Single variance	χ^2	$n - 1$
Equality of two variances	F	$n_1 - 1, \ n_2 - 1$
Correlation	t	$n - 2$
Independence (contingency)	χ^2	$(r - 1)(c - 1)$
Regression slope — value	t	$n - 2$
Regression — significance	F	$1, \ n - 2$

Use z only with a known population variance (or a large sample from a normal population); the t -test is the conservative default. Nonparametric tests apply when data are ranked, distributional assumptions fail, or the hypothesis is not about a parameter.

Simple Linear Regression

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

Y dependent (explained), X independent (explanatory), b_0 intercept, b_1 slope, ε_i residual. Least squares minimises $\sum \varepsilon_i^2$.

$$\hat{b}_1 = \frac{\text{Cov}(X, Y)}{\sigma_X^2} \qquad \hat{b}_0 = \bar{Y} - \hat{b}_1 \bar{X}$$

The fitted line always passes through $(\bar{X}, \bar{Y})$.

Four assumptions: linearity; homoskedasticity (constant residual variance); independence of observations and residuals; normally distributed residuals.

ANOVA and Goodness of Fit

SST (total): squared deviations of actual Y from $\bar{Y}$.

SSR (regression, explained): squared deviations of predicted $\hat{Y}$ from $\bar{Y}$.

SSE (error, unexplained): squared deviations of actual Y from predicted $\hat{Y}$. And $\text{SST} = \text{SSR} + \text{SSE}$.

$$R^2 = \frac{\text{SSR}}{\text{SST}} = 1 - \frac{\text{SSE}}{\text{SST}}$$

Proportion of variation in Y explained by X ; in simple regression $R^2 = \rho^2$.

$$\text{SEE} = \sqrt{\text{MSE}} = \sqrt{\frac{\text{SSE}}{n - 2}} \qquad F = \frac{\text{MSR}}{\text{MSE}}$$

Lower SEE means a tighter fit. Slope test: $t = \frac{\hat{b}_1 - B_1}{s_{\hat{b}_1}}$ with

$n - 2$ d.f.

Prediction and Functional Form

Predicted value $\hat{Y} = \hat{b}_0 + \hat{b}_1 X_p$; the prediction interval widens the further X_p lies from $\bar{X}$.

Log-lin: $\ln Y = b_0 + b_1 X$ — constant *growth rate*.

Lin-log: $Y = b_0 + b_1 \ln X$ — a fixed change in Y per *percent*-age change in X .

Log-log: $\ln Y = b_0 + b_1 \ln X - b_1$ is an elasticity.

ECONOMICS

Elasticity

Price elasticity of demand = $\frac{\% \Delta Q_d}{\% \Delta P}$. Demand is elastic if

$|E| > 1$ (revenue falls when price rises), unit elastic at 1, inelastic if $|E| < 1$. Substitutes available, a larger budget share and a longer time horizon all make demand more elastic. Income elasticity > 0 marks a normal good, < 0 an inferior good; positive cross elasticity marks substitutes, negative marks complements.

Costs, Breakeven and Shutdown

Profit is maximised where marginal revenue = marginal cost in every market structure.

- *Breakeven*: total revenue = total cost (economic profit is zero).

- *Continue in the short run* if $\text{TR} \geq$ total variable cost — the contribution covers some fixed cost.

- *Shut down in the short run* if $\text{TR} <$ total variable cost.

- *Exit in the long run* if $\text{TR} <$ total cost.

Economies of scale lower long-run average cost as output grows (specialisation, bargaining power); diseconomies raise it (bureaucracy, duplication).

Market Structures

Structure	Firms	Pricing pwr	Barriers / product
Perfect competition	Very many	None	None; identical product
Monopolistic competition	Many	Some	Low; differentiated, heavy advertising
Oligopoly	Few	Significant	High; either type of product
Monopoly	One	Substantial	Very high; unique product

Oligopoly models: kinked demand (prices are sticky downward), Cournot (quantity), Stackelberg (leader–follower), Nash/dominant firm, cartel.

Concentration measures: N -firm concentration ratio is simple but ignores entry barriers and mergers; the Herfindahl–Hirschman Index sums squared market shares and reacts properly to mergers.

Aggregate Output and the Business Cycle

Phases: *expansion* $\rightarrow$ *peak* $\rightarrow$ *contraction* $\rightarrow$ *trough*. Inventory–sales ratio rises early in a contraction and falls early in a recovery. Unemployment is a lagging signal; the participation rate and discouraged workers distort it.

- *Leading* indicators turn *before* the economy (yield-curve spread, building permits, new orders, stock prices, consumer expectations).

- *Coincident* indicators turn *with* it (industrial production, personal income, manufacturing/trade sales).

- *Lagging* indicators turn *after* it (average duration of unemployment, inventory–sales ratio, unit labour cost, prime rate).

Inflation

Headline inflation covers all goods; core excludes food and energy. A Laspeyres (fixed-basket) index such as the CPI overstates inflation through new-product, quality-improvement and substitution bias. *Demand-pull* inflation comes from excess demand and appears when output exceeds potential; *cost-push* inflation comes from higher input costs, especially wages.

Savings, Investment and the Fiscal Balance

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

A fiscal deficit is financed by an excess of private saving over domestic investment, by a trade deficit, or by both.

Fiscal Policy

Tools: government spending (transfers, current, capital) and taxes (direct, indirect). Expansionary when a deficit is *widening* or a surplus *shrinking*; contractionary in the reverse case. Automatic stabilisers (progressive taxes, unemployment benefits) act without legislation. Limitations: recognition, action and impact lags; crowding out; Ricardian equivalence (households save the tax cut in anticipation of future taxes) can neutralise the stimulus.

Monetary Policy

Central-bank objectives: price stability above all, plus stable output, employment and exchange rates. Roles: supply currency, act as banker to the government, lender of last resort, regulate and supervise, manage reserves, conduct policy. Effectiveness rests on *independence, credibility and transparency*.

$$\text{money multiplier} = \frac{1}{\text{reserve requirement}}$$

$$R_{\text{nominal}} \approx R_{\text{real}} + E(\text{inflation}) + \text{risk premia}$$

Neutral rate = real trend growth + inflation target. Policy is **expansionary** when the policy rate sits *below* the neutral rate and **contractionary** when it sits above. Tools are the policy rate, reserve requirements and open-market operations; quantitative easing is used once rates approach the zero bound. Limits: a liquidity trap, bond-market vigilantes, and the fact that banks may not lend the reserves created.

Policy mix. Easy fiscal + easy monetary $\Rightarrow$ sharply higher output, rates ambiguous. Tight + tight $\Rightarrow$ output falls. Easy fiscal + tight monetary $\Rightarrow$ higher rates, public sector grows relative to private.

Balance of Payments

Current account: goods and services, income receipts, unilateral transfers.

Capital account: capital transfers and sales/purchases of non-produced, non-financial assets.

Financial account: government-owned assets abroad and foreign-owned assets domestically.

A current-account deficit must be matched by a financial-account surplus (capital inflow).

Trade and Regional Agreements

Comparative advantage — the lower *opportunity* cost — drives gains from trade even when one country holds an absolute advantage in everything. *Ricardian* models trace advantage to technology, *Heckscher–Ohlin* to factor endowments. Tariffs, quotas and voluntary export restraints raise domestic price, cut consumer surplus and create deadweight loss; only tariffs generate government revenue.

- *Free trade area*: barriers between members removed.

- *Customs union*: + a common external trade policy.

- *Common market*: + free movement of labour and capital.

- *Economic union*: + common institutions and economic policy.

- *Monetary union*: + a single currency.

Foreign Exchange Quotes

Exam convention: quotes are **price currency** / **base currency** and read as the number of units of the price currency per one unit of the base. USD/EUR = 1.10 means one euro buys 1.10 dollars.

An *appreciation* of the base currency is a rise in the quote. Percentage change must be computed against the currency you designate as the base — invert the quote first if necessary.

Bid–ask: the dealer buys the base at the bid and sells it at the ask. Spreads widen with lower liquidity, longer maturity, higher volatility and weaker counterparty credit.

Cross rate: chain the quotes so the unwanted currency cancels.

$$\text{real exchange rate} = \text{nominal rate} \times \frac{\text{CPI}_{\text{base}}}{\text{CPI}_{\text{price}}}$$

A rise in the real rate means the price-currency country's purchasing power has fallen.

Forward Rates and Parity Conditions

No-arbitrage (covered interest rate parity):

$$\frac{F}{S_0} = \frac{1 + i_{\text{price}}}{1 + i_{\text{base}}}$$

The currency with the **higher** interest rate trades at a forward **discount**. Forward points = $(F - S) \times$ scaling factor; a positive number means the base trades at a premium.

- **Covered IRP** holds by arbitrage; forward contracts remove currency risk.
- **Uncovered IRP** predicts expected spot change $\approx$ interest-rate differential; it holds only over long horizons.
- **Purchasing power parity**: absolute PPP equates price levels; relative PPP says expected depreciation $\approx$ inflation differential.
- **International Fisher effect**: nominal rate differentials equal expected inflation differentials.

Exchange Rate Regimes

- **Formal dollarization** — adopt another country's currency.
- **Monetary union** — members share a currency.
- **Currency board** — domestic currency fully backed by foreign reserves.
- **Fixed peg** — maintained within roughly $\pm 1\%$ of a currency or basket.
- **Target zone** — the same idea with a wider band.
- **Crawling peg** — the peg is adjusted on a schedule.
- **Crawling band** — the permitted band widens over time.
- **Managed float** — authorities intervene without announcing a target.
- **Independent float** — the market alone sets the rate.

Geopolitics

Countries range from *autarkic* (self-sufficient, non-cooperative) through *hegemonic* (cooperation on its own terms) to *multilateral* and *bilateral* cooperation. Globalisation raises growth and lowers cost but increases interdependence and inequality. Tools of geopolitics: national security (military, espionage), economic (tariffs, sanctions, trade blocs) and financial (capital controls, currency arrangements). Risk arrives as *event*, *exogenous* or *thematic* risk, and is assessed by likelihood, velocity (high, medium or low speed of impact) and size.

FINANCIAL STATEMENT ANALYSIS

The Analysis Framework

1. State the objective and context.
2. Gather input data.
3. Process the data.
4. Analyse and interpret the processed data.
5. Report conclusions or recommendations.
6. Follow up and update the analysis.

Key sources: the four statements plus notes and supplementary schedules, MD&A, the auditor's report, proxy statements and interim filings.

Auditor's Opinions

- **Unqualified (clean)**: reasonable assurance the statements are free of material misstatement and conform to the applicable standards.
- **Qualified**: statements are fair *except* for identified departures.
- **Adverse**: statements are not presented fairly and do not conform.
- **Disclaimer**: the auditor cannot form an opinion (e.g. scope limitation).

The report also covers internal controls and highlights critical/key audit matters. A going-concern doubt is disclosed as an emphasis of matter.

Revenue Recognition — the Five Steps

1. Identify the contract with the customer.
2. Identify the separate performance obligations.
3. Determine the transaction price.
4. Allocate that price across the obligations.
5. Recognise revenue when (or as) each obligation is satisfied.

Principal reports gross revenue; an agent reports only the net commission.

Expense Recognition and Non-recurring Items

Match expenses to the revenue they generate; period costs are expensed as incurred. Judgement in bad-debt estimates, warranty provisions, depreciation method and useful life all shift reported income.

Discontinued operations, unusual or infrequent items and accounting changes are reported separately — strip them out before forecasting sustainable earnings.

Earnings per Share

$$\text{basic EPS} = \frac{\text{net income} - \text{preferred dividends}}{\text{weighted avg. common shares outstanding}}$$

Stock dividends and splits are applied retroactively to the start of the period; new issues are weighted by time outstanding. Diluted EPS assumes every dilutive security converts. Start from basic EPS and adjust both lines:

$$\text{diluted EPS} = \frac{\text{adjusted income available to common}}{\text{weighted avg. shares} + \text{potential shares}}$$

Add back to the numerator: convertible preferred dividends (if that preferred is assumed converted) and convertible-debt interest $\times (1 - t)$.

Add to the denominator: shares from converting preferred, shares from converting debt, and incremental shares from options and warrants. Options are handled by the *treasury stock method*: incremental shares = shares issued on exercise – shares repurchasable with the proceeds at the average market price. A security is **antidilutive** if including it *raises* EPS — exclude it.

Balance Sheet and Comprehensive Income

Assets = liabilities + equity. Current items are expected to be settled within one year or the operating cycle. Comprehensive income = net income + other comprehensive income (OCI). OCI typically holds: foreign-currency translation adjustments, certain pension remeasurements, revaluation surplus (IFRS), gains/losses on hedging instruments, and unrealised gains/losses on debt securities measured at fair value through OCI.

Investments in Financial Assets

- **Held-for-trading / FVPL**: carried at fair value; dividends, interest and *all* realised and unrealised gains and losses go to the income statement.
- **Available-for-sale / FVOCI**: carried at fair value; dividends, interest and realised gains/losses to income, but unrealised gains/losses to OCI.
- **Held-to-maturity / amortised cost**: carried at amortised cost; interest and realised gains/losses to income.

Cash Flow Statement

CFO, CFI and CFF must sum to the change in cash. Under US GAAP interest paid and received and dividends received are CFO, and dividends paid are CFF. *IFRS* permits interest and dividends paid in either CFO or CFF, and interest and dividends received in either CFO or CFI.

Direct method (preferred by standard setters, clearer for forecasting) starts from cash collected from customers and subtracts cash paid to suppliers, employees, for interest and for tax.

Indirect method starts with net income, then: add back non-cash charges (depreciation, amortisation, impairment); remove gains and add back losses arising from investing or financing; and adjust for changes in working capital — an *increase* in an operating asset is a use of cash, an increase in an operating liability is a source.

$$\text{FCFF} = \text{CFO} + [\text{interest} \times (1 - t)] - \text{FCInv}$$
$$\text{FCFE} = \text{CFO} - \text{FCInv} + \text{net borrowing}$$

Simple free cash flow = operating cash flow – net capital expenditure.

Common-Size Analysis

Vertical common-size statements express every line as a percentage of a base: total assets on the balance sheet, revenue on the income statement, and either total inflows/outflows or revenue on the cash flow statement. *Horizontal common-size* statements express each line relative to its value in a base year, isolating growth. Both neutralise size so companies of different scale can be compared.

Liquidity Ratios

$$\text{current} = \frac{\text{current assets}}{\text{current liabilities}}$$
$$\text{quick} = \frac{\text{cash} + \text{marketable sec.} + \text{receivables}}{\text{current liabilities}}$$
$$\text{cash} = \frac{\text{cash} + \text{marketable securities}}{\text{current liabilities}}$$
$$\text{defensive interval} = \frac{\text{cash} + \text{mkt. sec.} + \text{receivables}}{\text{average daily expenditures}}$$

Activity Ratios and the Cash Conversion Cycle

$$\text{receivables turnover} = \frac{\text{revenue}}{\text{average receivables}}$$
$$\text{inventory turnover} = \frac{\text{cost of goods sold}}{\text{average inventory}}$$
$$\text{payables turnover} = \frac{\text{purchases (or COGS)}}{\text{average trade payables}}$$

Days ratios convert each turnover: $365 / \text{turnover}$ gives days of sales outstanding (DSO), days of inventory on hand (DOH) and number of days of payables.

$$\text{cash conversion cycle} = \text{DOH} + \text{DSO} - \text{days of payables}$$

A shorter cycle frees working capital. Also:

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

plus fixed-asset turnover and working-capital turnover on the same pattern.

Profitability Ratios

$$\text{gross margin} = \frac{\text{gross profit}}{\text{revenue}}; \text{operating margin} = \frac{\text{EBIT}}{\text{revenue}}$$
$$\text{net margin} = \frac{\text{net income}}{\text{revenue}}; \text{ROA} = \frac{\text{net income}}{\text{avg. total assets}}$$
$$\text{return on total capital} = \frac{\text{EBIT}}{\text{average total capital}}$$
$$\text{ROE} = \frac{\text{net income}}{\text{average total equity}}$$

Solvency Ratios

$$\frac{\text{debt}}{\text{equity}}; \frac{\text{debt}}{\text{total assets}}; \frac{\text{debt}}{\text{total capital}}; \frac{\text{assets}}{\text{equity}}$$
$$\text{interest coverage} = \frac{\text{EBIT}}{\text{interest payments}}$$
$$\text{fixed charge coverage} = \frac{\text{EBIT} + \text{lease payments}}{\text{interest} + \text{lease payments}}$$

DuPont Decomposition

Three-part:

$$\text{ROE} = \underbrace{\frac{\text{net income}}{\text{revenue}}}_{\text{net margin}} \times \underbrace{\frac{\text{revenue}}{\text{assets}}}_{\text{asset turnover}} \times \underbrace{\frac{\text{assets}}{\text{equity}}}_{\text{leverage}}$$

Five-part — splits the margin into tax, interest and operating effects:

$$\text{ROE} = \frac{\text{NI}}{\text{EBT}} \times \frac{\text{EBT}}{\text{EBIT}} \times \frac{\text{EBIT}}{\text{revenue}} \times \frac{\text{revenue}}{\text{assets}} \times \frac{\text{assets}}{\text{equity}}$$

Read as: tax burden $\times$ interest burden $\times$ EBIT margin $\times$ asset turnover $\times$ financial leverage. Use it to locate *why* ROE moved, not merely that it did.

Sustainable Growth

$$g = \text{RR} \times \text{ROE}, \quad \text{RR} = 1 - \frac{\text{dividends declared}}{\text{net income}}$$

Inventory

Cost includes purchase, conversion and delivery-to-location costs; abnormal waste, most storage and all selling costs are expensed. IFRS permits FIFO, weighted average and specific identification — **LIFO is prohibited under IFRS**; US GAAP allows LIFO as well.

When prices are rising and quantities are stable or growing:

LIFO gives	FIFO gives
Higher COGS	Lower COGS
Lower gross profit, net income, taxes	Higher gross profit, net income, taxes
Lower inventory and equity	Higher inventory and equity
Better matched income statement	Better balance sheet valuation

Converting LIFO to FIFO: FIFO inventory = LIFO inventory + LIFO reserve; FIFO COGS = LIFO COGS – Δ LIFO reserve; add the reserve net of tax to equity. *LIFO liquidation* — selling older, cheaper layers — inflates margins unsustainably.

Write-downs: IFRS carries inventory at the lower of cost or net realisable value and permits reversal up to the original cost; US GAAP uses lower of cost or market for LIFO/retail and generally forbids reversal.

Long-Lived Assets

Capitalising spreads the cost over the asset's life: higher near-term net income, smoother earnings, larger assets and equity, and the outflow lands in CFI. *Expensing* does the opposite and puts the outflow in CFO. Interest incurred while constructing an asset for own use is capitalised.

Depreciation: straight line = (cost – salvage)/life; declining balance applies a multiple of the straight-line rate to the *full* carrying amount, ignoring salvage until the floor is reached; units-of-production tracks usage. Component depreciation is required under IFRS.

Research costs are expensed under both frameworks; *development* costs may be capitalised under IFRS once technical and commercial feasibility is shown, but are expensed under US GAAP (software after feasibility is the exception).

Impairment. IFRS writes down to the recoverable amount when the carrying amount exceeds it, and permits reversal. US GAAP applies a two-step test — undiscounted expected cash flows below carrying amount trigger a write-down to fair value — and prohibits reversal for held-for-use assets.

Revaluation. IFRS may carry an asset class at fair value: gains bypass income and sit in revaluation surplus in equity, except to the extent they reverse a prior impairment charged to income. US GAAP does not permit upward revaluation. Investment property under IFRS may use the fair value model, where *all* changes flow through income.

Income Taxes

Differences between taxable income (tax return) and pretax income (financial statements) are *permanent* (never reverse; they change the effective rate) or *temporary* (reverse over time; they create deferred items).

- *Deferred tax liability*: taxable income < pretax income now — e.g. accelerated depreciation for tax. Treat a DTL as equity if it is not expected to reverse.
- *Deferred tax asset*: taxable income > pretax income now — e.g. warranty provisions, carryforward losses. Under US GAAP a valuation allowance reduces the DTA when realisation is more likely than not to fail.

income tax expense = taxes payable + ΔDTL − ΔDTA

A tax-rate cut shrinks both DTLs and DTAs.

Leases

Lessee. Under IFRS every lease is treated alike: recognise a right-of-use asset and a lease liability at the present value of the payments; the asset amortises straight-line and the payment splits into interest expense and principal reduction. US GAAP keeps two classes. A *finance lease* matches the IFRS treatment. An *operating lease* puts a single straight-line lease expense in operating income, and the right-of-use asset is amortised as the plug that keeps asset and liability in step. *Lessor*. Finance lease: derecognise the asset, book a lease receivable, report interest income. Operating lease: keep the asset, depreciate it and report lease payments as income.

Pensions and Share-Based Compensation

Defined contribution: the contribution is the expense — no balance-sheet obligation.

Defined benefit: funded status = plan assets − PBO. A surplus is a net pension asset, a deficit a net pension liability. Assumptions matter: a higher discount rate or lower compensation-growth assumption shrinks the obligation and flatters income.

Stock grants, performance shares and options are measured at grant-date fair value and expensed over the vesting period; options require an option-pricing model, whose volatility and life assumptions are estimates.

Financial Reporting Quality

Quality spans a spectrum: GAAP-compliant and decision-useful with sustainable earnings at the top, down through biased or aggressive choices, then non-compliant reporting, and finally fictitious transactions. Warning signs include revenue growth outpacing receivables collection, widening gaps between net income and CFO, capitalising costs peers expense, frequent "non-recurring" charges, and repeated changes in auditor or estimates. Motivations: meeting guidance, covenant thresholds and incentive compensation; conditions: opportunity, motivation, rationalisation.

Sales-Based Pro Forma Model

1. Forecast revenue growth.
2. Estimate cost of sales (gross margin).
3. Estimate SG&A.
4. Estimate financing costs.
5. Estimate taxes.
6. Model working-capital accounts.
7. Estimate PP&E and capital spending.
8. Assemble the pro forma statements.

CORPORATE ISSUERS

Organisational Forms

Sole proprietorship and general partnership: unlimited liability, income taxed to the owners, limited access to capital. Limited partnership: general partners bear unlimited liability, limited partners' exposure is capped at their investment. Corporation: separate legal person, limited liability, unlimited life, best access to capital, but potential double taxation unless pass-through status applies.

Stakeholders and Governance

Groups with a claim on the firm: shareholders, the board, management, employees, creditors, suppliers, customers, government and communities. Principal-agent conflicts arise between shareholders and managers, between controlling and minority shareholders, and between shareholders and creditors (risk-shifting).

Mechanisms: shareholder rights (voting — statutory versus cumulative, proxy contests), an independent board with staggered or annual election, and the three key committees — *audit*, *nominating/governance* and *compensation/remuneration*. Strong governance lowers the cost of capital and reduces tail risk; weak governance invites related-party abuse and entrenchment. ESG factors are integrated through negative or positive screening, thematic investing and engagement.

Business Models

A business model states who the customer is, what is sold, how it is delivered and priced, and how the firm keeps the value it creates. Pricing approaches: value-based, cost-based, price discrimination, bundling, freemium, razor-and-blade, auction, subscription and hidden-revenue models. Key questions: unit economics, network effects, switching costs and scalability.

Working Capital and Liquidity

Net working capital = current assets − current liabilities. *Primary* sources of liquidity are ordinary — cash balances, collections, short-term lines and trade credit; *secondary* sources — renegotiating debt, selling assets, filing for protection — signal deterioration.

Drags on liquidity (uncollected receivables, obsolete inventory) and pulls (suppliers tightening terms, early payments) both consume cash.

Trade credit cost of forgoing a discount:

(1 + % discount / (1 - % discount))^(365 / days beyond discount) - 1

Short-term funding runs from bank lines (uncommitted, committed, revolving) and commercial paper for strong issuers, to factoring and asset-backed borrowing for weaker ones.

Types of Capital Investment

- *Going concern*: maintain operations or cut costs.
- *Regulatory/compliance*: required for safety or the environment — often negative NPV but mandatory.
- *Expansion*: grow the existing business; the hardest to forecast.
- *Other*: projects outside the current business, including R&D and strategic bets.

Capital Allocation Process

1. Generate ideas.
2. Analyse individual proposals.
3. Plan the firm-wide capital budget.
4. Monitor decisions and conduct a post-audit.

Principles: decide on *incremental after-tax cash flows*, not accounting income; ignore sunk costs; include externalities and opportunity costs; financing costs belong in the discount rate, not the cash flows.

Investment Decision Criteria

NPV = CF0 + CF1 / (1 + k)^1 + CF2 / (1 + k)^2 + ... + CFn / (1 + k)^n

Accept if NPV > 0. *IRR* is the discount rate that sets NPV to zero; accept if IRR > the required return. For mutually exclusive projects with different size or cash-flow timing the two can conflict — **always follow NPV**, because it measures the absolute value added and assumes reinvestment at the cost of capital. IRR can also be multiple or undefined when cash flow signs alternate.

Payback period ignores the time value of money and everything past the cut-off; *discounted payback* fixes the first flaw only. *Profitability index* = PV of future cash flows / initial outlay; accept if > 1.

Return on Invested Capital

ROIC = net operating profit after tax / average book value of invested capital

Value is created when ROIC exceeds WACC.

Real Options

Flexibility embedded in a project, valuable because managers can react after uncertainty resolves.

- *Timing*: defer the investment and learn more.
- *Abandonment*: exit and recover salvage value — like a put.
- *Expansion / growth*: scale up if early results are good — like a call.
- *Flexibility*: adjust price, output or inputs.
- *Fundamental*: the whole payoff tracks an underlying asset price.

Weighted Average Cost of Capital

WACC = wd kd (1 - t) + wps kps + wce kce

Use *target* market-value weights and marginal, not historical, costs. The tax shield applies to debt only.

- *Cost of debt*: yield to maturity on comparable outstanding debt, or a matrix estimate from ratings.
- *Cost of preferred*: kps = Dps / Pps.
- *Cost of equity — CAPM*: kce = Rf + β [E(Rmkt) − Rf].
- *Cost of equity — bond yield plus risk premium*: the firm's debt yield plus a 3–5% premium.

- *Cost of equity — dividend discount*: kce = D1 / P0 + g.

Country risk premium is added to the equity risk premium in developing markets.

Estimating Beta — the Pure-Play Method

Take a comparable listed firm's beta, strip out its capital structure, then apply your own:

βasset = βequity [1 / (1 + (1 - t) D/E)]
βproject = βasset [1 + (1 - t) D/E] subject firm

Operating and Financial Leverage

DOL = %ΔEBIT / %Δunits = Q(P - V) / (Q(P - V) - F)

DFL = %Δnet income / %ΔEBIT = EBIT / (EBIT - interest)
DTL = DOL × DFL
QBE = (F + interest) / (P - V) QOBE = F / (P - V)

Higher fixed costs and higher fixed financing charges both magnify the effect of a change in sales on shareholders.

Capital Structure Theories

- *MM with no taxes*: capital structure is irrelevant — firm value depends only on the assets. WACC is constant; ke rises exactly enough to offset cheaper debt.
- *MM with taxes, no distress costs*: the interest tax shield makes 100% debt optimal.
- *Static trade-off*: value rises with debt until the present value of financial distress costs outweighs the shield — an interior optimum where WACC is minimised.
- *Pecking order*: managers prefer internal funds, then debt, then external equity, because issuance signals information. An equity issue is generally read as a negative signal.
- *Agency costs* of free cash flow fall as debt rises, since interest disciplines managers.

Debt capacity depends on cash-flow stability, asset tangibility, tax position, and the legal and institutional environment.

PORTFOLIO MANAGEMENT

The Portfolio Perspective and the Process

Evaluate every holding by its contribution to portfolio risk and return, not standalone. Three steps: *planning* (analyse the investor, draft the IPS), *execution* (asset allocation, security analysis, construction), *feedback* (monitor, rebalance, measure performance).

Investor types: individuals; and institutions — defined benefit pensions (long horizon, liability driven), endowments and foundations (very long horizon, spending requirement), banks and insurers (short horizon, liquidity and regulation heavy), sovereign wealth funds.

Pooled vehicles: mutual funds (open-end trade at NAV; closed-end trade at a premium or discount), ETFs, SMAs, hedge funds, private equity funds.

Investment Policy Statement

Objectives: return requirement and risk tolerance (willingness × ability — the *lower* of the two governs).

Constraints — "TTLLU":

- *Time horizon*
- *Taxes*
- *Liquidity* needs
- *Legal* and regulatory factors
- *Unique* circumstances

The IPS also sets the strategic asset allocation, rebalancing policy, benchmark and review schedule. Strategic asset allocation combines the IPS with capital market expectations and explains the bulk of return variation over time.

Risk and Return of an Asset

Nominal risk-free rate ≈ real risk-free rate + expected inflation. Required return adds default, liquidity and maturity premiums. Historically, higher average returns have come with higher standard deviation: small-cap equity > large-cap equity > corporate bonds > treasuries.

Efficient Frontier and the Capital Allocation Line

The *minimum-variance frontier* holds the lowest-variance portfolio at each return; the part above the global minimum-variance portfolio is the **Markowitz efficient frontier**. Investors choose the point where their highest attainable indifference curve is tangent to it — more risk-averse investors have steeper curves and settle lower on the frontier.

Adding a risk-free asset produces the *capital allocation line*; the best one, tangent to the efficient frontier, is the **capital market line**, whose tangency point is the market portfolio:

E(Rp) = Rf + [(E(RM) - Rf) / σM] σp

The slope is the market Sharpe ratio — the price of risk. Points below the tangency are lending portfolios; beyond it, borrowing (leveraged) portfolios.

Systematic Risk and the CAPM

total risk = systematic risk + unsystematic risk

Unsystematic (firm-specific) risk is diversified away at low cost — most of the benefit is captured within roughly 30 well-chosen securities — so investors are compensated only for **systematic** risk.

βi = Cov(Ri, RM) / σM^2 = ρi,M σi / σM

E(Ri) = Rf + βi [E(RM) - Rf]

Plotted with beta on the horizontal axis this is the **security market line**. **Assumptions**: risk-averse, utility-maximising investors; frictionless markets; homogeneous, single-period expectations; unlimited risk-free borrowing and lending; divisible assets.

Mispricing rule. Estimated return above the SML $\Rightarrow$ the security is **underpriced** — buy it. Estimated return below the SML $\Rightarrow$ **overpriced** — sell or short. On the SML $\Rightarrow$ fairly valued.

Performance Measures

Sharpe = $\frac{R_p - R_f}{\sigma_p}$ Treynor = $\frac{R_p - R_f}{\beta_p}$

$M^2 = (R_p - R_f) \frac{\sigma_M}{\sigma_p} - (R_M - R_f)$

$\alpha_p = R_p - [R_f + \beta_p(R_M - R_f)]$

Sharpe and M^2 price excess return per unit of **total** risk — right for an investor's entire wealth. Treynor and Jensen's alpha price it per unit of **systematic** risk — right for one sleeve of an already diversified portfolio. Sharpe and Treynor are ordinal rankings; M^2 and alpha are stated in percentage terms.

Behavioural Biases

Cognitive errors come from faulty reasoning and can be reduced with education and data.

- **Belief perseverance:** conservatism, confirmation, representativeness, illusion of control, hindsight.
- **Information processing:** anchoring and adjustment, mental accounting, framing, availability.

Emotional biases come from feeling and impulse; they are usually accommodated rather than corrected: loss aversion, overconfidence, self-control, status quo, endowment, regret aversion. Market-level consequences: momentum and herding, bubbles and crashes, the value and size anomalies, and the home bias.

Risk Management Framework

Risk management is not risk *minimisation* — it is bearing the right risks, in the right size, given a defined risk tolerance. The framework: establish governance and risk tolerance; identify and measure exposures; monitor against limits; then modify the exposure by *avoiding*, *accepting*, *transferring* (insurance, derivatives) or *mitigating* (hedging, diversification). Financial risks include market, credit and liquidity risk; non-financial risks include operational, model, settlement, regulatory, legal and solvency risk.

EQUITY INVESTMENTS

Functions of the Financial System

Allow entities to save, borrow, raise equity, manage risk, exchange assets and trade on information — and do so at a fair rate of return, with capital allocated to its most productive use. A well-functioning market is *operationally efficient* (low transaction costs) and *informationally efficient* (prices reflect information quickly).

Market Structures and Orders

- **Quote-driven (dealer):** investors trade against a dealer's inventory.
- **Order-driven:** orders are matched by rules — price then display then time precedence. Call markets batch; continuous markets trade whenever the market is open.
- **Brokered:** brokers locate a counterparty; used for illiquid, unique assets.

Execution instructions (how to fill): market, limit, all-or-nothing, hidden, iceberg.
Validity instructions (when it can fill): day, good-till-cancelled, immediate-or-cancel, fill-or-kill, stop.
Clearing instructions (how to settle): including whether a sell is a long sale or a short sale.
A *stop-buy* is placed above the market, a *stop-sell* below it.

Margin Transactions

leverage ratio = $\frac{1}{\text{initial margin \%}}$

levered return = HPR $\times$ leverage ratio

Price at which a maintenance margin call is triggered on a long position:

$P_{\text{call}} = P_0 \times \frac{1 - \text{initial margin \%}}{1 - \text{maintenance margin \%}}$

The investor's return is also reduced by margin interest, commissions and, for shorts, dividends payable to the lender.

Security Market Indexes

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

Simple, but high-priced shares dominate and splits force divisor adjustments; it implies an equal *number of shares* of each constituent.

value-weighted = $\frac{\sum (\text{current price} \times \text{shares})}{\sum (\text{base price} \times \text{base shares})} \times \text{base value}$

Reflects economic importance but drifts toward overvalued, large companies. *Equal-weighted* indexes need frequent rebalancing and tilt small-cap. *Float-adjusted* market-cap weighting is the modern standard.

Index uses: market sentiment gauge, benchmark, proxy for the market portfolio, and basis for index funds and ETFs.

Types of Equity Securities

Common shares carry residual claims and voting rights (statutory — one vote per share per issue; cumulative — votes may be concentrated, which helps minority holders). Preference shares rank ahead of common on dividends and liquidation and may be cumulative, participating, convertible or callable. Private equity is illiquid with negotiated pricing and limited disclosure. Cross-listed shares and depository receipts (sponsored ADRs carry voting rights; unsponsored do not) provide foreign exposure. A company creates value when ROE exceeds the cost of equity; book value records history, market value records expectations.

Market Efficiency

- **Weak form:** prices already reflect all past price and volume data. Technical analysis cannot generate abnormal risk-adjusted returns.
- **Semi-strong form:** prices adjust rapidly to all *public* information. Fundamental analysis of public data cannot generate abnormal returns; only private information can.
- **Strong form:** prices reflect public *and* private information; even insiders cannot earn abnormal returns. Empirical evidence rejects this form.

Efficiency improves with more analysts, better disclosure, lower trading costs and fewer restrictions on arbitrage and short selling.

Anomalies — calendar (January), momentum, overreaction, size, value, closed-end fund discounts, earnings surprise — mostly vanish after transaction costs or are artefacts of data mining.

Industry and Competitive Analysis

1. Define the industry and group comparable companies.
2. Survey size, growth and profitability history.
3. Analyse industry structure.
4. Examine external influences.
5. Analyse the strategies of individual companies.

Porter's five forces: rivalry among existing competitors; threat of new entrants; threat of substitutes; bargaining power of buyers; bargaining power of suppliers.

PESTLE: political, economic, social, technological, legal, environmental.

Generic strategies: cost leadership, differentiation, and focus on a niche using either.

Industry life cycle: embryonic $\rightarrow$ growth $\rightarrow$ shakeout $\rightarrow$ mature $\rightarrow$ decline. Cyclical industries track the economy; defensive (non-cyclical) ones do not. Barriers to entry, concentration, capacity tightness and market-share stability jointly determine industry pricing power.

Company Analysis and Forecasting

Examine the business model, the revenue drivers (volume $\times$ price), the cost structure (fixed versus variable, hence operating leverage), the competitive position and capital intensity. Forecasts are built either *top-down* (economy $\rightarrow$ industry $\rightarrow$ company, using market-share assumptions) or *bottom-up* (from units, stores or contracts upward). A *hybrid* approach cross-checks the two. Always test the forecast against capacity, historical margin ranges and peer benchmarks.

Dividend Discount Models

One-period model — use the *expected* dividend D_1 :

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

Multi-period model:

$V_0 = \sum_{t=1}^n \frac{D_t}{(1 + k_e)^t} + \frac{P_n}{(1 + k_e)^n}$

Gordon (constant growth) model:

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

Assumptions: the company pays dividends; growth is constant forever; and $k_e > g_c$, or the model breaks down.

- As the spread $k_e - g_c$ widens, value falls.
- As it narrows, value rises.
- Small changes in the spread produce very large changes in value — always sensitivity-test it.

Supernormal (multi-stage) growth: discount each explicit high-growth dividend, then apply the Gordon model at the point growth becomes constant to obtain the terminal value $P_n = \frac{D_{n+1}}{k_e - g_c}$, and discount that back too.

$g = \text{retention rate} \times \text{ROE} = (1 - \text{payout}) \text{ROE}$

Preferred stock with a fixed perpetual dividend: $V_0 = D_p / k_p$.

Free Cash Flow to Equity

FCFE is the cash available to common shareholders after debt payments and reinvestment — useful when a firm pays no dividend or pays one unrelated to its capacity:

$\text{FCFE} = \text{CFO} - \text{FCInv} + \text{net borrowing}$

Discount FCFE at the required return on equity; discount FCFE at WACC and then subtract the market value of debt.

Price and Enterprise Value Multiples

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

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

Justified P/E from the Gordon model — the earnings multiplier:

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

So P/E rises with the payout ratio and growth, and falls as required return rises.

$\frac{P}{B} = \frac{\text{price per share}}{\text{book value per share}}; \quad \frac{P}{S} = \frac{\text{price per share}}{\text{sales per share}}$

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

Enterprise value = market value of common and preferred equity + debt — cash and short-term investments; EV/EBITDA is capital-structure neutral and works where earnings are negative.

- **P/E** fails with negative or volatile earnings and is exposed to accounting choices.
- **P/B** suits financials and asset-heavy firms; it is distorted by intangibles and buybacks.
- **P/S** is hardest to manipulate but ignores the cost structure entirely.

Multiples may be applied as *comparables* (relative to peers or history) or as *justified* multiples derived from fundamentals.

Asset-Based Valuation

Value equity as the market value of assets less the market value of liabilities. Most reliable for firms with liquid, marketable assets and little intangible value — financial institutions, natural-resource and holding companies — and least reliable for going concerns with substantial brand or human capital, or where inflation has left book values stale.

FIXED INCOME

Price, Yield and Coupon

Prices and yields move **inversely**.

- Coupon rate $<$ yield $\Rightarrow$ the bond trades at a *discount*.
- Coupon rate = yield $\Rightarrow$ trades at *par*.
- Coupon rate $>$ yield $\Rightarrow$ trades at a *premium*.

Constant-yield price trajectory: holding the yield fixed, a discount bond's price rises and a premium bond's price falls toward par as maturity approaches (the "pull to par"). Gains and losses are measured against this trajectory, not against the purchase price. **Other things equal**, a *lower coupon* and a *longer maturity* both make price more sensitive to a yield change. Price rises from a yield fall exceed price declines from an equal yield rise — this convexity is why duration alone understates the gain.

Bond Features

Issuers: sovereigns, non-sovereign and local governments, quasi-government agencies, supranationals, corporations, special purpose entities.
Maturity: money market $\leq$ one year; capital market beyond one year; perpetuals never mature.
Par (face) value is the principal repaid; *coupon* is an annual percentage of par, fixed or floating, divided by the periodicity to give the periodic rate.
Seniority: secured $>$ senior unsecured $>$ subordinated (junior). Secured bonds are backed by identified collateral; unsecured bonds are general claims on the issuer's cash flows and assets.
Covenants: affirmative (what the issuer must do — pay on time, maintain ratios, insure assets) and negative (what it must not do — pledge assets, over-borrow, sell key subsidiaries).
Legal/tax: bearer versus registered; some issues are tax-exempt; original-issue discount accrues taxable interest without cash.

Cash Flow Structures

- **Bullet:** coupons only, entire principal at maturity.
- **Fully amortising:** equal payments containing both interest and principal; nothing outstanding at maturity.
- **Partially amortising:** periodic principal plus a balloon payment at maturity.
- **Sinking fund:** scheduled early retirement of part of the issue — reduces credit risk, adds reinvestment risk.
- **Floating-rate note:** coupon = reference rate + quoted margin, reset each period.
- **Step-up, credit-linked, payment-in-kind, deferred and index-linked** coupons. Inflation-linked bonds adjust either the coupon (interest-indexed) or the principal (capital-indexed).

Embedded Options

Option	Benefits	Yield	Duration
Callable	Issuer	Higher	Lower
Puttable	Bondholder	Lower	Lower
Convertible	Bondholder	Lower	—

A *call* lets the issuer refinance when rates fall, so investors demand compensation. A *put* lets the holder sell the bond back, so investors accept less. A *convertible* is exchangeable for the issuer's common shares; *warrants* are usually detachable rights

to buy shares at a set price. Conversion value = share price × conversion ratio.

Bond Markets and Issuance

Domestic bonds: local issuer, local currency. Foreign bonds: foreign issuer, local currency and rules (Yankee, Bulldog, Samurai). Eurobonds are issued outside the jurisdiction of the currency of denomination, are less regulated and are usually unsecured and bearer form. Global bonds trade in a national market and the eurobond market simultaneously.

Underwritten offering: the bank buys the entire issue and resells it, bearing the risk. Best efforts: the bank acts only as agent. Shelf registration: register once, issue in tranches over time. Auctions are standard for sovereign issuance (single-price or multiple-price). Private placements skip the public market. Secondary trading is mostly over the counter, dealer-based, with settlement T + 1 for governments and T + 2 for corporates in most markets.

Repurchase Agreements

A repo is a sale with an agreement to repurchase — economically a collateralised short-term loan. The repo rate is the annualised percentage difference between the sale and repurchase prices; it is lower when the collateral is high quality, delivered to the lender, in short supply, and when the term is short. Initial margin is collateral in excess of the loan; the haircut:

haircut = 1 - 1 / initial margin

Bond Pricing and Accrued Interest

Value a bond as the present value of its cash flows at the appropriate discount rate(s) — either one yield to maturity or a series of spot rates.

full price = PV_{last coupon date} × (1 + YTM / m)^{t / T}

where m is the number of periods per year, t the days since the last coupon and T the days in the coupon period.

accrued interest = coupon × days from last coupon to settlement / days in the coupon period

Flat (clean) price = full price - accrued interest. Bonds are quoted flat; the buyer pays the full price. Day counts: actual/actual for government bonds, 30/360 for most corporates. Matrix pricing estimates the yield on an illiquid or new bond from actively traded bonds of similar credit quality and maturity, using linear interpolation to adjust for maturity differences.

Yield Measures

Effective annual yield depends on periodicity; for an annual-pay bond, YTM equals the effective yield. Semiannual bond basis = 2 × the semiannual discount rate. To compare bonds with different periodicities, convert to a common basis.

current yield = annual coupon / flat price

Simple yield adds straight-line amortisation of the discount or premium to the current yield. Yield to call uses the call date and call price; yield to worst is the lowest of all YTCs and the YTM. Street convention ignores holidays; true yield does not.

A YTM is only realised if the bond is held to maturity, the issuer pays in full, and every coupon is reinvested at that same yield. Money-market instruments quote either a discount basis (understates the return, uses face value as the denominator) or an add-on basis, and may use a 360- or 365-day year. Bond-equivalent yield is an annualised add-on yield on a 365-day year.

Yield Spreads

- G-spread: basis points over an interpolated government bond yield.
- I-spread: basis points over the swap rate for the same tenor.
- Z-spread: the constant spread added to every spot rate that makes the present value equal the price — it respects the shape of the curve.
- Option-adjusted spread (OAS): the Z-spread stripped of the value of any embedded option, so bonds with and without options can be compared. For a callable bond, OAS = Z-spread - option cost.

A spread widens with deteriorating credit quality, worsening liquidity and rising macro uncertainty.

Floating-Rate Notes

The quoted margin is fixed at issue over the market reference rate. The required (discount) margin is the spread that would price the note at par today. If credit quality deteriorates, the required margin exceeds the quoted margin and the note trades below par; if it improves, the note trades above par. Because the coupon resets, an FRN's duration is short — roughly the time to the next reset.

Spot and Forward Rates

A spot rate is the yield on a zero-coupon bond of a given maturity; the no-arbitrage price of any bond is the present value of its cash flows at the corresponding spot rates. A forward rate applies to a loan starting later — "1y3y" is the three-year rate beginning one year from now.

(1 + S₂)² = (1 + S₁)(1 + y_{1y})

More generally (1 + S_{A+B})^{A+B} = (1 + S_A)^A (1 + A y_{B y})^B. Forward rates above spot rates imply an upward-sloping curve.

Curve shapes and theories: pure expectations (forwards are unbiased forecasts); liquidity preference (a term premium makes the curve upward-sloping on average); segmented markets (supply and demand within maturity buckets); preferred habitat (investors leave their habitat only for adequate compensation). An inverted curve has historically preceded recessions.

Interest Rate Risk

A change in yield has two opposing effects on a horizon return: market price risk (price falls when yields rise) and reinvestment risk (coupons are reinvested at a higher rate).

- Investors with a short horizon are dominated by price risk.
- Investors with a long horizon are dominated by reinvestment risk.
- At a horizon equal to the bond's Macaulay duration the two exactly offset, and the realised return is locked in.

Macaulay duration is the weighted average time until the bond's cash flows are received, using the present value of each flow as its weight.

Duration and Convexity

modified duration = Macaulay duration / (1 + r)
approx. mod. duration = (V₋ - V₊) / (2 V₀ Δy)

Modified duration estimates the percentage price change for a 1% change in the bond's own yield. Money duration = modified duration × full price; a price value of a basis point is the money change for one basis point.

approx. convexity = (V₋ + V₊ - 2V₀) / (V₀(Δy)²)

%Δprice ≈ -duration × Δy + ½ × convexity × (Δy)²

The convexity term is always positive for an option-free bond, so duration alone understates gains and overstates losses.

Effective duration is required whenever cash flows are uncertain — callable, putable and mortgage-backed securities — because it shocks the entire benchmark curve rather than the bond's own yield:

effective duration = (V₋ - V₊) / (2V₀ Δcurve)

A callable bond exhibits negative convexity at low yields; a putable bond's price is supported at high yields. Key rate durations isolate sensitivity to individual points on the curve, capturing non-parallel shifts.

Portfolio duration is the market-value-weighted average of the constituent durations.

Credit Risk and Credit Analysis

Components: default risk (probability of failing to pay), loss severity (the fraction lost given default), spread risk (deterioration short of default), plus downgrade and market-liquidity risk.

expected loss = probability of default × loss given default
loss given default = 1 - recovery rate

Bottom-up (the Cs of credit): Capacity to repay, Capital (equity cushion), Collateral quality, Covenants protecting lenders, Character of management.

Top-down: Conditions in the economy and industry, Country risk, Currency of the obligation.

Key ratios: leverage (debt/EBITDA, debt/capital), coverage (EBIT/interest, EBITDA/interest) and margins. Higher leverage and thinner coverage mean weaker credit.

Ratings: investment grade is Baa3/BBB- and above; below that is high yield (Ba1/BB+ and lower). A corporate family rating applies to the issuer; a corporate credit rating applies to a specific issue and reflects seniority and covenants — so issue ratings can be notched above or below the issuer rating. Ratings are not perfectly correlated with default, lag the market and do not measure price volatility.

Sovereign analysis weighs both ability and willingness to pay: institutions, growth, external position, fiscal strength and monetary flexibility. Local-currency ratings usually exceed foreign-currency ratings. Non-sovereign government debt is either general obligation (backed by taxing power) or revenue-backed (repaid only from a specific project).

Securitization

The originator sells assets to a bankruptcy-remote special purpose entity, which issues securities backed by them. Benefits: the pool is legally separated from the sponsor's credit, investors get direct access to the cash flows, and tranching creates risk profiles that suit different buyers. Time tranching redistributes prepayment risk; credit tranching redistributes default risk.

Internal credit enhancement: overcollateralisation, excess spread, and a senior/subordinated waterfall in which junior tranches absorb losses first.

External credit enhancement: surety bonds, letters of credit, cash collateral accounts.

Mortgage- and Asset-Backed Securities

RMBS. Agency issues contain only conforming loans (size, loan-to-value and documentation limits) and carry a guarantee; non-agency issues may hold non-conforming loans and therefore need credit enhancement. Prepayment is the central risk: contraction risk when rates fall and prepayments accelerate, extension risk when rates rise and they slow. Measured by the single monthly mortality rate, conditional prepayment rate and PSA benchmark; weighted average life replaces stated maturity.

CMOs carve a pass-through pool into tranches — sequential-pay, or planned amortisation class (PAC) tranches whose prepayment risk is absorbed by support tranches.

CMBS are backed by non-recourse commercial mortgages, so the analysis turns on the debt-service-coverage ratio and loan-to-value, with call protection through lockouts, defeasance and yield-maintenance charges; balloon risk replaces prepayment risk.

Other ABS: credit-card receivables (non-amortising, with a lock-out then amortisation period), auto loans (amortising, prepayments less rate-sensitive), and CDOs, which are actively managed by a collateral manager and depend on the spread between collateral yield and funding cost.

DERIVATIVES

Derivative Features and Markets

A derivative's value is derived from an underlying asset, rate, index or event. Forward commitments — forwards, futures and swaps — create a firm obligation with a symmetric, linear payoff. Contingent claims — options, credit derivatives, and the options embedded in bonds — give a right but not an obligation, so the payoff is asymmetric.

Exchange-traded derivatives are standardised, centrally cleared and margined, which minimises counterparty risk but limits customisation. OTC derivatives are bespoke and bilateral, at the cost of counterparty exposure and lower transparency.

Benefits: risk transfer and hedging, price discovery, lower transaction costs, efficient leverage, ability to take positions otherwise unavailable.

Risks: leverage magnifies losses, opacity, basis risk, liquidity risk and counterparty default.

Issuer uses are hedging (cash flow, fair value, net investment); investor uses are hedging, directional exposure and yield enhancement.

Arbitrage, Replication and Cost of Carry

Law of one price: two positions with identical future cash flows in every state of the world must trade at the same price today; if they do not, riskless arbitrage profit exists. A combination with a certain payoff must earn the risk-free rate — which is why derivatives are priced by risk-neutral (not expected-return) methods and no risk premium enters.

Replication: long asset + short forward = risk-free asset; long asset - risk-free asset = long forward.

Cost of carry: carrying the underlying costs money (storage, insurance, financing) and may pay benefits (dividends, coupons, convenience yield). Forward price = future value of the spot price, plus carrying costs, less carrying benefits.

Prices versus Values

The price of a forward, futures or swap is written into the contract and is set so that the contract's value at initiation is zero. As the underlying moves, the value becomes positive for one party and equally negative for the other. Value of a long forward at time t:

V_t(T) = [S_t + PV_t(costs) - PV_t(benefits)] - (F₀(T) / (1 + R_f)^{T-t})

At expiration the value is simply S_T - F₀(T).

Futures versus Forwards

Futures are standardised, exchange-traded and cleared through a central counterparty, with initial and maintenance margin and daily mark-to-market settlement of gains and losses. Forwards are customised, bilateral and typically settled only at expiration. Daily settlement means futures carry interest-rate reinvestment effects: when rates are positively correlated with the underlying's price, futures prices slightly exceed forward prices, and the reverse when the correlation is negative. Otherwise the two prices are equal.

Interest Rate Derivatives

A forward rate agreement fixes a borrowing or lending rate for a future period; the long gains when the reference rate rises above the contract rate, and settlement is the discounted interest difference.

An interest rate swap exchanges fixed for floating payments on a notional principal. It can be replicated by a series of FRAs, or as the difference between a fixed-rate and a floating-rate bond. The swap fixed rate is set so that the present values of the two legs are equal — the contract is worth zero at initiation — and value shifts thereafter as the curve moves.

Options

- Long call — bullish, right to buy; loss limited to the premium, gain unlimited.
- Short call — bearish/neutral, obligation to sell; gain limited to the premium, loss unlimited.

- *Long put* — bearish, right to sell; loss limited to the premium.
- *Short put* — bullish/neutral, obligation to buy.

call intrinsic value = max(0, $S - X$)

put intrinsic value = max(0, $X - S$)

Option premium = intrinsic value + time value; time value decays to zero at expiration. A call is in the money when $S > X$, a put when $S < X$.

American options may be exercised at any time up to expiration; *European* options only at expiration. An American option is therefore worth at least as much as an equivalent European one, though early exercise of a call on a non-dividend-paying stock is never optimal.

Factors Affecting Option Value

An increase in...	Calls	Puts
Price of the underlying	Increase	Decrease
Exercise price	Decrease	Increase
Risk-free rate	Increase	Decrease
Volatility of the underlying	Increase	Increase
Time to expiration	Increase	Increase*
Costs of holding the underlying	Increase	Decrease
Benefits of holding the underlying	Decrease	Increase

*Except for some deep-in-the-money European puts, where more time delays receipt of the exercise price.

Put-Call Parity

For European options on the same underlying with the same strike and expiration:

$$c + \frac{X}{(1 + R_f)^T} = S + p$$

A *fiduciary call* (call plus a risk-free bond maturing at X) has the same payoff as a *protective put* (the asset plus a put). Rearranged, any one instrument is synthesised from the other three:

$$S = c - p + \frac{X}{(1 + R_f)^T} \quad p = c - S + \frac{X}{(1 + R_f)^T}$$
$$c = S + p - \frac{X}{(1 + R_f)^T} \quad \frac{X}{(1 + R_f)^T} = S + p - c$$

Put-call forward parity: substitute the present value of the forward price, $F_0(T)/(1 + R_f)^T$, wherever S appears.

One-Period Binomial Model

The underlying moves to $S^+ = S_0u$ or $S^- = S_0d$, where $d = 1/u$. The *risk-neutral probability* of an up move:

$$\pi_u = \frac{1 + R_f - d}{u - d}, \quad \pi_d = 1 - \pi_u$$

Value the option as the expected payoff under these probabilities, discounted at the risk-free rate:

$$c_0 = \frac{\pi_u c^+ + \pi_d c^-}{1 + R_f}$$

These are *not* real-world probabilities, and the underlying's expected return never enters. The same value follows from building a hedge portfolio of the underlying and the option that is riskless.

ALTERNATIVE INVESTMENTS

Features and Structures

Alternatives differ from traditional assets in their illiquidity, use of leverage and short selling, limited regulation and disclosure, concentrated positions, difficult valuation and higher fees. The classic vehicle is a *limited partnership*: the general partner runs the fund and bears unlimited liability; limited partners supply capital and are liable only for it. Access may also be through funds of funds (diversification and due diligence, at a second layer of fees), separately managed accounts, or co-investment alongside the GP.

Life Cycle

- *Capital commitment*: LPs pledge capital; the GP sources deals and issues capital calls on undrawn commitments.
- *Capital deployment*: capital is invested and the GP works actively with the portfolio companies or assets.
- *Capital distribution*: successful investments are realised and proceeds returned. The *J-curve* describes early negative returns from fees and write-downs before gains appear.

Fees and Waterfalls

- "2 and 20": a 2% management fee plus 20% of profits. Hedge funds charge management fees on assets under management; private equity charges on *committed* capital during the investment period.
- *Hard hurdle*: the incentive fee applies only to the return *above* the hurdle rate.

- *Soft hurdle*: once the hurdle is cleared, the incentive fee applies to the *entire* return.
- *High water mark*: no incentive fee until the value exceeds the previous peak, preventing charges for recovering earlier losses.
- *Clawback*: LPs can reclaim incentive fees already paid if later losses reverse the earlier gains.
- *Deal-by-deal (American) waterfall*: the GP takes carry as each deal is realised — favourable to the GP.
- *Whole-of-fund (European) waterfall*: LPs receive all distributions until their capital plus the hurdle is returned — favourable to the LP.

Fund-of-funds investors pay fees at both levels, so net returns fall well below gross.

Valuation and Redemption Terms

Fair value hierarchy: **Level 1** — quoted prices in active markets for identical assets; **Level 2** — observable inputs or model values based on them; **Level 3** — unobservable inputs, few or no comparable transactions. Level 3 dominates private capital and gives managers valuation discretion, which smooths reported returns and understates measured volatility and correlation.

Lockup period: the interval after investment during which redemption is barred or heavily penalised.

Notice period: the advance warning a fund requires before meeting a redemption, typically 30–90 days.

Gate: a temporary cap on the proportion of the fund that may be redeemed in any period.

Hedge Fund Strategies

- *Event driven*: merger arbitrage, distressed and restructuring, activist shareholder, special situations.
- *Relative value*: convertible arbitrage, fixed-income arbitrage (general and asset-backed), volatility, multi-strategy.
- *Equity*: market neutral, fundamental growth, fundamental value, long/short, short bias.
- *Opportunistic*: global macro, managed futures (CTAs).

Private Capital

Private equity. **Leveraged buyouts** acquire mature, cash-generative companies with heavy debt — management buyouts retain the existing team, management buy-ins install a new one.

Venture capital funds young companies: *formative* (angel, seed, early stage), *later* stage (expanding production and sales), and *mezzanine* stage (preparing for an IPO). Exit routes: trade sale, IPO, secondary sale to another sponsor, recapitalisation, or write-off.

Private debt. Direct lending, mezzanine (subordinated debt with equity features), venture debt, distressed debt and unitranche facilities. Returns come from illiquidity and complexity premiums; the analysis is credit analysis.

Real Estate and Infrastructure

Real estate covers residential and commercial property, REITs, mortgage-backed securities, whole loans and construction loans. It offers income plus a partial inflation hedge, but is illiquid, heterogeneous and appraisal-priced. Approaches: comparable sales, income (direct capitalisation, where value = NOI / cap rate, or discounted cash flow) and cost.

Infrastructure means long-lived assets for public use — transport, utilities, communications and social assets. *Greenfield* projects build new assets, often on a build-operate-transfer basis; *brown-field* investments upgrade existing ones; secondary-stage assets need no further development. Cash flows are long-dated, often regulated or contracted, and frequently inflation-linked — attractive to liability-driven investors but exposed to regulatory and political risk.

Natural Resources and Commodities

Commodity exposure is usually taken through *futures* rather than physical holdings. Total return = spot return + roll return + collateral return.

$$F_0 \approx S_0(1 + R_f) + \text{storage costs} - \text{convenience yield}$$

- *Contango*: futures price > spot price — rolling forward produces a negative roll return.
- *Backwardation*: futures price < spot price — rolling produces a positive roll return, typical when convenience yield is high.

Timberland offers biological growth plus optional harvest timing; farmland yields crop income plus land appreciation. Both provide partial inflation protection.

Digital Assets

Distributed ledgers record transactions across a network without a central authority, secured by consensus mechanisms (proof of work, proof of stake) and cryptography; permissionless ledgers are open to all, permissioned ledgers restrict participation. *Cryptocurrencies* are non-income-producing and have no intrinsic cash flow, so valuation rests on supply limits and adoption; *stablecoins* peg to a fiat currency or a basket by collateral or algorithm; *tokens* may be utility, security, governance or non-fungible. Exposure can be direct (coins, wallets), or indirect (fu-

tures, exchange-traded products, equity in exchanges and miners, venture funds). Risks: extreme volatility, custody and key loss, exchange failure, immature regulation, and correlations that rise sharply in stressed markets.

Alternative Investment Performance

Reported returns are flattered by *survivorship* and *backfill* bias and smoothed by appraisal-based valuation, which understates volatility and correlation with traditional assets. For private funds, use money-weighted measures — IRR and the multiples MOIC, DPI (realised), RVPI (unrealised) and TVPI (total) — rather than time-weighted returns, because the GP controls the timing of cash flows. Non-normal return distributions with negative skew and fat tails make the Sharpe ratio a poor risk measure; downside measures such as the Sortino ratio are more appropriate.

EXAM-DAY ESSENTIALS

Calculator Setup (BA II Plus)

- *Decimals*: 2ND → FORMAT → set DEC = 9. Rounding at intermediate steps is a common source of near-miss answers.
- *Payments per year*: 2ND → P/Y = 1. Then work in *periods*, not years, and convert the rate yourself.
- *Chain mode*: 2ND → FORMAT → Chn rather than AOS.
- *Clear before every problem*: 2ND CLR TVM for the TVM keys, 2ND CLR WORK inside the cash-flow and statistics worksheets.
- *Sign convention*: inflows positive, outflows negative. PV and FV must carry *opposite* signs or the calculator returns an error.
- *Annuity due*: 2ND → BGN → SET. Remember to switch back to END.

Decision Rules at a Glance

Measure	Act when
NPV	> 0 — accept the project
IRR	> required return — accept
Profitability index	> 1 — accept
ROIC	> WACC — value is created
p-value	< α — reject H_0
Return vs. the SML	Above $\Rightarrow$ buy; below $\Rightarrow$ sell
Coupon vs. yield	Coupon > yield $\Rightarrow$ premium
Required vs. quoted margin	Required > quoted $\Rightarrow$ FRN below par
Willingness vs. ability	Take the <i>lower</i> as risk tolerance
Conflicting NPV and IRR	Always follow NPV

Commonly Confused Pairs

- *Type I* vs. *Type II*. Type I rejects a true null (a false positive, probability α); Type II fails to reject a false null.
- *Macaulay* vs. *modified* vs. *effective duration*. Macaulay is measured in *years* and identifies the immunising horizon; *modified* is a *percentage* price sensitivity to the bond's own yield; *effective* shocks the benchmark *curve* and is the only valid choice when cash flows are uncertain.
- *Contango* vs. *backwardation*. Contango means futures above spot and a negative roll return; backwardation is the reverse.
- *Hard* vs. *soft hurdle*. A hard hurdle charges the incentive fee only on the excess return; a soft hurdle charges it on the whole return once the hurdle is cleared.
- *American* vs. *European waterfall*. Deal-by-deal (American) pays the GP earlier and favours the GP; whole-of-fund (European) favours the LP.
- *Sharpe* vs. *Treynor*. Sharpe divides by total risk, Treynor by beta. Use Sharpe for a whole portfolio, Treynor for a component of a diversified one.
- *CML* vs. *SML*. The CML plots efficient portfolios against *total* risk (σ); the SML plots any asset against *systematic* risk (β).
- *Capitalising* vs. *expensing*. Capitalising raises near-term income, assets and equity, smooths earnings and shifts the outflow to CFI.
- *DTL* vs. *DTA*. A DTL arises when taxable income is currently below pretax income; a DTA when it is above.
- *Price* vs. *value of a forward*. The price is fixed in the contract; the value starts at zero and moves with the underlying.

Units and Conversions to Watch

Basis points: 100 bps = 1%. Convert an annual rate to a periodic rate by dividing by the periodicity, and a periodic rate to an effective annual rate by compounding, never by multiplying. Match the frequency of the cash flows to the frequency of the discount rate before touching the calculator. Percentage changes in a currency quote must be measured against whichever currency you have designated as the base — invert the quote first if the question changes the base.

Answering strategy. Every Level I item is standalone and unpenalised for a wrong guess, so answer all of them. Read the final sentence of the stem first to learn what is actually being asked, then eliminate the option that contradicts a definition — one distractor is usually the correct calculation with a sign or frequency error, so check units before arithmetic.