

CFA® Level I

One-Page Learning Module Summaries

Portfolio Management

6 learning modules · one page each · built from CFA Program Level I curriculum, Volume 9

How each page works

■ Module banner	Exact module title, exam relevance (High/Medium/Low-yield) and whether it is calculation- or concept-heavy.
■ The big picture	Two or three sentences of intuition: why the module exists.
■ Learning outcomes	Every LOS of the module, in book order, rewritten as what you must know or do.
■ Key formulas / key facts	Formulas in curriculum notation with every variable defined; fact tables for concept modules.
■ Worked example	One numerical example (or a short Ethics case). Tagged [CFA curriculum] when taken from the curriculum, [Illustrative] when made up by RBei.
■ What examiners like to test	Traps, key distinctions and typical question angles.

Notes. (1) The curriculum lists LOS without letters; “LOS 1, 2, 3” follows the order in the book. (2) Exam relevance is RBei’s judgement from the number of LOS, the calculation LOS and the weight of worked examples and practice problems in each module; the curriculum does not rate modules. (3) [India context, not curriculum] marks Indian examples added for context; they are not curriculum. (4) [Note: ...] marks places where the curriculum is inconsistent or offers two framings.

Contents

LM 1	Portfolio Risk and Return: Part I	2
LM 2	Portfolio Risk and Return: Part II	3
LM 3	Portfolio Management: An Overview	4
LM 4	Basics of Portfolio Planning and Construction	5
LM 5	The Behavioral Biases of Individuals	6
LM 6	Introduction to Risk Management	7

Module 1 — Portfolio Risk and Return: Part I

Topic: Portfolio Management · Exam relevance: **High-yield** · Calculation + concept

The big picture

Investors dislike risk, so they demand extra return to bear it; the utility function turns that dislike into a number (A) and into indifference curves. Portfolio **return** is a weighted average, but portfolio **risk** is not: whenever correlation is below $+1$, combining assets cuts risk without cutting return. Adding a risk-free asset gives a straight capital allocation line; each investor picks the point where his indifference curve touches it.

Learning outcomes in plain language

- LOS 1 Major asset classes.** Historically (US) small caps > large caps > bonds > T-bills in both return and risk; compare periods with **real**, geometric-mean returns. Returns are **negatively skewed** with **fat tails**, and **liquidity** (bid-ask spread, price impact) adds trading cost.
- LOS 2 Risk aversion.** Sure GBP 50 vs a 50/50 gamble on GBP 100 or 0: risk averse ($A > 0$) takes the sure thing, risk neutral ($A = 0$) is indifferent (cares only about return), risk seeking ($A < 0$) gambles. Markets price assets for risk-averse investors.
- LOS 3 Optimal portfolio.** Indifference curves are convex, never cross, and are steeper for more risk-averse investors. The optimal investor portfolio is the **tangency** of the highest attainable indifference curve with the CAL. By **two-fund separation**, the optimal *risky* portfolio is the same for everyone; only the lend/borrow mix depends on A .
- LOS 4 Mean, variance, covariance from history.** Use historical returns to estimate mean, variance (σ^2) and covariance; convert with $\text{Cov}_{12} = \rho_{12}\sigma_1\sigma_2$. Covariance is unbounded (units $\%^2$); correlation lies in $[-1, +1]$. Historical risk and correlations are more stable than mean returns.
- LOS 5 Portfolio standard deviation.** Calculate two- and three-asset σ_p from weights, σ 's and correlations (or covariances), including a foreign asset treated as asset + currency.
- LOS 6 Less-than-perfect correlation.** $\rho = +1$: $\sigma_p = w_1\sigma_1 + w_2\sigma_2$ (no benefit); $\rho < 1$: σ_p below the weighted average; $\rho = -1$: σ_p can be zero. With many equal-weighted assets, average covariance (correlation) dominates portfolio risk.
- LOS 7 Frontiers.** The **minimum-variance frontier** holds the lowest-risk portfolio for each return; its left-most point is the **global minimum-variance portfolio**; the part above it is the **Markowitz efficient frontier**, whose slope falls as risk rises.

Key formulas

Notation: $E(R)$ expected return; σ standard deviation; w weights ($\sum w_i = 1$); ρ_{12} correlation; A risk-aversion coefficient; R_f risk-free rate; w_1 = weight in R_f on the CAL. Returns and σ in **decimals** inside U .

$$U = E(r) - \frac{1}{2}A\sigma^2 \quad E(R_p) = \sum_{i=1}^N w_i E(R_i) \quad \sigma_p^2 = w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\rho_{12}\sigma_1\sigma_2 \quad \text{Cov}(R_1, R_2) = \rho_{12}\sigma_1\sigma_2$$

$$\sigma_p^2 = \frac{\bar{\sigma}^2}{N} + \frac{N-1}{N}\overline{\text{Cov}} \quad (\text{equal weights}) \quad \text{CAL: } E(R_p) = R_f + \frac{E(R_i) - R_f}{\sigma_i} \sigma_p, \quad \sigma_p = (1 - w_1)\sigma_i$$

Foreign asset: $R_D = (1 + R_{lc})(1 + R_{FX}) - 1$, $\sigma_D = \sqrt{\sigma_{lc}^2 + \sigma_{FX}^2 + 2\rho_{lc,FX}\sigma_{lc}\sigma_{FX}}$. Three assets: add $w_3^2\sigma_3^2$ and a $2\rho_{ij}w_iw_j\sigma_i\sigma_j$ term for each pair. $w_1 < 0$ means borrowing at R_f ; CAL slope = market price of risk. Add a new asset if $\frac{E(R_{\text{new}}) - R_f}{\sigma_{\text{new}}} > \frac{E(R_p) - R_f}{\sigma_p} \rho_{\text{new},p}$.

Worked example (CFA curriculum)

(a) Utility ranking. Investments 1–4: $E(r) = 12\%, 15\%, 21\%, 24\%$; $\sigma = 30\%, 35\%, 40\%, 45\%$. With $A = 4$: $U_1 = 0.12 - 0.5(4)(0.30^2) = -0.0600$ (others $-0.0950, -0.1100, -0.1650$) $\Rightarrow$ choose **1**. With $A = 2$: $0.0300, 0.0275, \mathbf{0.0500}, 0.0375 \Rightarrow$ choose **3**. Risk-neutral and risk-seeking investors choose 4.

(b) Two-asset portfolio. 80% S&P 500 ($E = 9.93\%$, $\sigma = 16.21\%$), 20% MSCI EM ($E = 18.20\%$, $\sigma = 33.11\%$), $\text{Cov} = 0.0050$. $E(R_p) = 0.80(0.0993) + 0.20(0.1820) = \mathbf{11.58\%}$; $\sigma_p^2 = 0.01682 + 0.00439 + 0.00160 = 0.02281$, $\sigma_p = \mathbf{15.10\%}$: higher return and lower risk than the S&P 500 alone.

(c) Role of correlation. Two stocks, each 10% return and 20% risk, 50/50: $\rho = +1 \Rightarrow \sigma_p = 20\%$; $\rho = 0 \Rightarrow \sqrt{0.02} \approx 14\%$; $\rho = -1 \Rightarrow 0\%$. Return stays 10% throughout.

What examiners like to test

- **Units in utility:** use 0.30, not 30; $\frac{1}{2}A\sigma^2$ uses the *variance*. A risk-free asset gives every investor the same utility ($U = R_f$).
- **Weighted-average trap:** only return (and σ when $\rho = +1$) is a weighted average; the covariance term is doubled ($2w_1w_2\text{Cov}$).
- **Frontier vocabulary:** portfolios below the global minimum-variance portfolio are inefficient; the optimal *investor* portfolio depends on A , the optimal *risky* portfolio does not.

Module 2 — Portfolio Risk and Return: Part II

Topic: Portfolio Management · Exam relevance: High-yield · Calculation-heavy

The big picture

With lending and borrowing at R_f and homogeneous expectations, everyone holds the market portfolio and dials risk up or down along the capital market line. Nonsystematic risk can be diversified away for free, so only systematic risk (beta) earns a premium: the CAPM and its graph, the SML. Managers are then judged on total risk (Sharpe, M^2) or beta risk (Treynor, Jensen's alpha).

Learning outcomes in plain language

- LOS 1 Risk-free asset + risky portfolio.** Return and σ are both linear in the weight (a straight line); lending portfolios lie left of M , borrowing (leveraged) ones to the right; if $R_b > R_f$ the line is flatter beyond M .
- LOS 2 CAL vs CML.** A CAL joins R_f to any risky portfolio; the CML is the CAL whose risky portfolio is the **market** (homogeneous expectations). Slope = market price of risk.
- LOS 3 Systematic vs nonsystematic risk.** Total variance = systematic (market, non-diversifiable) + nonsystematic (firm-specific). No extra return for diversifiable risk: it can be removed at no cost, so only systematic risk is priced.
- LOS 4 Return-generating models.** Multi-factor (macroeconomic, fundamental, statistical; Fama–French, Carhart), single-index and the **market model** $R_i = \alpha_i + \beta_i R_m + e_i$, used to estimate beta and abnormal returns.
- LOS 5 Beta.** $\text{Cov}(R_i, R_m) / \sigma_m^2 = \rho_{i,m} \sigma_i / \sigma_m$; $\beta_m = 1$, $\beta_{R_f} = 0$; a negative beta moves against the market.
- LOS 6 CAPM and SML.** Assumes risk-averse utility maximisers, frictionless markets, one common holding period, homogeneous expectations, divisible assets, price takers. The SML plots $E(R)$ against **beta** and prices every asset.
- LOS 7 CAPM expected return.** $E(R_i) = R_f + \beta_i \times \text{MRP}$; a change in beta moves $E(R_i)$ by $\Delta\beta \times \text{MRP}$.
- LOS 8 Applications.** Project discount rate (NPV); performance appraisal; security selection (above SML = undervalued); adding non-index securities with weight $\propto \alpha_i / \sigma_{e_i}^2$.
- LOS 9 Performance measures.** Calculate Sharpe, Treynor, M^2 (M^2 alpha) and Jensen's alpha; total-risk measures for an investor's whole portfolio, beta measures for one part of a diversified portfolio.

Key formulas

Notation: R_f risk-free rate; $E(R_m)$, σ_m market return and risk; β_i beta; σ_e^2 nonsystematic variance; R_p , σ_p , β_p portfolio values (ex post: sample averages).

$$\text{CML: } E(R_p) = R_f + \left(\frac{E(R_m) - R_f}{\sigma_m} \right) \sigma_p \quad \sigma_i^2 = \beta_i^2 \sigma_m^2 + \sigma_e^2 \quad \beta_i = \frac{\text{Cov}(R_i, R_m)}{\sigma_m^2} = \frac{\rho_{i,m} \sigma_i}{\sigma_m}$$

$$\text{CAPM/SML: } E(R_i) = R_f + \beta_i [E(R_m) - R_f] \quad SR = \frac{R_p - R_f}{\sigma_p} \quad TR = \frac{R_p - R_f}{\beta_p} \quad \alpha_p = R_p - [R_f + \beta_p (R_m - R_f)]$$

$$M^2 = (R_p - R_f) \frac{\sigma_m}{\sigma_p} + R_f = SR \times \sigma_m + R_f \quad M^2 \text{ alpha} = M^2 - R_m$$

Borrowing at R_b : $E(R_p) = R_b + ([E(R_m) - R_b] / \sigma_m) \sigma_p$. Sharpe and Treynor need a positive numerator (Treynor also a positive beta). [Note: the curriculum calls the risk-adjusted return " M^2 " and its excess over the market " M^2 alpha"; some sources call the excess " M^2 ". Check which one a question asks for.]

Worked example (CFA curriculum)

(a) Performance appraisal. $R_f = 3\%$, market 9% ($\sigma_m = 19\%$). Manager X: $\bar{R} = 10\%$, $\sigma = 20\%$, $\beta = 1.1$. $E(R_X) = 0.03 + 1.1(0.06) = 9.6\%$; $SR = 0.07/0.20 = \mathbf{0.35}$; $TR = 0.07/1.1 = \mathbf{0.064}$; $M^2 = 0.35(0.19) + 0.03 = 9.65\%$, M^2 alpha = $\mathbf{0.65\%}$; $\alpha = 0.10 - (0.03 + 0.066) = \mathbf{0.40\%}$. Y (11%, 10%, 0.7): SR 0.80, TR 0.114, M^2 alpha 9.20%, α 3.80%. Z (12%, 25%, 0.6): SR 0.36, TR 0.150, M^2 alpha 0.84%, α 5.40%. **Y best on total risk, Z best on beta risk, X last on all four.**

(b) Beta and CAPM. $\sigma_i = 50\%$, $\rho = 0.95$, $\sigma_m = 25\%$, $R_m = 10\%$, $R_f = 3\%$: $\beta = 0.95(0.50)/0.25 = 1.90$, $E(R) = 0.03 + 1.90(0.07) = \mathbf{16.3\%}$. After $\sigma_i = 30\%$, $\rho = 0.75$: $\beta = 0.90$, $E(R) = \mathbf{9.3\%}$ (beta $-1.0 \Rightarrow$ return -7% , one MRP).

What examiners like to test

- CML vs SML:** the CML uses σ and holds only for efficient (fully diversified) portfolios; the SML uses β and prices every asset. Sharpe ratio = slope of the CAL.
- Ranking rules:** Sharpe and M^2 always rank identically; Treynor and Jensen's alpha use beta, so they can reverse a Sharpe ranking (Y vs Z above).
- Alpha sign:** actual (or forecast) return above the CAPM required return $\Rightarrow$ plots above the SML, undervalued, buy; below the SML $\Rightarrow$ overvalued, avoid or short.

Module 3 — Portfolio Management: An Overview

Topic: Portfolio Management · Exam relevance: Medium-yield · Concept-heavy

The big picture

Holding one company's shares (Enron employees' retirement plans) can wipe out an investor; a portfolio cuts risk far more than it cuts return. This module maps the topic: the three-step portfolio management process, the clients and their needs, the asset management industry, and the pooled products used to reach clients.

Learning outcomes in plain language

- LOS 1 Portfolio approach.** Judge each investment by its effect on the whole portfolio. Diversification cuts risk without necessarily cutting return (**portfolios affect risk more than returns**), but does not eliminate risk or give reliable downside protection (2008). **Diversification ratio** = $\sigma_{\text{equal-weighted portfolio}} / \sigma_{\text{random security}}$ (lower = more benefit).
- LOS 2 Process steps. Planning:** understand the client, write the IPS. **Execution:** asset allocation, security analysis, portfolio construction. **Feedback:** monitoring and rebalancing, performance measurement and reporting.
- LOS 3 Investor types.** Individuals (often saving for retirement) and institutions (table).
- LOS 4 DC vs DB plans.** **DC:** contributions defined, account in the employee's name; the **employee** bears investment and inflation risk. **DB:** the sponsor promises a defined retirement benefit and bears the funding risk; may match assets to liabilities. Sponsors increasingly favour DC.
- LOS 5 Asset management industry.** Active vs passive (passive $\approx$ a fifth of AUM, growing; smart beta); traditional (long-only, asset-based fees) vs alternative (performance fees; small share of AUM, large share of revenue); mostly privately owned. Trends: passive growth, big data, robo-advisers.
- LOS 6 Mutual funds vs other pooled products.** Open-end (shares issued/redeemed at NAV) vs closed-end (fixed shares, trade at a premium/discount to NAV); load vs no-load; money market, bond, stock and hybrid funds; compare with SMAs, ETFs, hedge funds, PE/VC.

Key facts

Client	Time horizon	Risk tolerance	Income needs	Liquidity needs
Individuals	Varies	Varies	Varies	Varies
DB pension plans	Typically long	Typically quite high	High (mature); low (growing)	Varies with maturity
Endowments & fdns	Very long	Typically high	Spending commitments	Typically quite low
Banks	Short	Quite low	Deposit interest, costs	High (deposit repayment)
Insurers	Short (P&C); long (life)	Typically quite low	Typically low	High (claims)
Investment cos.	Varies by fund	Varies by fund	Varies by fund	High (redemptions)
Sovereign wealth	Varies by fund	Varies by fund	Varies by fund	Varies by fund

SMA: owned directly by one client, customisable (ESG, tax), high minimum. **ETF:** trades intraday, can be shorted or bought on margin, pays out dividends, low minimum (mutual funds: once a day at NAV). **Hedge funds:** leverage, shorting, absolute return, 2% + up to 20% fees, restricted withdrawals. **PE/VC:** GP/LP partnerships, 7–10 year life, 1–3% fee on committed capital + carried interest (typically 20%).

[India context, not curriculum] SEBI-regulated open-ended and close-ended mutual fund schemes map onto these categories; NPS is a DC-type product.

Worked example (CFA curriculum)

Open-end fund. Seven investors put in USD 10 million; the fund issues 100,000 shares at a NAV of USD 100. Later NAV = USD 12 million, i.e. **USD 120** per share. New investor F invests USD 960,000 $\Rightarrow$ $960,000 / 120 = 8,000$ new shares. The same day investor E redeems 5,000 shares $\Rightarrow$ fund pays $5,000 \times 120 =$ **USD 600,000**. Net: +USD 360,000 to invest and +3,000 shares; other holders are unaffected.

Diversification ratio. Five HKSE shares: a randomly chosen share averaged 15.1% return with $\sigma = 24.9\%$; the equally weighted portfolio earned the same 15.1% with $\sigma = 17.9\%$. Ratio = $17.9 / 24.9 = 71.9\%$.

What examiners like to test

- **Which step?** Asset allocation is in the **execution** step; rebalancing is in the **feedback** step; the IPS is in the **planning** step.
- **Who bears the risk:** DC $\Rightarrow$ employee; DB $\Rightarrow$ sponsor. Banks and insurers have high liquidity needs and low risk tolerance; endowments have the longest horizon.
- **Product contrasts:** closed-end funds trade away from NAV; ETFs trade intraday; SMA assets are owned by the client.

Module 4 — Basics of Portfolio Planning and Construction

Topic: Portfolio Management · Exam relevance: **Medium-yield** · **Concept-heavy**

The big picture

The adviser first writes down what the client wants (return and risk objectives) and what limits the choice (constraints): the investment policy statement. IPS plus capital market expectations give the **strategic asset allocation** (policy weights); tactical deviations, security selection, rebalancing and ESG preferences are layered on top.

Learning outcomes in plain language

- LOS 1 Why a written IPS.** Starting point of the process: records objectives and constraints, the reference for suitability and review; sometimes legally required. Review regularly and after material changes.
- LOS 2 Components.** Introduction; statement of purpose; duties and responsibilities; procedures; investment **objectives**; investment **constraints**; investment guidelines; evaluation and review; appendices (strategic asset allocation, rebalancing policy).
- LOS 3 Risk and return objectives.** Risk: **absolute** (e.g. loss limit, VaR, σ) or **relative** to a benchmark (tracking risk), or liability-based (LDI). Return: absolute or relative, nominal or real, before or after fees and tax; must be realistic and consistent with risk.
- LOS 4 Willingness vs ability.** Ability is objective (horizon, income, wealth relative to liabilities); willingness is subjective (psychology, questionnaires). If they conflict, adopt the **lower** and document it.
- LOS 5 Constraints.** **Liquidity** (outflows need liquid, low-risk assets); **time horizon** (short $\Rightarrow$ avoid illiquid, risky assets); **tax** (taxable investors favour gains); **legal/regulatory** (pension limits, insider rules); **unique circumstances** (faith, values, human capital).
- LOS 6 Specifying asset classes.** Homogeneous within a class (high internal correlation), diversifying across classes (lower correlation), mutually exclusive, and together covering the investable universe.
- LOS 7 Portfolio construction.** SAA = IPS + capital market expectations. Then **risk budgeting** across SAA, **tactical allocation** and **security selection** (zero-sum); rebalance when drift breaches corridors. Newer: ETFs/robo-advice, risk parity.
- LOS 8 ESG integration.** Six approaches: negative screening, positive screening, ESG integration, thematic investing, engagement/active ownership, impact investing. Screens shrink the universe (use a matching benchmark).

Key formulas

$$\text{Nominal goal} = \text{Real goal} \times (1 + \text{inflation})^T, \quad \text{Required return: } \text{PV}(1 + r)^T = \text{Nominal goal}$$

$$U_p = E(R_p) - \lambda \sigma_p^2, \quad \sigma_p = \sqrt{\sum_i \sum_j w_{p,i} w_{p,j} \text{Cov}(R_i, R_j)}, \quad \text{TAA contribution} = \sum_i (w_{\text{actual},i} - w_{\text{policy},i}) \times R_i$$

λ = risk-aversion measure; T = years to goal. Tracking risk = σ of (portfolio – benchmark) returns: 2% implies within about 4% of the index roughly 95% of the time. [Note: LM1 writes utility as $U = E(r) - \frac{1}{2} A \sigma^2$; this module writes $U_p = E(R_p) - \lambda \sigma_p^2$. Both rank portfolios the same way (λ plays the role of $\frac{1}{2} A$); use the form the question gives.]

Risk tolerance grid: both below average $\Rightarrow$ below-average; both above $\Rightarrow$ above-average; mixed $\Rightarrow$ “resolution needed”.

Worked example (CFA curriculum)

Return objective (Marie Gascon). She has EUR 900,000 for retirement in 20 years and needs EUR 2,000,000 in today’s money; inflation 2%. Nominal target = $2,000,000 \times 1.02^{20} = \text{EUR } 2,971,895$ ($\approx$ EUR 3 million). Required return: $(2,971,895/900,000)^{1/20} - 1 = 6.15\%$, i.e. **about 6.2%** (EUR 900,000 at 6.2% for 20 years = EUR 2,997,318). Unique need: avoid oil stocks (her job is in oil).

Tactical allocation (European charity). Policy weights 30/15/20/20/15; the committee held European equities at 32% (upper corridor limit) instead of 30%. Next half-year returns: -9% , -6% , $+4\%$, $+4\%$, $+2\%$. TAA contribution = $(0.020)(-9\%) + (0.005)(-6\%) + (-0.011)(4\%) + (-0.009)(4\%) + (-0.004)(2\%) = -0.30\%$ of a total return of -2.0% .

What examiners like to test

- **Absolute vs relative:** “lose no more than JPY 1 billion” is absolute (restate as a 95% VaR); “within 4% of TOPIX” is relative (measure by tracking risk).
- **Ability vs willingness:** high ability + low willingness $\Rightarrow$ counsel, then go with the lower; low ability + high willingness $\Rightarrow$ below-average tolerance.
- **Which constraint?** Human capital in one industry is a *unique circumstance*; a tax bill due in six months is a *liquidity/time horizon* issue ruling out private equity.

Module 5 — The Behavioral Biases of Individuals

Topic: Portfolio Management · Exam relevance: **Medium-yield** · **Concept-heavy**

The big picture

Traditional finance assumes investors process all information rationally; behavioural finance shows how real financial market participants (FMPs) deviate. The key skill is to **name the bias** from a short description, say whether it is a **cognitive error** (faulty reasoning, fixable with information) or an **emotional bias** (feelings, usually only adapted to), and link biases to market anomalies such as momentum, bubbles and the value effect.

Learning outcomes in plain language

- LOS 1 Cognitive vs emotional.** Cognitive errors stem from statistical, information-processing or memory errors and are easier to correct through information, education and advice (**moderate** the bias). Emotional biases stem from impulse or intuition and are harder to correct, so the adviser often **adapts** to them. One bias can have both aspects, with one dominating.
- LOS 2 Common biases and their implications.** Recognise each bias in the table from a client's words or actions, state its consequences (under-diversification, holding losers, excessive trading, slow updating, inertia) and how to detect and overcome it (Bayesian updating, seeking contrary evidence, written plans, a strategic asset allocation).
- LOS 3 Biases and market behaviour. Momentum:** availability (recency), hindsight (regret) and loss aversion lead investors to extrapolate trends. **Bubbles and crashes:** overconfidence, confirmation and self-attribution, regret aversion on the way up; anchoring and cognitive dissonance on the way down, then capitulation. **Value vs growth:** halo effect, representativeness, overconfidence in growth forecasts, and home bias — or, per Fama–French, compensation for risk.

Key facts

COGNITIVE — BELIEF PERSEVERANCE (cling to prior beliefs; cognitive dissonance)

Conservatism	Keep prior view; underweight new information (underreact).
Confirmation	Seek evidence that confirms, ignore what contradicts; concentrated holdings.
Representativeness	Classify by stereotype/past pattern; base-rate and sample-size neglect.
Illusion of control	Believe one can control or influence outcomes; excessive trading, concentration.
Hindsight	Past events “were predictable”; overestimate own foresight.

COGNITIVE — PROCESSING ERRORS (information used illogically)

Anchoring	Anchoring and adjustment: stick to an initial number (e.g. purchase price), adjust too little.
Mental accounting	Treat money in separate “accounts” although money is fungible.
Framing	Answer depends on how the question is posed (gain vs loss frame; narrow framing).
Availability	Judge probability by ease of recall (recency); narrow opportunity set.

EMOTIONAL

Loss aversion	Losses hurt more than equal gains please; hold losers, sell winners early.
Overconfidence	Unwarranted faith in own ability: prediction (ranges too narrow) and certainty (probabilities too high).
Self-control	Short-term satisfaction over long-term goals; under-saving.
Status quo	Do nothing; inertia keeps unsuitable portfolios.
Endowment	Value an asset more because it is owned (e.g. inherited shares).
Regret aversion	Avoid action for fear it proves wrong; herding into consensus.

Worked example (CFA curriculum)

Framing in a risk questionnaire. Three portfolios have the same statistics but are shown two ways. Portfolio ABC: mean 10%, $\sigma = 16\%$, so the 95% (two- σ) range is $10 \pm 32 = -22\% \text{ to } 42\%$. DEF: 6%, $\sigma = 12\% \Rightarrow -18\% \text{ to } 30\%$. XYZ: 3.5%, $\sigma = 1.5\% \Rightarrow 0.5\% \text{ to } 6.5\%$. Shown as ranges, XYZ looks safe and ABC scary; shown as “return, then σ ”, ABC's 10% dominates attention. Same risk, different answers: **framing bias** (a processing error), so the adviser should present risk in more than one way. [Note: this example uses 67% for the $\pm 1\sigma$ probability ($-6\% \text{ to } 26\%$ for ABC); LM1 uses 68%.]

What examiners like to test

- **Classify first:** conservatism, confirmation, representativeness, illusion of control, hindsight, anchoring, mental accounting, framing, availability = cognitive; loss aversion, overconfidence, self-control, status quo, endowment, regret aversion = emotional.
- **Moderate vs adapt:** cognitive $\Rightarrow$ moderate (educate); emotional $\Rightarrow$ adapt (e.g. a portfolio the client can live with).
- **Look-alikes:** anchoring (to a number) vs conservatism (to a belief); status quo, endowment and regret aversion all lead to “hold what I have”.

Module 6 — Introduction to Risk Management

Topic: Portfolio Management · Exam relevance: Medium-yield · Concept-heavy

The big picture

Risk management is not avoiding risk: it is deciding how much risk to take, measuring how much is being taken, and moving the second toward the first. Governance sets the appetite, the risk budget allocates it, and managers identify, measure and then accept, avoid, transfer or shift risks by cost and benefit.

Learning outcomes in plain language

- LOS 1 Define risk management.** The process by which an organisation or individual defines the level of risk to be taken, measures the level being taken, and adjusts the latter toward the former, to maximise value or utility.
- LOS 2 Risk management framework.** Risk governance; risk identification and measurement; risk infrastructure; policies and processes; mitigation and management; communication; strategic risk analysis and integration.
- LOS 3 Risk governance.** Top-down guidance from the governing body (board) on goals, priorities and risk tolerance, taken from an **enterprise risk management** view of the whole economic balance sheet. Hallmarks: a risk management committee and a CRO.
- LOS 4 Risk tolerance.** Which risks are acceptable, which are not, and how much total loss the organisation can bear; combines an “inside” view (what shortfalls would make us fail?) with an “outside” view (which risk drivers are we exposed to?); set formally *before* a crisis.
- LOS 5 Risk budgeting.** Any means of allocating investments by their risk characteristics; quantifies the tolerance (one metric such as σ or VaR, or multi-dimensional/factor-based). Forces risk trade-offs.
- LOS 6 Sources of risk. Financial:** market, credit, liquidity. **Non-financial:** settlement (Herstatt), legal, compliance (regulatory, accounting, tax), model, tail, operational (incl. cyber), solvency. Individuals add health, mortality/longevity, property risk. Risks **interact**, often non-linearly.
- LOS 7 Measuring and modifying.** Measures: probability, σ , beta, duration, delta/gamma/vega/rho, VaR, CVaR, expected loss given default, plus scenario analysis and stress tests for tails. Modification: prevention/avoidance, acceptance (self-insurance, diversification), transfer (insurance), shifting (derivatives); choose by costs vs benefits.

Key facts

Value at risk (VaR): the *minimum* loss expected over a holding period a given percentage of the time (not the expected or maximum loss); **CVaR** = average loss beyond VaR. VaR is supplemented by **scenario analysis** and **stress testing**. **Solvency risk:** running out of cash.

$$\sigma_p = \sqrt{w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + w_3^2 \sigma_3^2 + 2\rho_{1,2} w_1 w_2 \sigma_1 \sigma_2 + 2\rho_{1,3} w_1 w_3 \sigma_1 \sigma_3 + 2\rho_{2,3} w_2 w_3 \sigma_2 \sigma_3}$$

Foreign bond = local bond (asset 2) + currency (asset 3), same weight; a full hedge removes asset 3. [Note: the curriculum's version of this formula in the example repeats the $\rho_{1,3}$ term; its numbers use $\rho_{2,3} w_2 w_3 \sigma_2 \sigma_3$, as shown here.]

Transfer vs shifting: insurance passes risk to a party who pools it; **derivatives** change the distribution of outcomes (forwards, futures, swaps: no upfront cost; options: premium).

Worked example (CFA curriculum)

Hedging currency with a forward. A UK investor holds 60% FTSE 100 ($E = 5.5\%$, $\sigma = 13.2\%$) and 40% US Treasuries ($\sigma = 4.0\%$ in USD, 1.5% expected return); USD/GBP $\sigma = 9.0\%$, expected FX return 0%. Correlations: FTSE–UST -0.32 , FTSE–FX -0.06 , UST–FX 0.33 . $E(R_p) = 0.6(0.055) + 0.4[(1.015)(1.0) - 1] = 3.9\%$. Unhedged: three-asset $\sigma_p \approx 8.4\%$. Fully hedging the USD with a one-year forward removes the currency term: $\sigma_p = \sqrt{0.6^2(0.132^2) + 0.4^2(0.040^2) + 2(0.6)(0.4)(-0.32)(0.132)(0.040)} \approx 7.6\%$. Cost: forward 0.7038 vs spot 0.7040 GBP per USD, about -0.03% . Not all FX risk goes: as the bond's value changes, the position becomes under- or over-hedged. [Note: the text gives the Treasury return as 1.6% but computes with 1.5%; and it states the cost as $40\% \times -0.03\%$ yet reports a hedged return of $3.9\% - 0.03\% = 3.87\%$ (applying 40% would give about 3.89%).]

What examiners like to test

- **VaR wording:** “minimum loss a given percentage of the time” is correct; “maximum loss” and “expected loss” are traps.
- **Tolerance vs budgeting:** tolerance = *how much* risk (governance); budgeting = *how* that risk is allocated. Set tolerance before a crisis, not after.
- **Classify the risk:** settlement, model, tail, legal, compliance and operational are non-financial; market, credit and liquidity are financial; insurance = transfer, derivatives = shifting.