

Introduction to Modern Portfolio Theory

LEARNING OBJECTIVES: MPT Framework • Assumptions • Risk Profiles • Expected Return & Variance • Efficient Frontier

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1 Framework — What is Modern Portfolio Theory (MPT)?

Modern Portfolio Theory (MPT) was introduced by **Harry Markowitz** in his 1952 paper "Portfolio Selection" (The Journal of Finance). He was awarded the **Nobel Prize in Economics in 1990** for this work. MPT provides a mathematical framework for constructing and selecting portfolios based on expected performance and investor risk appetite. It quantifies diversification by introducing the statistical concept of **covariance/correlation** between assets — demonstrating that variance of return is a meaningful measure of portfolio risk.

| Published | Nobel Prize | Core Idea | Risk Measure |
|--|--|---|---|
| 1952 — "Portfolio Selection" in The Journal of Finance | Harry Markowitz won Nobel Prize in Economics in 1990 | Quantifies diversification using covariance / correlation between assets | Variance of return = meaningful measure of portfolio risk |

2 Assumptions of MPT

| MPT Assumption | Implication |
|---|--|
| Investors maximise return for a given level of risk | Given equal returns, always choose the lower-risk asset |
| Investors maximise one-period expected utility | Each choice is evaluated on expected utility over a single period |
| Diminishing marginal utility of wealth | Every additional rupee of wealth yields progressively less utility |
| Risk is measured by variability of expected returns | Standard deviation / variance of returns = the risk proxy used in MPT |
| Decisions based solely on expected return and risk | Utility curves are functions of expected return and expected variance only |

3 Risk Profiles — Averse, Neutral & Seeking

| Investor Type | Behaviour | Fair Game? | CER vs Risk-Free Rate | Utility Adjustment |
|---------------------|--|-----------------|--|---------------------|
| Risk Averse | Rejects fair game; demands positive risk premium for risky investments | Rejects | CER may be BELOW risk-free — will reject risky portfolio | Downward adjustment |
| Risk Neutral | Evaluates only on expected return; risk is irrelevant | Accepts | CER = Expected return on risky portfolio | No adjustment |
| Risk Seeking | Will engage in a fair game; actively seeks higher risk | Accepts eagerly | CER is ABOVE expected return | Upward adjustment |

KEY CONCEPT

Fair Game: A prospect with zero risk premium. Risk-averse investors reject it. **Certainty Equivalent Rate (CER):** The risk-free rate that offers identical utility to a risky investment. A highly risk-averse investor assigns a low CER (below risk-free rate), rejecting the risky asset; a less risk-averse investor assigns a higher CER and accepts it.

4 Calculating Expected Return & Variance

Expected Return of an Individual Security

Expected return = sum of each possible return × its probability. Example: Stock A in 3 scenarios — Boom (prob 0.3, return 15%), Normal (0.5, 10%), Recession (0.2, 2%).

FORMULA

$$E(R) = \sum [\text{Probability} \times \text{Return}]$$

$$E(R_A) = 0.3 \times 15\% + 0.5 \times 10\% + 0.2 \times 2\% = 9.9\%$$

$$E(R_B) = 0.3 \times 25\% + 0.5 \times 20\% + 0.2 \times 1\% = 17.7\%$$

Variance of Return (Individual Security) — 7-Step Process

| Step | Action |
|------|---|
| 1 | List all yearly returns (X) |
| 2 | Compute the mean return (\bar{X}) |
| 3 | Subtract mean from each year's return ($X - \bar{X}$) |
| 4 | Square each deviation: $(X - \bar{X})^2$ |
| 5 | Sum all squared deviations |
| 6 | Divide by $(n-1)$ → this is the variance |
| 7 | Take square root of variance → this is the standard deviation |

Portfolio Expected Return = Weighted average of individual asset returns:

FORMULA

$$E(R_{\text{portfolio}}) = \sum [\text{Weight}_i \times E(R_i)]$$

$$\text{Example: } A(20\%, R=9\%) + B(10\%, R=12\%) + C(30\%, R=15\%) + D(40\%, R=18\%) = 14.7\%$$

Portfolio Variance (Two Securities)

FORMULA

$$\sigma^2(\text{port}) = w_A^2 \times \sigma_A^2 + w_B^2 \times \sigma_B^2 + 2 \times w_A \times w_B \times r_{AB} \times \sigma_A \times \sigma_B$$

$$\text{Number of covariance terms for } n \text{ securities} = (n^2 - n) / 2$$

$$\text{E.g. 50-security portfolio} \rightarrow 50 \text{ variances} + 1,225 \text{ covariance terms}$$

KEY INSIGHT

Perfect positive correlation ($r = +1$): No diversification benefit. Portfolio risk = weighted average of individual risks. **Perfect negative correlation ($r = -1$):** Maximum diversification benefit; risk can be eliminated entirely. **Partial correlation ($-1 < r < +1$):** Partial diversification benefit — the lower the correlation, the greater the risk reduction.

5 Efficient Frontier & Portfolio Optimisation

| Concept | Definition & Key Points |
|---------------------------|---|
| Efficient Frontier | Umbrella-shaped curve of optimal portfolios offering the highest return for a given risk level (or lowest risk for a given return). Portfolios BELOW = sub-optimal (insufficient return for risk). Portfolios to the RIGHT = sub-optimal (excess risk for given return). |

| Concept | Definition & Key Points |
|-----------------------------------|---|
| Minimum Variance Portfolio | The leftmost point on the efficient frontier — lowest possible risk for any combination of the assets. Starting point of the efficient set. |
| Sub-optimal Portfolio | Any portfolio that lies below or to the right of the efficient frontier — a better combination exists with same risk or same return. |
| Portfolio Optimisation | Process of selecting the optimal portfolio from the efficient frontier given investor constraints. Requires inputs: (1) Expected return of every asset; (2) Standard deviation of each asset; (3) Correlation coefficient for every pair of assets. |
| Estimation Risk | Error introduced by inaccurate estimates of inputs (returns, risk, correlations). For 50 securities, need 1,225 correlation estimates — large scope for error. Output quality depends entirely on input accuracy. |

■ CHAPTER 14 — QUICK REVISION: MODERN PORTFOLIO THEORY

| | |
|-------------------------------|---|
| Harry Markowitz | 1952 paper "Portfolio Selection"; Nobel Prize 1990. Father of Modern Portfolio Theory. |
| MPT | Framework to construct/select portfolios based on expected return and risk appetite. Quantifies diversification. |
| Key Insight | Variance of portfolio return is a meaningful measure of risk. Portfolio risk ≠ weighted average of individual risks. |
| Risk Averse | Rejects fair game. Demands positive risk premium. CER may be below risk-free rate — rejects risky portfolio. |
| Risk Neutral | Evaluates only on expected return. Risk is irrelevant. CER = Expected return. |
| Risk Seeking | Engages in fair game. Makes upward utility adjustment. CER above expected return. |
| CER | Certainty Equivalent Rate — risk-free rate that equals utility of a risky investment for a given investor. |
| Expected Return | $E(R) = \sum(\text{Probability} \times \text{Return})$. Portfolio expected return = weighted average of individual returns. |
| Variance (Indiv.) | $\sum(X - X^2) / (n-1)$. Standard deviation = $\sqrt{\text{Variance}}$. Measures dispersion of returns around mean. |
| Portfolio Variance | $\sigma^2(p) = w^2\sigma^2 + w^2\sigma^2 + 2w_1w_2r_{12}\sigma_1\sigma_2$. Depends on weights, individual SDs and correlation. |
| Covariance Terms | $(n^2-n)/2$ covariance terms for n securities. 50 securities = 1,225 covariance terms. |
| Efficient Frontier | Umbrella-shaped curve of optimal portfolios. Highest return for given risk; lowest risk for given return. |
| Portfolio Optimisation | Select optimal portfolio from efficient frontier using: expected returns, standard deviations, correlations. |
| Estimation Risk | Inaccuracy in input estimates (returns, risk, correlations) leads to sub-optimal portfolio construction. |
| Correlation = +1 | Perfect positive correlation — no diversification benefit. Portfolio risk = weighted average. |
| Correlation = -1 | Perfect negative correlation — maximum diversification; risk can be entirely eliminated. |

■ MCQ PRACTICE — Chapter 14 — Modern Portfolio Theory

10 Questions | Answers shown below each question

1 Who is credited with developing Modern Portfolio Theory and in what year did they receive the Nobel Prize?

- a) Benjamin Graham — Nobel Prize 1976 for value investing framework
- b) Harry Markowitz — Nobel Prize 1990 for his 1952 portfolio selection paper**
- c) William Sharpe — Nobel Prize 1990 for the Sharpe ratio and CAPM
- d) Eugene Fama — Nobel Prize 2013 for the Efficient Market Hypothesis

✓ **Answer: b) Harry Markowitz — Nobel Prize 1990**

Harry Markowitz published "Portfolio Selection" in **The Journal of Finance** in **1952**, introducing the mathematical foundation for portfolio construction using variance of return as a measure of risk. He was awarded the **Nobel Prize in Economics** in **1990**. William Sharpe also shared the 1990 Nobel Prize for developing CAPM, but MPT itself is credited entirely to Markowitz. His key contribution was quantifying diversification through the statistical concept of covariance between assets.

2 What is the Certainty Equivalent Rate (CER) in the context of MPT?

- a) The guaranteed minimum return offered by the government on risk-free securities
- b) The risk-free rate a risk-free investment must offer to be equally attractive as a risky portfolio**
- c) The expected return of the market portfolio used as the benchmark in CAPM
- d) The minimum return required by an investor before they invest in any asset class

✓ **Answer: b) Risk-free rate that equals utility of the risky portfolio for a given investor**

The **Certainty Equivalent Rate (CER)** is the rate a risk-free investment must offer to be **equally attractive** as a given risky investment for a specific investor. A highly risk-averse investor may assign a risky portfolio a CER **below** the current risk-free rate — meaning they reject the risky portfolio. A less risk-averse investor assigns a higher CER and accepts the risky portfolio. For a risk-neutral investor, CER simply equals the expected return on the risky portfolio (no risk adjustment).

3 A portfolio consists of securities A (weight 40%, return 12%) and B (weight 60%, return 18%). What is the portfolio's expected return?

- a) 14.40% — weighted by portfolio value at current market prices
- b) 15.00% — simple average of the two stock returns
- c) 15.60% — weighted average: $(0.40 \times 12\%) + (0.60 \times 18\%)$**
- d) 16.20% — geometric mean of returns weighted by market capitalisation

✓ **Answer: c) 15.60% — weighted average: $(0.40 \times 12\%) + (0.60 \times 18\%)$**

Portfolio expected return = $\Sigma(\text{Weight} \times \text{Individual Return})$. Calculation: $(0.40 \times 12\%) + (0.60 \times 18\%) = 4.80\% + 10.80\% = \mathbf{15.60\%}$. This is the weighted average return, where each security's contribution is proportional to its portfolio weight. Note: Portfolio standard deviation is NOT simply the weighted average standard deviation — it depends additionally on the correlation between the securities. Only the expected return calculation uses simple weighted averaging.

4 For a 50-security portfolio, how many covariance terms are needed to compute portfolio variance?

- a) 50 covariance terms — one for each security in the portfolio
- b) 100 covariance terms — two per security (correlation with each other)
- c) 1,225 covariance terms — using the formula $(n^2-n)/2$**
- d) 2,500 covariance terms — n^2 for all possible security pairs

✓ **Answer: c) 1,225 covariance terms — formula: $(n^2-n)/2$**

The number of covariance terms for a portfolio of n securities is given by the formula $(n^2-n)/2$. For 50 securities: $(50^2-50)/2 = (2500-50)/2 = 2450/2 = 1,225$ covariance terms. In addition to these 1,225 covariance estimates, 50 individual variance estimates are also required. This illustrates the "estimation risk" challenge in large portfolios — inaccuracies in any of these 1,275 inputs can significantly distort the optimal portfolio outcome.

5 What does the Efficient Frontier represent in Modern Portfolio Theory?

- a) A straight line connecting the risk-free asset to the market portfolio on the risk-return graph
- b) The umbrella-shaped curve of portfolios offering highest return for a given risk or lowest risk for a given return**
- c) The set of all possible portfolios including both efficient and inefficient combinations
- d) A straight line connecting two perfectly correlated securities on the risk-return space

✓ **Answer: b) Umbrella-shaped curve — highest return for given risk, or lowest risk for given return**

The **Efficient Frontier** is the set of optimal portfolios that provide: (1) the **highest expected return for a given level of risk**, or (2) the **lowest risk for a given level of expected return**. Graphically it appears as an umbrella-shaped curve. Portfolios **below** the frontier are sub-optimal — they could provide higher returns for the same risk. Portfolios to the **right** of the frontier are sub-optimal — they carry excess risk. Only portfolios **ON** the efficient frontier are truly optimal. The leftmost point is the Minimum Variance Portfolio.

6 What happens to portfolio risk when the correlation between two assets decreases (everything else constant)?

- a) Portfolio risk increases because lower correlation makes return patterns less predictable
- b) Portfolio risk decreases because lower correlation enhances the diversification benefit**
- c) Portfolio risk remains unchanged as correlation only affects expected return, not risk
- d) Portfolio risk doubles because the covariance term becomes negative, doubling variance

✓ **Answer: b) Portfolio risk DECREASES — lower correlation enhances diversification benefit**

In the two-security portfolio variance formula: $\sigma^2(p) = w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2r_{12}\sigma_1\sigma_2$, the correlation coefficient r_{12} appears in the covariance term. When correlation decreases, the covariance term shrinks, reducing total portfolio variance. At $r = +1$: no diversification benefit. At $r = 0$: partial benefit. At $r = -1$: maximum benefit — risk can theoretically be eliminated entirely. This is the mathematical foundation of the "don't put all eggs in one basket" principle.

7 Under MPT, which statement BEST describes the relationship between portfolio risk and the weighted average of individual asset risks?

- a) Portfolio risk always equals the weighted average risk of individual assets regardless of correlation
- b) Portfolio risk is always higher than the weighted average risk due to compounding volatility effects
- c) Portfolio risk equals weighted average risk ONLY when assets have perfect positive correlation; otherwise it is lower**
- d) Portfolio risk is always lower than the weighted average risk because diversification always reduces risk

✓ **Answer: c) Portfolio risk = weighted average ONLY when $r = +1$; otherwise it is lower**

This is a **fundamental insight of MPT**: portfolio standard deviation is NOT simply the weighted average of individual standard deviations — except in the single special case of perfect positive correlation ($r = +1$). In all other cases ($r < +1$), portfolio risk is **less than** the weighted average because the diversification effect partially or fully offsets individual risks. The magnitude of the reduction depends on the correlation coefficient. This is why combining assets with low or negative correlation significantly reduces portfolio risk without proportionally reducing expected returns.

8 What is "Estimation Risk" in the context of portfolio optimisation?

- a) The risk that the portfolio manager will select the wrong securities from the efficient frontier
- b) The potential error in portfolio outcomes arising from inaccurate estimates of return, risk, or correlation inputs**
- c) The market risk that cannot be diversified away even with the most optimally constructed portfolio
- d) The risk of estimation bias in reported NAV that distorts true portfolio performance

✓ **Answer: b) Error in portfolio outcomes from inaccurate estimates of input parameters**

For MPT portfolio construction, three types of inputs must be estimated for every security: (1) expected return, (2) standard deviation, and (3) correlation coefficient with every other security. **Estimation risk** refers to the potential error introduced by inaccuracies in these estimates. For a 50-security portfolio, 1,275 separate statistical inputs are required (50 returns + 50 variances + 1,225 correlations). Any error in estimation can lead to a portfolio that appears optimal but is actually sub-optimal in practice. This is a key limitation of MPT implementation.

9 Two portfolios both lie on the Efficient Frontier. Portfolio X has return 12% with risk 8%. Portfolio Y has return 16% with risk 14%. Which is preferred?

- a) Portfolio X is always preferred as lower risk means superior portfolio construction
- b) Portfolio Y is always preferred as higher returns always dominate in an efficient portfolio
- c) Neither dominates — the choice depends entirely on the individual investor's risk tolerance**
- d) Both portfolios are identical in utility as they both lie on the efficient frontier

✓ **Answer: c) Neither dominates — choice depends on the investor's individual risk tolerance**

Both Portfolio X and Y lie ON the Efficient Frontier — meaning both are optimal and cannot be improved upon for their respective risk levels. There is no objective superiority between them. The choice between them depends entirely on the investor's **risk tolerance and utility function**. A risk-averse investor will choose Portfolio X (lower risk). A growth-oriented investor will choose Portfolio Y (higher return). This is why MPT combines with an investor's indifference curves — where the curve is tangent to the efficient frontier is the investor-specific optimal portfolio.

10 If Securities A and B have a correlation coefficient of -1 , what is the maximum theoretical benefit of combining them?

- a) Portfolio return can be doubled as negative correlation amplifies gains
- b) Portfolio risk can be reduced to the weighted average of individual risks
- c) Portfolio risk can be reduced to zero — risk can theoretically be completely eliminated**
- d) Portfolio return becomes negative as the securities cancel each other's gains

✓ Answer: c) Portfolio risk can be reduced to ZERO — complete risk elimination is theoretically possible

When two assets have a **perfect negative correlation ($r = -1$)**, they move in exactly opposite directions with equal magnitude. By choosing the appropriate weights, an investor can theoretically construct a portfolio where the gains of one asset exactly offset the losses of the other — resulting in **zero portfolio variance (zero risk)**. This is the maximum possible diversification benefit. In practice, perfect negative correlation rarely exists in real markets, but the principle demonstrates why low-correlation assets (real estate, gold, bonds vs. equities) are valuable diversifiers in a portfolio.

Portfolio Construction Process

LEARNING OBJECTIVES: Asset Allocation • IPS • Investment Objectives & Constraints • Psychographic Analysis • Life C

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1 Asset Allocation & Correlation — The Foundation

Asset Allocation is the process of distributing an investor's wealth across different asset classes. Asset allocation is the **most critical investment decision** — empirical research (Brinson, Hood & Beebower 1986; Ibbotson & Kaplan 2000) shows that for a single fund, asset allocation explains **~90% of the fund's variation in returns over time**. Across all funds, it explains ~40% of return variation.

EMPIRICAL SUPPORT

Brinson, Hood & Beebower (1986): Target asset allocation explained the **majority** of a broadly diversified portfolio's return variability. Confirmed by **Ibbotson & Kaplan (2000):** asset allocation explains ~40% of return variation across all portfolios and **~90% of a single fund's return variability** over time. Individual security selection matters, but far less than the overall allocation decision.

Correlation across asset classes is the most relevant factor in achieving risk diversification. Assets within the same class have HIGH correlation; assets across different classes have LOW correlation. Correlations change over time and across economic regimes — past correlations should not be the sole basis for allocation decisions.

2 Portfolio Management Process — 5 Steps

| Step | Activity | Key Output |
|--------------|---|---|
| 1 — Plan | Develop Investment Policy Statement (IPS) — identify risk appetite, objectives, constraints | IPS Document — the roadmap for all investment decisions |
| 2 — Research | Study current financial conditions; forecast future market and economic trends | Capital market forecasts — expected risk/return for asset classes |
| 3 — Execute | Construct portfolio taking into account IPS, objectives, risk appetite, and market forecasts | Actual portfolio allocation — asset mix and security selection |
| 4 — Evaluate | Measure and evaluate portfolio performance against objectives and benchmark | Performance report — attribution analysis, benchmark comparison |
| 5 — Review | Periodic review — check consistency with objectives; note significant changes in investor situation | Revised IPS and rebalanced portfolio as needed |

3 Investment Policy Statement (IPS)

The IPS is the **most important document** in portfolio management — a road map guiding all investment decisions. It specifies the investor's objectives, goals, constraints, preferences, and risk tolerance. It must be updated and revised periodically as investor requirements change.

| IPS Component | Description |
|-------------------------------|---|
| Investment Goals & Priorities | Goals listed with priority ranking. Capital preservation / regular income / capital appreciation. |

| IPS Component | Description |
|--|--|
| Investment Objectives | Desired return (absolute or relative) aligned with time horizon. Risk and return have positive relationship; liquidity has inverse relationship with return. |
| Risk/Return Profile | Investor's risk tolerance — determines asset class mix. Higher risk = higher expected return; lower risk = more bonds/debt. |
| Liquidity Constraints | Emergency cash (2-3 months expenses), near-term goals, investment flexibility requirements. Specified clearly to avoid untimely redemptions. |
| Tax Constraints | Tax bracket, applicable rates on income vs capital gains, tax-efficient investment structures. |
| Regulatory Constraints | LRS limit (\$250,000 overseas/year), insider trading restrictions, sector/entity concentration limits per SEBI PMS Regulations 2020. |
| Unique Needs/Preferences | ESG / ethical / religious criteria; emotional attachment to certain stocks; any specific exclusions or inclusions. |
| Benchmark & Review Schedule | Performance benchmark selection, rebalancing periodicity, tolerance bands for deviation from target allocation. |

Four purposes of IPS: (1) Realistic return expectations for investor. (2) Effective investment decisions for portfolio manager aligned with objectives. (3) Framework for evaluating portfolio manager performance. (4) Protection against inappropriate or unethical investment decisions by the manager.

4 Investment Objectives & Constraints

| Objective | Asset Bias | Instruments |
|-----------------------------|--|--|
| Capital Appreciation | Equity-heavy — accepts higher risk for higher return potential | Equities, equity MFs, growth stocks |
| Capital Preservation | Debt/bonds-heavy — prioritises safety over returns | Govt. securities, AAA bonds, FDs, liquid funds |
| Regular Income | Income-generating assets — dividends, interest, rental income | Dividend-paying stocks, bonds, debt MFs, REITs |

Key investment constraints:

Liquidity: Emergency cash (2-3 months), near-term goals (liquid instruments), investment flexibility reserve. | **Tax:** Different rates on income (interest/dividend) vs capital gains; varies by investor tax bracket. | **Regulatory:** LRS limit; insider trading rules; SEBI exposure limits. | **Unique:** ESG preferences, ethical filters, emotional attachments, religious constraints.

5 Psychographic Analysis — BB&K Framework

Psychographic analysis bridges standard finance (rational investors) and behavioural finance (normal, biased humans). The **Bailard, Biehl & Kaiser (BB&K) framework** classifies investors on two axes: **Confident** ↔ **Anxious** and **Careful** ↔ **Impetuous**.

| BB&K; Type | Quadrant | Key Traits | Investment Approach |
|----------------------|------------------------------------|--|--|
| Adventurer | Confident + Impetuous (top-right) | Entrepreneurial; confident; willing to take big bets; have own investment ideas | Concentrate bets; may not seek advisers; high risk tolerance |
| Celebrity | Anxious + Impetuous (bottom-right) | Afraid of missing out; no own ideas; follows trends; most difficult client type | Goes to advisers; changes views often; confused beliefs |
| Individualist | Confident + Careful (top-left) | Analytical; does own research; contrarian; avoids extreme volatility | Methodical; value-oriented; self-directed research |
| Guardian | Anxious + Careful (bottom-left) | Wealth-preserving; cautious; typically older investors; no appetite for volatility | Conservative; capital preservation focus; low-risk assets |

| BB&K; Type | Quadrant | Key Traits | Investment Approach |
|-----------------------|-------------------|---|--|
| Straight-Arrow | Centre (balanced) | Well-balanced; composite of all four types; average risk appetite | Medium risk; diversified approach; moderate allocation |

NOTE Each investor can temporarily exhibit traits of other personality types based on recent experience. A **Guardian can become more like an Adventurer** after a winning streak. Most investors become more **Guardian-like** after periods of high volatility. The BB&K; type influences the appropriate investment approach and communication style required from the Investment Adviser.

6 Life Cycle Analysis of the Investor

| Phase | Life Stage | Risk Appetite | Asset Mix Focus | Key Goals |
|--------------------------------|---|--|--|---|
| Accumulation | Early career; net worth small relative to liabilities | HIGH — long horizon; growing income stream | High-return, high-risk; equity-heavy | Children's education, house, first investments |
| Consolidation | Mid-to-late career; income > expenses | MEDIUM — 15-20 yrs to retirement | Balanced equity + some lower-risk assets | Portfolio consolidation; some capital preservation |
| Spending / Decumulation | Post-retirement; living from accumulated assets | LOW — heavy reliance on investments | Stability + income-generating; some growth for inflation hedge | Dividend, interest, rental income; preserve capital |
| Gifting | Late stage; more assets than needed for living | VARIES — wealth transfer focus | Legacy-oriented; may include charitable vehicles | Leave legacy; charitable causes; wealth transfer planning |

7 SAA vs TAA & Portfolio Rebalancing

| Concept | Definition | Time Horizon | Key Approach |
|---|---|---------------------|---|
| Strategic Asset Allocation (SAA) | Long-term target policy portfolio — translates IPS into asset weights. Designed to meet investor goals over the long term. | Long-term (years) | "Time IN the market" — driven by investor goals, risk profile, and horizon |
| Tactical Asset Allocation (TAA) | Short-term deviations from SAA to exploit market opportunities. Portfolio manager temporarily overweights/underweights asset classes based on market outlook. | Short-term (months) | "TIMING the market" — PM reduces equity if overvalued; increases debt; reverses after booking gains |

Portfolio Rebalancing — Why, How, and Costs:

Rebalancing restores the portfolio to its target asset allocation after market price changes shift the mix. Also triggered by changes in investor goals, risk tolerance, or life stage. IPS must specify rebalancing periodicity and tolerance bands for deviation from target.

| Rebalancing Cost Type | Description | Implication |
|--------------------------|---|---|
| Transaction Costs | Research costs, brokerage, DP charges for buying/selling securities | Illiquid assets (PE, real estate) have higher transaction costs — harder to rebalance |
| Tax Costs | Selling appreciated assets triggers capital gains tax liability | Tax efficiency matters — consider tax impact when deciding rebalancing frequency |

| Rebalancing Cost Type | Description | Implication |
|-------------------------|---|---|
| Opportunity Cost | Moving from equity to debt may miss further equity upside | Over-frequent rebalancing may sacrifice returns; under-rebalancing increases risk drift |

■ CHAPTER 15 — QUICK REVISION: PORTFOLIO CONSTRUCTION PROCESS

| | |
|-----------------------------|--|
| Asset Allocation | Most critical investment decision. Explains ~90% of a single fund's return variability (Brinson et al. 1986). |
| IPS | Investment Policy Statement — road map for all investment decisions. Specifies objectives, constraints, risk tolerance. Must be reviewed periodically. |
| 4 Purposes of IPS | (1) Realistic return expectations; (2) Effective PM decisions; (3) PM evaluation framework; (4) Protection against inappropriate decisions. |
| Capital Preservation | Objective → debt/bonds/govt securities bias. Safety over returns. |
| Capital Appreciation | Objective → equity bias. Higher risk, higher long-term return potential. |
| Regular Income | Objective → dividend stocks, bonds, debt MFs, REITs. Periodic cash flow focus. |
| Liquidity Constraint | Emergency cash (2-3 months), near-term goals, investment flexibility. Specified in IPS. |
| LRS Limit | Indian residents can invest up to \$250,000 overseas per year under the Liberalised Remittance Scheme. |
| ESG Investing | Sustainable investing — considers Environmental, Social, Governance criteria. ESG = broader framework. |
| Ethical Investing | More personalised than ESG. Based on investor's moral principles. Avoids sin sectors (gambling, alcohol, firearms). |
| BB&K; Framework | Psychographic analysis: Adventurer (conf+impt), Celebrity (anx+impt), Individualist (conf+care), Guardian (anx+care), Straight-Arrow (centre). |
| Accumulation Phase | Early career. High risk, long horizon. Equity-heavy. Goal: children's education, house, investments. |
| Consolidation Phase | Mid career. Income > expenses. Medium risk. Balanced equity + lower-risk. |
| Spending Phase | Post-retirement. Low risk. Stability + income. Some growth for inflation hedge. |
| Gifting Phase | Late stage. More assets than needed. Legacy, charitable causes, wealth transfer. |
| SAA | Strategic Asset Allocation — long-term target policy portfolio. "Time IN the market." |
| TAA | Tactical Asset Allocation — short-term deviations from SAA to exploit opportunities. "TIMING the market." |
| Rebalancing | Restore portfolio to target allocation. Triggered by price changes or investor changes. Costs: transaction + tax + opportunity cost. |
| Concentration Risk | Risk from overexposure to single sector/entity. Exposure limits per SEBI PMS Regs 2020 prevent this. |

■ MCQ PRACTICE — Chapter 15 — Portfolio Construction Process

10 Questions | Answers shown below each question

1 According to landmark research on asset allocation, approximately what percentage of a single fund's return variability over time is explained by the fund's target asset allocation decision?

- a) 10% — individual security selection is the dominant driver of return variability
- b) 40% — the average contribution of asset allocation across all different funds
- c) 90% — for a single fund, asset allocation explains most of its return variability over time**
- d) 100% — asset allocation is the only variable that matters per Brinson et al. (1986)

✓ **Answer: c) ~90% — single fund return variability is primarily driven by asset allocation**

The landmark research by **Brinson, Hood and Beebower (1986)**, confirmed by **Ibbotson and Kaplan (2000)**, found that for a single fund, its target asset allocation explains approximately **90% of the fund's variation in returns over time**. Across all funds pooled together, asset allocation explains ~40% of the cross-sectional return variation. This confirms that the choice of asset class mix (equity vs. debt vs. gold etc.) is far more important than individual security selection in determining long-run portfolio performance.

2 An Investment Policy Statement (IPS) serves four key purposes. Which of the following is NOT one of them?

- a) Enables investors to have realistic return expectations from their investments
- b) Provides the portfolio manager with authority to exceed concentration limits when needed**
- c) Provides a framework for evaluating the portfolio manager's performance
- d) Protects the investor against inappropriate or unethical investment decisions

✓ **Answer: b) Granting PM authority to exceed limits is NOT a purpose of the IPS**

The **four purposes of the IPS** are: (1) Enables realistic return expectations; (2) Enables effective PM decision-making aligned with investor objectives; (3) Provides a framework for PM performance evaluation; (4) **Protects the investor** against inappropriate or unethical behaviour by the PM. An IPS never grants the PM authority to bypass concentration limits — in fact, it does the opposite by explicitly specifying these limits. The IPS is a client-protective document, not a PM empowerment document.

3 An investor is 35 years old with growing income and a 25-year investment horizon. What phase of the investment life cycle are they in and what is the appropriate risk approach?

- a) Spending phase — low risk with focus on capital preservation and regular income generation
- b) Consolidation phase — medium risk; balance equity growth with some capital preservation
- c) Accumulation phase — high risk tolerance; equity-heavy portfolio for long-term capital appreciation**
- d) Gifting phase — wealth transfer orientation; legacy and charitable planning focus

✓ **Answer: c) Accumulation phase — high risk; equity-heavy; long-term capital appreciation**

At age 35 with a 25-year horizon and growing income, this investor is in the **Accumulation Phase**. Key characteristics: net worth is still relatively small relative to potential future liabilities; the long time horizon allows recovery from market downturns; growing income provides ongoing investment capacity. The appropriate approach is **high-return, high-risk investments** like equities that maximise long-term compounding. Capital appreciation is the primary objective. Conservative debt-heavy portfolios would be inappropriate at this stage as they sacrifice the compounding power of equities over a long horizon.

4 Which BB&K; psychographic investor type is most likely to follow market trends, ask "should I be in this hot investment?", and be the most difficult client to manage?

- a) Adventurer — confident and impetuous, makes independent concentrated bets
- b) Celebrity — anxious and impetuous, fears missing out, has no own investment ideas**
- c) Guardian — anxious and careful, cautiously preserves wealth with low-volatility assets
- d) Individualist — confident and careful, does own research, contrarian and analytical

✓ **Answer: b) Celebrity — anxious + impetuous, follows trends, most difficult client type**

The **Celebrity** investor type (bottom-right quadrant of BB&K;) is characterised by anxiety combined with impetuosity. They constantly chase the latest investment trend ("Should I be in this?"), have no independent investment ideas, and are described in the framework as the **most difficult investors to manage** due to confused and conflicting beliefs. They typically rely heavily on advisers but frequently second-guess recommendations. This contrasts with the Adventurer (confident, own ideas, concentrates bets) or the Guardian (cautious, preservation-focused, avoids volatility).

5 Strategic Asset Allocation (SAA) vs Tactical Asset Allocation (TAA) — which statement is CORRECT?

- a) SAA involves short-term market timing; TAA involves the long-term target portfolio policy
- b) Both SAA and TAA involve the same long-term framework with only minor tactical adjustments
- c) SAA is the long-term target policy portfolio; TAA involves short-term deviations from SAA to exploit market opportunities**
- d) TAA is the primary determinant of portfolio performance; SAA provides minor refinements

✓ **Answer: c) SAA = long-term target; TAA = short-term deviations to exploit market opportunities**

SAA (Strategic Asset Allocation) is the long-term target policy portfolio — translating the IPS into asset weights. It reflects "time IN the market" and is designed to meet investor goals over years/decades. **TAA (Tactical Asset Allocation)** involves short-term deviations from the SAA target to exploit market opportunities. When a PM believes equities are overvalued and bonds undervalued, they may temporarily shift from the SAA equity weight to bonds — then rebalance back after booking gains. SAA is about investor goals; TAA is about timing markets. After TAA positions are closed, the portfolio must be rebalanced to the SAA target.

6 An investor has a primary objective of receiving regular monthly income from her investments. Which asset allocation is most appropriate?

- a) 100% allocation to growth equities with high capital appreciation potential over 10 years
- b) Diversified allocation to dividend-paying stocks, corporate bonds, and income-oriented debt MFs**
- c) 100% allocation to small-cap equity funds for maximum long-term return generation
- d) Concentrated allocation to a single sector fund with historically high dividend yield

✓ **Answer: b) Dividend stocks, bonds, income-oriented debt MFs — income-generating mix**

When the primary investment objective is **regular income**, the portfolio must be tilted toward assets that generate periodic cash flows: (1) **Dividend-paying stocks**; (2) **Interest-paying bonds** (corporate or government); (3) **Income-oriented debt MFs** like monthly income plans; and potentially (4) REITs for rental income. Pure equity growth funds (especially small-cap) generate returns through capital appreciation, not regular income. Concentration in a single sector creates unnecessary risk. The IPS should specify the required income amount and periodicity to guide the appropriate allocation.

7 What are the TWO types of costs associated with portfolio rebalancing that must be weighed before deciding frequency?

- a) Performance cost and advisory cost — both charged by the portfolio manager per rebalancing event
- b) Transaction cost and tax cost — buying/selling incurs brokerage and realized gains trigger tax liability**
- c) Liquidity cost and credit cost — illiquid securities and bond spreads make rebalancing expensive
- d) Opportunity cost and operational cost — missed returns and back-office processing fees

✓ **Answer: b) Transaction cost (brokerage etc.) and tax cost (capital gains on realised profits)**

Portfolio rebalancing involves a simple trade-off: cost of rebalancing vs. cost of not rebalancing. The two primary costs are: (1) **Transaction costs** — time and money costs like research, brokerage, and DP charges for buying and selling. Illiquid assets like private equity and real estate have particularly high transaction costs. (2) **Tax costs** — selling appreciated assets (especially equities) realises capital gains and triggers tax liability. These costs must be weighed against the risk of the portfolio drifting too far from the target allocation. Note: opportunity cost is also mentioned in the text as a consideration.

8 Under SEBI PMS Regulations 2020, which document must include the investment approach, type of instruments, and exposure limits?

- a) The Disclosure Document filed with SEBI detailing fees and performance
- b) The Agreement between the portfolio manager and investor specifying the investment approach**
- c) The Client KYC document capturing net worth, income, and risk tolerance
- d) The quarterly performance report comparing portfolio returns to benchmark

✓ **Answer: b) The PMS Agreement — must include investment approach, instruments, and exposure limits**

As per **SEBI (Portfolio Managers) Regulations 2020**, the **agreement** between the portfolio manager and investor must include the **investment approach** — a broad outline of the types of securities and permissible instruments to be invested in, taking into account investor-specific and security-specific factors. It must also include the type of instruments and **proportion of exposure**. Exposure limits to specific sectors, entities, and asset classes are set based on the investor's objectives, risk appetite, liquidity needs, tax constraints, time horizon, and regulatory requirements — avoiding concentration risk.

9 What is the key difference between "Ethical Investing" and "ESG Investing / Sustainable Investing"?

- a) Ethical investing is regulated by SEBI; ESG investing has no regulatory framework in India
- b) Ethical investing is personalised to the investor's individual moral principles; ESG follows broader standardised guidelines that screen investments on environmental, social and governance criteria**
- c) ESG investing is only for institutional investors; ethical investing is available to retail investors
- d) Ethical investing focuses exclusively on governance; ESG includes environmental and social factors too

✓ **Answer: b) Ethical = personalised to individual morals; ESG = broader standardised guidelines**

ESG / Sustainable Investing uses a standardised broader framework — screening investments on **Environmental** (pollution, water use, clean technology), **Social** (workplace safety, community development, human rights), and **Governance** (board independence, board diversity, executive compensation) criteria. It is applicable across many investors. **Ethical Investing** is more personal and individualised — it uses the investor's specific moral or ethical principles as the primary investment filter. It typically avoids "sin sectors" (gambling, alcohol, tobacco, firearms) based on personal values. The two terms are often used interchangeably but this is the key distinction noted in the NISM curriculum.

10 The Accumulation Phase of the investment lifecycle is typically characterised by:

- a) High net worth, low income, preference for capital preservation and dividend income
- b) Retirement income from accumulated assets, stability focus, some inflation hedge exposure
- c) Small net worth relative to liabilities, long horizon, high risk tolerance, equity-heavy allocation**
- d) More assets than needed for living expenses, focus on legacy and charitable giving

✓ **Answer: c) Small net worth vs liabilities, long horizon, high risk, equity-heavy**

The **Accumulation Phase** (early career stage) is characterised by: (1) **Net worth is typically small relative to liabilities** — income is growing but not yet large; (2) **Long time horizon** to retirement — can absorb volatility and wait for recovery; (3) **High risk tolerance** — can take concentrated equity positions; (4) **Equity-heavy portfolio** focused on capital appreciation and long-term compounding. Goals typically include children's education planning, first home purchase, and building an initial investment corpus. The contrast is the Spending/Decumulation Phase (post-retirement) where stability and income generation are prioritised over growth.

Portfolio Performance Measurement & Evaluation

LEARNING OBJECTIVES: HPR • TWRR vs MWRR • GMR vs AMR • Gross/Net/Pre-tax/Post-tax Return • Alpha & Beta • Risk Meas

Sneha Rege

1 Return Measures — Definitions & Formulas

Proper performance measurement must recognise BOTH return AND risk. Focusing solely on return without adjusting for risk leads to misleading comparisons.

| Return Measure | Formula / Method | Best Used For | Key Characteristic |
|---|--|---|--|
| HPR (Holding Period Return) | $(E - B) / B$ or $(I + E - B) / B$ | Point-to-point single period return; starting point | Most straightforward; ignores cash flows |
| TWRR (Time Weighted Rate of Return) | Link sub-period returns using wealth relatives; compound | Evaluating fund manager skill; SEBI mandates for PMS | Eliminates impact of investor cash flow timing; measures pure investment skill |
| MWRR (Money Weighted Rate of Return) | IRR of all cash flows including contributions + terminal value | Investor's actual personal wealth growth experience | Depends on TIMING of cash flows; not suitable for comparing PM skill |
| AMR (Arithmetic Mean Return) | Simple average of individual period returns | Estimating single-year expected return | Overestimates long-run wealth accumulation; use only for 1-period estimates |
| GMR (Geometric Mean Return) / CAGR | $[(1+R_1) \times (1+R_2) \times \dots \times (1+R_n)]^{(1/n)} - 1$ | Long-run wealth accumulation; multi-year comparison | Same as TWRR and CAGR. Always \leq AMR (except when all returns are equal) |
| CAGR | $(\text{Ending Value} / \text{Beginning Value})^{(1/n)} - 1$ | Most common long-term return measure; assumes dividend reinvestment | Depends only on start and end value — not on path taken |
| Gross Return | Return before fees, expenses, commissions | Evaluating investment performance at a broad level | Misleading for investor — cannot include all costs |
| Net Return | Gross return AFTER all fees, expenses, exit load | What the investor actually takes home | The only return that matters to the investor in practice |
| Pre-tax Return | Return before taxes are paid | Comparison across investors with different tax profiles | Pre-tax = Post-tax / (1 - tax rate) |
| Post-tax Return | Pre-tax return \times (1 - tax rate) | Investment decision-making; actual investor wealth change | What truly matters; varies by investor tax bracket |

PMS RULE

SEBI mandates that discretionary portfolio managers must disclose performance using **Time Weighted Rate of Return (TWRR)** for the immediately preceding three years. This ensures comparability across PMS providers regardless of client cash flow timing. Wealth manager software/adviser Excel reports typically use **MWRR** to show the client's actual personal return experience. CAGR is the same as GMR and TWRR mathematically.

2 Alpha, Beta & CAPM Return Decomposition

Portfolio returns can be decomposed into three components using the **Capital Asset Pricing Model (CAPM)**:

| | |
|-------------|---|
| CAPM | Required Return = $R_f + \beta \times (R_m - R_f)$ |
| | Alpha = Actual Portfolio Return – Required Return |
| | Alpha = $R_p - [R_f + \beta \times (R_m - R_f)]$ |
| | Portfolio Return = Risk-free Return + Beta Return + Alpha Return |

| Component | Definition | Reward For |
|--|---|---|
| Risk-free Return (Rf) | Return on a risk-free investment (T-bill rate) | Compensation for time value of money only — no risk |
| Beta Return ($\beta \times (R_m - R_f)$) | Market-related return proportional to portfolio's beta (systematic risk exposure) | Bearing systematic / market risk (non-diversifiable) |
| Alpha Return | Excess return above CAPM-required rate — the PM's "true" skill return | Bearing unsystematic / idiosyncratic risk ; also called Jensen Alpha |

WORKED EXAMPLE

Portfolio return = 25%. Market return = 15%. Beta = 1.5. Risk-free rate = 5%. Required return = $5\% + 1.5 \times (15\% - 5\%) = 20\%$. **Alpha = 25% – 20% = 5%**. Beta return = 15%. Risk-free return = 5%. Note: some professionals define simple alpha as $R_p - R_m = 25\% - 15\% = 10\%$.

3 Risk Measures

| Risk Measure | What It Captures | Key Formula / Interpretation |
|---|--|--|
| Standard Deviation (σ) | Total risk — variability of returns around the mean; both upside and downside deviations | Higher σ = higher risk. Most widely used measure. Works for any portfolio type. |
| Semi-variance / Semi-SD | Downside risk only — dispersion of returns BELOW the mean (or target return) | Captures loss risk only. Not widely used in practice due to complex estimation. |
| Beta (β) | Systematic / market risk — sensitivity of portfolio return to benchmark index movements | $\beta > 1$: more volatile than market. $\beta < 1$: less volatile. $\beta = 1$: moves with market. Cannot be diversified away. |
| Tracking Error | Standard deviation of the difference between portfolio returns and benchmark returns | Lower TE = portfolio closely mirrors benchmark. Also called Active Risk. Calculated against Total Return Index. |
| Systematic Risk | Risk from common factors (interest rates, exchange rates, commodity prices) — affects ALL assets | Measured by Beta. Cannot be diversified away. Can be hedged. |
| Unsystematic Risk | Sector-specific or company-specific risk — unique to individual securities | CAN be diversified away. Alpha return = reward for bearing this risk. |
| Credit Risk | Risk that the borrower cannot repay debt obligations on time | Relevant for debt instruments. Higher for lower-rated bonds. Compensated by higher yields. |

| Risk Measure | What It Captures | Key Formula / Interpretation |
|----------------|--|--|
| Liquidity Risk | Uncertainty in converting asset to cash at close to economic value | T-Bills = near-zero liquidity risk. Art/PE = high liquidity risk (hard to sell quickly at fair value). |

4 Risk-Adjusted Return Measures

| Measure | Formula | Risk Used | Best For | Higher = Better? |
|---|---|------------------------------|---|---------------------------------|
| Sharpe Ratio | $(R_p - R_f) / \sigma_p$ | Total risk (σ) | Evaluating a single portfolio in isolation; investor without adequate diversification | ✓ Yes |
| Treynor Ratio | $(R_p - R_f) / \beta_p$ | Systematic risk (β) | Well-diversified investors where only systematic risk matters; combining with other active portfolios | ✓ Yes |
| Jensen Alpha | $R_p - [R_f + \beta(R_m - R_f)]$ | Beta-adjusted | Measuring absolute manager skill; how much return beyond CAPM prediction | ✓ Yes (positive = outperformed) |
| Sortino Ratio | $(R_p - R_f) / \text{Semi-SD}$ | Downside risk only | Investors who view risk as "chances of losing money" rather than total volatility | ✓ Yes |
| Information Ratio | $(R_p - R_b) / \text{TE}$ | Active risk (Tracking Error) | Determining if active return (alpha) is due to skill or luck; active manager evaluation | ✓ Yes |
| M ² (Modigliani-Mo digliani) | Lever/de-lever portfolio to market SD; compare adjusted return to market return | Adjusted to match market SD | Direct comparison of risk-adjusted return to benchmark in % terms (intuitive) | ✓ Yes (+ve = outperformed) |

KEY FORMULAS

$$\text{Sharpe} = (R_p - R_f) / \sigma_p \quad \text{Treynor} = (R_p - R_f) / \beta$$

$$\text{Jensen Alpha} = R_p - [R_f + \beta(R_m - R_f)]$$

$$\text{Sortino} = (R_p - R_f) / \text{Semi-SD}$$

$$\text{Information Ratio (IR)} = (R_p - R_b) / \text{Tracking Error}$$

SHARPE vs TREYNOR

Sharpe uses total risk (σ); Treynor uses systematic risk (β). For a completely well-diversified portfolio, both give IDENTICAL rankings (total risk = systematic risk when unsystematic risk is zero). For a poorly diversified portfolio, Treynor ratio may rank it higher than Sharpe (ignores unsystematic risk). **Use Sharpe** when evaluating an investor whose entire wealth is in this portfolio (not adequately diversified). **Use Treynor** when the investor holds a well-diversified total wealth portfolio and the portfolio in question is just one component.

5 Benchmarking & Performance Attribution

| Concept | Definition / Key Points |
|------------------------------------|---|
| Benchmark (GIPS Definition) | Independent rate of return forming an objective test of effective implementation of investment strategy. A collection of investment opportunities representing the portfolio's characteristics and approach. |
| Good Benchmark Criteria | (1) Clearly defined constituents and weights; (2) Investable (can passively replicate it); (3) Consistent with portfolio's investment approach/style; (4) Same risk-return profile as portfolio; (5) Performance is measurable. |

| Concept | Definition / Key Points |
|---------------------------------------|--|
| Customised Benchmark | Used when market-based indices don't match PM's investment universe/style. Higher construction cost; but meets validity criteria better. Offered at higher fee than standard index benchmarks. |
| Benchmarking Error | Using benchmark that doesn't represent the portfolio — e.g., comparing mid-cap portfolio to Nifty 50. Benchmark must match portfolio style (value fund vs. value index). Benchmark must also be reviewed when portfolio strategy changes. |
| Peer Group / Universe Analysis | Comparing portfolio against median of similar portfolios. Portfolio ranking firms maintain databases of portfolios with similar characteristics. Investors naturally interested in relative performance vs peers. |
| Performance Attribution | Decomposing return into: (1) Return from benchmark; (2) Differential return. Identifies whether differential return came from skill or luck. Key attribution sources: Asset/Sector Allocation, Security Selection, Market Timing, Currency effect. |
| Asset/Sector Allocation Effect | Differential return from overweighting/underweighting sectors vs benchmark. Being overweight in an outperforming sector adds alpha; underweight in underperforming sector also adds alpha. |
| Security Selection Effect | Differential return from selecting specific securities that outperformed within each sector vs benchmark securities. Requires deep fundamental research to generate consistently. |
| Market Timing | Ability to anticipate market moves and position portfolio accordingly. Research shows market timing is generally NOT a consistent source of outperformance. |
| Currency Effect | For foreign investments: return in local currency ≠ return in INR. INR appreciation REDUCES foreign returns in INR terms; INR depreciation ENHANCES foreign returns. |

| | |
|-------------------------|---|
| CURRENCY EXAMPLE | Indian investor: Invests Rs.50L in US equity when USD/INR = 70. Fund returns 15%. Rupee appreciates to 65/USD. Initial USD amount = Rs.50L / 70 = \$71,428.57. End value = \$82,142.86. Converted @ 65 = Rs.53,39,286. Return in INR = 6.79% (not 15%). INR appreciation from 70→65 reduced return by ~7%. Conversely, INR depreciation (common historically) ADDS to foreign investment returns. |
|-------------------------|---|

■ CHAPTER 16 — QUICK REVISION: PERFORMANCE MEASUREMENT & EVALUATION

| | |
|------------------------|---|
| HPR | Holding Period Return = $(E-B)/B$. With income: $(I+E-B)/B$. Starting point for performance measurement. |
| TWRR | Time Weighted Rate of Return. Removes effect of external cash flow timing. SEBI mandates for PMS (3-year disclosure). = Geometric Mean Return. |
| MWRR | Money Weighted Rate of Return = IRR of all cash flows. Depends on timing of contributions. Used by advisers for client wealth reporting. |
| TWRR vs MWRR | TWRR measures PM's investment skill (cash-flow neutral). MWRR measures investor's personal experience (cash-flow dependent). Use TWRR to compare PMs. |
| AMR | Arithmetic Mean Return — simple average. Best for single-period estimation. Overstates long-run wealth accumulation. |
| GMR / CAGR | Geometric Mean Return = CAGR = TWRR. Accurately measures long-run wealth accumulation. Always \leq AMR (except when all returns are equal). |
| CAGR Formula | $(\text{Ending Value} / \text{Beginning Value})^{(1/n)} - 1$. Depends only on start and end values, not path. |
| Gross Return | Return before fees and expenses. Used for broad investment evaluation. Cannot be used for actual investor wealth assessment. |
| Net Return | Return after ALL fees, expenses, exit loads. What the investor actually earns. The only relevant return for investor decision-making. |
| Pre-tax Return | Return before taxes. Used for cross-investor comparison. Pre-tax = Post-tax / (1-tax rate). |
| Post-tax Return | Pre-tax return \times (1-tax rate). What the investor takes home. Decision-making return. |

| | |
|-----------------------------------|--|
| Cash Drag | Uninvested cash lowers overall portfolio return. Must be included in return calculation over the entire capital commitment. |
| Alpha (Jensen) | $R_p - [R_f + \beta(R_m - R_f)]$. Excess return above CAPM required return. Reward for unsystematic risk / PM skill. |
| Beta | Systematic risk. $\beta > 1$: more volatile than market. $\beta < 1$: less volatile. Portfolio β = weighted average of individual betas. |
| Sharpe Ratio | $(R_p - R_f) / \sigma$. Reward to variability. Uses TOTAL risk. Best for standalone portfolio evaluation or poorly diversified investors. |
| Treynor Ratio | $(R_p - R_f) / \beta$. Uses SYSTEMATIC risk. Best for well-diversified investors where unsystematic risk is minimal. |
| Sortino Ratio | $(R_p - R_f) / \text{Semi-SD}$. Uses downside risk only. For investors who define risk as losses, not total variability. |
| Information Ratio | $(R_p - R_b) / \text{Tracking Error}$. Active return per unit of active risk. Tests if alpha is from skill or luck. |
| M² (Modigliani) | Adjusts portfolio risk to match market risk; compares adjusted return to market return. Positive M ² = outperformance. |
| Tracking Error | Standard deviation of (Portfolio Return – Benchmark Return). = Active Risk. Lower = closer to benchmark. Always vs Total Return Index. |
| Systematic Risk | Common risk factors (interest rates, FX, commodity prices). Measured by Beta. Cannot be diversified away. Can be hedged. |
| Unsystematic Risk | Company/sector-specific risk. CAN be diversified away. Alpha return = compensation for this risk. |
| Good Benchmark | Clearly defined, investable, consistent with portfolio style, same risk-return profile, measurable performance. |
| Attribution Analysis | Decomposes return into: benchmark return + differential return. Sources: sector allocation, security selection, market timing, currency. |

■ MCQ PRACTICE — Chapter 16 — Portfolio Performance Measurement

10 Questions | Answers shown below each question

1 SEBI mandates that Discretionary Portfolio Managers disclose performance using which return measure for the immediately preceding three years?

- a) Money Weighted Rate of Return (MWRR) — because it reflects investor cash flow experience
- b) Arithmetic Mean Return (AMR) — because it is the simplest and most widely understood
- c) Time Weighted Rate of Return (TWRR) — to enable comparability across PMS providers**
- d) Gross Return — to show investment performance before fee deductions

✓ **Answer: c) TWRR — SEBI mandates for PMS to enable comparability across providers**

SEBI (Portfolio Managers) Regulations 2020 requires discretionary portfolio managers to disclose performance using **Time Weighted Rate of Return (TWRR)** for the immediately preceding three years. TWRR is mandated because it **eliminates the impact of external cash flow timing** (contributions/withdrawals by clients) — ensuring a pure measure of the PM's investment skill that is **comparable across different PMS providers** regardless of when their clients invested. MWRR, by contrast, is affected by cash flow timing and is better suited for showing each investor's personal return experience.

2 A portfolio generated returns of -50% in year 1 and +100% in year 2. What are the Arithmetic Mean Return (AMR) and Geometric Mean Return (GMR)?

- a) **AMR = 25%, GMR = 0% — showing that GMR correctly captures that investor's wealth is unchanged**
- b) AMR = 0%, GMR = 25% — GMR overstates returns as it compounds positive and negative together
- c) AMR = 50%, GMR = 50% — both measures converge after a two-year period
- d) AMR = 25%, GMR = 25% — both are equivalent when calculated over exactly two periods

✓ **Answer: a) AMR = 25%, GMR = 0% — GMR accurately captures unchanged wealth**

Arithmetic Mean: $(-50\% + 100\%) / 2 = 25\%$. Geometric Mean: $\sqrt{[(1-0.5) \times (1+1.0)]} - 1 = \sqrt{[0.5 \times 2.0]} - 1 = \sqrt{1} - 1 = 0\%$. Starting with Rs.1,00,000: after -50% = Rs.50,000; after +100% = Rs.1,00,000 (back to start). The AMR of 25% is misleading — it suggests the investor made money when wealth is unchanged. The **GMR correctly shows 0%**, which is the only honest representation of what happened to the investor's actual wealth. This is why geometric mean (CAGR/TWRR) must be used for long-run performance measurement.

3 An investor invested Rs.1 lakh in a portfolio that grew to Rs.1.34 lakh over 5 years. What is the CAGR?

- a) **5.60% — using the CAGR formula $(1.34/1.00)^{(1/5)} - 1$**
- b) 6.80% — simple average of the 5-year total return divided by 5
- c) 34.00% — total return over the 5-year period on the initial investment
- d) 8.00% — approximation using the rule of 72 for doubling time

✓ **Answer: a) 5.60% — CAGR = $(1.34/1.00)^{(1/5)} - 1 = 6.02\% \approx 5.60\%$**

CAGR = $(\text{Ending Value} / \text{Beginning Value})^{(1/n)} - 1$. Calculation: $(1,33,960 / 1,00,000)^{(1/5)} - 1 = (1.3396)^{(0.2)} - 1 \approx 6.02\%$. The CAGR depends **only on the initial and final portfolio values** — not on the path by which that value was achieved. It represents the steady annual compounding rate that would produce the same terminal value from the same starting investment. Note that CAGR = GMR = TWRR (all three measure the same thing).

4 Which risk-adjusted return measure should an investor use when evaluating a portfolio that represents his ENTIRE investable wealth (i.e., the investor is not well-diversified overall)?

- a) Treynor Ratio — uses Beta to adjust for systematic risk
- b) Jensen Alpha — uses CAPM required return as the benchmark
- c) **Sharpe Ratio — uses standard deviation (total risk) as the denominator**
- d) Information Ratio — uses tracking error relative to benchmark

✓ **Answer: c) Sharpe Ratio — total risk (σ) is relevant when portfolio IS the investor's wealth**

When a portfolio represents an investor's **entire investable wealth**, the investor has NOT achieved adequate diversification at the wealth level. In this case, **total risk (standard deviation) is the relevant risk measure** — both systematic and unsystematic risks matter because there are no other portfolio components to offset them. The **Sharpe Ratio** uses standard deviation and is therefore the appropriate measure for standalone portfolios or poorly diversified investors. The Treynor Ratio uses beta (systematic risk only) and is appropriate only when the investor holds a WELL-DIVERSIFIED total wealth portfolio and this portfolio is just one component of it.

5 A fund manager's portfolio earned 10.5% vs a benchmark of 8%. The tracking error (standard deviation of active returns) is 3%. What is the Information Ratio?

- a) **0.83 — Information Ratio = $(10.5\% - 8\%) / 3\% = 2.5\% / 3\%$**
- b) 3.50 — Active return divided by risk-free rate as the denominator
- c) 2.50% — the raw active return with no risk adjustment applied
- d) 1.31 — using standard deviation of total portfolio returns as denominator

✓ **Answer: a) IR = 0.83 — $(10.5\% - 8\%) / 3\% = 2.5\% / 3\% = 0.833$**

Information Ratio (IR) = $(R_p - R_b) / \text{Tracking Error} = (10.5\% - 8\%) / 3\% = 2.5\% / 3\% = \mathbf{0.83}$. The numerator ($R_p - R_b = 2.5\%$) is the active return — the portfolio manager's outperformance vs benchmark. The denominator (Tracking Error = 3%) is the active risk — the consistency of that outperformance. A higher IR indicates more return generated per unit of active risk taken. The IR helps determine whether outperformance is from skill (consistent, high IR) or luck (inconsistent, low IR).

6 What is the key difference between Systematic Risk and Unsystematic Risk?

- a) Systematic risk can be diversified away; unsystematic risk cannot be eliminated regardless of portfolio size
- b) **Systematic risk affects all investments (market-wide); cannot be diversified away; measured by Beta. Unsystematic risk is company/sector-specific; CAN be diversified away**
- c) Unsystematic risk is measured by Beta; systematic risk is measured by standard deviation
- d) Both types of risk can be eliminated through sufficient diversification across asset classes

✓ **Answer: b) Systematic = market-wide, cannot diversify, measured by Beta; Unsystematic = specific, CAN diversify**

Systematic Risk: Arises from common market factors (interest rates, exchange rates, commodity prices) that affect ALL investments regardless of sector. Measured by **Beta**. **Cannot be diversified away** by adding more securities — it stays. Can be hedged using derivatives. **Beta return** is compensation for bearing systematic risk. **Unsystematic Risk:** Arises from sector-specific or company-specific factors (management changes, product failures, strikes). **CAN be diversified away** by adding more uncorrelated securities. **Alpha return** is compensation for bearing unsystematic risk. Most practitioners aim to eliminate unsystematic risk through diversification.

7 Portfolio A: Return 14%, Beta 1.2, Standard Deviation 10%. Portfolio B: Return 14%, Beta 0.8, Standard Deviation 10%. Risk-free rate = 4%. Which has the higher Sharpe Ratio and which has the higher Treynor Ratio?

- a) Sharpe: A=B (identical); Treynor: A=B (identical) — same return and same standard deviation
- b) **Sharpe: A=B (identical); Treynor: B is higher — lower beta means higher return per unit of systematic risk**
- c) Sharpe: A is higher; Treynor: B is higher — different denominators lead to different rankings
- d) Sharpe: B is higher; Treynor: A is higher — lower beta indicates better total risk management

✓ **Answer: b) Sharpe: A=B (same return + same SD); Treynor: B is higher (lower beta)**

Sharpe Ratio = $(R_p - R_f) / \sigma$: Both A and B have **same return (14%) and same SD (10%)**, so Sharpe = $(14\% - 4\%) / 10\% = \mathbf{1.0}$ for both — identical ranking. Treynor Ratio = $(R_p - R_f) / \beta$: Portfolio A = $(14\% - 4\%) / 1.2 = \mathbf{8.33}$; Portfolio B = $(14\% - 4\%) / 0.8 = \mathbf{12.5}$. Portfolio B has a **higher Treynor Ratio** because it achieved the same excess return with LESS systematic risk (lower beta). The difference in rankings arises because Portfolio A has higher beta — implying it took on more market risk to achieve the same return. Treynor penalises this; Sharpe doesn't.

8 An Indian investor invested Rs.50 lakh in US equities when USD/INR = 70. The US fund returned 15%. By the time the investor redeems, INR has appreciated to 65/USD. What is the approximate return in INR terms?

- a) 15% — foreign returns are always translated at the same rate as investment
- b) 6.79% — INR appreciation reduces US dollar returns when converted back to rupees**
- c) 22% — INR appreciation adds to the dollar return making it higher
- d) 7.14% — partial return recognition based on proportional currency movement

✓ **Answer: b) ~6.79% — INR appreciation reduces dollar returns in INR terms**

Calculation: Initial USD = Rs.50L / 70 = \$71,428.57. After 15% return = \$82,142.86. Converted at new rate 65: Rs.82,142.86 × 65 = Rs.53,39,286. **Return = Rs.3,39,286 on Rs.50L = 6.79%**. The **INR appreciation** from 70 to 65 (rupee strengthened by ~7%) eroded the 15% dollar gain, resulting in only ~6.79% in INR terms. Note: **INR depreciation** (which is more common historically) does the opposite — **ADDS** to foreign investment returns in INR. This is why Indian investors in gold ETFs (which track global USD gold prices) benefit from both gold price appreciation AND INR depreciation.

9 Which performance attribution source involves the fund manager's ability to overweight sectors that outperformed and underweight sectors that underperformed versus the benchmark?

- a) Security selection — choosing individual securities that outperform within each sector
- b) Market timing — anticipating overall market direction to shift between equities and bonds
- c) Asset/Sector allocation — differential return from sector over/underweighting vs benchmark**
- d) Currency effect — return differential from currency movements in foreign investments

✓ **Answer: c) Asset/Sector allocation — overweighting outperforming sectors vs benchmark**

Asset/Sector Allocation Effect measures the differential return achieved by the PM's decision to **overweight or underweight specific sectors relative to the benchmark**. If the PM was overweight in IT (which outperformed the benchmark) and underweight in metals (which underperformed), both decisions contribute positively to the allocation effect. This is distinct from **Security Selection** (choosing better individual stocks within sectors) and **Market Timing** (shifting overall equity/debt mix). Performance attribution analysis decomposes total active return into these components to identify whether the PM's skill lies in allocation, selection, or timing.

10 What is the M² (Modigliani-Modigliani) measure and what does a NEGATIVE M² indicate?

- a) M² measures the information ratio; negative M² means the fund had higher tracking error than expected
- b) M² adjusts portfolio risk to match market risk; negative M² indicates the risk-adjusted portfolio UNDERPERFORMED the market benchmark**
- c) M² measures Jensen Alpha multiplied by beta; negative M² means the portfolio had negative alpha return
- d) M² is the Sharpe ratio expressed in percentage points; negative M² means the fund underperformed risk-free rate

✓ **Answer: b) M² adjusts portfolio to market risk level; negative M² = risk-adjusted underperformance vs benchmark**

The **M² (Modigliani-Modigliani) measure** works by leveraging or de-levering the portfolio to match the **standard deviation of the market portfolio**. The adjusted portfolio's return is then directly compared to the market return. This makes the comparison intuitive — expressed as a percentage return differential. A **positive M²** means the portfolio outperformed the market on a risk-adjusted basis; a **negative M²** means it underperformed. Example from text: Portfolio SD=42%, Market SD=30%. Portfolio is de-levered to 30% SD. Adjusted return = (0.714×35%) + (0.286×6%) = 26.7% vs market 28%. M² = 26.7%–28% = –1.3% (underperformed market by 1.3% on risk-adjusted basis).