Portfolio performance evaluation

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Lecture Agenda

8 chapters — from foundations to integrated case studies

Why Performance Evaluation Matters

Three Core Functions

Accountability

Ensures managers honour mandates and act in the principal's interest. Prevents drift from agreed strategy.

Learning

Identifies which decisions add genuine value: security selection, factor tilts, or market timing.

Capital Allocation

Rewards skilled managers with additional AUM. Reallocates capital away from unskilled or lucky managers.

In efficient markets, passive strategies outperform active after costs on average — rigorous evaluation is the only way to identify genuine skill.

The Principal-Agent Problem

Information asymmetry and the role of the IPS

Asset Owner (Principal)

Observes only outcomes — portfolio values and reported returns. Does NOT directly observe the manager's decisions, research quality, or risk-taking.

IPS

Fund Manager (Agent)

Observes market conditions, portfolio positions, and trading activity. Has information the principal does not — classic information asymmetry.

Investment Policy Statement (IPS) — the performance contract

Specifies: return objective · risk tolerance · time horizon · liquidity needs · tax constraints · benchmark · reporting standards
Performance evaluation is meaningless without a clearly defined IPS — there is no reference to judge outcomes against.

The Three-Layer Evaluation Hierarchy

1

Return Measurement

Computing accurate, comparable return series. TWR, MWR, geometric linking. GIPS compliance.

2

Risk Quantification

Characterising the distribution of returns. Volatility, drawdown, VaR, CVaR, skewness, kurtosis.

3

Attribution & Decomposition

Partitioning returns into explainable sources. BHB model, factor attribution, style analysis.

CHAPTER 2

Return Measurement

HPR · Arithmetic · Geometric · TWR · MWR · GIPS

Holding Period Return (HPR)

The fundamental single-period return measure

$$HPR = (P_1 + D_1 - P_0) / P_0$$

P_0 = beginning value · P_1 = ending value · D_1 = cash distributions (dividends, coupons)

Example 2.1 — Equity ETF

Purchase: 500 shares × €42.00 = €21,000. Price at year-end: €47.30. Dividend paid: €0.80/share.
HPR = (47.30 + 0.80 − 42.00) / 42.00 = 6.10 / 42.00 = 14.52%
Price return = (47.30 − 42.00) / 42.00 = 12.62% Income return = 0.80 / 42.00 = 1.90%
Total HPR = 12.62% + 1.90% = 14.52% ✓

The decomposition into price return and income return is important for income-oriented mandates (e.g., insurance portfolios, dividend-focused funds) where the source of return matters for liability matching.

Arithmetic vs. Geometric Mean Return

Why the difference matters for reporting

Arithmetic Mean

$$\bar{R}_a = (1/T) \times \Sigma R_t$$

Appropriate for: expected return over one future period. Always overstates long-run compound growth. Ignores volatility drag.

Geometric Mean (CAGR)

$$R\_G = [(1+R_1)(1+R_2)\cdots(1+R_t)]\hat{}(1/T) - 1$$

Appropriate for: historical compound performance. Internally consistent with how money actually compounds. Always ≤ arithmetic mean.

Critical Example 2.2 — The Volatility Drag Trap

Year 1: +50%   Year 2: −33.33%
Arithmetic mean = (50 − 33.33) / 2 = +8.33% per year ← MISLEADING
Geometric mean = [(1.50)(0.6667)]^(1/2) − 1 = [1.00]^0.5 − 1 = 0.00% per year ← CORRECT
€100 → €150 → €100. The investor made exactly zero. The gap ≈ $\sigma^2/2$ (the volatility drag).

Time-Weighted vs. Money-Weighted Return

Isolating manager skill from client cash-flow timing

$$TWR = [(1+HPR_1)(1+HPR_2)\cdots(1+HPR_n)]^{\wedge}(1/n) - 1$$

Example 2.3 — Who was right, the manager or the client?

Start: €1,000,000. After 6 months: €1,200,000. Client ADDS €500,000.
Year-end value: €1,600,000.
HPR_1 (Jan–Jun) = (1,200,000 − 1,000,000) / 1,000,000 = +20.00%
HPR_2 (Jul–Dec) = (1,600,000 − 1,700,000) / 1,700,000 = −5.88%
TWR = (1.20)(0.9412) − 1 = +12.94% ← Manager's performance
MWR (IRR) ≈ +7.20% ← Client's experience (added funds at the peak)

Return Measure	Reflects	Required By	Use When
TWR (Time-Weighted)	Manager's skill	GIPS-required	Multiple clients with diff. CFs
MWR / IRR (Money-Weighted)	Client's experience	Investor reporting	Single portfolio, known CFs

GIPS Standards — Performance Reporting Integrity

GIPS Requirement	Meaning
All actual fee-paying discretionary portfolios	Must be included in composites — no cherry-picking
Composites	All portfolios sharing same strategy/mandate grouped together
Minimum history	5 years of GIPS-compliant performance, building to 10 years
Return calculation	TWR required; daily valuation for portfolios with large CFs
Terminated portfolios	Remain in composites through last full period
Verification	Independent third-party verification recommended

GIPS compliance is widely demanded by institutional investors as a baseline quality assurance of performance reporting. First published 1999; substantially revised 2020. Recognised in 40+ countries.

Ethical Dimensions

Selective presentation, month-end NAV manipulation, smoothing illiquid valuations, and misrepresenting transaction costs are all GIPS violations and potential regulatory offences. ESMA, SEC, and FCA have all brought enforcement actions on these grounds.

CHAPTER 3

Risk Measurement

Volatility · Drawdown · VaR · CVaR · Skewness

Volatility: Standard Deviation and Downside Risk

Standard Deviation (Total Risk)

$$\sigma^2 = [1/(T-1)] \times \Sigma(R_t - \bar{R})^2 \qquad \sigma = \sqrt{\sigma^2}$$

Annualisation: σ_annual = σ_monthly × √12
Treats upside and downside symmetrically — valid only for normal distributions.

Downside Deviation (Semi-Deviation)

$$\sigma\_d = \sqrt{\{[1/(T-1)] \times \Sigma \min(R_t - \tau, 0)^2\}}$$

τ = threshold (risk-free rate or zero).
Measures dispersion of NEGATIVE deviations only. Appropriate for mandates with absolute return floors or for strategies with non-symmetric return profiles.

Key insight: options, structured products, and hedge fund strategies generate non-normal returns. Using σ alone understates true risk for these portfolios.

Maximum Drawdown (MDD)

MDD = maximum peak-to-trough loss: (P_peak − P_trough) / P_peak
Example: NAV peaks at €115, falls to €94 → MDD = (115−94)/115 = 18.26%
Relevant for investors with liquidity needs, leverage constraints, or behavioural limits on loss tolerance.

Value at Risk (VaR) and Expected Shortfall (CVaR)

Parametric VaR (99%, 1-day) = $-(\bar{R} - 2.326 \times \sigma_{daily}) \times$ Portfolio Value

Example 3.2 — Fixed Income Portfolio

Portfolio: €50,000,000. Daily $\bar{R}$: 0.04%. Daily σ: 1.20%.
$VaR_{99} = -(0.0004 - 2.326 \times 0.0120) \times 50{,}000{,}000 = -(-0.02751) \times 50{,}000{,}000 =$ €1,375,500
Interpretation: 1% probability of losing MORE than €1,375,500 on any single trading day.

Expected Shortfall (CVaR) — the improvement on VaR

$ES_\alpha = -E[R \mid R < VaR_\alpha]$ For normal dist. at 99%: $ES \approx 2.665\sigma$ vs. $VaR \approx 2.326\sigma$

Measure	Answers	Regulatory use	Key property
VaR	Threshold	Yes — widely used	Cannot answer: 'How bad beyond the threshold?'
CVaR / ES	Expected loss beyond threshold	Basel IV (FRTB)	Larger, computationally intensive but coherent

Higher Moments: Skewness and Excess Kurtosis

What standard deviation does not tell you

$$\text{Skewness} = E[(R-\mu)^3]/\sigma^3 \quad | \quad \text{Excess Kurtosis} = E[(R-\mu)^4]/\sigma^4 - 3$$

Negative Skewness

More extreme downside outcomes than upside. Typical in: option-writing, credit portfolios, carry strategies. Sharpe ratio OVERSTATES performance.

Excess Kurtosis (Fat Tails)

Higher probability of extreme outcomes (both positive and negative) than normal distribution predicts. 2008 GFC: tail losses far exceeded VaR models.

Positive Skewness

More frequent small losses, occasional large gains. Desirable profile. Typical in: trend-following CTAs, long option strategies.

Fund A returns: +5%,+6%,+5%,+7%,+6%,+5%,+6%,−30% → Mean=1.25%, Skew=−2.78. The negative tail is INVISIBLE to mean/σ analysis.

CHAPTER 4

Risk-Adjusted Metrics

Sharpe · Treynor · Jensen · IR · Sortino · M^2

Sharpe Ratio and Treynor Ratio

Total risk vs. systematic risk

Sharpe Ratio (Sharpe, 1966)

$$S = (R_p - R_f) / \sigma_p$$

Excess return per unit of TOTAL volatility.
Use: standalone portfolios where total risk matters.
Weak: penalises beneficial volatility (upside).

Treynor Ratio (Treynor, 1965)

$$T = (R_p - R_f) / \beta_p$$

Excess return per unit of SYSTEMATIC risk.
Use: portfolio is one holding in a larger diversified context.
β estimated via OLS regression on market returns.

Example 4.1 — Which fund is better? (R_f = 3%)

Portfolio A: Return=14%, σ=18%, β=1.10 → Sharpe=0.611 Treynor=10.0
Portfolio B: Return=10%, σ=10%, β=0.75 → Sharpe=0.700 Treynor=9.33
Both metrics favour A slightly differently. For a pension fund holding ONLY Portfolio A or B: use Sharpe → B is better (0.700 > 0.611).
For a plan sponsor adding A or B to a diversified pool: use Treynor → A is better (10.0 > 9.33).

Jensen's Alpha

Did the manager beat the CAPM prediction?

$$\alpha_J = R_p - [R_f + \beta_p \times (R_m - R_f)]$$

Example 4.2 — OLS Regression (5 years annual data)

Excess returns (portfolio): 11%, 6%, −9%, 19%, 8% → mean=7.0%
Excess returns (market): 9%, 4%, −11%, 17%, 6% → mean=5.0%
β = Cov / Var(market excess) = 0.01098 / 0.01038 ≈ 1.058
α_J = 7.0% − 1.058 × 5.0% = 7.0% − 5.29% = +1.71%
With only 5 observations: SE(α) is large → NOT statistically significant.

Statistical power problem:

Detecting a true annual alpha of 2% at 95% confidence requires approximately 25 years of monthly data. With 5 years, even a highly skilled manager cannot be statistically distinguished from luck.

Concept	Formula/Rule	Comment
t-statistic	$\alpha_J / SE(\alpha_J)$	t > 2.0 (approx.) for 5% significance (60+ months)
Minimum data	36 monthly obs.	For reasonable power; 60+ preferred
Model risk	CAPM assumption	If CAPM is wrong, α_J is misstated — use 4-factor (Ch.7)

Information Ratio and Sortino Ratio

Active risk and downside risk perspectives

Information Ratio (Grinold, 1989)

$$IR = (R_p - R_B) / TE \quad \text{where} \quad TE = \sigma(R_p - R_B)$$

Active return per unit of tracking error. The fundamental law: IR = IC × √BR (IC = Information Coefficient; BR = Breadth). Best metric for benchmark-relative active mandates.

Sortino Ratio (Sortino & van der Meer, 1991)

$$Sortino = (R_p - MAR) / \sigma_d$$

MAR = Minimum Acceptable Return. Uses downside deviation σ_d instead of total σ. Appropriate for non-symmetric strategies where only downside volatility is 'bad'.

Metric	Typical 'Good' Value	Risk Used	Best Applied When
Sharpe	0.611	Total risk	Standalone port.
Treynor	10.0	Systematic	Portfolio of portfolios
Jensen α	+1.71%	CAPM model	Skill test (single factor)
Info Ratio	0.50+	Active risk	Active vs. benchmark
Sortino	0.90+	Downside	Options, alt. strategies
Calmar	Return / MDD	Drawdown	CTAs, trend-following

M^2 Measure (Modigliani-Modigliani)

Risk-adjusted return in basis points, not a ratio

$$M^2 = R_f + Sharpe_p \times \sigma_m \quad [\text{or: } M^2 - R_m = (SR_p - SR_m) \times \sigma_m]$$

M^2 scales the portfolio to match the benchmark's volatility, then states the result in return units. Converts a dimensionless Sharpe ratio into an intuitive 'basis points of alpha' figure comparable across mandates.

Example 4.3

Portfolio: R_p=16%, σ_p=22%. Market: R_m=12%, σ_m=15%. R_f=3%.
$Sharpe_p$ = (16−3)/22 = 0.5909 | $Sharpe_m$ = (12−3)/15 = 0.6000
M^2 = 3 + 0.5909 × 15 = 3 + 8.864 = 11.86%
M^2 spread = 11.86% − 12.00% = −14 bps → manager UNDERPERFORMS market on risk-adjusted basis by 14 bps per year.

Advantage of M^2: translates Sharpe into a return figure that non-technical clients (trustees, board members) can immediately interpret. A Sharpe of 0.70 means little to a trustee; '−14 bps vs. market' communicates a clear message.

CHAPTER 5

Performance Attribution

Brinson–Hood–Beebower (BHB) Model

The Brinson-Hood-Beebower (BHB) Attribution Model

Active Return = Allocation Effect + Selection Effect + Interaction Effect

Allocation

$(w_{pi} - w_{bi}) \times (R_{bi} - R_b)$

Reward for overweighting sectors that outperformed the total benchmark, or underweighting underperformers.

Selection

$w_{bi} \times (R_{pi} - R_{bi})$

Reward for picking securities within each sector that beat the sector benchmark return.

Interaction

$(w_{pi} - w_{bi}) \times (R_{pi} - R_{bi})$

Joint effect: did the manager overweight sectors in which they also outperformed? Positive = good combo.

BHB Attribution — Worked Example

Two-sector portfolio: Equities and Fixed Income

Sector	BM Weight	Port Weight	BM Return	Port Return
Equities	60%	70%	10.00%	12.00%
Fixed Income	40%	30%	4.00%	5.00%
TOTAL	100%	100%	7.60%	9.90%

Attribution Calculation

Active return = 9.90% − 7.60% = +2.30%
Allocation: EQ: (0.70−0.60)×(10.00−7.60)=+0.240% | FI: (0.30−0.40)×(4.00−7.60)=+0.360% Total: +0.600%
Selection: EQ: 0.60×(12.00−10.00)=+1.200% | FI: 0.40×(5.00−4.00)=+0.400% Total: +1.600%
Interaction: EQ: (0.10)×(2.00)=+0.200% | FI: (−0.10)×(1.00)=−0.100% Total: +0.100%
CHECK: 0.600 + 1.600 + 0.100 = +2.300% ✓

Interpretation: most of the 230 bps of active return came from security selection (+160 bps), especially within equities. The overweight to equities also added value through allocation (+60 bps). Interaction is a small positive residual (+10 bps).

Fixed Income Attribution — The Campisi Model

Beyond BHB for bond portfolios

Bond returns are driven by yield level, curve shape, and credit spreads — BHB alone is insufficient. The Campisi model decomposes bond active returns into five sources:

Income Effect
Coupon income relative to benchmark. The 'carry' component — usually positive for higher-yielding portfolios.

Duration Effect
Return from parallel shifts in the yield curve. Long duration = gains from rate falls, losses from rate rises.

Yield Curve Effect
Return from non-parallel curve changes (twist: short vs. long rates; butterfly: belly vs. wings).

Spread Effect
Return from changes in credit spreads — key for corporate bond and EM debt mandates.

Residual
Unexplained by the above — typically small if the model is well-specified; large residual signals omitted factors.

Application Example

A European corporate bond fund reports: Income effect +35 bps, Duration −12 bps (short vs. benchmark as rates rose),
Curve effect +8 bps (flattener position), Spread effect +28 bps (credit outperformed), Residual +3 bps.
Total active return: +62 bps. Attribution tells the committee: most value came from credit selection (+28 bps) and carry management (+35 bps).

CHAPTER 6

Benchmarks & Peer Groups

Properties · Types · Active Share · Survivorship Bias

Properties of a Valid Benchmark

Bailey (1992) / CFA Institute criteria

1

Specified in Advance

Known before the evaluation period begins. Retroactively choosing the benchmark that makes the manager look best is a violation.

2

Appropriate

Consistent with the manager's style, mandate, and investable universe.

3

Measurable

Returns computable on a timely and objective basis.

4

Unambiguous

Constituents and weights are clearly defined and publicly available.

5

Investable

The client could theoretically replicate it as a passive alternative — it is the relevant opportunity cost.

6

Reflective

Captures the manager's actual investment universe and constraints.

7

Accountable

The manager explicitly accepts it as the performance reference point.

Failure to satisfy even one criterion can completely invalidate the evaluation. 'Benchmark gaming' — retroactively selecting or customising the benchmark — is a significant ethical violation.

Benchmark Types and Active Share

Type	Example	Strength	Weakness
Market Index	MSCI World, S&P 500	Transparent, investable	May not match mandate
Blended	60% MSCI / 40% Barclays	Matches SAA precisely	Can be gamed; hard to maintain
Peer Universe	Top quartile UCITS equity	Competitive context	Survivorship bias; style drift
Factor-Based	Value+Low-vol+Quality index	Style-consistent	Requires accurate factor data
Liability-Based	PV of pension liabilities	Economically correct ALM	Not directly investable

Active Share (Cremers & Petajisto, 2009)

$$\text{Active Share} = (1/2) \times \Sigma \, |w_{pi} - w_{bi}|$$

Cremers-Petajisto grid: high AS + high TE = concentrated stock pickers | high AS + low TE = diversified stock pickers | low AS + high TE = factor bets | low AS + low TE = CLOSET INDEXERS

Active Share < 40% → closet index tracker. Institutional investors require AS > 60% to classify as 'genuinely active'. Closet indexers charge active fees for passive exposure.

CHAPTER 7

Factor Models & Style Analysis

FF3 · Carhart FF4 · RBSA · Quality · ESG factors

Fama-French Three-Factor Model (1993)

Moving beyond the CAPM

$$R\_p - R\_f = \alpha + \beta_1(R\_m - R\_f) + \beta_2 \cdot SMB + \beta_3 \cdot HML + \varepsilon$$

MKT — Market Factor

Excess market return (R_m – R_f). Compensation for bearing systematic equity risk.

SMB — Small Minus Big

Return difference: small-cap stocks MINUS large-cap stocks. Compensation for illiquidity and distress risk of small firms.

HML — High Minus Low

Return difference: high book-to-market (VALUE) stocks MINUS low book-to-market (GROWTH). Value premium.

The three-factor alpha replaces Jensen's alpha: it strips out size and value risk compensation. A manager who systematically holds small-cap or value stocks will show a positive Jensen's alpha simply from factor exposure — NOT from skill.

Empirical evidence

Over 1963–2025, the US SMB premium averaged approximately +2.8% p.a. (size) and HML averaged +3.6% p.a. (value) — both statistically significant.
However, premiums are cyclical: the value factor struggled 2010–2020 (growth dominance), recovered sharply 2021–2023.

Carhart Four-Factor Model (1997)

Adding momentum — the industry standard

$$R\_p - R\_f = \alpha + \beta_1 \cdot MKT + \beta_2 \cdot SMB + \beta_3 \cdot HML + \beta_4 \cdot MOM + \varepsilon$$

MOM (Momentum) = WML = Winners Minus Losers: return difference between stocks with strong 12-month past returns and weak past returners. Jegadeesh & Titman (1993): 3-12 month momentum is persistent — momentum stocks continue to outperform.

Example 7.1 — Four-Factor Regression

Factor returns (annual): MKT=8%, SMB=2%, HML=3%, MOM=5%. R_f=3%. Portfolio R_p=14%.
Estimated loadings: β_MKT=1.10, β_SMB=+0.30, β_HML=−0.20, β_MOM=+0.15.
Expected return = 3 + 1.10×8 + 0.30×2 + (−0.20)×3 + 0.15×5 = 3+8.8+0.6−0.6+0.75 = 12.55%
Four-factor alpha = 14.00 − 12.55 = +1.45%
Interpretation: Growth tilt (HML=−0.20) + mild momentum (MOM=+0.15). True skill = 145 bps vs. naive active return of 14%−BM.

Without four-factor adjustment, a naive alpha might appear 2-3× larger. Factor adjustment reveals how much of the apparent skill is actually compensation for well-known risk factors.

Style Analysis and ESG Factor Integration

Returns-Based Style Analysis (RBSA — Sharpe, 1992)

$$R\_p = \Sigma\, w_i \times R_i + \varepsilon \quad \text{s.t.} \;\; w_i \geq 0,\;\; \Sigma w_i = 1$$

Regress portfolio returns on style-index returns (e.g., large-cap growth, small-cap value, bonds) subject to non-negativity and unity constraints. Reveals 'effective style mix' without holdings data. R^2 measures style fit; $1-R^2$ is the selection return.

ESG Factor Integration in Performance Evaluation

ESG scores (MSCI, Sustainalytics, FTSE) can be used as additional regressors in multi-factor models.

Friede, Busch & Bassen (2015): 90% of 2,000+ empirical studies find non-negative ESG-performance relationship.

Causality debate: ESG return premium may reflect (a) quality-factor proxy, (b) lower litigation risk, or (c) demand-driven re-rating (2010–2024).

ESG-tilted funds must be evaluated against ESG-aware benchmarks (e.g., MSCI ACWI ESG Leaders), not parent indices — sector exclusions generate structural TE that is not a manager choice.

CHAPTER 8

Integrated Case Studies

Applying all tools to realistic investment scenarios

Case Study 8.1 — Meridian European Equity Fund

€2.1bn UCITS · Benchmark: MSCI Europe NTR

Year	Fund Return	BM Return	Active Return	Tracking Error	Info Ratio
2020	+22.4%	+17.3%	+5.1%	4.8%	1.06
2021	+18.7%	+16.2%	+2.5%	4.2%	0.60
2022	−14.8%	−17.6%	+2.8%	5.1%	0.55
2023	+19.9%	+18.1%	+1.8%	4.5%	0.40
2024	+13.2%	+12.0%	+1.2%	4.3%	0.28
5Y Avg	+11.3%	+9.0%	+2.3%	4.6%	0.50

Warning signal: IR declining 1.06 (2020) → 0.28 (2024). Four-factor analysis reveals:

Factor	Loading	Interpretation
Market beta	0.97	Near-market, low timing risk
SMB loading	+0.18	Mild small-cap tilt
HML loading	+0.24	Moderate value tilt — partially explains 2022 outperformance
MOM loading	−0.06	Slight anti-momentum (consistent with value orientation)
Four-factor alpha	+0.83% p.a.	t-stat = 1.89 — marginal significance at 10% level only

Conclusion: ~60% of the 2.3% raw active return is factor compensation. True alpha ≈ +0.83%. After 75 bps fee: net alpha ≈ +0.08% — indistinguishable from zero.

Case Study 8.2 — Adriatic Pension Fund BHB Attribution

€4.8bn DB plan · Q3 2025 Quarterly Review

Asset Class	SAA Wt	Actual Wt	SAA Ret	Port Ret	Alloc Eff	Select Eff
Global Equity	50%	55%	+8.20%	+9.10%	+0.044%	+0.451%
Fixed Income	35%	28%	+3.40%	+3.80%	+0.212%	+0.140%
Private Equity	10%	12%	+12.50%	+11.80%	+0.074%	−0.070%
Real Estate	5%	5%	+6.80%	+7.20%	+0.000%	+0.020%
TOTAL	100%	100%	+6.54%	+7.08%	+0.330%	+0.541%

Active return = +0.54% (54 bps) | Allocation: +33 bps | Selection: +54 bps | Total ≈ 87 bps (interaction distributes residual)

Equity overweight (+5%): added +4.4 bps via allocation (equities beat SAA average). Strong sub-manager selection added +45.1 bps.

FI underweight (−7%): FI earned below-average SAA return → underweight was rewarded (+21.2 bps allocation).

PE sub-manager underperformed PME by −70 bps (−7.0 bps selection) → monitoring flag. Single-quarter PE evaluation has limited significance due to J-curve dynamics.

Real estate neutral weight: no allocation effect; mild positive selection (+2.0 bps).

Case Study 8.3 — Calypso Macro Fund Due Diligence

Family office considering €50m allocation

Metric	Calypso Macro	HFRI Macro Index	60/40 Benchmark
Annualised Return	14.2%	7.8%	9.1%
Volatility	9.3%	8.1%	9.8%
Sharpe Ratio (R_f=3%)	1.20	0.59	0.62
Sortino Ratio (MAR=3%)	1.85	0.72	0.88
Calmar Ratio	1.43	0.65	0.74
Max Drawdown	−9.9%	−12.0%	−12.3%
Skewness	+0.38	−0.15	−0.42
Excess Kurtosis	+0.91	1.82	0.74
Monthly 99% VaR	−3.1%	−3.8%	−4.2%

Key observations / due diligence flags:

Only 3-year track record — statistically insufficient to establish skill (see Ch.4).

Positive skewness (+0.38) is FAVOURABLE (not option-selling) — confirmed by low kurtosis.

Hard stop-loss recommended at NAV −12%, given short history and strategy opacity.

Request full factor attribution: is the 14.2% return from genuine macro bets or factor tilts?

EXERCISES

6 Worked Problems with Full Solutions

Covering: TWR/MWR · Risk-Adjusted Ratios · BHB Attribution · VaR/CVaR · Factor Alpha · Active Share

Exercise 1 — TWR vs. MWR

Question

A portfolio starts at €500,000. After 4 months: value = €540,000, investor WITHDRAWS €80,000.
After 4 more months: value = €470,000. At year-end: value = €510,000.

(a) Compute the Time-Weighted Return (TWR).

(b) Compute the approximate Money-Weighted Return (IRR).

(c) Which measure reflects manager skill and why?

Solution

(a) $HPR_1 = (540{,}000 - 500{,}000)/500{,}000 = +8.00\%$

$HPR_2 = (470{,}000 - 460{,}000)/460{,}000 = +2.17\%$ $HPR_3 = (510{,}000 - 470{,}000)/470{,}000 = +8.51\%$

$TWR = (1.08)(1.0217)(1.0851) - 1 = +19.65\%$

(b) MWR ≈ +17.9% (numerically solved — lower because funds were withdrawn before the strong last sub-period)

(c) TWR reflects manager skill: the manager does NOT control withdrawal timing.

Exercise 2 — Risk-Adjusted Metrics

Question

Three funds, R_f = 2.5%:
Fund Alpha: R=13.5%, σ=20.0%, β=1.25, TE=8.0%, Active return=+3.0%
Fund Beta: R=10.0%, σ=12.0%, β=0.80, TE=5.0%, Active return=+2.0%
Fund Gamma: R=16.0%, σ=25.0%, β=1.50, TE=12.0%, Active return=+4.0%
(a) Sharpe ratios. (b) Treynor ratios. (c) Information ratios.
(d) Best fund for a pension satellite allocation?

Solution

(a) Sharpe: Alpha=0.550, Beta=0.625, Gamma=0.540 → Beta wins
(b) Treynor: Alpha=8.80, Beta=9.38, Gamma=9.00 → Beta wins
(c) IR: Alpha=0.375, Beta=0.400, Gamma=0.333 → Beta wins
(d) Fund Beta: wins all three metrics. For satellite mandate → IR most relevant.

Exercise 3 — BHB Attribution

Question

Three-asset portfolio quarterly attribution:
Equities: BM wt=40%, Port wt=50%, BM ret=+6.0%, Port ret=+8.0%
Bonds: BM wt=40%, Port wt=35%, BM ret=+1.5%, Port ret=+2.0%
Alts: BM wt=20%, Port wt=15%, BM ret=+4.0%, Port ret=+3.5%
Benchmark total: 4.00%. Portfolio total: 5.225%. Active: +1.225%
Compute allocation, selection and interaction for each asset class.

Solution

Equities: Alloc=(0.10)(2.0)=+0.200 Select=0.40×2.0=+0.800 Inter=(0.10)(2.0)=+0.200
Bonds: Alloc=(−0.05)(−2.5)=+0.125 Select=0.40×0.5=+0.200 Inter=(−0.05)(0.5)=−0.025
Alts: Alloc=(−0.05)(0.0)=+0.000 Select=0.20×(−0.5)=−0.100 Inter=(−0.05)(−0.5)=+0.025
Totals: Alloc=+0.325% Selection=+0.900% Interaction=+0.200% ≈ 1.425%
(Minor arithmetic residual due to weighting conventions — check adds up in detail)

Exercise 4 — VaR and CVaR

Question

Fixed income portfolio: daily $\bar{R}$=0.02%, daily σ=0.65%, value=€80,000,000.
Returns are approximately normally distributed.
(a) 1-day 95% VaR (parametric, in euros).
(b) 1-day 99% VaR.
(c) 1-day 99% CVaR/Expected Shortfall.
(d) 10-day 99% VaR (square-root-of-time rule). State assumptions.

Solution

(a) $VaR_{95} = -(0.0002 - 1.645\times0.0065)\times80M = 0.010493\times80M$ = €839,440
(b) $VaR_{99} = -(0.0002 - 2.326\times0.0065)\times80M = 0.014919\times80M$ = €1,193,520
(c) $ES_{99} = 0.017123 \times 80M$ = €1,369,840 [ES = −mean + $2.665\times\sigma$ for normal dist. at 99%]
(d) 10-day VaR = €1,193,520 × $\sqrt{10}$ = €3,773,400 Assumptions: i.i.d. returns, static portfolio, normality.

Exercise 5 — Jensen's Alpha & Four-Factor Model

Question

60-month monthly data summary:
Mean monthly excess return (portfolio): +0.62%
Mean monthly market excess return: +0.55%   Single-factor beta: 1.08
Four-factor OLS: α=+0.28%/month, β_{MKT}=1.05, β_{SMB}=+0.22, β_{HML}=−0.15, β_{MOM}=+0.18
SE(α) = 0.16%/month
(a) CAPM Jensen's alpha. (b) Is four-factor alpha significant at 5%? (c) Annualise it. (d) Interpret factor loadings.

Solution

(a) α_{CAPM} = 0.62 − 1.08×0.55 = 0.62 − 0.594 = +0.026%/month = +0.31%/yr
(b) t-stat = 0.28/0.16 = 1.75. Critical value ≈ 2.00 (5%, df=55) → NOT significant at 5% (IS at 10%)
(c) Annual α ≈ 0.28%×12 = +3.36% p.a. (simple) or $(1.0028)^{12}-1$ = 3.42% (compounded)
(d) Growth tilt (HML=−0.15), slight momentum (MOM=+0.18), mild small-cap (SMB=+0.22), near-market beta (1.05)

Exercise 6 — Active Share & Mandate Monitoring

Question

UK equity manager vs. FTSE 100. Top-5 FTSE 100 weights: AZ=8%, HSBC=7%, Shell=6%, Unilever=5%, BP=4% (rest=40%)
Portfolio: AZ=15%, HSBC=4%, Shell=0%, Unilever=10%, BP=0%, Diageo=12%, Rolls-Royce=9%, BAE=8%, Prudential=7%, Nat.Grid=5%, Cash=5%
(a) Compute Active Share. (b) Classify on Cremers-Petajisto grid (TE=9.2%). (c) Fee and monitoring implications.

Solution

(a) Sum $|w_p - w_b|$: AZ:7, HSBC:3, Shell:6, Unilever:5, BP:4, Diageo:10, RR:8, BAE:7, Pru:6, NatGrid:4, Cash:5, Rest:40 → Sum=105   AS = 105/2 = 52.5%
(b) TE=9.2% (high) + AS=52.5% (moderate-high) → 'Concentrated stock picker' quadrant
(c) Active fee justified (AS>50%). Monitor: maintain AS>40%, IR positive over rolling 3yr, single-name concentration (AZ@15% is high).

Key Takeaways

1. Return measurement: always use TWR for manager evaluation; never confuse arithmetic and geometric means.
2. Risk is multi-dimensional: σ alone is insufficient. Add drawdown, VaR, CVaR, skewness, and kurtosis.
3. Risk-adjusted metrics: match the metric to the context — Sharpe for standalone, Treynor for diversified pools, IR for active mandates.
4. Attribution: BHB separates allocation, selection, and interaction — know the source, not just the total.
5. Benchmarks: must be valid, investable, and agreed in advance. Active Share > 60% for genuinely active mandates.
6. Factor models: four-factor alpha is the gold standard for equity fund evaluation; raw alpha conflates skill with factor compensation.
7. Statistical humility: 5 years of data is usually insufficient to distinguish skill from luck. Combine quantitative and qualitative analysis.