

Guiding Principles for Investment Risk & Performance Measurement Functions

IMAS BEST PRACTICE GUIDANCE

November 2025 (Updated Edition)

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PREFACE.....	2
1. INTRODUCTION TO THE GUIDANCE	2
1.1 INTRODUCTION AND PURPOSE	2
1.2 SCOPE AND APPROACH	3
2. GOVERNANCE	4
2.1 GOVERNANCE OF THE RISK AND PERFORMANCE UNIT	5
2.2 GOVERNANCE WITHIN THE RISK AND PERFORMANCE UNIT	5
3. INVESTMENT RISK MANAGEMENT	7
3.1 INVESTMENT RISK SHOULD BE INDEPENDENTLY MEASURED AND MONITORED	7
3.2 PORTFOLIO AND EXECUTION RISK CONTROLS	7
3.3 IMPORTANCE OF DATA	7
3.4 COMPREHENSIVE USE OF RISK ANALYTICS	8
3.4.1 Value at Risk ("VaR") and Conditional Value at Risk ("CVaR")	9
3.4.2 Percentage and Marginal Contribution to Active / Total Risk	9
3.4.3 Portfolio Characteristics	9
3.4.4 Factor Attribution	10
3.4.5 Style Analysis	10
3.4.6 Leverage	10
3.4.7 Risk Measures for Alternatives	11
3.5 RISK CONCENTRATIONS SHOULD BE UNDERSTOOD AND ANALYZED	12
3.6 PORTFOLIOS SHOULD BE SUBJECT TO REGULAR SCENARIO ANALYSIS AND STRESS TESTING	12
3.7 PORTFOLIO AND POSITION LIQUIDITY RISK SHOULD BE MEASURED AND MONITORED	13
3.8 THE ROLE OF INVESTMENT RISK MANAGEMENT IN SUSTAINABILITY (ESG)	14
3.8.1 Measurement and Scenario Analysis	14
3.8.2 Stewardship & Product Design	14
3.9 INVESTMENT RISK SHOULD BE REPORTED VIA THE USE OF KEY RISK INDICATORS	14
3.10 RISK MODELS SHOULD BE INDEPENDENTLY REVIEWED AND AUTHORIZED	15
3.11 RISK MODELS SHOULD BE BACKTESTED ON A REGULAR BASIS	15
4. PERFORMANCE ANALYSIS	17
4.1 FUND PERFORMANCE SHOULD BE REVIEWED REGULARLY	17
4.2 FUND OUTPERFORMANCE SHOULD BE CONSIDERED EQUALLY WITH FUND UNDERPERFORMANCE	17
4.3 PERFORMANCE ATTRIBUTION SHOULD BE CONDUCTED REGULARLY	18
4.3.1 Biggest Contributors / Detractors	18
4.3.2 Portfolio / Sub-portfolio / Returns versus Benchmarks	18
4.3.3 Performance Attribution	19
4.3.4 Derivatives	19
4.4 THE PROCESS OF ATTRIBUTION SHOULD BE RELEVANT TO THE MANDATE	19
4.5 PERFORMANCE SHOULD BE CALCULATED AND REPORTED IN ACCORDANCE WITH GIPS	20
4.6 WHERE RELEVANT, PEER GROUP ANALYSIS SHOULD BE PERFORMED	20
ACKNOWLEDGEMENTS	21

Preface

This document is an updated edition of the 2015 IMAS *Guiding Principles for Investment Risk & Performance Measurement Functions*. The update consolidates recent industry developments, and expands sections on model governance, data quality, sustainability, and the use of Artificial Intelligence/Machine Learning (AI/ML) in investment processes.

1. Introduction to the Guidance

1.1 Introduction and Purpose

Investment management firms manage risks on behalf of clients and owners to generate returns. It is therefore critical to the effective management of these organisations that they are able to calculate, analyse and act upon information about the investment risk and returns of their products.

Similar to a manufacturing process, the investment portfolio creation and management process should, at minimum, be documented. Clear definitions of the process and methodologies should be established to assure those undertaking this process that it is operating as expected and with no deviations. Where there are, these deviations should be actively understood. The outcome of the process (realized performance or volatility) should also be reviewed periodically to provide feedback and refinement to the underlying process.

Unfortunately, due to legacy structures, business structure and internal politics, the lack of consistent client and regulatory demands or simply the sheer cost and operational efficiency needed to maintain such a review and feedback process, significant inconsistencies exist across firms in how they perform investment risk and performance functions.

The Guiding Principles for Investment Risk & Performance Measurement Functions (The Guidance) seeks to address this issue by providing investment management professionals in Singapore with a set of guiding concepts, principles or best practices to be considered when establishing, developing or reviewing the risk and performance function in an investment management company. **This document is by no means comprehensive, neither does it seek to prescribe or delve into the technical specifications of calculations. Instead, it has been produced by IMAS as a baseline document to help develop the dialogue amongst investment professionals and in particular risk and performance practitioners inside their organisations and across the industry in Singapore to improve the consistent application of best practices in this area.**

The document acts in concert with well-established standards, such as the Global Investment Performance Standards (GIPS), to provide a general roadmap for risk and performance professionals with oversight responsibilities, to strengthen their functional capabilities and build a best-in-class unit.

1.2 Scope and Approach

In this guide, the Risk and Performance Committee of IMAS identified that Governance, both investment companies and the investment process, was as critical to discuss as the areas of investment risk and Performance measurement. Therefore, The Guidance is structured around introducing the key concepts necessary for good investment risk and performance in three (3) broad and generic areas:

- a) Governance
- b) Investment risk management
- c) Performance Measurement

2. Governance

An effective investment risk and performance function acts as a control function as well as a service function of the firm. There are generally two operating models where investment management firms (“firm”) have the Investment Risk and Performance function as a single combined unit or separately structured. In larger firms, the Investment Risk function typically forms part of the Enterprise Risk Management function as a second line of defense. The Performance function more typically sits within the Chief Operating Officer (“COO”) function as an analysis and reporting capability. The firm will have to decide on the model that suits their operational set-up based on both their strategic business vision and goals driven by scale, complexity, and market opportunities, as well as practical matters such as size, budget, and available resources. However, it is accepted that there is a need for consistency and scope for synergy between these two functions, particularly around mapping, monitoring, and understanding the investment process. It has also been accepted that the production and calculation of metrics needed to support both risk and performance functions require potentially different skills from those needed to effectively interpret and communicate this analysis to other functions, and through the relevant governance bodies and stakeholders.

Increasingly, the Investment Risk function has progressed from a control function to a business partnership with the Investment team to understand the risk exposures (intended or unintended) in the portfolio. Investment Risk functions as a second line of defense needed to maintain the level of independence to escalate risk exposures that are out of tolerance in accordance with the manager’s governance structure. The focus of an Investment Risk function typically covers both risk exposure (i.e., loss potential as measured by certain risk measurements such as value at risk or tracking error) and investment exposure (i.e., issuer, sector, country exposure). It is useful to highlight monitoring of investment or regulatory limits, being a control function that is managed by Investment Risk in some firms.

Therefore, governance of both how the function fits into the organisational structure and the activities of the function are critical to the success of that function in discharging its duties and supporting the need for both control and reporting in an investment management firm.

The key areas of responsibility for the unit in an investment manager can include, but are not limited to:

- a) Performance measurement, to accurately and consistently measure returns and ex-post risk indicators of *all* portfolios;
- b) Performance attribution, to explain the impact of investment manager’s decisions and strategies on the return (and risk) of the portfolio;
- c) Investment manager, product, and business investment performance appraisal, by providing information and analysis to key internal and external stakeholders;
- d) Investment risk measurement (including ex-ante risk analysis);
- e) Technical input into product analysis, Investment policy documents, Investment Management Agreements, prospectus / offer documents, regulatory documents such as factsheet, key investor information document; and

- f) Operational oversight and target operating model governance over portfolio / risk system / data providers

The unit thus plays a critical role in the overall information flow in the investment manager, being one of the only functions that can effectively see the “end-to-end” flow of data from trade to final investment presentation. This breadth of scope and the need to be unbiased in discharging its function is why the unit needs to operate in a controlled setting, with clear governance over the unit, thus providing independent governance over various activities of the investment manager.

2.1 Governance of the Risk and Performance Unit

The unit should sit independently of the investment function and other related functions (including marketing, client services, and product), so as to be able to effectively discharge its oversight and information support duties. The unit also needs to sit at a senior enough level within the organisation to support the need for independence and lack of bias in its discharge of its duties. In many firms, therefore, the unit can report to a Chief Operating Officer or a Chief Risk Officer, to allow for arms-length dealing with the various businesses in the investment management firm. In the absence of the posts existing at a senior enough management level, the function could report directly to the CEO.

It is important that the unit establishes operational service level agreements within the firm, to ensure appropriate workflow, management of production activities, as well as change requests mandated by internal and external stakeholders. It may not be feasible in smaller investment management companies to have in place a full framework as mentioned, but this is desired as best practice for the company to strive towards, especially as it grows in size and/or complexity.

2.2 Governance within the Risk and Performance Unit

The unit provides an independent (of the investment team or specific investment manager) source of governance for the firm to understand its exposures, concentrations, and strategies from an investment risk and performance perspective, which ultimately has far-reaching benefits for the business of the investment manager.

The unit should advocate and promote internally, the adherence to best practices in how risk and performance is calculated and presented, including standards promoted by key industry bodies (such as IMAS), codes of conduct, such as those provided by the CFA Institute, and rigor in the provision of the risk and performance analysis.

The unit should provide input into the design and ongoing maintenance of policies across the organisation, including product definitions, investment management agreements, risk guidelines and operational frameworks to support the various businesses in the investment manager.

The unit should also ensure consistency in the benchmarks (BMKs) used for risk and performance monitoring, as well as consistency in portfolio data utilized for risk and performance attribution.

Commented [1]: data providers, vendors for mid-back office, valuation agent is primarily operations or data team's responsibilities

The unit therefore should seek to create internal structures that ensure its technical insight is leveraged as a key value-added function in the company, ultimately securing the ambition of the investment manager to grow the business through Assets Under Management (AUM) in an appropriately managed, risk-aware and risk-controlled manner.

3. Investment Risk Management

Investment risk management plays an integral role in proactive portfolio management and its focus is expected to go beyond traditional ex-post reporting. It involves consideration of economic exposures and relevant portfolio characteristics to identify, measure and monitor the sources of risk.

3.1 Investment risk should be independently measured and monitored

Whilst it is best practice for an organisation to embed the notion of risk management broadly at all levels, with specific focus on senior management understanding the business risks in abnormal markets, it is now a fundamental expectation across the industry that investment managers have processes by which investment risk in portfolios is independently measured and monitored. To be clear, in many firms, there is the role of investment strategist or an investment risk professional who operates as part of the investment team. This is considered by some as best practice and has not been disputed as adding value in organisations that have such a structure. However, it is key to distinguish between this function and its benefits and the need for independent oversight of the portfolio management process as a whole.

3.2 Portfolio and Execution Risk Controls

Execution control is a key component of Investment Risk Management. Various limits can be applied or may be specified in an investment management agreement. For example, counterparty risk limits or stop-loss limits. Limits or Key Risk Indicators can also be set for the risk analytics set out below to monitor the alignment of risk versus appetite, and, or investment style.

In addition to traditional risk controls, the performance team can enhance oversight by conducting analysis on trading prices, such as comparing traded prices against intraday price movements. This provides deeper insight into execution quality and market impact and complements performance attribution with a more granular view of trading efficiency.

3.3 Importance of Data

Accurate, complete, and timely data is the foundation of effective risk management. Clean, reliable, and trustworthy data enables the investment risk team to conduct meaningful analysis, identify emerging risks, measure exposures accurately and ensure compliance with regulatory requirements. Poor quality or inconsistent data can lead to ineffective risk controls, exacerbated by lack of trust in the underlying information and resulting insights, while increasing potentially the propensity of regulatory and/or investment breaches.

To safeguard data integrity, firms should consider the following best practices:

- a) source data only from verified and reputable providers.
- b) ensure that the data lineage, validation, and reconciliation processes are in place.
- c) Design an optimal data quality control process across technical and business rules.
- d) maintain clear documentation, process maps and audit trails of all data inputs and amendments.
- e) apply consistent and comprehensive data governance standards and policies and
- f) establish regular reviews and exception reporting to identify and address anomalies promptly.

3.4 Comprehensive Use of Risk Analytics

Risk analysis which relies solely on a single or limited number of statistics can prevent a holistic risk profile of a portfolio from being built. Indeed, a key issue highlighted in the aftermath of the Global Financial Crisis was the over-reliance upon a single risk measure, VaR, as a proxy for a total risk management framework.

Examples of risk analytics which could be appropriate are set out below. However, it is important to note that the most relevant set of risk statistics will differ by asset class or strategy. These should be discussed and agreed on by both the investment and the risk management teams. Increasingly, the traditional long-only fund manager has added investment capabilities in alternative asset classes in the firm's product or strategy offerings. Broadly, alternative investments are categorized into¹:

- a) private equity ("PE")
- b) private debt
- c) real assets (real estate, infrastructure)
- d) hedge fund (liquid alternatives)

Each category requires very different investment skill sets compared to traditional asset classes of public equity and debt. Firms that do not have sufficient resources to build large Investment teams may start with Fund of Funds ("FoF"), e.g., fund of PE funds. Consequently, this increases the complexity of understanding and in finding the appropriate risk measures for FoF vehicles / strategies.

Thus, there is a need to appreciate that risk analytics relevant to the asset class, investment strategy identified by the portfolio manager, and generic risk analytics, are necessary to ensure that the firm does not focus only on the risks they believe are relevant, to avoid developing a "tunnel vision" from a risk perspective.

¹ Adapted from Chartered Alternative Investment Analyst Association

3.4.1 Value at Risk (“VaR”) and Conditional Value at Risk (“CVaR”)

VaR and CVaR (also known as expected tail loss) aim to describe the expected potential loss of a portfolio (set of portfolios) over a specified time horizon at a pre-determined probability. CVaR is a complementary measure to VaR, providing an estimation of how much we could lose, on average, if the portfolio losses exceed our VaR estimation.

Given that there are several approaches to calculating these numbers, deciding upon the appropriate models for different strategies is key. For example, where portfolios exhibit greater levels of non-linearity, it is best practice to adopt a Monte Carlo framework which is based on a stochastic process where randomness is not normally distributed. Aligned with model choice is the choice of appropriate timeframe for measurement of VaR and CVaR; the time horizon should correspond with the investment strategy, especially with respect to the inherent expected volatility and turnover characteristics.

As an extension and drill down into a specific measure of VaR, which is a typical measure for market risk, firms can also include Credit VaR, which is used to measure the VaR arising from credit risk for their fixed income portfolios.

While VaR and CVaR are effective in capturing tail risk, risk analysis can be further enhanced by examining the “fatness of the tail” through statistical measures such as skewness and kurtosis. These metrics provide deeper insight into the asymmetry and extremity of return distributions, helping to identify hidden vulnerabilities in portfolio risk profiles.

3.4.2 Percentage and Marginal Contribution to Active / Total Risk

The contribution to active / total risk in both marginal and percentage terms is effectively an attribution of the overall market risk of a portfolio, typically measured as tracking error or volatility. The decomposition of risk is performed in an ex-ante framework, and can be split by various groupings, depending on model choice and/or investment strategy. For example, the decomposition of tracking error for an equity portfolio can be performed according to the Global Industry Classification Standard (GICS) sectors, while the decomposition of volatility of a bond portfolio can be performed by maturity or duration bands.

This risk decomposition also provides a quantification of overall common factor risk and specific risk in the portfolio (and the relevant benchmark), and the contribution from each attribute in the portfolio decomposition. It can be normalised to a percentage form such that direct comparisons can be made (and the numbers added up), or in a marginal manner so that the impact of a change in the position by a certain amount (typically 1%) can be quantified, to assess sensitivity.

3.4.3 Portfolio Characteristics

Portfolio characteristics may differ depending on the asset class. For equity portfolios, P/E, P/B, dividend yield and other financial ratios could be viewed while fixed income portfolios should be viewed along the

likes of currency, duration, spread duration, duration time spread (DTS) and yield. The portfolio characteristics should be viewed and aggregated by security attributes that facilitate an understanding of the sources of risk along the lines of currency, country, and sector. For fixed income portfolios, additional attributes like key rate, maturity bucket and yield bucket are used.

3.4.4 Factor Attribution

The use of risk factors is a common approach among practitioners to manage the sources of risk in the portfolios. Types of risk factors include fundamental, statistical, and macroeconomic factors, and differ by portfolio type. For example, equity portfolios might consider portfolio exposure by country, sector, and market capitalization, whilst fixed income portfolio exposure is frequently understood through intuitive factors that relate the portfolio's duration and spread duration to interest rate and spread changes. DV01 and spread DV01 are examples of such analytics. In addition, it is important to understand the duration across the key rates for all currencies, as well as spread risk across all currencies, sectors, and ratings.

3.4.5 Style Analysis

In equity portfolios, besides the usual schema that aggregates the portfolio exposure by country and sector, some practitioners use style analysis to measure and manage the portfolio's major exposure to styles such as growth, value, and momentum. The style analysis quantifies the sensitivity of the portfolio to changes in growth, value, and momentum factors. Note that the use of market / vendor driven definitions may differ and not be commensurate with the actual investment process, and hence it is key to define the style factors collaboratively with the investment manager(s) to ensure consistency with the investment process. Besides risk exposures, performance attribution can also be done using style analysis to determine style drivers of performance in the portfolio.

3.4.6 Leverage

Leverage is a critical dimension of investment risk that must be measured and monitored consistently. Regulatory frameworks such as ESMA's UCITS guidelines prescribe robust standards for leverage calculation, including both the Commitment Approach and the Sum of Notionals method. To ensure effective risk oversight, the risk management unit should be able to calculate leverage metrics on a daily basis, taking into account derivatives exposures and embedded leverage within investment structures. Monitoring leverage in this manner enhances transparency, supports regulatory compliance, and provides an early warning mechanism to guard against excessive risk-taking.

3.4.7 Risk Measures for Alternatives

Traditional financial risk measures may not be appropriate for measuring market risk of alternatives investments. Other risk measures tailored to the asset class should be applied and complemented by early involvement of the risk function in the deal assessment, given the potentially less liquid and opaque nature of these investments. This proactive approach helps ensure underwriting assumptions are sound and supports robust portfolio construction.

For private equity, the common performance metrics will include Distribution to Paid-in (“DPI”), Residual Value to Paid-in (“RVPI”), Total Value to Paid-in (“TVPI”), Multiple Over Invested Capital (MOIC). While these are typical performance measures, they can be used to indicate if PE investment is performing according to the original investment thesis and under-writing case. In addition, ratios such as DPI/TVPI provide some insights into the realised return vs. unrealised value; for example, a low ratio shows that most of the value is unrealised which has a potentially higher exit or timing risk.

Private credit—also called private debt—is lending conducted outside traditional banks and public bond markets. It spans strategies from direct lending to acquisition financing and distressed opportunities but is used mainly to provide bespoke loans to businesses of all sizes. The main risk is default. Private credit managers, much like banks, perform thorough underwriting and ongoing loan monitoring. Understanding the credit quality via some form of internal credit rating, the extent of and the quality of collateral (or collateralisation) will help to measure and assess default risk.

Another commonly used metric is the performance drawdown, i.e., a peak-to-trough decline in fund NAV. This can be extended to include Calmar Ratio which is the risk-adjusted return of the alternative investments.

It is important to understand each alternative investment and select a set of appropriate performance and risk metrics.

In private markets, traditional performance metrics such as TVPI and DPI must be interpreted in the context of asset type and fund maturity, particularly given the J-curve effect. Early-stage funds often show low DPI and elevated TVPI due to unrealized gains, which is expected. However, persistent underperformance in DPI or stagnation in TVPI beyond the typical lifecycle may indicate deeper issues. Integrating these metrics into a RAG framework — calibrated by strategy and vintage — enables timely risk identification and escalation, even in the absence of daily market signals.

The integration of Public Market Equivalent (PME) and scenario analysis into private asset oversight strengthens the risk management framework by introducing comparative and forward-looking dimensions. PME enables benchmarking of private fund performance against public market indices, supporting relative value assessments and strategic allocation decisions. Scenario analysis facilitates stress-testing of valuation, liquidity, and cash flow outcomes under adverse macroeconomic or sector-specific conditions. Together, these tools enhance visibility into potential downside risks and complement traditional metrics such as TVPI and DPI, enabling more informed and proactive portfolio governance.

3.5 Risk Concentrations should be Understood and Analyzed

Monitoring the sources of risk can be useful in tracking and managing concentration risk which affects the portfolio in several ways. Concentration in certain instruments may hurt the portfolio in times of stress and make liquidation costly and difficult. Concentration risk exists not only within the portfolio or strategy, but also across the firm's portfolios using the same strategy. Concentration risk can also arise from positions with small market value percentages in the portfolio but disproportionately high contributions to tracking error, particularly when exposures are active relative to the benchmark. It is best practice to link this back to section 3.2 in terms of the setting of risk limits, considering counterparty exposures as well.

Hotspots are identified not only through the portfolio's exposure to risk factors, but also through their risk contribution to the portfolio. The exposure in dollar terms and in relative terms within the portfolio and across the firm's portfolios provides insight into the concentration risk of each investment and risk factor. When evaluating the holdings of a bond across the firm's portfolios, the assessment should consider how much the firm holds as a percentage of issuance outstanding. When examining the holdings of a stock across the firm's portfolios, it is recommended to identify not only how much the firm holds as a percentage of market capitalization, but also as a percentage of free float adjusted market capitalization. Ideally, a look-through approach should be applied in Fund of Funds (FoF) structures to capture the complete concentration risk, including both direct and indirect exposures. This look-through analysis should also be extended to private equity (PE), private credit (PC), and venture capital (VC) investments to ensure comprehensive risk visibility.

3.6 Portfolios should be Subject to Regular Scenario Analysis and Stress Testing

Scenario analysis and stress testing, while different in approach and scope, are highly intertwined. Scenario analysis reprices a portfolio using changes in market factors, such as equity market moves, yield curve changes, and currency fluctuations, experienced in historical scenarios. By contrast, stress testing uses pre-determined changes to market factors, either in isolation or in conjunction with one another – the key difference being that the tests can consider the correlations between factors or perform them on an uncorrelated basis.

Since the Global Financial Crisis, investors, managers, and regulators the world over have become more focused on the impact on their portfolios of a stressed market environment, and the ensuing impacts to the wider financial system. Normal market assumptions need to be augmented with extreme market scenario analysis. This has also meant that the variables and assumptions used in the risk models need to be stressed as well, to ascertain their applicability, appropriateness, and stability.

Stress testing should also be conducted not just on market factors but should include other factors, such as liquidity, to provide a more holistic view of risk. Aspects such as trading volumes, bid-ask spreads, volatility, investment structures (for example fund gates) should all be modelled in a range of plausible yet extreme scenarios. The techniques should be performed in a regular continuous cycle, with appropriate feedback into the investment process, starting with the setting of the objectives themselves. Regular model reviews,

including the list of scenarios to be tested, should be discussed and reviewed for relevance and rigor at the risk committee level.

In addition to stress test or scenario analysis, firms can also use reverse stress testing. Reverse stress testing starts with the endpoint: define what would count as failure—such as a 20–30% drawdown, a capital or liquidity shortfall—then work backward to find the combinations of market moves, factor tilts, sector concentrations, or correlation breaks that could cause it. Unlike traditional stress tests that begin with a fixed scenario, reverse tests search for the smallest plausible shocks that push a portfolio past its limits. The exercise exposes hidden tail risks and guides practical mitigants (e.g., hedges, de-risking triggers, liquidity buffers), helping the firm to build more resilient portfolios.

It is also highly recommended that the CIO and the front office as well as the board of the investment manager set forth key scenarios that will impact the business, and monitor these risks including liquidity, in a regular senior forum. This will allow the business to not just react to markets in times of stress, but to be able to proactively manage the business (such as expansion, new markets, product launches and terminations).

3.7 Portfolio and position liquidity risk should be measured and monitored

Liquidity risk is often cited as the “hidden risk” – it is always persistent yet not focused upon until markets are in stress. Liquidity risk can tend to overwhelm the other risks being considered in a portfolio, especially when considering stressed market scenarios, so measuring and monitoring liquidity risk should be a standard and explicit part of the risk measurement and management process.

There are two aspects to liquidity risk for investment management companies, both of which should be measured and monitored:

- a) Portfolio liquidity, which concerns the ability of the portfolio to meet certain obligations, chiefly net outflows. The key elements are the extent of the liabilities faced by the portfolio, as well as the proportion of liquid assets that are readily available to cover these liabilities ensuring that the portfolio liquidity profile is not materially compromised when meeting these liabilities; and
- b) Position liquidity, which refers to risk, is embedded in a portfolio through its particular positioning of assets. The key attributes being the size of the position, the relative size of the trading volume and markets in which the position can be traded, the underlying volatility of the position, as well as the bid-ask spread of the security underlying the position. Position liquidity can also be assessed at aggregated level across portfolios to uncover potential vulnerabilities when groups of portfolios liquidate at the same time due to a change in view or management style.

The output of liquidity risk can also provide valuable insights into potential market dislocations or drawdowns, for example, sudden spikes in short-term volatility or widening bid-ask spreads.

It can also serve as a feedback loop for the calculation of swing factors.

Commented [2]: Modified slightly to cover that portfolio liquidity should not only be about meeting liabilities but also ensuring that remaining investors post a large redemption are not left with a significantly less liquid portfolio.

Ideally, the estimated liquidation cost for 10% of the portfolio should be of the same magnitude as the swing factor applied, ensuring alignment between liquidity stress and investor protection mechanisms.

3.8 The Role of Investment Risk Management in Sustainability (ESG)

Sustainability-related risks and opportunities—spanning environmental, social and governance (ESG) issues—are increasingly material to investment outcomes across asset classes. Climate change, nature-related dependencies, and governance or social practices can affect cash flows, discount rates, default probabilities, valuations, and liquidity. Embedding sustainability within the investment risk framework enhances fiduciary oversight and strengthens portfolio resilience.

3.8.1 Measurement and Scenario Analysis

Sustainability key risk indicators (KRIs) should complement traditional market and credit analytics and be proportionate to the mandate while considering practical implementation matters such as materiality to the investment process and data availability. Examples include basic ESG scores, ratings as well as more defined portfolio carbon metrics (such as weighted average carbon intensity, financed emissions, implied temperature rise), exposure to high transition risk sectors and geographies, physical climate risk at issuer/asset level, and indicators of taxonomy aligned or credible “transition” activities where relevant.

Portfolios should also be assessed against a range of climate pathways—orderly and disorderly transitions, as well as “hot house” outcomes—capturing both transition and physical effects. Importantly, any pathways and metrics should be science-based to ensure rigor. In private markets, due diligence should cover counterparties’ transition plans, regulatory exposure (such as carbon pricing), permits, nature dependencies and physical risks, with ongoing covenant monitoring.

3.8.2 Stewardship & Product Design

Engagement can be an explicit risk response for positions with elevated sustainability risks. While stewardship is generally managed by a dedicated team, risk managers should maintain an understanding of the engagement activities undertaken to help monitor progress and assess the ongoing risk posed by these positions. Risk should also contribute to product design, investment policy documents, and client disclosures to ensure claims are accurate and avoid greenwashing.

3.9 Investment Risk should be reported via the use of Key Risk Indicators

Given the wide range of portfolio characteristics and risk analytics that are available, it is more optimal to present Key Risk Indicators (KRIs) through the mechanism of an investment monitoring dashboard that

provides a summary view of the portfolio(s). This reporting could be sorted by KRIs, examples of which could include:

- a) The top / bottom ten contributors to absolute risk, for the portfolio and for the benchmark, if applicable;
- b) A similar breakdown of tracking error, if applicable;
- c) A clear split between common factors and specific risks;
- d) Guidance in the form of limits (shown through “traffic lights”) to highlight concentration bands;
- e) Trend analysis, comparing current results with at least two discrete prior periods; and
- f) Comparison of the decomposition to ex post return attribution, to highlight the risk-return trade-off.

The results should be made available to key decision makers and be regularly reviewed at portfolio construction meetings or similar forums, to ensure that material results (especially changes) are acted upon in an appropriate manner.

3.10 Risk Models should be Independently Reviewed and Authorized

Risk models must be appropriate and robust if analysis is to be relevant to the investment strategies, and the investment risk oversight process. Models are also a source of operational risk. As such models should be independently validated. Validation should cover the evaluation of methodology, parameters, data governance, assumptions used as well as the model governance framework. There are numerous best practice and standards in the marketplace such as ISAE3402 and CMMI 3 which provide a measure of comfort to the end users and recipients of risk reports that the models used have been tested and validated.

3.11 Risk Models should be Back tested on a Regular Basis

Backtesting is the process of real-world testing of the empirical and model results with actual achieved results, to ascertain either the goodness of fit of the model to the actual results and / or the extent of the variation of the strategy in practice, from the stated objectives. By using techniques such as VaR and Tracking Error envelopes, the investment manager can better understand the behavior of the portfolio through time in both absolute and active risk dimensions.

Backtesting is important as it tests a fund’s actual risk results with the forecasted risk results (which are an execution of the investment parameters of the strategy);

Given the importance of backtesting, and the ability of the technique to add value and assist in the management of risk, a suggested best practice is for the exercise to be carried out by the risk and performance unit as an independent and consistent measurement of the strategy effectiveness. For this to be an effective process, the unit must be in close contact with the front office in terms of understanding both the investment strategy as well as the implementation methods undertaken to execute the strategy.

A common platform of data, calculations and reporting integrated across the business is important in ensuring consistency and accuracy of measurement, which in turn enhances the ability to manage the outcomes more effectively. A best practice is, for example, to have an integrated solution that links both the ex-post achieved results with the ex-ante forecast projections, and for the platform to be able to proactively provide alerts in a dynamic setting. This allows the exercises to be conducted holistically rather than in a reactionary manner.

In recent years, technological advancement has made significant progress, and the use of Artificial Intelligence / Machine Learning (“AI/ML”) is increasingly more common in the investment or portfolio construction process. Firms that use AI/ML in their investment process should have more robust model risk management processes. The risk of high model bias may lead to under-fitting of the model. Developers of these models should also include periodic model reviews to ensure explainability of the model output. The investment team must be able to understand, interpret, and trust how a machine learning model makes predictions, recommendations or generate alpha signals.

4 Performance Analysis

4.1 Fund Performance should be Reviewed Regularly

The review of a fund's performance is a critical function which tests whether investment strategies are appropriate to achieve investment objectives and are implemented in the way they were intended. It can also feed into the refinement of investment process and the evaluation of portfolio managers.

A prerequisite for performance review is a clearly defined performance calculation, performance measurement, performance attribution and performance reporting process. There is no one best practice model for these activities, rather it must be tailored to the firm's, stakeholders' and portfolio manager's objectives and strategy. Once the performance measurement and attribution process is defined, it needs to be industrialized and validated with an impartial, unbiased, and consistent process which will be the official performance review.

The performance review process should occur in accordance with clearly defined frequencies, be that weekly, monthly, quarterly, and/or annually. Common measures include both pure ex-post performance statistics, as well as some ex-ante risk-based calculations. Common practices and recommendations for such indicators include: 1) one, three, and five year performance on an absolute (and active basis, if applicable) which allows for a view of trends over time; 2) comparison against a benchmark that reflects the investment strategy of the portfolio, if applicable; 3) peer group percentile ranking for relativity to "like" products, if applicable; 4) risk-adjusted ratio analysis (for example, information ratio, Sharpe ratio, and Sortino ratio); and 5) yearly performance against a pre-set absolute or alpha target.

The performance review process should examine how the performance was achieved, through a comparison to stated investment objectives (perhaps the Investment Management Agreement or Policy Risk Guidelines) and test accountability by challenging the rationale for key portfolio positions versus these objectives. This process of appraisal provides assurance that appropriate investment strategies are being deployed by the portfolio manager and that the performance is not driven by style drift or bets inconsistent with investment strategy. The performance review also ensures that all portfolios are being monitored and reviewed with the same rigor. Reporting templates based on management's and client's objectives should be defined for these performance reviews to facilitate these discussions and highlight exceptions.

4.2 Fund outperformance should be considered equally with fund underperformance

It is a natural tendency to focus on the underperforming funds and overlook the outperforming funds during the portfolio review process. However, a positive fund performance could easily turn into underperformance in a short time frame, and rather than examining the investment process and strategies only when the fund underperforms, the performance review provides a consistent, comprehensive and periodic focus on

attributing portfolio performance to key factors, examines whether performance was backed by strong conviction and establishes clear line of sight and accountability in the investment process.

4.3 Performance attribution should be conducted regularly

In the course of the investment process, it is critically important to understand not only what a portfolio's return was, but also how that return was achieved. Attribution analysis can be used to fully recognize where this out-performance or under-performance comes from (relative to an index). There are a number of ways to section and organize performance results to do attribution. To cut through this noise and be most effective for investment management, the attribution methodology should be consistent with the investment process it is assessing, and where appropriate, utilizes factors relevant to the portfolio's primary drivers of performance. The Performance attribution should also be read in sync with that of ex-ante Factor Risk Reports. Ex Ante Risk Factor/style reports tend to have same style/factors for excess returns in the long run. The factors that can be considered will differ by portfolio type, but could include:

4.3.1 Biggest Contributors / Detractors

Biggest contributors / detractors segregate the portfolio's return into factors and components, such as common factors, market timing and stock selection. A basic framework of attribution should include contributors (and detractors alike) to specific return indicators, taking into account each position's (active) weight and the difference between that position's return and the return attributed to the specific factors.

The biggest contributors / detractors clearly identify the factors or components affecting the returns, especially when compared on a time-series basis to spot trends and biases. This consistency analysis also helps support tactical changes to the investment strategy depending on the frequency of analysis and appropriateness to the strategy. The magnitude of impact further provides useful data points for investment managers to actively manage the portfolio. It could also be a basis for the consideration of an investment manager's remuneration, especially the factors relating to stock selection.

The biggest contributors / detractors are widely used for portfolio analysis but usually used in conjunction with other methods. They are mostly used for post-mortem purposes, especially in commentaries to investors and investment articles. The frequency of formal analysis is usually quarterly if not longer.

Top contributors/detractors tend to be top idiosyncratic risk names in ex-ante risk reports.

4.3.2 Portfolio / Sub-portfolio / Returns versus Benchmarks

This is the monetary return experienced by the holder of a portfolio compared to a specific benchmark. Sub-portfolio returns (i.e., by sub strategies, by investment mandates, by sectors, etc.) can be calculated on a daily or long-term basis to serve as a method of assessing a particular investment strategy. This indicator is important to track the performance of the portfolio and its sub-portfolios against benchmarks for asset allocation purposes. This is particularly important for investment mandates with multiple strategies or sectors

handled by different fund managers. It can also serve as the basis for assessing the performance of the individual fund managers.

4.3.3 Performance Attribution

Using the guiding principle of attributing returns according to relevant decision making, it is recommended to perform strategy Performance Attribution where appropriate. In theory this approach can appear complex, but as a basic starting point, utilising familiar attribution models with customised hierarchies can provide valuable insights.

For example, if positions are grouped by the strategies they belong to, using the Brinson-Fachler methodology against these groups as sectors or countries will provide insights into the allocation and selection impacts for these strategies. This requires close collaboration between the risk and performance unit and the front office to define the hierarchy for the attribution, as well as a rigorous maintenance process by which the strategy tags are updated to ensure the attribution remains informative and relevant.

4.3.4 Derivatives

Derivatives form an important component of many investment strategies, and their modelling is a key aspect of both performance attribution and risk analysis. Proper assessment requires distinguishing whether derivatives are used primarily for hedging purposes or for taking directional positions. Performance and risk teams should work closely to ensure that the scope and intent of derivative use is clearly defined and monitored. Furthermore, performance attribution should evaluate the effectiveness of derivative hedges in mitigating risk, providing deeper insight into portfolio outcomes and supporting more informed decision-making.

4.4 The process of attribution should be relevant to the mandate

The approach to performance attribution will differ by asset class, as well as investment style. For equity attribution, it is common to use the Brinson-Fachler methodology, which is seen as an industry standard. It arithmetically (the most typical implementation) decomposes active returns into the value-add from Allocation and Selection decisions made across a given grouping of assets relative to its index. The key benefit of this approach is that it can be adapted to a standard top-down or bottom-up or mixed investment decision making process and highlights the alpha generated accordingly. A best practice for multi-currency portfolios is to perform the analysis in local terms, with currency decisions (passive/active) treated separately.

For Fixed Income, given the nature of a bond versus an equity instrument and the plethora of investment strategies, the basic tenet should be that attribution should be viewed through the lens of yield curve factors that impact a bond's performance, such as effects due to parallel rate shifts (duration and convexity), changes in the shape of the yield curve (twist, butterfly), roll-down, carry return, inflation, and changes in swap and credit spreads. It is best practice to treat currency separately.

By contrast, given that multi-asset portfolios combine both equity and fixed income asset classes into one portfolio, if a detailed factor-based view is required then different methodologies need to be combined. The aspect which is commonly unique in the Multi-Asset space is the impact of asset class level allocation decisions. Accordingly, best practice is that the attribution model used will capture this effect. For a given portfolio, this is achieved through treating each asset class as its own sector with a corresponding asset class level benchmark. Since the portfolio now effectively has two levels of benchmarks (one for the overall portfolio, and one for the sub asset classes), there will be two allocation effects instead of one as typically observed. The first level allocation impact is the effect of value-add due allocation of asset classes relative to the top-level benchmark. The second level allocation impact is the effect of value-add due to the allocation within asset classes relative to the asset class specific benchmark. Lastly, there will also be a selection impact which is the effect of security choice excess return within each asset class. As with previous examples, this is an effective means of increasing explanatory power to align with how the investment decisions are made. It is best practice to be able to combine “best-of-breed” approaches in a multi-asset model, with equity attribution models for equity asset classes, and a suitable fixed income attribution model for bond allocations.

4.5 Performance should be calculated and reported in accordance with GIPS

Defined in the GIPS Handbook, a GIPS composite is an aggregation of one or more portfolios into a single group that represents a particular investment objective or strategy. Composite presentations give potential investors insights into the past performance of an investment manager's strategy. The method of calculation and disclosures presented should be in accordance with GIPS which allows investors to compare the performance of different fund management companies on a fair basis.

Composite presentations will typically display both gross-of-fee and net-of-fee total returns. The use of GIPS composites in the industry is mixed, with an overall trend observed that the bigger the firm the more likely it is to use GIPS composites, compared to the smaller firms.

4.6 Where relevant, peer group analysis should be performed

Peer group analysis is the practice of comparing a firm's results to those of similar companies or competitors. The emphasis here is on comparing "apples to apples," which means that the constituents of the peer group should be fairly similar to the strategies or funds being compared, particularly in terms of their main styles, benchmarks, or other key drivers of performance.

Peer group analysis is widely used by end clients when comparing their pool of asset managers to study opportunity cost as a critical part of their appraisal of the performance process. It is also a valuable tool in promoting fund performance to select clientele, and aids in business development activity. Hence it is important that the choice of peer group, the frequency of data management and any survivorship bias are all tested and validated by the risk and performance unit, in conjunction with the product control and investment teams.

Acknowledgements

The Investment Management Association of Singapore (IMAS) would like to convey our appreciation to the following contributors in developing the Updated Edition of the *Guiding Principles for Investment Risk & Performance Measurement Functions*.

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We also gratefully acknowledge the foundational work of the original contributors to the inaugural edition of this guide. Their efforts laid the groundwork for this refresh and continue to inform our approach today.

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