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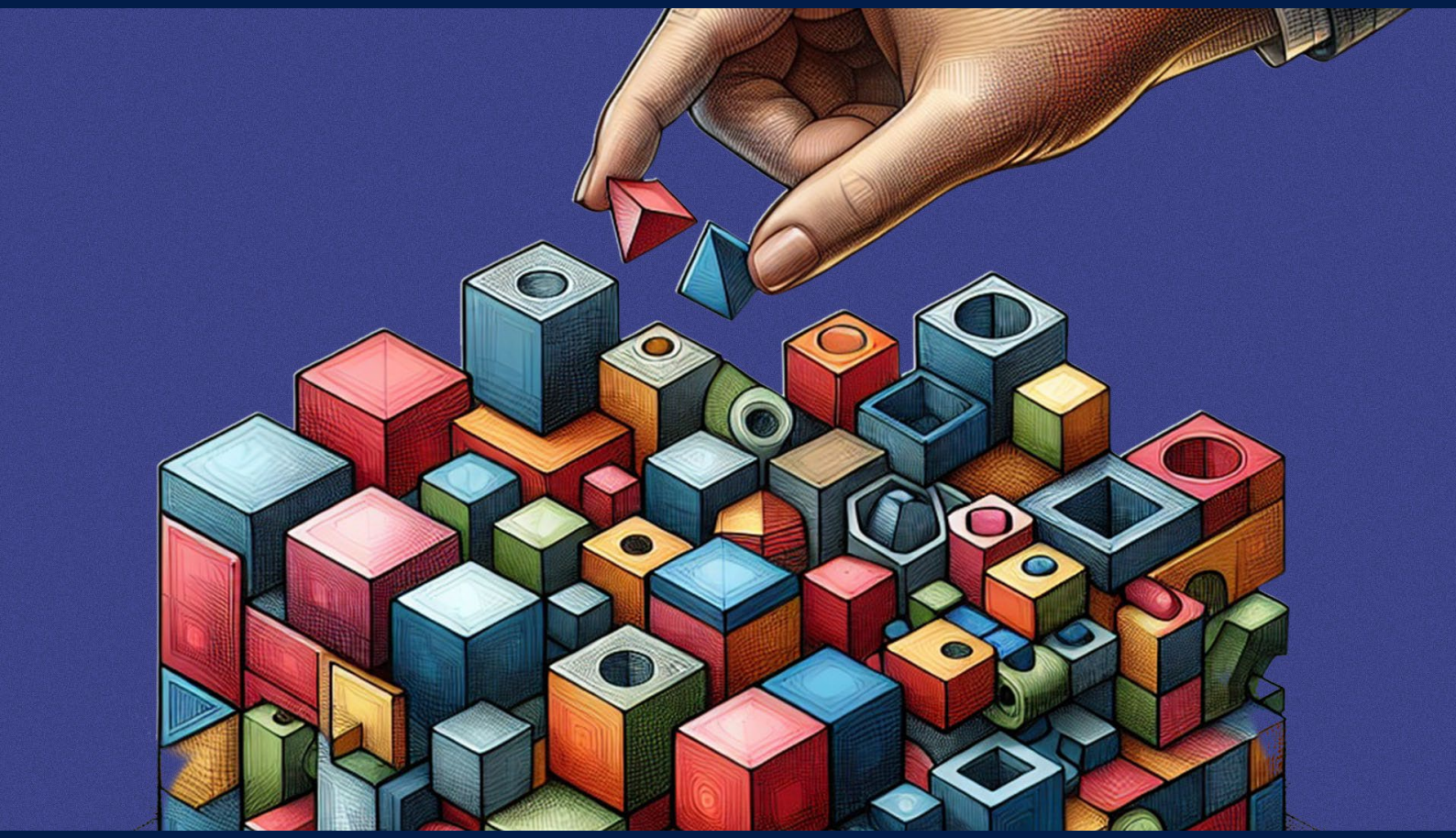

Building a Hedge Fund Allocation: Integrating Top-down and Bottom-up Perspectives

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Executive summary

- This paper presents an integrated top-down and bottom-up hedge fund allocation framework for investors. As institutional investors focus on ways to diversify a traditional 60/40 portfolio and generate a higher share of returns through alpha rather than beta, especially in an increasingly challenging investment environment, hedge fund allocation has emerged as a timely topic.
- Our framework discusses both top-down and bottom-up perspectives. From the top-down angle, we emphasise the importance of articulating the roles we expect hedge funds to play in the total portfolio and use that to design allocation ranges and structural guidelines for the programme.
- Our paper proceeds by first identifying three primary attributes that investors seek from hedge fund investments — low correlation to equities, resilience in equity drawdowns, and alpha generation.
- As opposed to classifying hedge funds by strategy, we propose an alternative method for categorising hedge funds — based on the three attributes identified. We break down the hedge fund universe into four hedge fund sub-groups with unique risk/return profiles: Loss Mitigation, Equity Diversifier, Equity Complement, and Equity Substitute.
- We then show, through a portfolio construction case study, that a standalone hedge fund portfolio tends to lean towards higher beta funds to achieve higher returns, while an approach that seeks to integrate the hedge fund allocation with the broader portfolio tends to favour diversifying funds. Instead of taking more beta risk in hedge fund allocation to achieve higher returns, we also explore utilising leverage on diversifying funds to increase risk taking without deteriorating the portfolio's Sharpe ratio.
- From the bottom-up perspective, we then provide insights on manager selection and day-to-day portfolio management. On manager selection, we emphasise the importance of choosing managers whose

characteristics align with the desired hedge fund roles, demonstrate a clear competitive advantage, and complement other funds fulfilling similar roles. We also explore the benefits of investing in emerging managers.

- Last, we discuss the considerations and trade-offs concerning the optimal number of funds and the sizing of each fund, as well as risk management.
- The hedge fund framework serves as a concrete example of the total portfolio approach that many institutional investors have been implementing. Here, top-down total portfolio needs guide the allocation ranges and structural guidelines, while bottom-up observations and insights continually feed back into top-down portfolio considerations, creating a continuous cycle of improvement. Compared to traditional strategic asset allocation (SAA) models which separate top-down and bottom-up considerations, we believe that an integrated framework is more effective.

Introduction

As institutional investors focus on ways to diversify a traditional 60/40 portfolio and generate a higher share of returns through alpha rather than beta, hedge fund allocation has emerged as a timely topic. This paper aims to provide a holistic framework for hedge fund allocations and discuss practical considerations when building and actively managing a hedge fund portfolio.

Investment inherently involves risk, but today's macroeconomic and market landscape presents an especially uncertain and challenging environment. After reaping the benefits of globalisation, low and stable inflation, and falling interest rates for years, we are now witnessing a regime shift — escalating geopolitical tensions and fragmentation, along with structurally elevated inflation, interest rates, and market volatility. All these make asset allocation via long-only return streams across both public and private markets more challenging.

Here, we find that hedge funds offer a unique value proposition by deriving returns from both long and short positions and dynamic investment strategies. Given these characteristics, as well as the heterogeneity within the hedge fund universe, a well-designed and actively managed hedge fund portfolio can provide resilience and alpha across various market conditions. As such, we expect hedge funds to play an increasingly important role in institutional portfolios as a tool to help mitigate losses, enhance macro resilience, and improve risk-adjusted performance.

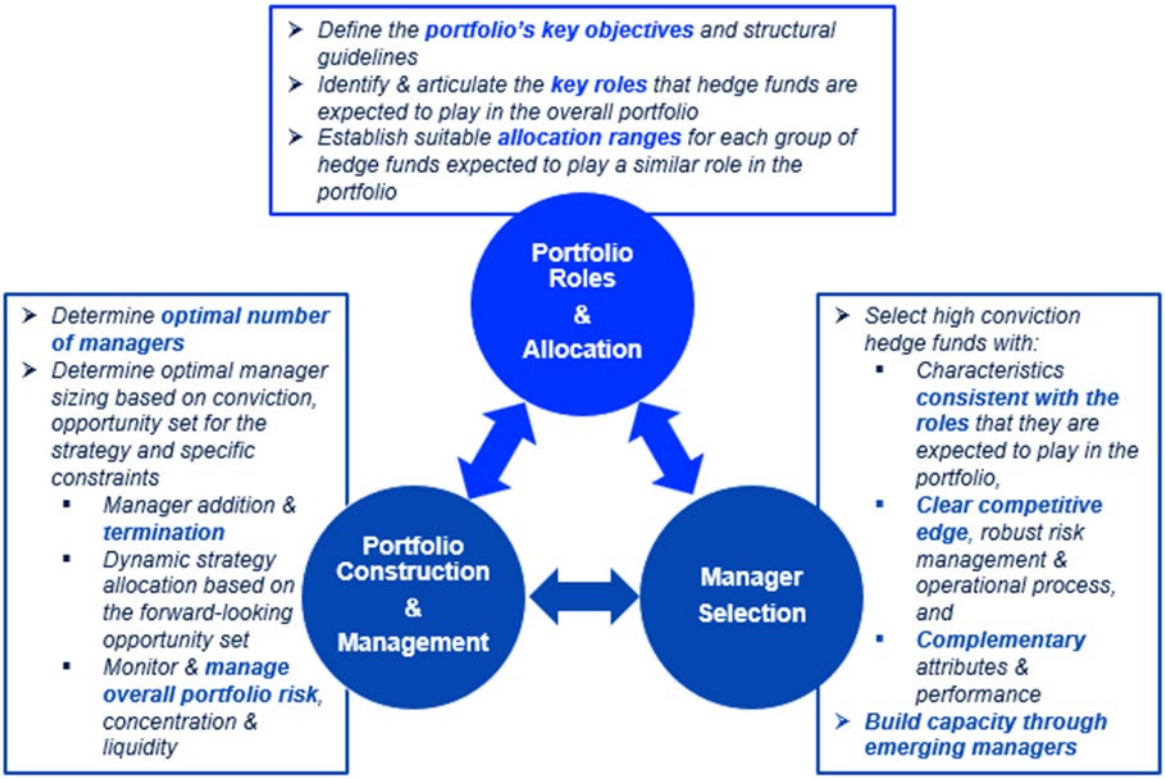
Our proposed hedge fund allocation framework combines top-down asset allocation considerations with bottom-up manager selection, along with robust and proactive portfolio construction and management. As illustrated in **Figure 1**, the framework comprises three components:

- The first component adopts a top-down total portfolio perspective, defining the roles that hedge fund allocation is expected to fulfil and determining the

desired allocation ranges for different types of hedge funds.

- The next two components take a bottom-up perspective, highlighting crucial areas that are often neglected when selecting managers and managing the hedge fund portfolio on a day-to-day basis.
- Together, they comprise a comprehensive process and generate insights essential for building a successful hedge fund allocation.

Figure 1: Illustrative hedge fund allocation framework



Source: JPMAM and GIC, 30 April 2024.

This paper consists of three sections:

First, we identify the primary attributes (low correlation, capital preservation in equity drawdowns, and alpha generation) that investors typically seek from hedge fund investments and assess the degree to which hedge funds have demonstrated these traits. We observe that over the past decade, hedge funds have shown the potential to deliver on these three attributes. However, there is

considerable variation among hedge funds, even within the same general strategy classifications commonly employed in the hedge fund industry. As such, using these standard strategy classifications to build desired hedge fund portfolios may not be the most effective approach.

Second, we propose a different approach to categorise hedge funds based on the three attributes mentioned earlier. We identify four distinct sub-groups of hedge funds with unique risk/return profiles, that span different strategy classifications. **We demonstrate how the optimal hedge fund mix differs based on the investor's target role for hedge funds in the portfolio.** To illustrate, we examine two roles: (1) a standalone hedge fund allocation with attractive risk-adjusted returns, and (2) a hedge fund allocation that is integrated into a 60/40 portfolio to enhance total portfolio risk adjusted returns. We find that a standalone allocation would allocate to higher beta hedge funds to achieve higher returns, while an integrated allocation would lean more toward low beta, diversifying hedge funds. While the integrated hedge fund allocation has lower returns than the standalone allocation, it reduces total portfolio risk, which can be monetised by adding risk assets like equities to the portfolio. We also discuss an alternative to taking more beta risk to achieve higher returns, which is to add leverage to a suite of less correlated managers.

Finally, we delve into key considerations when taking a bottom-up perspective, focusing on manager selection and portfolio management. We believe that the success of a hedge fund allocation relies heavily on both process and experience. While this last section is not exhaustive, it serves to illustrate the breadth behind a long-running hedge fund investment programme.

Section I: Expected Hedge Fund Attributes and Track Records

Investors expect several specific yet not mutually exclusive characteristics from their hedge fund portfolios:

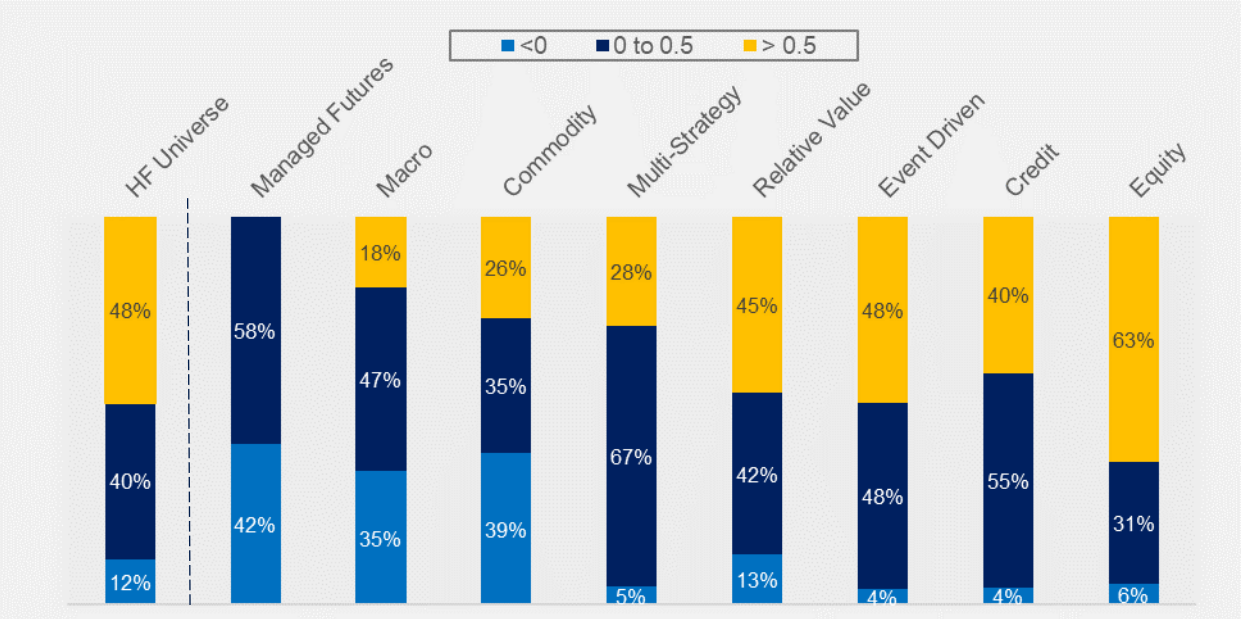
1. Returns with low correlation to equities,
2. Capital preservation during equity market drawdowns, and
3. Alpha or excess returns above a market benchmark.

In this section, we analyse if investor expectations are realistic, testing these characteristics across ~1000 unique hedge funds with full net of fee return track records over a 13-year period (between Jan 2011 – Dec 2023).

Can hedge funds generate returns that are lowly correlated to equities?

We observe that over half of all hedge funds have a correlation of less than 0.5 with equities, which lends credence to the term 'hedge' funds. At the strategy level, we find that hedge funds that are classified as having Managed Futures, Commodities, and Macro styles have low equity correlations because they carry few structural biases (i.e. they can be long, short, or neutral on various asset classes) and adjust their positions dynamically. The typically long-biased Equity, Event Driven, and Credit strategies are more correlated to equities. One less intuitive observation was that 30-40% of Multi-strategy and Relative Value funds have equity correlations of above 0.5 despite being broadly regarded as market neutral.

Figure 2: Equity correlation of hedge fund universe and sub-strategies



Source: JPMAM, GIC, HFR, and Pivotalpath, returns from Jan 2011 to Dec 2023. Last extracted in April 2024.

Can hedge funds preserve capital during equity market declines?

Hedge funds lost around 7% on average compared to the 18% for the MSCI World index across the five worst equity drawdowns between Jan 2011 – Dec 2023. While hedge fund industry losses were higher than some would expect, this was skewed by Equity, Event Driven and Credit strategies which tend to be more directional. In contrast, Managed Futures and Macro delivered positive returns while Commodity, Muti-Strategy, and Relative Value funds had smaller losses.

Figure 3: Hedge fund average performance during the five worst MSCI World drawdowns

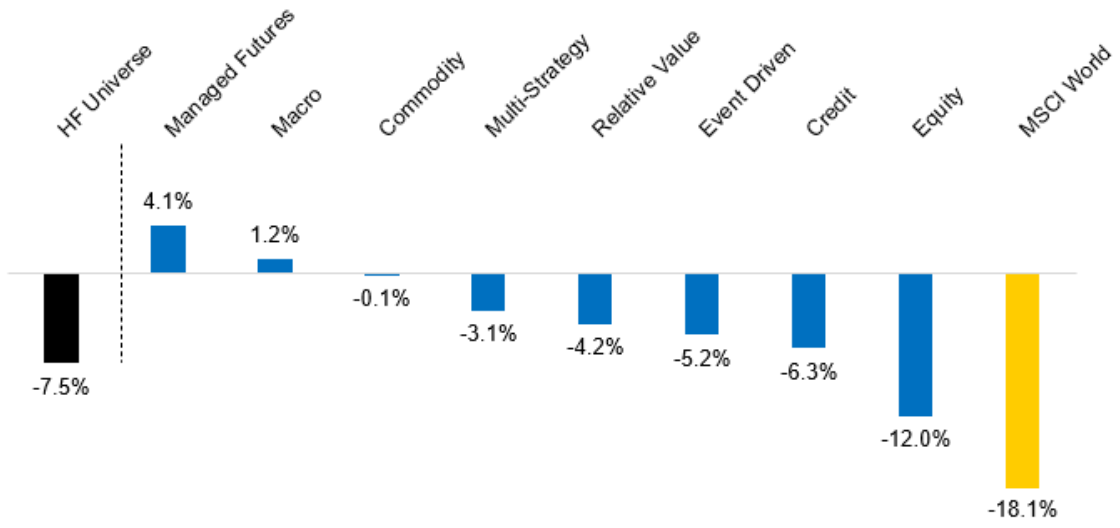


Table 1: Details on the five worst MSCI World drawdowns

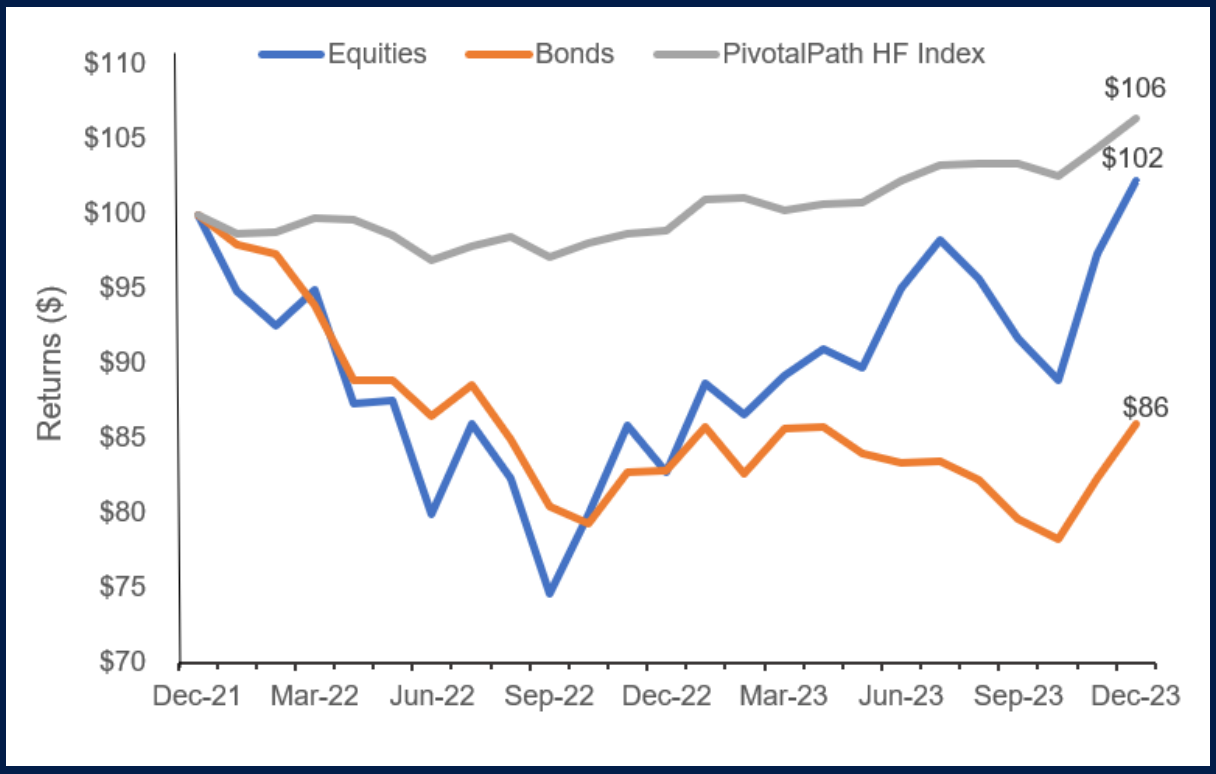
5 Worst MSCI World Drawdowns	Max drawdown	Days In Drawdown	Start of Drawdown	End of Drawdown	Valley
DD1	-19%	580	5/31/2011	12/31/2012	9/30/2011
DD2	-12%	458	6/30/2015	9/30/2016	2/29/2016
DD3	-13%	181	10/31/2018	4/30/2019	12/31/2018
DD4	-21%	213	1/31/2020	8/31/2020	3/31/2020
DD5	-25%	334	1/31/2022	12/31/2022	9/30/2022

Source: JPMAM, GIC, HFR, and Pivotalpath, returns from Jan 2011 to Dec 2023. Last extracted in April 2024. Past performance is not indicative of current or future results.

Hedge funds as a bond alternative to preserve capital during an equity drawdown?

High-quality sovereign bonds have traditionally been the go-to option for allocators seeking to safeguard capital during an equity drawdown. This approach was reinforced by the unprecedented bond rally over the past two decades, largely as a consequence of quantitative easing in the post-GFC period. Indeed, for most equity drawdowns over the period, government bonds provided downside protection while being cost-effective and highly liquid. However, in the new regime marked by heightened inflation and higher rates, while nominal government bonds offer improved yields, their ability to preserve capital during equity drawdowns may be limited. In 2022, the rising interest rate environment resulted in simultaneous losses to both global equities and bonds, revealing a weakness to this narrow approach to portfolio diversification. Over the same period, hedge funds in contrast, succeeded at delivering consistent returns with low volatility. Hedge funds could play an increasingly important role in institutional portfolios because their dynamic and long/short approach seeks to profit regardless of market direction.

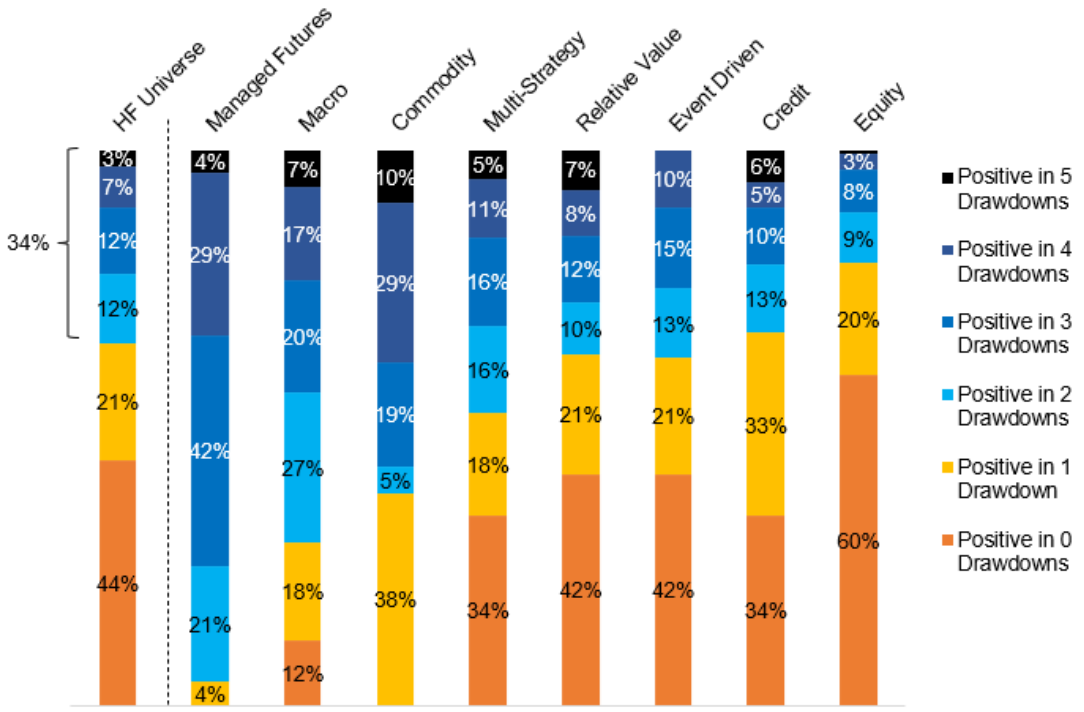
Figure 4: Bonds, equities, hedge fund cumulative return (2022-2023)



Source: JPMAM, GIC, and HFR. Hedge funds represented by the PivotalPath Composite Index, Bonds represented by Barclays Global Aggregate, and Equities by the MSCI World. Data from Jan 2022 to December 2023. Past performance is not indicative of current or future results.

To assess the reliability of hedge funds in preserving capital, the following analysis looks at how often they were able to generate positive returns in the five worst equity market drawdowns. Note that we are taking a strict definition of capital preservation here, as investors generally would also include funds that have had shallower losses than the market.

Figure 5: Hedge fund performance consistency during the five worst MSCI World drawdowns



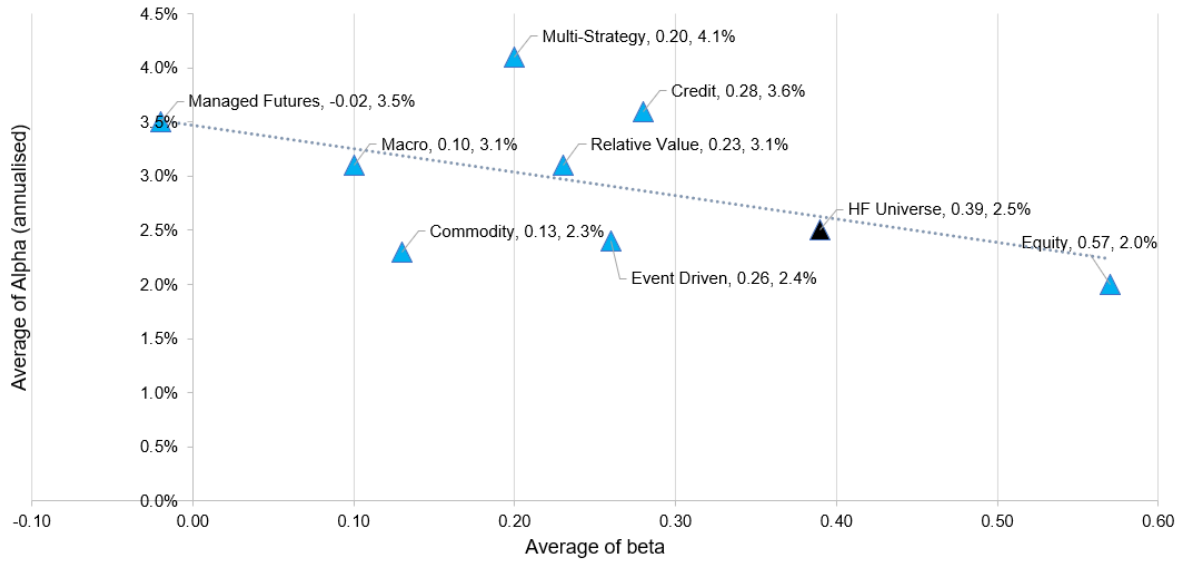
Source: JPMAM, GIC, HFR, and Pivotalpath, returns from Jan 2011 to Dec 2023. Last extracted in April 2024. Past performance is not indicative of current or future results.

We find that around 34% of hedge funds delivered positive returns during two or more of the five worst equity drawdowns. Almost all Managed Futures funds were positive in two or more drawdowns. In contrast, this was true for only 20% of Equity strategies over the same period. For many of the other strategies, the results were more mixed.

Can hedge funds generate alpha?

On average, hedge funds have generated annualised excess return (over cash) of around 2.5% on top of equity beta over Jan 2011 – Dec 2023. We find that lower beta strategies generate higher alpha and vice versa.[1] For example, equity hedge fund strategies have the highest beta (0.6) and the lowest alpha (2%) on average. Empirically, we have observed that exposure to volatile risk factors such as equity risk occasionally leads to meaningful drawdowns and poor trading decisions. After incurring steep losses, managers may feel pressured to cut risk; if they are slow to add risk back, they may fail to recover when markets rebound.

Figure 6: Beta vs. alpha by hedge fund strategy



Source: JPMAM, GIC, HFR, and Pivotalpath, returns from Jan 2011 to Dec 2023. Last extracted in April 2024. Past performance is not indicative of current or future results.

[1] For simplicity and illustration purposes, we have modelled hedge fund alpha as annualised excess return over cash after controlling beta to public equities. Beyond our illustration, investors may define other systematic risk factors (e.g. duration, credit, volatility, style factors such as momentum, size etc.) on top of public equities to extract a pure form of "alpha" (a proxy for true value-add of hedge funds).

Section II: Role-based Hedge Fund Allocations

Our analysis underscores the potential of hedge funds to deliver three key attributes that investors typically seek:

1. Returns that exhibit low correlation with equities,
2. Capital preservation during equity market downturns, and
3. Alpha, or returns that exceed a market benchmark.

However, the analysis also reveals significant variability among hedge funds, even within the same headline strategy classification. This highlights that these generic but widely used industry classifications are inadequate for designing hedge fund allocations.

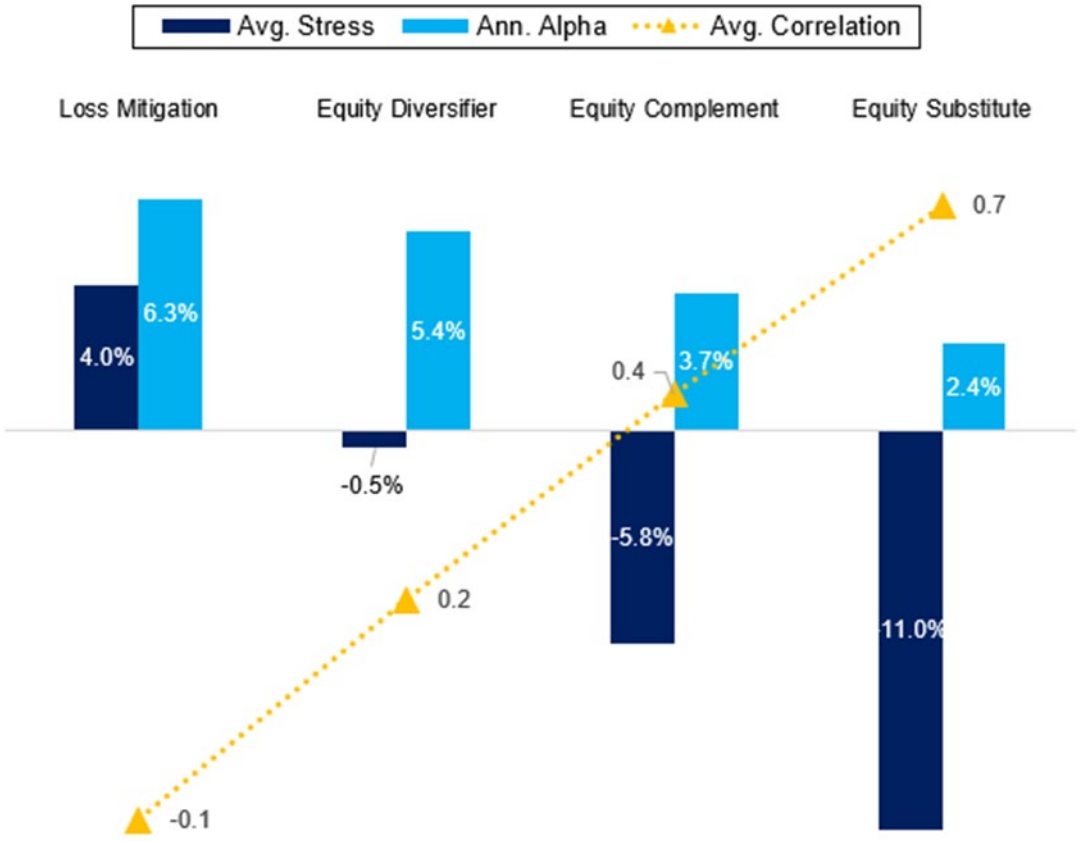
We use a quantitative clustering technique to classify the hedge fund universe based on the above risk-return characteristics of correlation, resilience during equity drawdowns, and alpha. Through this, we identify four distinct hedge fund sub-groups which we label below as Loss Mitigation, Equity Diversifier, Equity Complement, and Equity Substitute, as depicted in **Table 2**.

Table 2: Four hedge fund sub-groups based on risk-return characteristics

Loss Mitigation	Equity Diversifier	Equity Complement	Equity Substitute
• Negative correlation • Positive performance during periods of stress • Highest alpha	• Low correlation • Small losses during periods of stress • High alpha	• Moderate correlation • Moderate losses during periods of stress • Moderate alpha	• High correlation • Large losses during periods of stress • Lowest alpha

Source: JPMAM, GIC.

Figure 7: Average return during equity drawdowns, annualised alpha, and average equity correlation of four hedge fund sub-groups

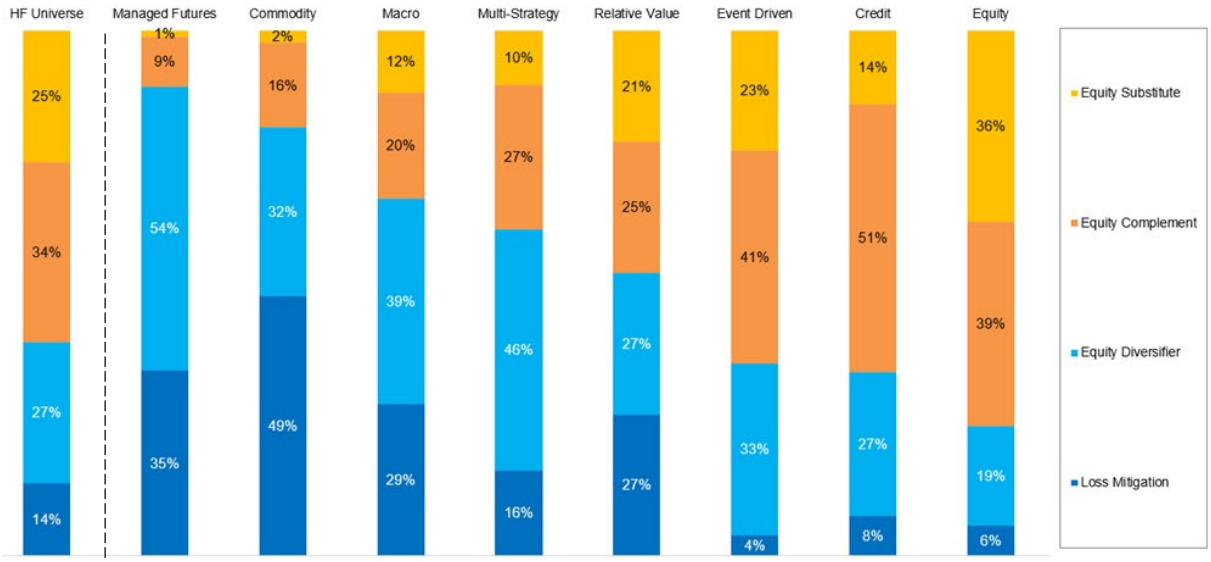


Numbers in bars refer to performance during stress periods, and excess performance.

Source: JPMAM, GIC, HFR, and Pivotalpath, clustering analysis returns are based on data from Jan 2000 to Dec 2023. Last extracted in April 2024. See Appendix for details on clustering analysis. Past performance is not indicative of current or future results.

Perhaps unsurprisingly, each of the four distinct hedge fund sub-groups exist in every strategy type. The hedge fund industry consists of 60% high equity correlation funds (Equity Substitute and Equity Complement) and 40% diversifying funds (Loss Mitigation and Equity Diversifier). Managed Futures, Commodity and Macro funds, the hedge fund sub-strategies traditionally perceived as low correlation and diversifying, indeed consist mostly of funds belonging to the Loss Mitigation and Equity Diversifier groups. Yet even in these strategy types, 10-30% of these funds' return and risk profiles are more similar to Equity Substitute/Complement.

Figure 8: Four hedge fund sub-groups within each strategy



From the second bar onwards, the chart is sorted by the total share of funds in the Loss Mitigation and Equity Diversifier sub-groups, in descending order.

Source: JPMAM, GIC, HFR, and Pivotalpath, clustering analysis returns are based on data from Jan 2000 to Dec 2023. Last extracted in April 2024. See Appendix for details on clustering analysis.

This is a reminder of the tremendous variety and, at times, complexity, within any hedge fund strategy classification. It drives much of the performance dispersion that is observed in the industry, and arises from differences in mandate, investment universe, risk tolerance and risk management frameworks, as well as team structure, skills, and competitive edge, etc. For example, diversified macro platforms which have multiple portfolio managers tend to have meaningfully different return distributions from macro funds that rely on a single portfolio manager.

Certain market environments might exacerbate the differences mentioned above by exposing managers' vulnerabilities, e.g. illiquid positions often become correlated to the market during periods of stress. On average, there has been double-digit performance dispersion across funds within almost every hedge fund classification during the five worst MSCI World drawdowns up to December 2023 (refer to **Figure 21** in the Appendix). The key takeaway for investors is that manager research should focus on understanding the historical and forward-looking performance characteristics of individual funds and avoid over-reliance on classifications.

Determining allocation ranges based on total portfolio needs

Investors have different approaches to hedge fund allocations. Some use hedge funds as an independent allocation for achieving absolute returns, while others use them to improve the returns of an existing multi-asset portfolio. Here, we illustrate how the optimal mix of hedge funds will vary based on the roles they are expected to play.

We will examine two case studies:

1. A standalone hedge fund allocation, and
2. A hedge fund allocation that is integrated into a 60/40 portfolio.

Table 3: Definition and outputs of the hedge fund allocation case study

Portfolio Objective		Illustrative Optimisation Output
Standalone hedge fund allocation	*Maximise hedge fund portfolio returns subject to a given level of risk*	• The hedge fund portfolio with the highest Sharpe ratio has a mix of 59% Loss Mitigation, 19% Equity Diversifier, and 22% Equity Complement. • The hedge fund portfolio with the highest returns has a 100% allocation to Equity Substitute — this also has the lowest Sharpe ratio and the highest correlation to equity markets.
Hedge fund allocation integrated within a 60/40 equity-bond portfolio	*Maximise total portfolio return subject to the same volatility as a 60/40 portfolio*	• The total portfolio allocates 20% to hedge funds, which was the maximum allowable limit set, and funds this entirely from bonds. The hedge fund portfolio consists entirely of Loss Mitigation (20%) to limit the total portfolio drawdown and volatility, which results in more effective compounding. • Given the reduced volatility, the total portfolio allocates more to equities, which increases overall returns.

Source: JPMAM and GIC.

The return, risk, as well as correlation assumptions we used are shown in the table below. For simplicity, we use long-term

historical return to represent expected return[2] and simple mean variance optimisation to illustrate the case study. A 20% capacity limit is assumed on the hedge fund allocation.

Table 4: Return/volatility assumptions for the allocation case study

Long-Run Return/ Risk	Loss Mitigation	Equity Diversifier	Equity Complement	Equity Substitute	MSCI ACWI	Global Agg	Cash
Ann. Return	6.3%	7.0%	7.2%	7.4%	8.9%	0.8%	1.1%
Ann. Vol	4.8%	6.1%	8.0%	11.3%	15.9%	6.1%	0.4%

Source: JPMAM, GIC, HFR, and Pivotalpath, clustering analysis returns are based on data from Jan 2000 to Dec 2023. Last extracted in April 2024. Past performance is not indicative of current or future results. Adjustments were applied to the returns of the four sub-groups to account for the smoothening effect of taking returns from a large number of hedge funds as compared to the smaller number of funds that an investor would plan to invest in.

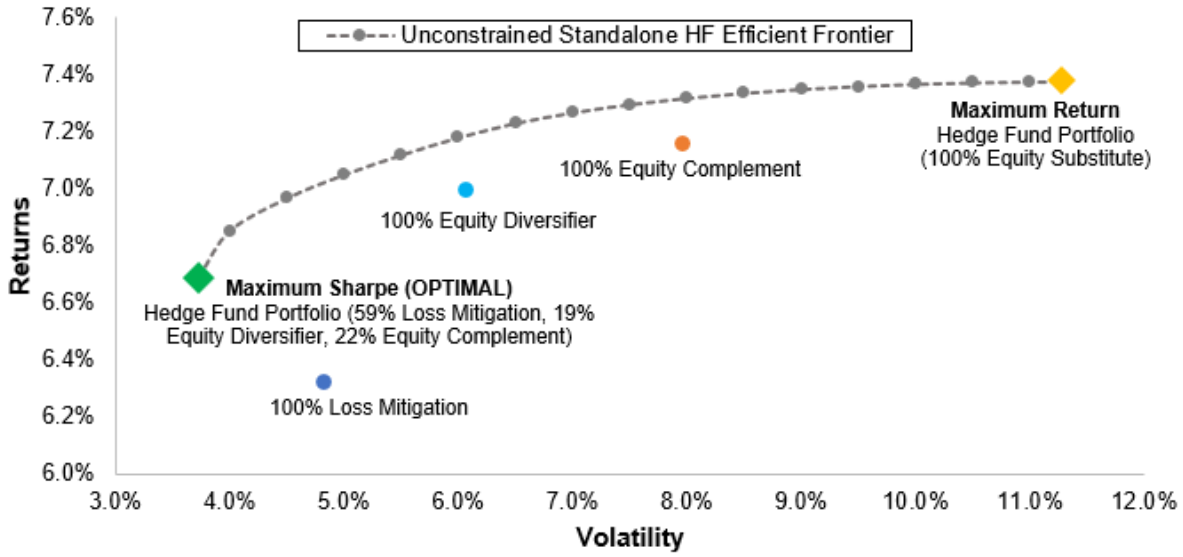
Table 5: Correlation assumptions for the allocation case study

Long-Run Correlation	Loss Mitigation	Equity Diversifier	Equity Complement	Equity Substitute	MSCI World	Global Agg
Loss Mitigation	1.00	0.22	-0.14	-0.19	-0.29	-0.07
Equity Diversifier	0.22	1.00	0.34	0.34	0.28	0.24
Equity Complement	-0.14	0.34	1.00	0.84	0.76	0.28
Equity Substitute	-0.19	0.34	0.84	1.00	0.90	0.32
MSCI ACWI	-0.29	0.28	0.76	0.90	1.00	0.00
Global Agg	-0.07	0.24	0.28	0.32	0.00	1.00

Source: JPMAM, GIC, HFR, and Pivotalpath, clustering analysis returns are based on data from Jan 2000 to Dec 2023. Last extracted in April 2024.

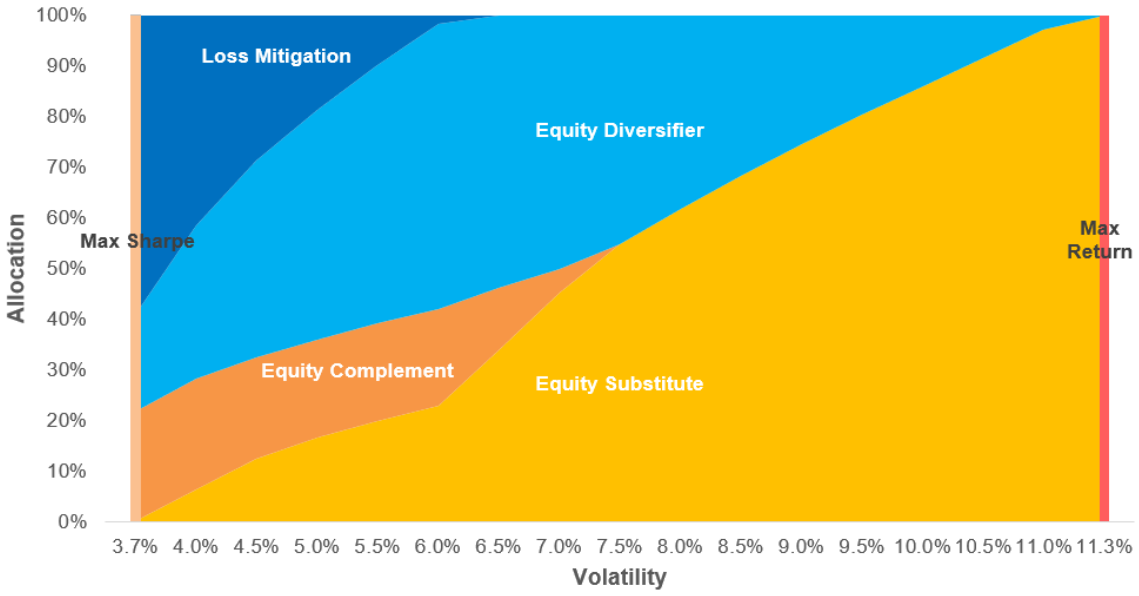
[2] Optimisation output is sensitive to expected return and risk measures used. While we use long term historical return and risk for illustration purposes, in practice, investors should apply forward-looking expected return assumptions. For equity and bonds, starting valuations are an important anchor for long term forward returns. For hedge funds, it is important to adjust for survivorship bias and factor in potential regime shifts.

Figure 9: Efficient frontier of standalone hedge fund portfolios



Source: JPMAM, GIC, HFR, and Pivotalpath, clustering analysis returns are based on data from Jan 2000 to Dec 2023. Last extracted in April 2024. Past performance is not indicative of current or future results.

Figure 10: Optimal portfolio composition across the efficient frontier



Source: JPMAM, GIC, HFR, and Pivotalpath, clustering analysis returns are based on data from Jan 2000 to Dec 2023. Last extracted in April 2024.

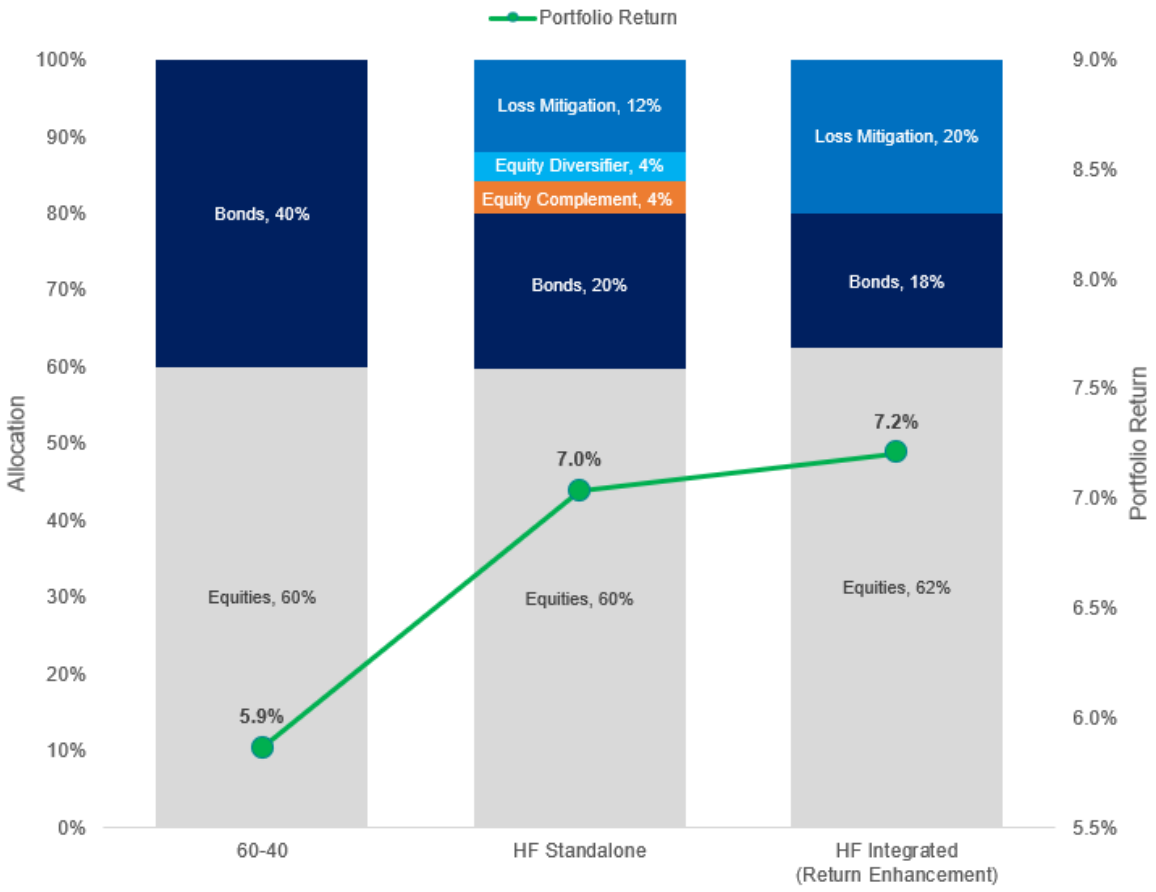
In **Figure 9**, we construct the mean-variance efficient frontier for a standalone hedge fund allocation using the four hedge fund sub-groups. As expected, the frontier lies above the four sub-groups. Figure 10 showcases the underlying portfolio mix for the efficient frontier. On the left end of the frontier, the minimum volatility portfolio consists of 59% Loss Mitigation, 19% Equity Diversifier, and 22% Equity Complement. This has lower volatility than Loss Mitigation itself given that Loss Mitigation is negatively and lowly correlated to Equity Complement and Equity Diversifier respectively. On the right end, the maximum return portfolio consists of 100% Equity Substitute.

For a standalone hedge fund allocation, maximising risk-adjusted return (Sharpe-Ratio) is a common objective. The portfolio on the efficient frontier with maximum Sharpe is the minimum volatility portfolio. We refer to this as the Standalone optimal portfolio. In the next section, we will compare this Standalone optimal portfolio with one that is optimised with a 60/40 portfolio.

Case Study 2: The optimal 60/40-integrated hedge fund portfolio

In this section, we will look at what the optimal total portfolio is when hedge funds are integrated into a 60/40 portfolio. Optimal is defined as the maximum return portfolio including equity, bonds, and hedge funds, which has the same volatility as a 60/40 equity and bond portfolio.

Figure 11: Return and underlying composition of Standalone vs. Integrated hedge fund portfolios



HF Standalone is defined as the portfolio where the optimal hedge funds mix (59% Loss Mitigation, 19% Equity Diversifier, 22% Equity Complement) from Case Study 1 is optimised together with equities and bonds. HF Integrated is defined as the portfolio where hedge funds, equities, and bonds are directly optimised together. Both optimisations are subject to the same risk as the 60/40 portfolio which is 9.6%, and a hedge fund capacity limit of 20%.

Source: JPMAM, GIC, HFR, and Pivotalpath, clustering analysis returns are based on data from Jan 2000 to Dec 2023. Last extracted in April 2024. Past performance is not indicative of current or future results.

Table 6: Return and risk profile of Standalone vs. Integrated hedge fund portfolios

	60/40	HF Standalone	HF Integrated
Total Portfolio Return	5.9%	7.0%	**7.2%**
Total Portfolio Volatility	9.6%	9.6%	9.6%
Hedge Fund Portfolio Return		**6.7%**	6.3%
Hedge Fund Portfolio Volatility		3.7%	4.8%

Source: JPMAM, GIC, HFR, and Pivotalpath, clustering analysis returns are based on data from Jan 2000 to Dec 2023. Last extracted in April 2024. Past performance is not indicative of current or future results.

In **Figure 11**, we see that the inclusion of hedge funds is clearly additive as it accounts for 20% of the total portfolio, which we set as the allocation ceiling. The Integrated hedge fund portfolio funds its allocation from bonds, an intuitive result given that both help to diversify equity returns. The hedge funds consist entirely of the Loss Mitigation sub-group — these exhibit negative correlation to global equities and are thus more effective diversifiers than nominal bonds. The Loss Mitigation allocation serves to reduce the total portfolio volatility, which allows for an additional 2% equity allocation. This results in a return improvement, with portfolio volatility unchanged.

Rather than the precise optimal mix of hedge funds, which is sensitive to assumptions on return, risk, and other constraints an investor may face in practice, the key takeaway from this case study is the difference between the two approaches – the hedge fund Standalone optimal mix and the Integrated optimal mix. Comparing the two, we observe that a standalone-designed hedge fund mix tends to have more exposure to high beta types of managers (Equity Complement and Equity Substitute), to reach a desired absolute return. The total portfolio optimised, or Integrated hedge fund mix, on the other hand, tends to have more exposure to diversifying hedge funds (Loss Mitigation) and gain equity beta exposure directly from global equity investment. Intuitively, this illustrates the simple concept that the cheapest and most direct way to obtain equity beta is via

investing in global equities. Accessing it via embedded equity beta from hedge fund managers is only desirable if these managers provide bigger alpha. However, as shown in the earlier section, alpha tends to be higher for low beta hedge fund groups and lower for high beta groups.

An alternative approach to building a hedge fund portfolio with higher volatility/return

As evidenced in the standalone hedge fund efficient frontier (**Figure 9**), investors who aim to achieve a high return/high risk target through their hedge fund allocation often are inclined to favour higher equity beta managers, which we label as Equity Substitute type funds. An alternative and potentially more optimal approach is to increase volatility through higher leverage. Levering up a Standalone hedge fund allocation could result in a higher Sharpe portfolio that is more optimal than moving towards the right-hand side of the efficient frontier, provided that an investor is comfortable with and capable of managing leverage risk.

In the context of hedge funds, higher leverage can generally be achieved by:

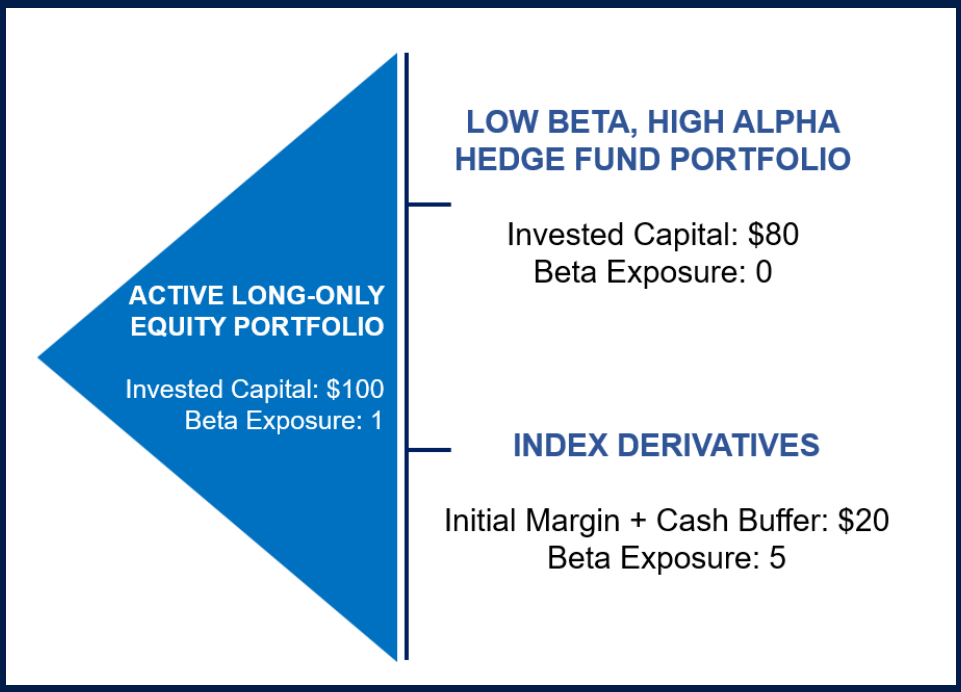
1. **Selecting managers that use higher leverage:** While operationally easy, this approach is not always possible due to the limited supply of higher-octane hedge funds that are well risk-managed (higher leverage might expose investors to larger tail risks).

2. **Investing in hedge funds through under-funded Separate Managed Accounts (SMAs):** This solution can be powerful but is complex to implement. For example, it requires establishing relationships with several counterparties and managing the SMA's unencumbered cash balance carefully. This approach could lead to a negative selection bias as the most established and successful managers are often reluctant to run SMAs for specific investors.

3. **Borrowing capital from third party providers to invest in hedge funds:** This solution is generally expensive especially for less liquid strategies.

4. A more feasible solution would be for **institutional investors with large traditional equity and fixed income allocations to "borrow" against their liquid buckets to fund a stable hedge fund portfolio (with low beta exposure) that is focused on alpha generation**; and replicate the beta exposure through low margin derivatives.

Figure 12: Illustration of portable alpha



Source: JPMAM and GIC.

An investor with a $100 allocation to a beta 1 equity portfolio could instead invest $80 in an uncorrelated and stable hedge fund portfolio, and then use the remaining $20 to buy a futures contract on the equity benchmark corresponding to $100 in terms of notional exposure (the $20 would serve to cover the futures contract's initial margin and potential margin calls). The combined investment would also exhibit a beta of 1 and would rely on the hedge fund portfolio to generate excess return (i.e. alpha). For this “portable alpha” type of solution, investors can either consider the volatility of the combined portfolio (beta replication plus hedge fund portfolio) or solely consider the volatility (and return) of the hedge fund allocation on a leveraged basis. For example, by assuming $1 being borrowed for each $1 of directional exposure provided.

To summarise, based on distinct behaviours across three attributes (equity correlation, return during equity drawdown, and alpha), this section identifies four sub-groups of hedge funds — Loss Mitigation, Equity Diversifier, Equity Complement, and Equity Substitute. Depending on the roles hedge funds are expected to fulfil in an institutional portfolio, the optimal mix between these four sub-groups will differ. Hence, an investor’s first step to building a successful hedge fund allocation is to clearly define the investment objectives. The starting point should be to decide if the goal is to achieve

standalone return/risk targets or to complement existing investments to maximise total portfolio efficiency. With this foundation established, investors can then apply their preferred portfolio construction techniques to determine the desired allocation ranges of the different types of hedge funds.

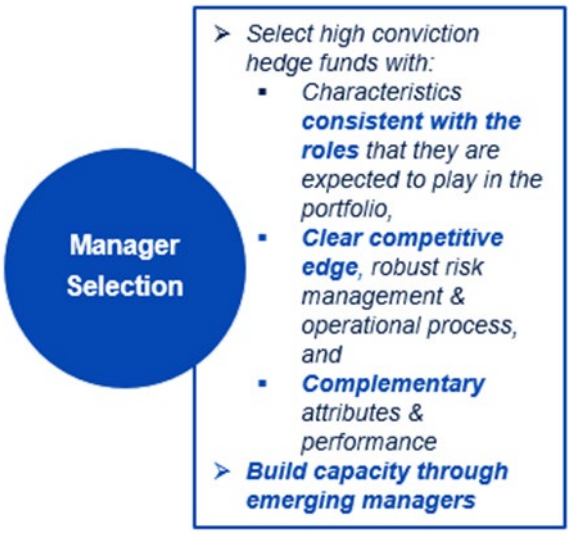
Section III: Implementing a Hedge Fund Allocation

To recap, in our hedge fund allocation framework, the 'Portfolio Roles & Allocation' component is a top-down consideration and was described in the first two sections of this paper. Equally crucial, however, are the selection of hedge fund managers (Manager Selection) and the day-to-day portfolio management process (Portfolio Construction & Management) which this section will focus on. The aim is not to be exhaustive but to highlight practical considerations that are often neglected by new hedge fund investors.

Manager Selection

Detailed and up-to-date research on managers is at the heart of achieving the desired outcomes discussed in the earlier sections. Most investors understand that due diligence is critical in this fast-moving corner of the investment world. In the post-investment phase, investors should continue to deepen (and verify) their understanding of managers, even when they are performing well.

Figure 13: Recap of 'Manager Selection' step in hedge fund allocation framework



Source: JPMAM and GIC, 30 April 2024.

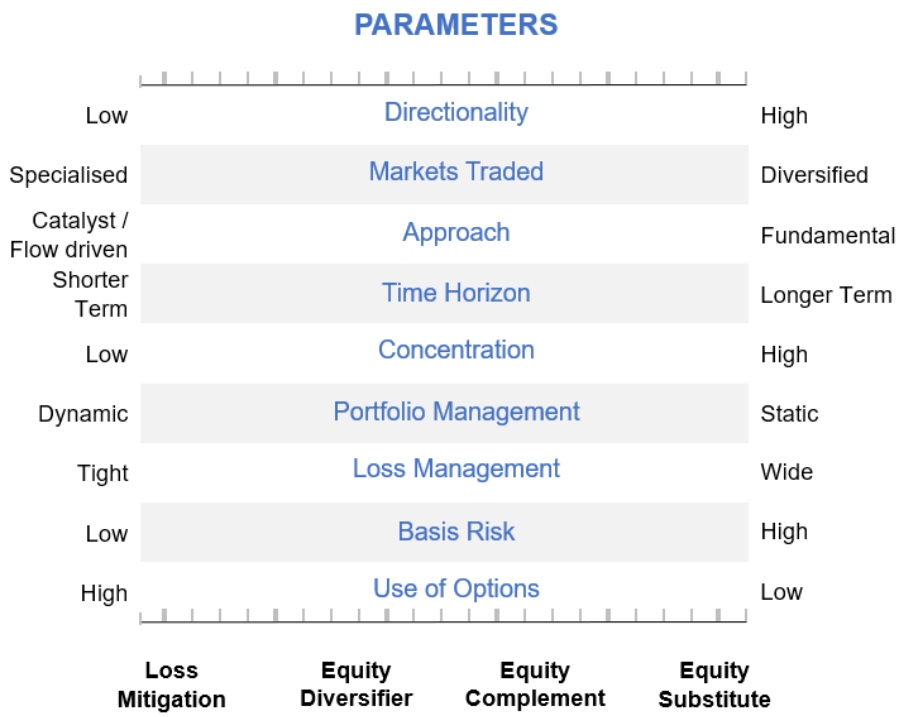
Ensuring that hedge funds' characteristics are consistent with the roles they are supposed to play in the portfolio

From an investment due diligence perspective, an investor should seek to build a granular understanding of the manager's investment approach and source of alpha. This foundation is necessary to set realistic expectations about a fund. Without this, one is likely to be overly influenced by recent performance, which could lead to sub-optimal 'buy high, sell low' allocation decisions.

A manager's past performance may be historically attractive, but this could be due to reasons that are neither repeatable nor reliable in the future. Take the example of traditional Commodity Trading Advisor funds (CTAs), which rely on trend-following indicators to determine whether to be long or short specific futures markets. Throughout the 2000s-2010s, these funds consistently exhibited net long fixed income biases and thus benefitted from flight-to-quality situations. This has led many investors to assume that CTAs are inherently defensive strategies. In a period of rising and unstable yields however, CTAs may not necessarily be long fixed income nor benefit from risk-off events.

Ensuring that a hedge fund has structural characteristics that are consistent with the role it is expected to play requires thorough due diligence on the manager's investment and risk management processes. To illustrate the point with an Equity Long/Short example, **Figure 14** below highlights distinctive features/parameters of the investment process that should be considered when evaluating managers.

Figure 14: Parameters to consider for Equity Long/Short managers



Source: JPMAM and GIC.

The chart shows a sliding scale for some parameters that describe a manager's process and portfolio. Generally, characteristics on the left of the chart align better with the Loss Mitigation sub-group, while those on the right align with the Equity Substitute sub-group. In practice, managers will exhibit characteristics found on either side.

This approach is potentially helpful for pinpointing a manager's edge, analysing performance, making peer comparisons, and assessing inter-manager correlations over market conditions, among other things. For example, an Equity Long/Short manager exhibiting low net and low basis risk, and higher turnover is more likely to preserve capital during periods of stress than a long-biased, long-term fundamental manager with a more static portfolio.

Armed with a clear understanding of how a manager implements its strategy, an investor is better able to assess where the manager has an edge over its closest peers. A

competitive edge should be demonstrable, repeatable (skill-based), and sustainable (persistent). For example, a Commodity manager may have more insights into the supply/demand situation for a given market because of its direct involvement in physical trading. Similarly, a macro manager might exhibit a proven ability to structure attractive risk-reward positions through mispriced asymmetric derivatives.

Maximising robustness through complementary managers

Investors generally understand the concept of reducing risk through manager diversification. However, the challenge is to identify managers that have distinct characteristics and truly complement each other, especially among managers that are expected to play a similar role in the portfolio. In practice, an investor should select managers that:

1. Exhibit reasonably low cross-correlations to each other,
2. Experience non-overlapping drawdowns (i.e. low tail correlation), and
3. Pursue reasonably differentiated approaches in terms of technique/methodology, asset classes, instruments, geographical zones, time horizons, etc.

Building capacity through emerging managers

Investors naturally have a preference to invest in larger, more established managers. Some of these managers might have relatively attractive track records, and many would have an institutional set-up, deeper resources, better infrastructure, and more negotiating power with counterparties, among other attributes. However, successful established managers are often closed to new investments or have reserved capacity for loyal, long-term investors. Furthermore, their size might prevent them from being nimble or from meaningfully sizing more attractive strategies that have limited capacity; and they may potentially be in more crowded positions.

Emerging managers can hence play an important role in investors' portfolios despite their perceived riskiness (due to shorter or less well-defined track records and leaner teams). Some younger, smaller managers pursue specialised, high-

Sharpe strategies with the potential to deliver strong and unique alpha but are very constrained in their capacity. Often, sophisticated early investors will invest and lock in rights to future capacity, making the manager much less accessible to later investors.

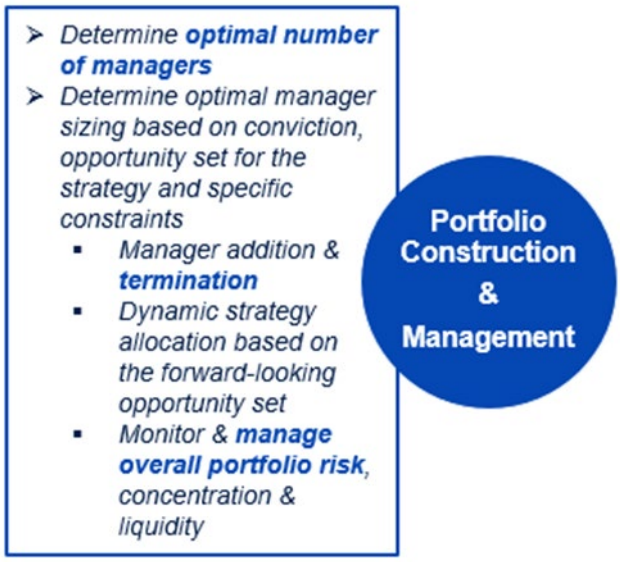
There are advantages to investing early. At this stage, managers are often highly motivated and nimble because of their small assets under management (AUM). They may be more transparent, allowing early investors to build a deep understanding of the organisation, investment approach, and portfolio. They may also be more open to customisation, from carveouts to separately managed accounts and co-investments. Other concessions may include discounted fees and/or shared economics. Beyond these discrete benefits, there is also potential to build a mutually beneficial partnership with managers at this stage and influence their adoption of best practices, whether operational, related to sustainability, or in other areas.

To be successful in early investing, scale, and size matter. Investors need to accept that some investments will disappoint and should have enough emerging managers in the portfolio to ensure that successes more than compensate for the disappointments. While the initial investment may be sized small, the path to growing it over time should be clearly defined upfront and based on measurable milestones including, but not limited to, performance thresholds.

Portfolio construction and management

After selecting a line-up of complementary managers, the Portfolio Construction component focuses on combining these managers in an optimal way that will maximise the probability of achieving the portfolio objectives (in terms of return, risk tolerance, and investment guidelines). This is an ongoing effort; pro-active portfolio management is needed for the portfolio to remain optimally positioned as opportunities and hedge funds change over time.

Figure 15: Recap 'Portfolio Construction & Management' step in hedge fund allocation framework

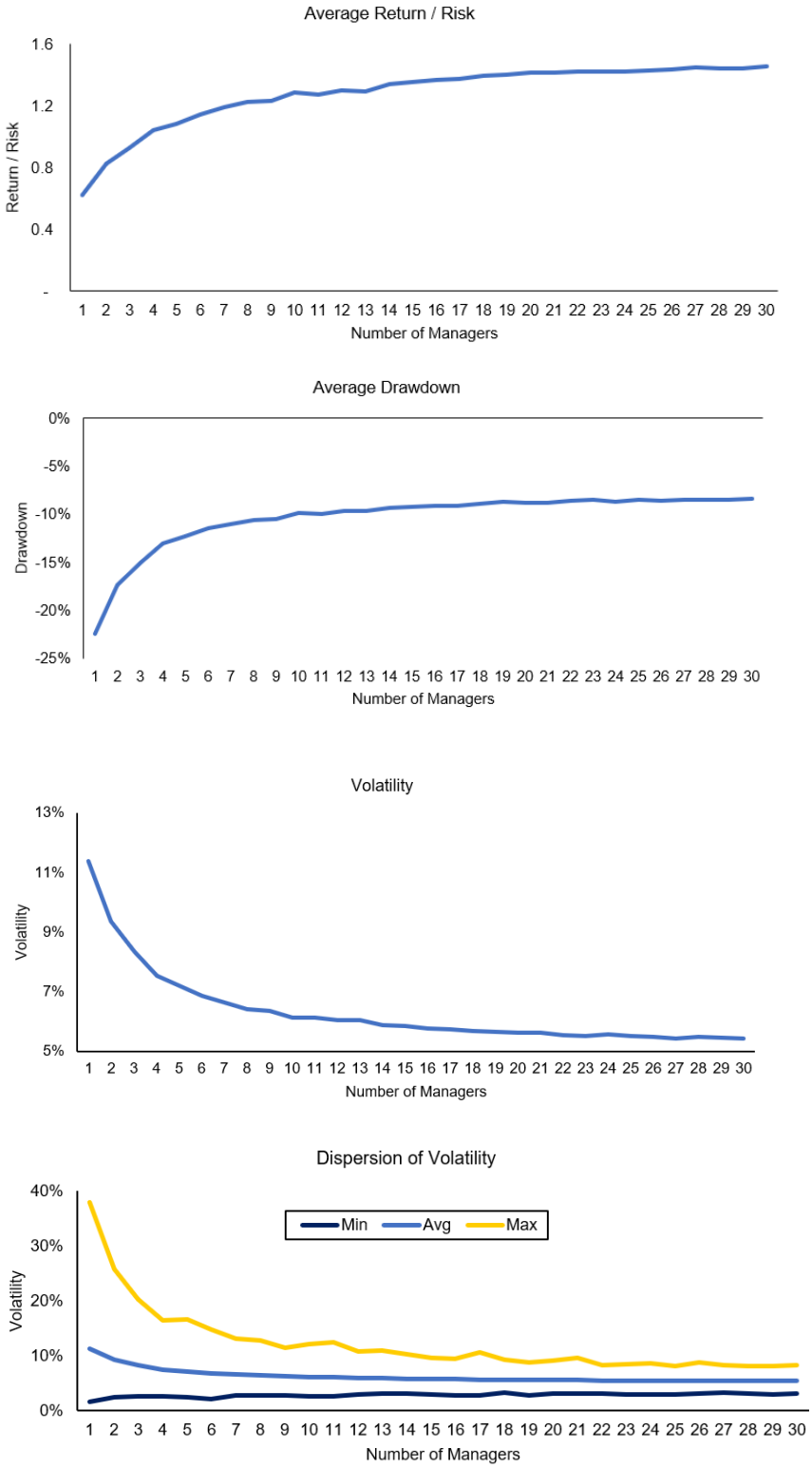


Source: JPMAM and GIC, 30 April 2024.

The optimal number of managers

In **Figure 16**, simple Monte Carlo simulations of portfolios combining different numbers of managers suggest that the marginal diversification benefit coming from including additional managers diminishes above 15 to 20 managers.

Figure 16: Monte Carlo simulations on the marginal return/risk profile of a hedge fund portfolio with increasing number of managers



Note: Portfolios composed of n managers, with n ranging from 1 to 30 — i.e. 1000 simulations for each portfolio.

Source: JPMAM, GIC, HFR, and Pivotalpath. Returns from Jan 2011 to Dec 2023. Last extracted in April 2024. Past performance is not indicative of current or future results.

In practice, the number of managers in a portfolio is likely to be higher because unlike most statistical analyses, the manager selection process is not random, and managers are usually not equal-weighted. Several other factors will influence the number of managers, such as inter-manager correlations, capacity, conviction levels and liquidity requirements. A portfolio will often include a number of managers in transition (lower conviction), including managers that are being scaled up as they prove themselves, 'watch list' names, and those in the process of being redeemed.

Terminating a manager during a drawdown

Terminating a manager for poor performance can be the right thing to do, but any decision to terminate and replace should not be taken lightly as it has implicit costs. These termination costs are driven by structural reasons as hedge funds, unlike most traditional investment vehicles, charge an incentive fee above a high-water mark (HWM) and are subject to restrictive liquidity terms. These unique features mean that replacing an underperforming manager during a drawdown incurs an opportunity cost of being in cash (typically for at least a month) while waiting for redemption proceeds, and the loss of the HWM (managers in a drawdown need to recoup their losses before they can charge incentive fees). All things equal, the replacement manager would need to make significantly above what the terminated manager has lost, in order for the investor to be better off by switching rather than waiting for the first manager to recover. The higher the incentive fee, the deeper the drawdown, and the larger the position — the higher the termination cost.

When making allocation decisions, investors are often inclined to rely on past performance instead of focusing on a manager's ability to perform going forward. Past performance can be misleading (for reasons explained in the 'Manager Selection' section), meaning that a backward-looking mindset can lead to unrealistic expectations and overly reactive allocation decisions. By allocating after periods of strong performance and de-allocating following drawdowns,

investors will underperform hedge funds' reported track records on a dollar-weighted basis.

The goal of due diligence is to build conviction in a manager's investment process and to better understand the range of performance outcomes in different market conditions. When performance is weak, an investor should understand if this is within expectations or if it points to broader problems. Making rational allocation decisions at critical moments is only possible if investors have done thorough due diligence pre- and post-investment. Hedge funds change over time, especially as they accept more capital or struggle on the performance front. Even when they do not change, their circumstances might. For example, the opportunity set for their strategy might become less attractive, or stronger players may emerge. One of the most challenging tasks for any analyst is to distinguish between a manager's evolution (which is positive) and a strategy drift (which is negative). The difference lies in the process taken for this change, which is observable if investors are in regular, meaningful dialogue with managers.

Static vs. dynamic strategy allocations

Generally, careful selection and a thoughtful combination of managers based on deep, bottom-up insight are what drive hedge fund portfolio outcomes. However, there are times when additional value can be created by dynamically adjusting allocations to reflect structural shifts in the forward-looking opportunity set.

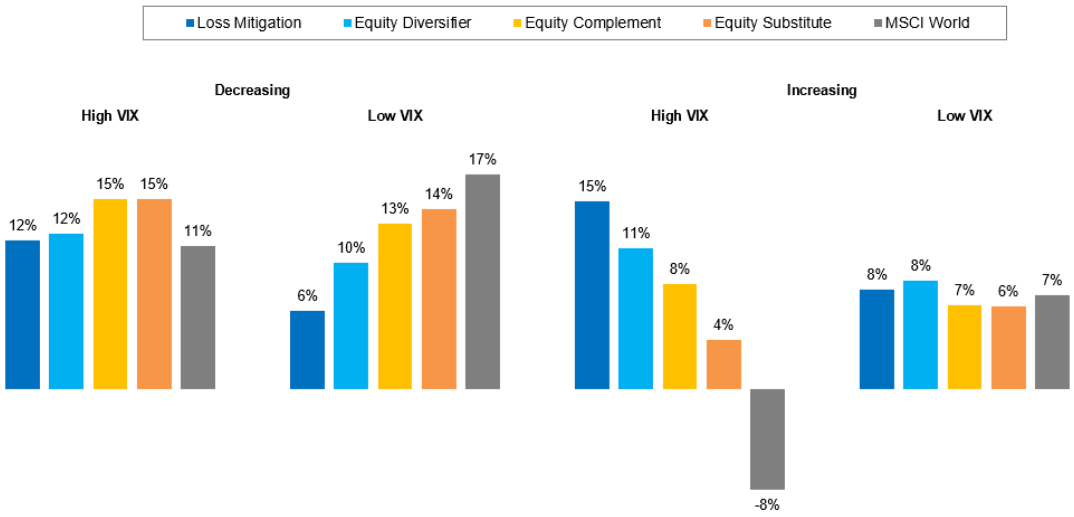
Figure 17: Examples of top-down hedge fund performance drivers

Market environment	Cyclical factors	Directional forecasts
Expected volatility	Credit spreads	Equities
Inflation regime	Convertible bond premiums / discounts	Fixed Income
Stock / Credit dispersion	M & A spreads	Commodities, etc.

Source: JPMAM and GIC

Figure 18 models the historical performance of the hedge fund sub-groups across different volatility periods as represented by changes in the VIX. This shows that investors could have benefitted by over-sizing the least correlated sub-groups (Loss Mitigation & Equity Diversifier) when volatility was expected to increase.

Figure 18: Sub-group performance in different volatility regimes



Source: JPMAM, GIC, HFR, and Pivotalpath, clustering analysis returns are based on data from Jan 2000 to Dec 2023. Last extracted in April 2024. Past performance is not indicative of current or future results.

Top-down allocation decisions should, however, be taken carefully as they tend to be less reliable than bottom-up ones. A well-known challenge to the top-down approach is that the relationship between hedge fund strategies and specific risk factors or environment indicators can be unstable and difficult to prove statistically, making forecasting difficult.

Furthermore, the attractiveness of a strategy needs to be assessed on an absolute and relative basis, which requires:

1. A deep understanding of what creates the inefficiency and why it should normalise (e.g. historically, wide credit spreads are not necessarily a good entry point in the context of an unprecedented crisis), and
2. A consistent framework to compare risk-reward across strategies that might exhibit different characteristics.

Sometimes, the hurdles may be more practical. Redemption caps and long notice periods make it difficult to rebalance tactically. Capacity may drive the timing decision, where some of the highest quality managers may re-open only after a draw down. Conversely, an investor may stay invested in a

manager even when the outlook is suboptimal, to keep a long-term allocation to a capacity-constrained fund. Investors should always be careful about force-fitting a suboptimal manager into a desirable strategy. This can be counterproductive as lower conviction managers can be difficult to hold during periods of disappointing performance, and an investor might redeem and miss the targeted opportunity or strategy.

Managing portfolio risk exposures

A hedge fund portfolio should not be a collection of individual allocations. Investors should leverage the insight gained on managers through deep due diligence, to select complementary managers and ensure that their aggregated exposure to specific risk factors is acceptable and consistent with the investor's mandate. Note that there is an important distinction between static risk factor exposures and dynamic risk factor exposures, where managers are explicitly trying to add value through timing-specific factors. We focus here on static and unintended risk factor exposures.

Table 7: Types of risk factors

Types of Risk Factors	Examples
Market Risk	Sensitivity to specific markets (e.g. equity, fixed income, commodities, etc.)
Traditional Risk Factors	Country, sector, style (e.g. momentum, value, growth, size, etc.)
Liquidity Risk	Exposure to markets likely to become illiquid during periods of stress (e.g. emerging markets, credit, small caps, etc.)
Liquidation Risk	Crowded positions, high short interest stocks, quantitative unwind
Ad-Hoc Risk Factors	Risk factors driving the markets during a specific period (e.g. COVID)

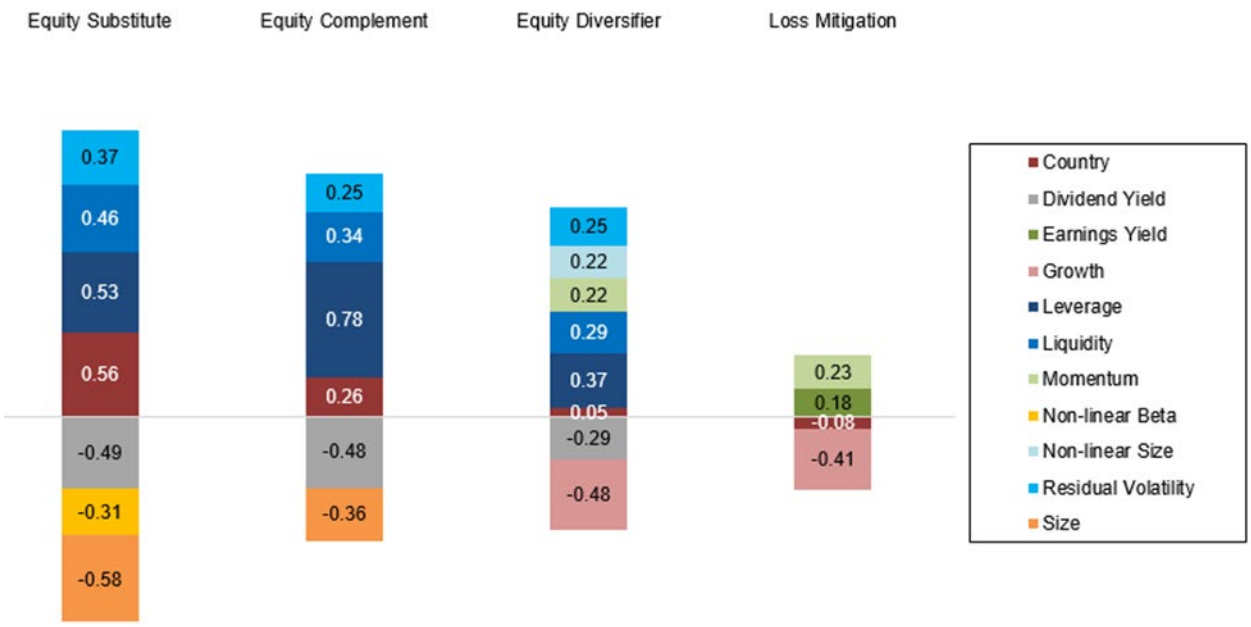
Source: JPMAM and GIC

A manager's risk factor exposure might change over time based on the opportunity set, or due to adjustments to its mandate or investment process. In practice, this means that the portfolio's initial calibration needs to be well thought out so that extreme positioning from any given manager does not

result in excessive risk factor exposure at the portfolio level. These exposures should be monitored and potentially managed through sizing on an ongoing basis.

Exposure to risk factors introduces correlation risk across managers and the potential for a synchronised drawdown. Investors should therefore favour managers that are exposed to idiosyncratic risks (which are residual risks not explained by the risk factors listed above). Unfortunately, most hedge fund managers, especially the more correlated ones, exhibit some sensitivity to these factors. This is illustrated below in **Figure 19**, where we assess the factor loadings of the hedge fund sub-groups from Section II to determine the extent to which performance is sensitive to market moves. In practice, stress tests should be used as one of the methodologies to help identify portfolios' exposure to the various risk factors.

Figure 19: Risk factor exposure in the hedge fund sub-groups



Source: JPMAM, GIC, HFR, and Pivotalpath, clustering analysis returns are based on data from Jan 2000 to Dec 2023. Last extracted in April 2024. Analysis is based on an iterative regression of the sub-groups' returns against Barra style returns to identify the factors with the most sensitivity.

When modelling these risk exposures, it is worth pointing out that quantitative analysis is limiting and needs to be

augmented by a qualitative approach for several reasons. For example, managers' track records may be too short for statistically significant analyses, or portfolio transparency may be insufficient. While stress tests are useful, they may also overstate the impact of these risks because they do not consider a manager's risk management protocols. Importantly, a manager's portfolio construction and/or risk management framework may have changed over time, rendering its historical profile less relevant for the current analysis.

Conclusion

In this paper, we present a comprehensive framework for constructing and managing a hedge fund allocation. The contribution is a timely one given today's more uncertain and challenging environment, and as investors increasingly focus on diversifying a traditional 60/40 portfolio.

Investors may invest in hedge funds because of their ability to deliver returns that exhibit moderate, low, or even negative correlation to the equity markets, their potential resilience during periods of market stress, and because they are at least partially driven by managers' skills. Our historical data analysis demonstrates that these expectations are generally realistic since a meaningful number of hedge funds exhibit characteristics consistent with these criteria. However, the analysis also underscores the importance of being selective (as hedge funds exhibit high return dispersion) and cautious about relying on widely used strategy classifications to determine what role specific hedge funds should play in a diversified portfolio.

Investors need to carefully define what they want to achieve from their hedge fund allocations as their specific objectives will meaningfully impact the allocation outcome. In this paper, we highlighted that integrating a hedge fund portfolio into a traditional 60/40 portfolio leads to a mix of managers that are meaningfully different from a standalone constructed hedge fund portfolio. Similarly, we established that the composition of a standalone constructed hedge fund portfolio might vary widely based on the investor's risk tolerance, return target, and comfort with leverage.

While this paper utilises historical data and a quantitative approach for illustration, we draw the reader's attention to the risk of overreliance on past performance to make investment decisions. Many hedge funds do not have sufficiently long track records to be statistically significant or at least indicative of what to expect across the entire cycle. In addition, market dynamics can change meaningfully over time, hedge funds might evolve (which might positively or negatively impact their characteristics and attributes), and specific

circumstances might lead to misleading outcomes (the impact of luck on performance, for example, should not be underestimated).

In the end, the high level of flexibility that hedge funds offer presents both an opportunity and a challenge for investors and requires thorough due diligence to understand what to expect under various market scenarios. This insight should not only minimise the likelihood of unwelcome surprises when managers behave in a way that is inconsistent with investors' expectations, but also reduce the risk that investors make reactive and counterproductive allocation decisions.
Our framework for hedge fund allocation emphasises the need to integrate both top-down and bottom-up considerations. Here, bottom-up observations and insights continually feed back into top-down portfolio considerations, helping to refine the determination of roles and structural guidelines for hedge fund allocation and creating a continuous cycle of improvement for investors' processes. While there remains a broader unexplored set of considerations beyond the scope of this paper, we hope this proposed framework provides valuable insights for investors to build a successful hedge fund allocation.

Appendix: Data Sources and Methodology

Section I

The hedge fund performance database is sourced from JP Morgan Alternative Asset Management's internal database, which has over 25 years of history, HFR, and PivotalPath. Note that the use of historical databases introduces survivorship bias or the risk that the data does not reflect the characteristics of funds that have stopped reporting or ceased to exist, and which may have performed poorly.

We applied eight distinct hedge fund strategy classifications to consolidate the data into a single database of 4160 unique hedge funds. In Section I, which tests for the characteristics of hedge funds, the analysis covers 907 of the 4160 funds that report complete monthly returns from the period of Jan 2011 – Dec 2023.

Table 8: Database of 4160 unique hedge fund managers based on eight distinct strategy classifications

	Number of Managers	
Hedge Fund Strategy Classification	**Database**	**Full history from Jan 2011 to Dec 2023**
Equity	2004	485
Macro	566	119
Credit	473	88
Relative Value	445	84
Event Driven	259	48
Multi-Strategy	178	38
Commodity	125	21
Managed Futures	110	24
Total	**4160**	**907**

Section II

Using the consolidated database from Section I and extending the time period from Jan 2000 – Dec 2023, we undertake a clustering analysis which grouped the hedge fund universe into four sub-groups (or portfolio roles) based on alpha, correlation, and drawdown during stress periods. After excluding funds with (1) less than 24 months of performance data and (2) funds that did not have performance data over at least three drawdown periods, the hedge fund count was 3085. We analysed sub-group returns over sub-periods and then created a time series (which sought to solve for time series continuity, while also maintaining a robust set of time series for each of the sub-periods). For each of the sub periods, we perform a sampling exercise to estimate the average performance of a randomly selected 10-manager portfolio. The sub-periods are then stitched together to form the full period time series.

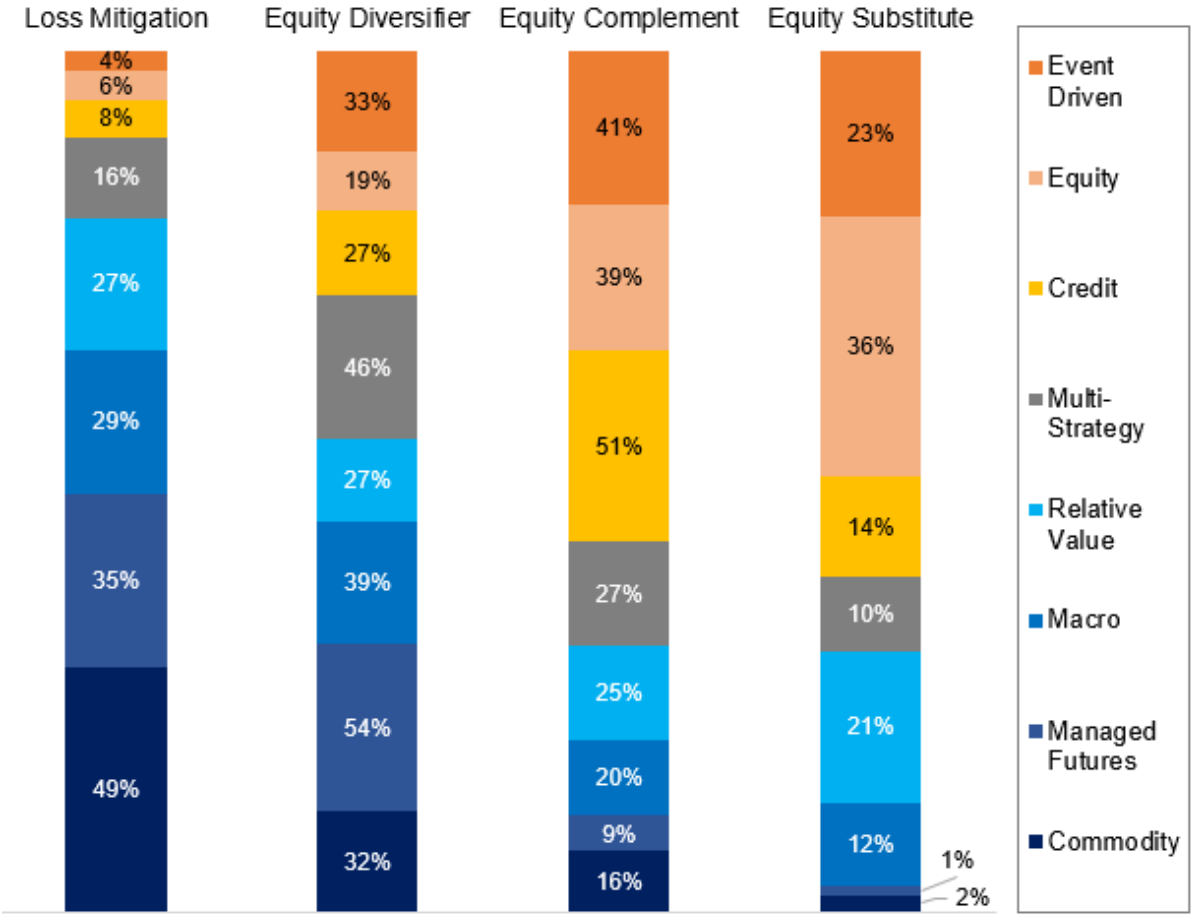
The methodology for calculating the three clustering characteristics are as follows:

Alpha	• The alpha of each fund is the average of the rolling 12-month alpha against MSCI World.
Correlation	• The correlation of each fund is the average of the rolling 12-month correlation with MSCI World.
Stress	• Represented by 16 non-overlapping stress periods over Jan-2000 to Dec-2023 for the MSCI World where cumulative declines are over -10%.

The clustering analysis results in four sub-groups (or portfolio roles) with distinct profiles. The four portfolio groups showed relatively attractive risk-adjusted performances, especially for the least correlated groups, partly due to the smoothening effect of allocating to a large number of hedge funds. In practice, these sub-groups are not investable, and investors

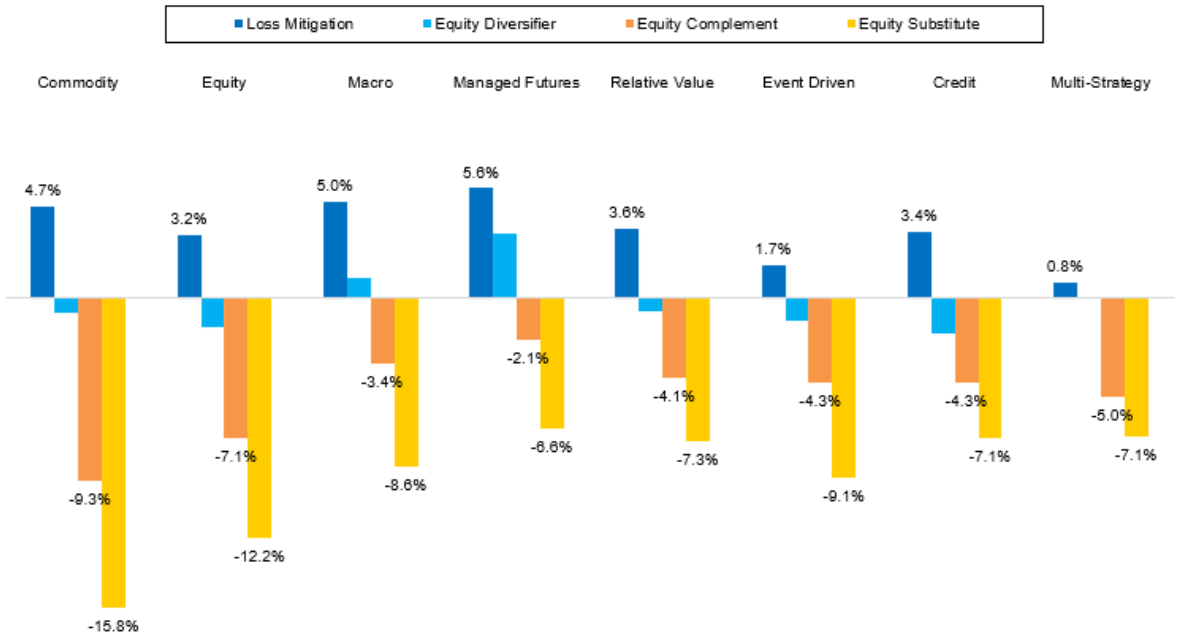
would have to select a much smaller number of funds in their hedge fund portfolios. To determine an appropriate adjustment to apply to the sub-groups, we used a sampling approach that randomly selects portfolios of 10 funds and used their average returns to create a return composite from Jan 2011 – Dec 2023. Note that while all 3085 funds were used to calculate the sub-group composite returns, not all had a complete enough track record to be included and even so, it is unlikely that all qualifying funds would have been picked up through the random sampling process. The adjusted sub-groups' returns were then used in the optimisation analysis.

Figure 20: Strategy types within each hedge fund sub-group



Source: JPMAM, GIC, HFR, and Pivotalpath, clustering analysis returns are based on data from Jan 2000 to Dec 2023. Last extracted in April 2024.

Figure 21: Average stress performance of hedge funds by strategy classification vs. four hedge fund sub-groups



The chart is sorted by the size of performance range per strategy classification, in descending order.

Source: JPMAM, GIC, HFR, and Pivotalpath, clustering analysis returns are based on data from Jan 2000 to Dec 2023. Last extracted in April 2024. Past performance is not indicative of current or future results.

Section III

We model the performance of the hedge fund groups from Section II across different volatility periods, where:

- High VIX is defined as any year-over-year average (using monthly data) VIX reading above the historical median, while 'low' VIX is defined as any year-over-year average VIX reading below the historical median; and
- Increasing/decreasing is determined by whether the previous year's value was less than, or greater than the current year's value.

We assess the factor loadings of the hedge fund sub-groups from Section II to determine the extent to which performance is sensitive to market moves. For each sub-group, this is achieved by a repetitive two-step approach of regressing returns against all of the relevant Barra style returns and eliminating factors that are not relevant, i.e. p_val > 0.05.

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