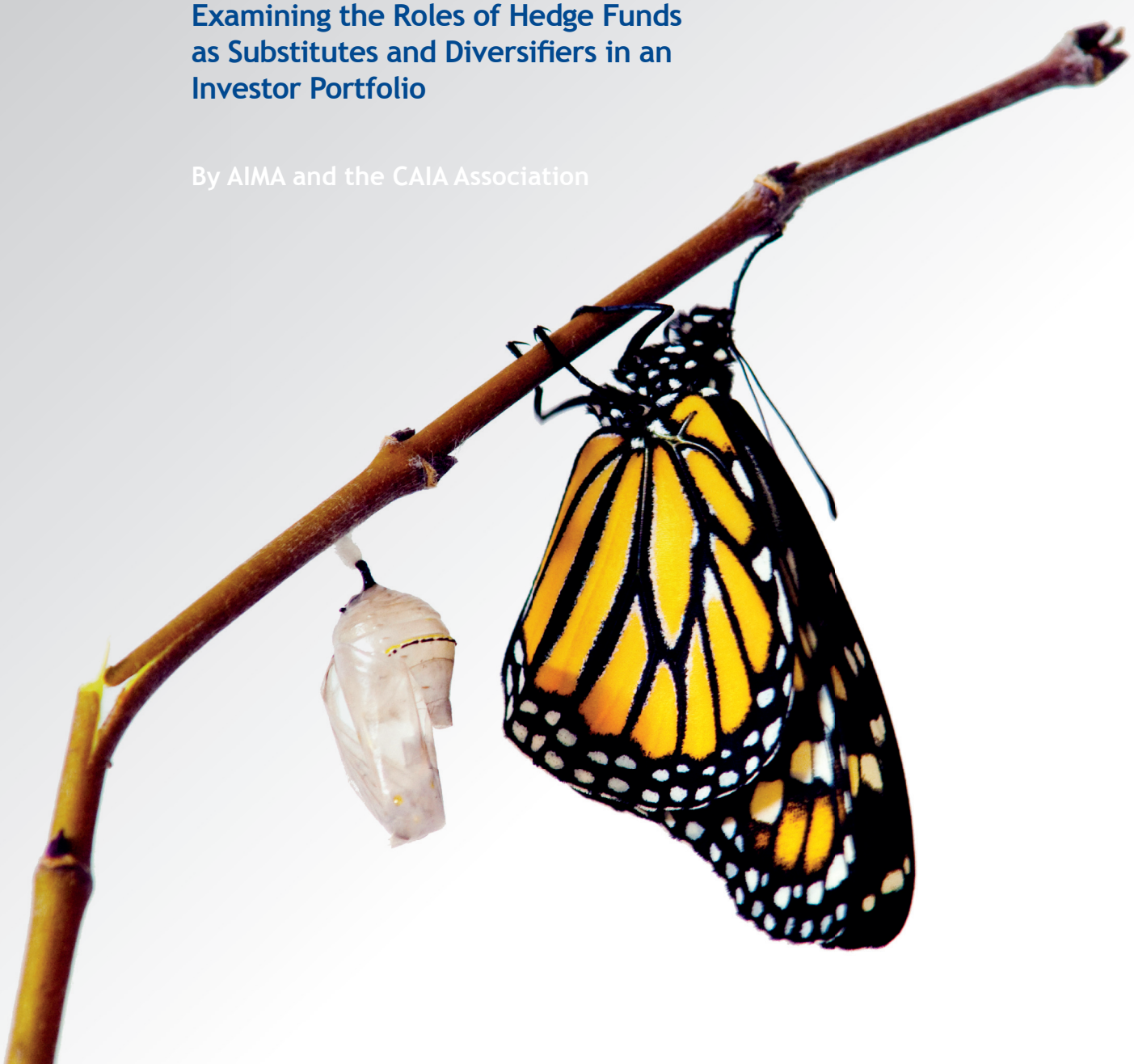
Alternative Investment Management Association

HELPING TRUSTEES NAVIGATE THE HEDGE FUND SECTOR

# PAPER 2: Portfolio Transformers

## Examining the Roles of Hedge Funds as Substitutes and Diversifiers in an Investor Portfolio

By AIMA and the CAIA Association



# Contents

# Foreword

**by Mark Anson**

Comparatively little educational material about hedge funds and other alternative investments has been written for trustees and other fiduciaries. And so at the beginning of 2015, AIMA and the CAIA Association embarked on a long-term joint programme to produce accessible information about hedge funds for this important but under-served audience.

AIMA and CAIA's first paper, titled 'The Way Ahead: Helping Trustees Navigate the Hedge Fund Sector'[1], set out hedge funds' core value proposition while objectively discussing some of the challenges that investors face when considering a hedge fund allocation.

In this second paper, 'Portfolio Transformers: Examining the Roles of Hedge Funds as Substitutes and Diversifiers', AIMA and CAIA have sought to build on this foundation by providing a more detailed guide to how hedge funds can adapt and diversify portfolios of investors such as endowments and foundations, pension funds, insurance companies, private family offices and sovereign wealth funds.

Investment mandates vary from investor to investor. There is no one size fits all. These differences in objectives naturally lead to differences in overall asset allocations, risk-return profiles and the like, with the possible inclusion of hedge funds performing different roles and thus satisfying different risk and return objectives.

Increasingly, institutional investors consider an allocation to hedge funds as playing the role of either a substitute or a diversifier within their total portfolio. Where investors view hedge funds as taking on the role of a substitute and/or complement, they may allocate to certain hedge fund strategies to replace some or all of their investment in traditional long-only equity, credit and/or fixed income investments. Such hedge fund strategies ought to reduce the overall volatility (i.e. reduce the risk) of the portfolio's public markets allocation, with a more attractive risk/reward profile. Other hedge fund strategies may have a low correlation to equity and credit markets and offer a higher probability of generating out-sized returns (albeit by taking on a higher level of risk).

The paper reflects how the hedge fund industry has grown and matured over the last 15 years. Since the bursting of the tech bubble in 2000, when hedge funds generally outperformed, assets under management in the hedge fund industry have grown from about $500 billion to over $3 trillion. Much of this growth came from institutional investors, who have allocated to hedge funds primarily for three reasons:

[1] http://www.aima.org/en/document-summary/index.cfm/docid/F4D1F5DA-B20A-4052-80D8CC894090C9A1

1. To access investment strategies that were outside of the domain of traditional asset managers;
2. To take advantage of investment opportunities on both the long and the short side of the market; or
3. To find manager skill that may not reside in the traditional world of long-only asset management.

However, as the hedge fund industry has matured, there are new reasons why sophisticated investors seek out hedge funds:

- For risk budgeting – building a hedge fund portfolio with a lower volatility than the traditional equity markets. The hedge fund portfolio effectively "buys" risk units that can then be "spent" on more risky parts of the portfolio.
  - This strategy is increasingly used by institutional investors to get more "return buck" for the risk taken.
- As a fixed income substitute by building a hedge fund portfolio that is market neutral but offers higher yields than traditional bonds.
  - Low bond yields across the developed markets make bonds a poor investment decision for diversification, liability matching, and risk dampening.
- As a replacement for traditional asset management. While in the past, hedge funds were used as a complement to a long-only portfolio, investors are increasingly allocating to hedge funds as their primary equity, bond or credit strategy.
  - Sophisticated investors are replacing their long-only managers with long-short managers who manage either a beta or volatility target such that the institutional investor gets the same level of asset class exposure but with higher expected returns for the risk underwritten.

However, these are but a sample of the strategies that institutional investors pursue with respect to hedge funds. Given their individual pension obligations, university budgets, philanthropic goals, or insurance payment schedules, the liability streams of institutional investors is as varied as the colours in a rainbow. This is the beauty of hedge funds, whose investment strategies and styles can match these many-varied liability streams with a matching set of colours.

We all can agree that the future is uncertain. No institutional investor can predict with 100% accuracy what liability stream they will need to fund in the future. But hedge funds, as is explained in this paper, can help to bridge this uncertainty gap. The variety, fluidity and sheer creativity of their investment strategies provides the flexibility to adapt to any uncertain liability stream that can be constructed by an institutional investor. In that way, hedge funds have evolved into solution providers – and portfolio transformers.

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Mark Anson

# Introduction

## It is time to think about hedge funds in a new way.

The old distinctions that have underpinned portfolio construction for at least the last 25 years are rapidly disappearing. Many of the most experienced hedge fund allocators worldwide no longer see hedge funds as a separate *bucket* – ring-fenced, somehow, from the "traditional" assets in a portfolio – but as *substitutes* for long-only investments and *diversifiers* capable of *transforming* the risk and return characteristics of their entire portfolios.

Take the substitutes. Those investors who, for example, are now choosing to replace some of their long-only equities allocation with an equity hedge fund are not merely substituting a long-only allocation with a hedged position. They are also improving the way their portfolio as a whole performs under a variety of market conditions due to hedge funds' superior risk-adjusted characteristics over time. The result of all this – the capital of the investor is better preserved while its' volatility is also reduced across the entire equities allocation.

Some hedge funds are simply too uncorrelated to equities, say, to be a straight swap – since the way they behave under certain market conditions is substantially different to the way the underlying asset class behaves. These hedge funds are not regarded by hedge fund allocators as substitutes, but as *diversifiers*.

All hedge funds offer diversification. But the *diversifiers* (in this context) comprise hedge fund strategies that are particularly uncorrelated to the underlying traditional assets in the portfolio – and thus, provide the potential for significant diversification and the highest possibility of generating out-performance.

Which hedge funds are substitutes and which are diversifiers? For this paper, new analysis has been undertaken – using a statistical method known as cluster analysis – to accurately categorise the risk and return characteristics of the main hedge fund strategy types. This is what the analysis has found:

## Substitutes

- Long/short equity funds
- Long/short credit funds
- Event driven funds
- Fixed income arbitrage funds
- Convertible arbitrage funds
- Emerging markets funds

## Diversifiers

- Global macro funds
- Managed futures funds/CTAs
- Equity market-neutral funds

Thinking of hedge funds as substitutes or diversifiers poses an intriguing, final question: what is the optimum split in a portfolio between hedge funds and long-only investments? We do not, in this paper, seek to answer this question directly, since we recognise that institutional investors are not a homogeneous group. Pensions, endowments, foundations, insurers and family offices are very different entities, with different challenges and divergent aims and objectives.

But the logical conclusion of this new thinking points to a future in which investors no longer have a target hedge fund allocation in mind – say, 15% or 20% of the total portfolio – but rather, they view hedge funds as another method of investing in equities, bonds or other asset classes. It is transformative thinking.

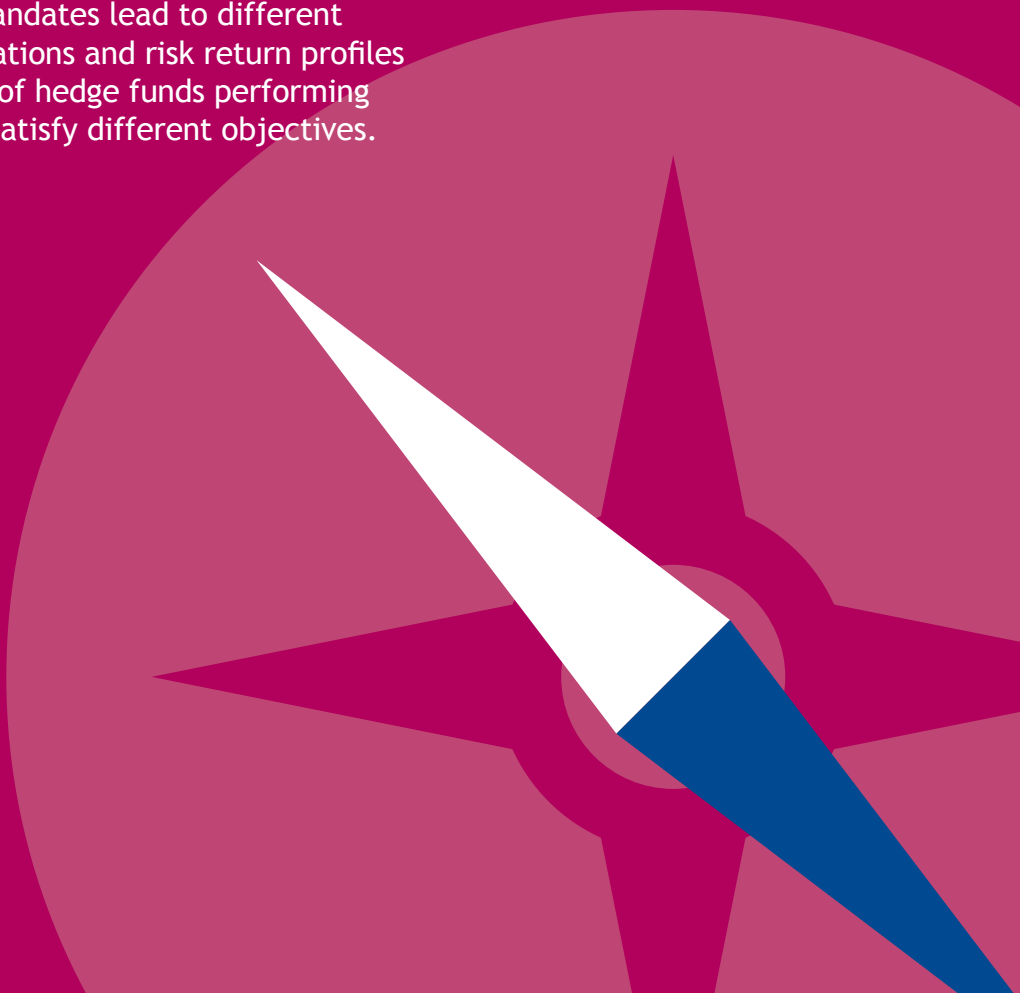
*Note: This paper assumes a level of understanding that at a minimum, investment advisors or their equivalent at pension plans (and/or their equivalent standing at other investor types) should understand.*

# 1 Different Investment Portfolios for Different Investment Mandates

Pensions, sovereign wealth funds, endowments and foundations, insurers and family offices have different aims and objectives.

Goals and objectives differ depending on the investor mandate.

These different mandates lead to different overall asset allocations and risk return profiles with the inclusion of hedge funds performing different roles to satisfy different objectives.



Hedge fund investors are heterogeneous in nature, with each having their own unique risk and return characteristics. This leads to different overall asset allocations by the investor with the inclusion of hedge funds being deployed to perform different roles to satisfy different objectives.

## 1. Endowments & Foundations:

A commonly stated objective of an endowment or foundation (E&F) is to generate a reasonable level of predictable cash flows (after adjusting for all levels of spending and inflation), to grow the value of its investment fund and maintain the capital in real terms over the long term whilst providing an annual income to support its activities.

E&F portfolios are typically pools of assets designed to run in perpetuity while striving to deliver some pre-established spending amount over the course of a year. For example, in the U.S., governing statutes require that foundations pay out a minimum amount (usually 5% of the average trailing three-year total market value of the portfolio) to satisfy the required tax treatment or status of its plan. Managing assets under this structure is likely to dictate a certain investment mandate which requires the construction of a portfolio comprised of long-term investments across a diversified range of assets (e.g., stocks, bonds, real assets) that will deliver sustainable, risk-adjusted results. Changes in the inflation rate can affect the level of the plan's future income derived from any donations and bequests made. Given this strong sensitivity, this often results in the CIO of an E&F plan making large allocations to inflation-sensitive and real return assets, such as commodities, real estate, infrastructure, timberland and farmland.

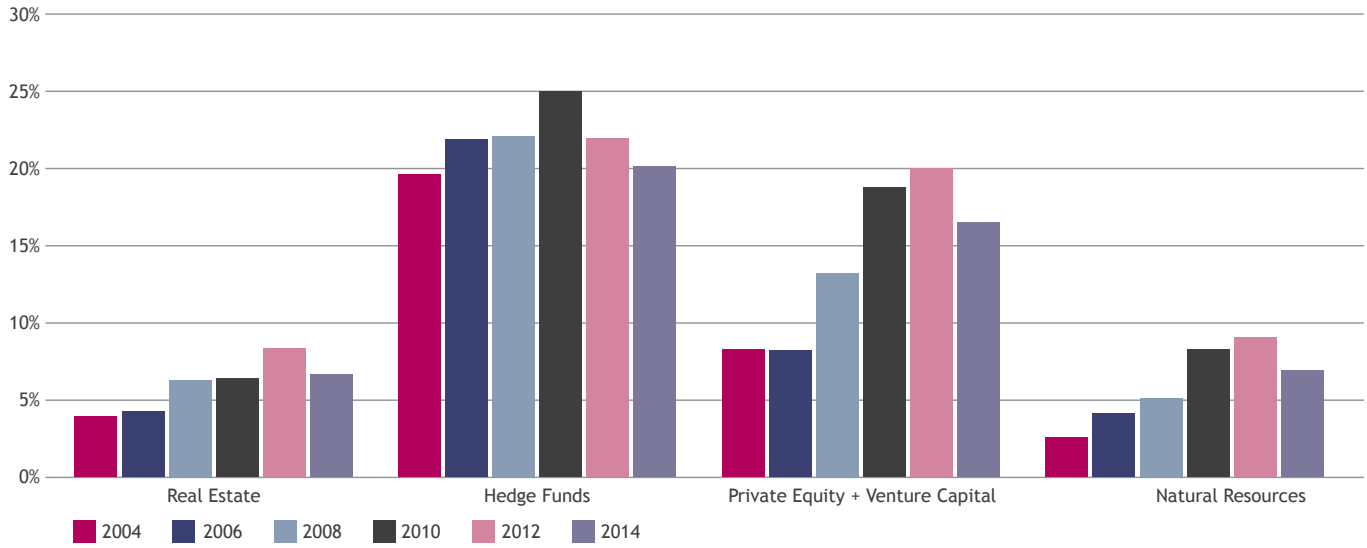
A prolonged bear market and/or a severe economic recession can cause a reduction in any contributions and bequests to an E&F investment plan, ultimately threatening the prospect of it being able to match its required spending rate.

Confronting these challenges opens up a special niche for alternative investments such as hedge funds to be allocated to an E&F portfolio. The proven ability of hedge funds to protect an investor's capital when it is highly correlated to underlying market positions and generate high long-term returns by exploiting market inefficiencies makes hedge funds attractive to E&Fs.

The landscape of endowments investing in hedge funds is largely made up of US institutions; 94% of active endowments globally are based in the US. Notably, Yale and Harvard university endowments have pioneered a model[2] for the large scale use of alternative assets, including hedge funds and private equity.

With long-term time horizons, E&Fs are able to take a long term approach to their investment in hedge funds. Further, they are generally more able to tolerate more illiquidity and longer lock-ups compared to other investors.

**Exhibit 1: Allocation to Alternative Assets for US and Canadian Colleges and Universities with Assets exceeding $1 billion.**




Source: NACUBO-Commonfund Study of Endowments (2014).

[2] David Swensen's Yale model yielded an IRR of 15% p.a. over a 20 year period (1987-2007).

## 2. Pensions:

Pension plans are long-term pools of capital that are managed on behalf of retirees. These are invested in pools of assets designed to provide a given stream of income to meet the pension plan's projected liabilities over time. Unlike E&Fs, which have to spend a set amount each year and can determine the timing of their payouts, pension plans do not have such flexibility. They are often legally required to meet their monthly obligations regardless of their economic cycle or their plan's funding status, etc. This approach will dictate a different kind of investment mandate, not one that prioritises the risk-adjusted returns of the pension plan, but rather the consistency and quality of the plan's income and its capital appreciation to meet any liability needs.

By and large, the universe of pension funds can be divided into two groups, public sector pension funds (providing benefits for state and/or local government employees) and private sector pension funds (set up by private sector employers to assist the retirement needs of their employees). The majority of public sector plans are funded by defined benefit schemes while private sector plans are often funded through defined contribution schemes.

The challenging economic conditions arising from the financial crisis in 2008 and the subsequent downturn in equity markets and historically low interest rates has resulted in an increase in defined-benefit pension fund deficit levels. As of the end of 2014, the average value of public pension funds (as a measure of the ratio of the plan's assets to liabilities) has fallen to a level of approximately 74% versus 101% in 2001.[3]

By extension, pensions and other investor types (notably insurers) are finding it much tougher to source assets that meet their needs; those that can deliver growth while being also able to diversify risks within their portfolio. Consequently, they are having to look beyond the traditional investment model (which typically is comprised of an allocation to bonds and equities) and invest more in alternatives – and among these, hedge funds.

Many pension plans see the benefit of making an allocation to hedge funds. Although their allocation is lower than that of E&Fs, the global pension plans that are allocating to hedge funds have an average allocation of 10% of their total portfolio.[4]

Public pension funds remain the most significant group of institutional investors that allocate capital to hedge funds today with latest estimates stating they account for 20% of all institutional capital invested. Close behind, private pension plans have also been building up their portfolios of hedge funds over recent years accounting for 19% of all institutional capital invested.[5]

## 3. Sovereign Wealth Funds:

Sovereign wealth funds (SWFs) are broadly divided into two types of funds: (a) funds created to counteract the adverse effect of market cycles on government spending and the national economy; and (b) savings funds created with a view to building up savings for future generations. In pursuing the objectives of their state plans, SWFs invest across a wide variety of liquid and illiquid asset classes.

One of the primary differences between SWFs and other investor types are that they are predominantly funded by proceeds earned from the sale of their country's natural resources (usually oil and gas) or the foreign currency reserves that result from foreign trade surpluses. Not only do these funds have to build up vital savings for future generations, but they must also act in the best interests of their citizens to stabilize potentially unpredictable economies (in particular, resource-rich countries) by diversifying their sources of income.

SWFs tend to have a bias towards investing in their home public markets, which can be a constraint when their country's public markets lack both breadth and depth. In these instances, investing in hedge funds enables the SWF to gain exposure to global markets as well as have access to new financial markets and instruments. All these factors combined tend to result in the SWF's investment portfolio having a better level of diversification spread across both asset classes and geographically.

## 4. Insurance Companies:

As a consequence of insurers having to hold large amounts of capital against investments in certain asset classes[6], including equities and alternatives, their portfolios have been traditionally heavily weighted towards investments in bonds and credit. Further, given insurers invest to meet their portfolio's actuarially modelled future liabilities, they will align the majority of their investments so that (i) they mature close to or when their liabilities are due and (ii) they are capable of yielding a rate in excess of the discount rate used for premiums.

In a low-yield environment (as has been the experience in recent years) insurance companies must search for new strategies to enhance their portfolio and do so by taking on

[3] Centre for Retirement and Research, Boston, 2015.

[4] Preqin.

[5] 2015 Preqin Hedge fund report.

[6] In the US, the National Association of Insurance Commissioners (NAIC) which regulates US domiciled companies stipulate insurers must hold specified levels of regulatory capital, while insurance companies based in Europe will be subject to a similar and even stricter RBC framework with the advent of Solvency II rules from January 2016.

more credit risk, interest rate risk or other types of risks in their investment portfolios. Depending on the type of insurer (for example, health vs. property and casualty vs. life), these strategies can include investing in other fixed income investments (including structured credit, high yield credit and municipal bonds) as well as in common and preferred equities.

Insurance companies' liabilities (in particular life insurance companies) are generally long-term in nature. Consequently, they can invest a portion of their portfolio in less liquid assets which have a higher propensity to generate excess returns albeit with higher volatility or liquidity risk. There are a number of ways insurance companies can do this, including an investment in (i) emerging market bonds to complement the plan's developed market exposures; (ii) lower credit quality instruments to complement high grade exposures; and (iii) alternative investments to complement the plan's credit exposure. While each of these options should offer some incremental yield to the total portfolio, the diversified and uncorrelated return stream of hedge fund investments combined with the enhanced downside protection that they offer make them a potentially attractive option for insurance company portfolios.

## 5. Family Offices:

Family offices are pools of capital invested on behalf of family trusts or estates to meet the ongoing beneficiary or philanthropic objectives of the founders and their families.

For the purposes of this paper, any reference that we make about family offices will infer a single family office (SFO). An SFO manages the financial and personal matters of one wealthy family. As it is driven purely by the needs and preferences of the underlying family, a high range of disparity exists between the needs of different family offices. The investment policy statement of the SFO largely follows the objectives and constraints of the key family members. A key challenge for any SFO is how to build its investment portfolio so that it is capable of producing prudent levels of growth, while being resilient enough to withstand large swings in asset valuations so that the family's wealth can be passed onto multiple generations.

Typically, a well-managed larger SFO (where the AUM of the fund would be $5 billion or greater) would invest across all asset classes. The aforementioned challenging economic conditions characterised by low yield returns from fixed income investment and lower-than-expected returns from equity investing means that SFOs are increasingly more likely to allocate to hedge funds.

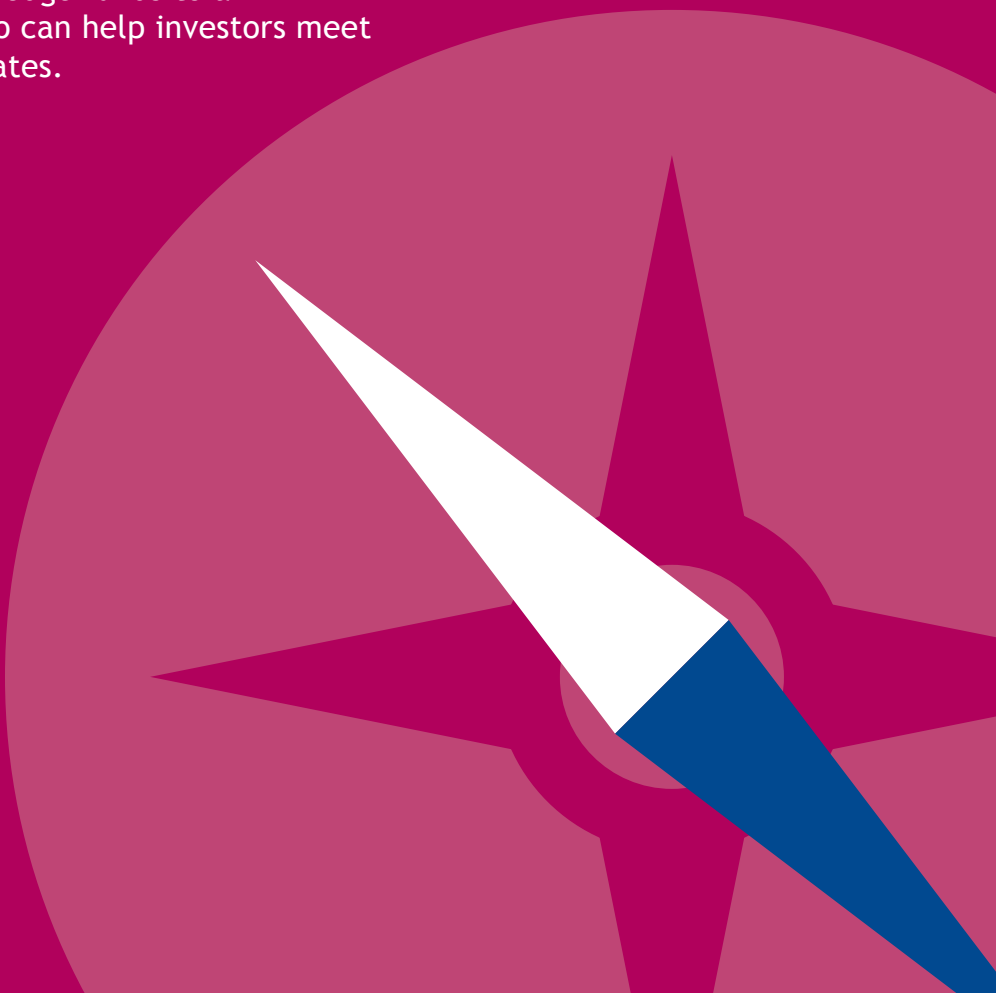
In section 4, we will elaborate further on an investor's practical considerations regarding its investment portfolio and how different investor types are allocating to hedge funds.

# 2 Hedge Fund Strategies

The hedge fund universe is populated by many different investment styles and strategies, each with their own risk and return characteristics.

These strategies are generally not confined to any one side of the market, which means they are often able to outperform in a range of market conditions.

Carefully applying hedge funds to an investment portfolio can help investors meet their specific mandates.



Some investors view hedge funds as legal structures for amassing and investing assets subject to some stated philosophy and bound by certain pre-established parameters over where these assets are invested. Others define them simply as an asset class, no different in the investing lexicon from references to traditional asset classes like equity and fixed income. Most accept hedge funds to be a little bit of both, with two distinguishing features.

First, hedge funds are generally not confined to one side of the market or trade and are thus referred to as unconstrained. This means that hedge funds can succeed when markets are going up (i.e., when one takes a long position in a security or as the practice is more familiarly known, "going long"), or going down (i.e., when one takes a short position in a security or as the practice is more familiarly known, "going short"). Short-selling is usually thought of as a hedge fund hallmark. Unlike traditional buy-and-hold investing, hedge funds have a degree of versatility that is not commonly known, understood or even available to average retail investors.

Second, hedge funds have the ability to use leverage. This means: (1) relatively small amounts of capital can be positioned in such a way as to control larger pools of assets across investable assets worldwide and (2) leverage is used as a means of regulating a fund's level of risk.

There are many different hedge fund strategies. Each of them provides their own unique risk and return characteristics. These include differing levels of risk-adjusted returns and correlations to public market indices, levels of volatility and degrees of downside protection. Given these differences, a classification model (or taxonomy) is utilised. Depending on the investment consultant or hedge fund index provider, these classifications can vary widely. Some are broad in scope, while others take a more granular view. Based on these classifications, investors can build their investment portfolio comprised of different hedge fund strategies to meet a specific investment mandate.

For the purposes of this paper, we set out the five primary hedge fund strategies employed by investors: long/short, event driven, relative value, global macro and managed futures. This format is loosely based on the taxonomy developed by Hedge Fund Research Inc, which provides insight around the various investment techniques that a hedge fund can employ.

## (i) Long/short hedge funds (e.g., long/short equity, long/short credit, emerging markets):

Long/short equity is the most frequently used hedge fund strategy. Essentially it entails buying undervalued stocks (going long) and borrowing and then selling overvalued stocks (going short). Depending on the hedge fund's investment focus, the manager attempts to reduce the volatility (or risk) of its portfolio by hedging its trading positions (i.e., offsetting the risk of any adverse price movements) across regions, industries, sectors, and market capitalisations to reduce the risk.

Long/short equity hedge funds dominate the equity hedge fund category by both the size of assets that they manage and the number of funds that employ the strategy. Because most long/short strategies maintain a large degree of equity exposure, their performance relies more on the stock market environment than other alternative strategies. Consequently, the returns from long/short equity strategies tend to be highly correlated with equities, but with nearly half the risk. Over a 25-year period, the HFRI equity hedge index reported an annualised return of 11.9% with a risk of 8.9% compared to the S&P 500 reporting an annual return of 7.36% with a risk of 14.6% over the same period.[7]

Short bias funds generally maintain a net short exposure to the market. Like long/short managers, short bias managers can seek enhanced returns from establishing long positions in under-priced stocks and short positions in overpriced stocks, with the size of the short positions exceeding the size of the long positions. This behaviour provides them with a higher probability of making positive returns during declining equity markets. By contrast, they are expected to rise very little or perhaps even decline in a generally rising market.

Going long or taking a long/short position is not solely the domain of equity investors. In contrast to an equity long/short strategy, where managers construct net long or net short positions using equity hedging strategies, long/short credit managers focus their allocation on fixed income securities where the majority of the return (or "carry" as it can be called in other parlance) is derived from holding an investment in a fixed income instrument. Long/short credit managers employ a variety of strategies to invest across the capital structure on both a long and short basis. Typically hedge funds take positions as a result of bottom-up, fundamental credit analysis on the company and its capital structure. Strategies utilised by long/short credit managers include the purchase or short sale of stressed and distressed bonds, high yield debt and securities from recently reorganised firms (including equities). The strategy attempts to capitalise on inefficiencies in the marketplace while maintaining a lower degree of cyclicality and directionality as well as it having potentially higher liquidity than a typical distressed debt investment.

[7] As measured by indices performance reported by Hedge Fund Research and the S&P 500.

## Focus on:

**Equity long/short – Pairs trade**

A hedge fund manager who thinks that Coca-Cola will outperform its peers in the soda market can structure their trade by buying shares of Coca-Cola and selling short shares of Pepsi. With this trade, any event that causes all soda companies to fall in value will lead to a loss on the Coca-Cola position and a profit on the Pepsi position. By taking this approach, if the value of the Coca-Cola position declines and the manager's fundamental research is correct, any loss incurred should be offset from the holding that the manager has in Pepsi.

Assume Coca-Cola trades at $100 per share and Pepsi at $50 per share. A manager can bet on Coca-Cola's share price relative to Pepsi while hedging general market risks by going long 1 share in Coca-Cola (i.e. buying) in the expectation that the price will increase relative to Pepsi and going short (i.e., borrowing and selling) 2 shares of Pepsi, in the expectation that the price will decrease relative to Coca-Cola.

Scenario 1: Assume the market goes up and all soda prices increase in value:

| | Gain/loss |
|---|---|
| • Price of Coca-Cola shares increases by 50% from $100 to $150 | $50 |
| • Price of Pepsi shares increases by 20% from $50 to $60 (recall our manager borrowed and sold 2 Pepsi shares for $100 (2*$50)). The holding is now worth $120, incurring a loss of $20 (they would need to buy back shares at higher price of $60 per share) | - $20 |
| *Overall profit on the long/short trade* | *$30* |

Scenario 2: Assume the market goes down and all soda prices decrease in value:

| | |
|---|---|
| • Price of Coca-Cola shares falls 20% from $100 to $80 | -$20 |
| • Price of Pepsi shares also falls 50% from $50 to $25 (recall our manager borrowed and sold 2 Pepsi shares for $100 (2*$50)) | + $50 |
| *Overall profit on the long/short trade* | *$30* |

**Why do investors allocate to this strategy?**

The successful management of a fully-integrated portfolio of long and short positions can help to increase portfolio returns even in difficult market conditions. Hedge fund managers that have employed the long/short strategy have proven to be very adaptable, as these funds are able to generate returns in both up and down markets or flat and trendless markets. While the market exposure of this strategy is typically less than when investing in a long-only fund, the long and short positions that a fund may take in its equity or bond selection can best provide the manager with an opportunity to earn greater returns in a variety of market of market cycles.

### (ii) Event driven (e.g., activist, merger arbitrage, special situations, distressed securities):

Under an event-driven strategy, a hedge fund takes positions based upon an event, which can include: (1) a merger between two or more companies; (2) an activist manager influencing a company's management to take action to increase the value of the company's stock; (3) taking a controlling position in the debt or equity of a distressed company with severe financial problems; and (4) seeking to profit from other types of stock-specific events, such as spin-offs or changes in capital structure.

These types of trades are sometimes called special situations due to the uniqueness of the event involved in determining the price of the security or securities. In a merger arbitrage situation, the manager seeks to take advantage of the price difference that exists between the current price of the shares of a company being acquired and that of the shares of the acquiring company. This may entail buying the stock of the takeover target and shorting the stock of the acquirer. Since most takeovers are done at a premium to the target's stock price, the manager will gain from an increase in the price of the target's stock and the decline in that of the acquirer's.

Long/short equity or credit managers (to which we refer to above) may become activist investors. An activist manager attempts to influence a company's management to take some form of action that in the end will increase the price of the company's securities. This is frequently done in a constructive manner with the cooperation of the company management.[8]

Activist credit funds often become involved in a company's financial and/or its organisational restructuring. Several of these types of funds hold board seats on companies in which they have significant holdings. Distressed investing managers invest in the debt or equity of a company close to or in bankruptcy (via an investment in bank debt, corporate debt, trade claims, structured credit instruments, or warrants). The manager buys securities if they think they can improve

[8] The increasing role of hedge fund managers engaging in shareholder activism is the subject of a 2015 research paper published by AIMA – Unlocking value: the role of activist alternative investment managers downloadable on AIMA's website.

the prospects of the company or if the value of the firm post-bankruptcy (whether liquidated or reorganised) is greater than the current value of the debt.

### Focus on:

**Merger arbitrage**

Consider the acquiring firm with a stock price of $20 who offers one share of its stock for two shares of a target stock. At the time of the announcement, the target share price increases from $7 to $9. The arbitrageur will pay $18 (= $9 x 2) for two shares and sell short the acquiring firm for $20. If the merger is closed on these terms, the arbitrageur will profit by $2 or 11.1% of the purchase price of the target firm. However, if the deal fails to close, shares of the target firm are expected to return to the pre-deal price (i.e. shares will revert back to $14 (=$7 x2) for a loss of 22.2%.

**Why do investors allocate to this strategy?**

Predicting catalysts that move the price of an underlying security or asset is challenging for most investors, which is why they often use hedge fund managers that can act quickly to structure trades to capture any upside premium from such an inefficiency. Event-driven and related strategies tend to be less influenced by the general stock market since the returns are driven by company-specific events rather than market-driven events. Some hedge fund managers such as activists can also serve as the catalyst for an "event" to take place, encouraging the company to take specific steps to unlock value or reduce risks within the relevant equity or credit investment that an investor has taken an interest in, ultimately transforming its long-term prospects.

## (iii) Relative value (e.g., fixed income, convertible bond arbitrage, market neutral):

Relative value strategies seek to take advantage of differences in the pricing of related financial instruments. Strategies that fall under relative value typically have less market exposure to the underlying equity or bond market than long/short strategies. Their objective is to extract or capture value from any structural anomalies that exist in the markets between related securities. In its simplest form, a relative value arbitrage strategy entails purchasing a security that is expected to appreciate, while at the same time selling short a related security that is expected to decline in value. Related securities can be either bonds of the same company, securities of two different companies in the same sector or different bonds issued by the same company with different maturities, credit ratings and/or coupons. Regardless, the securities are closely related, such as issued by the same underlying firm or others in the same industry.

Considerable fundamental analysis on the part of the hedge fund manager is used to determine whether any mispricing exists. Quantitative models are used to highlight anomalies in relative valuations, although positions are not taken on the basis of altered mathematical relationships alone. The model outputs are used as signals only and fundamental credit research is undertaken to determine what factors may have caused the change in conditions and whether they are expected to continue.

Relative value strategies are among the most hedged strategies, as the long positions are of similar risk to the short positions with the goal of substantially reducing the market risk of the portfolio. These strategies retain specific risk and may also have exposure to leverage and liquidity risks. Investors today can deploy a wide variety of relative value strategies, with the majority heavily invested in fixed income securities. These strategies may trade sovereign debt, investment grade and distressed corporate bonds, as well as convertible bonds.

### Focus on:

**Fixed income arbitrage – U.S. Treasury convergence trade (on-the-run vs. off-the-run)**

Consider two treasury bonds. The 30-year US Treasury bond generally trades at a premium relative to the 29.5 year bond, even though they are otherwise quite similar. Price discrepancies in this market occur because on-the-run securities are newly issued and have relatively more active and liquid markets than off-the-run securities, which are slightly more seasoned. Because of the relatively higher demand, the price of a newly issued treasury bond will be more expensive compared to the off-the-run bond issued six months ago.

In this case, a few months lapse (so the 30 year bond has aged to a 29.5 year bond and the 29.5 year bond has aged to 29 years), and a new 30 year bond is issued. What was previously a 30 (now 29.5) year Treasury has now become off-the-run, and its liquidity should decrease as demand lessens. A hedge fund manager can purchase the relatively low priced off-the-run security (29.5 year bond) while simultaneously selling short the 30 year on-the-run security. After a short time, the on-the-run security will become seasoned and its price should converge to the already seasoned securities, thereby generating a profit for their manager, which should primarily result solely from the Treasury's changed liquidity premium.

**Why do investors allocate to this strategy?**

In most market environments, predominately those characterised by stable or declining risk levels, relative value strategies can earn investors reasonable returns with low risk. However, investors need to perform careful due diligence as some funds may employ considerable levels of leverage or have a high degree of liquidity risk.

## (iv) Global Macro:

Managers that deploy a global macro strategy research the global economic landscape and seek to profit from any macro-economic imbalances and/or geopolitical events. Often having no limitation in terms of the types of instruments, asset classes, markets and geographies that they can invest in, macro hedge funds enjoy the broadest investment mandate of any of the major hedge fund strategies.

A macro hedge fund manager can hold both long and short positions in various equity, fixed income, currency, interest rates and commodity derivatives markets. Further, they can dynamically allocate capital to the asset class, sector or region in which they think the best opportunities currently lie, hence most funds tend to be recognised by the more popular label of global macro funds. While some macro funds trade single stocks in anticipation of market themes, most macro funds concentrate their trading in forwards, futures and swaps in commodities, currencies, equities bonds and interest rate investment vehicles. Most often, the securities being traded are very liquid so the manager can react quickly to changes taking place in the macro environment.

### Focus on:

**Global macro trading**

A global macro hedge fund manager believes that the Japanese economy is heading into a slowdown, and expect further central bank intervention (via a policy of quantitative easing). Consequently the manager goes short the Japanese yen (believing the currency is likely to fall further in value) and goes long the stock market.

Over a period of months that follow, his actions are proved correct, the continued quantitative easing lowers the value of the Yen and pushes down interest rates. As a consequence, the yield on an investment in treasuries, and other bonds also fall, pushing investors into relatively riskier investments in search of a better return – a factor that is likely to push up stock market prices. The macro manager has therefore been successful in his trade.

**Why do investors allocate to this strategy?**

Over time the unconstrained investment mandate of a global macro trading strategy has proven to deliver solid positive risk-adjusted returns and an attractive investment diversification while sharing similar risk management properties to holding an investment in bonds. Global macro hedge funds generally exhibit a low correlation to traditional asset classes and therefore incorporating the strategy into a traditional portfolio has the potential to enhance the portfolio's overall return while decreasing its risk.

## (v) Managed futures/CTA:

The term managed futures (or CTA[9] funds as they are synonymously called) refers to the active trading of futures and forward contracts on physical commodities, financial assets and exchange rates to earn the risk and return of active management within the futures market.

Managed futures tend to be based on systematic trading more than discretionary trading (the latter being the predominant investment strategy among global macro managers). Futures managers tend to use relatively more technical analysis as opposed to trading based on fundamental analysis. Systematic trading strategies are generally categorised into three groups: trend-following; non-trend following; and relative value.

CTA managers take a position by applying advanced technical analysis tools. They look for a trend in the market and take a position through trading futures aiming to profit from the trend continuing. That is, they take long positions when markets are expected to trend higher and short positions when markets are expected to trend lower. CTAs usually invest in futures on financial instruments with a focus on commodities. CTAs are funds managed quantitatively, using complex mathematical models implemented by very powerful computers. These funds are amongst the most liquid vehicles available, enabling them to move rapidly and at a limited cost. Often they will actively engage in short selling across the markets that they trade.

[9] Commodity Trading Advisors.

## Focus on:

**Trend-following – Simple moving average**

One of the most popular classes of trend-following strategies uses moving averages to signal trades. A moving average is a series of averages that is recalculated through time based on a window of observations. The window of observations is composed of a fixed number of lagged prices. For example, a current 10-day moving average price (day 0) is formed using the 10 prices corresponding to the 10 days immediately preceding the current price (days -1 to -10). Yesterday's (day -1) 10-day moving average would be composed of the prices corresponding to the 10 days prior to that day (days -2 to -11).

SMA Description

In a simple moving average, the daily prices are equally weighted. As each new price observation is added to the series, the oldest observation falls away, creating a window of averaged prices that is often charted.

SMA Trading Signals

(a) Enter long if current price Pt > SMAt(n)

(b) Enter short if current price Pt < SMAt(n)

*Numerical Practice:* A stock price experiences the following 10 consecutive daily prices corresponding to days -10 to -1: 100, 102, 99, 97, 95, 100, 109, 103, 103, and 106. What are the simple (arithmetic) moving average prices on day 0 using 3-day and 10-day moving averages, as well as the 3-day moving average for days -2 and -1?

Using the data, the three-day moving average on day 0 is [(103 + 103 + 106)/3], or 104. For days -2 and -1, the three-day moving averages are 104 and 105, respectively. The 10-day moving average for day 0 is 101.4. Because the price on day -1 moved above the recent three-day moving averages, a classic interpretation of a simple moving average trading system would be that a long position should have been established.

**Why do investors allocate to this strategy?**

In recent years, the robust performance of CTA and macro hedge funds during the financial crisis of 2008 has prompted many investors to include these strategies as part of a tactical allocation to their portfolio. Both these strategies were able to post uncorrelated returns and generate large profits at a time when equity markets were losing on average 40% of their value.

Historically, macro and managed futures managers have had the most balanced return profile, experiencing lower drawdowns than many other investment strategies and having a relatively rare ability to earn profits when equity and bond prices are declining.

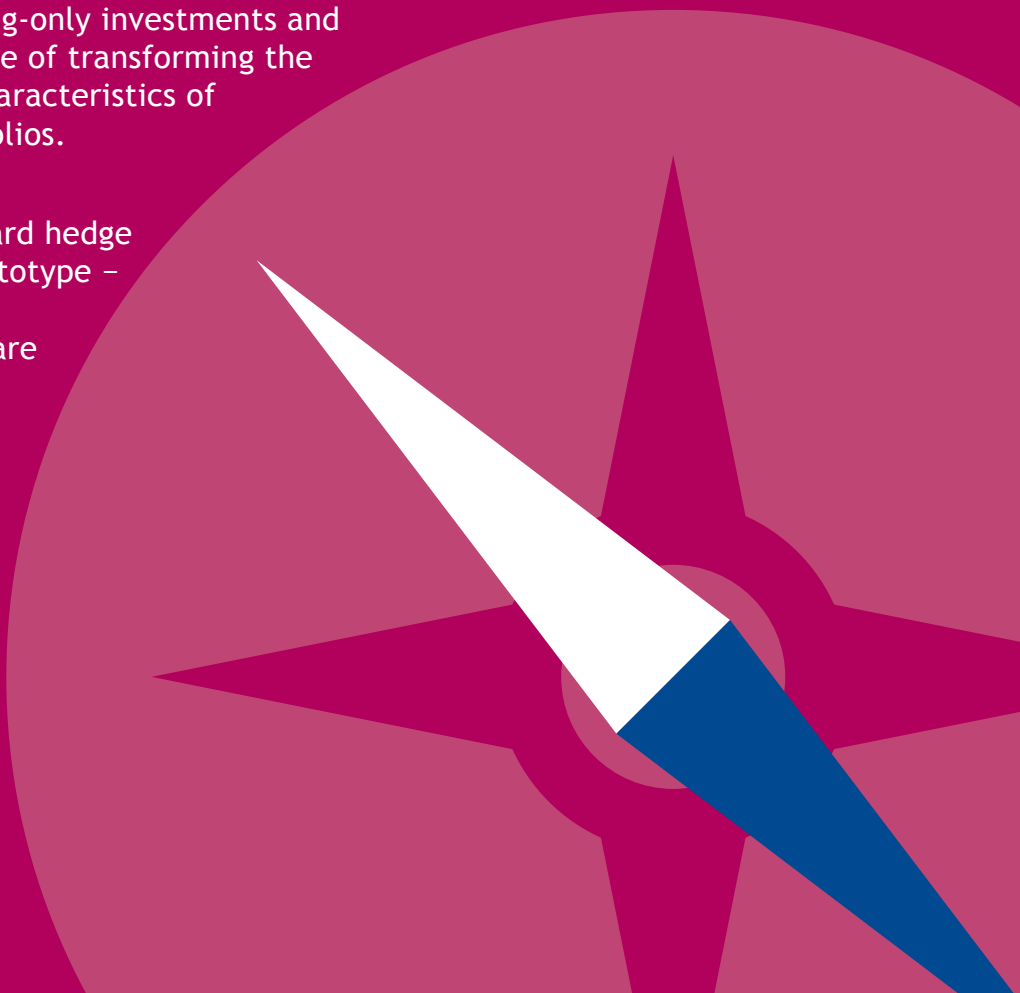
Managed futures have the unusual quality of having a positive correlation or near zero correlation to various equity indices in rising equity markets and a negative correlation during falling markets, all of which demonstrate excellent diversifying power for these investments. Given their underlying investments are highly liquid in nature, CTAs are able to offer crucial liquidity to investors, and were of significant benefit to investors during the credit crisis which saw liquidity dry up in both equity and credit markets.

# 3 Analysis of the Potential Role of Hedge Funds in a Traditional Portfolio

Hedge funds are increasingly deployed as risk-management tools within investors' portfolios.

Experienced allocators no longer view hedge funds as 'homeogeneous' (part of a separate bucket – detached from the traditional assets in their portfolio) but as 'heterogeneous' substitutes for long-only investments and diversifiers capable of transforming the risk and return characteristics of their entire portfolios.

There is no standard hedge fund portfolio prototype – a range of simple strategic options are available.



Hedge funds are being increasingly used as tools within investors' portfolios, enabling investors to achieve their individual objectives in terms of risk-adjusted returns, measure of correlations and/or low volatility to other assets within the overall portfolio.[10] In this section we discuss how hedge funds have interacted with fixed income and equities and how an allocation to hedge funds within a 60/40 stock/bond portfolio can be used to meet an investors' needs to attain the best level of risk-adjusted returns possible.

## Grouping hedge funds using cluster analysis

What is the role of each hedge fund strategy within an investor's portfolio? Beyond the traditional strategy "bucketing," as in section 2, one can also analyse the hedge fund universe statistically. One such method is cluster analysis, a statistical methodology which clusters or groups a set of objects in such a way that objects in the same group are more similar to each other than those in other groups.

Creating a cluster analysis is useful for an investor in both its portfolio construction as well as hedge fund selection as it creates a classification of the hedge fund universe, compiles peer indices, and helps them to better diversify their portfolio or to identify hedge funds which exhibit style drift in the portfolio.

Applying this technique, we are able to consolidate a universe of hedge fund returns data, equity indices returns data and fixed income returns data over the past 20 years, grouping them into separate clusters that share similar risk and return characteristics.

Our deployment of cluster analysis reverses the usual process of classifying hedge funds according to their stated strategy but instead groups them according to their observed risk-adjusted returns and compares them with the risk-adjusted returns of the traditional asset classes - fixed income and equity markets. Taking this one step further, a review of the results of this analysis demonstrates how the various hedge fund strategies (and their underlying exposures) interact with each other as well as a balanced portfolio (typically representative of a portfolio which has 60% of its assets invested in equities and 40% in bonds).

*Note: The appendix to this paper provides detailed information on the steps and parameters which we use in constructing the cluster analysis and the resultant dendrogram (tree diagram) for the various strategy clusters that we provide.*

[10] "Beyond 60/40, the evolving role of hedge funds in institutional investor portfolios," AIMA, May 2013.

[11] Style drift occurs when the portfolio manager may deviate from a stated investment mandate.

## Hedge funds as substitutes or diversifiers within an investor portfolio

Many of the more experienced allocators are no longer seeing hedge funds as a separate bucket – detached from the traditional assets in their portfolio – but as a substitute for long-only investments and diversifiers capable of transforming the risk and return characteristics of their entire portfolios. Investors are now choosing to replace some of their long-only allocation equity or credit position with a hedge fund, but not merely to substitute one for the other, but as a strategy to reduce the volatility of their overall portfolio holding and to best preserve its capital.

In drawing up the cluster analysis, we are able to identify the various hedge fund strategies that can take on the role of a substitute within the total investment portfolio (60/40 portfolio) or may act as a diversifier. We observe from the two pillars in exhibit 2 below that the hedge fund universe is divided into two big families of hedge fund strategies. The first pillar (the substitutes) combines several hedge fund strategies that predominantly provide downside protection, and reduce volatility risk within the total portfolio. Investors are now choosing to replace some of their long-only allocation equity or credit position with a hedge fund, but not merely to substitute one for the other, but as a strategy to reduce the volatility of their overall portfolio holding and to best preserve its capital.

Some hedge funds are simply too uncorrelated to equities to be a straight swap, and the way they behave under certain market conditions is substantially different to the way the underlying asset class behaves. These hedge funds are not regarded therefore as substitutes but take on more the role of acting as a diversifier to the portfolio (as depicted in the second pillar below). All hedge funds offer diversification. But the diversifiers (in this context) comprise strategies that are particularly uncorrelated - and thus provide the potential for significant diversification and the highest probability of generating out-performance.

**Exhibit 2: Hedge Fund Substitutes and Diversifiers within an Investor Portfolio**

| Substitutes | Diversifiers |
|---|---|
| Long short equity/credit | Global macro |
| Event driven | Managed futures/CTA |
| Fixed income arbitrage | Equity market neutral |
| Convertible arbitrage | |
| Emerging markets | |

# (A) Substitutes

## (i) Long/short equity/credit, event driven

**Properties:**

Hedge funds that deploy these strategies are going to be highly influenced by price movements in their underlying markets. Broadly speaking, these funds will do well when the underlying equity or credit markets are performing strongly and tend to do so with more attractive risk-adjusted returns than if you were to hold a long-only investment. Increasingly these strategies are being acknowledged by investors for their ability to reduce risk in a given portfolio of equity and credit with other and for being able to provide downside protection to the overall investment portfolio when grouped with other similar investments.

**Hedge fund contribution:**

An allocation to a long/short strategy and/or event driven hedge fund strategy can either (i) take on the role of a substitute for an equities or credit investment in an investor's public markets portfolio or (ii) complement the long-only equity or credit portion of a balanced portfolio (where the typical portfolio split ranges from a 60% allocation to equities and a 40% allocation to bonds).

Event-driven hedge fund strategies have demonstrated better performance during certain macro regimes (for reference see exhibits B, C in the appendix) than an investment in equities. Given these qualities, they are often tactically deployed within the investor's equity portfolio to generate higher levels of return.

## (ii) Relative value (fixed income arbitrage, convertible arbitrage)

**Properties:**

Relative value hedge fund strategies are associated with delivering long periods of stable positive returns, sporadically interrupted by short periods of losses (see for reference Table 1 and Exhibit C in the appendix). Returns from the strategy are amplified via the use of leverage instead of the net market exposure of the various positions being held.

The strategy tends to be less successful when returns are tested against a more volatile market environment (such as that witnessed in 2008/2009, and during the Asia financial crisis of 1997).

**Hedge fund contribution:**

These strategies could be used as a substitute in a bond portfolio and/or in a standalone fund of hedge funds. Dependent on stringent fund selection, the relative value strategies could contribute to lower absolute risk of the bond portfolio.

## (iii) Emerging Markets

**Properties:**

Emerging market hedge funds can invest in equities, fixed income instruments, real estate, commodities and/or currencies of emerging markets. Managers of these funds can either invest worldwide or focus on a particular region such as Asia excluding Japan, Latin America or Eastern Europe.

For this research, the data collated from emerging market hedge funds are primarily from equity long/short funds as well as some emerging market credit funds. It is not surprising then to see this index grouped together in a cluster with fixed income and equities (see for reference, cluster 5 in exhibit A in the appendix).

**Hedge fund contribution:**

Hedge fund investing in emerging markets originated via the large global macro funds (that were established at the beginning of the 1990s) allocating some of their capital to trading external debt and currencies. Given the rapid recovery and strong growth levels produced by some BRIC[12] markets post-2008, investors have begun to take a greater interest in emerging market investing. Among the most popular styles are long/short[13], relative value and event-driven funds.

For an investor, an allocation to an emerging market hedge fund could be deployed as a satellite[14] (i.e. main purpose will be to provide diversification and the potential for higher return) in an emerging market equities portfolio (a common approach is to combine a long-only allocation with a long/short allocation[15]) or an emerging market bond portfolio. Further, this strategy is also a popular addition when deployed within a fund of hedge funds portfolio looking to capture any potential return from an investment exposure to emerging markets.

[12] BRIC refers to the popularised emerging market countries of Brazil, Russia, India and China.

[13] However, the majority are hedge funds that have a long-only approach since obtaining borrowings or derivatives to gain short exposure can be problematic or expensive in emerging markets.

[14] With reference to core & satellite management.

[15] Long/short may seem like a misnomer as many emerging market regions do not have shorting capacity.

# (B) Diversifiers

## (i) Global Macro

**Properties:**

When combined with a portfolio of traditional assets, the global macro hedge fund strategy has generally produced a positive set of returns (for reference please see the global macro scatter graph in Exhibit C of the appendix to this paper). Historically, global macro managers (and managed futures managers) have had the most balanced return profile experiencing lower drawdowns than many other investment strategies and have a relatively unique ability to earn profits when equity and bond prices are declining.

**Hedge fund contribution:**

Because of the strategy's low correlation to bonds and equities, an allocation to a global macro hedge fund strategy is a popular choice among investors to act as a diversifier (see for reference Cluster 3 in Exhibit A in the appendix) within its total portfolio via (i) a smaller allocation in a bond portfolio with a selection concentrated in a relative value global macro fund; (ii) a smaller allocation in a balanced portfolio (60% equity / 40% bond) portfolio; or (iii) a larger standalone allocation to generate returns and reduce the equity risk factor in a standalone fund of hedge funds.

## (ii) Managed futures/CTA

**Properties:**

The diverse range of markets in which managed futures/CTA funds invest and their ability to generate positive risk-adjusted returns provide a strong case for investors to consider allocating to this strategy. Over the 10 years from January 2005 to December 2014, the CTAs'[16] annualised rate of return of 6.85% compares favourably to the hedge fund composite index[17] which produced an annualised rate of return of 5.11%. For several years since the financial crisis, markets seemed to move in lock-step, making it more difficult for CTA funds to play the risk/return profile of different asset classes off each other. Since the start of 2014, there have been diverging monetary policies in the US, Europe and Asia, causing shifts in currency markets, plus a prolonged slide in the price of oil. Against this background, CTAs that are trend-followers have been among the best-performing hedge fund strategies.

**Hedge fund contribution:**

Similar to global macro hedge fund strategies, the characteristics of a managed futures hedge fund lend it to be a strong diversifier to a total portfolio (see for reference, Table 1 and Exhibit C of the appendix) and an allocation to the same could be used in a variety of ways, for example: (i) as a smaller allocation of a balanced portfolio, or (ii) as a tool to mitigate the equity risk in a fund of hedge funds portfolio that invests across all strategies.

## (iii) Equity market neutral

**Properties:**

Market-neutral portfolios are generally constructed so they are neutral across sectors, industries and investment styles. The basic principles behind the equity market-neutral strategy are similar to that of a long/short equity manager (i.e., they both establish long and short positions in the equity market), with a few important differences. Equity market-neutral managers rely exclusively on their stock-picking capabilities to offer returns, while long/short equity managers tend to keep a long exposure to the market over time. Further, equity market-neutral funds are more resilient against sudden changes in liquidity due to the strategy's balanced nature. That is not to say that liquidity risk does not exist with market-neutral funds, but rather is less acute than with other strategies – particularly those that deploy shorting. An allocation to an equity market-neutral portfolio should help protect investors from the worst impacts of market crises and bouts of extreme market volatility.

Many equity market-neutral hedge fund managers use sophisticated computer-run quantitative models to select stocks. These models are used to create both a statistical advantage in picking stocks (statistical arbitrage) as well as provide a strategic advantage to the investor in controlling her exposure to systemic risk. The characteristics of the market-neutral strategy make it more inclined to take on the role of a diversifier within the total portfolio. The market-neutral strategy characterises performance stability, low volatility and a low correlation to a traditional institutional balanced portfolio (i.e. a 60/40 stock/bond portfolio). For reference, please see the market-neutral scatter graph in Exhibit C in the appendix to this paper.

**Hedge fund contribution:**

Equity market-neutral funds have demonstrated their resilience over the past 20 years, posting steady long-term risk-adjusted returns. Further, they have also reported less severe drawdowns than that recorded by equity markets and the traditional 60/40 portfolio (see Table 1 in the appendix).

The low volatility and beta-neutral characteristics of a market-neutral strategy have made it a popular choice among investors, either via (i) a small allocation in an equity portfolio, (ii) a balanced portfolio (i.e. an allocation of 60% of the portfolio to equities and the remainder (40%) to bonds) or (iii) a contributor in a fund of hedge funds portfolio, in order to offer a standalone product that is stable over time with less exposure to market risk.

[16] As measured by HFRI Macro systematic diversified.

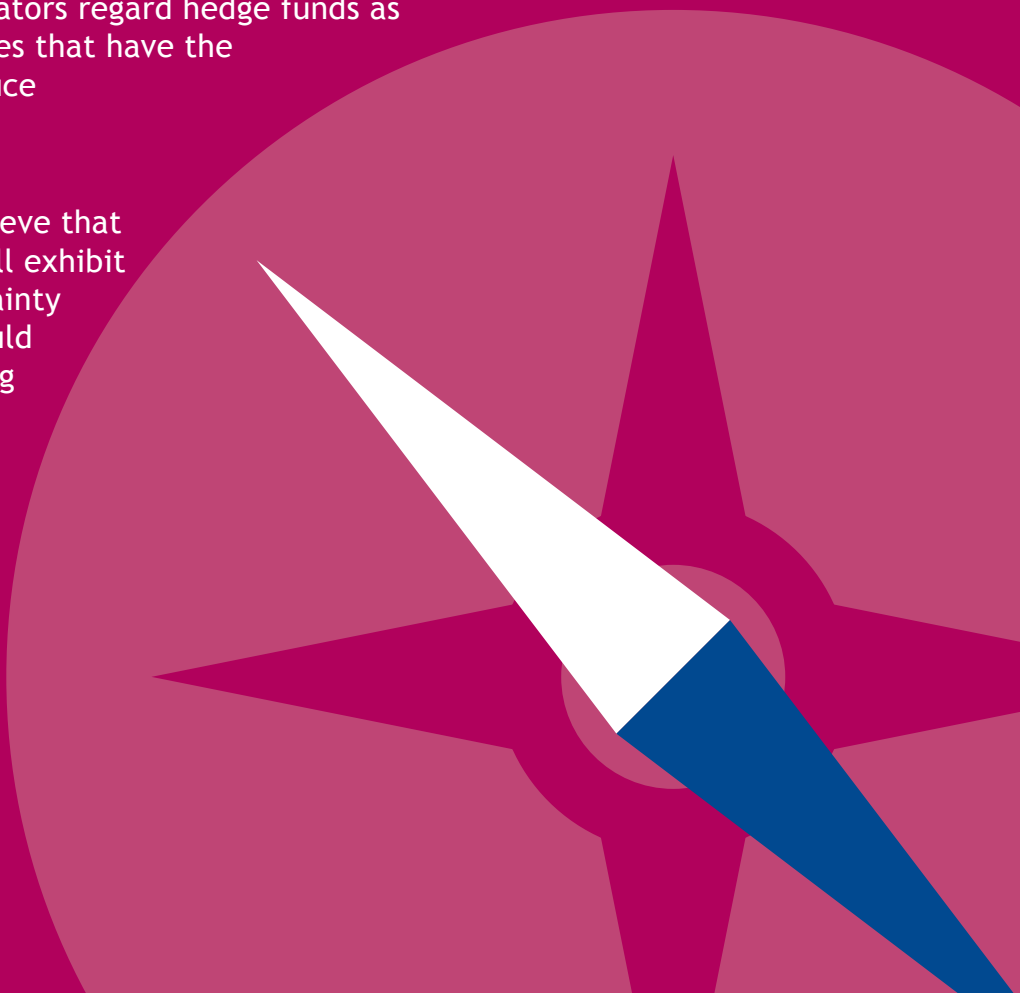
[17] As measured by HFRI Fund Weighted Composite.

# 4 Combining Selected Hedge Funds/ Strategies in a Traditional Investment Portfolio

Institutional investors are moving away from the traditional stock/bond portfolio and are using hedge funds to reduce the risk in their portfolio.

Experienced allocators regard hedge funds as investment vehicles that have the potential to produce out-performance.

Investors who believe that public markets will exhibit increasing uncertainty and volatility should consider increasing their allocation to unconstrained investment strategies such as hedge funds.



When constructing a portfolio, an investor seeks to create the best combination of strategies (via a strategic allocation) that together meet their plan's objectives over time. The starting point for any portfolio construction is to define the goals[18] of the investment plan, identify the constraints, formulate expectations for future performance of the different asset classes and other qualitative inputs, then select the most appropriate asset allocation method which is best suited for the investor's needs and finally, evaluate its results.

Before one can properly define the role of a hedge fund investment, one should ensure first there is a clear articulation of the given portfolio's mandate with agreement and buy-in from the portfolio's fiduciaries, its principals and architects, and then secondly, that the investment mandate is expressed in an implementable investment policy statement (IPS). This IPS becomes the governing document that, as it evolves, forms the basis of the portfolio's construction. Over time this should evolve with the markets and sophistication of the decision-makers. Part of the portfolio construction may include a well-defined niche, role and rationale for hedge funds, if and where applicable.

As discussed, some institutional investors use a core versus non-core approach to allocate their assets. Core assets are typically held at a higher weight with less active risk, such as indexing the majority of an equity portfolio. Non-core or satellite assets often have smaller allocations with a more active risk, such as investing the balance of the equity portfolio with managers who hold concentrated portfolios or even engage in shareholder activism in a hedge fund structure. By limiting the risk in the core portfolio, investors can take more risk in the non-core portfolio in search of higher returns, but with a reasonably well-defined risk level for the entire fund.

## Investor's objective: Deploy hedge funds to help preserve capital and improve risk-adjusted returns

As we can see from above, depending on an investor's objectives, the optimisation model to be used in portfolio construction (i.e., the process of choosing the proportion of various assets in a given portfolio in such a way as to make the portfolio better than according to some other criterion) could be implemented in different ways. Below we present two strategies where investors may consider making an allocation to hedge funds in order to best preserve the capital wealth of the portfolio and earn better risk-adjusted returns.

Assume an investor managing a $10bn portfolio whose goals are to make an annualised return greater than 5%. Historically the portfolio has been invested across a mix of both liquid and illiquid assets, with the most recent allocation being 76% into liquid assets and 24% into illiquid assets.

Given the current allocation strategy, the portfolio is likely to come under increasing pressure to meet its target return. Against the back-drop of current economic conditions, yield from bonds are likely to remain at best modest while performance from equities will be dependent on generating any beta returns from the same. The risk of the portfolio at 11.32% is also expected to increase further amidst more volatility likely from equity market performance.

**Figure 1: Investment portfolio in fixed income, private equity, and real estate**

| Asset Classes | LTPWs | Annual return Expectations (Next 5 years) | Weighted Return | Assumed standard deviation | Correlation to listed equities |
|---|---|---|---|---|---|
| LIQUID ASSETS | **76.00%** | | | | |
| Fixed Income | 40.00% | 2.00% | 0.80% | 9.00% | 0.512 |
| Listed Equities | 36.00% | 7.00% | 2.52% | 19.00% | 1.000 |
| | | | | | |
| ILLIQUID ASSETS | **24.00%** | | | | |
| Private Equity | 10.00% | 8.00% | 0.80% | 25.00% | 0.879 |
| Real Estate | 14.00% | 7.30% | 1.02% | 12.50% | -0.21 |
| Standard deviation of the portfolio | | | **5.14%** | | |

***Expected return of the portfolio***
***Total risk of the portfolio = 11.32%***

Note: The risk of the portfolio (as measured by its standard deviation) takes into account the correlation between the various assets in the portfolio. Calculations for the correlation series can be found in the appendix 2.

[18] CFA institute lists these as being risk tolerance, income, taxes, total wealth, and time horizon.

## Strategy A: Build a stand-alone multi-strategy hedge fund portfolio

In taking up this option, the investor will deploy a percentage of its total portfolio into a multi-strategy hedge funds portfolio. Prudent portfolio construction of such a portfolio leads to building a total portfolio using a variety of hedge fund strategies that when incorporated with a fund's public market exposures is designed to generate the return and risk characteristics to match the investor's goals.

In this case, the investor could deploy 10% of its portfolio at the expense of its initial fixed income allocation, therefore the revised portfolio mix will show the fixed income allocation being reduced from 40% of the total portfolio to 30% of the portfolio, with the balance being allocated to a multi-strategy fund. The multi-strategy funds typically are characterised by their ability to allocate capital based on perceived opportunities among several hedge fund strategies. In this instance, the investor deploys a variety of hedge fund strategies[19] which combined are expected to return an estimated 6% and a risk of 9%. As per figure 2 below, we can see that when deploying a multi-strategy allocation, the returns of the overall portfolio have improved from 5.14% to 5.54%, an increase of 8% in absolute terms.

## Strategy B: Deploy hedge funds to offer complementarity and/or have a core-satellite approach with an equity portfolio, bond portfolio or 60/40 portfolio

Another investment strategy (which is gaining in popularity) is for an investor to incorporate hedge fund strategies into their respective equity, fixed income/credit investments allocations. For instance, a pension plan may blend a larger share of its equity portfolio allocation with directional hedge fund managers (e.g., equity long/short-focused hedge fund managers).

Employing this approach (where hedge funds take on the role of a substitute or complement the equity or fixed income portfolio) offers the plan a way of reducing the volatility (risk) within their public equity allocation, with little if any reduction in the portfolio's total performance. This approach reflects a change in the mind-set of investors (and in particular pension plans) regarding their allocation to hedge funds. The investor's motivation to allocate to hedge funds is because of the latter's proven ability to reduce the volatility of its overall portfolio and best preserve its capital. In taking this approach, it is crucial for the investor to take into account the interaction between hedge fund strategies allocated to the total portfolio and the core portfolio itself, and use this information to select complementary and substitute strategies for the total portfolio.

**Figure 2: Deploying a multi-strategy fund of hedge funds portfolio**

| Asset Classes | LTPWs | Annual return Expectations (Next 5 years) | Weighted Return | Assumed standard deviation | Correlation to listed equities |
|---|---|---|---|---|---|
| **LIQUID ASSETS** | **76.00%** | | | | |
| Fixed Income | 30.00% | 2.00% | 0.60% | 9.00% | 0.512 |
| Listed Equities | 36.00% | 7.00% | 2.52% | 19.00% | 1.000 |
| | | | | | |
| Multi-Strategy Hedge Fund Allocation | 10.00% | 6.00% | 0.60% | 9.00% | 0.807 |
| | | | | | |
| **ILLIQUID ASSETS** | **24.00%** | | | | |
| Private Equity | 10.00% | 8.00% | 0.80% | 25.00% | 0.879 |
| Real Estate | 14.00% | 7.30% | 1.02% | 12.50% | -0.21 |
| ***Expected return of the portfolio*** | | | **5.54%** | | |
| ***Total risk of the portfolio = 11.40%*** | | | | | |

Note: The risk of the portfolio (as measured by its standard deviation) takes into account the correlation between the various assets in the portfolio. Calculations for the correlation series can be found in the appendix 2.

[19] In working out the risk and returns expectations for the next five years, we used a series of capital market and hedge fund indices assumptions and in some cases have applied a discount or premium factor.

In the case of this investor, 50% of the total portfolio has been deployed to a combination of hedge funds, with 80% of this piece (or 40% of the portfolio's total) allocated to fixed income arbitrage and long/short hedge funds and the remaining 20% (or 10% of the portfolio's total) to opportunistic hedge funds (or funds that can take on the role of a diversifier).

For the purposes of figure 3 below, the investor has used a combination of hedge fund index benchmarks including fixed income arbitrage, long/short equity, global macro and managed futures[20]. Similar to strategy A, the investor beats the return of the portfolio (with no hedge fund allocation) by 12% in absolute terms. But more significantly, the risk of the portfolio has fallen from 11.32% to 7.34%, reducing the risk level by one third if the portfolio were invested only in bonds, equities, real estate and private equity (as in Fig 1).

It is important to remember that the portfolio construction or optimal allocation for the portfolio should lie within the combination of the qualitative and quantitative limits stated in the investment policy statement of the investor. Historical risks and returns may differ substantially from those experienced in the future. Investors will need to carefully derive expectations of future risks and returns, taking into account how they may be impacted by current market conditions before investing.

## Results evaluation

The risk of the portfolio (as measured by its standard deviation) takes into account the correlation between the various assets in the portfolio. Investors prefer to invest in assets with the lowest possible correlation to listed equities and the other assets in their portfolio. While the standard deviation of individual assets in the portfolio range from 5% to 25%, the standard deviation of the portfolio using strategy B is 7.34%. This standard deviation, which is lower than the

**Figure 3: Deploying 50% of the total portfolio into hedge funds that can act as substitutes and diversifiers**

| Asset Classes | LTPWs | Annual return Expectations (Next 5 years) | Weighted Return | Assumed standard deviation | Correlation to listed equities |
|---|---|---|---|---|---|
| **LIQUID ASSETS** | **76.00%** | | | | |
| **Traditional** | | | | | |
| Fixed Income | 15.00% | 2.00% | 0.30% | 9.00% | 0.512 |
| Listed Equities | 11.00% | 7.00% | 0.77% | 19.00% | 1.000 |
| | | | | | |
| **Hedge Funds** | | | | | |
| Fixed Income Arbitrage (substitute) | 20.00% | 5.00% | 1.00% | 5.00% | 0.397 |
| Long-Short Equity (substitute) | 20.00% | 6.00% | 1.20% | 8.00% | 0.878 |
| Global Macro (opportunistic) | 5.00% | 6.00% | 0.30% | 6.00% | 0.227 |
| Managed Futures (opportunistic) | 5.00% | 7.00% | 0.35% | 7.00% | 0.148 |
| | | | | | |
| **ILLIQUID ASSETS** | **24.00%** | | | | |
| Private Equity | 10.00% | 8.00% | 0.80% | 25.00% | 0.879 |
| Real Estate | 14.00% | 7.30% | 1.02% | 12.50% | -0.21 |
| ***Expected return of the portfolio*** ***Total risk of the portfolio = 7.34%*** | | | **5.74%** | | |

Note: The risk of the portfolio (as measured by its standard deviation) takes into account the correlation between the various assets in the portfolio. Calculations for the correlation series can be found in the appendix 2.

Figs 1-3, Source: HFR, MSCI World, Credit Suisse, Hedge Fund Research, Barclays, Preqin, Case Shiller

[20] In making our risk and return assumptions we have used a series of capital market and hedge fund indices and in some cases applied a discount or premium.

weighted average of the individual assets, reflects the diversification effect of the investor's portfolio. Notice that those hedge fund strategies that offer the best diversification are those with the lowest correlation to listed equities such as managed futures at 0.148 and global macro at 0.227.

It is essential then that the investor considers the variable behaviour of hedge fund strategies based on the market environment when building their investment portfolio.

The analysis that we have shown in the earlier sections of this paper demonstrate that hedge fund strategies are attractive because they provide different risk and return profiles, enabling them to adapt to changing market conditions. As a result, hedge funds are able to offer a range of combinations for various investor types and their respective risk/return goals.

The role of the portfolio manager is integral to the investment process as they create the best combination of investment strategies that best meets the investor's objective in a lasting, stable manner. It has been demonstrated that no standard hedge fund portfolio prototype exists. However, a range of strategic options available for the investor does exist. In choosing their preferred allocation option, the investor should, above all, define their plan's expectations and objectives, and then decide as to whether it wants to position hedge funds within their investment portfolio to apply a rigorous selection and portfolio construction process.

While the above example is illustrative, it is also largely indicative of a change in approach taken by institutional investors when considering hedge funds for inclusion in their portfolio. An allocation to hedge funds are deployed primarily as a tool to ensure steady risk-adjusted returns over time for their investments as well as best preserve the capital investment of the same.

Revisiting Section 1 of this paper, where we describe a broad overview of the more prominent hedge fund investor types, and from the sections in the paper that follow describing the strategy classification of hedge funds and their behaviour when invested alongside other asset classes, we will now consider how each investor approaches their allocation to hedge funds and their motivation for doing so.

## (i) Endowments and foundations

Consider, for example, a mid-sized university endowment (responsible for investing $1bn AUM) whose portfolio needs to meet a return target of, for example, 6% plus inflation each year. With a long investment horizon, its portfolio tends to be equity dominant. In today's market climate, the CIO of this portfolio is likely to be navigating an environment where the returns from their portfolio rise and fall with the vicissitudes of equity market performance.

As noted in Section 3, while fixed income investments tend to exhibit low levels of volatility relative to an investment in equities, their risk-adjusted returns are not likely to be enough to match the portfolio's target return.

It is recognised that the inclusion of hedge funds in an investor's portfolio comprised of bonds, equities and other asset classes can provide a more controlled risk profile and help to reduce its overall volatility. The financial crisis of 2008 provides a compelling example. While major equity indices were down 40%, the equity-focused hedge fund indices were down 'only' 20% over the same period[21]. An allocation to a hedge fund portfolio consisting of predominantly substitute style strategies (e.g., relative value fixed income arbitrage, long/short, event driven) can therefore help to best position the portfolio to meet its target return, while also reducing the volatility within its public markets portfolio.

Reverting to the example above, the CIO of this endowment could best position itself to meet its portfolio target return through building a more diversified portfolio comprising of both traditional investments and alternatives. To facilitate this action, the CIO would need to change the asset allocation within its portfolio. Whether such an allocation is taken from the total percentage allocation of the investment portfolio in equities or bonds will be determined by the portfolio's tolerance for risk. Given the target return for this portfolio is 5% plus inflation, it is likely that if the CIO allocates more of its portfolio to hedge funds, it will do so at the expense of its fixed income quotient rather than its allocation to equities.

## (ii) Pension plan

How a pension plan may decide to deploy an allocation to hedge funds is determined by the plan's goals/objectives and constraints. In the case of the former, these can range from (a) the portfolio having to generate a positive return regardless of how their public market investments perform; and (b) the portfolio generating a more favourable risk-adjusted return with a low correlation to the public equity markets portfolio. In the case of the latter, two common constraints in a pension's investment plan are: (a) the plan's maximum allocation to hedge funds; and (b) the minimum or maximum allocation that a plan can invest into a single hedge fund.

As an example, consider a public pension plan that manages the retirement assets of numerous employees working for a variety of different entities (i.e. municipalities, counties etc.). Assuming that the target return for the plan is 7% for the investment portfolio, the plan therefore needs to generate a

[21] Data as per HFR ( source reference from HFR).

return of 7% or greater to meet any current or future liabilities (i.e. disbursement of retirement benefits to employees). If the pension plan is unable to match the targeted return over the long term, it will be necessary to raise the contribution rate of its employees and/or the entities or trim the various benefits it provides. Either way, not reaching the plan's target return will impose a financial hardship on both the employees and the entity if the contribution rates need to be increased.

Against the recent economic climate of historically low interest rates and shrinking yield opportunities from fixed income investments, increasingly pension funds are finding that the traditional 60/40 model of investment is not sufficient to meet their plan's target rate of return over the long term.

By incorporating alternatives (including an allocation to hedge funds) into the pension plan's portfolio, the probability of meeting the plan's target return increases. One key benefit from the pension plan's allocation to hedge funds is their ability to protect the plan's capital during a sustained down-market cycle.

In deploying hedge funds to their investment portfolios, pension plans are using a variety of different hedge fund styles. Whether hedge funds are being deployed with the aim of having them act as a diversifier to the total portfolio or to take on the role of a substitute or complement to the underlying equity or credit investments of the portfolio, the end result is that the overall asset allocation now looks more like a 45/25/30 portfolio (equities, fixed income and alternatives). In making this change to the pension plan's allocation mix, it is increasing the plan's probability to achieve a higher return with less risk compared to similar returns or worse but with a higher risk, if the portfolio is invested via a 60/40 allocation or has little to no hedge fund exposure.

## (iii) Sovereign wealth funds

There are more than 50 SWFs globally today, at least 40 of which were established in the last 10 years. Many of these funds are looking to diversify their revenues (in the wake of spectacular increases in the value of their holdings - particularly those countries that have significant commodity interests). The present market climate of low global interest rates and weaker equity market returns is driving participants to expand their portfolios into hedge funds and other alternative investments.

Due to their common aims of both managing and protecting the wealth of a state/entire nation for generations, SWFs are increasingly deploying hedge funds to take on the role of both a substitute and diversifier to their total investment portfolio. As per the rationale cited above, the superior risk-adjusted returns on offer from certain hedge fund strategies enable them to act as volatility dampeners in a credit or equity portfolio.

Like E&Fs, SWFs tend to have fewer short-term liabilities and as such can seek investments with a longer-term investment horizon compared to most other institutional investor types. In recent years, these funds increasingly have allocated to private market investments and deployed hedge funds in the first instance to avail of their expertise to help them access and navigate these areas.[22] Some have taken this relationship one step further, with an increasing trend of co-investment taking place with hedge funds (as has also been witnessed between other institutional investor types) for their greater benefit.

## (iv) Insurance Companies

In recent years, depressed bond yields (amidst a historically lower interest rate environment) that have epitomised the experience of most investor portfolios have prompted many insurers to increase their exposure to other asset classes in search of higher returns.

Without any meaningful increase in interest rates likely, and amidst falling yields and tighter credit spreads[23] over the short term, insurers have limited choices for investing cash from maturing securities and new premiums to obtain targeted risk-adjusted returns on their portfolios. Consequently, insurers have changed their approach to portfolio construction in their attempt to maximise returns. Many have increased their allocation to a variety of non-traditional long-term asset classes including hedge funds and private equity as well as other specialty investments such as infrastructure and real estate. In statutory filings, these non-traditional investments are classified in the US as Schedule BA assets[24].

In the period 2007 through to year-end 2013, life & annuity insurers have increased their schedule BA exposure by 23.3% while property & casualty insurers have increased their exposure by approximately 39%[25]. Among the life insurers, the most substantial increases in Schedule BA assets have been via a heavy exposure to private equity and hedge funds. In absolute terms, this exposure has risen by approximately 80%

[22] See for reference, AIMA's Report, "The Extra Mile".

[23] At the time of going to print – October 2015.

[24] Insurance companies also have been increasing their exposure to alternatives (including hedge funds) which the NAIC classifies as "schedule BA"assets.

[25] Source: National Association of Insurance Commissioners (NAIC).

since 2008. Schedule BA alternative assets now account for as much as 5.4% of insurers total invested assets, up from 3.8% in 2008[26].

Insurers are investing in these investments for a variety of reasons. Many are looking to their investment portfolios' alternative allocation to realise their diversification benefit and provide returns that are less correlated to their core fixed income portfolios. Others are seeking to tap enhanced return potentials through both yield generating (e.g., infrastructure, mezzanine finance, equity real estate funds) and capital appreciation (e.g., hedge funds, LBO, venture capital, commodities) investments.

Depending on the type of insurer, their deployment of hedge funds within their portfolios may vary substantially according to their portfolio's objectives/constraints.

**(a) Life & annuity insurers:**

Because of their preference for income over capital appreciation, life & annuity insurers have been slower than other insurers in making allocations to more volatile assets, such as schedule BA assets[27]. Similar to the rationale described above for other institutional investors, life insurers often use an allocation to hedge funds to smooth out any potential volatility from their investments being exposed to the underlying credit or equity holdings within their total portfolio. Many of these insurers learned from the credit crisis that their investments in low-risk investments and equities were not always sufficient to protect their capital.

Given life & annuity insurers have longer-term liabilities, they tend to concentrate more on less liquid investments, which may yield significant income potential. In recent years, many such investors have migrated towards direct lending and private debt funding, given the potentially higher yield opportunities (particularly relevant in the current low-yield, low-growth environment), and this participation seems likely to continue as non-bank lending becomes more prominent[28].

By being able to select a longer course for investment, such insurers can rebalance their alternative distributions according to the underlying market conditions present. This is particularly useful during a given period when the insurance industry is soft (and premium income is down). Increasingly, life insurers are also investing in less correlated alternatives (among these hedge fund strategies that act as diversifiers) to mitigate their portfolios' overall risk levels.[29]

**(b) Property & casualty insurers:**

Unlike life & annuity insurers, most property & casualty (P&C) insurers' liabilities are typically short term and any claims payments tend to be covered by the premiums collected. With shorter duration liabilities and generally higher liquidity needs, this requires P&C insurers' investment portfolios to maintain significant levels of liquidity allowing asset sales to raise any necessary cash in these loss scenarios.

Over the last number of years, P&C firms have tended to reallocate any surplus funds that they have generated into alternatives. When using hedge funds, a P&C insurer tends to predominantly deploy any hedge fund allocation to act as a substitute/complement investment to their underlying equity and credit portfolios. As we have learned, some hedge funds target equity-like returns with bond-like volatility while others prefer to target absolute returns. Unlike private equity and other investment options within Schedule BA assets, insurance companies typically look to their hedge fund allocations to generate the desired risk-adjusted return profile in a more liquid portfolio comparative to private equity.

The application of risk-based capital charges to various asset classes held in insurance company portfolios provides a lens through which the investor can allocate investment capital more efficiently. This in turn helps to ensure that insurance companies keep enough surplus funds available in order to pay out on any claims incurred. Because a portfolio of hedge funds typically has a low beta to the broader equity market, under some capital adequacy regimes and again depending on the type of hedge fund and the type of insurance company in question, they can be an important diversifying asset for insurance companies to invest a portion of their surplus capital. It is clear, from their returns expectations and their direct approach to investment in the asset class, insurance companies as a whole have confidence in hedge funds to be able to play an integral role in their wider investment portfolios.

## (v) Single family offices

Similar to the investment characteristics of an E&F, an SFO employs a flexible investment mandate for its portfolio. The investment goal for the majority of family office portfolios is to ensure as much as possible the preservation of the family's wealth while at the same time to source investments that have the potential to deliver out-performance relative to its public market investments.

Traditionally, the allocation process for an SFO has been underpinned by the investment portfolio being predominantly invested in regional opportunities, ranging from equities, fixed income and real estate. Consequently, a typical SFO allocated the majority of its portfolio in equities, fixed income, and alternatives (predominantly real estate), the equity tranche accounting for over 50% of its total portfolio

[26] AM Best, "Industry Interest in Non-Traditional Assets Continues", 2015.

[27] Undoubtedly the risk based capital charges for US life & annuity insurers for holding these assets ranging from 22.5% to 45% (NAIC) has been a deterrent too.

[28] AIMA, "Financing the Economy: The role of alternative asset managers in the non-bank lending environment", 2015.

[29] Source: AIMA interrview with insurance manager, 2015.

invested. In a similar pattern of behaviour to other investor types, the challenging macro conditions of recent years has led many mid and large-sized family offices to look beyond an investment portfolio of traditional investments and make an allocation to alternatives, and among these hedge funds.

SFOs deploy hedge funds to take on the role of both substitutes and diversifiers. In recent years, there has been an increased shift among family office investors towards replacing the majority of their equity and fixed income allocations with an investment in hedge funds of certain strategies given their propensity to reduce the overall volatility within the total equity or credit investments that they have in their portfolio.

By virtue of their risk appetite and ability to hold investments for the longer term, family offices invest a high percentage of their wealth in products that can offer a higher level of return, albeit by taking on a higher level of risk. In doing so, they are willing to invest more of their alternatives allocation in illiquid assets. It is not unusual for family offices to invest as much as 25% of their alternatives portfolio into a more opportunistic strategy. By deploying hedge funds in this manner, the family office is utilising its hedge fund allocation to access strategies and sources of return where they may not have the internal expertise to invest directly. Hedge funds therefore represent a diversifying strategy, in the sense that they represent a different source of return to other assets that they hold within their overall portfolio. Typical allocations of this type include hedge funds that invest in sub-investment grade, macro-strategies and multi-strategy opportunistic funds. Given a greater level of involvement by hedge funds in family office investment portfolios, family office investors have increased their mean hedge fund allocation of total assets to 19% as at the end of 2014, up from 14.9% recorded at the end of 2011.[30]

## Conclusion

Institutional investors have developed a nuanced set of expectations regarding hedge funds through careful study of their history and taxonomy. Investors who believe that markets will exhibit increasing uncertainty and increasing dispersion should consider making an allocation to unconstrained strategies such as hedge funds. Of course, investors need to consider the risks associated with the different strategies and manage them appropriately in order to realise the highest value from their hedge fund allocation.

Hedge funds are often perceived as complex and risky. With this paper we hope to have achieved a better understanding of basic hedge fund strategies and the sources of their returns as well as demonstrate that hedge fund strategies, when correctly employed in a portfolio, actually lead to a lowering of risks for their investors. Increased transparency and better risk reporting by hedge fund managers also leads to a better understanding of how the different hedge fund strategies fit into institutional investors' portfolios and is leading to increasing allocations to the sector. The next paper in this series will focus on leverage. It will address how hedge funds obtain and deploy a variety of hedge fund leverage measures, quantifying each of them. We will argue that leverage should be an important consideration in the evaluation of hedge fund managers while higher leverage does not always indicate higher risk, as it must be understood in the context of the investment strategy being deployed by the hedge fund manager. We expect this paper to be published in the first half of 2016.

## Key takeaways for trustees and other fiduciaries:

1. Different investor mandates will lead to different overall asset allocations in a given investment portfolio, resulting in a different level of risk-adjusted returns.
2. The hedge fund universe consists of a wide variety of hedge fund strategies. These strategies are generally not confined to any one side of the market which allows them to succeed when markets are reporting positive performance or enduring a difficult time.
3. The breadth of the hedge fund universe allows the investor to evaluate and classify hedge funds according to a series of risk factors and use different strategies in portfolio construction.
4. Institutional investors are moving away from the traditional portfolio of investing in bonds and equities and are increasingly using hedge funds as volatility dampeners, and investment vehicles that have the potential to produce out-performance and be less correlated sources of return.
5. There is no standard hedge fund portfolio prototype. However a range of strategic options available for the investor do exist.
6. Deploying certain hedge fund strategies as a substitute or complement to an underlying portfolio of equity or credit investments can help the investor to dampen overall portfolio risk as well as preserve its capital value.
7. Deploying certain hedge fund strategies in the role of a diversifier can help the investor to access new markets and investments that have the potential to produce out-performance and can offer a less correlated source of returns to a portfolio comprised of bonds and equities.
8. Investors who believe that public markets will exhibit increasing uncertainty and volatility should consider increasing their allocations to unconstrained strategies such as hedge funds.

[30] Source: Preqin.

# Appendix 1:

## Cluster analysis

Beyond the hedge fund taxonomy classification which is published by hedge fund data providers, an alternative way to construct the variety of hedge fund strategies is through using statistical analysis – one such method that can be applied is to use cluster analysis.

Cluster analysis is useful for both portfolio construction as well as fund selection as it allows for a classification of the universe, creation of peer indexes, peer analysis, and the ability to identify funds with style drift or the ability to diversify the investor's portfolio.

**Interpreting clusters and identifying the potential contribution of each strategy in a traditional portfolio**

The output of constructing a cluster analysis is both qualitative as well as quantitative. Qualitative information could include the type of strategy, asset class, region and description of the investment process. Quantitative information is slightly less intuitive. Before one can use such analysis, the data has to be cleaned of certain biases inherent in hedge fund returns, and we highlight the biases of most relevance to our study below:

- Smoothing bias: Stale pricing enables fund managers to book reserves in a good month, which they can release in a negative month. By removing data outliers, the risk in the portfolio is being reduced, which in turn will increase the Sharpe ratio of the fund.
- Positive autocorrelation in a time series: a positive month is followed by another positive month, and conversely. This is partially linked to the previous bias as the P&L reserves cannot be hidden for too long, and are usually released one or two reporting periods later.

Both of these effects are particularly prominent in investments valued intermittently, such as private equity or private real estate (which usually have quarterly reporting). In this context, risk measures will be calculated using returns that are corrected for first-order autocorrelation.[31,32]

- Asymmetric returns (negative skewness): Negative returns are not as frequent or as evenly distributed as positive returns. Special attention should be paid to the size of the losses relative to the size of the gains, as some strategies may have consistent small gains and less frequent large losses. In this context, the parametric value-at-risk using the Cornish-Fisher expansion[33] will also be used to meet this objective.[34]

[31] The formula used for the first-order autocorrelation correction is as follows: $R_t^{un} = \frac{(R_t - \beta R_{t-1})}{(1-\beta)}$ where R t = return over time t of the autocorrelated series, = return over time t of the corrected series, = Beta regression.

[32] Bern Scherer, "Portfolio Construction and Risk Budgeting", 2004.

[33] Cornish, E. A; Fisher, Ronald A., "Moments and Cumulants in the Specification of Distributions", Review of the International Statistical Institute, 1938.

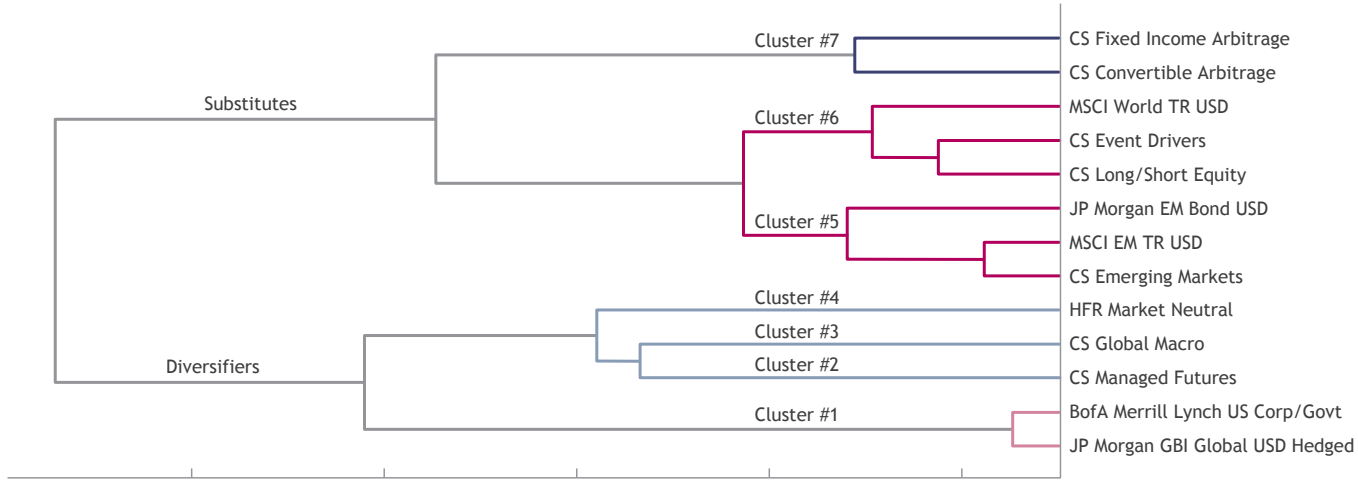
[34] Favre and Galeano, 2002, "Mean-modified Value-at-Risk optimization With Hedge Funds", Journal of Alternative Investment, Fall 2002, Volume 5.

- Non-linear relationship with equity markets: Hedge funds try to exhibit an option-like profile: losing less in down markets than they make in up-markets. This relationship must be considered in order to appreciate each strategy's behaviour in different market environments. In order to visualize these return characteristics, these are a number of analytical techniques that can be employed.
- Scatter graph with polynomial regression. This exhibit summarizes a set of statistical properties (correlation, beta) and visually distinguishes the behaviour of hedge funds during periods of down and up markets.[35] Exhibit C on page 34 presents the results for each strategy.
- The calculation of performance and risk/return in different market environments: 1994 to 1999, 2000 to 2002, 2003 to 2007, 2008 to 2009, 2009 to 2014.

## Results:

To better understand the source of diversification of hedge funds, a dendrogram (below) is a classification tree obtained after the cluster is established. A dendrogram (or tree diagram) is a branching diagram that represents the relationships of similarity among a group of entities. We can use a dendrogram to represent the relationships between any kinds of entities as long as we can measure their similarity to each other. In the dendrogram which we produce below (see Exhibit A below), groups sharing a high (low) similarity are depicted as clusters that are close together, (depicted as clusters that are apart), for example Clusters 2, 3, 4 share similar characteristics, while Clusters 5 and 6 share different characteristics to the other clusters. The length of the horizontal lines indicates the closeness among the groups and clusters.

**Exhibit A: Dendrogram of hedge fund strategies and traditional asset classes 1994-2014**




Source: Hedge Fund Research, Credit Suisse, Bank of America, JP Morgan, MSCI.

[35] These graphs are calculated using monthly returns of suppliers and are created in the following manner: X axis is the return of the pension fund index, namely, 40% JP Morgan GBI Global USD Hedge and 60% MSCI World TR USD, Y axis, the return of the hedge fund strategy.

We observe in Exhibit A that the universe is divided into two major families of hedge fund strategies through which diversification can be exploited. Within the two major families, seven clusters of strategies are created.

The family of diversifiers combines the strategies that have long-term low correlation with equity markets and have little correlation among them. The family of substitutes combines several hedge fund strategies that exhibit similar behaviour with the equity risk factor over a complete cycle, while being correlated with each other. This result corroborates with the statistical proprieties of each hedge fund strategy in Exhibit C below.

Applying these principles, table 1 (below) presents the universe of monthly returns of the Credit Suisse hedge fund indexes,[36] as well as selected equity and bond indices which we use for the cluster analysis.

It is important to assess whether the properties and classification of groups are maintained through various market environments. To this end, the graphics in Exhibit B show the performance, risk and correlation of each strategy across different market environments.

**Table 1: Hedge fund statistical properties over a long period: 1/1/1994-31/12/2014**

| | Cluster #1 | | Cluster #2 | Cluster #3 | Cluster #4 | Cluster #5 | | | Cluster #6 | | | Cluster #7 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | JP Morgan GBI Global USD Hedged | BofA Merrill Lynch US Corp/Govt | CS Managed Futures | CS Global Macro | HFR Market Neutral | CS Emerging Markets | MSCI EM TR USD | JP Morgan EM Bond USD | CS Event Driven | MSCI World TR USD | CS Long/Short Equity | CS Convertible Arbitrage | CS Fixed Income Arbitrage | 60/40 portfolio |
| Annualised Return | 5.9% | 5.8% | 5.7% | 10.9% | 5.5% | 7.2% | 5.3% | 9.0% | 9.2% | 7.5% | 9.4% | 7.0% | 5.4% | 7.2% |
| Return Autocorrelation | Yes | No | No | No | Yes | Yes | Yes | No | Yes | No | Yes | Yes | Yes | No |
| Annualised Standard Deviation* | 3.9% | 4.2% | 11.5% | 9.2% | 3.7% | 18.9% | 27.7% | 13.1% | 8.8% | 15.1% | 11.5% | 12.3% | 9.7% | 8.9% |
| Monthly VaR Cornish Fisher* | -2.4% | -2.9% | -7.2% | -7.9% | -2.6% | -22.0% | -23.6% | -19.1% | -12.4% | -12.7% | -9.3% | -20.9% | -17.9% | -7.2% |
| Skewness | (0.13) | (0.23) | 0.02 | 0.08 | (0.27) | (0.78) | (0.70) | (2.18) | (2.20) | (0.78) | (0.03) | (2.69) | (4.67) | (0.77) |
| Excess kurtose | 0.29 | 1.23 | (0.01) | 4.52 | 2.16 | 5.95 | 1.99 | 13.38 | 10.90 | 1.74 | 3.67 | 17.39 | 34.95 | 1.60 |
| Return/Annualised Standard Deviation* | 1.51 | 1.36 | 0.49 | 1.19 | 1.48 | 0.38 | 0.19 | 0.69 | 1.04 | 0.50 | 0.81 | 0.57 | 0.56 | 0.81 |
| Return/Monthly VaR Cornish Fisher* | 0.20 | 0.16 | 0.07 | 0.11 | 0.17 | 0.03 | 0.03 | 0.04 | 0.06 | 0.05 | 0.08 | 0.03 | 0.03 | 0.08 |
| Maximum Drawdown | -5.3% | -6.0% | -17.7% | -26.8% | -9.2% | -45.1% | -61.4% | -30.9% | -19.1% | -53.7% | -22.0% | -32.9% | -29.0% | -33.6% |
| Maximum Drawdown Period | 1994/01 | 2008/02 | 1995/03 | 1998/07 | 2008/06 | 1997/07 | 2007/10 | 1998/04 | 2007/10 | 2007/10 | 2007/10 | 2007/10 | 2008/01 | 2007/10 |
| | 1994/06 | 2008/10 | 1995/11 | 1999/09 | 2009/04 | 1999/01 | 2009/02 | 1998/08 | 2009/02 | 2009/02 | 2009/02 | 2008/12 | 2008/12 | 2009/02 |
| Beta vs 60/40 Portfolio | (0.01) | 0.06 | 0.03 | 0.27 | 0.12 | 0.93 | 2.08 | 0.84 | 0.45 | 1.67 | 0.75 | 0.30 | 0.23 | - |
| Correlation vs 60/40 Portfolio | -3.3% | 13.0% | 2.5% | 26.3% | 33.7% | 58.9% | 79.4% | 56.9% | 66.3% | 99.0% | 71.1% | 41.1% | 38.1% | - |

* Risk measures are corrected for presence of Autocorrelation

Source: JP Morgan, Credit Suisse Hedge Fund Index, MSCI, HFR.

[36] The series of returns of the CST Market Neutral index contains significant noise, namely, the performance from the Madoff fund in which the index suffers from this loss in November 2008. In order to effectively grasp the nature and behaviour of this strategy, we have used the HFR Market Neutral index rather than that of CST.

**Exhibit B: Risk, return, correlation profile of each hedge fund strategy in different market environments**

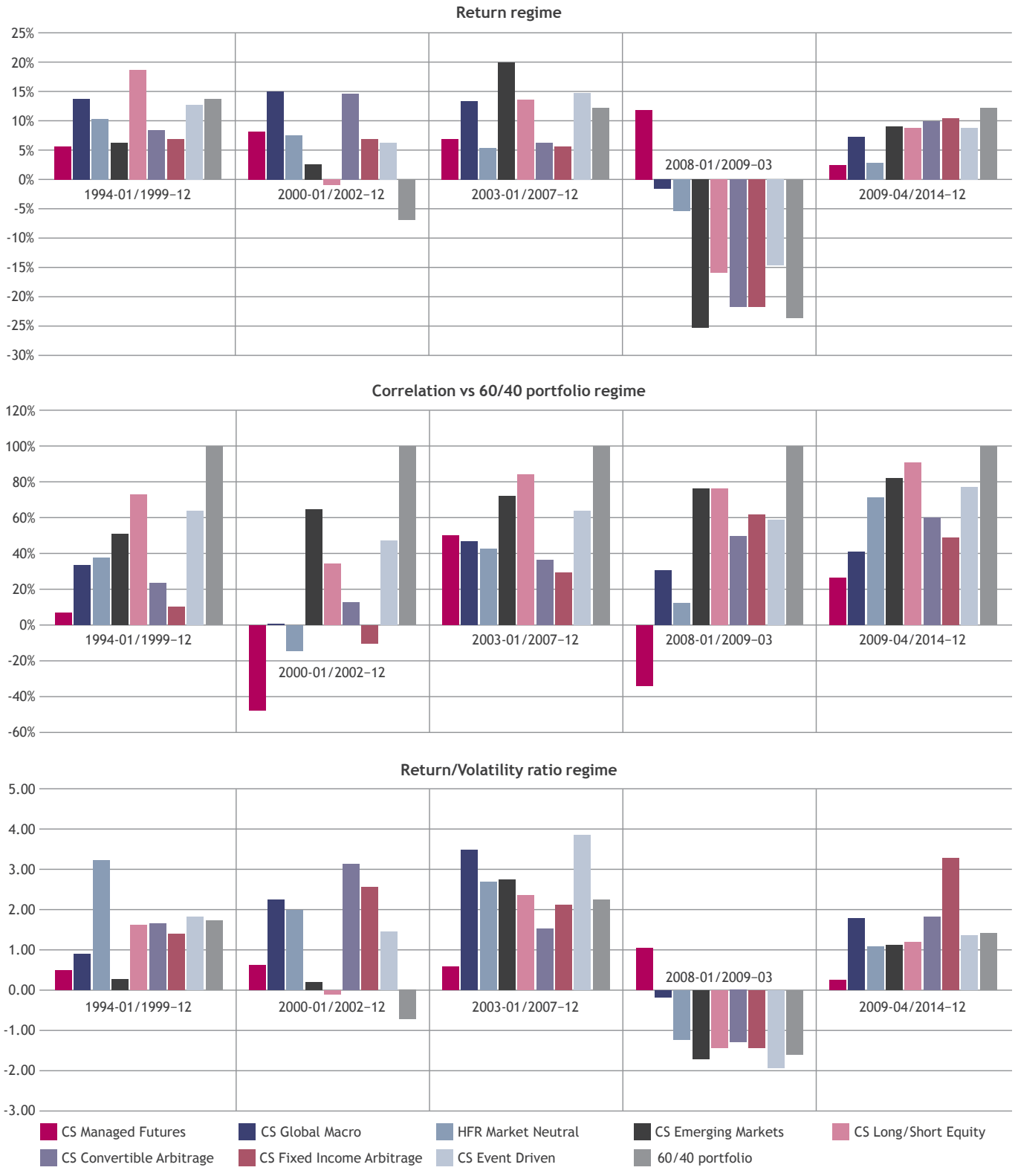
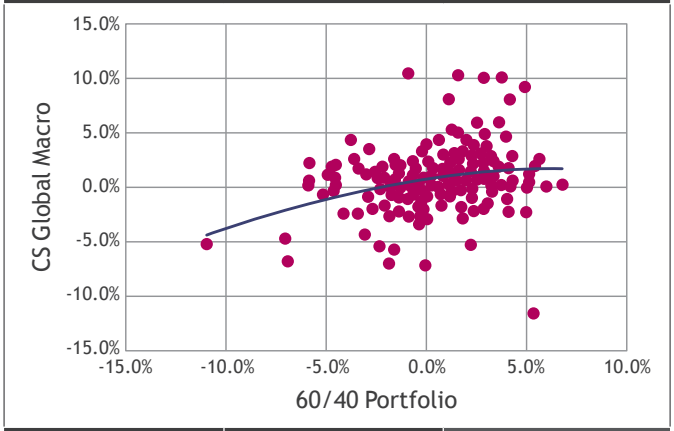


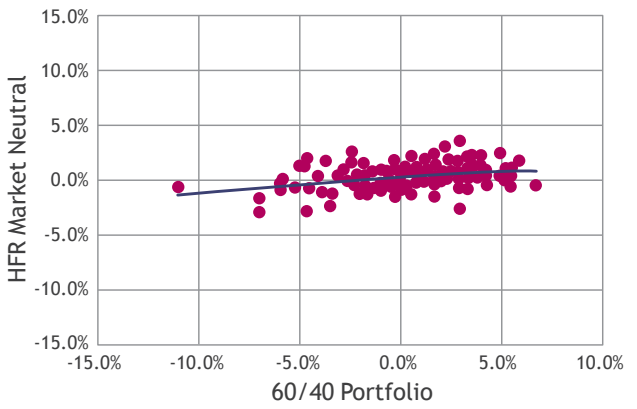
**Exhibit C: Scatter graph of cluster analysis applying polynomial regression techniques.**

Global Macro (01/1994 – 12/2014)



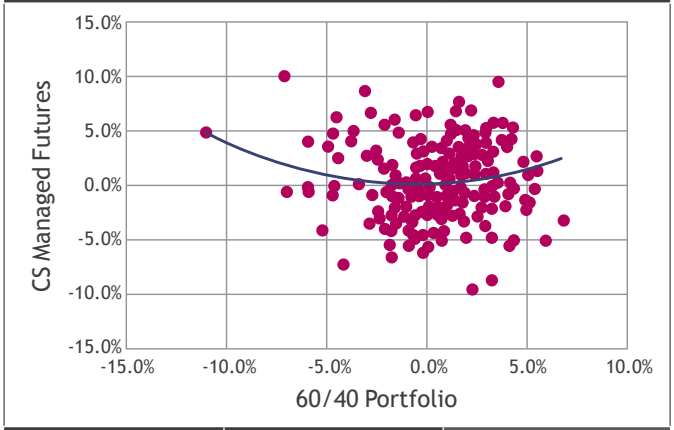

| | When 60/40 Portfolio is down | When 60/40 Portfolio is up |
|---|---|---|
| Median return | 0.2% | 1.2% |
| Correlation | 18% | 2% |
| % Winning | 53% | 83% |

HFR Market Neutral (01/1994 – 12/2014)



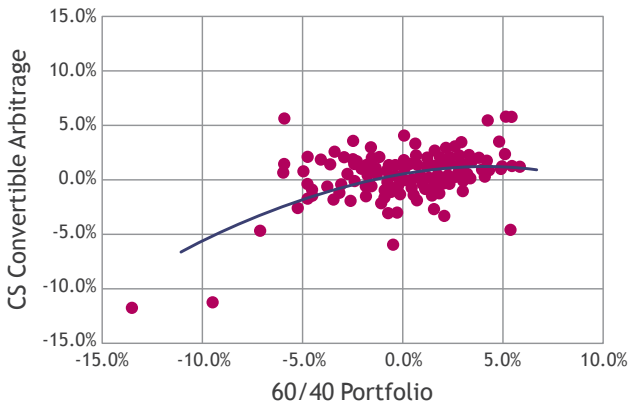

| | When 60/40 Portfolio is down | When 60/40 Portfolio is up |
|---|---|---|
| Median return | 0.1% | 0.6% |
| Correlation | 26% | 9% |
| % Winning | 53% | 87% |

CS Managed Futures (01/1994 – 12/2014)



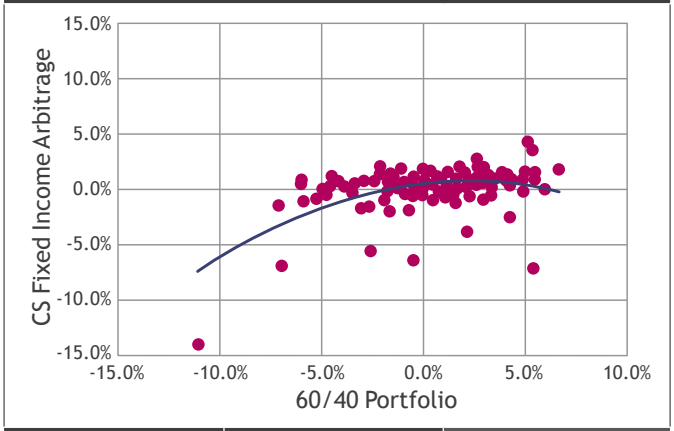

| | When 60/40 Portfolio is down | When 60/40 Portfolio is up |
|---|---|---|
| Median return | -0.3% | 0.9% |
| Correlation | -30% | 8% |
| % Winning | 47% | 61% |

CS Convertible Arbitrage (01/1994 – 12/2014)



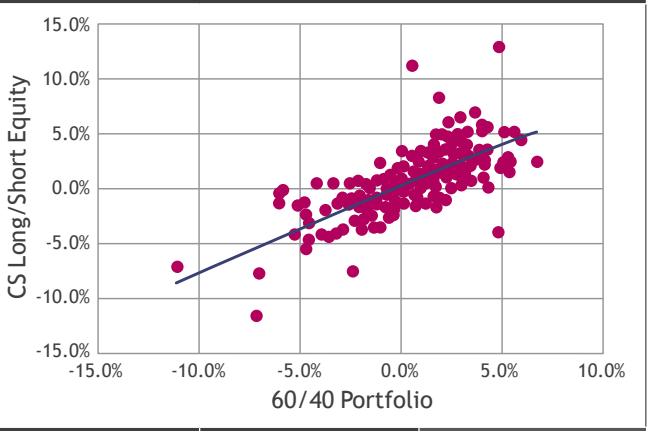

| | When 60/40 Portfolio is down | When 60/40 Portfolio is up |
|---|---|---|
| Median return | 0.2% | 1.0% |
| Correlation | 39% | 27% |
| % Winning | 58% | 83% |

## CS Fixed Income Arbitrage (01/1994 – 12/2014)



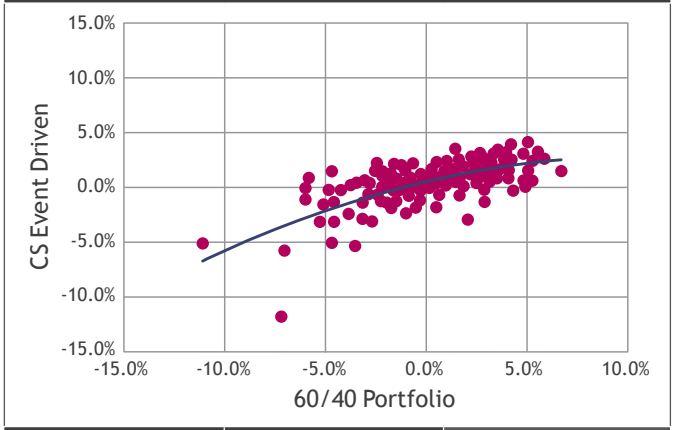

| | When 60/40 Portfolio is down | When 60/40 Portfolio is up |
|---|---|---|
| Median return | 0.5% | 0.8% |
| Correlation | 48% | 10% |
| % Winning | 72% | 85% |

## CS Long/Short Equity (01/1994 – 12/2014)



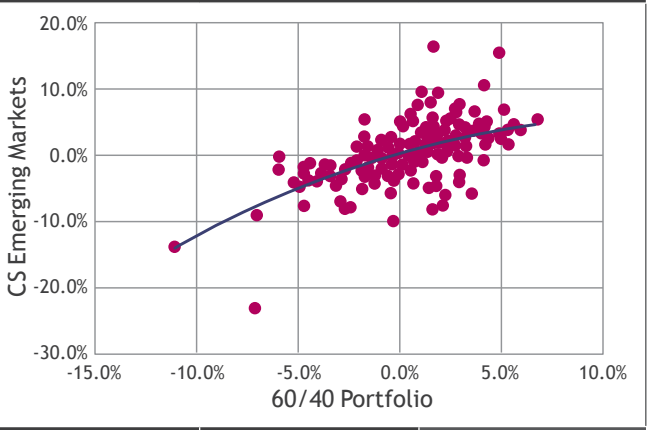

| | When 60/40 Portfolio is down | When 60/40 Portfolio is up |
|---|---|---|
| Median return | -1.1% | 1.9% |
| Correlation | 59% | 38% |
| % Winning | 25% | 89% |

## CS Event Driven (01/1994 – 12/2014)




| | When 60/40 Portfolio is down | When 60/40 Portfolio is up |
|---|---|---|
| Median return | -0.1% | 1.5% |
| Correlation | 56% | 38% |
| % Winning | 47% | 93% |

## CS Emerging Markets (01/1994 – 12/2014)




| | When 60/40 Portfolio is down | When 60/40 Portfolio is up |
|---|---|---|
| Median return | -1.2% | 2.0% |
| Correlation | 55% | 27% |
| % Winning | 32% | 81% |

**Table 2: Methodology used to construct cluster analysis**

| Steps | Application for the paper |
|---|---|
| Define the measurable attributes of hedge funds | Monthly returns from the strategies. Returns are normalised to distinguish the data through correlation |
| Select the type of distance to use to measure the degree of similarity between funds | Euclidian distance: $d(x,y)=\sqrt{\sum_i (x_i - y_i)^2}$ |
| Select and apply the cluster algorithm | Ward Linkage |
| Classification method | Hierarchical since we use little data and this method is very visual. However, with more data, it is important to add steps to the cluster analysis including the combination of hierarchical classification method and the non-hierarchical classification method |
| Interpret and validate the classification results | By looking at the group statistics and their components through different plans and through knowledge of the strategies |

# Appendix 2:

**Correlation Matrix**

| Initial Portfolio – no hedge funds | | | | |
|---|---|---|---|---|
| **Correlation matrix** | Fixed Income | Listed Equities | Private Equity | Real Estate |
| Fixed Income | 1 | 0.512 | 0.619 | -0.058 |
| Listed Equities | 0.512 | 1 | 0.879 | -0.21 |
| Private Equity | 0.619 | 0.879 | 1 | -0.174 |
| **Real Estate** | -0.058 | -0.21 | -0.174 | 1 |

| Portfolio including multi-strategy fund of fund | | | | | |
|---|---|---|---|---|---|
| **Correlation matrix** | Fixed Income | Listed Equities | Multi-Strategy Hedge Fund Allocation | Private Equity | Real Estate |
| Fixed Income | 1 | 0.512 | 0.513 | 0.619 | -0.058 |
| Listed Equities | 0.512 | 1 | 0.807 | 0.879 | -0.21 |
| Multi-Strategy Hedge Fund Allocation | 0.513 | 0.807 | 1 | 0.815 | -0.159 |
| Private Equity | 0.619 | 0.879 | 0.815 | 1 | -0.174 |
| **Real Estate** | -0.058 | -0.21 | -0.159 | -0.174 | 1 |

| Portfolio with 50% allocation to hedge funds | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Correlation matrix** | Fixed Income | Listed Equities | Private Equity | Real Estate | Fixed Income Arbitrage (substitute) | Long-Short Equity (substitute) | Global Macro (opportunistic) | Managed Futures (opportunistic) |
| Fixed Income | 1 | 0.512 | 0.619 | -0.058 | 0.422 | 0.528 | 0.406 | 0.3 |
| Listed Equities | 0.512 | 1 | 0.879 | -0.21 | 0.397 | 0.878 | 0.227 | 0.148 |
| Private Equity | 0.619 | 0.879 | 1 | -0.174 | 0.411 | 0.885 | 0.229 | 0.139 |
| **Real Estate** | -0.058 | -0.21 | -0.174 | 1 | -0.215 | -0.218 | -0.192 | -0.163 |
| **Fixed Income Arbitrage (substitute)** | 0.422 | 0.397 | 0.411 | -0.215 | 1 | 0.387 | 0.195 | 0.138 |
| **Long-Short Equity (substitute)** | 0.528 | 0.878 | 0.885 | -0.218 | 0.387 | 1 | 0.336 | 0.227 |
| **Global Macro (opportunistic)** | 0.406 | 0.227 | 0.229 | -0.192 | 0.195 | 0.336 | 1 | 0.824 |
| **Managed Futures (opportunistic)** | 0.3 | 0.148 | 0.139 | -0.163 | 0.138 | 0.227 | 0.824 | 1 |


Alternative Investment
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The Alternative Investment Management Association (AIMA) has over 1,600 corporate members (and over 10,000 individual contacts) in over 50 countries. Members include hedge fund managers, fund of hedge funds managers, prime brokers, legal and accounting firms, investors, fund administrators and independent fund directors. AIMA's manager members collectively manage more than $1.5 trillion in assets. All AIMA members benefit from AIMA's active influence in policy development, its leadership in industry initiatives, including education and sound practice manuals, and its excellent reputation with regulators worldwide. AIMA is a dynamic organisation that reflects its members' interests and provides them with a vibrant global network. AIMA is committed to developing industry skills and education standards and is a co-founder of the Chartered Alternative Investment Analyst designation (CAIA) – the industry's first and only specialised educational standard for alternative investment specialists. For further information, please visit AIMA's website, www.aima.org.

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