



Degree Program in Economics and Business

Course of financial Markets and Institutions

# Characteristics, Investment Strategies, and Historical Returns of the Hedge Fund Industry From the 1940s Until Today

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Academic Year 2023/2024

## Abstract

Hedge funds are private investment partnerships that imply a wide range of strategies to generate profits under various market conditions using leverage and different financial instruments. Despite the lack of a general definition that precisely defines these investment partnerships, this paper aims to study how these funds' main characteristics, investment strategies and performance have evolved throughout the years since the inception of the hedge fund industry in 1949.

After discussing the history of the hedge funds industry, the common characteristics of these participants, and the main risks that arise from operating in it, the paper analyses the most common hedge fund strategies including directional, relative value and event-driven strategies in addition to discussing funds of funds and multi-strategy funds.

Finally, the paper thoroughly analyzes the hedge fund industry's returns between the 90s and today, focusing on how the returns have been impacted by the Global Financial Crisis and other economic factors that have characterized the first decades of the 21<sup>st</sup> century.

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## Chapter 1: What Is a Hedge Fund?

The term “hedge fund” was first coined in 1949 when Alfred Winslow Jones decided to create a private investment fund by combining both short and long positions to hedge against market exposure and generate returns from a market-neutral position. Over the years, the behaviors and strategies of hedge funds have changed, rendering the previous definition not sufficient to fully describe the extent of this industry, however, no legal or general definition has been coined.

In the Security and Exchange Commission’s annual report of 1969, published just 20 years after the first ever hedge fund was established in 1949, the SEC started the section about these relatively new investment vehicles by addressing them as: “In January 1969 the Commission commenced an investigatory study of so-called "hedge funds." These are generally private investment partnerships which employ speculative investment techniques with a view to rapid capital appreciation.”

On the other hand, a contemporary definition of hedge funds is provided by the Hedge Fund Association (HFA): “Hedge funds refer to funds that can use one or more alternative investment strategies, including hedging against market downturns, investing in asset classes such as currencies or distressed securities, and utilizing return-enhancing tools such as leverage, derivatives, and arbitrage.”

Despite this definition focusing on various important aspects of hedge funds such as leverage and arbitrage, it does not cover how the funds are organized and who can access the investment pool. To do so, the ECB often refers to the definition of hedge funds provided by the US President’s Working Group on Financial Markets<sup>1</sup> which characterized such entities as “any pooled investment vehicle that is privately organized, administered by professional investment managers, and not widely available to the public.”

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<sup>1</sup> “Occasional Paper No.34” published by the European Central Bank in 2005 refers to the definition provided by the US President’s Working Group on Financial Markets in 1999.

However, the ECB added that the definition of “hedge fund” should also mention their key characteristic of not having any restrictions on the type of instruments or strategies they can implement due to their unregulated or lightly regulated nature.

In 2003 the Security and Exchange Commission (SEC) published a document reporting other common definitions of the term<sup>2</sup>. Among them, the definition of the Financial Services Authority<sup>3</sup> of 2002 describes hedge funds through their main characteristics:

"There is no universally accepted meaning of the expression 'hedge fund'; indeed, many competing (and sometimes partially contradicting) definitions exist. The term first came into use in the 1950s to describe any investment fund that used incentive fees, short-selling, and leverage. A summary definition frequently used in official sector reports is 'any pooled investment vehicle that is privately organised, administered by professional investment managers, and not widely available to the public'. The term can also be defined by considering the characteristics most commonly associated with hedge funds. Usually, hedge funds:

- are organised as private investment partnerships or offshore investment corporations;
- use a wide variety of trading strategies involving position-taking in a range of markets;
- employ an assortment of trading techniques and instruments, often including short-selling, derivatives and leverage;
- pay performance fees to their managers; and
- have an investor base comprising wealthy individuals and institutions and a relatively high minimum investment limit (set at US\$100,000 or higher for most funds)."

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<sup>2</sup> The document is titled “Selected Definitions of Hedge Funds”.

<sup>3</sup> The Financial Services Authority (FSA) is the agency that regulated financial services in the UK between 2001 and 2013.

## 1.1 Hedge Fund History: From the Origin Until Today

### **The First Hedge Fund**

The birth of the first hedge fund dates back to 1949 when Alfred Winslow Jones, an Australian sociologist, and journalist, discovered the world of finance while working on a finance-related paper and decided to create the first ever hedge fund called A.W. Jones & Co.

The fund was originally created as a general partnership between Jones and four of his friends who had collectively managed to raise US\$100,000 in assets to be invested in the market by utilizing a unique combination of three existing tools:

- **Private company:** Jones initially opted for a general partnership, later transformed into a limited partnership in 1952, to benefit from as much freedom as possible in the construction of the investment portfolio. By adopting a private structure Jones managed to fit into the set of exemptions allowing investment funds not to register with the SEC<sup>4</sup>.
- **Short selling:** Jones' investment strategy consisted of combining both long and short positions to create a market-neutral portfolio, maximizing returns and reducing the negative effects of a market drawdown. Thanks to this investment strategy the term "hedge funds" was born.
- **Leverage:** The last step of Jones' investment strategy was to utilize leverage to maximize the fund's returns after hedging the portfolio against market risk. Leverage was seen as a useful tool to increase the impact of stock selection.

Another interesting feature of the A.W. Jones & Co "hedged fund"<sup>5</sup> is the fact that despite Jones never managing his own fund, he believed that fund managers should be

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<sup>4</sup> The Investment Company Act of 1940 cites a series of exemptions allowing funds not to register with the SEC.

<sup>5</sup> Before the term "hedge fund" was coined, an article published by Fortune in 1966 denominated Jones' company a "hedged fund".

paid at least 20% of net profits determined by an incentive-based fee. However, at the time the additional fixed management fees were not yet present.

### **The Development of the Hedge Fund Industry Between the 60s and 80s**

During the first 20 years of Jones' fund history, the assets under management grew from US\$100,000 to around US\$200 Million, spurring the growth of the United States' hedge fund industry. In 1969 the Security and Exchange Commission commented "During the last few years, there has been a rapid increase in the number and assets of hedge funds. It is estimated that the number of such funds is now approaching 200, with estimated total assets of about \$1.5 billion."<sup>6</sup>

However, this flourishing period was interrupted by several market drawdowns, first in 1969 and 1970 and then again in 1974 and 1975, causing a severe contraction of the hedge fund industry, reaching its minimum in 1984 with only 68 active hedge funds.

The hedge fund industry managed to recover only in the second half of the 80s thanks to a relatively new hedge fund that had been established in 1980: Julian Robertson's Tiger Fund. The publicity and clamor around this new fund derived from the alternative investment strategy proposed by Robertson denominated "global macro strategy". This strategy was based on taking leveraged positions in securities and currencies, based on assessments of global macroeconomic and political conditions.

An article published in May 1986 by Institutional Investor reported that the Tiger fund closed the year 1985 with a record annual return of 63% and an average annual return of 43% since its inception.

### **The Growth of the Hedge Fund Industry Between the 90s and Today**

The exceptional returns of the Tiger fund generated much interest in the hedge fund industry, and more specifically, in the global macro strategy. According to Van Hedge, the number of hedge funds reached 1,000 in 1988 and it continued to grow over the next

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<sup>6</sup> Security and Exchange Commission's 1969 annual report.

20 years reaching 10,000 and US\$1.92 trillion in assets under management before going back down in 2008 due to the Great Financial Crisis.

The hedge fund industry returned to its assets under management high-water mark in 2012 and at the end of 2015, it counted once again over 10,000 funds, reaching almost US\$3 trillion in assets under management.

In 2024 the value of the total asset under management of the hedge fund market is expected to reach US\$4.74 trillion growing from the previous 2023 value of US\$4.53 trillion<sup>7</sup>. Additionally, the same study estimated the Compound Average Growth Rate (CAGR) of the industry at 3.14% between 2024 and 2029, expecting the market size to reach US\$5.47 trillion in 2029.

## 1.2 Characteristics of Hedge Funds

Going back to the previously listed definitions of hedge funds, it becomes apparent that there are no generally accepted expressions that fully cover these investment vehicles and their unique characteristics, especially if we consider how they have evolved over time. Because of this, most institutions opt for defining hedge funds through their key characteristics.

According to the ECB: “The key difference is that hedge funds do not have any restrictions on the type of instruments or strategies they can use owing to their unregulated or lightly regulated nature.”<sup>8</sup>

A few years later, Capocci D. stated: “The main concept to bear in mind from this introductory definition of hedge funds is freedom. Hedge fund managers create private

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<sup>7</sup> According to a study performed by Modor Intelligence.

<sup>8</sup> Occasional Paper Series No.34, 2005.



structures to apply original investment strategies with the greatest level of freedom possible.”<sup>9</sup>

In conclusion, the founding principle of hedge funds is their freedom as an investment vehicle, and this characteristic is reflected in every aspect of the hedge fund industry ranging from the structure, to the investors’ requirements, strategies, managers’ compensation, and even their regulation and disclosure procedures.

### **Hedge Funds’ Structure**

The first factor that differentiates hedge funds from other investment vehicles such as mutual funds is the fact that hedge funds often take the legal form of private investment vehicles through a limited partnership. This legal form has been the natural evolution caused due to the willingness of these investment vehicles to trade riskier financial instruments, therefore limiting the constraints that the financial authority could impose on the fund.

### **Investors’ Requirements**

One of the constraints that hedge funds must satisfy regards restricting advertising and being limited to professional or high-networth individuals. In the US, investors eligible to access hedge funds are either called “accredited” or “qualified” and these names are attributed to the investors who have: “(1) a \$1 million net worth, excluding the positive equity in such person’s primary residence or (2) an annual income of \$200,000 (\$300,000 if combined with a spouse) for each of the two most recent years.”<sup>10</sup>

This definition restricts the pool of eligible investors only to a small portion of the population, however, this is deemed necessary due to the sophisticated and risky nature of the hedge funds’ investment strategies to protect smaller investors with a lower degree of risk. Accredited investors, instead, are deemed either more knowledgeable, able to afford a consultation if needed, or capable of sustaining a higher degree of risk and illiquidity of the investment.

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<sup>9</sup> The Complete Guide to Hedge Funds and Hedge Fund Strategies, 2013.

<sup>10</sup> according to Rule 501 of Regulation D of the Securities Act of 1933.

This is because investors can only periodically withdraw their money from the fund, usually either quarterly or semiannually. Additionally, funds often have a gate provision that allows managers to set a limit of total daily withdrawals expressed as a percentage of the fund's total assets under management and even the right to suspend all withdrawals for a period of time under extraordinary circumstances.

### **Instruments, Leverage and Strategies**

The third key characteristic of hedge funds is their freedom in determining their strategies and which financial instruments to use. Generally, hedge funds engage in riskier and more aggressive positions, strongly differentiating from the “long-only” strategy commonly adopted by mutual funds. Hedge funds, aside from traditional financial instruments such as stocks and bonds, often invest and trade many derivatives including options, futures, swaps, warrant or convertible bonds, and more.

Additionally, depending on the investment strategy of the fund, most hedge funds also engage in complex investment strategies that include arbitrage, short selling, and even leverage by borrowing funds to increase the exposure and the returns.

This set of complex strategies and instruments is composed by the managers of each hedge fund to achieve their return objective, which often consists of generating positive profits under every market condition which is made possible by having a net short market exposure during downturns and a net long position during market booms.

### **Managers' Compensation**

In the legal structure of a hedge fund, fund managers are the individuals in charge of the investment decisions of the fund and they are recognized as general partners.

Additionally, fund managers often reinvest the majority of their cash holdings into their managed fund, aligning their interests with the investors'.

Since the first hedge fund was created in the first half of the 20th century, fund managers have been primarily remunerated through performance-related fees, usually

varying between 15% and 25% of the funds' net profits. However, more recently, hedge funds have also introduced a management fee charged as a flat percentage fee over the total Assets Under Management. The most common fee structure is currently called "2 and 20" which consists of a 2% management fee and a 20% performance fee.

However, it is important to notice that the performance fee is often locked behind two forms of investors' protection mechanisms called a "high-water mark" and a "hurdle rate". The high-water mark is a mandatory rule that states that if the net asset value of the fund drops, no performance fees can be charged to the investors until the fund has returned to the previous all-time high AUM, preventing investors from paying performance fees on the same profits twice. A hurdle rate is instead the minimum return, either fixed or floating, that the managers must achieve before charging any performance fees.

### **Regulation and Disclosure**

Finally, another distinguishing factor between hedge funds and other investment vehicles is the fact that hedge funds are characterized by absent or very minimal regulatory oversight and mostly only voluntary disclosure requirements.

### **1.3 Hedge Funds' Risks**

Despite the term "hedge" being present in the name of these investment vehicles, the strategies and operations pursued by these funds are not without any risk. As briefly mentioned during the section on the history of hedge funds, the term "hedge" was simply attributed to the original market-neutral long/short strategy adopted by Alfred Winslow Jones' fund. However, even Jones' fund was subject to different sources of risk despite hedging its positions against market risk. Because of this, it is better to think of a hedge fund as a fund that aims at reducing any risk not related to its speculative strategy, rather than every risk that might impact its operations.

When it comes to defining the riskiness of the fund's operation, such a metric can generally be calculated based on two different types of returns: total returns and active

returns. For traditional investment vehicles, fund managers are mainly focused on active returns, calculated as total returns minus benchmark returns, as the active returns would be the only portion explained by the fund's operations. On the other hand, the benchmark asset in the hedge fund industry is simply risk-free cash, since each manager will pursue their strategies without overly relying on a specific index. Because of this, active returns and total returns coincide in the case of hedge funds, explaining why the total risk overlaps with the active speculative strategies of the fund plus other risks that might be either too costly or impossible to differentiate.

One of the main components of active risk is market risk, which can be defined as the uncertainty related to any investment decision. For example, hedge funds operating on an international scale might be strongly affected by interest rates, exchange rates, and commodity prices amongst many other factors, whereas specific asset risks might mainly impact equity long/short funds. Generally, some of these risks can and are reduced through the role of hedging which is often able to reduce the correlation between the portfolio and broader market indexes, however, it might also increase the correlation with some specific factors.

Another relevant risk in the hedge fund industry is liquidity risk, which can be described as the inability to cover short-term financial obligations due to the difficulty of converting longer-term securities into liquid assets without incurring substantial losses (H. K. Baker, G. Filbeck; 2017). Even though many hedge fund strategies involve the trade of extremely liquid assets, many others such as emerging markets and distressed securities are highly exposed to this type of risk due to their strategies involving targeting mispriced illiquid securities through arbitrage-based operations.

Additionally, hedge funds are exposed to two types of credit risk. The first kind involves the potential default of the assets held in the fund's portfolio and it is particularly relevant in strategies involving fixed-income arbitrage and distressed securities. The second type is instead related to the financial leverage that most hedge funds use to increase their returns and it involves being able to repay on time the financial institutions that extend hedge funds their credit.

Under particularly adverse conditions, liquidity and credit risks often become two sides of the same coin. During a crisis, a hedge fund might receive a margin call from their credit institution requiring the deposit of additional funds to reduce the leverage. However, if the fund is highly subject to liquidity risk, they might not be able to liquidate their positions inducing a fire sale below fair value that might lead to significant losses.

### **Risk Measurement**

Regarding measuring active risk, two methods have been adopted over the years: the variance-based model and the Value-at-Risk approach (VaR). The variance-based approach consists of calculating the risk of the portfolio through the deviation of the returns from the mean, whereas the value-at-risk approach is based on the maximum portfolio drawdown within a certain time frame at a given level of probability.

Originally, the variance-based approach was the most popular method used to estimate portfolio risk since when returns have a linear factor structure they can be decomposed into two components: a linear response to several market factors and an asset-specific risk. By doing so, the model allowed its users to determine the different components of risk and how they interacted. Additionally, if the portfolio returns perfectly follow a linear distribution, the variance of the portfolio coincides with the riskiness of the return. However, if the returns are slightly non-normal, the variance-based model can still be applied but the model becomes less and less precise the more the returns are non-normal or do not follow a linear structure.

Since nowadays most hedge funds hold and trade derivatives in their investment portfolios, which follow a non-linear relationship with their underlying asset, the variance based-model has become less used, especially after the near-fall of the Long Term Capital Management (LTCM) at the end of 1998 when most regulators and organizations decided to improve the risk management procedures in the hedge fund market.

The alternative method promoted during the President's Working Group on Capital Markets meeting in 1999 was the Value-at-Risk (VaR) approach with the intent of better measuring the portfolio risk of hedge funds and accounting for extreme events that might happen. The VaR is defined as the maximum loss to be sustained within a given time period for a given level of probability, and it is equivalent to the portfolio variance in the special case of normally distributed returns. So, for example, if a hedge fund has a VaR of \$200,000 at 1% probability within a 5-day period, it means that 1 time out of 100 the fund loses \$200,000 within a single trading week.

On the other hand, despite being better than the variance-based approach from an accuracy standpoint, even this method carries several drawbacks mainly related to the difficulties encountered in its precise estimation. First of all, as opposed to the other method, there are no precise rules for determining the single asset contribution in the portfolio's VaR and no linear factors can be used to decompose the individual risk of securities between specific factors and market risk. Furthermore, VaR relies on the precise estimation of low-probability events as it consists of describing the lower tail of the cumulative probability value of the portfolio returns. Such probabilities can be extremely difficult to estimate, potentially causing imprecise estimations.

However, as opposed to the variance-based method, this alternative can be performed also for portfolios containing derivatives and other strategies that do not follow a linear return pattern, so hedge funds are required to implement other risk assessment strategies to improve the results of the VaR. The most popular one is "stress testing" which consists of performing computer-generated scenarios where some severe adverse conditions occur to estimate the response of market variables to the simultaneous changes in different market parameters.

### **Risk Management Practices**

After the near-collapse of the Long Term Capital Management (LTCM) on the 23rd of September 1998, many private and public initiatives were launched to limit the risk exposure of the hedge funds. However, due to the mostly unregulated status of the hedge fund industry, these initiatives couldn't be imposed directly on hedge funds due

to their ease of moving domicile and exploiting regulatory arbitrage. Because of this, the public and private initiatives that arose in the years following the 1998 fall of the LTCM hedge fund were mainly risk management practices attributed to hedge funds' counterparties with the intent of indirectly regulating Highly Leveraged Institutions (HLI).

The first major public sector initiative was published by the Basel Committee on Banking Supervision (BCBS) in September 1999, listing a series of sound practices for bank's interactions with Highly Leveraged Institutions (HLIs). These practices were aimed at covering all the areas that contributed to the fall of LTCM by promoting more in-depth credit analyses, credit limits, exposure measurement, and information transparency and gathering. Then, in a later report published in 2000, the BSCB noted that even though risk management practices had strengthened, there was still a need to improve risk exposure measurements and introduce stress testing.

On the other hand, private sector initiatives have been mainly piloted by the Counterparty Risk Management Group (CRMPG), the International Swaps and Derivatives Association (ISDA), and the Institute of International Finance (IIF). These three associations published in the 90s, and revised after the fall of LTCM, a series of enhancements, recommendations and standards aiming at strengthening risk management for financial firms that provide credit in the derivatives and securities market, and at refining collateral management practices.

## Chapter 2: Hedge Fund Investment Strategies

Hedge funds' strategies have been evolving ever since the first fund was established in 1949. Starting from a directional equity long/short portfolio, most funds nowadays adopt complex financial instruments and strategies that allow them to generate positive returns regardless of the broader market's performance.

One of the main characteristics of hedge fund strategies that is used to classify them into sub-categories is directionality. Directional hedge fund strategies are those that provide the portfolio with exposure to the wider market, either positively or negatively correlated. Examples of directional hedge fund strategies are global macro, emerging markets, equity long/short and short-biased funds.

Alternatively, non-directional strategies, also referred to as relative value strategies, are those which can generate profits regardless of market direction based on the relative price of different securities. The most common examples of relative value strategies are equity market neutral, volatility arbitrage and convertible arbitrage. In these cases, hedge funds aim to achieve a balanced exposure either through a beta-neutral portfolio or a net dollar amount invested equal to zero.

The third main category of hedge fund investment strategies is event-driven, which is based on targeting particular events or situations to generate a profit. The most popular event-driven strategies are merger arbitrage, distressed securities investment and Private Investments in Public Equity (PIPE). It is important to note that event-driven strategies can either be based on a directional or a relative value position depending on the strategy itself.

Then, it is also important to mention multi-strategy funds and funds of funds. Multi-strategy funds are single investment vehicles said to adopt a hybrid solution by combining two or more of the different strategies we have listed so far. On the other hand, funds of funds are hedge funds that differentiate their portfolio by investing in other hedge funds. These two investment vehicles tend to have slightly different properties and characteristics so they will be discussed separately.



## 2.1. Directional Strategies

### 2.1.1. Equity Long/Short Funds

Equity Long/Short is the oldest hedge fund investment strategy as it dates back to the second half of the 20<sup>th</sup> century when Alfred W. Jones created the first ever private investment firm later to be denominated “Hedge Fund”. The equity long/short strategy is based on building a portfolio by combining both long and short positions to hedge a portion of the risk while maintaining a certain degree of exposure to the wider market. The result of an equity long/short strategy is a long-biased portfolio constructed by going long on cheap stocks and selling expensive ones.

Usually, fund managers pursuing this strategy implement fundamental analysis to identify the stocks to add to the portfolio by evaluating important metrics such as price-to-earnings and price-to-book ratios while utilizing complex mathematical models to compare the current stock price to the overall market and its historical values. Then, after the stocks have been chosen, it is not uncommon for fund managers to utilize technical analysis to identify the precise entry point of each position.

Generally, equity long/short funds retain a 40% to 60% net long exposure with the intent of benefitting from the equity market’s performance. However, depending on the specific strategy implemented by the fund manager, the net exposure might substantially vary. One strategy that managers might adopt is slightly more passive and it is based on identifying companies that outperform during bull runs and that experience less volatility during market drawdowns. Alternatively, fund managers can actively manage their risk exposure to achieve the same objective. Because of this, it is not rare to observe equity long/short funds with a market neutral or even net short exposure during uncertain market conditions, whereas during market rallies the net long exposure can reach up to 75%. Additionally, when it comes to leverage, equity long/short funds do not have any precise rules, however, the total exposure of these funds usually never exceeds 200%.

However, over the years multiple substrategies of the original equity long/short have been developed. Short-biased funds, for example, maintain a net short position reaching the opposite side of the net exposure spectrum of traditional equity long/short funds. Fund managers pursuing this strategy identify companies whose share price is expected to fall in the future due to a relatively high price and unsustainable margins, regulatory changes, legal proceedings and sanctions, impossibility of raising capital and more.

Another sub-strategy is equity non-hedge, which instead aims to achieve a net long exposure even larger than traditional equity long/short, however, these funds remain significantly different from the more traditional long-only mutual fund strategies due to their ability to implement leverage and to invest in illiquid securities. As opposed to equity long/short positions which are often diversified to reduce both market and industry risk, equity non-hedge positions are usually concentrated in only a few sectors and in illiquid securities which cannot be hedged.

The main advantage of the equity long/short strategy is the ability to maintain some degree of exposure to benefit from the long-run return of the equity market while partially reducing both market and industry risks. Moreover, equity long/short funds are characterized by a high degree of liquidity due to the fact that managers tend to have 50 to 80 positions open simultaneously. However, the main disadvantage of this strategy is the reliance on the managers' abilities to hedge against market volatility during periods of turmoil. Because of this, it is not unlikely for equity long/short funds to record negative returns during periods of high market volatility.

### 2.1.2. Global Macro Funds

Historically, global macro funds have contributed to the development of the hedge fund market almost as much as the original long/short strategy developed by Jones. After the first couple of decades since the establishment of the first hedge funds, the economy was impacted by extremely difficult financial conditions that caused a drop in the number of hedge funds to only 68 entities actively operating in 1984. The strategy that helped the industry restart its expansive growth was the newly introduced "global macro

strategy” first applied by Julian Robertson’s Tiger Fund, which had managed to earn a 43% average annual return between its inception in 1980 and the end of 1985.

This strategy significantly differentiated itself from its predecessor because it is entirely based on macroeconomic factors and grants the manager complete flexibility on the instruments and positions used to generate a positive return. More specifically, a global macro strategy uses a “top-down approach” based on studying the macroeconomic trends generated by changes in technology, the economic cycle, fiscal or monetary policies, and many other factors. After identifying the trend, the top-down approach consists of estimating the effect that the changes will have on the different financial instruments before crafting a compelling strategy built on a case-to-case basis to profit from the macroeconomic change.

When applying this strategy managers usually have the utmost flexibility in choosing the set of financial instruments that best suit their objectives. However, their research and decisional process is often based on applying technical analysis to study whether or not the long-term macroeconomic trends are reflected in the short-term market structure to present a potential entry point. Managers define a satisfactory entry point when the price of the instrument is distant more than a standard deviation from its mean, as most price fluctuations tend to remain within this range which is commonly defined as an ordinary level of volatility. Additionally, it might also happen that the deviation from the mean exceeds two standard deviations, in which case the entry opportunity is defined as excellent. However, in a global macro strategy, the difficulty for the manager remains to correctly identify the macroeconomic trend and define the position while successfully carrying out the trade in the relatively short timeframe in which the opportunity is presented.

One of the most popular strategies performed by global macro managers is called “carry trade”, which consists of profiting from an interest rate difference between two countries. The main principle behind this strategy is to borrow funds in the country that offers the lower interest rate and to invest in the assets of the country with the higher interest rate. By doing so it is possible to generate returns from two different sources:

- Returns from the interest rate differential: the investor earns the spread between the lending and the borrowing interest rate.
- Exchange rate appreciation: additional return generated from the appreciation of the currency with the higher interest rate.

The most common currency with which this strategy is most used is the Japanese Yen due to the stable and low interest rate environment that the Bank of Japan has created over the last decades. Because of this, the most used currency pairs are the yen against the pound sterling, the Australian dollar, the euro, the Canadian dollar, and the US dollar. However, oftentimes also the pound sterling against the Swiss franc is used.

The main advantage of the global macro strategy is the flexibility granted to the managers in choosing any instrument that best fits the investment opportunity that is presented by the macroeconomic setting. Usually, managers can build positions using equity and debt instruments, currencies and commodities. This degree of flexibility often allows global macro funds to achieve great results independently of market conditions. However, the main drawback of this strategy is that managers usually adopt a relatively high leverage that causes a high degree of volatility that could potentially cause a significant loss in just a few months. Additionally, the ability of a global macro manager must reside also in the capacity of correctly timing the market by identifying the opportunity and carrying a trade before the market conditions return to their equilibrium.

### 2.1.3. Emerging Markets Funds

Emerging markets funds operate by taking positions on securities issued in countries that are defined as “emerging” based on the Gross National Income (GNI) per capita of the country, according to World’s Bank main criterion. Based on GNI, economies around the world can be categorized into one of these four categories:

- Low: GNI per capita lower than US\$1,005
- Lower-middle: GNI per capita between US\$1,006 and US\$3,975

- Upper-middle: GNI per capita between US\$3,976 and US\$12,275
- High: GNI per capita higher than US\$12,276

Investing in emerging markets is a challenging task that requires managers to have an in-depth understanding of not only the traded securities, but also of the country, region and even the management of the issuing business. This is because emerging markets are characterized by a higher degree of inefficiency due to the lack of transparent information and solid standards for corporate governance. Therefore, emerging markets fund managers must be proficient in identifying undervalued securities and able to determine the optimal portfolio strategy given a potentially weak financial infrastructure. Furthermore, to lessen the issue generated by the lack of transparent information, international accounting standards and proper corporate governance, a local presence or at least regular visits are considered a necessity for the fund to ensure a proper evolution of the investment.

However, it is also important to note how not all emerging markets share the same differences listed in the above paragraph and each region offers its own unique characteristics. For example, Emerging Europe offers a substantial reserve of commodities led by Russia and it presents the support of the European Union. Asia, on the other hand, is unique for its export-driven growth and internal consumption that is slowly starting to increase and contribute to the countries' development. Africa, instead, offers the possibility to invest in the earliest stage of development and most countries are well-renowned for their abundance of natural resources. Finally, Latin America is highly interconnected with the United States and, just like Emerging Europe, it offers an abundance of commodities, especially in Brazil and Venezuela.

The first investment alternative for emerging market funds is through an equity investment. In this case, the fund manager performs a fundamental analysis to estimate the intrinsic value of the company through a competitors' analysis and a study of the financial statements. Then, if the fund manager can successfully determine that the market value is below the intrinsic value of the company, the second step is to determine if the company has a satisfactory growth potential, not only based on its fundamental

values, but also taking into account the macroeconomic environment in which the company operates. To perform the second step, the fund must perform on-site visits to evaluate the company's management and the entire environment in which the company operates, including local and national regulations, customers, market suppliers and competitors. Only if the expected growth rate of the company is satisfactory, the fund might consider pursuing the equity investment.

Alternatively, emerging market funds often also consider investing in the fixed income market either through local currencies or hard currencies, meaning stable and reliable currencies that are issued by a government and widely accepted. Historically, the main fixed income strategy was to invest in hard currencies, and more specifically, in US dollar bonds. By buying US dollar bonds issued in an emerging market the fund would earn an additional spread over the T-bill rate paid in local currency plus an additional amount to cover the risk of inflation.

On the other hand, over the last decades investing in local currencies has far surpassed the historical strategy of betting on hard currencies. In this case, fund managers directly invest in corporate emerging market debt, government bonds and inflation-linked emerging market securities. However, despite appreciating over the long run, local currencies tend to remain much more volatile than hard currencies, so emerging market funds usually build their positions by combining both types of currencies.

Hedging against risk, given the lack of transparency and the volatility in emerging markets, is often a prime concern of most fund managers. However, due to the lack of liquidity, hedging positions through shorting is not always an option even though in later years it has now become possible to do so on the most liquid Eastern European, Asian and Latin American Companies. Because of this, most funds hedge portfolios contain a short position of American Depository Receipts (ADRs), which are American securities that certify ownership in a foreign company and are often used to hedge short-term foreign market volatility. Alternatively, fund managers often short regional and local market indices or consistently maintain several out-of-the-money put options that would protect the investment against a sharp decline, usually of 5% or more.

The main advantage of an emerging market strategy is the fact that the long-run growth potential is extremely positive, however, in the short term these investments can be highly volatile causing a significant degree of risk. The main risks of an emerging market strategy are the lack of information and accounting standards, poor corporate governance and unspecialized management, political risk and election uncertainty, a higher exposure to a world economic slowdown and a high vulnerability to flights to quality during uncertain market conditions.

## 2.2. Relative Value Strategies

### 2.2.1. Equity Market Neutral Funds

Equity market neutral funds, similarly to equity long/short ones, adopt different strategies to invest in the equity market both through long and short positions. However, in this case, the objective is to achieve a market neutral position in order to fully hedge against market risk and to generate a profit regardless of market direction as opposed to long/short equity funds which often build a long-biased portfolio. Additionally, equity long/short managers often have greater flexibility in adjusting the net exposure of the fund to better exploit the current market trend and generate a higher alpha, meaning a greater excess return over the fund's benchmark.

However, there are various interpretations of how market neutrality can be defined. One interpretation that can be pursued by fund managers is having a weighted average beta of the portfolio close to zero. Alternatively, since market betas tend to be extremely volatile, most market neutrality conditions are meant as neutral in dollar amounts by investing the same amount of money both in long and short positions. In this case, the beta is often slightly negative because of the fact the securities that are sold short carry a higher volatility and therefore a higher negative beta.

When it comes to categorizing the different strategies adopted by market neutral managers, two main alternatives arise: a qualitative approach and a quantitative approach. The first of the two is based on identifying undervalued and overvalued stocks and building a position to profit from this deviation. One alternative is simply to

go long on the undervalued and short on the overvalued one trying to achieve a market neutral position through dollar neutrality. Another alternative is to build a position between two stocks that are closely linked together to eliminate market exposure and only profit from the relative performance of the two. Finally, a qualitative position can also be constructed by dividing the portfolio into different sub-portfolios with different net exposures.

Likewise, quantitatively managed funds can be split into different categories: quantitative funds that use mathematical models to integrate fundamental data and statistical arbitrage funds. The first type of quantitative strategy is based on defining a series of parameters, including market capitalization, market sectors and other investment parameters, to screen the market searching for undervalued and overvalued companies. Then, the fund managers will use mathematical models based on quality, growth, momentum and valuation factors to estimate the intrinsic value and risk factors of the company before deciding whether to invest or not. Statistical arbitrage, instead, is based on a statistical analysis based on the historical data of the company in order to identify significant deviations between the long-run and short-run trends based on the key concept that in the long run the price of a security returns to its mean.

The main advantage of the various equity market neutral strategies is the fact that a fund can achieve positive returns in both bull markets and downturns due to the very limited market exposure. Additionally, thanks to the need to maintain a neutral net exposure, the fund is not vulnerable to the active risk present in a long/short equity strategy when a manager decides to change the net exposure in order to better profit from a given market trend.

On the other hand, equity market neutral strategies often tend to significantly underperform the other directional strategies during bull markets due to the fact that the positive returns coming from the markets are significantly offset by the short positions. Additionally, equity market neutral funds, especially quantitative managed funds, tend to have portfolios containing 200 to 300 positions and often achieve a very high turnover ratio to mathematically maintain a market neutral position. These conditions



cause these funds to suffer from high transaction costs due to the fees incurred when opening and closing a position.

### 2.2.2. Volatility Arbitrage Funds

Volatility arbitrage is an investment strategy adopted by hedge funds to profit from differences between implied volatility and realized volatility. Mathematically, volatility is defined as the annualized standard deviation of a security and volatility arbitrageurs usually profit from it by taking complex positions mainly through derivatives such as call and put options on many different underlying assets, including equity, currencies, interest rates and commodities.

The typical volatility arbitrage position is built based on an internal valuation analysis carried out by the fund managers to estimate the intrinsic value of an option contract. One of the main factors determining the value of an option strategy is the volatility of the underlying asset since the higher the volatility, the higher the probability that an out of the money option will end up in the money before the expiration date. So, implied volatility is a positively correlated determinant of the price of the option strategy. If the internal valuation analysis signals that the option is relatively undervalued, meaning that the implied volatility priced in the option contract is lower than the realized volatility, the fund manager might decide to buy the option taking a long position to profit from the appreciation of its price driven by the increase in implied volatility. Then, the position is usually hedged by either selling or buying the underlying security through another option contract to limit market exposure. The hedging ratio, also denominated delta, represents the sensitivity of the price of the option strategy to changes in the underlying price.

One particular group of funds that stems from the wider set of volatility arbitrage are Short volatility funds, which specialize in shorting options to achieve a volatility arbitrage position. The typical short position in this case is built by short selling out of the money put options in order to collect a premium and profit from the higher implied volatility than the realized one. However, short selling options is usually extremely

risky and it requires attentive management as these instruments carry a limited potential profit and an unlimited potential loss.

As opposed to other hedge fund strategies, the main advantage of a volatility arbitrage strategy is that by using a complex option position the payoffs are predetermined, so the fund managers exactly know the maximum P&L and the probability of hitting either of the two levels by the expiration date. Additionally, by building the positions through options, managers can adjust and correct them by adding and selling contracts before the expiration date. However, volatility arbitrage often results in extremely complex positions that are not always easily understandable by investors. Additionally, since derivatives depend on multiple factors aside from volatility and the price of the underlying, volatility arbitrage positions can often be relatively risky. Finally, shorting options often results in strategies that provide an unlimited potential loss and a limited potential gain, so it is not unusual to observe stable and constant returns for a prolonged period of time before a significant loss in just a couple of weeks.

### 2.2.3. Convertible Arbitrage Funds

Convertible arbitrage is a relative value strategy based on profiting from the spread between the price of a convertible bond and the underlying equity. Convertible bonds are hybrid securities composed of a bond and a call option allowing the bondholder to convert each debt security into a fixed number of common or preferred shares as described by the bond certificate. Because of this, the pricing of convertible bonds is fairly complex, enabling arbitrageurs to find mispriced and undervalued securities to perform the fund's strategy.

The first step of performing a convertible arbitrage strategy is to perform a fundamental analysis to identify desirable convertible bonds to invest in. To do so, hedge funds perform multiple analyses involving the use of the Black & Scholes model, binomial option valuation model, bond valuation models and equity valuation models to determine the security's intrinsic value. The main factors that are considered by these equations are:

- Price of the equity
- Probability of default of the issuer
- Time to maturity
- Volatility
- Ratio of conversion premium to conversion ratio
- Coupon and yield

Then, after finding a potential arbitrage opportunity a position is built by purchasing the convertible bonds and shorting the company's stocks. Selling the company's shares is necessary to build a delta neutral position because as the share price increases, the conversion premium of the convertible bonds increases in price, whereas when the price of the share decreases, the premium loses value and the price of the convertible bonds approaches the bond floor, which is the price of the bond without the convertible option. So, a delta neutral position allows the fund to build a relative value position that will profit based on the convergence between the convertible bonds' price and the shares' price. However, similarly to other relative value strategies, during periods in which the fund manager expects an increase in the underlying share price the number of shares that are sold short is slightly less to obtain a positive delta in the position and to maintain a certain degree of market exposure. The portion of shares sold short is called the hedging ratio.

After the position has been entered, the fund manager might decide to close the trade if one of these 5 conditions occurs:

- The price of the convertible bonds increases relative to the price of the underlying security, so the trade reaches the expected profits and the position is closed.
- The price of the convertible bonds decreases relative to the price of the underlying security, so the trade reaches the stop loss and the position is closed, or at least to reduce the exposure to the equity short position if the share price is increasing.

- Any news impacting either the company or the sectors is released the fund manager believes that it will negatively impact the position.
- There is a forced conversion by the issuer.
- The market is undergoing a period of significant stress and the fund expects a significant reduction in liquidity over the next period.

Convertible arbitrage was a particularly popular strategy adopted by hedge funds during the early 2000s, so much so that it became an extremely competitive niche and the number of convertible arbitrage opportunities significantly dropped between 2003 and 2004. Because of this, over the following years this strategy has evolved and 5 main branches have developed:

- Increased exposure to credit: the original convertible arbitrage strategy usually contained credit default swaps or other instruments that were used to reduce credit exposure during the arbitrage position. Over time, some fund managers decided to drop this hedge and take on more credit risk.
- Addition of capital arbitrage strategies: some fund managers have started implementing the traditional convertible bond arbitrage with other types of arbitrages involving subordinated equities, bonds and even derivatives. One particular case is “stub trading” which consists of shorting a company’s shares and buying the shares of one of its subsidiaries that is considered mispriced relative to its intrinsic value.
- Inverse Convertible Arbitrage: another variant of the traditional strategy that has developed over the years is inverting the arbitrage by shorting the convertible bonds and going long in the underlying security. However, this strategy is generally considered riskier due to the potential exercise of the option that would generate a significant loss for the fund in the case in which the share price increases significantly.
- Investing in Catastrophe Bonds (CAT): catastrophe bonds, also known as “CAT”, are debt securities issued by insurance companies to raise money to face natural catastrophes such as earthquakes and tornadoes. CAT bonds are high-yielding securities with a relatively short maturity of 3 to 5 years that pay a

periodic coupon payment to its investors. However, if one of the catastrophes specified in the bond certificate occurs, the insurance company obtains access to the raised funds and the obligation of repaying investors coupon and principal at maturity is either deferred or forgiven. More specifically, if the costs incurred by the insurance company to cover the natural disaster are greater than the amount raised by the issuance, the insurance company does not repay the principal at maturity.

- Synthetic Convertibles: The last evolution of the traditional convertible arbitrage came in the form of a synthetic position where the arbitrage was artificially built by the fund manager without the need for a convertible bond. This position was constructed by going long on a corporate or government bond, a long position in a call option with equity exposure and a short put option position to earn a premium at inception.

Despite the different evolutions of the same strategy, the majority of convertible arbitrage positions share the main advantage of generating many different types of cash flows at different dates. Usually, a convertible arbitrage position would benefit from periodic coupon payments, the interest on the cash received from the short sale and the capital gain on the equity and convertible bond positions.

On the other hand, convertible arbitrage positions also carry many significant sources of risk. First of all, convertible bonds are subject to the same 5 factors that affect the price of options, which are: equity price, strike price, days to expiration (DTE) and volatility. So, going long on a convertible bond also means going long on the share's volatility, which could result in significant losses if the implied volatility of the underlying significantly drops. Additionally, convertible arbitrage positions are also subject to credit risk and interest risk which are often respectively hedged with the use of credit default swaps and either interest rate swaps or interest rate futures.

## 2.3. Event-Driven Strategies

### 2.3.1. Merger Arbitrage Funds

Merger Arbitrage, often also called risk arbitrage, is an event-driven investment strategy that involves taking a position whenever the news of a potential merger between two companies is announced. As an event-driven strategy, merger arbitrage aims at leveraging the uncertainty generated by merger and acquisition transactions to generate returns.

The idea behind this type of arbitrage is not to predict or anticipate the merger announcement, rather it is to use the broadly available information around the transaction to profit from the arbitrage spread, which can be defined as the difference between the currently traded stock price of the target company and the price offered by the buyer.

The first step pursued by the fund manager when a merger and acquisition transaction is announced is to evaluate the probability that the transaction is fully carried out and that it can fully satisfy the regulations governing these procedures. Correctly evaluating this probability is a crucial step for the fund as most failures tend to occur during the first stages of the transaction. Secondly, the fund manager will also have to evaluate how the transaction will be perceived by the market in case it is completed. This second step also requires the manager to study the possibility of counteroffers and the participation of third parties as the potential returns tend to be higher when multiple potential buyers are involved.

Then, when it comes to M&A transactions, the three types of events that are tracked by merger arbitrage fund managers are friendly takeovers, hostile takeovers and partial sales. Friendly takeovers occur when the target company is willingly acquired by the buyer, and in these cases, the offered price is generally significantly higher than the current trading price of the company. Hostile takeovers, instead, occur when the buyer acquires publicly traded shares to obtain control over another company without the approval of the target company's board of directors. This procedure is often performed

by buying publicly traded shares until the acquirer has reached a stake capable of allowing them to request a shareholders' meeting and elect new directors who will vote in favor of the merger between the target and the acquirer. Finally, partial sales include the sale of a portion of the company that is valued slightly below its market value or intrinsic price.

The profitability in merger arbitrage transactions greatly depends on the spread between the current trading price and the offered price, which in turn is highly dependent on the type of merger and acquisition transaction that is being performed. Friendly takeovers tend to have a larger spread and more widely available information, whereas both hostile takeovers and partial sales carry a much higher degree of uncertainty that must be factored in when deciding whether to enter the position and its eventual size. In most cases, fund managers enter progressively larger positions when the deal becomes more and more certain to limit the potential fallout of a failing M&A transaction.

Once a manager has determined that the opportunity is likely profitable and that it is worth entering, the next step is to determine the type of position based on whether the manager wants to limit market risk or not. In a merger arbitrage market risk is reduced through a hedge position built by a long position in the target company and a short position in the acquiring company. It is important to note that this position is also often used when the transaction is settled not with cash, but with the acquirer's own stock. On the other hand, when a transaction is settled in cash, hedging a position using the acquirer's stock wouldn't be as effective, so in this case, fund managers often enter into a naked long position by buying the target company's shares. Finally, the fund manager will have to determine the leverage to be used in the position. Despite being an arbitrage strategy, the leverage used in merger arbitrage positions tends to be relatively low, often remaining below two times.

From a fund's perspective, merger arbitrage transactions tend to have a limited exposure to market risk and are mainly based on widely available information about the transaction. Additionally, risk arbitrage positions are often closed within a few months, allowing the fund to renew the portfolio. However, because merger arbitrage positions

are closely related to the individual risk of the interest companies, funds might experience relatively high short-term volatility, causing pressure from investors looking for short-term returns. Furthermore, this instability is even more accentuated by the fact that merger and acquisition transactions often move in cycles, potentially inducing significantly different returns year on year. Because of this, most risk arbitrage funds implement a multi-strategy approach and branch out toward other event-driven strategies.

### 2.3.2. Distressed Securities Funds

The distressed securities investment strategy is based on taking a position on securities issued by a company that is experiencing financial or operational difficulties and that is undergoing a process of reorganization or liquidation under bankruptcy law.

Distressed securities often present investment opportunities due to their illiquidity and the fact that they might be inefficiently priced below their fundamental value because of fire sales, low analysts' coverage and the negative sentiment surrounding the company's financial hardship.

However, successfully carrying out a distressed securities investment strategy does not only require the correct understanding of the market's sentiment and of the company's fundamental value, but also of bankruptcy law and the potential limitations and implications of the company's financial distress. The United States is the main market for distressed investing mainly due to the United States Bankruptcy Code, and more specifically its chapter 11. This chapter allows entrepreneurs and businesses to develop a reorganization plan to keep their business alive in case of bankruptcy and to repay their creditors over time instead of pursuing the more traditional liquidation procedure. Reorganization is often defined as "debtor friendly", as opposed to the "creditor friendly" liquidation because by allowing the debtor to remain in business it is possible to generate a higher total value than through a traditional bankruptcy procedure.

Because of this, the targets of distressed investment strategies are companies with a credit rating of CCC or below and that are following a restructuring procedure.



Depending on the risk profile of the hedge fund, the manager can decide when to enter and the size of the position based on how far along the company is on their restructuring. Entering an early position before or right after a company has filed for bankruptcy usually carries a higher degree of uncertainty and higher potential profits compared to investing when a rescue plan has already been approved.

Based on the role that hedge funds adopt when investing in a distressed company, it is possible to define three approaches to performing a distressed investing strategy:

- The first approach is passive investing and it is usually carried out by hedge funds entering a position after the bankruptcy has already taken place with the intent of trading the company's securities and generating a profit over a relatively short period of time. In this case, the fund is not interested in achieving influence over the bankruptcy procedure of the debtor, but just in reselling the securities at a higher price.
- The second approach is an active and noncontrolling strategy where the fund wants to gain an influential position over the bankruptcy process while remaining on the creditor side without gaining control over the company's management.
- The third approach is an active and control strategy, which is most often adopted by the early investors entering a position before the rescue plan is approved. This approach is based on building a substantial position that allows the fund to gain access not only to the bankruptcy procedure, but also to have a direct impact on the company's management. This strategy is either performed by a single fund or as a syndicate.

Then, regardless of the approach chosen by the fund manager, there are two main ways in which a position can be built to generate profits using a distressed security investment strategy. The first method is building an absolute position by going long on the company's distressed securities. An absolute position is taken when based on fundamental analysis the fund has estimated that the value of the security is expected to increase once the restructuring process has been completed.

The other alternative is building a relative position, which is also called capital structure arbitrage. This other strategy is not exclusive to distressed investing but it is also implemented in other event-driven positions and it consists of taking a position on a pair of securities that are considered to be relatively mispriced. It is common for the price of a particular security to move more than others during a restructuring, so the role of the fund manager is to short the more expensive security and buy long the cheaper one. However, in distressed investing shorting a security might be significantly difficult, or even outright impossible, due to the illiquidity of the investment and potential rules involving insider information.

More specifically, the main disadvantage of a distressed securities investment strategy is the fact that in most cases, except when following a passive investment strategy, the fund managers gain access to the companies' inside information causing various trade restrictions and the impossibility of selling the position until the bankruptcy process is complete. Because of this, and to avoid a significant number of withdrawals before any profits are realized, hedge funds pursuing this strategy often lock in their investors for relatively long periods of time and allow redemptions at most quarterly, but in some cases, redemptions can only be performed every 12 months with either a 6- or 12-month notice.

On the other hand, the main advantage of this strategy is the fact that it is event-driven so, despite the illiquidity, the fund can generate relatively constant profits over time regardless of the market's performance.

### 2.3.3. PIPE Funds

The term PIPE is an acronym that stands for Private Investments in Public Entities/Equities and it describes the direct investments made between a fund and a public company, meaning an entity whose shares are totally or partially traded on stock exchanges. The role of PIPE funds is to provide liquidity to public companies that have lost efficient access to the markets and in exchange these funds are paid in private

securities issued at a price below market value which they will be able to resell on the secondary markets.

The main target of PIPE funds are relatively small companies with a capitalization that ranges between \$250 million and \$25 million (nano-cap companies) that have just gone public through an IPO and subsequently lost access to efficient fundraising through the market. When first going public, this might happen due to a severe decrease in liquidity, operational issues and even adverse conditions so, in these cases, a public company might turn to a PIPE fund to raise the necessary funds.

As opposed to distressed securities funds, PIPE funds' target companies might not necessarily be overcoming a bankruptcy procedure and might just be looking for additional funds to pursue a new project. Raising funds through a private entity is usually faster, cheaper and the company does not have to forecast how receptive the market would be to a new issuance.

The typical PIPE transaction starts with a thorough evaluation of the financial health of the company. As opposed to distressed funds, the discount on the securities' prices is negotiated directly with the public company and it does not derive from a negative market sentiment. So, PIPE funds are interested in performing transactions with companies that are showing strong financial health and which are not displaying a significant risk of bankruptcy. However, if the expected return is sufficient, a PIPE fund might decide to proceed with a transaction even if the public company is expected to remain in business for just an additional 12 to 18 months with no guarantee of later success.

After the research and evaluation, the second step is negotiating the transaction. PIPE transactions involve the private placement of unregistered securities at a price lower than the market value. In the United States, these securities are issued according to the disclosure exemption explained under Regulation D of the Securities Act, which allows public companies to sell the shares to an accredited investor without the need to register

them with the SEC under certain limits. Because of this, PIPE funds are also commonly referred to as “Regulation D funds”.

However, these private placements are often bound by the requirement of registering the securities with the SEC, allowing PIPE funds to resell them on the secondary market to realize their profits at a later date. The most common security used for PIPE transactions are convertible bonds, which can only be traded on the secondary market after the registration process is completed, which usually takes between 90 and 120 days.

The convertible bonds issued by public companies usually offer a coupon payment between 6% and 12% and are acquired by the fund at a discounted price previously negotiated between the two parties. However, one crucial detail that determines the PIPE transaction is the conversion rate.

- Traditional PIPE deals have a fixed conversion ratio in convertible bonds, meaning that regardless of how the stock’s price moves, the PIPE is granted the same number of shares at conversion. In this case, the PIPE fund bears the risk of a decrease in price between the issuance and the conversion of the security.
- Structured PIPE deals, also called toxic PIPE deals, are based on a variable conversion ratio based on a fixed value of shares, and not a fixed number of shares. Because of this, these deals are defined as “toxic” from the public companies’ standpoint as a severe drop in the stock price might even cause the fund to gain control over the entire company.

When it comes to PIPE transactions, the main advantage comes from the stable and significant returns that these funds can generate over time, regardless of the market condition. Additionally, in the transaction, together with convertible bonds, are often also negotiated a portion of long-term warrants that will help the fund generate profits over time if the public company remains successful after the sale of the securities on the secondary markets.

However, the main risk of this strategy is linked to the illiquidity of the securities issued by the company. Not only the fund is not able to sell them before they are registered with the SEC, potentially exposing the fund to a drop in the stock price, but also the fund might have severe difficulties in reselling the securities on the secondary market. Since the companies are usually relatively small, their trading volumes are extremely limited and often the securities are exchanged at a price that ranges from a few dollars to a few cents per share. Because of this, funds often take multiple months to liquidate their securities as they must avoid a sharp decline in the stock price.

## 2.4. Hybrid Strategy: Multi-Strategy Funds

Multi-strategy funds are often associated with funds of funds due to their unique ability to provide their clients with a differentiated product offering, however, there are multiple significant differences between these two types of funds.

Multi-strategy hedge funds are investment vehicles that operate by utilizing multiple hedge fund strategies, usually between 5 and 8. However, as opposed to funds of funds, these investment vehicles operate as a single fund under a single fund manager. To do so, multi-strategy funds are divided into different sub-portfolios that perform their independent strategy. Each sub-portfolio is usually managed by its own team and portfolio manager, but in some instances, similar strategies can be grouped under the same team, for example, in the case of convertible arbitrage and volatility arbitrage.

Furthermore, in some cases, multi-strategy hedge funds are actively managed by varying the strategy breakdown based on the macroeconomic condition or the market sentiment. These funds usually record all of their positions inside a single portfolio that is then managed by the fund manager as a global portfolio by deciding to increase the exposure to a specific asset class or to achieve a particular net exposure with respect to the market.

The main advantage of multi-strategy is the ability to provide investors with the possibility to diversify their investments in the hedge fund industry with a lower amount

of capital compared to individually investing in different investment vehicles. Additionally, compared to funds of funds, multi-strategy fund managers do not have to perform an in-depth market analysis to discover the best-performing hedge fund managers for each strategy, often resulting in a more advantageous fee structure. Finally, the last advantage of multi-strategy funds is that they are at least as liquid as the underlying strategies that the fund is performing. Because of this, multi-strategy funds rebalance relatively often, at least quarterly but it can even be a continuous activity based on investment opportunities and are hardly ever subject to a lockup period.

On the other hand, as opposed to funds of funds, multi-strategies hedge funds do not offer any diversification on fund managers, so if the fund invests in 6 different strategies and on top of them offers a multi-strategy product, the multi-strategy fund will only be invested in the fund's own portfolios which are ultimately governed by the same fund manager. Finally, one last important difference between funds of funds and multi-strategy funds is that usually when a sub-portfolio of a multi-strategy fund is closed to new investments, the entire fund is also closed to new investments whereas a traditional fund of funds would normally continue its operations.

## 2.5. Funds of Funds

An alternative hedge fund strategy that is used to provide investors with a diversified portfolio is the fund of funds strategy. As opposed to multi-strategy funds, fund of funds are investment vehicles that simply invest in other hedge funds to construct a diversified portfolio.

Based on the construction of the fund of funds portfolio, Hedge Fund Research, Inc. divides the strategy into four sub-strategies:

- Conservative: these funds generally achieve lower volatility than the industry average and achieve stable returns regardless of market conditions. To achieve such results these funds mainly invest in relative value strategies such as equity market neutral, fixed income arbitrage and convertible arbitrage.

- Diversified: these funds show a very similar return distribution to the industry average through the construction of a thoroughly diversified portfolio. These funds usually achieve less severe losses during market drawdowns and better performance during bull runs.
- Market Defensive: these funds are characterized by a net negative exposure to the market manifested through a negative correlation between the fund of funds' portfolio and the benchmark index. These funds invest in short-biased strategies and generally achieve better returns during bear markets than during bull runs.
- Strategic: these funds generally seek higher returns at the cost of higher volatility by investing in event-driven funds such as emerging markets and PIPE funds. Generally, strategic funds of funds outperform during up markets and underperform during bear markets the industry average.

The reason behind their popularity is the fact that the elements in the fund's portfolio are carefully chosen by a professional team of analysts and the fund manager through both a qualitative and quantitative analysis, significantly reducing the amount of due diligence that must be performed by an investor looking to build a diversified hedge fund portfolio. Additionally, professional investors often have access to the specific asset composition and deeper knowledge of other hedge funds, so fund of funds generally evaluate their potential investments on a more precise level than what the average investor could.

Furthermore, just like multi-strategy funds, funds of funds do not require the minimum amount of capital that would have been needed to separately invest in the underlying funds. On top of this, funds of funds usually have significantly lower minimum deposit requirements than the industry standard, averaging at \$50,000 and sometimes even falling below this amount.

Another benefit of funds of funds is the ability to diversify managers and to invest in truly independent funds as opposed to multi-strategy funds in which the strategies are often linked and globally controlled by the fund manager. However, both strategies

remain relatively liquid compared to the hedge fund industry average and often offer monthly or quarterly liquidity.

Finally, the last major advantage of fund of funds is the stability in the returns. In a relatively volatile industry, funds of funds target a 5 to 8 percent yearly return with a standard deviation below 6 percent. These stable returns are usually achieved by rarely using leverage and diversifying across more than 20 hedge funds; however, some people argue that funds of funds are oftentimes over-diversified and the large number of funds in the portfolio significantly reduces the yearly returns due to the introduction of suboptimal elements. It is not uncommon for fund of funds to underperform the top 10 funds in their own portfolio.

Lastly, the most significant drawback of funds of funds is the double fee structure. By investing in other hedge funds independently managed by other fund managers, every position in a fund of fund's portfolio will be impacted by a management fee and a performance fee. To reduce the negative effect of the double fee structure, funds of funds usually charge lower fees with the management fee averaging at 1.4% while ranging between 0.5% and 2% while the performance fee averages at 10% ranging between 0% and 20%. However, to further limit the impact on the returns, funds of funds' fees are often protected by high-water mark systems and hurdle rates.



## Chapter 3: Hedge Fund Performance Over Time

As mentioned in Chapter 1, the hedge fund industry experienced a rocky start during its first decades of existence. Initially, the exceptional performance of Jones' fund, which outperformed by 44% the best mutual fund of the time between 1961 and 1966, brought a significant amount of attention to this new industry due to its attractive profitability. However, the recession of 1969-1970 and the following market crash in 1974-1975 strongly impacted the hedge fund market, reducing the number of active funds from around 200 to just 68 in 1984. Over the following years, with the advent of the Tiger Fund and the boom of the global macro strategy, the hedge fund industry resumed a more stable growth from the 90s until today.

### 3.1. Hedge Fund Performance From 1997 to 2016

When analyzing the returns of the hedge fund industry the last three decades are often split into two sections: from the 90s to 2007 and from 2008 to today. The reason behind this distinction is the fact the Global Financial Crisis, and its consequences, brought an appreciable impact on the returns ultimately changing the relative performance of the hedge fund industry against an equally weighted portfolio of bonds and stocks.

During the 1997-2007 period, an equally weighted hedge fund index generated a cumulative return of +225%, far outperforming an equally weighted portfolio of bonds and equities that generated +125% over the same period (Figure 1A). However, during the second sub-period defined from 2008 to 2016, the same hedge fund portfolio gained a cumulative return of just +25% against the +70% returns of the stock and bond portfolio despite the market crash caused by the Global Financial Crisis (Figure 1B). Additionally, transitioning from the first sub-period to the second, the number of funds with a positive alpha statistically different from zero dropped from 20% to 10% and the number of funds with a statistically negative alpha increased from 5% to 20%.

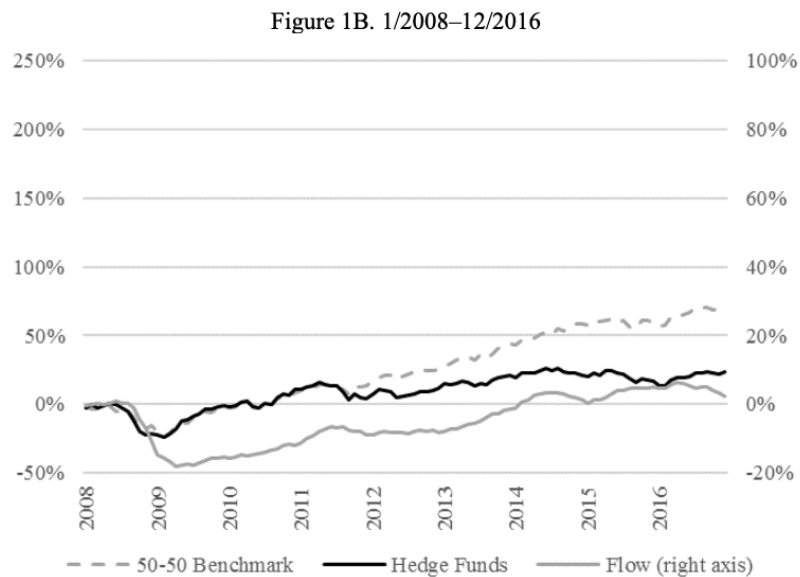
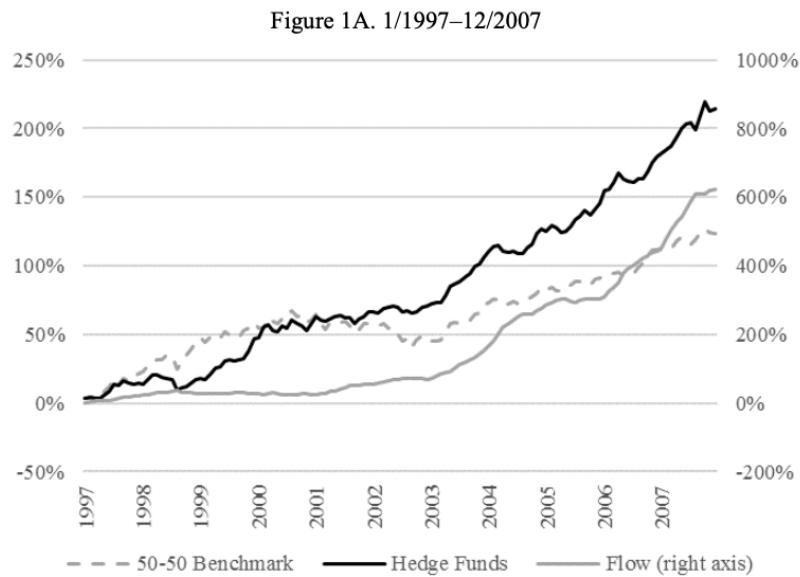


Figure 1: Cumulative Returns and Hedge Fund Capital Flow

Source: N. Bollen, J. Joenväärä, M. Kauppila; 2021, "Hedge Fund Performance: End of an Era?"

However, since hedge funds are risky investments, it is unlikely that an investor will allocate 100% of their portfolio to various hedge funds. Because of this, it is useful to repeat the experiment by building a portfolio that allocates 20% to the hedge fund industry, 30% to the stock market and 50% to the bond market. In this portfolio, equities are introduced by investing in the S&P 500 and bonds through the Vanguard Total Bond Market Index fund (VBTIX) whereas the composition of the hedge fund allocation is

randomly determined by a Monte Carlo simulation that selects 15 funds out of the top quantile and repeats the experiment 1000 times.

During the first sub-period, the 20/30/50 portfolio slightly outperformed the stock and bond benchmark by achieving an average annual return of +7.9% against the +7.6% of the benchmark (Panel A, Table 1). However, what substantially differentiates the two portfolios is the significant reduction of standard deviation that is achieved by allocating 20% of the portfolio to the hedge fund industry. On top of having higher returns, the 20/30/50 portfolio also registered a 5.5% standard deviation as opposed to the 6.4% of the benchmark. As a consequence, the portfolio containing hedge funds achieved a Sharpe Ratio of 0.79, significantly higher compared to the 0.54 Sharpe Ratio recorded by the equally weighted portfolio. However, it is important to note the difference in the Sharpe Ratio between the 75<sup>th</sup> and the 25<sup>th</sup> quantiles of the 20/30/50. This difference demonstrates a large dispersion demonstrates the necessity to invest in a relatively large portfolio of hedge funds to diversify their risk.

During the second sub-period, instead, it is possible to notice the same drop in hedge fund performance that was shown by the cumulative returns. The average annual return of the 20/30/50 portfolio dropped to +5.2% compared to the average return of the benchmark which only decreased to +6.3% annually. Furthermore, the decrease in returns was also paired with an increase in standard deviation, which in the case of the portfolio containing hedge funds reached 6.4% whereas in the stock and bond portfolio, it reached 7.9%. Moreover, it is possible to notice the significant increase in the stock and bond portfolio's Sharpe Ratio between the first and second sub-period, which increased from 0.54 to 0.77. This increase was motivated by the sharp decrease in interest rates as a monetary policy response to curb the crash of the Global Financial Crisis. On the other hand, the Sharpe Ratio of the 20/30/50 portfolio remained relatively unchanged at 0.78 due to the proportional decrease in both returns and volatility. However, it is important to notice how in the second sub-period both the Sharpe Ratio and the average returns of the hedge funds' 25<sup>th</sup> quantile are negative and the Sharpe Ratio of the 75<sup>th</sup> quantile is still lower than the Sharpe of the 50/50 benchmark, indicating a severe underperformance of the hedge funds.

Panel A. 1/1997–12/2007						
	Stock/bond	20/30/50	Hedge funds (N = 3,225)			
	Portfolio	Portfolio	Average	25th	50th	75th
Avg	7.6 %	7.9 %	10.8 %	5.4 %	9.7 %	14.6 %
Dev	7.4 %	5.5 %	12.8 %	6.3 %	9.9 %	15.8 %
Skewness	-0.36	-0.37	-0.06	-0.48	-0.03	0.41
Kurtosis	0.25	0.33	2.30	-0.03	0.77	2.35
Sharpe	0.54	0.79	0.78	0.22	0.65	1.17
Alpha	0.34%	1.22%	5.01%	0.49%	4.36%	8.84%

Panel B. 1/2008–12/2016						
	Stock/bond	20/30/50	Hedge funds (N = 6,069)			
	Portfolio	Portfolio	Average	25th	50th	75th
Avg	6.3 %	5.2 %	2.7 %	-0.8 %	3.2 %	6.8 %
Dev	7.9 %	6.4 %	14.7 %	8.3 %	12.6 %	18.3 %
Skewness	-0.85	-0.89	-0.18	-0.55	-0.15	0.25
Kurtosis	2.03	2.54	2.23	0.13	0.91	2.41
Sharpe	0.77	0.78	0.88	-0.08	0.24	0.61
Alpha	0.95%	0.52%	-2.26%	-7.44%	-1.18%	3.48%

Table 1: Hedge Fund Performance

Source: N. Bollen, J. Joenväärä, M. Kauppila; 2021, "Hedge Fund Performance: End of an Era?"

Alternatively, due to the large variety of hedge fund strategies and the different returns associated with them, another method that can be used to evaluate the performance of hedge funds is to divide them into two groups based on their estimated CAPM beta. The hedge funds with a beta different from zero at a 10% confidence level will be placed in a "Have Beta" portfolio and compared to the S&P 500 whereas the "Zero Beta" portfolio contains the remaining funds which are then compared to the 3-month Libor.

Comparing the performance of the Have Beta hedge funds (Panel A and Panel B, Table 2), it is possible to explain the severe underperformance of the 20/30/50 portfolio in the second sub-period analyzed in the previous Table 1. In the first sub-period Have Beta hedge funds returned on average +11.9% compared to +10.2% per year of the S&P 500, whereas after the Global Financial Crisis, the average annual returns dropped to +2.6% and +8.2%, respectively. Furthermore, the Sharpe Ratio of the S&P increased from 0.44 to 0.51 due to the rapid decrease of interest rates, as opposed to the Sharpe Ratio of the

hedge funds which dropped from 0.76 to 0.26 in the second sub-period. Finally, the median alpha of the Have Beta funds dropped from +4.91% to -2.47%.

On the other hand, Zero Beta hedge funds have reported slightly more stable metrics. Despite the fall in average annual returns from +7.8% to +3.7% across the two sub-periods, the excess returns remained relatively stable slightly decreasing from +3.7% to +3.0% due to a sharp fall in the 3-month Libor rate. Additionally, the decrease in the benchmark rate caused a significant increase in the average Sharpe Ratio, which went from 0.62 to 0.91, and a slight improvement of the median alpha of the Zero Beta funds.

Panel A. 1/1997–12/2007										
	Have Beta hedge funds (N = 2,429)					Zero Beta hedge funds (N = 796)				
	S&P 500	Average	25th	50th	75th	3M Libor	Average	25th	50th	75th
Avg	10.2 %	11.9 %	6.5 %	10.6 %	15.8 %	4.1 %	7.8 %	3.1 %	6.8 %	11.1 %
Dev	14.6 %	13.3 %	6.9 %	10.6 %	16.6 %		10.4 %	4.5 %	8.1 %	13.1 %
Skewness	-0.53	-0.07	-0.48	-0.04	0.37		-0.03	-0.47	0.03	0.54
Kurtosis	0.67	1.82	-0.05	0.70	2.14		3.10	0.07	1.02	3.28
Sharpe	0.44	0.76	0.29	0.71	1.22		0.62	0.00	0.46	1.01
Alpha		5.60%	1.01%	4.91%	9.35%		3.40%	-1.05%	2.78%	7.00%

Panel B. 1/2008–12/2016										
	Have Beta hedge funds (N = 4,905)					Zero Beta hedge funds (N = 1,164)				
	S&P 500	Average	25th	50th	75th	3M Libor	Average	25th	50th	75th
Avg	8.2 %	2.6 %	-1.1 %	3.1 %	6.7 %	0.7 %	3.7 %	0.0 %	3.7 %	7.3 %
Dev	15.7 %	15.3 %	9.2 %	13.7 %	19.2 %		11.0 %	5.4 %	8.7 %	13.3 %
Skewness	-0.70	-0.24	-0.58	-0.20	0.17		0.05	-0.32	0.11	0.53
Kurtosis	1.43	2.00	0.15	0.92	2.39		2.68	0.06	0.88	2.63
Sharpe	0.51	0.26	-0.09	0.21	0.56		0.91	-0.02	0.38	0.94
Alpha		-3.45%	-8.43%	-2.47%	2.36%		2.93%	-0.65%	3.18%	6.89%

Table 2: Performance of Have Beta and Zero Beta Hedge Funds

Source: N. Bollen, J. Joenväärä, M. Kauppila; 2021, "Hedge Fund Performance: End of an Era?"

### 3.2. Causes Behind the Underperformance of the Hedge Fund Industry

#### Following the Global Financial Crisis

To understand the significance of the decline in performance some statistical analyses have been performed to evaluate the potential effect of certain biases or macroeconomic events. The first set of variables that had been tested regarded potential database-related factors. The first tested variable was backfilling, a database-related bias introduced

when managers first decide to report. Usually, managers decide to start reporting when they have achieved some very positive results in the prior months and might decide to omit periods with a worse performance. Correcting the data for the backfill bias results in estimates not significantly different from the previous ones, despite being slightly worse across both sub-periods.

Secondly, another type of database-related bias occurs when, following a period of extremely positive returns, fund managers decide to cease their reporting activity as they reach their maximum AUM and no longer need to advertise their returns resulting in a negative bias. However, by analyzing the hedge fund data it is possible to see that the number of funds that ceases to report due to superior performance decreases from 0.7% to 0.4% across the two periods and that this portion is much lower than the number of funds that ceases to report due to failure, which instead increased from 3% to 5.4% over the same timeframe. Finally, another list database-related hypothesis that was tested was the possibility that hedge funds that had never reported their returns achieved a higher performance. However, also this hypothesis was rejected determining that no database-related bias could explain the underperformance of the hedge fund industry after the Global Financial Crisis.

On the other hand, three economic hypotheses could explain the hedge funds' underperformance. Firstly, in the aftermath of the Global Financial Crisis, the Federal Reserve engaged in a rapid expansionary policy while the US Congress passed the "Economic Stimulus Act", a \$152 billion stimulus to help curb the effect of the recession. These actions have increased the correction both among risky assets and market sectors, making it more difficult for fund managers to implement short-term and arbitrage strategies as most assets are simultaneously affected by the same stimulus actions. Across the 1997-2016 period, the correlation among risky assets doubled from 0.15 to 0.30 (Figure 2A) whereas the correlation among S&P industry indexes increased from 0.54 to 0.69 (Figure 2B). Both these increases are statistically significant and therefore can be interpreted as one of the factors that impacted the performance of the hedge fund industry.

Figure 2A. Stock Correlations

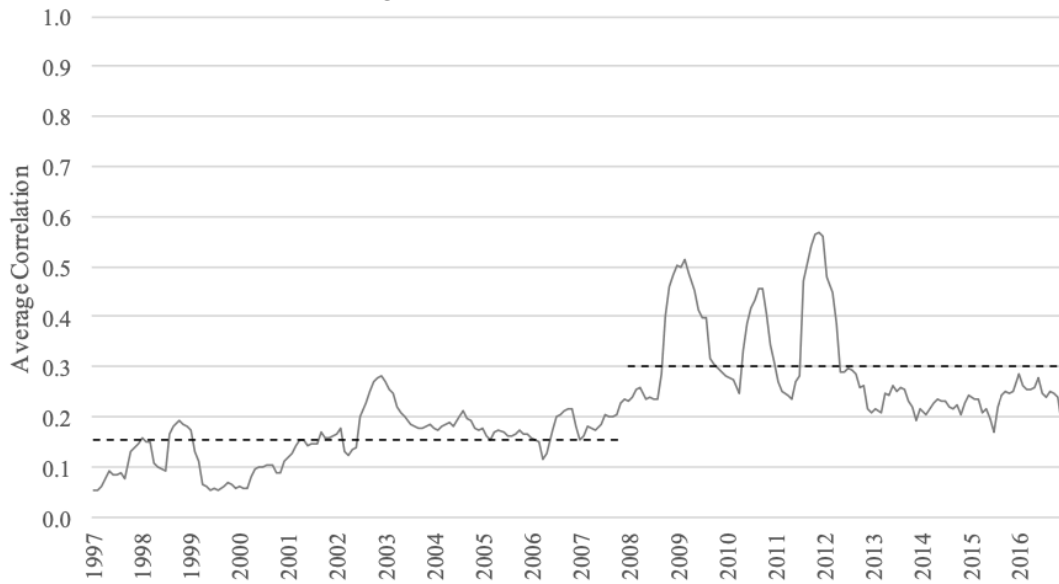


Figure 2B. Sector Correlations

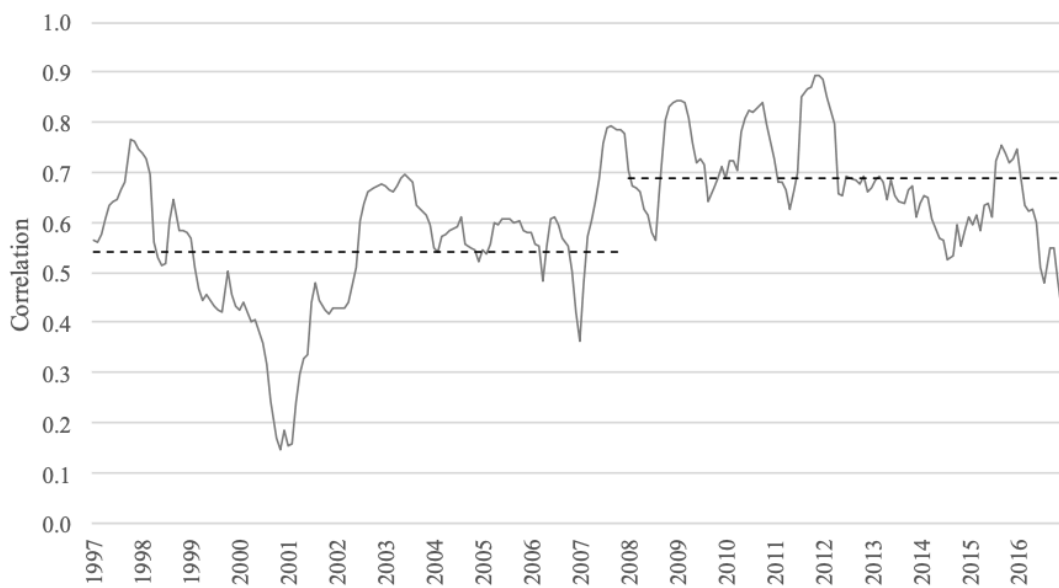


Figure 2: Equity Correlations

Source: N. Bollen, J. Joenväärä, M. Kauppila; 2021, "Hedge Fund Performance: End of an Era?"

The second factor that has significantly impacted the performance of the hedge fund industry following the 2007-2008 crisis has been the increased regulatory pressure as a consequence of the managerial misconduct that led to the crisis. This pressure culminated in 2010 with the passage of the Dodd-Frank Act which introduced a more

intensive regulatory scheme that increased the average hedge fund's regulatory compliance cost by \$150,000 per year. However, the effect of the Dodd-Frank Act also further restricted the possibility of performing illegal practices such as insider trading, other trading violations and various measures of misreporting, negatively impacting the observed hedge funds' performance.

Finally, the last economic-related explanation of the decline in performance of the hedge fund industry is related to the possibility of decreasing returns to scale. By running a regression it is possible to demonstrate that the coefficient of the industry size regressed on the hedge funds' returns is statistically lower than zero and around -0.28. This finding estimates that for every 1% in the hedge fund industry, hedge fund performance decreased by 28 basis points.

### 3.3. Warren Buffett's Bet Against the Hedge Fund Industry

Despite these economic factors only explaining the underperformance of the hedge fund industry during the Global Financial Crisis and the following recession, it is possible to argue that some other negative aspects of the hedge fund industry were already showing a potential underperformance of the industry. Observing and understanding these aspects on the 19th of December 2007 Warren Buffett decided to enter into a US\$1 million bet against the hedge fund industry, and more specifically, against funds of funds. Warren Buffet was convinced that over 10 years a passive investment in an index fund tracking the S&P 500 would have outperformed a portfolio of 5 funds of funds selected by Protégé Partners, a privately-owned hedge fund manager that decided to be the counterparty to Buffett's bet. The name of the funds chosen by Protégé Partners remained unknown, however, it was disclosed that the 5 funds collectively owned an interest in more than 200 individual hedge funds.

The prize for the bet was constructed by each partner purchasing US\$500,000 face amount of 10-year US government zero coupon bonds, acquired at an issuing price of US\$318,250. Then, the winner of the bet will receive the entire \$1 million face value at maturity.



The results of the bet (Figure 3) demonstrate a clear superior performance of the passive investment in the passive index fund compared to a diversified investment across 5 actively managed funds of funds. Despite the hedge fund portfolio incurring lower losses during the market drawdown of 2008, during the following years the average annual return of the funds never exceeded the return of the market. Furthermore, the cumulative average return of the 5 funds after the 10 years was +36.3%, around a fourth of the S&P 500's cumulative return which amounted to +125.8%.

<u>Year</u>	<u>Fund-of-Funds A</u>	<u>Fund-of-Funds B</u>	<u>Fund-of-Funds C</u>	<u>Fund-of-Funds D</u>	<u>Fund-of-Funds E</u>	<u>S&amp;P Index Fund</u>
2008	-16.5%	-22.3%	-21.3%	-29.3%	-30.1%	-37.0%
2009	11.3%	14.5%	21.4%	16.5%	16.8%	26.6%
2010	5.9%	6.8%	13.3%	4.9%	11.9%	15.1%
2011	-6.3%	-1.3%	5.9%	-6.3%	-2.8%	2.1%
2012	3.4%	9.6%	5.7%	6.2%	9.1%	16.0%
2013	10.5%	15.2%	8.8%	14.2%	14.4%	32.3%
2014	4.7%	4.0%	18.9%	0.7%	-2.1%	13.6%
2015	1.6%	2.5%	5.4%	1.4%	-5.0%	1.4%
2016	-3.2%	1.9%	-1.7%	2.5%	4.4%	11.9%
2017	12.2%	10.6%	15.6%	N/A	18.0%	21.8%
Final Gain	21.7%	42.3%	87.7%	2.8%	27.0%	125.8%
Average Annual Gain	2.0%	3.6%	6.5%	0.3%	2.4%	8.5%

Figure 3: Funds of Funds' and S&P 500's Returns

Source: W. Buffett; 2018, "2017 Annual Letter to Shareholders"

Warren Buffett analyzed the results by stating that the market did not achieve abnormal returns, averaging +8.5% per annum, a long-term gain that would have been forecasted by the majority of analysts at the time the bet was made. The main cause of the funds of funds' underperformance is caused by the double fee structure that helped fund managers generate significant personal returns while hedge fund investors underperformed the market. In the 2017 annual letter to shareholders, Warren Buffet commented: "Indeed, Wall Street "helpers" earned staggering sums. While this group prospered, however, many of their investors experienced a lost decade. Performance comes, performance goes. Fees never falter."

### 3.4. Hedge Funds' Performance Between 2016 and Today

To study the recent performance of the hedge fund industry it is possible to extend the timeframe of the previous example and to compare the results of the industry to the returns of the risk-free rate and the S&P 500. To do so, the hedge fund performance data is taken from Aurum, a hedge fund investment specialist who collects data about the industry and manages several funds of hedge funds portfolios. For the risk-free rate, instead, the estimation uses the average annual interest rate offered by the US government for 3-month treasury bills. Then, the S&P 500's returns are measured by the SPX index whereas the bond portfolio's returns are measured by the VBTIX total returns, which consider both capital gains and income returns.

Between the beginning of 2016 and the end of 2023, the hedge fund portfolio composed of around 4,500 funds collectively managing just below US\$3 trillion returned on average +5.32% with a standard deviation of 5.16%. Over the same period, the S&P 500 gained on average +12.44% per year with a standard deviation of 17.13%, whereas the bond portfolio represented by the VBTIX only gained on average +1.7% each year with a standard deviation of 6.98%. Finally, using the risk-free rate it is possible to estimate the excess return and its standard deviation to calculate the Sharpe Ratios of the portfolios. The hedge funds' portfolio achieved the highest ratio at 0.69, followed by the S&P 500's 0.63 and trailed by VBTIX's 0.02 (Table 3).

By constructing the 50-50 stocks and bonds portfolio and the 20/30/50 hedge fund, it is possible to observe the effect of the introduction of these alternative investments on the portfolio's returns, standard deviation and Sharpe Ratio. The 50-50 portfolio achieved an average annual gain of +7.07% and a standard deviation of 11.50%. However, by introducing the 20% allocation to the hedge fund industry at the expense of the S&P 500, both the returns and the standard deviation decreased to +5.64% and 9.12%, respectively. Furthermore, by adding the exposure to the hedge fund industry the Sharpe ratio worsened from 0.47 to 0.44 (Table 3).

Portfolios	Average Return	Std	Average Excess Return	Std Excess Return	Sharpe Ratio
HF	5,32%	5,16%	3,75%	5,46%	0,69
S&P 500	12,44%	17,13%	10,87%	17,21%	0,63
VBTIX	1,70%	6,98%	0,12%	7,06%	0,02
50-50 Stocks and Bonds	7,07%	11,50%	5,50%	11,58%	0,47
20/30/50	5,64%	9,12%	4,07%	9,23%	0,44
3-Month US T-Bill	1,57%	1,63%	-	-	-

Table 3: Portfolios' Returns, Standard Deviations and Sharpe Ratios Between 2016 and 2023

Sources: Aurum.com, Tradingview.com and Vanguard.com

To better represent the differences in return and volatility across the different portfolios it is necessary to chart the cumulative returns across the sub-period (Figure 4). From the graph it is possible to notice how the S&P 500 outperformed all other portfolios achieving a cumulative return of +133.8%. Trailing the S&P 500, the 50-50 portfolio concluded the period with a total gain of +65.24%. Then, the hedge fund portfolio and the 20/30/50 portfolio concluded at approximately the same cumulative return level, +50.10% and +50.88%, respectively. In last place, VBTIX with a cumulative return of +12.41% closing behind the +13.19% of the 3-month US T-Bills.

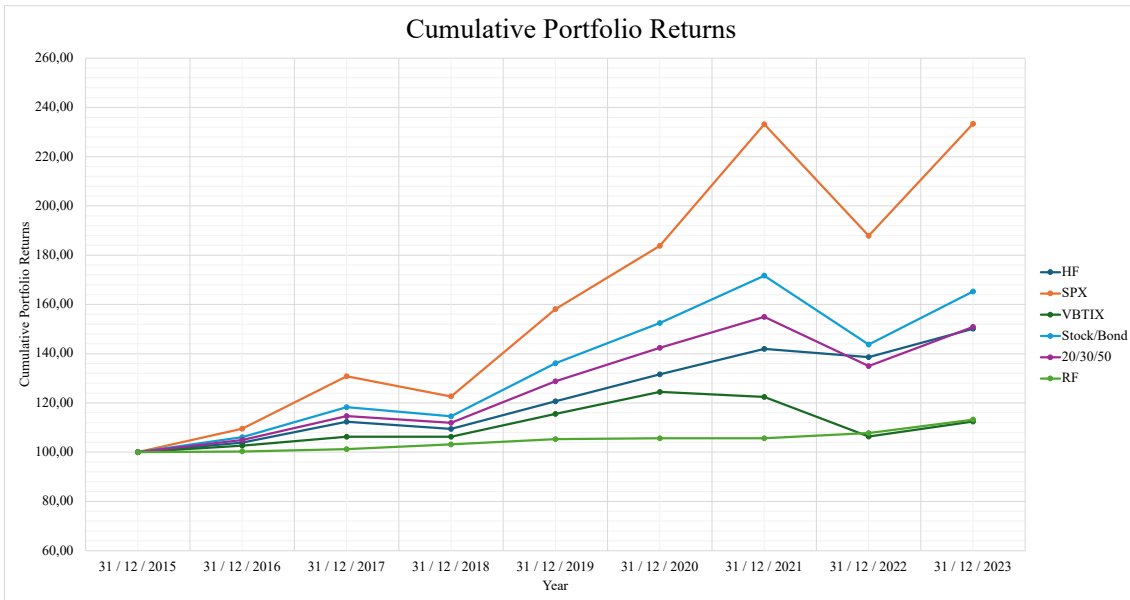


Figure 4: Cumulative Portfolio Returns Between 2016 and 2023

Sources: Aurum.com, Tradingview.com and Vanguard.com

Observing the cumulative returns presented in the above chart it is necessary to make some considerations. First of all, the last 8 years have been a unique period characterized by a pandemic and the sudden switch from an expansionary monetary policy to a restrictive monetary policy. After years of expansionary monetary and fiscal policies following the Global Financial Crisis, the Federal Reserve increased its interest rate from 0.25% to 2.5% between the end of 2015 and the end of 2018. Then, with the advent of the pandemic, the interest rate quickly reached 0.25% by the 15th of March 2020. The following two years were once again characterized by a period of expansionary monetary policy before the beginning of a further tightening cycle that culminated on the 26th of July 2023 when the Fed Funds Rate reached 5.5%.

This period of significant monetary policy changes and stimulus actions might have negatively impacted the hedge funds' returns as they did during the years following the Global Financial Crisis. Additionally, the higher interest rate environment generated by the tight monetary policy of the Federal Reserve caused a significant increase in the risk-free rate, reducing the excess returns and the Sharpe Ratios over the last 8 years and inducing a sharp decline in the price of debt securities causing a severe underperformance of the VBTIX index compared to previous sub-periods.

Finally, another factor that might induce a negative bias is the size of the hedge fund portfolio. In the previous analysis the hedge funds' portfolio was constructed by 15 random funds from the top-performing quartile, whereas in this case, the portfolio took into consideration a database with more than 4,500 funds. Therefore, restricting the number of funds and limiting the selection to the best-performing ones might improve the returns of the portfolios containing hedge funds' exposure and it might also reduce the risk of over-diversification. However, it would also probably decrease the standard deviation limiting the positive effect that the change would have on the Sharpe ratio.

## Conclusion

By analyzing the returns over the observation period it is possible to conclude that a modest portfolio allocation to hedge funds can significantly lower the volatility of the

traditional portfolio composed of stocks and bonds in equal proportions. Moreover, during the first sub-period, spanning from 1997 to 2007, the diversification benefit of hedge funds not only managed to decrease the portfolio volatility, but also to increase the average annual returns and the portfolio's Sharpe Ratio.

However, the benefits of allocating a portion of the traditional 50-50 portfolio to hedge funds kept decreasing over the years. In the second sub-period from 2008 to 2016 such introduction caused both a decrease in volatility and in the average annual return, significantly reducing the previous improvement of the portfolio Sharpe Ratio. Moreover, by analyzing the 20/30/50 portfolio returns between 2016 and today it was possible to notice how the simultaneous reduction in both returns and standard deviation led to a decrease of the Sharpe ratio below the one of the traditional portfolio composed of stocks and bonds.

The severe and progressive underperformance of the hedge funds industry has been attributed to various statistically relevant factors, including the regulatory changes introduced by the Dodd-Frank Act, the decreasing returns to scale of the industry and, finally, the monetary policy changes and stimulus programs that have been enacted in order to lessen the aftermath of the financial crisis and the pandemic.

Nonetheless, it must also be noted that on several occasions, including during the bear markets and periods of higher uncertainty and volatility, specific hedge fund strategies significantly outperform the broader market. For example, between 2000 and 2002 the MSCI All Country World Index suffered a loss of 47% following the burst of the "dot com bubble". However, during the same years equity market neutral funds just lost -0.4% and merger arbitrage funds -0.8%. Because of these reasons, there is enough evidence to conclude that hedge funds can still be considered as a reliable diversification instrument that can be adopted by more risk-averse investors to reduce the volatility of a traditional equally weighted stocks and bonds portfolio due to the diversification benefit that is obtained by allocating a modest portion of the portfolio to this alternative investment vehicles.

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