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Hedge funds operational strategies: evaluating the exposure of market risk factors on fund returns

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Introduction

Hedge funds have been the subject of both fascination and mystery due to their exclusive and secretive nature. Unlike other types of investment vehicles, hedge funds are typically only available to qualified or accredited investors and this has led to a perception that hedge funds operate in a world of secrecy and exclusivity, making them mysterious and alluring to many people. The hedge fund industry has experienced significant growth in recent decades and the hedge funds investment strategies have become increasingly important to understand. The global financial crisis has demonstrated that even financial experts are unable to predict all aspects of the future. The crisis, which began in the United States, quickly spread globally, resulting in consecutive drops in stock market indices. This underscores the interconnectedness of financial markets. Investing in these markets entails exposure to both regional and global risk factors, which can be challenging to anticipate. Hedge funds typically use a range of sophisticated investment strategies to generate high returns; however, it involves taking on greater exposure to market risks than traditional funds. Market risk refers to the potential financial loss resulting from changes in market prices, such as interest rates, foreign exchange rates, commodity prices, or equity prices. The purpose of this thesis is to provide a comprehensive overview of hedge funds structures highlighting the main features of this investment vehicle while providing a statistical analysis to evaluate the exposure of the market risk variables on the returns of the different strategies employed by the funds.

The first chapter discuss the hedge fund's structure and their various characteristics, including their historical evolution, types, typologies of investor, fee's structure, leverage adoption, costs, regulatory and fiscal framework highlighting the main difference across the globe.

The second chapter will focus on describing the different hedge fund strategies subdivided into three main categories starting from the less risky and less profitable to the high risky and high profitable: respectively, market neutral, event driven and directional strategies. This chapter will provide a comprehensive overview of the functioning and the main features of each specific strategy and serve as a base for the analysis conducted in the next chapter.

The third chapter will evaluate through a statistical analysis the exposure to market risk factors of hedge fund strategies to understand the magnitude and the direction of the relationship between these variables highlighting what factors impact the strategies the most. This research is based on previous works where the authors investigated the impact of market risk factors on the returns of hedge funds, as well as how the effects of these risk factors may differ across various hedge fund strategies. Keeping in mind these premises we will try to answer the following questions: How do market risk factors affect the return of hedge funds? How may the effects of these risk factors vary across different hedge fund strategies? This work has been accomplished using regression analysis and other statistic techniques to provide valuable insights into the magnitude and the direction of the exposure to the risks on the different hedge fund strategies, in particular we employed R-Studio to perform this analysis highlighting the main features of the multiple linear regression for each investment strategy. This work may serve as a base for further analysis, helping investors to make more informed decisions. Incorporating this information into risk models can help investors build more accurate models and make more informed investment decisions. However, since the Multiple Linear Regression model suffers from several limitations, we suggest further analysis to better understand the risk exposure of the different strategies.

Chapter 1 - Background on the Hedge Fund

This section presents a background of the hedge fund industry, focusing on the definition of a hedge fund, their structural characteristics, the fiscal and juridical aspects, highlighting the main differences between the U.S., Europe, and other offshore jurisdictions.

1.1 Definition of Hedge Fund

There is no universally agreed definition of a hedge fund, and this brings an aura of mystery around this instrument; William H. Donaldson, former S.E.C. Chairman, in a past interview tried to explain that "*The term 'hedge fund' is undefined, including in the federal securities laws. Indeed, there is no commonly accepted universal meaning. As hedge funds have gained stature and prominence, though, 'hedge fund' has developed into a catch-all classification for many unregistered privately managed pools of capital. These pools of capital may or may not utilize the sophisticated hedging and arbitrage strategies that traditional hedge funds employ, and many appear to engage in relatively simple equity strategies. Basically, many 'hedge funds' are not actually hedged, and the term has become a misnomer in many cases"* [1]

The S.E.C. defines hedge funds as *"Like mutual funds, hedge funds pool investors' money and invest the money to make a positive return. Hedge funds typically have more flexible investment strategies than mutual funds. Many hedge funds seek to profit in all kinds of markets by using leverage (in other words, borrowing to increase investment exposure as well as risk), short-selling and other speculative investment practices that are not often used by mutual funds*."[2]

[1] https://www.sec.gov/news/testimony/testarchive/2003test.shtml
[2] U.S. securities and exchange commission, Glossary: Hedge Fund, 2023
https://www.investor.gov/introduction-investing/investing-basics/glossary/hedge-funds

In the literature, there are different definitions of the term "hedge fund" provided by relevant international authors where each of them is focused on different features based upon their opinion; however, it remains difficult to narrow the "hedge fund" down into a single category.

Figure 1 Hedge Fund common features

HEDGE FUND FEATURES	
Accessibility	High barriers to enter
	May not be open to the public
Investment Strategies	Capacity constraints in terms of the amount of money that can be managed
	Lack of transparency
	Long and short position may be taken
Leverage	High usage
Regulatory Supervision	Low
Fees	Performance Fee
	Annual Management Fee
Liquidity	Minimum investment time horizon

Source: Author' elaboration from J. J. Caslin, "Hedge Funds", British Actuarial Journal, Vol. 10, No. 3, p.5 (2004)

J. J. Caslin in a paper published by Cambridge University Press on behalf of Institute and Faculty of Actuaries highlighted some features that hedge fund may have in common:[3]

Starting off in term of accessibility, hedge fund has high barriers to enter in term of minimum investment capital requirement; so that, hedge funds are limited to wealthier investors or large institutions who can afford the higher fees and risks of hedge fund investing; moreover, they may not be open to the public.

[3] J. J. Caslin, "Hedge Funds", *British Actuarial Journal*, Vol. 10, No. 3, p.5 (2004)

Secondly, the level of regulatory supervision may be low; indeed, hedge funds are not regulated as heavily as mutual funds and generally "*have more leeway than mutual funds to pursue investments and strategies that may increase the risk of investment losses*."[4]

One of the most important aspects is the investment strategy which may take long, and short position designed to obtain superior profits while providing an element of risk mitigation, or hedge, when markets decline because gains on short positions will cover losses on long positions.[5] Unfortunately, may be capacity constraints on the amount of money that can be managed within a hedge fund. In addition to that, investors may encounter a general lack of transparency or the "*ability of the investor to look through its investment portfolio to determine compliance with the fund's investment guidelines and risk parameters*"[6] , which may represent a limit to the use of this investment.

One of the main features that all the hedge funds have in common is the high usage of the leverage because it allows hedge funds to "*magnify their exposures and, as a direct consequence, magnify their risks."*[7] Moreover, hedge funds use leverage to boost low-risk strategy returns, to reduce risk levels, to improve liquidity and to cut transaction costs.

For what concern fees structures, they are structured at two levels, the annual management fee, and a performance fee. This structure, called "2 and 20" helps hedge funds to finance their operations. The 20% performance fee is charged on profits, rewarding the management team, while the 2% flat rate fee is applied on the total AUM, regardless of the performance of

[4] S.E.C., "Hedge Funds", Investor.gov, *Source: https://www.investor.gov/introduction-investing/investing-basics/investment-products/private-investment-funds/hedge-funds*
[5] Eric Stampfel, "Long Short Equity Strategies: "Hedging" Your Bets", Morgan Stanley Investment Management, AUGUST 08, 2022
[6] JAMES R. HEDGES IV, "Hedge Fund Transparency", The Hedge Fund Journal, TECHNICAL ISSUE 21, Oct. 2006
[7] Hedge Funds, "Leverage, and the Lessons of Long-Term Capital Management", Report of the President's Working Group on Financial Markets, April 1999

the investment; usually, used to pay the operational expenses such as staff salaries, administrative and office expenses. [8]

Lastly, commonly for all hedge funds, there may be a minimum investment time horizon, defined as a lock-up period before investors can withdraw their money.

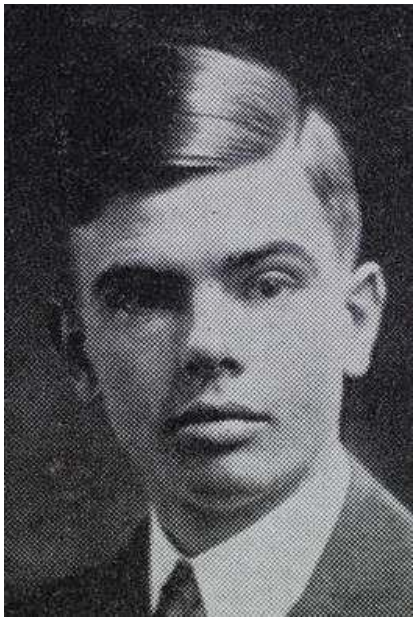
These features will be analyzed in detail in the next chapters.

[8] CFI Team, "2 and 20 (Hedge Fund Fees)", Corporate Finance Institute, Dec. 9, 2022

1.2 What are hedge funds?

In the 1949, Alfred Winslow Jones was the first person who introduce the concept of "Hedge Fund", an alternative investment vehicle able to integrate within a conservative investment system the short-selling and the leverage; so that, the fund's capital is both leveraged and "hedged". The leverage was used to obtain superior profits while exposing to greater loss; the hedge is provided by short position.

Figure 2.1 Alfred Winslow Jones, from his Harvard Yearbook



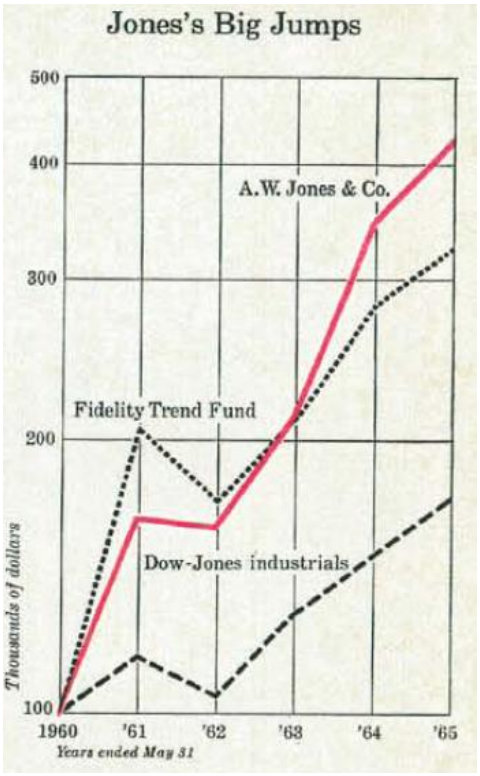
Source: Landrigan L., 2022, "THE UNLIKELY INVENTOR OF THE HEDGE FUND", New England Historical Society

Jon's strategy, to construct a portfolio 130% long and 30% short, consisted in the simultaneous purchasing of stocks with high growth potential and the short selling of stocks with opposite trends to partially defend him if he had made the wrong assumption on the general trend of the market. Moreover, he decided to introduce an annual performance fee of 20% on profits as an incentive for the General Partner (the asset manager) and any loss would have been replenished prior to the receipt of any future profit by the general partner.

This primordial hedge fund model has all the main characteristics of a contemporaneity hedge fund: the edging, the leverage, the performance as base for the general partner's compensation and lastly the general partner's direct financial participation in the fund. [9]

The performance of the Jones' fund, at that time, was astonishing; between 1955 and 1965 the fund gained 670% return compared to the 358% of the best mutual funds at that time and the 225% return of the S&P 500.

Figure 3.1 Jones's Big Jumps



Source: Carol J. Loomis, 1996, "The Jones Nobody Keeps Up With", FORTUNE Classic

The picture above illustrates the performance of Jones' found compared with the Dow-Jones industrial average and the Fidelity Trend Fund knew as the best mutual fund and the time; the comparison assumes initial investment of $100000 (net of sales charges and commissions),

[9] Manuli A. E., "Hedge Funds: I vantaggi di una forma di investimento alternativa", Jackson Libri, 2003

the reinvestment of all capital gains and dividends and it shows the Jones' fund gains after the annually deduction of 20%.

Jones's best years were 1961 and 1964, in which his investors made 65% meanwhile he had only a small dip during 1962 market slide where the "hedge" concept helped him to cut his losses. [10]

[10] *Carol J. Loomis, 1996, "The Jones Nobody Keeps Up With", FORTUNE Classic*

1.2.1 Historical Evolution

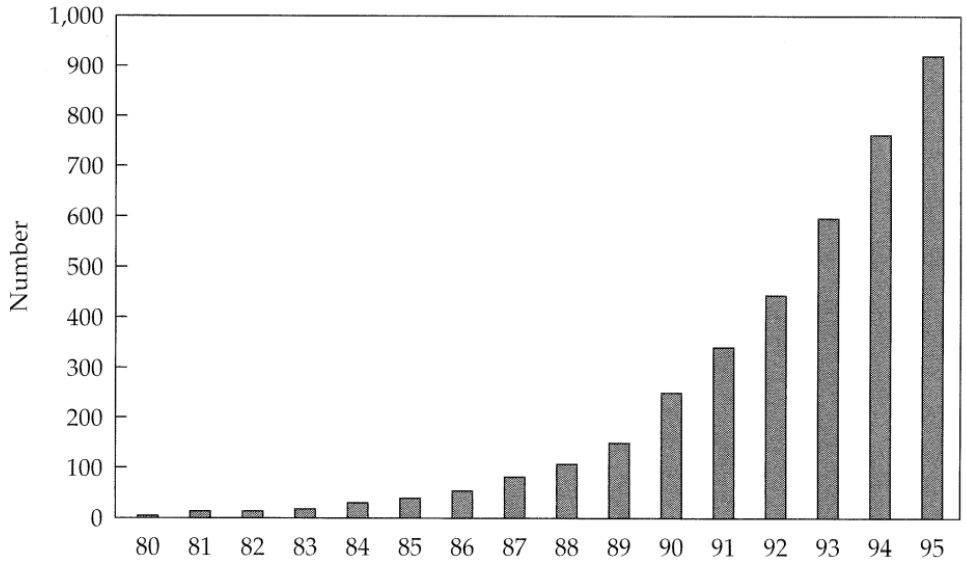
At the beginning of 1966 the hedge fund industry was still in its prime but after the publication, in the same year, of the article "The Jones Nobody Keeps Up With" on Fortune many investors and asset managers began to pay attention to Jones. The former was attracted by the high returns achieved in that period, instead the latter were more interested in increasing the profitability of their portfolio through the performance fee of 20%.

In the following years the hedge fund market size increased by 55% annually until the first crisis during 1970. Indeed, the new asset managers soon realized the difficulties and the costs to be incurred in hedging using the short-selling method; so many began to invest only in long positions, without "hedging", even though they still presented themselves as "hedge funds" to take advantages of the performance fee. The period between 1969 and 1974 was characterized by severe crises so that many players, especially those who had not understood the importance of the Jones' model during these periods, were kicked out and only a small percentage of funds survived.

After the first crisis, the hedge funds sector resurged in the 80s when many funds experienced extraordinary growth due to a combination of unconstrained investment style, the high usage of the leverage and the large movements in the currency and commodity markets combined with an increased interest from highly wealthy individuals and families.[11]

[11] On the Performance of Hedge Funds, Bing Liang, Taylor & Francis, Ltd.
Source: https://www.jstor.org/stable/4480184?seq=2#metadata_info_tab_contents

Figure 4: Growth of hedge fund between 1980 and 1995

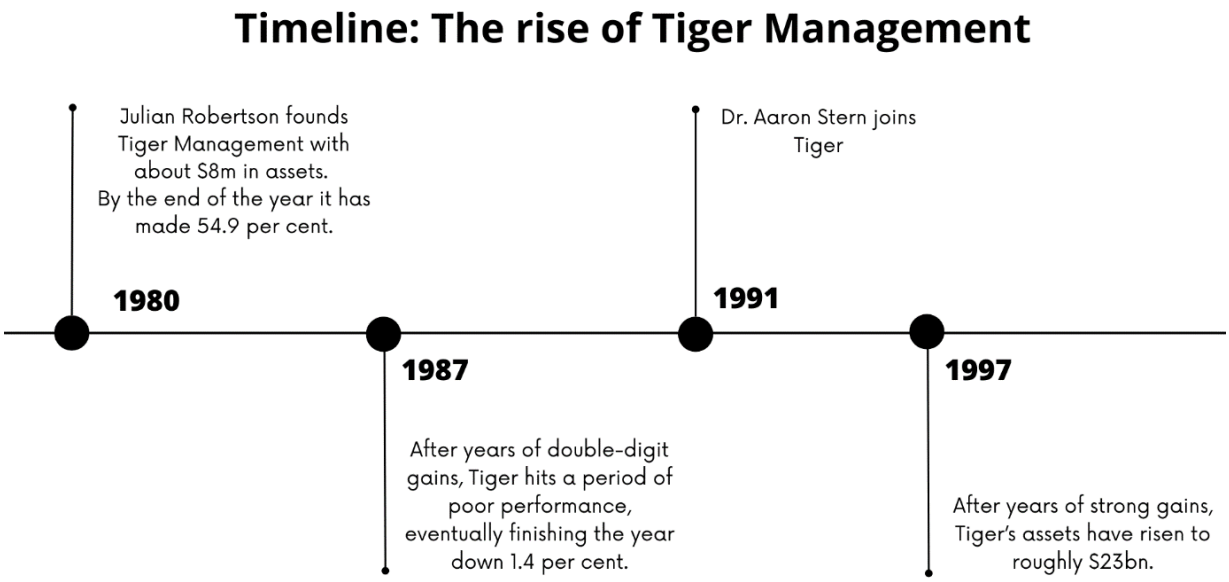


Source: On the Performance of Hedge Funds, Bing Liang, Taylor & Francis, Ltd

One example of a successful Hedge Fund in that period was the Tiger Management Corporation founded by Julian Robertson which began investing in 1980 with $8 million in capital reaching $23 billion in value during 1996.[12]

[12] Fletcher L. and Agnew H. "Tiger Cubs: How Julian Robertson built a hedge fund dynasty", FT, June 4, 2021

Figure 5 - The rise of Tiger Management



Source: Author' elaboration from Fletcher L. and Agnew H., "Tiger Cubs: How Julian Robertson built a hedge fund dynasty", The Financial Times Limited, 2023.

Hedge fund business picked up in the 1990s, fueled mainly by new wealth generated during the 1990s equity bull market.[13]Indeed, this era was characterized by the emergence of superstar managers concurrently with new investment strategies that covered a broad group of asset classes and styles of investment such as global-macro, distressed securities, multi-strategy, arbitrage etc... As mentioned earlier, in this decade many superstars were born including the Bridgewater Associates founded by nowadays renowned Ray Dalio, the Appaloosa Management, the SAC Capital Advisors and the Och-Ziff Capital Management. Despite the extreme success of many hedge funds, it is important to underline the first major failure of the sector, occurred in 1999 by the company Long Term Capital Management due

[13] " Demystifying Hedge Funds". IMF, Vol.43 n.2, June 2006

to the company's highly leveraged nature, combined with a Russia's financial crisis in ignited by the default on its debt declared in August 1998. In that moment, LTCM hold a significant position in Russian government bonds and as consequences it suffered massive losses and when they approached $4 billion loss, the Federal government of the United States orchestrated a bailout to calm down the markets creating a $3.65 billion dollar loan fund enabling LTCM to survive and liquidate in an orderly manner in early 2000. That is because if LTCM had gone into default, it would have triggered a global financial crisis.[14]

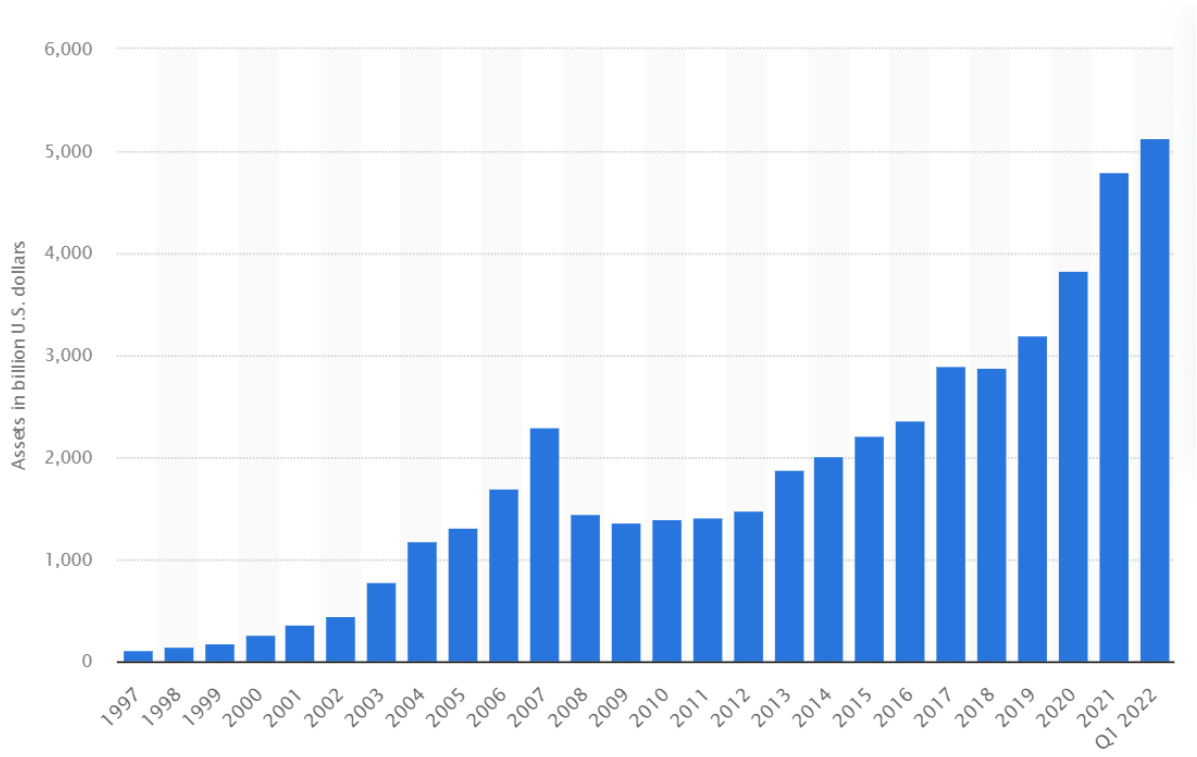
At the beginning of the new century the hedge fund industry moved further into the mainstream; indeed, after the dotcom bubble burst the AUM increased ranching almost $2 trillion by 2008 due to the entry of new investors such as pension funds, insurance companies and sovereign wealth funds. However, one of the most significant events of that decade was the 2008 financial crisis, ignited by the sub-prime loans crisis, which challenged the hedge funds sector resulting in the failure of lots of funds. Indeed, some authors gave possible answers to these hedge funds' failure such as the restrictive measures taken by the authorities (S.E.C.), which have prohibited the short selling during the most critical phases of the crisis damaging non only the founds that have adopted direction strategy but even all the other funds that needed short positions to protect themselves from market downturn. Secondly, the subprime crisis spread its effects across different asset classes and different markets at the same time, thus nullifying the diversification portfolios strategy; moreover, the high levels of volatility may have helped to generate unreliable trading signals for different funds which based their strategy on arbitrage techniques, and it may have disturbed in a generally way the models used for the study of markets. Lastly, another reason to the hedge funds failure could be traced back to a credit crunch issued by banks because it has prevented hedge funds from finding the resources needed to correctly conduct their investment strategies after suffering

[14] Hayes A. "What Was Long-Term Capital Management (LTCM) and What Happened?", May 2021

losses because of the bankruptcy of Lehman brothers, from which the hedge funds used for prime brokerage services.[15]

The 2010s was characterized by the introduction of the Dodd-Frank Act in direct response to the 2008 crisis, leading to greater requirements for registering and reporting to the SEC. Moreover, the Alternative Investment Fund Manager Directive (AIFMD) was introduced, which forced hedge funds to upgrade their compliance and operational frameworks. Another important regulation introduced was the Volcker Rule that prohibited banking entities from engaging in proprietary trading or investing in/or sponsoring hedge funds or private equity funds.[16] The result of these regulations led to a growth of barriers to entry; however, hedge funds rebounded well from the financial crisis proven by the AUM increase from $1.4 trillion in 2011 to $3 trillion in 2019.

Figure 6 Value of assets managed by hedge funds worldwide from 1997 to Q1 2022



Source: Statista, 2022

[15] Strömqvist M. "Hedge Funds and Financial Crises", Sveriges Riksbank Economic Review, 2009

[16] Board of Governors of the Federal Reserve System "Volker Rule", *https://www.federalreserve.gov/supervisionreg/volcker-rule.htm*

Despite the increase in the AUM, the 2020 was characterized by the COVID´19 pandemic started in February 2020 that was unprecedent, referring to the scale and speed of the impact of external movements on the markets.

Hedge funds could perform better in the middle of turbulence phases; however, in situations of difficult predictability, the consequences can vary. Indeed, the first quarter of 2020 was characterized by a negative record in terms of startups and liquidation and in addition, there were a significantly reduction of the performance and management fees, respectively 16.40% and 1.38% highlighting the entire market sufferance. These initial months of 2020 have been distinguished for the high volatility and greater loss; however, the subsequent resumption has led to remarkable results.

2021 was characterized by a strong positive trend, in particular way the first half of the year. Indeed, the main actor that led to strong performance have been the reopened trade positions and the dynamical activities of IPO and M&A.[17] However, in November 2021 the hedge funds sector has a setback due to the new emerging variant, the Omicron, that ignite a big selloff where equities and macro hedge funds suffered big losses. [18] Despite these harsh last months of 2021 marked by high volatility with interest rate hikes and new variants, the total AUM in 2022 reached more than $5 billion, the highest result ever reached by the industry.

According to data from Hedge Fund Research (HFR) in 2022, the hedge fund industry experienced a significant loss of assets due to performance losses, with almost $125 billion in assets leaving the industry. This was the result of the volatility caused by various events, including high inflation, interest rate hikes, and geopolitical tensions. As a result, investors rethought their investments in hedge funds, leading to a net outflow of $55 billion, the largest capital flight from the industry since 2016. The worst-performing strategy was buying and

[17] Forbes, "State of The Hedge Fund Industry at Year-End 2021", 2021
[18] Hedgeweek, "Hedge funds hammered after Omicron variant spooks market", 2021.

selling stocks, which lost $112.5 billion, and saw a net outflow of $40.4 billion in investor money. The only strategy that saw an increase in investment was event-driven mergers and acquisition and credit funds, which attracted $4.3 billion in investor money. Despite the challenges, the size of the hedge fund industry grew in the fourth quarter of 2021 to $3.83 trillion, representing a quarterly increase of $44 billion. HFR's president, Kenneth J. Heinz, noted that strategies that demonstrated their ability to navigate extreme market volatility are likely to attract capital in the future. Overall, the hedge fund industry experienced a difficult year in 2021, with a 4.2% decline in performance, the worst since 2018. Equity strategies were particularly affected, falling 10.21%, but still outperforming the S&P 500, which fell 19.4% in its worst year since 2008.[19]

[19] Mackenzie N. “Hedge fund industry lost $125 bln worth of assets in 2022 – HFR”, Reuters, 2023

1.3 Hedge Fund Features

The hedge fund world is composed of many funds in continuous evolution. Indeed, there are several types depending on size, investment strategy, fiscal residence, services provided, etc. The most often used structures are the offshore corporation, limited partnership, and the limited liability company. A typically U.S. hedge fund is formed through the Limited Partnership (LP) model, which consists of a general partner, that is an investment professional which determine the investment strategies and execute them, and limited partners, usually a non-investing professional such as pension funds, college institutions, wealthy individuals, endowments and so on.

The general partner acts in the name and on behalf of the principal and has unlimited liability in the case of failure; however, money manager of offshore funds enjoys limited liability because the hedge funds are formed using the LLC type. On the other hand, the limited partners enjoy limited liability; they may lose at most the capital invested in the fund. Investors share the partnership's income, expenses, gains, losses, and taxation according to their respective share of the partnership.

Hedge funds utilize service providers to support their operations such as prime brokers, executive brokers, administrators, and auditors. Prime broker offers a wide range of services to the hedge fund such as clearing and settlement of securities transaction, acting as counterparty to derivative contracts and provides lending securities service for long/short investment strategies and convertible bond arbitrage strategies [20] , custodial services, research capabilities and the most important, leverage and short-term financing, so that they establish how much to lend to each of its client in order to help the hedge fund to gain margin and execute trades. Usually, they are investment divisions of large investment banks such as

[20] Fabozzi F.J. "Handbook of Finance, Financial Markets and Instruments", Wiley, p.749

UBS, Morgan Stanley, Credit Suisse, etc., subjected to the federal regulation which has an indirect effect over the hedge fund activities. Another type of actor that deals with the hedge fund is the executive broker which is responsible for the transaction, the distribution of the securities and the marketing required by its client, ensuring that it complies with policies and procedures.

The examination of financial information in accordance with the standard accounting practices and the International Financial Reporting Standards are carried out through independent accounting firms which perform auditing on the fund's financial statements verifying the fund's Net Asset Value[21] and the Asset Under Management to make sure that the fund's activities are made in accordance with the law and to protect of investors from potential threats.

Lastly, the hedge fund may hire and hedge fund administrator that supports the investment manager with the operation management, accounting procedures, process subscriptions, redemptions and the most important, the evaluation of the fund's Net Asset Value. The fund's NAV calculation is a crucial task because it determines the price at which investors buy and sell shares or units of the fund. [22] It includes the pricing of securities at the current market value and the calculation of fund's expenses and income, the calculation of fund performance, the fees and financial reports. The line that brings the world of hedge funds within uniform boundaries is found in the legal form, in the harsh relationship between

[21] Net asset value (NAV) is defined as the value of a fund's assets minus the value of its liabilities. The NAV formula is as follows:
Net Asset Value = Value of assets – Value of liabilities
Where:
- Value of assets is the value of all the securities in the portfolio.
- Value of liabilities is the value of all liabilities and fund expenses (such as staff salaries, management expenses, operational expenses, audit fees, etc.)

The NAV is typically represented on a per-share basis. In such a case, the formula would be:
Net Asset Value = (Value of assets – Value of liabilities)/Total shares outstanding

[22] AIMA "Guide to Sound Practices fo Hedge Fund Administrators", Sept. 2009

managers and investors due to the lack of transparency and in some typical structural characteristics that represent the very foundation of their existence.[23]

1.3.1 Types and Structures

Fund types match the diverse needs of the investors like tax exemptions, limited liability, better transparency, and high protection; to give a comprehensive idea of the different typology of funds, a table below will resume the most used hedge fund types and the relative features.

Figure 7 - Hedge Fund Types

Commingled Fund	Managed Account	Fund of One	Listed Fund	UCITS	Alternative Mutual Fund
Pool capital from multiple external investors into one account	The manager is limited to making investment decisions on behalf of a single investor	One dedicated investor	Usually listed and traded on a small market exchange	Come under the European regulatory framework	Registered as mutual funds under the United States Investment Company Act of 1940
Advised by the fund manager	Sub-advised by the fund manager	The fund manager will have ultimate liability	Subject to a greater degree of scrutiny	High levels of investor protection	Adopts hedeg funds strategies
Assets shared by all investors in the fund	Individual investor will own the actual assets being invested in	Benefits of customization	Portfolio of assets invested does not need to be disclosed	Can be marketed to investors across the EU	Daily liquidity
Most traditional fund type	Reduction in the risk	Manager retains control over the fund strategy and the assets invested in		Fortnightly liquidity and monthly transparency	Periodic transparency documentation
	Full transparency	Often structured as a limited partnership		Underlying investments and level of leverage are regulated	Restriction on underlying investments
	Investor can nominate their own service providers			Smaller returns	Cap on leverage
	Often require a sizable capital commitment			Lower performance fee	

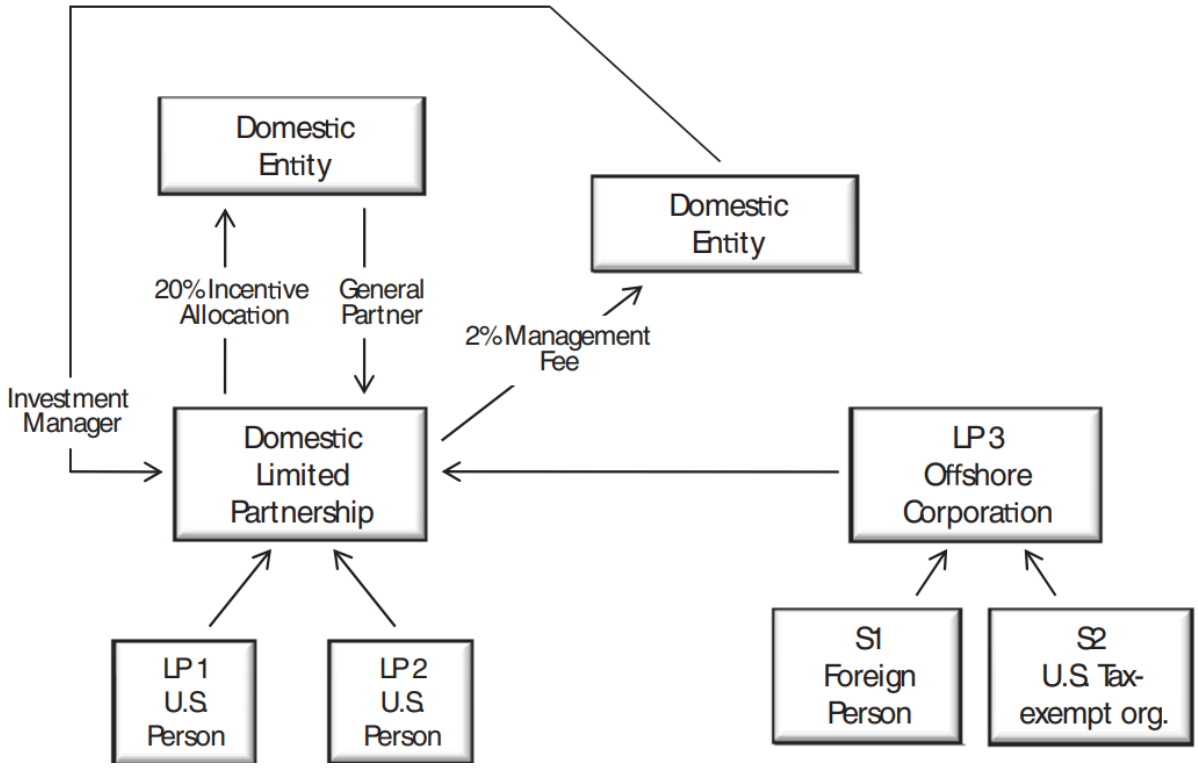
Source: Author' elaboration from Preqin, "Hedge Fund Fees, Types, and Structures", Sept. 2020

[23] Manuli A. E., "Hedge Funds: I vantaggi di una forma di investimento alternativa", Jackson Libri, 2003

Hedge funds are typically structured in Master Feeder, Side-by-side, and the Standalone forms, depending on where the fund is registered (Domicile), the investors' location and the investment criteria adopted by the hedge fund. However, entrepreneurs may choose other legal structures such as OEIC, open-ended investment companies, SICAV typically used in Western Europe, QIF defined as qualifying investor fund aimed at Ireland-based investors and so on. The first four categories will be analyzed.

The Master Feeder fund is aimed to invest capital raised by U.S.-taxable, US-exempt, and non-US investors and pooling it into one central master fund.

Figure 8 - Classic Master-Feeder Structure

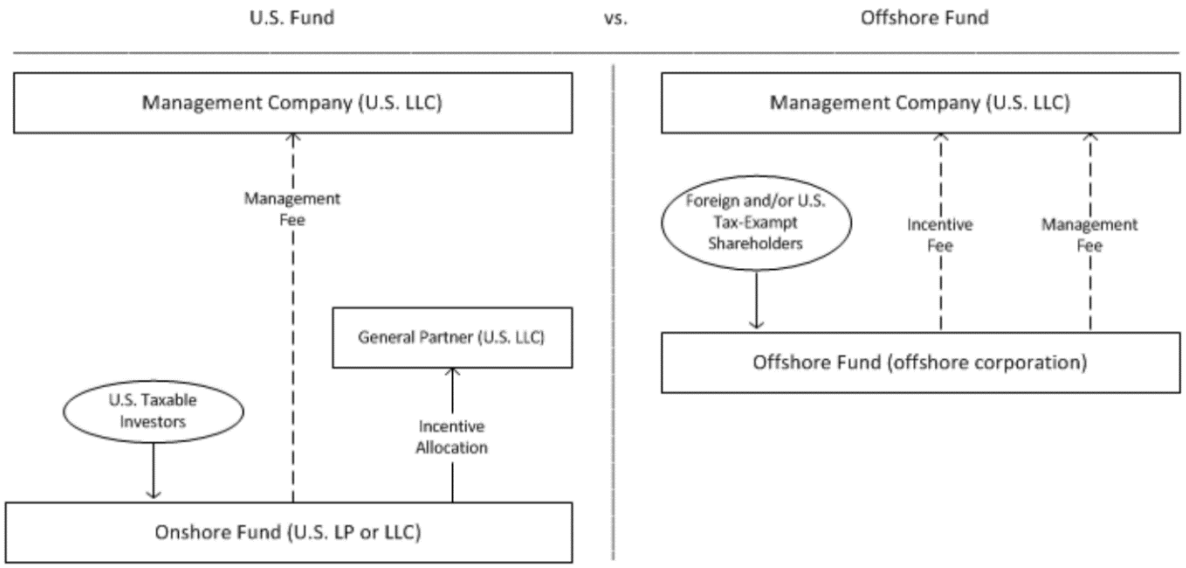


Source: Daniel A. Strachman, "The Fundamentals of Hedge Fund Management", Second Edition, 2012

Usually, the Master Feeder fund, where feeder means "Separate investment vehicles" is registered into an offshore country and subject to that country's jurisdiction for a tax purpose and the capital flows in it through two separate dedicated funds were investors put their money in: one dedicated for US-taxable investors and another one aimed for Non-US and US tax-exempt investors. The major advantages that this structure has are the greater pool of capital that flows into the master fund, the consolidation of various portfolios into one entity, the economies of scale which contribute to operation efficiency improve while reducing operating and trading costs, the benefit for investors to pay fees at the feeder-fund level only and more favorable terms offered by financial institutions.

Side-by-side fund structure, as its name suggests, invests alongside another fund. Indeed, it provides that US-based investors run investment activities in an onshore US-fund using the limited partnership meanwhile managing an off-shore fund aimed to replicate the onshore fund' performance, holding the same investment strategy.

Figure 9 - Side-by-side structure

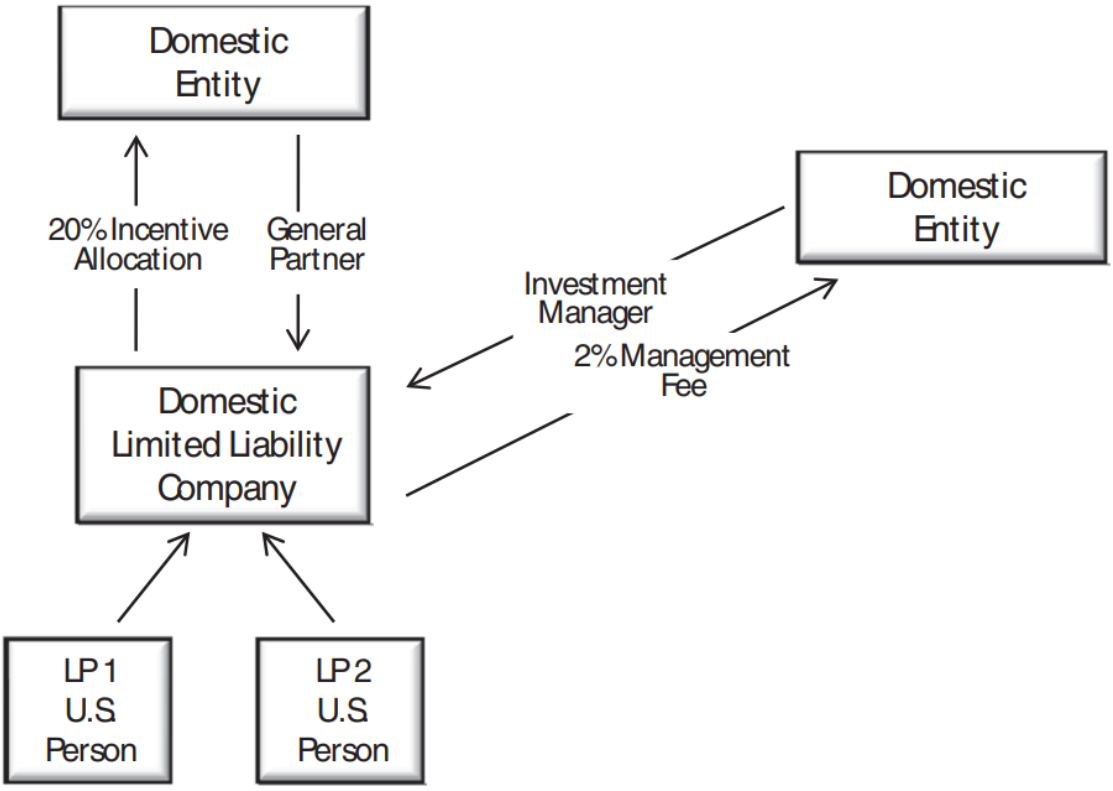


Source: Kalajian N., "Private Fund Structuring "101"", ValueWalk, June 2020

It is recommended for funds which use certain strategies such as a fund of funds strategy. However, the main constraint of this model comes from the difficulty encountered by the manager allocating the trades to both funds while trying to achieve the same returns.

The third most used structure is the standalone or single fund structure widely spread across offshore funds which raise capital from non-US investors or only to US tax-exempt investors[24]

Figure 10 - Simple Onshore Structure



Source: Daniel A. Strachman, "The Fundamentals of Hedge Fund Management", Second Edition, 2012

This figure above illustrates a classic stand-alone fund structure that simply replaces the limited partnership with a limited liability company. For reasons best known to the drafters

[24] Preqin, "Hedge Fund Fees, Types, and Structures", Sept. 2020

of the fund documents, they prefer the limited liability company. The general partner can, in certain situations, suffer more adverse income tax consequences from this structure.[25]

1.3.2 Qualification of Investors

For hedge funds, whose are in exemption from registering as investment company, where securities are not publicly offered, and with a number of investors up to 100, falling under the Section 3 (c) (1) of the Investment Company Act provision; interests are offered to potential investors in accordance with the rule 506 of Regulation D of the 1933 Securities Act. Under this Regulation, securities may be offered to accredited investors and up to 35 sophisticated investors. The latter are considered sophisticated since it is believed that they and their purchaser representatives have experience and knowledge to correctly evaluate risk and opportunities for hedge fund investing. On the other hand, for accredited investors we refer to *a natural person with an individual net worth, or joint net worth with his or her spouse, at the time of purchase more than $1,000,000.*

A natural person *with an individual income more than $200,000, or in excess of $300,000 with his or her spouse, in each of the two most recent years and who has a reasonable expectation of an income in excess of $200,000 individually, or in excess of $300,000 with his or her spouse, in the current year*.

A natural person who holds the title of *executive officer, director, or general partner* of the company of the securities offered.[26]

An employee benefit plan within the meaning of Title I of the Employee Retirement Income Security Act of 1974, as amended ("ERISA"), (a) whose investment decisions are made by a

[25] *Daniel A. Strachman, "The Fundamentals of Hedge Fund Management", Second Edition, 2012*

[26] Sadis & Goldberg, "Qualification Of Investors In A Section 3(C)(1) Hedge Fund", 2011

plan fiduciary, as defined in Section 3(21) of ERISA, which is either a bank, insurance company or registered investment adviser; or (b) having total assets in excess of $5,000,000; or (c) if self-directed, the investment decisions are made solely by persons that are accredited investors;[27]

A trust, directed by a sophisticated investor, with more than $5,000,000 in assets, not originally aimed at the specific purpose of hedge fund investing and an entity in which *each of the equity owners are accredited investors*.

On the other hand, funds that fall within Section 3 (c) (7) with more than 500 investors, securities are offered only to qualified purchasers. The term, qualified purchasers, includes: Any natural person with $5 million in investment and any other person, including institution investors that owns and invests frequently at least $25 million. [28]

Understanding hedge funds strategies may be hard for the investors and often is the same fund manager whose complicate the situation, not providing sufficient information on its work. The main information is reported on the offering document or memorandum which present the investment goals, the fees, the expenses, the risks associated with the investment, the profit/loss allocation methods, the minimum investment required, the window during which the capital remains tied, the fiscal policy and the main information regarding the strategy adopted by the manager. Moreover, only with the memorandum, future offering could be advanced, legally.

This document is extremely important for the investors because it allows them to understand, from the beginning, the risks connected to hedge fund investing. However, it often results in not being sufficiently useful for a right investment evaluation.

[27] https://www.sec.gov/Archives/edgar/data/1177845/000110465907071145/a07-17371_9ex10d1.htm
[28] Sadis & Goldberg "Qualification of Investors In A Section 3(C)(7) Hedge Fund", 2011

Considering the lack of information and the inability to correctly evaluate the information (limited rationality) we are in a contest of asymmetric information, defined as a situation where some participants in an economic transaction have access to more, or better, relevant information than other participants.

A perfect scenario is represented by what happened to the Ufficio Italiano Cambi, which in the autumn of 1998 was involved in a sensational financial crash due to lack of sufficient information on the investment they were going to make and without conducting a correct risk evaluation, has invested $ 250 million in the American Hedge Fund LTCM which with its fall drag the whole financial system down.

After this crash, the problem of transparency and lack of regulation has been placed at the center of a debate that sees two opposing sides: who proposes a adoption of more rules and those who defend the free movement of capital. However, the lack of transparency and absence of a correct regulation are not the only main causes of the hedge funds 'issues; instead the investors should had have an active role on the supervision over the manager and the responsibility must be found in all those financial institutions which have not conduct an appropriate analysis of the way these funds were investing.

1.3.3 Liquidity

Hedge funds liquidity is one of the main appealing factors that attract investors to invest in this typology of alternative assists because compared with other investments such as private equity, real estate funds, private debts, venture capital, hedge funds can provide better level of liquidity. The liquidity or relative illiquidity depends on the fund's strategies; for example, a long/short strategy can provide superior liquidity provision than an event driven strategy. Furthermore, the liquidity depends on the restrictions around the capital accessibility such as the maximum leverage imposed by the fund that result in a limit on the amount that the investment manager can borrow against the committed capital from investors or imposing a fund limit in the number of investments that an investor can make in each time, called subscription frequency. Another frequently used capital restriction is a gate provision, that limit the capital redemptions during bad times; they may be imposed at the fund level as well as investors level.[29] Lastly, commonly capital restriction to the hedge funds industry is the lock up period in which accredited investors cannot redeem company shares before a certain date. This time constraint could be explained through several reasons:

Figure 11 - Lock Up Reasons

Lock-up reasons
Keep away investors with short investment horizion
Avoid amministrative issues due to high cash flow movements
Allows the investment manager to reach is long term investment goals
Avoid "Bank Run" in bad periods

[29] Preqin, "Hedge Fund Fees, Types, and Structures", Sept. 2020, p.3

Source: Author 'elaboration from Preqin, "Hedge Fund Fees, Types, and Structures", Sept. 2020, p. 3

A first difference could be found in the hedge fund situated in USA and those situated in tax heaven; indeed, the former has a lockup period range between 3 and 12 months instead the latter offers more favorable terms referring to minimum of 1 month lock up period.

Nevertheless, the whole alternative investments require long investment time horizon to reach a goal, the hedge fund remain the investment vehicle with highest liquidity compared with other alternative investments such as the venture capital or private equity where they require a minimum of 5 years to a maximum of 10 year lock up period due to the nature of the investment itself, increasing the risk exposure of the investment capital.[30] For this reason, the hedge fund investment should be consider the best option when an investor seeks for high liquidity.

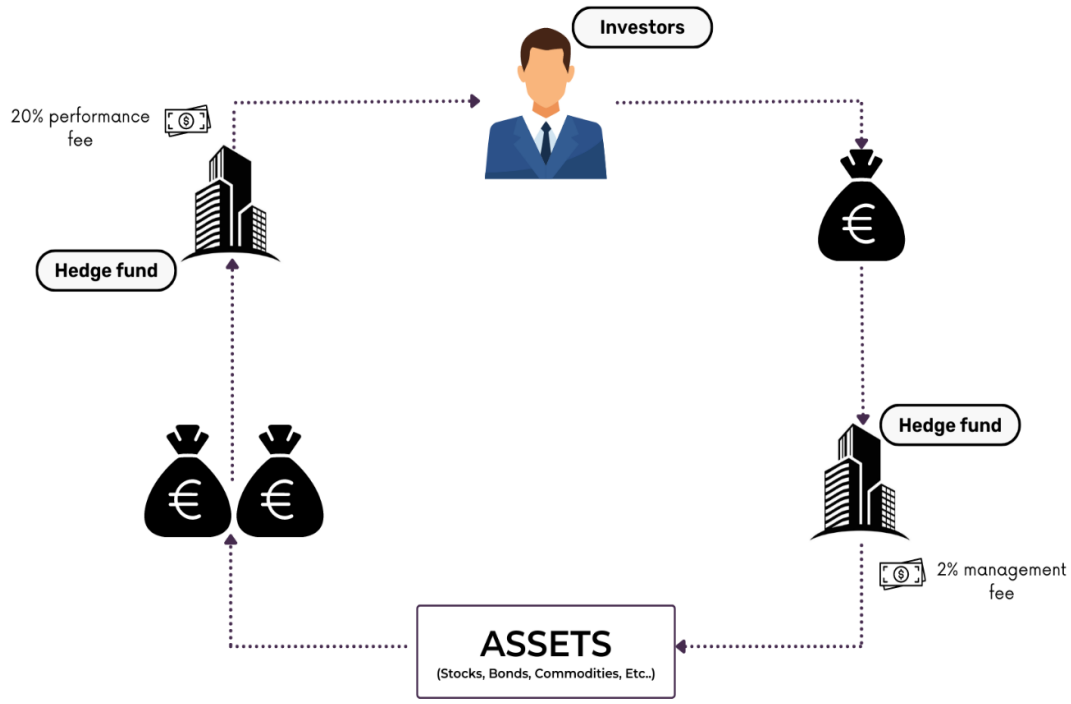
1.3.4 Fees Structure

A key feature that distinguishes hedge funds is the 2 and 20 fee structure, respectively:

- Management Fee: annual fee charged by a manager to finance their operations. The fee is typically 2% of a fund's net asset value NAV over a 12-month period.
- Performance Fee: The 20% performance fee charged on profits serves as a reward for the management team.

[30] Manuli A. E., °Hedge Funds I vantaggi di una forma di investimento alternativa°, Jackson Libri, 2003

Figure 12 - Hedge fund fees structure



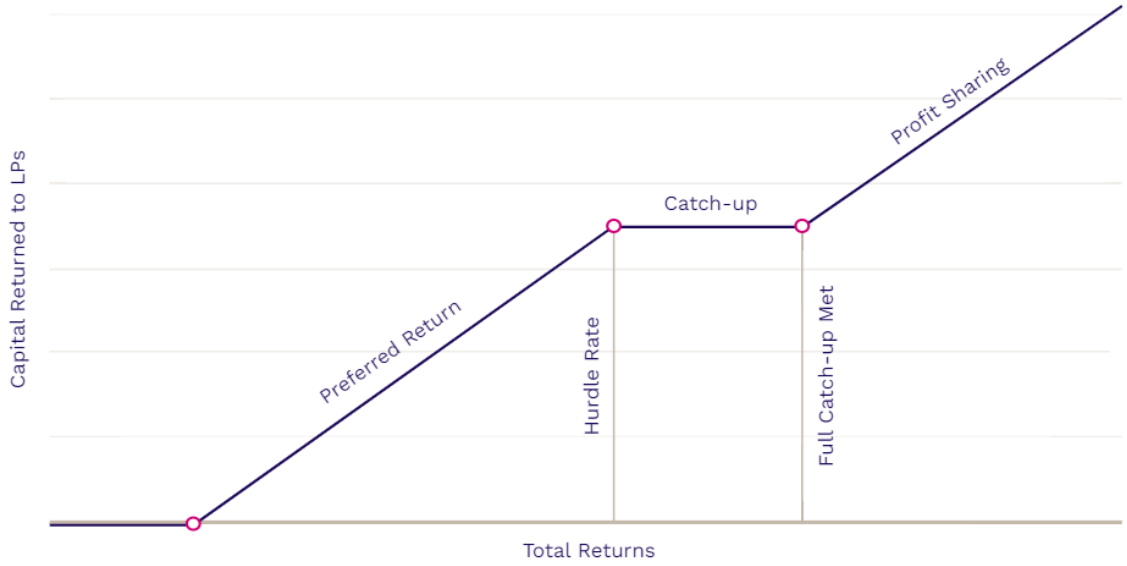
Source: Author 'elaboration from Preqin, "Hedge Fund Fees, Types, and Structures", Sept. 2020, p. 3

Preqin's research, conducted in 2019 figured out that the hedge funds are facing more pressure to reduce fees. Indeed, *Preqin has observed marginal decreases to the industry's fee structure, to an average of 1.50% management fee and 19.00% performance fee* [31]

A hurdle rate, defined as the minimum rate of return that the investment professional should generate before earning the performance fee, helped to ensure performance fees are not previously taken, which may trigger investors to exercise a claw-back provision, so they can receive back any fees paid equal to the earlier percentage accordance agreed.

[31] Preqin, Lesson 3: Hedge Fund, Sept. 2020

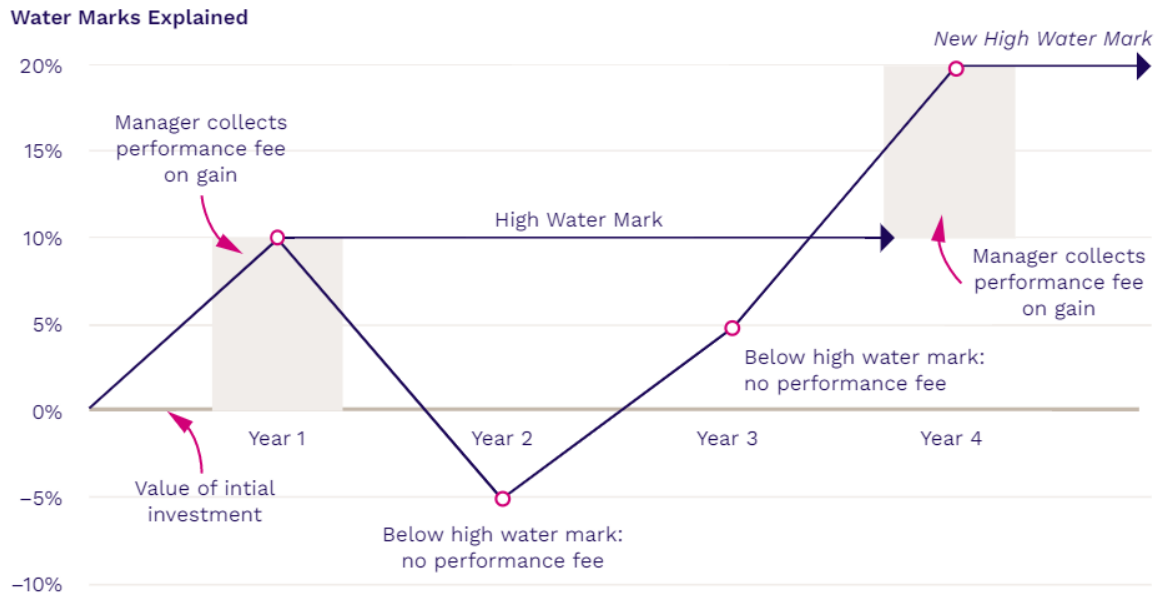
Figure 13 - Hurdle Rate Explained



Source: Preqin, "Hedge Fund Fees, Types, and Structures", Sept. 2020, p. 3

As you can see in the chart above, a certain amount of preferred return must be reached in order to reach the hurdle rate; after that, there is a window span time when costs associated with the investment are paid and only then the remain returns enter the profit-sharing region, where investors gain profits and performance fees are charged upon them. Hedge funds may include a high-water mark mechanism, as well. In this case, the investment manager will only be paid fees if the fund value exceeds the highest value that that hedge fund has ever reached as well represented by the figure below.

Figure 14 - Water Mark Explained



Source: Preqin, "Hedge Fund Fees, Types, and Structures", Sept. 2020, p. 3

This mechanism serves as incentive for the investment manager because performance fees are only paid on new profits generated instead of only over profits because, following the Preqin research, *that simply offset the losses of previous years.*[32]

Finally, if a hedge fund adopts both the hurdle-rate and the high-water mark, the investment manager will receive a performance fess only if the fund value is higher than high-water mark while exceeding the hurdle rate.

1.3.5 Leverage and Risks

Since successful hedge funds have excellent internal credit standing with banks and brokers, they have access to, and are extensive users of leverage, a common hedge fund's feature that has always attracted investors. Indeed, researchers in a study on the dynamics of hedge fund leverage reported to the Lipper TASS data during a 16-year period from January 2002 to

[32] Preqin, Lesson 3: Hedge Fund, Sept. 2020

December 2017 estimated that over 73% of the fund/months use leverage.[33] Leveraging results in magnifying returns and losses while increasing the economic clout of these funds, especially creating a multiplier effect in the event of losses as for example what happened in the US turmoil bond market during 1993-94, where hedge funds contributed to increase market volatility due to the substantial leverage position they held.[34]

The Federal Reserve in a previous research conduct over a dataset collected by the SEC suggested that, both on-balance-sheet leverage and gross leverage remained above their historical averages, however *the use of hedge fund leverage had decreased between mid-February and mid-August (2022) amid tighter price and nonprice borrowing terms.*[35]

As mentioned above, leverage may be used to amplify returns, an explicit case is the usage of this instrument for the long/short strategy where once the investment manager has selected the shorted securities for which they immediately receive cash used to buy more securities than what the fund originally could afford; however, the manager *must buy the shorted security back later, so there is a risk of price appreciation of the underlying security, which would drain cash in the future*.[36]

Another explicit use of leverage is for derivatives such as future, swap, options and forward contracts that exposes the buyer to amplified price movements in the underly securities with the benefit of a small fraction of cost and without put the capital that would be needed in the underling's market.

Moreover, leverage is used to magnify low-risk strategy returns as in case of the arbitrage trades, risk mitigation (common to all the hedge funds) for example using the long/short

[33] Wiley Online Library, "Hedge fund leverage: 2002–2017", European Financial Management, Volume 25, Issue 4 p. 908-941
[34] Eichngreen B. Mathieson D. "Hedge Fund and Financial Market Dynamics", IMF, May 1998, p.34
[35] "Financial Stability Report – November 2022", Federal Reserve
[36] Preqin, " Hedge Fund Fees, Types, and Structures", Sept. 2020

strategy, liquidity improving, especially in the commodities market where taking position in derivatives increase strategy efficiency than the commodity itself [37], and to reduce cost associated with transactions.

1.3.6 Direct Fund Management

Another important feature is the direct participation in the fund shares by the money manager, which works as an incentive to overcome the agency problem between the money manager and limited partners, reducing the friction between them. Indeed, the former is interested in achieving long-term results instead the latter are more interested in short-term profits, resulting in possible divergence between them. Since, the money manager is involved personally in the investments, sometimes even more than 50% of the total assets[38], in a worst-case scenario he/she will lose its personal capital invested; moreover, in case of zero-profit the manager will lose the right to performance fee, so that the manager's direct fund participation may be considered as a great incentive to increase the fund value.

1.3.7 Historical Costs

Hedge Funds are made in the form of corporate enterprises so they must deal with the consulting, administrative and marketing services and consequently they must sustain growing structural costs that may have negative impact over the overall fund's performance. However, hedge funds may minimize their expenses, avoid marketing practices, and have a restricted number of employees accurately selected. [39]

A hypothetical comprehensive historical cost as well a hypothetical budget is provided. In general, to launch a US-based hedge fund, costs are between $50,000 to $100,000 and first

[37] Preqin, "Hedge Fund Fees, Types, and Structures", Sept. 2020
[38] HEDGEfundamentals.org "How Hedge Funds Are Structured", Managed Funds Association, June 2016
[39] Manuli A. E., °Hedge Funds I vantaggi di una forma di investimento alternativa°, Jackson Libri, 2003

year total operational costs usually are between 75,000 to $150,000. For offshore hedge fund, start-up costs range between $75,000 to $125,000 with operational costs between $100,000 and $175,000 per year. [40]

More specifically, operating cost are represented below:

Table 1- Hedge Funds Operating Costs

COST ITEM	COST RANGE ($)	
Legal fees and attorney representation	20000	150000
Marketing	15000	25000
Audit	20000	100000
Administration fees	24000	100000

Source: Author's elaboration from Grant Thornton LLP," How do you start a hedge fund? The new era of hedge fund creation and operational management"

To conclude, a manager that is looking to start either a domestic or offshore hedge fund needs a budget between approximately $75,000 to sustain startup costs and an average of $100,000 for annual costs.

1.4 Regulation

This section begun analyzing the juridical aspects of the hedge fund regulation among North America, Europe, Asia countries and several offshore jurisdictions providing a comprehensive analysis of the main regulation and advantages of these countries for hedge funds. The second part of this section will discuss the fiscal aspects characterizing the hedge funds industry highlighting the main fiscal treatments between U.S., U.K., EU and offshore

[40] "How do you start a hedge fund? The new era of hedge fund creation and operational management", Grant Thornton LLP

countries. Hedge funds must comply with national, federal, and state laws in their respective countries; these regulations are made to minimize the risk of potential frauds, losses and avoid systemic risks and financial collapse that could harm the economic stability of our modern society.

1.4.1 North America: U.S.

To begin with, in 1922 the first round of regulation which affects the hedge fund operation was the Grain Future Act which provided rules on trading in commodity futures to prevent frauds and other types of market manipulations. [41]

A second round of regulation was established with the Security Act of 1933, designed to control the securities market, which imposed that the activities involving the selling of securities must be registered with the United States Securities and Exchange Commission, in order to pursue two objectives: keep the investors updated about financial and non-financial informations while prevent any types of manipulations/frauds. [42]

The purpose of registration is the disclosure of important financial information that enables investors to be aware of their investment decision avoiding get involved in scams and in a case of losses they would have important recovery rights if they can prove that there was incomplete or inaccurate disclosure of important information.

One year later, the U.S. Securities and Exchange Commission was established in Washington D.C. with the purpose of *protecting investors, maintaining fair, orderly, and efficient markets, and facilitating capital formation*.[43] In the same year, the Securities Exchange Act of 1934 was enacted; providing a regulation for the "aftermarket" or secondary trading of securities since tons of money was made and lost each year, but on the hedge funds view, the

[41] https://www.cftc.gov/sites/default/files/opa/speeches04/opabrown-hruska-22.htm
[42] S.E.C. "The Laws That Govern the Securities Industry", Investor.gov, 2022, *https://www.investor.gov/introduction-investing/investing-basics/role-sec/laws-govern-securities-industry#:~:text=Often%20referred%20to%20as%20the,in%20the%20sale%20of%20securities.*.
[43] https://www.sec.gov/about/what-we-do

breakthrough was the introduction of the obligation to register with the SEC when a company has *$10 million in assets whose securities are held by more than 500 owners*.[44]

A milestone was the introduction of the 1940 Investment Adviser Act designed to supervise and regulate the advisors and the hedge fund manager activities, which introduced restrictions regarding the number and the types of investors and prohibiting public offers of their shares. One of the most remarkable innovations was that: for hedge funds whose securities are owned by not more than 100 "persons", the obligation to register as an investment company with the SEC under Section 3(c)(1) is not required. Furthermore, Section 3(c) (7) of the Investment Adviser Act was introduced after the National Securities Markets Improvements Act of 1996 that *in part, exempts investment companies from registration if the securities are owned exclusively by "qualified purchasers" as defined in the Act. However an hedge fund with 500 or more investor is required to register with SEC*.[45]

The Act gives a definition of the "qualified purchaser" as *any natural person who owns at least $5 million in investments and any other person (e.g., an institutional investor) that owns and invests on a discretionary basis at least $25 million in investments.*[46] In addition, the 1996 Act allows hedge funds with a maximum of 100 investors that does not make any public offer to buy or sell its shares, to be turned into a fund which falls under the section 3 (c) (7) even if not all the investors are certified "qualified investors" as long as the latter provides adequate information on transformation occurred.[47]

[44] https://www.investor.gov/introduction-investing/investing-basics/role-sec/laws-govern-securities-industry#secexact1934

[45] https://web.archive.org/web/20110315052730/http://www.sglawyers.com/hedgefundworld/forming-a-hedgefund/exemption-from-registration.aspx

[46] https://web.archive.org/web/20110322202040/http://www.sglawyers.com/hedgefundworld/forming-a-hedgefund/section-3c1.aspx

[47] Manuli A. E., °Hedge Funds I vantaggi di una forma di investimento alternativa°, pag. 15, Jackson Libri, 2003

In response to the 2008 crisis, the Dodd-Frank Wall Street Reform and Consumer Protection Act, commonly known as the Dodd-Frank Act was enacted on July 21, 2010.[48] This federal law provides changes affecting the whole financial services industry and its actors; in particular, for investors advisers whose has more than $150 million under management, SEC registration was required. Moreover, under these new regulations, hedge fund managers must fill the Form ADV[49] and must provide information to SEC and the newly created Financial Stability Oversight Council, regarding their trading positions as well as portfolio assets.[50]

To provide addition information on the funds' assets and positions, the hedge funds must file the Form PF that provides the SEC and the FSOC[51] salient addition information regarding the basic operation and strategy of the funds aimed to *establish a baseline picture of the private fund industry for use in assessing systemic risk*.[52]

With the aim to increase the number of hedge funds under SEC supervision; the government chose to *raise the assets threshold for federal regulation of investment advisers from $30 million to $100 million*[53], bringing an innumerable number of funds to register with the SEC. In addition, the act have introduced regulations for *overseas hedge funds with more than 15 U.S. clients and investors with more than $25 million in AUM, which were required to register for the first time with the Securities and Exchange Commission*[54]

Lastly, the Dodd-Frank Act introduced the Volker Rule, proposed by the American economist Paul Volcker which have imposed restriction over banks' speculative activities;

[48] Miller, Rena S. (2019). The Dodd-Frank Wall Street reform and Consumer Protection Act : Title VII, derivatives. Washington D.C.: Library of Congress. Congressional Research Service (CRS).
[49] https://adviserinfo.sec.gov/
[50] Lemke & Lins, Regulation of Investment Advisers (Thomson West, 2014 ed.).
[51] FSOC: Financial Stability Oversight Council
[52] Proposed Amendments to Form PF, SEC, https://www.sec.gov/files/ia-5950-fact-sheet.pdf
[53] "Brief Summary of the Dodd-Frank Wall Street Reform and Consumer Protection Act", banking.senate.gov. United States Senate, 10 July 2010.
[54] Ismail, Netty "Asia's Cash-Poor Small Hedge Funds". Bloomberg L.P, 27 February 2011

specifically referred on proprietary trading[55] in securities, derivatives, or certain other financial instruments *in which commercial banks borrow money to trade on their own accounts*[56] while limiting banking entities to invest, sponsoring, or having investment relationships with hedge or private equity funds.[57]

In 2022, the SEC finalized new rules aimed at increasing transparency and reducing risk in the hedge fund industry, including requirements for more frequent reporting and greater disclosure of information to investors.[58] In addition, the CFTC (Commodity Futures Trading Commission) proposed new rules for the regulation of cryptocurrency and digital assets, including hedge funds that invest in these areas.[59] In order to improve the resilience and transparency of money market funds, the Federal Reserve proposed new rules for the regulation of money market funds, which are popular investment vehicles for hedge funds and other institutional investors[60].

1.4.2 Europe Onshore

In Europe, hedge funds are regulated by the European Securities and Markets Authority (ESMA) and are subject to the Alternative Investment Fund Managers Directive (AIFMD). The AIFMD sets out rules for the management, operations, and supervision of alternative investment funds, including hedge funds, and requires them to be authorized and supervised by a national regulator. The directive also imposes reporting and disclosure requirements, as well as risk management standards, on hedge fund managers. Hedge Fund managers are subject to the European Directive on Alternative Investment Fund Managers (AIFMD) aimed

[55] https://www.theguardian.com/business/2010/jan/21/proprietary-trading-wall-street-banks
[56] Drum K. "Prop Trading and the Volcker Rule", Mother Jones, Apr. 3', 2010
[57] Board of Governors of Federal Reserve System, " Federal Reserve issues final rule to implement Volcker Rule conformance period", Press Release, February 09, 2011
[58] Dartley E., Holston K., Delaney R., "SEC PROPOSES SIGNIFICANT NEW RULES FOR PRIVATE FUND ADVISERS", K&L Gates, 2022
[59] Franck T. "Bipartisan crypto regulatory overhaul would treat most digital assets as commodities under CFTC oversight", CNBC, 2022
[60] https://www.federalregister.gov/documents/2022/02/08/2021-27532/money-market-fund-reforms

to create a comprehensive and secure framework for the supervision and prudential oversight of AIFM in the EU.[61] To protect investors and mitigate systemic risks hedge fund managers require registering to national regulatory authorities and to provide information about their investment activity more frequent basis.

AIFMD introduced the concept of "passport"; *which allows AIFM to 'passport' their services throughout the EU on the basis of a single authorization.* Moreover, the *passport will be extended to the marketing of non-EU funds, managed both by EU AIFM and AIFM based outside the EU.* A potential limitation for the hedge fund sector is the remuneration through bonus deferrals and claw back provision. In addition, The AIFM takes care of the transparency problem in relation to the leverage usage, that has had consequences over all financial market amplifying the effect of financial crisis. *Each AIFM will be required to set a limit on the leverage it uses and will be obliged to comply with these limits on an ongoing basis.*[62]

Th Undertakings for Collective Investment in Transferable Securities is a EU directive that lays down rules for the management and distribution of collective investment schemes within the European Union. UCITS funds are required to meet certain eligibility criteria and must comply with strict investor protection and regulatory requirements. The aim of UCITS is to increase consumer confidence in these types of investment vehicles and facilitate cross-border distribution within the EU.

UCITS funds must meet certain eligibility criteria to ensure that they are suitable for retail investors, moreover they must comply with strict investor protection rules, such as clear

[62] https://ec.europa.eu/commission/presscorner/detail/de/MEMO_10_572

disclosure of fund objectives, risk and charges, to ensure that investors are fully informed. Since EU regulations is more focused on investor protection, UCITS funds must ensure that they have sufficient liquidity to meet redemptions by investors and they must appoint a depositary to oversee the safekeeping of assets and ensure compliance with regulatory requirements.

These funds are subjected to a set of regulatory requirements, including reporting and transparency, to ensure that they are managed in the best interests of investors. For what concern the distribution, the usage of these fund has been approved making easier for investor to access a wide range of investment opportunities. [63]

UCITS regulations bring increased transparency and investor protection to hedge funds, which can increase their appeal to retail investors. However, these regulations also impose investment and operational restrictions on hedge funds, which may limit their ability to generate returns or manage risk effectively that can reduce their appeal to institutional investors.

In summary, the impact of UCITS on hedge funds can be seen as a trade-off between increased accessibility and increased regulation.

In 2020, EU adopted new regulations known as UCITS V. This update introduced several changes to the UCITS framework, including the introduction of stricter rules for depositaries, increased transparency requirements, and strengthened oversight by national regulators, the introduction of new risk management requirements aimed at ensuring that UCITS funds operate in a prudent and safe manner, new liquidity management rules aimed to meet redemption requests from investors in a timely and orderly manner and new provisions to encourage UCITS funds to consider ESG factors in their investment decision-making.

[63] https://ec.europa.eu/commission/presscorner/detail/el/MEMO_10_572

Overall, UCITS V aims to improve the functioning and stability of the UCITS market, while also enhancing investor protection and promoting sustainable finance.[64]

In 2022, most European hedge funds were domiciled in a few key jurisdictions, including: London (UK)[65] that has long been a hub for the hedge fund industry in Europe, Dublin (IE) that has become an increasingly popular location for hedge fund domiciliation in recent years, due to its favorable tax regime and well-developed financial infrastructure[66], Luxembourg (LU) also is a popular choice for hedge fund domiciliation due to its favorable tax regime[67] and the expertise of its financial services industry, Guernsey and Jersey cities (Channel Island) which are becoming popular locations for hedge fund domiciliation due to their favorable tax regimes and well-developed financial services industries.[68]

These jurisdictions have attracted hedge funds due to their favorable tax regimes, well-developed financial services industries, and experienced regulatory authorities.

1.4.3 U.K.

Hedge funds in the United Kingdom are subject to more regulatory establishment criteria than funds in the United States.[69]However, U.K. has been the largest hedge fund market by

[64] PDF: "https://www.matheson.com/docs/default-source/asset-management---ucits-briefing-notes/ucits-v-overview---september-2017---ucits-briefing-note.pdf?sfvrsn=fd523677_4"
[65] Mendel J., "UK home to second most hedge funds, as US dominates rise of crypto strategies", CITY A.M., 2022
[66]PDF: https://irishfunds-secure.s3.amazonaws.com/1551880566-5648-Irish-Funds-Why-Ireland-Brochure_EU_WEB.pdf
[67] Banzaca J. "How Can Hedge Fund Managers Use Luxembourg Funds to Access Investors and Investments in Europe, Asia and Latin America?", Hedge Fund Law Report, 2012
[68] "Alternative investment funds: are Guernsey and Jersey the 'new Luxembourg'?", Zedra, 2022
[69] Zucchi K. "How to Start a Hedge Fund in the U.K.", May 19, 2022

considerable margin[70] in Europe for long time before the withdrawal of the UK from the European Union in February 2020. [71]

For what concern the regulatory framework, the Financial Conduct Authority (FCA) authorizes the hedge fund manager for the properly conduct of the business activity. Moreover, since Hedge Fund Managers are "investment firms" they are subject to regulation that affects fund's marketing and investment strategies imposed by the MiFID II Directive that *has been maintained in the UK post-Brexit, with some adjustments to make the regime operate properly from a UK-only perspective.*[72]

Other fundamental regulations are those imposed by the Market Abuse Regulation (MAR), which regulates the behavior of market participants, including hedge funds, to prevent market abuse such as insider trading and manipulation and by The Financial Promotions Order which sets out the rules for promoting hedge funds product to the public. For this reason, hedge funds must ensure that any promotional material they produce is fair, clear, and not misleading.

In addition to these regulations, hedge funds in the UK must also comply with other relevant financial laws, such as the Companies Act 2006 and the Financial Services and Markets Act 2000.[73]The FCA enforces these regulations and has the power to impose fines and sanctions on hedge funds that breach them.

[70] https://uk.practicallaw.thomsonreuters.com/w-009-9984?transitionType=Default&contextData=(sc.Default)&firstPage=true#co_anchor_a861203
[71] Prequin, "Hedge Funds: a journey through time", Sept. 2020
[72] https://www.lw.com/en/london-finreg-portal/markets/mifidii
[73] https://www.legislation.gov.uk/ukpga/2000/8/introduction

Table 2 - United Kingdom Hedge Funds advantages

Light touch regulation by FCA	• Greater Flexibility • Lower level of regulation
Passporting (AIFMD)	• Larger pool of EU investors
Experienced workforce	• Large and experienced financial services workforce
Reputation	• A well-established reputation as a hub for hedge fund activity.
Favourable Tax Regime	• Low corporation tax and a network of tax treaties with other countries

For what concern investment restrictions in the United Kingdom, hedge funds are generally restricted from investing more than a certain percentage of their assets in any one security or issuer, short selling, or the selling of securities that are not owned, can be restricted during periods of market stress or volatility. Another restriction regards insider trading, which prohibit the use of material non-public information for the purpose of trading securities.

Hedge funds are also subject to restrictions on their exposure to counterparty risk, which is the risk of loss if a counterparty to a transaction fails to perform its obligations. Moreover, the FCA regulates the amount of leverage that hedge funds can use, to limit the potential for excessive risk-taking. By the way, these restrictions aim to promote stability and integrity in the financial markets, and to protect investors from excessive risk-taking by hedge funds.

1.4.4 European Offshore Jurisdictions

There are several offshore jurisdictions within Europe that are popular among hedge funds and other financial entities as mentioned above Ireland, Luxemburg and the Channel Island are the preferred one by funds; however, there are other European offshore jurisdictions that attract hedge funds including, the Netherlands, Gibraltar, Malta, Cyprus, Lichtenstein, and

Switzerland. Each of these jurisdictions has its own unique features, and hedge funds and other financial entities will often choose to incorporate in the jurisdiction that best fits their specific needs and requirements.

Among the main offshore jurisdiction, for simplicity, we will examine the regulatory advantages of one of these countries for information and comparative purposes. "*Dublin is the hedge fund administration winner by a long way, while Luxembourg is second on volume of business," adds Martin Cornish, senior legal lawyer of Katten Muchin Rosenman Cornish*[74]*;* moreover following an Eurekahedge report *"..the recent market statistics show that over 63% of European domiciled hedge funds currently use Irish legal structures while over 40% of global alternative investment funds (both Irish and non-Irish domiciled) are administered in Ireland.*"[75]

Indeed, the Irish regulatory environment for investment funds is based on principles of openness, transparency, and protection for investors. Ireland is well-regarded for its robust and efficient regulation that allows for market and product advancements while safeguarding investor interests. The Central Bank's regulations on counterparty risk and prospectus disclosure are viewed as responsible and the Irish regulatory framework provides for independent administration and depositary functions. The Irish funds industry is renowned for its thought leadership, demonstrated by its contributions to the development of international industry practices and its role in leading and responding to regulatory developments both in the EU and nationally.[76]

[74] Funds Europe," offshore war", 2007
[75] Browne M., "Hedge Funds in Ireland", Eurekahedge, 2012
[76] Lardner P. "WHY IRELAND FOR FUNDS", irishfunds.ie, 2018

1.4.5 APAC

Another important region where hedge funds are placed is the Asia-Pacific Area especially where we will analyze deeply the regulatory framework of the China's Offshore financial center, Hong Kong, and the Singapore region.

Starting off with the key bodies, statutes and regulations that govern hedge funds jurisdiction, and a comprehensive regulatory framework is provided.

The 證券及期貨事務監察委員會 Securities and Futures Commission (SFC) is the primary regulatory body that authorizes and licensed hedge funds. To remain licensed, they must comply with SFC requirements and obligations regarding financial resources, structure, financial health as well as qualified personnel and internal system. The first distinction is the difference in regulation between private hedge fund from retail hedge funds. The non-retail hedge funds are regulated through the requirements applicable to HK based licensed fund managers. They are licensed under Part V of the Security and Futures Ordinance (SFO) to trade with securities and manage assets for investors.[77] The crucial aspect is that they must respect the SFC'S codes and guidelines, in particular the Fund Manager Code of Conduct. On the other hand, retail hedge funds are subject to SFO legislation, codes, and guidelines specifically on the Code on Unit Trust and Mutual Funds. Retails hedge funds are subject to regulations provided by the Securities and Future Commission (SFC) and the Listing rules when they become listed. To ensure compliance with international standards, SFC supervises the compliance of qualified personnel and over the internal system to properly manage risks that must follow the business plan proposed to the SFC. Moreover, the Facility Management Consultants Council (FMCC) requires managers to value the portfolio regularly on the valuation basis disclosed to clients and sets out default rules of valuation on securities in

[77] https://www.elegislation.gov.hk/hk/cap571

accordance with the fund's constitutional documents to correctly calculate the fund NAV. In addition, hedge funds should comply with SFC's recommendations which covers a wide range of internal control such as segregation of duties, training, and policies. Mangers will be liable if they engage in any forms of market misconduct prohibited under the SFO such as insider trading, false trading, price-trading, disclosure information about prohibited transaction, misleading information, and stock market manipulation; for these misconducts, civil sanctions and criminal penalties apply.[78] For what concern the investment strategies, naked short selling is prohibited. Covered short selling remains allowed but only for those stocks designated by the Stock Exchange of Hong Kong Limited. Indeed, *the SEHK imposes the "uptick rule" under which short sales cannot take place at less than the best ask price, to prevent short sales having an abnormal effect on market prices.*[79] To conclude, Anti-Money Laundering and Counter-terrorism Financing Ordinance applies and imposes due diligence and record keeping requirements to avoid money laundering and any types of terrorism's financing.

Singapore is a hub for financial activity in Asia and offers hedge funds easy access to the rapidly growing markets in the region; it has a strong infrastructure, including a reliable legal system and high-quality financial services sector and it has a highly skilled and highly educated workforce making it an attractive location for hedge funds to conduct business.

In Singapore, there is no official definition of a hedge fund, but it is usually classified as a collective investment scheme under the Securities and Futures Act. The Monetary Authority of Singapore provides guidelines through the Code on Collective Investment Schemes, which states that a hedge fund aims for high returns through advanced investment strategies. The key regulatory instruments for collective investment schemes are the Securities and Futures

[78] SFC.hk "Tackling Market Misconduct", SFC QUARTERLY BULLETIN AUTUMN, 2002
[79] Simmons & Simmons, "Hedge funds in Hong Kong: regulatory overview", Thomson Reuters, Sept. 2019

Act, the Securities and Futures (Offers of Investments) (Collective Investment Schemes) Regulations 2005, and the CIS Code.[80]

Singapore's Monetary Authority of Singapore (MAS) has a reputation for being a light touch regulator, allowing hedge funds to operate with relatively low levels of bureaucratic red tape. Indeed, hedge funds enjoy several regulatory advantages, indeed it offers attractive tax incentives for hedge funds, including a favorable corporate tax rate, exemptions from capital gains tax, and tax-free income for offshore investors. Hedge fund managers must have proper risk management and monitoring procedures, as well as internal controls in place, and must annually certify to the MAS that these procedures are outlined in the prospectus according to the CIS Code for retail hedge funds.

Singapore offers various legal vehicles for setting up a hedge fund, such as companies, limited partnerships, and unit trusts, but most hedge fund managers in Singapore opt for Cayman Islands-based hedge funds. For hedge funds established in Singapore, the preferred option is the unit trust, which is a trust arrangement where the trustee holds assets for the benefit of investors who hold units in the trust. The unit trust structure has advantages such as being largely contractual and not having the same statutory regulations as a Singapore corporate vehicle, and being able to constitute as an umbrella fund. However, it also has disadvantages such as not having a separate legal personality and requiring the appointment of a trustee, which adds costs, and being less familiar to investors in certain jurisdiction. A hedge fund manager in Singapore must hold a capital markets services license or be registered with the Monetary Authority of Singapore as a Registered Fund Management Company unless an exemption applies. The requirements to obtain a license or registration include being a Singapore-incorporated company with a permanent physical office in Singapore, meeting base capital and risk-based capital requirements, having experienced staff

[80] Tan D. “Hedge funds in Singapore: regulatory overview”, Thomson Reuters, 2019

and compliance arrangements, having a risk management framework in place, being subject to internal audit, and meeting annual audit requirements. The licensing requirements under the Securities and Futures Act have extraterritorial effect, meaning that the act done partly in and outside of Singapore that would constitute an offense under the SFA will be subject to the act's requirements, as well as any act done outside of Singapore that has a substantial and foreseeable effect in Singapore. To operate a hedge fund in Singapore, a manager must have a license from the Monetary Authority of Singapore (MAS) or be registered as a "Registered Fund Management Company." Requirements for obtaining this license include being a Singapore-incorporated company with a physical office in the country, meeting base capital thresholds and risk-based capital requirements, having experienced staff, having a compliance plan and risk management framework, and meeting annual audit requirements. Offshore hedge fund managers must also comply with the licensing requirements under the Securities and Futures Act (SFA), which have extraterritorial effect. Hedge funds typically allow redemptions, with terms and conditions set out in the constitutive documents. These can include limits on the number of units that can be redeemed on a given day to protect the fund and its assets. Authorized hedge funds must provide at least one regular dealing day per month and pay redemption proceeds within 90 days of accepting a request. Transfers to third parties may be restricted and these restrictions can be found in the constitutive documents of the hedge fund.

In Singapore, there are no restrictions on investments or use of leverage for hedge funds offered on a private placement basis. However, if the section 305 exemption is used, the investment objectives and focus of the fund must be disclosed to investors in the information memorandum and a Singapore-licensed/registered fund manager must be used to ensure adequate disclosure about the use of leverage, within the limits of the investment mandate.

1.4.6 Other Offshore countries

Offshore funds provide a high level of tax-exemptions, ensuring a high level of anonymity, while maintaining a high degree of flexibility; so that they can offer great incentives for investors.

Offshore funds are often organized as corporations in tax heaven countries such as Cayman Islands, Bermuda, Virgin British Islands, Bahamas, etc. Investors are individuals and institutions that are not resident on the U.S. as well as to U.S. tax-exempt entities such as pension funds and charitable organizations. Intuitively, the main reason behind this choice is the different tax treatments, while investing in a domestic hedge funds may be subjected to tax on unrelated business taxable income" or "unrelated debt-financed income," investing in offshore hedge funds allow the investors to be exempt from U.S. taxation. Moreover, Cayman Island is a popular location for hedge funds due to its proximity to the US and its status as the primary offshore jurisdiction for hedge funds globally. However, U.S. taxable investors would generally be harmed by investing in an offshore fund because of onerous U.S. taxes applicable to foreign investments.

Cayman Island are known as the most country with the larger number of hedge funds domiciliated there. Cayman Islands is a well-established hedge fund domicile, with a large number of hedge funds registered there. The island is known for its favorable tax environment and strong infrastructure for the financial services industry, which has made it an attractive location for hedge fund managers.

Most managers of Cayman funds do not have a physical presence in the Cayman Islands. A management firm from anywhere in the world can provide investment management and advice to a fund registered in Cayman and will not be subject to Cayman laws and regulations. The management firm can establish an offshore entity in the form of a company,

limited partnership, trust, or SPC registered in the Islands, or register as a foreign entity in Cayman. The Securities Investment Business Law (SIBL) applies to management entities registered in Cayman. SIBL regulates securities investment business, including managing securities, dealing in securities, arranging deals in securities, and advising on deals in securities. Some exemptions are available but require a yearly fee of US$6,100. If the management entity is not exempt, they must obtain a license from CIMA, which may come with conditions and costs a minimum of US$10,000.

Hedge funds domiciled in the Cayman Islands typically take advantage of the island's legal and regulatory framework, which provides a high degree of flexibility and autonomy for fund managers. The island has a well-developed legal system based on English common law, which provides a stable and predictable environment for hedge fund operations. Additionally, the Cayman Islands government has implemented a regulatory regime for the financial services industry that is designed to promote the growth and stability of the sector.

One of the key benefits of domiciling a hedge fund in the Cayman Islands is the favorable tax environment. The island has no direct taxation, which means that hedge funds are not subject to income tax, capital gains tax, or withholding tax on income derived from their operations. This can result in significant cost savings for hedge fund managers, which can be passed on to investors in the form of higher returns.

Overall, the Cayman Islands is a popular destination for hedge fund managers looking to establish a presence in an offshore jurisdiction. The combination of favorable tax and regulatory environments, strong infrastructure, and a well-developed legal system makes it an attractive location for hedge funds seeking to minimize costs and maximize returns. The open-ended fund in the Cayman Islands will fall under the category of a mutual fund as per the Mutual Funds Act (MFA) and will be regulated by the Cayman Islands Monetary

Authority (CIMA). Hedge funds are usually considered "registered" funds if the minimum initial investment by a single investor is at least CI$80,000 (US$100,000). Open-ended funds with 15 or fewer investors, who hold the power to appoint and remove directors, will also be subject to regulation by CIMA under the MFA.[81]

Cayman Islands' master funds, which are open-ended funds that hold investments and execute trades to achieve the investment objectives of a regulated feeder fund, are also regulated under the MFA. A registered fund must appoint a fund administrator, auditor, custodian/broker, and at least two directors (who do not need to be based in the Cayman Islands).

The Cayman Islands offer zero tax status to entities registered there but do business mainly outside the islands. Management firms can choose to be resident in the islands and have access to top quality professional service providers. Cayman law distinguishes between businesses within the islands and outside the islands. Foreign management firms can conduct business within the islands by setting up a resident company, but foreign ownership is restricted. Resident businesses are subject to laws and regulations governing resident businesses, including the Local Companies Law. Resident companies must have at least one director and there are no capitalization requirements or exchange controls. The Cayman Islands do not have any double taxation treaties and SIBL applies equally to resident and non-resident management firms registered in Cayman. Resident businesses pay annual registration fees and an annual trade or business license fee.[82]

[81] Conyers, “Guide to Establishing Hedge Funds in the Cayman Islands”, 2022

[82] Mourant, “The Cayman Islands: A guide for hedge fund managers”, 2017

1.5 Fiscal aspects

The tax treatment of hedge funds can vary significantly between countries and regions, including the United States, Europe, and offshore jurisdictions. In the United States, hedge funds are typically taxed as partnerships, with the fund's income and gains being passed through to the individual investors who must report this income on their tax returns. In Europe, the treatment of hedge funds can vary by country, but many EU member states have implemented AIFMD, which established a regulatory framework for the management and marketing of alternative investment funds in Europe. The AIFMD imposes certain tax and reporting requirements on hedge funds operating in the EU.

Offshore jurisdictions are popular destinations for hedge funds due to their favorable tax regimes, light regulation, and strong investor protections. In these jurisdictions, hedge funds may be structured as exempt companies or limited partnerships and may benefit from tax exemptions on income and gains derived from foreign sources. However, investors in offshore hedge funds may still be subject to taxes in their home countries, and they should be mindful of any tax reporting requirements and potential tax liabilities associated with their investments.

In this section, we will conduct a thorough examination of the various tax treatments related to the hedge fund industry, focusing on the major countries where they have fiscal residency, including the United States, Europe, and offshore nations.

1.5.1 North America: U.S.

The United States has a complex tax regime for hedge funds. The taxation of hedge funds depends on several factors, including the structure of the fund, the type of investors, and the types of investments held.

To begin with, the compensation for hedge fund managers comes in the form of carried interest. This income is considered a return on investment, not a salary for services, and is taxed at a lower rate of 23.8%, which includes a 20% tax on net capital gains and a 3.8% tax on net investment income. This is lower than the top ordinary income tax rate of 37%. This provides significant tax savings for hedge fund managers.[83]

In the US, hedge funds typically take the form of limited partnerships or limited liability companies. This structure allows the hedge fund to be taxed as a partnership, which means that the income is passed through to the individual partners and is taxed at their individual tax rates. The general partner, who manages the hedge fund, typically receives carried interest, which is taxed as a long-term capital gain, provided certain holding period requirements are met.

Hedge funds also face potential tax issues related to the taxation of swaps and other derivatives. In recent years, the Internal Revenue Service (IRS) has taken a closer look at the tax treatment of these instruments, which have become increasingly popular in the hedge fund industry. The IRS has issued guidance on the taxation of swaps and other derivatives and has taken enforcement actions against hedge funds that have failed to comply with the tax rules.

[83] https://www.irs.gov/taxtopics/tc409

In addition to the tax issues related to the hedge fund structure and investments, hedge funds also face potential tax issues related to withholding. If the hedge fund is investing in foreign securities, it may be subject to foreign withholding taxes on the income it receives. The hedge fund may also be subject to backup withholding if it fails to provide the required tax identification information to the withholding agent.

Finally, hedge funds may also face tax issues related to the allocation of expenses and tax attributes. The hedge fund must allocate expenses and tax attributes, such as deductions and losses, in a manner that is consistent with the partnership agreement and the tax rules. If the hedge fund fails to properly allocate expenses and tax attributes, it may face penalties and interest charges.

The tax treatment of hedge funds has been a controversial topic, with some critics arguing that the structure provides a loophole for hedge funds to avoid paying taxes. A typical usage of this trick was well described in the NYT article entitled " For the Wealthiest, a Private Tax System That Saves Them Billions" were billionaires hedge funds managers and family offices use Bermuda jurisdiction avoiding paying taxes.[84]

The Tax Cuts and Jobs Act made some changes to the carried interest rule, under which hedge fund managers receive income from the fund as a return on investment, which is taxed at the long-term capital gains rate of 23.8% instead of the higher ordinary income tax rates. The new law requires that funds must hold assets for more than three years for gains to be considered long-term, but this change has limited impact on most hedge funds, which generally hold assets for more than five years. The law aims to reduce the tax advantage of hedge funds, but its effectiveness in closing the perceived loophole remains a subject of debate.

[84] Scheiber N. Cohen P. "For the Wealthiest, a Private Tax System That Saves Them Billions", NYT, 2015

In conclusion, the tax regime for hedge funds in the United States is complex and constantly evolving. Hedge funds must carefully consider the tax implications of their structure, investments, and operations in order to minimize their tax liability and ensure compliance with the tax laws.

1.5.2 Europe Onshore

In Europe continent, the taxation of hedge funds can vary depending on the country in which the fund is based and the country of residence of the investors. Some countries have tax treaties in place with each other to avoid double taxation, while others do not. For example, in the United Kingdom, hedge funds are typically structured as limited partnerships or limited liability partnerships and are subject to corporation tax on their income. Investors in the fund are then taxed on their share of the fund's income in their country of residence, which may or may not have a tax treaty with the UK.

In Ireland, hedge funds are often structured as an investment company and are subject to corporation tax on their income. The taxation of investors in the fund is determined by their country of residence; while in France, hedge funds are subject to corporate tax on their income and social security contributions on their personnel. Investors in the fund may be subject to additional taxes in their country of residence. It is important to note that the taxation of hedge funds in Europe can be complex and can vary significantly depending on the specific circumstances of the fund and the investor.

Table 3 - Tax treatment for hedge funds

Cyprus	• **AIF operations taxed at 12.5% corporate income tax** • **Taxable base can be reduced by up to 80% through notional interest deduction** • **Incoming dividends exempt from tax under certain conditions** • **Trading in securities exempt from tax** • **Fund management services exempt from VAT with conditions** • **No capital gains tax**
France	• **FCPs exempt from corporate income tax** • **SICAVs fully exempt from tax** • **Resident investors taxed as if they received income directly** • **Individual investors taxed at progressive rates up to 45%** • **Corporate investors taxed up to 33.33%** • **Non-resident investors taxed, law defines who falls in this category**
Ireland	• **Exempt from tax on their income and gains.** • **No subscription tax payable on investment in an Irish fund and transfers of units of Irish funds are exempt from stamp duty.**
Isle of Man	• **The Isle of Man offers a tax neutral environment for fund operations and doesn't impose capital or inheritance taxes.** • **Fund in corporate/company form in the Isle of Man is liable to income tax at the standard rate of 0%, but a 10% rate applies to certain income sources.** • **Fund administrator and investment manager fees are exempt from VAT in the Isle of Man.** • **Isle of Man LPs with separate legal personality are transparent for tax purposes and any income is taxable on the partners according to their partnership agreement.**

Source: Author's elaboration from Thomson Reuters, "Tax treatment for hedge funds", Practical Law, 2019

Table 4 - Tax treatment for hedge funds

Luxemburg	• **The annual subscription tax for hedge funds is usually 0.01%.** • **Exemptions exist under certain laws.**
United Kingdom	• **Tax transparent partnerships not subject to tax on partnership profits** • **Offshore corporate vehicles that are tax residents exclusively in their offshore home country have full profit tax exemption** • **UK offshore fund rules apply to UK resident investors in hedge funds, taxing disposal gains from fund interests as income unless fund is certified as a "reporting fund"** • **UK investors are taxable on all distributed and reported fund income** • **UK bond fund rules treat distributions from funds primarily invested in debt-like assets as interest (taxable)**
Switzerland	• **No corporate income tax for entities except for directly owned real estate** • **Distributions or accumulation of profits are subject to withholding tax**
Portugal	• **Hedge funds are subject to 21% Corporate Income Tax (CIT) rate** • **Exempt from municipal and state surcharges** • **No withholding tax** • **Taxable income corresponds to the fund's net profit assessed based on accounting standards, with some exceptions** • **Losses can be carried forward for 5 years** • **Income from blacklisted jurisdictions is always taxed** • **Funds investing solely in money market instruments and bank deposits are taxed at 0.0025% per quarter, while other funds are taxed at 0.0125% per quarter**

Source: Author's elaboration from Thomson Reuters, "Tax treatment for hedge funds", Practical Law, 2019

1.5.3 Other Offshore Countries

Offshore tax regimes refer to tax laws in countries outside of an investor's home country and can be used by hedge funds to minimize their tax liability. Indeed, many countries offer tax

incentives to hedge funds that are based in their jurisdiction, such as low corporate tax rates, exemptions from certain taxes, or tax holidays. For example, some countries in the Caribbean and the Channel Islands have a reputation for being tax-friendly for offshore hedge funds. However, the use of offshore tax regimes for hedge funds has come under increasing scrutiny in recent years, as governments around the world have sought to clamp down on tax avoidance and the use of tax havens. Some countries have introduced legislation aimed at preventing the use of offshore tax regimes or have entered into agreements with other countries to share tax information and prevent tax evasion.

It is important to note that investing in offshore hedge funds can carry legal and reputational risks, and investors should carefully consider the tax implications of their investments before planning.

In Singapore, the Income Tax Act (ITA) requires that tax be paid on income generated within Singapore and foreign-sourced income that is received in Singapore. The source of income is determined based on a factual analysis of each case. If a hedge fund manager is carrying out investment management activities in Singapore, the profits generated by the hedge fund are subject to Singapore income tax as the manager is considered a permanent establishment of the hedge fund.

To encourage fund management activities in Singapore, there are three tax exemption schemes available for fund management: Qualifying Fund Scheme, Resident Fund Scheme, and Enhanced-Tier Fund Scheme. The scope of tax exemption under each scheme is the same, with specified income from designated investments being exempt from tax in Singapore. To qualify for these schemes, the hedge fund must be managed or advised by a fund manager in Singapore that holds a capital markets services license under the Securities and Futures Act (SFA) or is exempt from holding the license.

The Qualifying Fund Scheme is for non-resident companies and trusts and requires that the hedge fund and its investors meet certain conditions, including not carrying out any business or having a permanent establishment in Singapore (other than a fund manager) and being "Qualifying Investors", which include individual investors, bona-fide entities not resident in Singapore, or designated government entities. The fund manager must also comply with reporting obligations, including providing annual statements to investors and reporting any non-qualifying investors to the tax authorities.

The Cayman Islands does not impose any direct taxes such as corporate income tax, capital gains tax, or withholding tax on the income or profits of hedge funds established in the jurisdiction. This lack of taxation has made the Cayman Islands a popular location for hedge fund formation and management. However, it is important to note that the Cayman Islands have recently implemented new economic substance regulations, which require certain Cayman Islands-based hedge funds to demonstrate that they have adequate economic substance in the jurisdiction. This means that hedge funds must have a sufficient physical presence and staff in the Cayman Islands, as well as conducting core income-generating activities in the jurisdiction.

A number of well-known hedge funds utilize Bermuda's reinsurance industry to lower their tax burden. This is because Bermuda doesn't impose a corporate income tax, leading hedge funds to establish their own reinsurance companies there.[85]Reinsurance companies provide coverage to insurance firms for risks deemed too large for them to handle on their own. By sharing the risk with reinsurers, insurance companies can keep less capital in reserve to cover potential losses.

[85] https://www.gov.bm/taxes-business-bermuda

The hedge funds transfer funds to the reinsurance companies in Bermuda, which then invest those funds back into the hedge funds. Any profits generated by the hedge funds go to the tax-free Bermuda reinsurers. The investments in the hedge funds grow tax-free until the investors sell their stakes in the reinsurers, at which point capital gains taxes become due.[86]

To qualify as a legitimate business, the Bermuda operation must be an insurance business, as other types of businesses may incur penalties from the IRS for passive foreign investment companies. The IRS considers insurance an active business, and a reinsurance company[87] must maintain an active level of activity and not hold a pool of capital larger than what it requires to underwrite the insurance it sells. Though some reinsurance companies do engage in business, it is typically on a smaller scale compared to the funds from the hedge funds used to form the companies.[88]

A table with the main tax regimes offshore (exemption for those in Europe already studied) will illustrate in detail the main difference across these countries in order to provide a comparative overview useful for fund managers:

Table 5 - Other offshore countries tax treatment

[86] https://www.irs.gov/taxtopics/tc409
[87] https://www.irs.gov/pub/irs-drop/n-03-34.pdf
[88] Deloitte, "International Tax Bermuda Highlights ", 2022

Country	Tax Treatment
British Virgin Islands	No taxes
Cayman Island	Tax Neutrality (no income tax, corporate tax, capital gains tax, or value-added tax)
Dubai International Financial Centre	No corporate taxes
Mauritius	Corporate income tax of 15% on net business profits (excluding any capital gains) A 2% corporate social responsibility (CSR) levy: The full amount of any tax paid abroad can be used as tax credits against tax payable in Mauritius Tax credit is also allowed if the fund holds at least 5% of the underlying investment
Singapore	The profits of the hedge fund from discretionary management may be subject to income tax Tax exemption opportunities may be available if certain conditions are met
United Arab Emirates (DIFC Excluded)	**Abu Dhabi Global Market (ADGM):** A financial free zone with its own legal and regulatory framework No corporate tax on income generated within the ADGM Hedge funds operating in ADGM are generally exempt from corporate tax **Mainland UAE:** Hedge funds may be subject to corporate tax, value-added tax (VAT), and other fees and charges The exact tax implications depend on the specific circumstances of each fund, including the type of fund, location of investors, and location of assets.

Source: Author's elaboration from Thomson Reuters, "Tax treatment for hedge funds", Practical Law, 2019

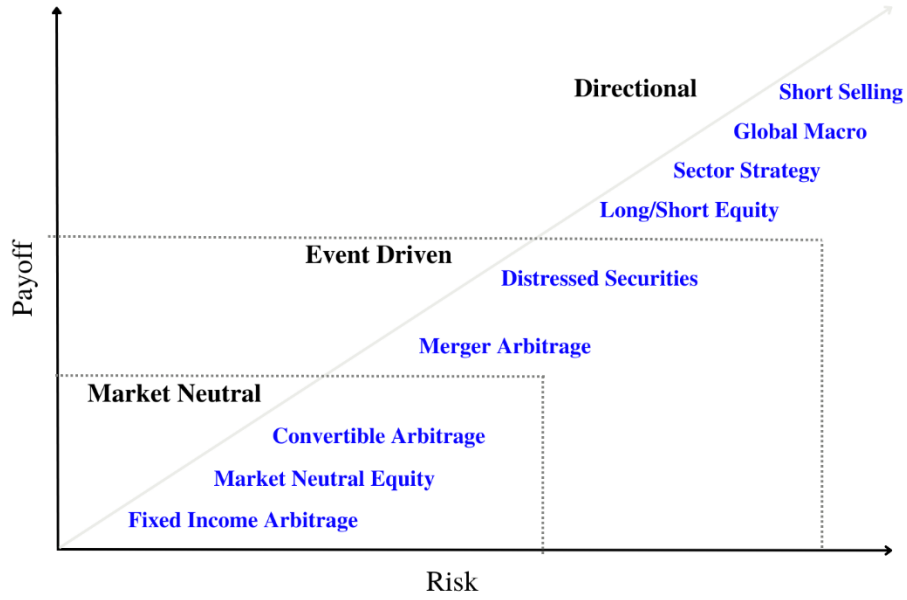
Chapter 2 – Hedge funds investment strategies

Different investment strategies are distinguished from each other by the different assets in which hedge funds invest; Hedge funds have access to asset classes, that are not accessible to other traditional funds, such as options, futures, banks bonds, account receivable from low-rating companies or from companies under insolvency proceeding. [89]

2.1 Classification of hedge funds based on investment strategies

Based on the investment strategy, it is possible to divide hedge funds into three macro-categories which in turn have sub-categories depending on the level of risk and return associated with:

[89]ANSA, "Strategie di Investimento degli Hedge Fund", Jan.2023



Another way to see the different investment strategies is distinguishing between, Directional strategies, where the performance of the investment strategies depends on the financial market performances the non-Directional strategies, where the performance of the strategies are not correlated with the financial markets:

Figure 15 Hedge fund strategy classification

Categories	*Strategies*	*Sub-strategies*
Non-directional strategies	*Market neutral*	*Equity market neutral* *Statistical arbitrage*
	Event driven	*Fixed income arbitrage* *Mortgage-backed securities* *Convertible arbitrage* *Event driven* *Risk arbitrage* *Distressed securities* *Special situations* *PIPE/regulation D* *Activist*
	Arbitrage	*Relative value arbitrage* *Option arbitrage* *Closed-end fund arbitrage* *Volatility arbitrage*
	Multi-strategy arbitrage	*Multi-strategy arbitrage*
	Others	*Asset-based lending* *Others*
Directional strategies	*Long/short equity*	*Developed markets* *Emerging markets* *Global*
	Sector	*Sector*
	Credit	*High yield*
	Short selling	*Short selling*
	Long only (leveraged)	*Long only (leveraged)*
	Macro	*Macro*
	Managed futures	*CTA* *Short-term trader*
Fund of funds	*Diversified*	*Diversified*
	Niche	*Niche*

Source: Capocci D. "The Complete Guide to Hedge Funds and Hedge Fund Strategies", Palgrave Macmillan, 2013

2.2 Market neutral strategies

Market neutral investment strategies consists in the combination of *the purchase of undervalued securities, with the short sale of overvalued securities in such a way as to neutralize the impact of the overall market for that type of security.*[90] To employ market neutral strategies, various asset classes have been used such as fixed income, currencies, risk arbitrage, linked-security arbitrage, and hedged strategies. This strategy could be described as "zero beta" strategy because, since the portfolio has no correlation with the overall market it

[90] Mark T. Finn, "Market Neutral Investing", Journal of Financial Planning, August 1998

has no volatility. Using the Capital Asset Pricing Model (CAPM)[91], the expected return depends on the expected return on risk-free assets and the average market risk premium, which is the difference between the returns of a high-risk investment (R_m) and a risk-free investment (R_f). The α (alpha) and the β (beta) represent the linear regression coefficients obtained by tracing the historical portfolio performance (R_p) compared to the market performance of reference (R_m)

$$R_p = \alpha + \beta (R_m - R_f)$$

The investment manager seeks to maximize the long alpha as well as the short alpha managing them in an integrated manner; where α (Alpha) measures the return that is uncorrelated with the stock-picking and the market-timing ability of the manager as well as with the market return. Alpha represents the expected extra yield from each undervalued security in both long and short positions; so that the investment manager, whose intent is to construct a market neutral portfolio, must picks stocks with $\alpha > 0$ and with β coefficient near 0, so that the returns generated are uncorrelated to the market. However, it will be difficult to keep the β coefficient near 0 because even a small stock price variation will result in a change of β value so that the investment manager must continually rebalance the portfolio to keep β low resulting in high negotiation costs. Moreover, a β coefficient near 0 does not guarantee total market neutrality because since: $\beta = \frac{cov(R_p, R_m)}{var(R_m)} = \rho_{p,m} \times \frac{\sigma_p}{\sigma_m}$ where $\rho_{p,m}$ represents the portfolio's market correlation and $\frac{\sigma_p}{\sigma_m}$ represents the relationship between portfolio risk and market risk even if the quantity $\frac{\sigma_p}{\sigma_m}$ is low, resulting in a low β, it does not implies a low correlation with the market ($\rho_{p,m}$). [92]

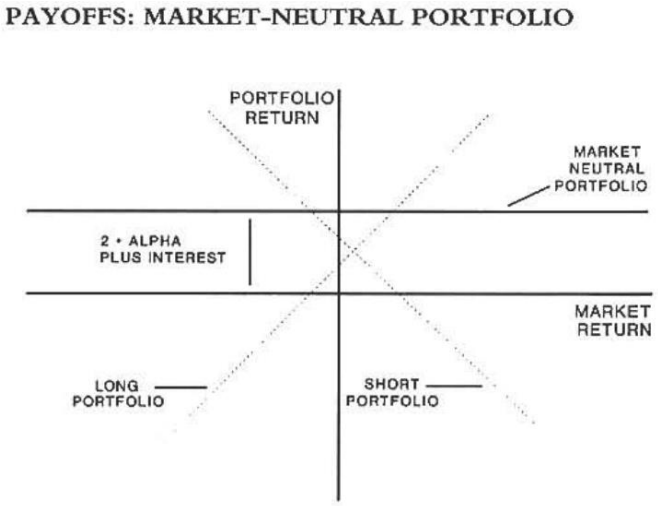
[91] CFI Team "Capital Asset Pricing Model (CAPM): A method for calculating the required rate of return, discount rate or cost of capital", CFI, Nov. 24, 2022

[92] CFI Team, "Beta Coefficent", CFI, 2022

The relationship between the correlation of the hedge fund with the market and the beta means that a hedge fund with a low beta level does not implies that it has a low correlation with the market; instead, only hedge funds with low beta level and low correlation with the market can be considered equity market funds neutral.

A market neutral strategy is also called "absolute return strategy" since the payoff is not tied up to the performance of the underlying market and it can guarantee profitability whether the market goes up or down. Most market neutral portfolios are composed by long covered positions, and short positions, aimed to take advantages of anomalies between directly or indirectly correlated securities and derivatives. [93]

Figure 16 - Market Neutral Portfolio Payoff



Source: Bruce I. Jacobs and Kenneth N. Levy "Long/Short Equity Investing"

Considering the implicit assumption that all the capital is full invested into both long and short, *the market neutral portfolio's payoff line is horizontal at level above the origin by twice the level of alpha plus interest*.[94]

[93] ANSA, "Strategie di Investimento degli Hedge Fund", Jan.2023
[94] Bruce I. Jacobs and Kenneth N. Levy "Long/Short Equity Investing"

Market neutral strategies have a low market risk degree, the exposure of the security to uncertainty linked to future market movements. However, these strategies are subject to a high stock picking risk; indeed, the expected return depends largely on α meaning that the return depends by the ability of the manager to correctly picking stocks; assuming long positions in undervalued stocks and the equivalent amount of short position on stock that are considered overvalued. In conclusion, portfolio diversification is recommended to minimize unwanted risk exposures and profits rely exclusively on the ability of the investment manager to identify over/under valued stocks, independently from the market direction and timing.

We distinguish three different types of market neutral categories: Fixed Income Arbitrage, Equity Market Neutral and Convertible Arbitrage.

2.2.1 Fixed Income Arbitrage

The Fixed Income Arbitrage strategy consist in counterbalance long position with short one in fixed income securities, investing mainly in debt products and currencies and extensively using derivative products such as Treasury bills, corporate bonds, swaps, guaranteed securities, debt of emerging markets countries, seeking to profit by exploiting pricing inefficiencies between related fixed income securities while neutralizing the interest rate fluctuations. *They estimate whether this spread is justified and take a position if they expect this spread to disappear.* [95]Hedge funds managers seek to protect themselves from fluctuations in interest rates by buying fixed-income securities at a favorable price, meanwhile assuming short positions in an equal number of fixed-income securities but at a higher price. An increase in interest rates has a negative impact on the long position; instead, it has a positive impact on short positions and gain will be realized when the relationship between the price of the fixed income securities falls within the gap estimated from the

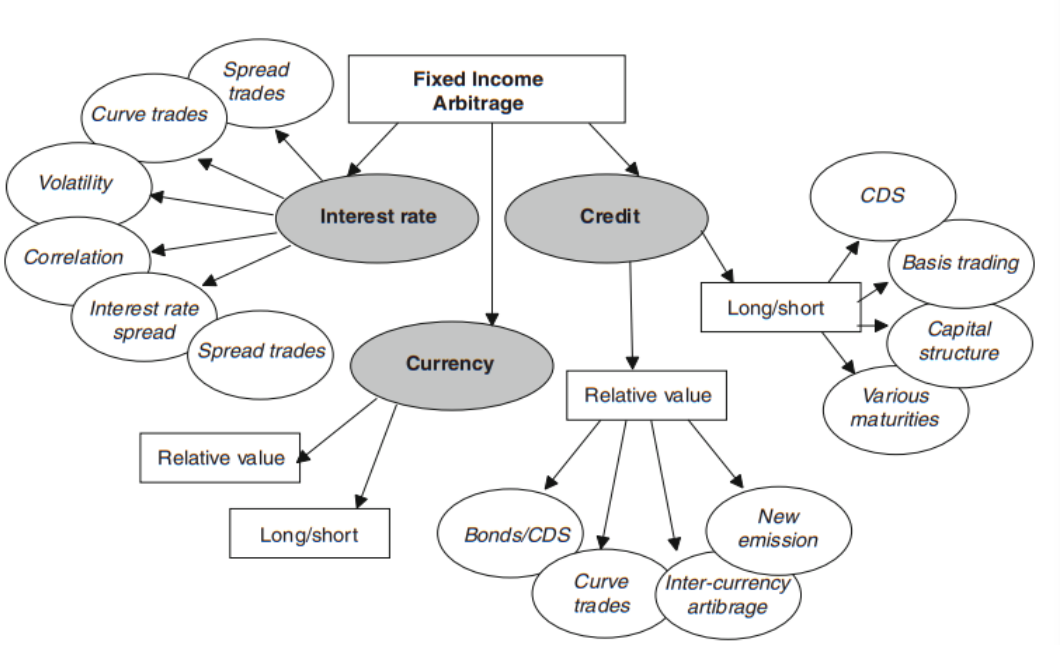
[95] Capocci D. "The Complete Guide to Hedge Funds and Hedge Fund Strategies", Palgrave Macmillan, 2013

investment manager. Therefore, the best strategy is to buy a security and sell another one for a similar duration[96] to counterbalance the effects of a change in interest rates.[97]

At the beginning, the investment manager seeks to identify the relations that exist between interest rate products and then tries to recognize when one or several of these relations move outside their historical limits; indeed, may exist events that are capable of generate moves include *market events, external shocks, or changes in investor preference*. In the next step, an estimates if this relation is expected to fall within their historical limits or if it will move outside ,is provided and then the manager will take a position accordingly. Markets on which these funds operate include *the interest rate market, the credit market, and currencies.*[98]

Figure 17 Fixed income arbitrage strategy illustration.

[96] CFI Team, Duration definition: "*Duration measures the sensitivity of the value fluctuations to changes in interest rates."*
[97] ANSA, "Strategie di Investimento degli Hedge Fund", Jan.2023
[98] Capocci D. "The Complete Guide to Hedge Funds and Hedge Fund Strategies", Palgrave Macmillan, 2013



Source: The Complete Guide to Hedge Funds and Hedge Fund Strategies

The investment goal is to build a portfolio that is not enraged by the change in interest rates, minimizing the overall portfolio duration. For fixed-income securities characterized by low duration and low payoffs, the leverage is a fundamental tool to reach substantial profits since arbitrage is conducted among very low spreads; however, the use of leverage must be balanced with the level of liquidity and the risk of the portfolio.[99]

2.2.2 Equity Market Neutral

In an Equity Market Neutral strategy, the portfolio allocation process may take into account the securities β (beta) differences; indeed, in order to reduce the systemic market risk, the

[99] ANSA, "Strategie di Investimento degli Hedge Fund", Jan.2023

weighted average of the long position individual stock, called Beta Long, must approach to the Beta Short, i.e. the weighted average of short position stock. In this portfolio, β tends to 0 while the returns are uncorrelated with the stock market performance, so this strategy is also part of the so-called "non-directional strategies". [100]

There exist different variants of this strategy, for example, long/short strategies specialized in each industry sector, dollar neutral with equal long and short positions on the dollar and thesector neutral or dollar neutral typologies with weights of different sectors balanced in both positions.

A portfolio composed of short-selling stocks may have a high absolute return if managed effectively. As already illustrated in Chp.1, hedge funds are subject to a more favorable regulations and conditions than traditional fund resulting in fewer restrictions and great freedom of act; so that, they can take the advantage of the opportunities arising from over-valued securities, usually favored by economic bubbles, markets turbulence and structural financial market changes. The main advantage is that the hedge fund can exploit the position of the overvalued asset considering only its investors risk aversion.

The activity of residual risk controlling, in a long-only portfolio, involves the control over the weight of each security held, which results in the limited possibility of undervaluation or overvaluation instead a long/short market neutral portfolio, if properly built, is not subject to the limited possibility of under valuating or over valuating a stock, that instead is a typical limit of a long-only funds and since long and short positions offset each other they contribute

to the elimination of systematic risk that results in a risk-free return. However, to make this strategy profitable, a good balance between short and long positions must be ensured.[101]

2.2.3 Convertible Arbitrage

This investment strategy involves the analysis of all companies that issue convertible bonds to identify those that are considered undervalued and that show price discrepancies with the underlying security. The profit results from the price ratios between the convertible bonds and the underlying stocks, buying the convertible bond and taking a short position on the underlying security. To hedge positions in convertible securities, short sales of underlying securities are made to offset the long positions, and since positions are inversely correlated, fluctuations in one position are offset against fluctuations in the other, which results in a market movements neutrality, that is the reason why this strategy belong to the Market Neutral strategies. The main benefits of this investment strategy arise from the fixed-income security downside protection and the stock volatility; on the other hand, the risks involved in this strategy concern both the stock market risk and the interests rate risk.

The investment strategy consists of the purchase of convertible bonds meanwhile short selling on a certain number of shares belonging to the same company at the same time to cover the portfolio from market exposure; *the three main approaches to convertible arbitrage are "cash-and-carry trading," "volatility trading" and "credit trading," and these approaches differ in the degree of hedging and the leverage used.*[102]

[101] ANSA, "Strategie di Investimento degli Hedge Fund", Jan.2023
[102] AIMA "Convertible Arbitrage Strategy", AIMA Canada's paper, 2006, n.6, p.3

It is crucial to build a well-structured hedging strategy because in general the price of the convertible bond decreases less quickly than the price of the underlying in a bearish stock market and it reflects more accurately the price of the stock in a bull market.

The payoff will be higher when the bond market is rising, and the stock market is falling; while it will show negative performance when the stock market is flat, and the bond market is falling.

To conclude, convertible arbitrage falls in "non-directional strategies" because its performance is not correlated with the financial markets' performance, but it depends on the investment manager's ability to identify and exploit directional spreads. [103]

2.3 Event-driven

Event driven strategies hedge funds undertake trades in the securities of specific companies, seeking to exploit pricing inefficiencies that may occur before or after a corporate event including Risk/Merger Arbitrage, Distressed Securities, Opportunistic and Activist strategies. The performance of these strategies depends on the opportunities arising from major changes in the activity, business restructuring or extraordinary operations; such events include recapitalizations, reorganizations, bankruptcies, balance sheet restructuring, mergers and acquisitions, dismantling, initial public offerings or share, buybacks. The fund will invest to profit when the expected event takes place as predicted. Since Markets follow cyclical path each strategy will perform better at certain points in the cycle, for example, distressed securities transactions work well after a recession where many companies are affected by short-term issues or are involved in financial difficulties, creating an opportunity for profits or on the other hand, during positive market phases many activities bloom and so the M&A market will be particularly profitable.

[103] ANSA, "Strategie di Investimento degli Hedge Fund", Jan.2023

Managers use a button-up approach since decisions are based on scientific research and industry sectors knowledge.

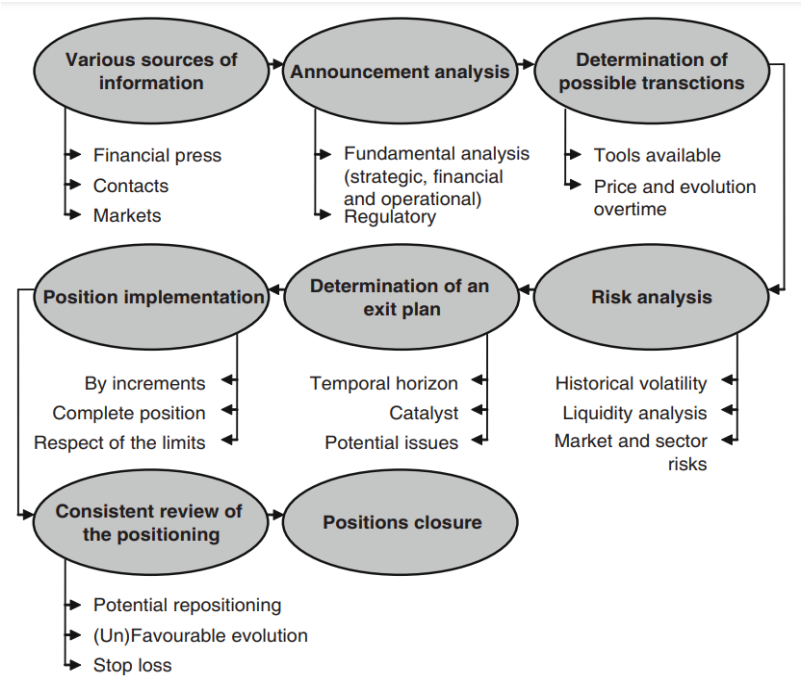
The investment process of an Event driven fund started when the investment team realize that the event will be finalized and then they will estimate the investment time horizon, keeping a balance between the liquidity of the portfolio and the investment horizon.

Once the outcome of the transaction and the investment time horizon were being predicted, the manager should carefully choose the most appropriate securities for the transaction analyzing the price of each security and their relative evolution over time as well as the risks connected in terms of volatility, liquidity, market and sector risks.

The final step consists in determining how to close position and the probabilities associated of each of the possible outcomes. The manager will choose to take a partial or full position only if that event offers an attractive return at fair risk level and if it helps to diversify the portfolio.[104] The typical structure of an event driven investment process is reported in Figure 21:

Figure 18 - Typical investment process of an event driven fund.

[104] Capocci D. "The Complete Guide to Hedge Funds and Hedge Fund Strategies", Palgrave Macmillan, 2013, p.195



Source: Capocci D. "The Complete Guide to Hedge Funds and Hedge Fund Strategies", Palgrave Macmillan, 2013

Important events are usually classified into three categories: Distressed securities, M&A/ Risk arbitrage, and other special situations.

2.3.1 M&A/Risk Arbitrage

Merger arbitrage or risk arbitrage involves investment in event-driven situations such as mergers, acquisitions and leveraged buyouts. In these scenarios, the stock of the targeted company that is going to be acquired will increase its price while the stock of the acquiring company decreases in value. [105]

The success of this strategy is closely dependent on the outcomes of the M&A process. The investment manager must carry out research on the merger or acquisition transaction to assign a probability to the various outcomes of the transaction. The sources of information are public documents on companies, company financial statements, analyst reports, SEC

[105] Eichengreen B., Mathieson D., "Hedge Funds and Financial Market Dynamics", IMF, May 1998, no.166, p.54

Filing such as 10K, 10Q, proxy, tender document, merger agreement, etc. The manager has to conduct an analysis of hypothetical scenarios and the potential losses or gains that may occur.[106]

As mentioned before, after one company announces its intention to acquire another, the price of the target company is supposed to rise but not to the level of the offer.

The compensation for the hedge fund manager is represented by the positive spread between the offered price and the actual price, however, may exist the case when the actual price is higher than the offered price, resulting in potential losses. The higher the risk of a transaction failing, the larger the spread.

Since there is a specific deal risk, the returns on the stocks of the acquiring company will be higher to reflect this risk, thus leading to a lower stock price compared to the price when the deal closure. The manager has two ways: taking a position after the announcement of the transaction has been given or trying to anticipate the M&A event before the announcement is released. Usually, the managers operate after the event was announced. Furthermore, the investment manager must carefully assess the time window for which the capital remains locked-up before the transaction is concluded to reduce the risk related to the delay of the conclusion of the transaction, which led to an investment reduction.

Sometimes, a market downturn may happen before the conclusion of the M&A operation, resulting in a price downfall of the buyer's stocks so that will cause the failure of the transaction. To protect from this risk, investment managers may use the put options to protect the investment from violent market downturns. Put option contracts are chosen when the spread is such that the payoff could cover the option contracts purchase cost. Another way that investors must mitigate the deal risk is choosing a diversification strategy on more deals.

[106] ANSA, "Strategie di Investimento degli Hedge Fund", Jan.2023

Some managers, anticipating the failure of some operations, choose a different strategy short selling the target company stocks.[107]

This strategy is particularly indicated when the level of M&A is growing/higher, allowing the investors to take advantage of these opportunities and make profits from them.

2.3.2 Distressed securities

Hedge funds whose usually use distressed securities strategies invest and sell short the securities of companies where the security price is expected to be affected by a distressed situation such as reorganizations, bankruptcies, distressed sales, etc. The investment is made through bank debt, corporate debt, trade claims, common stock, preferred stock, and warrants.[108]

Hedge Funds specializing in distressed securities buy the securities of the companies at discounted prices seeking to make a profit; for example, by investing in publicly held debt securities traded at lower prices than the initial price that give a yield to maturity, or they may invest in debt securities and stocks of defaulting companies which claim an application laws on the protection of the debtor such as the Chp.7 of US Bankruptcy Code[109] that involves the liquidation of the property of the debtor and the distribution of proceeds to the creditors or the claim the application of Chp.11 of the US Bankruptcy Code by which the company operates under the supervision of the court that is following the bankruptcy process while maintaining the ownership of the company's assets.[110] The prices of such stocks come down, thus anticipating the period of failure, when their holders decide to sell them rather than maintain their investments in a company in financial crises. [111]

[107] ANSA, "Strategie di Investimento degli Hedge Fund", Jan.2023
[108] Eichgreen B. Mathiesn D. "Hedge fund and financial market dynamics", IMF, May 1998, p.51
[109] United States Courts, "Chapter 7 - Bankruptcy Basics"
[110] United States Courts "Chapter 11 - Bankruptcy Basics"
[111] ANSA, "Strategie di Investimento degli Hedge Fund", Jan.2023

The success of this strategy depends mainly on the depth and the level of attention of how the analyses are carried out.

The hedge fund's money manager must then proceed with a careful analysis of the events that may reduce the value of the dissected company's security; indeed, it is possible that the company has diversified activities but still has a solid core business; or the company may be in financial crisis due to legal problems or affected by external events not related to the solidity of the core business or it may have management issues that can be resolved simply by a change of leadership.

In the following step the investment manager will buy the securities because shareholders, creditors and banks would try to sell them quickly since they have not the tools or the time to correctly conduct a company evaluation. The investment manager may purchase options on the issuer's shares or by taking over a credit default swap.

In this strategy, leverage should not be used as distressed securities already have implicit leverage because they are traded with huge discount.

The risks associated with this strategy concern the widening credit spreads on distressed securities due to the long net exposure that the hedge fund has on these securities that may lead to prices reduction and negative performances. In addition, further risks are those relating to liquidity and those related to the complexity of bankruptcy law.

Investing in hedge funds that adopt this strategy, investors will expect to have quarterly, half-yearly or annual liquidity due to the liquidity of the securities itself and the long-time horizons needed for the strategy's finalization. [112]

[112] ANSA, "Strategie di Investimento degli Hedge Fund", Jan.2023

2.4 Directional strategies

2.4.1 Long/Short equity

The long/short strategies, used by the hedge fund's investment manager, are based on the assumption of taking long positions in stocks expected to have performance higher than the market and short-selling stocks or taking positions on stock indexes that are supposed to have lower performance in the future aimed to build a portfolio where returns are not correlated with the market trend but depends upon the stock picking ability of the manager.

The net market exposure of these portfolios is generally positive and therefore tends to be positively correlated with the stock market trend. However, managers are aware that, often, the prices of a single securities may be subjected to high fluctuation in directly response to factors unrelated to the evolution of the market; hence, it is necessary to make an adequate stock selection to obtain positive performance both in the bullish and bearish market's phases.

Short positions are more used to generate high returns than covering long positions using short-selling and hedging practices while ensuring lower volatility and a lower market exposure, especially during a bearish market phase. Instead during the bullish market's phase, the long/short strategy could generate high returns focused on stock selection and long positions.

We distinguish two types of investment manager; the manager so-called prudent who seek to minimize risk by keeping market exposure between 0 and 100%, and the aggressive manager whose seek to increase their exposure over 100% or, in alternative, by maintain a net short exposure equal to the difference between long and short exposure relative to invested capital.

The downside of the long/short strategy lies in the fact that the positions in portfolio must be periodically rebalanced due to the high correlation of portfolio's securities with the market performance. [113]

2.4.2 Sector strategy

The investment strategy adopted by the sector funds restricts the investment exclusively in a specific sector or into one specific geographical area, taking advantage of its information advantage.

At the beginning the investment manager must research and identify securities on which taking long positions and securities where assuming short positions; therefore, choosing undervalued securities or identifying those securities with lower profits and lower cash flows compared to the real "intrinsic value" of the target company. In any case, the manager must pay attention to macroeconomic, monetary and cyclical factors that could have a certain degree of influence on the stock market as in a specific sector; moreover he should analyze the microenvironment of the company to monitor the positioning of the target company within that specific industry.

Usually, the investment manager builds the portfolio using a bottom-up approach focusing on individual positions, playing aggressively, and taking a long bias on a single sector or a single geographical area.

The sectorial portfolio is usually characterized by two main components: "base" positions and hedging positions. The first group includes long-term securities aimed to generate most of the strategy's payoff, while in the second group felt short-selling securities (deemed overvalued), securities aimed to speculation purposes and securities for hedging purposes.

[113] ANSA, "Strategie di Investimento degli Hedge Fund", Jan.2023

Hedge fund sectorial specialists are looking for a catalyst event that will bring investor's interest into investing in a particular company.

The main players are funds focused on the technology-media-telecommunication sector that aim to identify companies based on failures rate and the evolution of technological innovation, the biotech-focused hedge funds that base their strategy on the promotion or rejection of a drug issued by the FDA, Food and Drug Administration, which with its decisions causes strong movements in the share's prices, hedge funds that take long/short positions on investments related to gold and other valuable materials and lastly hedge funds that invest in emerging markets that will be deeply analyzed in detail in the next sub-paragraph.[114]

2.4.3 Emerging Markets

The hedge funds that invest in emerging market focus their attention on the financial markets of developing countries basing their strategies on the inefficiencies of these markets, seeking to make profits from their potential growth and from those markets that are not mature enough, trying to identify undervalued companies through a bottom-up approach and a careful on-site analysis of the different companies.[115]

2.4.4 Global Macro

The Global Asset Allocators are hedge funds of huge size characterized by the ability to move large masses of capital that can affect the entire market by investing in any type of market using any financial instrument.

[114] ANSA, "Strategie di Investimento degli Hedge Fund", Jan.2023
[115] ANSA, "Strategie di Investimento degli Hedge Fund", Jan.2023

Usually, these hedge funds invest in extremely liquid markets using financial instruments such as stocks, bonds, currencies and commodities, swaps, forwards, options, futures, and others. They use short selling and leverage to increase the impact of market movements; indeed, this strategy is often considered among the riskiest but also among the most profitable, while trying to avoid influencing market prices through the movements of their positions. Moreover, this strategy is characterized by a great lack of transparency towards investors as fund managers are very reluctant to show their investment ideas.

Investment managers use a top-down approach, as investment choices are based on the analysis of macroeconomic and political variables across countries seeking to identify trends and trying to make huge profits. The manager seeks to anticipate changes in prices by often assuming directional positions. At the beginning, the manager must identifies the trend to anticipate through a top-down analysis and then he/she must identify the correct time of entry and the most appropriate financial instrument so that performance depends on the quality and market timing of the investment manager. Any investment choice should be in line with the macroeconomic analysis and the portfolio's risk degree since the main goal of this strategy is capital retention(protection).[116]

2.4.5 Short selling

The Hedge Funds that use this strategy seek to profit from the decrease in the market value of some stocks by short selling the overvalued' stocks: if the stocks 'value falls, the investment manager will gain profits; On the contrary, if stock prices increase, a loss will take place.

The ideal company to go short usually has these features:

[116] ANSA, "Strategie di Investimento degli Hedge Fund", Jan.2023

Figure 19 - Features of a company on which using short-selling.

Bad fundamentals and a possible catalyst event capable of inducing adverse change to the targeted company in the short term
Companies which belong to sector affected by worsening dynamics adversely affected by external changes
Changes in the ownership structure
Companies characterized by low cash-flow level, high price earning and high leverage
Companies whose book value were being falsified
Companies whose are destroying value
Companies with high insider selling

Source: ANSA, 2023

Instead, the ideal stock where go short may have a high free-float, it has to be overvalued and/or may have low financial resources.

Hedge funds use short selling for a purely speculative purpose. The long position is characterized by a limited loss (max 100% of the investment) and limited potential gains, instead a short position may perform unlimited loss and limited gains (max 100% of the investment).

In the Short selling strategy, the investment manager, once carried out the preliminary investigation, asks to loan the stocks to a broker, on which he wants to go short. Meanwhile he also opens a margin account, constituted by cash or securities, with a broker where the size varies from country to country. Subsequently, the manager sells the shares on the market and remunerates the broker through a percentage of the interest gained on the transaction and through the so-called "short rebate".

The broker will make a profit if the estimate of the margin of guarantee recalculated is lower than the deposit, which then will return the excess to the money manager.

At the end of the transaction, when through the sale of stocks on the market the manager is able to give back the stocks to the broker, he/she will record a profit, or a loss based on his ability and the accuracy of the analyses previously made. However, the manager is subjected

to an uncertainty's degree by the position of the broker; indeed, the broker could ask to give back the shares before the conclusion of the transaction, risking a huge loss for the hedge fund. Instead, the positive result of this operation depends on the ability of the manager to implement correct stock picking and through the right market timing.[117]

Chapter 3 – Evaluating the risk exposure between the hedge funds strategies.

3.1 Intro

The hedge fund industry has experienced significant growth in recent decades as showed earlier in Figure 6,[118] and the hedge funds investment strategies have become increasingly important to understand. The global financial crisis has demonstrated that even financial experts are unable to predict all aspects of the future. The crisis, which began in the United States, quickly spread globally, resulting in consecutive drops in stock market indices. This underscores the interconnectedness of financial markets. Investing in these markets entails exposure to both regional and global risk factors, which can be challenging to anticipate.[119] Hedge funds typically use a range of sophisticated investment strategies to generate high returns; however, it involves taking on greater exposure to market risks than traditional funds. Market risk refers to the potential financial loss resulting from changes in market prices, such as interest rates, foreign exchange rates, commodity prices, or equity prices. It is evaluated based on factors such as the sensitivity of the institution's earnings or capital to market changes, management's ability to identify and manage market risk, and the nature and complexity of interest rate and market risk exposure, including trading and foreign operations.[120] Hedge funds often use a variety of techniques to manage market risks. For example, they may use leverage to amplify potential returns, but this can also increase the

[117] ANSA, "Strategie di Investimento degli Hedge Fund", Jan.2023
[118] Coresignal, "Top Hedge Fund Industry Trends in 2023 and Beyond", Dec. 2022
[119] N. L. Jerreling, "Hedge Fund Strategies: How does risk exposure vary between them?", 2016
[120] https://www.federalreserve.gov/supervisionreg/topics/market_risk_mgmt.htm

potential for losses. They may also use derivatives such as options and futures contracts to hedge against specific market risks.

However, it's important to note that hedge funds are not immune to market risks. Even with risk management strategies in place, unexpected events such as a sudden market downturn or a major geopolitical event can cause losses for hedge funds.

Taking in mind what said above, it is important to examine the impact of market risk factors on hedge fund returns, as these factors can have a significant impact on the performance of these investment vehicles and we can gain a better understanding of the different types of risks that hedge funds are exposed to, such as credit risk, exchange risk, currency risk, inflation risk, equity risk, and volatility risk; indeed, hedge fund managers can use the insights from our research to better manage their risk exposures. Moreover, by understanding which market risk factors are most relevant to their hedge fund strategies, managers can implement risk management strategies that are more tailored to their specific risks. To perform this analysis, we used a multiple regression model in R, with the hedge fund returns strategies (seen in Chp.2) as the dependent variables and the market risk factors as the independent variables. The output of the regression can provide information on the magnitude and direction of the relationship between the hedge fund strategies and the market risk factors. This type of analysis may provide valuable insights into the potential risks and benefits of different hedge fund strategies and can help investors and hedge fund managers make more informed decisions. However, it is important to note that multiple linear regression is a limited model, and there are several limitations to consider when interpreting the results. Indeed, the model assumes a linear relationship between the independent variables and the dependent variable, which may not be the case. Additionally, the model may not capture all relevant factors that impact hedge fund returns, and there may be omitted variable bias if important variables are not included in the analysis. Usually, to measure market risk,

investors and analysts use the value-at-risk (VaR)[121] method that is a statistical risk management technique which quantifies potential losses and the probability of those losses occurring for a stock or portfolio. However, certain assumptions, such as an unchanged portfolio over a specific period, can limit its accuracy for long-term investments or factor analysis used to identify underlying factors or dimensions that may explain the variation in a set of variables.

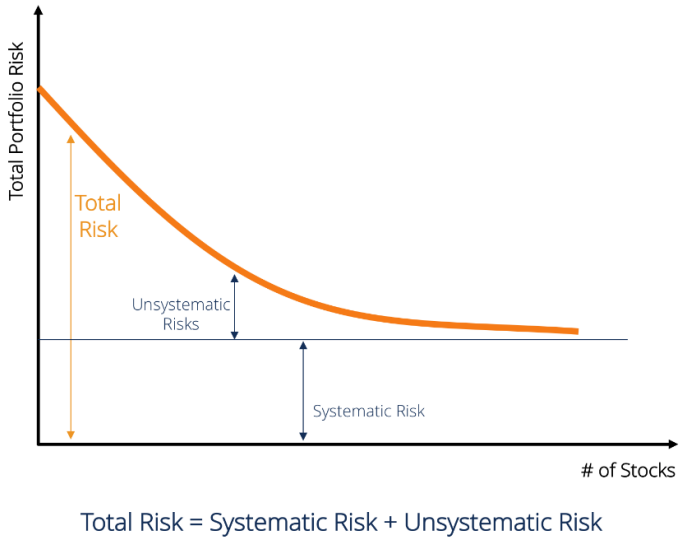
In our research we used Beta (β) as risk metric used to measure the volatility of the hedge funds returns in comparison to the market factors index; this metrics will be explained in detail in section 3.5.2.

3.2 Systematic Risk

Systematic risk refers to the possibility of a widespread failure or collapse of a company, industry, financial institution, or entire economy. It is the danger that a significant event in the financial system will trigger a chain reaction that leads to instability and significant harm to the overall system. This type of risk arises from the interconnections and interdependence within the financial system, where the loss of confidence in one institution can spread to others, potentially causing a crisis. As a result of its inherent nature in a market system, systematic risk is considered unavoidable.[122]

[121] CFI Team, "Market Risk: The uncertainty associated with any investment decision", CFI, 2023
[122] CFI Team, "Systematic Risk", CFI, 2023

Figure 20 - Total Risk and Systematic Risk



Source: CFI Team, "Systematic Risk ", CFI 2022

Systematic risk includes market risk, interest rate risk, purchasing power risk, and exchange rate risk. Market risk arises from the tendency of security prices to move together, making it almost two-thirds of total systematic risk. Interest rate risk arises due to changes in market interest rates and affects primarily fixed income securities such as bonds. Purchasing power risk arises due to inflation, which erodes the purchasing power of money and affects fixed income securities the most. Exchange rate risk is the uncertainty associated with changes in the value of foreign currencies and affects the securities of companies with foreign exchange transactions or exposures.[123] By examining the relationship between these market risk factors, and hedge fund returns, we are able to obtain valuable information about the factors that contribute to systematic risk and can inform efforts to mitigate this risk.

3.3 Purpose of the research

The relationship between hedge fund strategies and market risks is important for managing risk exposure, evaluating performance, and developing an effective investment strategy.

[123] CFI Team, "Systematic Risk: Risk caused by factors beyond the control of a company or individual. ", 2022

Allocating more capital to hedge fund strategies that are less correlated with the broader market can reduce exposure to systemic risk. Incorporating this information into risk models can help investors build more accurate models and make more informed investment decisions.

The purpose of this research is to measure the dependence between hedge funds returns and market risk factors and to relate returns to the different risks incurred.

The study is based on a previously work conducted by Linnér Jerreling N. "Hedge Fund Strategies How does risk exposure vary between them?"(2016) whose propose two questions to answer:

- How market risk factors affect the return of hedge funds?
- How may the effects of these risk factors vary across different hedge fund strategies?

3.4 Previous Research

In his study published in 1992, Sharpe explores the relationship between mutual fund performance and strategy. To do this, he uses a multiple regression model, where the returns of mutual funds are regressed against indices that represent 12 different asset classes. The coefficients estimated for each asset class indicate its contribution to the overall return, allowing for the determination of an investment style. According to Sharpe's conclusion, mutual fund returns are highly correlated with the returns of major asset classes.[124] The portion of the return that cannot be explained by the regression is attributed to security selection within the asset class or market timing.[125] In 1997, Fung and Hsieh put forth an extension to Sharpe's 12-factor model to better understand the returns of hedge funds, which are not correlated with the returns of major asset classes. Fung and Hsieh (1997) conducted a

[124] Linnér Jerreling N. "Hedge Fund Strategies How does risk exposure vary between them?", Lund University School of Economics and Management, 2016
[125] https://web.stanford.edu/~wfsharpe/art/sa/sa.htm

well-known study in the field of finance that analyzed the performance of mutual funds and hedge funds. In their study, they used the regression analysis to explain the variation in mutual fund and hedge funds returns based on several factors such as market risk, size, and style. They reported that approximately 40% of the variation in hedge funds returns is explained using that model. However, it is important to note that this result is based on a particular dataset and may not necessarily generalize to other datasets or time periods..[126] According to Fung and Hsieh (2001), hedge fund returns cannot be easily accounted for using linear models. Instead, the authors employ a combination of options, such as lookback straddles, to model the returns of hedge funds that implement a trend-following strategy, which is described as uncorrelated to equity, bond, commodity, and currency indices. The study's findings reveal that funds utilizing this strategy tended to perform well during both the best and worst financial market months. The authors also demonstrate that the lookback straddles offer a better explanation for hedge fund returns than conventional asset indices.[127] Fung and Hsieh (2011) found that Long/Short equity hedge fund returns can be explained by a four-factor model, which includes the return of the equity market, the spread between large and small cap stocks, the spread between value and growth stocks, and momentum. The study also found that there is no exposure to dynamic option-like factors in these funds. After adjusting for risk, 20% of the hedge funds showed significant positive alpha values over time, but the decay of alpha over time is evident. The observed alphas do not seem to come from other risk factors but are market volume related. The correlation with alpha is positively correlated with market volume and negatively correlated with short sale volume.[128] Billio, Getmansky, and Pellizzon (2012) found that hedge fund index returns depend on the level of

[126] Fung, William, and David A. Hsieh. "Hedge Fund Benchmarks: A Risk-Based Approach." Financial Analysts Journal, vol. 60, no. 5, 2004, pp. 65–80. JSTOR, http://www.jstor.org/stable/4480604. Accessed 10 Feb. 2023.
[127] Fung, William (Bill) and Hsieh, David Arthur, Asset-Based Hedge-Fund Styles and Portfolio Diversification (October, 2001). Duke University Fuqua School of Business Working Paper, Available at SSRN: https://ssrn.com/abstract=278737 or http://dx.doi.org/10.2139/ssrn.278737
[128] Hsieh, David. (2011). The Risk in Hedge Fund Strategies: Theory and Evidence from Long/Short Equity Hedge Funds. Journal of Empirical Finance. 18. 547-569. 10.1016/j.jempfin.2011.04.001.

volatility in the equity market. They use the VIX, a measure of implied volatility on the S&P 500, to capture these dynamics. The study suggests that hedge fund strategies change their exposure to common risk factors depending on market conditions. Several risk factors can have zero exposure in tranquil times, but significant exposure during volatile periods. Hedge funds also show explicit exposure to the Small-Large risk factor during market downturns, which suggests that this factor captures liquidity risk.[129]In 2014, Bodie, Kane, and Marcus delved deeper into the differences between mutual funds and hedge funds with regards to the fund style analysis introduced by Sharpe. They note that while this method is well-suited for mutual funds, it may not be appropriate for hedge funds as they can take short positions in assets and the coefficient estimates are not required to be non-negative. Nevertheless, the authors still found significant results in their analysis of hedge fund return exposure using a linear model. They conclude that the returns of Long/Short Equity funds are dependent on the S&P 500 index, while Convertible and Fixed Income Arbitrage funds are dependent on US Treasury rates.[130]

In their 2014 study, Bali, Brown, and Caglayan investigate the impact of macroeconomic uncertainty on returns across various hedge fund strategies. They introduce alternative measures of macroeconomic risk based on the time-varying volatility of common macroeconomic risk factors, which generate uncertainty betas used to regress hedge fund excess returns. The authors' findings suggest that macroeconomic risk is a stronger determinant of cross-sectional hedge fund returns than conventional risk measures. The study also reveals that managers of directional and semi-directional hedge funds possess the ability to adjust portfolio exposure in response to changes in macroeconomic risk, reducing exposure

[129] https://gcfp.mit.edu/wp-content/uploads/2013/08/Econometric-Measures-of-Connectedness-and-Systemic-Risk-in-the-Finance-and-Insurance-Sectors.pdf
[130] Bodie, Z., Kane, A. and Marcus, A. (2014) Investments. Global Edition, 10th Edition, McGraw Hill Higher Education, New York.

when risk increases and vice versa. In contrast, managers of non-directional hedge funds do not exhibit the same timing ability.[131]

Bussière, Hoerova, and Klaus (2015) investigated the commonality across hedge fund strategy returns and found that hedge funds with high commonality in returns were typically exposed to equity-oriented risk factors. The study concluded that increased exposure to emerging markets equity between 2003 and 2006 increased commonality. During this upmarket period, investment in assets with high downside and risk exposure increased commonality further. Due to commonality, the authors argue that various hedge funds did not offer diversification benefits to investors as claimed.[132]

Linnér Jerreling N. in his work "Hedge Fund Strategies: How does risk exposure vary between them?" (2016) The author's conclusion is that their research did not find any significant exposure of hedge fund returns on various indices, including the S&P500, VIX, US T-bond rate, US T-bill rate, USD/GBP exchange rate, and the USD/JPY exchange rate. Additionally, the research did not suggest any differences in risk exposure across different hedge fund strategies. The author acknowledges that these conclusions may not represent the true relationship between the variables and indices and suggests investigating other independent variables or using a different research method to gain a better understanding of hedge fund risk exposure. The author also suggests that access to a large hedge fund database with fund-level data would be helpful for future research.

[131] Turan G. Bali, Stephen J. Brown, Mustafa O. Caglayan, Macroeconomic risk and hedge fund returns,
Journal of Financial Economics, Volume 114, Issue 1, 2014, Pages 1-19,ISSN 0304-405X
[132] https://econpapers.repec.org/article/eeejbfina/v_3a54_3ay_3a2015_3ai_3ac_3ap_3a266-280.htm

3.5 Theoretical framework

Studying the relationship between hedge fund returns and market risk variables typically involves statistical analysis methods used to study this relationship such as multi-factor models, Correlation Analysis, Regression analysis, Factor analysis and Risk-adjusted methods. For this research, the Multiple linear regression analysis has been adopted, to provide a base for further analysis.

3.5.1 Multiple Linear Regression Model

Regression analysis is a group of statistical techniques used to estimate the relationship between a dependent variable and one or more independent variables. This method can be used to evaluate the strength of the relationship between the variables and to predict their future relationship. There are several types of regression analysis, including linear, multiple linear, and nonlinear.[133] The most common models are simple linear and multiple linear, while nonlinear regression analysis is used for more complex data with a nonlinear relationship between the dependent and independent variables.[134] Analytically:

$$Y_1 = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots \beta_n X_n + \varepsilon$$

Where:

- Y_1 is the independent variable.
- β_0 is the intercept.
- β_1, β_2 are the regression coefficient representing the change in Y relative to a one-unit change in X_1, X_2.
- β_p is the slope coefficient for each independent variable.
- ε is the model's random error (residual) term.

[133] *Data Analytics Multiple-Choice Questions (MCQs) - Includehelp.com*, https://www.includehelp.com/data-analytics/mcq.aspx.
[134] CFI Team, "Regression Analysis, CFI 2022

Multiple Linear Regression has five assumptions that must be met for the analysis to be valid:

- linear relationship between the dependent and independent variables
- independent variables are not highly correlated with each other
- the variance of residuals is constant,
- independence of observations
- multivariate normality of residuals.

To check these assumptions, scatterplots, Variance Inflation Factor method, standardized residual plots, Durbin Watson statistic, normal probability plot, and other statistical method has been used.[135]

This method is like correlation analysis, but it goes a step further by estimating the coefficients of a regression equation that predicts hedge fund returns based on market risk factors. The coefficients represent the estimated relationship between each risk factor and hedge fund returns.

Even if the multiple linear regression is a useful tool, it has limitations and should be used in conjunction with other statistical techniques to provide a more comprehensive understanding of the relationship between hedge fund returns and market risk variables. The model assumes a linear relationship between the variables and does not account for non-linear interactions or complex market dynamics. As a result, caution should be exercised when interpreting the results of multiple linear regression analysis.

3.5.2 β (beta) Coefficient

Systematic risk refers to the portion of total risk that is outside the control of a specific company, such as economic, political, and social factors. This type of risk can be measured by a security's sensitivity to the overall market return, which is represented by the β (beta)

[135] CFI Team, "Multiple Linear Regression", CFI, 2022

coefficient. This coefficient is calculated by regressing the security's return on the market return, and the resulting equation provides an estimate of the β coefficient.

The estimated equation is:

$$R_p = \alpha + \beta R_M + \epsilon$$

$R_M = Market\ Return$
$R_P = Portfolio\ Return$
$\epsilon = Error\ Term$

The return on a specific security is denoted as R_S, while the market return is denoted as R_M. The relationship between R_S and R_M can be expressed using a linear regression model, where the regression coefficient β represents the sensitivity of R_S to changes in R_M. The model also includes an intercept term α, which represents the expected return on the security when the market return is zero. The calculation of β involves dividing the covariance of R_S and R_M by the variance of R_M. This formula can be used to estimate the β coefficient for a given security.

To calculate β we can use the following formula:

$$\beta = \frac{Covariance(R_P, R_M)}{Variance(R_M)}$$

Where:

R_M is the market return.

R_P is the portfolio return.

The Beta coefficient is a tool used in finance to measure the volatility of a stock or portfolio relative to the market. It can be viewed as a measure of systematic risk, which represents the risk that is inherent in the entire market and cannot be diversified away. A Beta value of 0

suggests that the stock or portfolio is uncorrelated with the market return, while a negative Beta value indicates an inverse correlation. When the Beta value is between 0 and 1, it indicates a positive correlation with the market return but with less volatility than the market, while a Beta value of 1 represents a perfect correlation. A Beta value greater than 1 suggests a positive correlation with the market but with greater volatility, indicating that the stock or portfolio is riskier than the overall market.[136]

3.5.2 Correlation and Autocorrelation

A correlation is a statistical tool that measures the strength of the relationship between two variables. It is most effective when the variables display a linear relationship. The relationship can be visually displayed in a scatterplot, which allows us to analyze the data and determine whether the variables are correlated or not. The correlation coefficient is a measure of the degree of association between two variables and can range from -1 to 1. A value of -1 indicates a perfect negative correlation, meaning the variables move in opposite directions, whereas a value of 0 indicates no correlation between the variables. A value of 1 indicates a perfect positive correlation, meaning the variables move in the same direction.[137]

The correlation formula is:

$$r = \frac{\sum (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum (x_i - \bar{x})^2 \sum (y_i - \bar{y})^2}}$$

Where:

[136] CFI Team, "Systematic Risk: Risk caused by factors beyond the control of the company or individual", CFI, 2022

[137] CFI Team, "Correlation: A statistical measure of the relationship between two variables", 2022

r – the correlation coefficient of the linear relationship between the variables

$\mathbf{x_i}$ – the values of the x-variable in a sample

$\bar{\mathbf{x}}$ – the mean of the values of the x-variable

$\mathbf{y_i}$ – the values of the y-variable in a sample

$\bar{\mathbf{y}}$ – the mean of the values of the y-variable

On the other hand, autocorrelation, also known as serial correlation, measures the extent to which there is a correlation between the values of a variable across different time periods in time series data. This is often applied to observations that occur at different time points, such as measuring wind speed on different days of the week. If the wind speed values measured closer in time are more similar than those measured farther apart, the data is said to exhibit autocorrelation.[138]

3.5.3 Durbin-Watson Test

The Durbin Watson statistic is a test statistic to detect autocorrelation in the residuals from a regression analysis.[139] The Durbin Watson statistic is a test statistic used to identify the presence of autocorrelation in the residuals of a regression analysis. The value of the statistic ranges between 0 and 4, with a value of 2 indicating the absence of autocorrelation. This test can be used to forecast the movement of stock prices based on historical data by measuring the degree of correlation between the values of variables across different data sets, also known as serial correlation or autocorrelation.

he hypotheses followed for the Durbin Watson statistic:

H_0 = First-order autocorrelation does not exist.

[131] [139] CFI Team, "Durbin Watson Statistic", 2022

H_1 = First-order autocorrelation exists.

The assumptions of the test are:

- Errors are normally distributed with zero mean
- Stationary errors

The formula for the D-W test is:

$$d = \frac{\sum_{t=2}^{T}(\varepsilon_t - \varepsilon_{t-1})^2}{\sum_{t=1}^{T}\varepsilon_t^2}$$

Where:

- E_t is the residual figure.
- T is the number of observations of the experiment.

3.5.4 Newey–West estimator

The Newey-West estimator is a statistical method used to adjust standard errors in regression analysis to account for autocorrelation and heteroscedasticity in the data. The estimator was developed by Whitney K. Newey and Kenneth D. West and is widely used in econometrics.

The formula for the Newey-West estimator is:

$$NW = \beta / [1 + 2\sum(1-h/l)^2]$$

Where NW is the Newey-West estimator, β is the ordinary least squares (OLS) estimator, h is the lag order, l is the number of observations, and ∑ represents a summation over the lag

order. The Newey-West estimator is the ratio of the OLS estimator and a bias correction term that depends on the lag order and number of observations.[140]

The Newey-West estimator is used to correct for heteroscedasticity and autocorrelation in the residuals of a regression model, which can lead to biased standard errors and incorrect hypothesis testing results. By adjusting the standard errors, the Newey-West estimator allows for more accurate statistical inference.

3.5.5 Variance Inflation Factor and Multicollinearity

The Variance Inflation Factor (VIF) is a statistical tool used to measure the extent of multicollinearity in regression analysis. VIF measures the impact of collinearity on the variance of a regression coefficient. It shows how much the variance of a coefficient increases due to collinearity.

VIF can be calculated by the formula below:

$$VIF_i = \frac{1}{1\text{-}R_i^2} = \frac{1}{\text{Tolerance}}$$

The coefficient of determination for regressing an independent variable on the other independent variables is represented by R_i^2. VIF and tolerance can be used to detect multicollinearity, where VIF shows the severity of multicollinearity by measuring the increase in the variance of the regression coefficient, and tolerance is the reciprocal of VIF. A VIF above 4 or tolerance below 0.25 suggests the possibility of multicollinearity, while a VIF above 10 or tolerance below 0.1 indicates significant multicollinearity.

[140] Newey, Whitney K., and Kenneth D. West. "A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix." Econometrica, vol. 55, no. 3, 1987, pp. 703–08. JSTOR, https://doi.org/10.2307/1913610. Accessed 18 Feb. 2023.

Multicollinearity can be corrected by removing one or more highly correlated variables or by using principal components analysis or partial least square regression instead of ordinary least squares regression. High VIFs can be safely ignored in certain situations, such as when high VIFs only exist in control variables, when high VIFs are caused by the inclusion of the products or powers of other variables, or when a dummy variable that represents more than two categories has a high VIF.[141]

3.5.6 Heteroskedasticity and Homoskedasticity

Heteroskedasticity refers to the situation where the variance of the residuals is not constant over the range of measured values. In regression analysis, this results in unequal scatter of the residuals or error term. Heteroskedasticity can be identified by observing a fan or cone shape in the plot of the residuals. This statistical issue is problematic because ordinary least squares (OLS) regression assumes that the residuals are drawn from a population with a constant variance. If the scatter of the residuals is unequal, the OLS regression results may be invalid. While heteroskedasticity can be caused by various factors, it often occurs due to problems with the dataset. Regression models that involve a wide range of values are more susceptible to heteroskedasticity because of the significant differences between the smallest and largest values.

The presence of unequal residual variance indicates heteroskedasticity, whereas constant residual variance is known as homoskedasticity. Homoskedasticity implies that the residuals are equal across all independent variables. A homoscedastic model satisfies one of the assumptions of OLS regression and leads to a more accurate model.[142]

[141] CFI Team, "Variance Inflation Factor (VIF) A measure of the severity of multicollinearity in regression analysis", 2022

[142] CFI Team, "Heteroskedasticity: Situations where the variance of the residuals is unequal over a range of measured values", 2022.

3.5.7 Breusch-Pagan Test

The Breusch Pagan Test, which was developed by Trevor Breusch and Adrian Pagan in 1979, is a statistical technique used to detect heteroskedasticity in a linear regression model. The method assumes that the error terms of the model follow a normal distribution and examines whether the variance of these errors is related to the values of the independent variables. This test is performed using a $\chi 2$ test.[143]

3.5.8 Return and liquidity

In the first chapter we discussed liquidity and why hedge funds typically hold more illiquid assets than mutual funds. Illiquidity is viewed as a risk, and investors will only accept holding illiquid assets if they are compensated with higher returns. As previously illustrated, hedge funds often utilize lock-up periods of several years, during which investors cannot withdraw their capital, to invest in illiquid assets. It is essential to consider this when analyzing hedge fund returns since high returns may result from illiquidity compensation rather than superior trading skills.[144]

3.6 Conducting the research.

As previously mentioned, certain research studies, suggest that it is challenging to use linear models to explain hedge fund returns. However, other studies, such as Bode, Kane and Marcus (2014), have been able to obtain significant results using linear models. In order to conduct our we used the multiple linear regression model using the software R Studio after all the datasets have been subject to an accurate cleaning process.

[143] https://cran.r-project.org/web/packages/olsrr/vignettes/heteroskedasticity.html
[144] Bodie, Z., Kane, A., & Marcus, A. J. (2014). Investments. 10th ed. Berkshire: McGraw-Hill.

At first, we kept the assumptions made by Linnér Jerreling N. (2016) for both the dependent variables and the independent variables:

- Independent variables are chosen from previous research.
- All HFs[145] indices regress on the same independent variables.
- Equity variables are included because the HFs operate in these markets.
- Measure of volatility included since previous research suggest to.
- Interest rate variables are included because many HFs operate in the fixed income markets.
- Exchange rates versus currencies are included since HFs trade in foreign markets.
- All the regressors are tested for autocorrelation and heteroscedasticity.

Moreover, to support the assumptions made before, we based our analysis on risk variables that have an influence on the systemic risk as reported by the Corporate Finance Institute (CFI) website; respectively, market risk, interest rate risk and purchasing power risk. [146]

As previously illustrated, these risk factors are correlated with systemic risk, making it important to understand their impact. Interest rate risk is caused by fluctuations in interest rates and may affect hedge funds that invest in fixed-income securities, such as bonds.[147] Currency risk stems from potential changes in exchange rates that can impact the value of hedge fund investments. Equity risk arises from changes in the value of equity securities, such as stocks, and can have a significant impact on the returns of hedge funds that invest in these securities. Volatility risk is the possibility of rapid and substantial changes in the value of financial assets and is particularly relevant to hedge funds that use leveraged investments or complex investment strategies.

[145] HFs stand for "Hedge Funds"
[146] https://corporatefinanceinstitute.com/resources/capital-markets/market-risk/
[147] https://www.fidelity.com/learning-center/investment-products/fixed-income-bonds/fixed-income-investing-risks

These market risk factors can be correlated with systemic risk in several ways. Systematic risk can be captured by the sensitivity of a security's return to the overall market return. This sensitivity is calculated by the β (beta) coefficient as explained in section 3.5.2; the Beta of a stock or portfolio is a measure of the instrument's volatility relative to the overall market volatility. It serves as a proxy for the stock's systematic risk and can indicate how risky a stock is in comparison to market risk. [148] In addition, if hedge funds are heavily invested in a particular market or asset class, a decline in that market or asset class can have a significant impact on the hedge funds and their investors, potentially triggering a chain reaction that spreads throughout the financial system.

3.6.1 Methodology

For what concern the hedge funds strategies returns, data have been obtained from CISDM (the Center for International Securities and Derivatives Markets) database where the eight individual CISDM Hedge Fund Strategy Indices reflect the median performance of funds within self-reported fund of fund and hedge fund strategy classifications reporting to the Morningstar CISDM Hedge Fund Database. [149] The data set used in this study for hedge funds encompasses monthly returns over the holding period, starting from January 1994 (or January 1998 for the Fixed Income arbitrage index) up until April 2022. The dataset is composed of 340 observations and 15 variables. The indices being analyzed include Convertible Arbitrage, Distressed Securities, Equity Long/Short, Equity Market Neutral, Event-Driven, Fixed Income Arbitrage, Global Macro, and Merger Arbitrage.

[148] https://corporatefinanceinstitute.com/resources/risk-management/systematic-risk/
[149] https://www.isenberg.umass.edu/centers/center-for-international-securities-and-derivatives-markets/cisdm-indices

On the other hand, the data relative to market risk factors has been obtained from investing.com referring to the period between the 01/01/1994 and the 01/04/2022.[150] All the data in this research are denominated in US dollars.

Taking into account what has been said in paragraph 3.6 the most critical risks for hedge funds are represented by interest rate risk, currency risk, equity risk and volatility risk; so, in order to conduct this research, we chose to adopt the following market risk index:

- INX: refers to the S&P 500 Index, a stock market index that measures the performance of the 500 largest publicly traded companies in the US. (Market/Equity Risk)
- VIX: refers to the CBOE Volatility Index, a measure of the market's expectation of volatility over the next 30 days. (Volatility risk)
- US10Y: refers to the US 10-Year Treasury Yield, which is the interest rate on US government bonds with a maturity of 10 years. (Equities Risk)
- US3M: refers to the US 3-Month Treasury Yield, which is the interest rate on US government bonds with a maturity of 3 months. (Equities Risk)
- USD/GBP: refers to the British Pound, a currency. (Exchange Rate Risk)
- USD/JPY: refers to the Japanese Yen, a currency. (Exchange Rate Risk)
- USD/EUR: refers to the Euro, a currency. (Exchange Rate Risk)

Moreover, to improve the model, we choose these market Index:

- EUIDX: refers to an index that measures the performance of the European Union economy. (Currency Risk)

[150] https://www.investing.com/currencies/usd-eur-historical-data

- IXIC: refers to the NASDAQ Composite Index, a stock market index that measures the performance of all the companies listed on the NASDAQ Stock Exchange. (Equity Market Risk)
- USDX: refers to the US Dollar Index, which measures the value of the US dollar relative to a basket of foreign currencies. (Currency Risk)
- FEDFUNDS: refers to the Federal Funds Rate, which is the interest rate at which banks lend money to each other overnight. (Interest Rate Risk)
- DJI: refers to the Dow Jones Industrial Average, a stock market index that measures the performance of 30 large publicly traded companies in the US. (Market Risk/Equity Risk)

The statistical analysis is divided into three steps; first we will conduct the Multiple Linear Regression Model, which was used to examine the relationship between the market risk factors and the dependent variables. Then, we will use the Durbin-Watson Test to evaluate the existence of autocorrelation in the residuals or the Breusch Pagan Test to detect the heteroscedasticity of the regression model and then use the Newey-West adjusted covariance matrix used to correct for heteroscedasticity and autocorrelation in the residuals of a regression model, which can lead to biased standard errors and incorrect hypothesis testing results. By adjusting the standard errors, the Newey-West estimator allows for more accurate statistical inference. Lastly, we used the Variance Inflation Factors (VIFs) function on each predictor to measure the degree to which the variance of a predictor's estimated regression coefficients is increased by multicollinearity with the other predictors in the model. Multicollinearity can be corrected by removing one or more highly correlated variables or by using principal components analysis or partial least square regression instead of ordinary least squares regression.

3.6.2 Limitations

The data regarding the returns of the hedge funds strategies are available since 01/01/1994 till 01/04/2022 in the CISDM archive; we choose this dataset to improve the precedent model developed by Niklas Linnér Jerreling (2016) which use the same dataset for his research. Taking this consideration in mind, we choose the same time frame for the market risk index to provide a better comparison.

For what concern the model we decide to test the multiple linear regression model because I was able to perform a regression analysis using R Studio learnt in the Marche Polytechnic University to replicate and improve the result obtained by the previously mentioned author. However, we already know from previously works that regression analysis may not be adequate to study the relationship between hedge fund returns and market risk factors, due to several reasons Firstly, hedge fund returns may not have a linear relationship with market risk factors, which a regression assumes. This nonlinearity can make it difficult for regression analysis to capture the true relationship between the variables. Secondly, the market risk factors used in the regression model may be highly correlated with each other, leading to multicollinearity. This can affect the accuracy and reliability of the regression results and make it challenging to identify the variables that are most important in explaining hedge fund returns. Finally, outliers in hedge fund returns, caused by factors not captured by market risk factors, can skew the regression results, and make it hard to draw meaningful conclusions. Moreover, the findings of this research are supported by the work conducted by Fung and Hsieh (2001) where the authors proved that a linear model may not be enough to explain hedge fund returns.[151]

[151] https://www.grahamcapital.com/TheRiskinHedgeFundStrategies.pdf

3.7 Empirical results

The table below shows the different results obtained from the Multiple Linear Regression (MLR) for each strategy highlighting the significant regressors, the goodness of the model (R-squared) and the beta level for each strategy. We have chosen a significant level of 0.05 (5%) for which the regressors with the P-value higher than this threshold are statistically insignificant.

Figure 21 – Multiple Linear Regression Model Results

Investment Strategy	R^2	Regressor	Beta	t value	Pr(>|t|)	Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
Convertible Arbitrage	34%	S&P500	0.09	2.0219	0.044	*
		USD/JPY	0.19	2.4376	0.015315	*
		USDX	-0.53	-2.0457	0.041585	*
Distressed Securities	43%	Alpha	0.004	3.54	0.0004	***
		S&P500	0.104	2.7891	0.0055946	**
		USD/JPY	0.16	3.1904	0.0015587	**
		IXIC	0.057	2.9146	0.003807	**
		USIDX	-0.46	-2.8122	0.0052183	**
Event Driven	62%	Alpha	0.003	3.4192	0.0007	***
		S&P500	0.19	3.723	0.0002318	***
		FEDFUNDS	0.0007	2.1112	0.035514	*
		USIDX	-0.42	-2.5954	0.0098749	**
		IXIC	0.04	1.9309	0.0543624	.
		US10Y	0.022	2.5542	0.0110977	*
		USD/JPY	0.15	2.3419	0.0197834	*
Long-Short	72%	Alpha	0.002	2.1322	0.0337328	*
		S&P500	0.11	1.8693	0.0624684	.
		US10Y	0.01	2.3614	0.0187931	*
		IXIC	0.17	3.8998	0.0001169	***
		USIDX	-0.4	-2.5599	0.0109209	*
		FEDFUNDS	0.001	2.9455	0.0034559	**
Fixed Income Arbitrage	30%	S&P500	0.13	2.2552	0.024895	*
		USD/GBP	-0.11	-3.1788	0.001645	**
		USIDX	0.12	2.0626	0.04008	*
		FEDFUNDS	0.001	3.2643	0.001234	**
Market Neutral	30%	Alpha	0.0036	4.7073	3.71E-06	***
		USD/JPY	0.04	1.8141	0.0705762	.
		FEDFUNDS	0.0007	3.6177	0.0003443	***
Global Macro	30%	S&P500	0.13	2.2552	0.024895	*
		USD/GBP	-0.11	-3.1788	0.001645	**
		USIDX	0.12	2.0626	0.04008	*
		FEDFUNDS	0.001	3.2643	0.001234	**
Merger Arbitrage	33%	Alpha	3.06E-03	3.8025	0.0001	***
		S&P500	8.46E-02	3.0289	0.0026495	**
		IXIC	3.12E-02	2.4731	0.0139014	*
		FEDFUNDS	8.30E-04	2.741	0.0064628	**

3.8 Discussion

The average R^2 score of the 8 indices being 0.41375 implies that the independent variables can explain near than 40% of hedge fund returns. This result is pretty good since prior research by Fung and Hsieh (1997) using a similar model could explain 40% of fund returns.

3.9.1 Convertible Arbitrage

Referring to Convertible Arbitrage Strategy, the following independent variables are statistically significant (based on a p-value less than 0.05): S&P500, USD/JPY, USDX and FEDFUNDS. The S&P 500 (INX) have a positive impact on the returns of the convertible arbitrage investment strategy, with a β coefficient of 0.09293157, meaning that for every unit increase in the S&P 500 index, the returns of the convertible arbitrage strategy increased by 0.09293157 units. Indeed, a $\beta \geq 0$ means that an increase in the INX index is associated with an increase in the returns of the convertible arbitrage strategy.

The USD/JPY (JPY) exchange rate also has a positive impact on the returns of the convertible arbitrage investment strategy, with a β coefficient of 0.19023238. This suggests that an increase of one unit of the USD/JPY exchange rate may lead to an increase of 0.19 in the returns of the convertible arbitrage strategy.

Instead, the USDX index has a negative impact on the returns of the convertible arbitrage investment strategy, with a β coefficient of -0.54353891. A β is ≤ 0 means that an increase in the USDX index is associated with a decrease in the returns of the convertible arbitrage strategy. Since the USDX index measures the value of the US dollar relative to a basket of other currencies, including the euro, yen, pound, franc, Canadian dollar, and Swedish korona; an increase in the value of the USDX indicates that the US dollar is strengthening relative to other currencies, while a decrease in the value of the USDX indicates that the US dollar is weakening relative to other currencies.

Finally, the FEDFUNDS rate had a positive impact on the returns of the convertible arbitrage investment strategy, with a β coefficient of 0.00056899. This suggests that an increase in the FEDFUNDS rate leads to a small increase in the returns of the convertible arbitrage strategy. Changes in interest rates, as represented by the FEDFUNDS rate, can also impact the returns of the convertible arbitrage strategy.

So, to answer the previously answer we can state that the result of the regression analysis shows that returns of hedge funds whose adopt convertible arbitrage strategy are exposed mainly to the equity market risk, the exchange rate risk, the currency risk and the interest rate risk in the manner indicated on the table.

In this case, the R-squared value is 0.3362, meaning that about 34% of the variation in the monthly returns of the convertible arbitrage investment strategy can be explained by the independent variables in the model. The adjusted R-squared value is 0.3139, which is like the R-squared value and adjusts it based on the number of independent variables in the model.

The median residual is close to zero, which suggests that the regression model fits the data well. However, the spread of the residuals, as indicated by the first and third quartiles, indicates that there may be some heterogeneity in the residuals.

Figure 22 - Convertible Arbitrage Residuals

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.073817 -0.005243 -0.000156  0.005971  0.044828
```

The Durbin-Watson statistic is DW = 1.3952, which is lower than 2, implying that there is positive serial correlation (autocorrelation) in the residuals. The p-value (8.03e-09) is very small, meaning that the probability of observing such a low DW statistic under the

assumption of no autocorrelation is extremely low. So, the alternative hypothesis (true autocorrelation is greater than 0) is supported by the data. Since there is presence of serial correlation in the residuals of the regression we used the Newey-West adjusted covariance matrix to correct for heteroscedasticity and autocorrelation in the residuals.

Lastly, we calculate the Varian Inflation Factor technique to measure the extent of multicollinearity in regression analysis obtaining this result:

Figure 23 - VIF Convertible Arbitrage

INX	VIX	US10Y	US3M	GBP	JPY	EUIDX	IXIC	USDX	FEDFUNDS	DJI
4.899385	1.896070	1.239246	1.033861	3.352731	3.837747	10.732413	3.647790	21.312754	1.039981	1.037016

Based on the VIF values the variables with the highest collinearity are:

- USDX with a VIF value of 21.312754
- EUIDX with a VIF value of 10.732413

These VIF values indicate that these variables have high levels of collinearity with the other predictor variables in the model. This high collinearity may cause problems for the model, such as making it difficult to estimate the coefficients accurately or leading to unstable predictions, so further adjustment is suggested.

3.9.2 Distressed Securities

Based on the result, S&P500, USD/JPY, IXIC, and USIDX are significant in the model (p-values less than 0.05). The residuals should be normally distributed with mean 0 and constant variance; in this case the median of 0.000447 being close to 0 supports this assumption.

Figure 24 - Distressed Securities Residuals

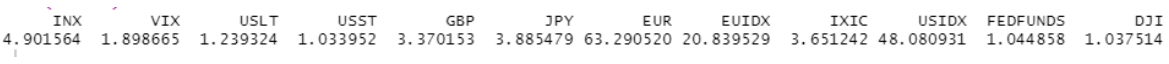
```
Residuals:
      Min        1Q    Median        3Q       Max
-0.068142 -0.006110  0.000447  0.007270  0.034089
```

The DW statistic is 1.3488, with a p-value of 6.564e-10. The low p-value indicates that there is evidence of autocorrelation. Since the autocorrelation can affect the validity of the regression results, we used the NW estimator to correct the t values. The variables S&P500, USD/JPY, IXIC, USIDX, have p-values less than 0.05, meaning that there is evidence that these variables are related to the dependent variable. The Beta values for these market risk factors variable are respectively: 0.104, 0.16, 0.057 and -0.46 meaning that there exists a positive relationship between these variables and the distressed securities returns except for the USIDX index. The intercept (Alpha) represents the expected value of the dependent variable when all the predictor variables in the model are zero. A significant intercept suggests that there is a non-zero baseline value for the dependent variable, even when all the predictor variables are absent or have a value of zero. In practical terms, this means that there are factors influencing the dependent variable other than the predictor variables included in the model. However, further analysis is suggested.

The multiple R-squared value is 0.4333, which means that about 43.33% of the variance in the dependent variable is explained by the independent variables. The adjusted R-squared is 0.4125, which is a correction of the R-squared to account for the number of independent variables in the model. The F-statistic is 20.83 with a p-value of less than 2.2e-16, which means that the model is significant, and the independent variables have a meaningful relationship with the dependent variable.

Based on the VIF values the variables with the highest collinearity are INX, EUR, EUIDX, and USIDX

Figure 25 - VIF for Distressed Securities



INX	VIX	USLT	USST	GBP	JPY	EUR	EUIDX	IXIC	USIDX	FEDFUNDS	DJI
4.901564	1.898665	1.239324	1.033952	3.370153	3.885479	63.290520	20.839529	3.651242	48.080931	1.044858	1.037514

To conclude, from this research we found out that the returns of hedge funds whose adopt distressed securities strategies are exposed mainly to the equity market risk, the exchange rate risk, the currency risk, and the interest rate risk in the manner indicated on the table.

3.9.3 Event Driven

Based on the result, S&P500, US10Y, USD/JPY, IXIC, USIDX and FEDFUNDS are significant in the model (P-values less than 0.05).

The S&P 500 Index has a positive impact on the Event Driven strategy returns. For a unit increase in INX, the Event Driven returns are expected to increase by 0.19. The positive relationship between the S&P 500 Index and the Event Driven strategy returns could happen for several reasons. Generally, when the S&P 500 performs well, it can be a sign of a healthy stock market and a strong overall economy. In such an environment, companies are more likely to perform well and generate positive returns, which can benefit the Event Driven strategy. The US 10-Year Treasury Yield variable is significant, meaning that the interest rate on US government bonds has a positive impact on the Event Driven strategy returns. For a unit increase in US10Y, the Event Driven strategy returns are expected to increase by 0.02. The relationship between US10Y and Event Driven strategy returns may be related to the fact that Event Driven strategies often involve investing in corporate events such as mergers, acquisitions, and restructurings. The USD/JPY variable is significant, for a unit increase in JPY, the Event Driven returns are expected to increase by 0.15. The IXIC variable is less significant, meaning that the performance of the companies listed on the NASDAQ Stock

Exchange has a small positive impact on the Event Driven returns, although the p-value is close to the significance level of 0.04. The USDX (US Dollar Index) variable is significant, for a unit increase in USDX, the Event Driven strategy returns are expected to decrease by 0.42%; meaning that the value of the US dollar relative to a basket of foreign currencies has a negative impact on the Event Driven strategy returns. The FEDFUNDS variable is significant; for a unit increase in FEDFUNDS, the Event Driven returns are expected to increase by 0.00077, meaning that the interest rate at which banks lend money to each other overnight has a positive impact on the Event Driven strategy returns. In this case alpha is significant meaning that there are factors influencing the dependent variable other than the predictor variables included in the model.

In this case, the R-squared value is 0.6151, meaning that about 62% of the variation in the monthly returns of the event driven investment strategy can be explained by the independent variables in the model. The adjusted R-squared value is 0.601, which is like the R-squared value and adjusts it based on the number of independent variables in the model.

The Durbin-Watson statistic is DW = 1.7443, with a p-value = 0.007998, indicating that the null hypothesis of no autocorrelation in the residuals can be rejected, so there is positive autocorrelation in the residuals and NW test should has been adopted. Lastly the VIF shows that INX, EUR, EUIDX, USIDX suffer from multicollinearity.

Figure 26 - VIF Event Driven

```
      INX       VIX      USLT      USST       GBP       JPY       EUR     EUIDX      IXIC     USIDX  FEDFUNDS       DJI
 4.901564  1.898665  1.239324  1.033952  3.370153  3.885479 63.290520 20.839529  3.651242 48.080931  1.044858  1.037514
> |
```

To conclude, from this research we found out that the returns of hedge funds whose adopt event driven strategies are exposed mainly to the equity market risk, the exchange rate risk, the currency risk and the interest rate risk in the manner indicated on the table.

3.9.4 Long-Short Equity

In this case, the residuals range from -0.045029 to 0.041607, with a median of 0.000120. The first quartile (25th percentile) of the residuals is -0.006394, while the third quartile (75th percentile) is 0.006042. This suggests that most of the residuals are fairly small, with some larger residuals that may be outliers.

Figure 27 - Long Short residuals

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.045029 -0.006394  0.000120  0.006042  0.041607
```

The residual standard error is 0.01196, and the multiple R-squared is 0.7158, which indicates that about 71.58% of the variation in the dependent variable is explained by the independent variables included in the model. The adjusted R-squared, which adjusts the R-squared for the number of independent variables in the model, is 0.7053. The F-statistic and its corresponding p-value of 68.62 and < 2.2e-16, respectively, indicate that the overall fit of the model is statistically significant.

For what concern the Durbin-Watson test statistic is DW = 1.7251, with a p-value = 0.004845 that suggests positive autocorrelation in the residuals, which indicates that the model may not be capturing all the relevant information in the data.

After performing a t test, we discover that the returns of Long-Short equities strategies are positive correlated with the S&P500 (β = 0.11), US10Y (β = 0.015), IXIC (β = 0.17) and FEDFUNDS (β = 0.001) significant regressors; instead the USIDX exchange rate shows a negative relationship (β = - 0.40). The positive exposure to equity risk supports the thesis of Fung and Hsieh (2011) and also the work made by Billo, Getmansky and Pellizon (2012) where they find a positive exposure to the equity market. In this case, Alpha is quite

significant means that there are factors influencing the dependent variable other than the predictor variables included in the model.

Based on the VIF values the variables with the highest collinearity are INX, EUR, EUDIX, USIDX

Figure 28 - VIF for Long-Short equity strategies

INX	VIX	USLT	USST	GBP	JPY	EUR	EUIDX	IXIC	USIDX	FEDFUNDS	DJI
4.901564	1.898665	1.239324	1.033952	3.370153	3.885479	63.290520	20.839529	3.651242	48.080931	1.044858	1.037514

To conclude, ss result of this analysis, the returns of hedge funds whose adopt long-short strategies are exposed mainly to the equity market risk, the exchange rate risk and the interest rate risk in the manner indicated on the table.

3.9.5 Fixed Income Arbitrage

In this case, the most significant regressors are S&P500, USD/GBP, USIDX and FEDFUNDS. For each increase in one unit of S&P500 the FIA returns an increase of 0.13. The exchange rate USD/GBP shows a negative relationship with the FIA returns, indeed an increase of one unit on the exchange results in a decrease of 0.11 in FIA returns. The USIDX shows a positive relationship with the FIA returns, for each unit of percent in increase of USIDX the return increase of 0.124. The FEDFUNDS show a weak positive relationship, for each percent unit in increase of FEDFUNDS, the FIA returns increase of 0.001. According to the previously result, the CFI sustains that interest *rate changes are the main source of risk for fixed income securities such as bonds and debentures.*[152] The residuals suggest that the range of residuals is relatively small, and the median of the residuals is very close to zero,

[152] CFI Team, "Systematic Risk: Risk caused by factors beyond the control of a company or individual", CFI, 2022

indicating that the model is making accurate predictions on average. Additionally, the difference between the 1Q and 3Q values is relatively small, which suggests that the residuals are somewhat evenly distributed around zero.

Figure 29 - Fixed Income Arbitrage Residuals

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.143050 -0.004632  0.000687  0.005678  0.037591
```

The result of the Durbin-Watson statistic for this regression model is 1.9038, close to 2 indicating the absence of autocorrelation and the p-value of 0.1866, larger than 0.05, which confirms the result previously obtained.

As in the case of the global macro we check for the heteroskedasticity using the studentized Breusch-Pagan statistical test. The p-value of 0.001124 suggests that there is strong evidence against the null hypothesis and that the variance of the errors is not constant across all levels of the independent variables. Therefore, this may indicate that there is heteroscedasticity in the data, which means that the variability of the errors is different for different levels of the independent variables, so we proceed with the t test.

The multiple R-squared value is 0.2994, which means that about 30 % of the variance in the dependent variable is explained by the independent variables. The adjusted R-squared is 0.2693, the F-statistic is 9.937 with a p-value of 3.539e-16.

Based on the VIF values the variables with the highest collinearity are EUIDX, USIDX

Figure 30 - VIF for fixed income arbitrage

INX	VIX	USLT	USST	GBP	JPY	EUR	EUIDX	IXIC	USIDX	FEDFUNDS	DJI
2.154775	1.984044	1.300022	1.031141	1.812280	1.281994	1.945054	4.754595	1.052699	4.862737	1.059020	1.040914

To conclude, ss result of this analysis, the returns of hedge funds whose adopt fixed income strategies are exposed mainly to the equity market risk, the exchange rate risk and the interest rate risk in the manner indicated on the table.

3.9.6 Global Macro

In the case of global macro strategies, the most significant regressors are S&P500, USD/GBP, USIDX, FEDFUNDS. The S&P500 has a positive β coefficient of 0.1319, which means that for each unit increase in the S&P 500, the monthly return of the global macro investment strategy may increase by 0.1319.

For what concern the USIDX it has a positive β coefficient of 0.1248, which means that for each unit increase in the USIDX, the monthly return of the global macro investment strategy may increase by 0.1248. FEDFUNDS also has a positive β coefficient of 0.001078, which means that for each unit increase in the Federal funds rate, the monthly return of the Global Macro investment strategy may increase by 0.001078.

Lastly the USD/GBP has a negative β coefficient of -0.1187, which means that for each unit increase in the GBP exchange rate, the monthly return of the global macro investment strategy decreases by 0.1187. This result confirms what Bodie, Kane and Marcus (2014) showed negative exposure to an increase in the value of the US dollar.

The residuals suggest that the model is well-fitted, as the range of the residuals is small, the median is close to zero, and the 1Q and 3Q values are relatively close to the median

Figure 31 - Global macro residuals

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.143050 -0.004632  0.000687  0.005678  0.037591
```

The R-squared value is 0.2994, which means that about 29.94% of the variation in the monthly returns of the Global Macro investment strategy can be explained by the independent variables included in the model. The Durbin-Watson test statistic value is 1.9038, which is between 0 and 2, suggesting that there is no significant positive or negative autocorrelation in the residuals. Additionally, the p-value of 0.1866 is above the typical significance level of 0.05, indicating that there is no evidence to reject the null hypothesis that there is no autocorrelation in the residuals. Therefore, based on these results, it appears that the Durbin-Watson test did not detect any significant autocorrelation in the residuals, which is generally considered a good thing. In this case to check for the heteroscedasticity we used the Studentized Breusch-Pagan test is a statistical test used to check for the presence of heteroscedasticity (non-constant variance) in the errors of a linear regression model.

In our case, the BP test statistic is 32.582 and has 12 degrees of freedom. The p-value of the test is 0.001124. The null hypothesis of the test is that the variance of the errors is constant (homoscedasticity). The alternative hypothesis is that the variance of the errors is not constant (heteroscedasticity). Since the p-value is less than the commonly used significance level of 0.05, we can reject the null hypothesis and conclude that there is evidence of heteroscedasticity in the residuals of the model.

Based on the VIF values the variables with the highest collinearity are EUIDX, USIDX

Figure 32 - VIF for global macro strategies

INX	VIX	USLT	USST	GBP	JPY	EUR	EUIDX	IXIC	USIDX	FEDFUNDS	DJI
2.154775	1.984044	1.300022	1.031141	1.812280	1.281994	1.945054	4.754595	1.052699	4.862737	1.059020	1.040914

To conclude, as result of this analysis, the returns of hedge funds whose adopt global macro strategies are exposed mainly to the equity market risk, the exchange rate risk and the interest rate risk in the manner indicated on the table.

3.9.7 Market Neutral

In this case, the residuals appear to be centered around zero, with a minimum value of -0.0184945 and a maximum value of 0.0280415. The first quartile is -0.0035495 and the third quartile is 0.0031734, indicating that most of the residuals are relatively small. The median residual is -0.0003303, which is very close to zero. Overall, these statistics suggest that the model's residuals are distributed evenly around zero, with some moderate outliers in either direction.

Figure 33 - Market neutral residuals

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.0184945 -0.0035495 -0.0003303  0.0031734  0.0280415
```

The residual standard error is 0.006208, and the R-squared is 0.3015, which means that about 30% of the variation in Market Neutral strategy returns is explained by the independent variables in the model. The F-statistic (11.76) and its corresponding p-value (< 2.2e-16) indicate that the model is highly significant. The DW test statistic is 1.6636 and its p-value of 0.0008017 indicates that there is evidence of positive autocorrelation in the residuals.

The t-tests provide similar results as the regression indicating that FEDFUNDS regressor is highly significant predictors of Market Neutral with a β of 0.007 and USD/JPY is a significant predictor at the 5% significance level with a β of 0.04. In this case, Alpha is highly significant means that there are factors influencing the dependent variable other than the predictor variables included in the model. Without being said, the main goal of the Market Neutral strategies is keeping the β level near 0 *in to hedge out any sort of systematic risk.*[153]

[153] Loo A., "Market Neutral: An investment strategy wherein the investor profits from an increase and a decrease in stock prices", CFI, 2023

Based on the VIF values the variables with the highest collinearity are INX, EUR, EUIDX, USIDX.

Figure 34 - VIF for market neutral strategies

INX	VIX	USLT	USST	GBP	JPY	EUR	EUIDX	IXIC	USIDX	FEDFUNDS	DJI
4.901564	1.898665	1.239324	1.033952	3.370153	3.885479	63.290520	20.839529	3.651242	48.080931	1.044858	1.037514

To conclude, as result of this analysis, the returns of hedge funds whose adopt market neutral strategies are exposed mainly to the exchange rate risk and the interest rate risk in the manner indicated on the table.

3.9.8 Merger Arbitrage

In this case, the residuals range from -0.043550 to 0.069298, with a median of -0.000596. The first quartile (25th percentile) of the residuals is -0.003929, while the third quartile (75th percentile) is 0.003943. This suggests that most of the residuals are fairly small, with some larger residuals that may be outliers.

Figure 35 - Merger Arbitrage residuals

```
Residuals:
      Min        1Q    Median        3Q       Max
-0.043550 -0.003929 -0.000596  0.003943  0.069298
```

The summary of the regression output shows that the model has a residual standard error of 0.00893, which is the average of the residuals, and a multiple R-squared of 0.3267. The F-statistic is 13.22 and its p-value is less than 2.2e-16, which indicates that the model is significant.

The Durbin-Watson test is a statistical test that is used to detect the presence of serial correlation in the residuals of a regression model. The test statistic is 1.3701 and its p-value is

2.184e-09, which is less than 0.05. This suggests that there is evidence of positive serial correlation in the residuals of the model.

The results of the Newey-West adjusted t-test suggest that the coefficients of S&P500, FEDFUNDS and IXIC are significant.

The S&P500 is a significant predictor for the merger arbitrage strategies, it shows a positive relationship with the fund returns with a β value of 0.084557. FEDFUNDS regressor is highly significant predictors with a β of 0.00082978 and IXIC is a significant predictor at the 5% significance level with a β of 0.031236. In this case, Alpha is highly significant means that there are factors influencing the dependent variable other than the predictor variables included in the model.

Based on the VIF values the variables with the highest collinearity are INX, EUR, EUIDX, USIDX.

Figure 36 - VIF for merger arbitrage strategies

INX	VIX	USLT	USST	GBP	JPY	EUR	EUIDX	IXIC	USIDX	FEDFUNDS	DJI
4.901564	1.898665	1.239324	1.033952	3.370153	3.885479	63.290520	20.839529	3.651242	48.080931	1.044858	1.037514

To conclude, as result of this analysis, the returns of hedge funds whose adopt merger arbitrage strategies are exposed mainly to the equity risk and the interest rate risk in the manner indicated on the table.

Conclusion

This thesis aimed to evaluate the exposure of the returns of different strategies to the market risk through a statistical analysis conducted using R studio, answering the earlier questions; how market risk factors affect the return of hedge funds? How may the effects of these risk factors vary across different hedge fund strategies?

The findings of this thesis suggest that the average R^2 score of the 8 indices being 0.41375 implies that the independent variables can explain nearer than 40% of hedge fund returns. This result is pretty good since prior research by Fung and Hsieh (1997) using a similar model could explain 40% of fund returns, instead the model adopted by Niklas Linnér Jerreling (2016) had an average R^2 score for 9 indices (he considers even the Found of Found strategies) of 0,1933. The result of the regression have provided information on the magnitude and the relationship between the variables, indeed market risk variables such as VIX, US3M, USD/EUR, EUIDX and DJI are not significant for all the strategies that we tested; on the contrary, the hedge funds return shows an exposure to the S&P500, US10Y, USD/JYP, USD/GBP, USIDX, IXIC, FEDFUNDS which vary across the 8 strategies proposed. β levels differ from each strategy but from our analysis emerges that no β levels are above 1. Indeed, the values are between 0 and 1, sometimes near 0 and lower which means less volatility than the market. From our analysis emerge that equity risk factors, exchange rate risks, and interest rate risk affects the hedge funds strategy the most so this result may be useful for investors and regulators for what concern the systematic risk. However, since the regression analysis suffers from several limitation highlighted in section 3.6.2, we recommend further analysis using other statistical techniques to have the complete picture of the exposure of market risk factors on hedge funds strategy return. Some common

methods that could be used are the Value at Risk (VaR) typically used by investors and risk managers to measure and manage the risk of financial investments and portfolios or Multiple Factor analysis a statistical technique used to identify underlying factors or dimensions that may explain the variation in a set of variables.

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