

HEDGE FUNDS PERFORMANCE:
ANALYSIS OF EXPLANATORY
FACTORS

by

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Abstract

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The industry of hedge funds is considered to be one of the most unregulated and volatile segment of global financial markets. Since 2014, on average, hedge funds have been underperforming major benchmark for the broad market performance – S&P 500. Presence of such descending trend in the performance of the hedge funds motivated us to research this topic, aiming to analyze the factors, which could explain the general trend over the long-run.

In this research, within the applied statistical framework, we analyzed the behavior of factors, which could explain performance of the hedge funds. Targeting to understand whether there exists any pattern of such factors' behavior, our study covered seven different time frameworks of crisis and pre-crisis periods in global financial markets, using four investment strategies employed by the hedge funds.

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GLOSSARY

AUM. Assets Under Management

CAPM. Capital Assets Pricing Model

CBOE. Chicago Board Options Exchange

FI. Fixed Income

GP. General Partner

GFC. Global Financial Crisis

HFR. Hedge Fund Research

VIX. CBOE Volatility Index

LP. Limited Partner

M&A. Mergers & Acquisitions

FED. Federal Reserve

MCap. Market Capitalization

M&A. Mergers and Acquisitions

QE. Quantitative Easing

YTM. Yield To Maturity

Chapter 1

INTRODUCTION

Hedge funds are defined as investment vehicles, which imply various active investment strategies to generate returns, or “alpha” on invested capital. The industry of hedge funds is considered to be one of the most unregulated segments of financial markets with US\$ 5.1tn in assets under management, as of the end of 2022. Weak regulation framework implied, alongside with the diversified structure of LPs, provides hedge funds with an ability to invest into the wide spectrum of asset classes, mostly including, but not limited to: equity, fixed income, derivatives and commodities.

Apart from the asset classes, major differential factor for hedge funds is the implied Investment Strategy. The strategy of a fund is defined by legally structured strict restrictions on portfolio exposures to the particular asset classes, tenure of investments, and positioning. According to the Hedge Fund Research classification, there are eight commonly defined strategies: Global Macro, Event Driven, Distressed Securities, Equity Market Neutral, Equity Long/Short, Fixed Income Arbitrage, Fund of Funds, Convertible Arbitrage and Merger Arbitrage.

Notwithstanding the chosen strategy of number of strategies, core purpose of the hedge funds is to provide their LPs with above-market absolute returns, e.g. alpha, which is commonly treated as a performance measurement. During the past 20 years, hedge funds had to deal with different economic cycles, several periods of steady, high and low volatility in the financial markets. Aggressive investment approach, and high risk-tolerance are the common standards for the

industry. During 2002-2022 time period, 38% of hedge funds had been wiped out from the market, due to the losses recognized within their portfolios, and those, which have survived are 9,163 funds competing for the investor’s capital, structuring their strategies in a way to generate higher alpha, beating the broad market (i.e., S&P500 index). Due to different risk exposures, availability of leverage, market conditions and, foremost, strategies, the weighted average annual return across all the hedge funds during 2003-2021 has been varying from (19.54%) to +36.55%.

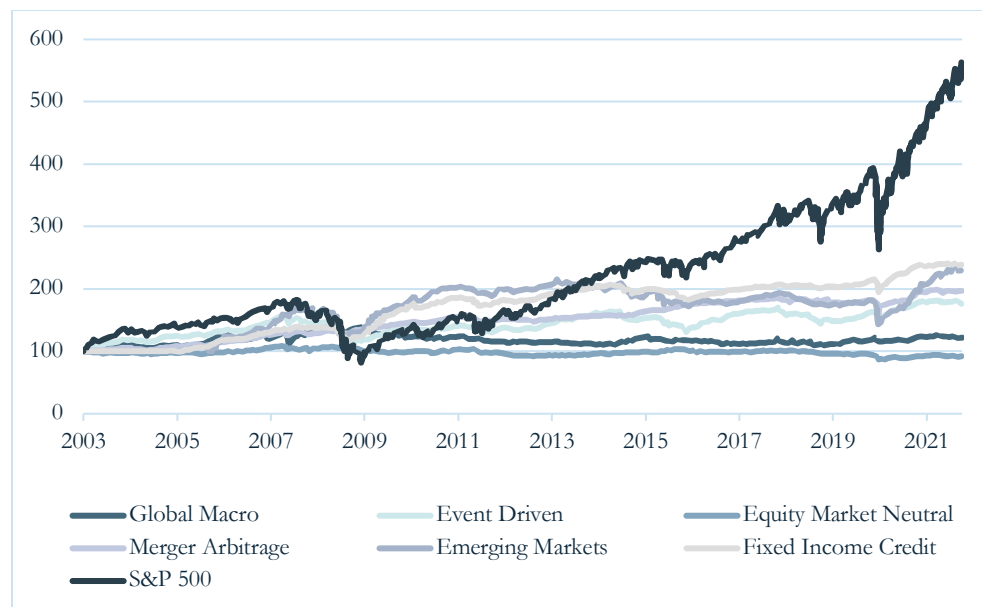


Figure 1. Historical performance of Hedge Funds strategies versus S&P500.

The data exhibited on the chart above lays a foundation for the chosen topic of our research and stressed hypothesis within this work. The chart represents daily returns (performance) of six major strategies employed by the hedge funds, versus the S&P500’s performance, which is also defined as “broad market performance”.

It is observable that the hedge funds, employing various investment strategies to generate alpha, used to compete for the superiority of performance with the broader market during 2003-2009 time period, and had been outperforming S&P500 after the Global Financial Crisis of 2008, and up until 2014. However, starting from late 2014, the pattern diverged, and, the performance of hedge funds industry during 2014-2021 was beaten by the broader market. There are 4 major defined reasons explaining descending trend in the performance of the hedge funds (Bollen, Joenväärä, Kauppila, 2021), (HFR, 2023):

- Post-GFC interventions of central banks into the financial markets, including QE programs, which had reduced market volatility, and impacted the correlations of risk assets. As a result, returns of previously robust investment strategies implied by the hedge funds had been steadily squeezing, and descended to single-digit numbers on the industry-average basis over time.
- Rapid development of long-only mutual funds and asset managers employing passive index-investing strategies contributed to the reduction in mid-term market volatility, and smoothed patterns in trading volumes, which mainly resulted in the reduced viability of the major investment theses under long/short equity, and arbitrage strategies implied by the hedge funds.
- Additional compliance costs occurred with the imposed in 2010-2012 Anti-money-laundering regulations, alongside with the mounted technological operational expenses, have negatively impacted the net returns structure of the funds over time.
- Reflecting the unfavorable developments within the industry occurred post-GFC, during 2014-2022, hedge fund industry recorded an outflow of 10.8% in registered number funds. Such trend, in conjunction with the improvements in access to information and rising availability of technologically advanced

analytical tools, facilitated the substantial growth in level of competition among the players remaining within the sector, and, consequently, increased efficiency, have been squeezing the room to generate alpha for an average, less-sophisticated hedge fund.

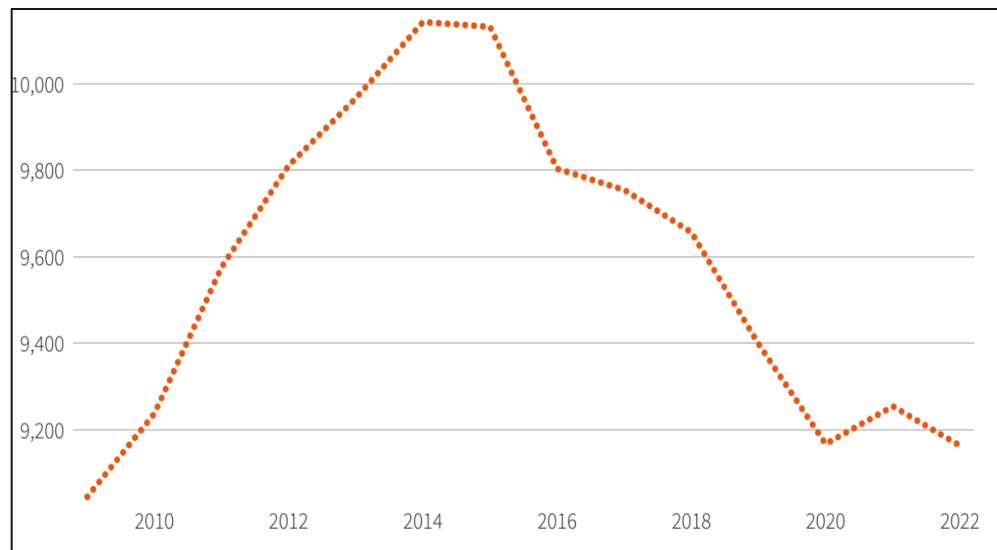


Figure 2. Total number of registered and active Hedge Funds.

As a consequence of the trends mentioned above, starting from 2014, average net returns within the hedge fund industry deteriorated to 7.2 % p.a. (2014-2021 average).

Notwithstanding the general decline in returns, the variety of consistently top-performing players like Bridgewater Associates, Man Group, Millennium, Citadel, Davidson Kempner, TCI, AQR, Point72, Capula, PIMCO were capable of generating average of more than 13% in net annual returns (Bloomberg, 2023).

Despite the given disparity in returns among the broad industry and top-players, as exhibited on the Figure 1, returns of various investment strategies employed

by hedge funds shows a different behavior within particular periods of time. While some strategies tend to generate higher returns during the bull market - other underperform, and vice versa. Hence, the main question appears – which factors can explain performance of a particular investment strategy during a particular time period in financial markets?

The purpose of this research is to investigate, which economic factors have the highest statistical significance on a particular hedge fund strategy's performance in periods of smooth and heightened market volatility. The analysis of such factors could provide an ability to discover some patterns of a particular set of strategies behavior in resemblant phases of the financial markets taken place during various cycles in between 2003 and 2021. While there exist a number of researches within the field, under this research, we aim to use a unique set of five investment strategies (Global Macro, Event Driven, Equity Market Neutral and Merger Arbitrage), implying a broad set of seven time periods, tracking not only the significance of explanatory factors, but also stressing a hypothesis on a persistence of the coefficients over time. Alongside with the augmented approach in selection of strategies and time frames, the results of this research might produce practical implications for the hedge funds' analysts and portfolio managers, as well as for their LPs.

Hence, the core objective of this research is to stress the following hypothesis: over different periods in financial markets, there exists a persistent pattern in significance, magnitude and sign of explanatory factors, which explain performance of a hedge fund, which is measured as net returns of particular investment strategy used by a fund.

This thesis is constituted by 6 Chapters: the following Chapter 2 with literature review guides through the defined characteristics of hedge fund strategies, empirical findings on robustness of the models relevant to this research, and other studies performed on the analysis of historical performance of hedge fund industry. Chapter 3 explains the methodological approach and reasonability behind the selection of statistical model. Chapter 4 covers the descriptive statistics of used data, and its sources. Chapter 5 exhibits the results of estimations using the top-down approach, while Chapter 6 summarizes major conclusions of this work, also providing the implications for further research within this field.

Chapter 2

LITERATURE REVIEW

There exists a vast number of both theoretical and empirical studies focusing on hedge funds' strategies performance evaluation. To be concrete, the first step is to define the strategies breakdown approach to be matched with the data availability. According to the mentioned below studies, one of the most reputable categorization source is the paper by Phillips and Surz (2003), who proposed the following strategies breakdown: Global Macro, Event Driven, Distressed Securities, Equity Market Neutral, Equity Long/Short, Fixed Income Arbitrage, Fund of Funds and Convertible Arbitrage.

Global Macro strategy implies short-term investments aiming to generate alpha on the market movements. The hedge funds rely on financial markets movements caused by macroeconomic and political shifts. Typically, the strategy implies long and short positions in equities. The significant portion of leverage is usually used to maintain the portfolio exposures.

Event Driven strategy is mainly focused on particular incidents like spin-offs, divestitures, mergers and acquisitions, liquidity events and corporate governance issues. In case of spin-offs, divestitures and M&A, hedge fund managers go into the risk arbitrage, simultaneously opening short and long equity positions on equities of the companies involved into the corporate transaction. Considering liquidity events and corporate governance issues, hedge funds aim to profit from both equity and credit strategies, forecasting the market reaction on a stand-alone or a sequence of events in the particular company or industry.

Distressed Securities strategy implies an exposure to the equity of companies with below-investment grade which experience financial distress or are already in default, since they are priced with a significant discount to their par value. Hedge fund managers aim to profit from the upside potential of such securities in the medium or in the long term.

Equity Market Neutral strategy focuses on both long and short investing in securities exhibiting beta of less than 0.1. In such a manner, the strategy delivers a balanced portfolio of stocks with upside-implied market inefficiencies in their valuations, while keeping the entire portfolio without a significant risk of the exposure to the entire market movements risks.

Equity Long/Short strategy is exploited by fund managers to profit from the current market inefficiencies in terms of a particular stock or group of stocks valuation. Hedge funds take long positions in equities that they believe for being undervalued, simultaneously hedging the position with a particular type of derivatives, such as options, futures or swaps and vice-versa with short positions in overvalued stocks.

Fixed Income Arbitrage strategy is designed to benefit from the identification of price inefficiencies in fixed income securities: while the FI securities which are estimated to be overpriced are to be in short position, for those which are believed to be undervalued, the fund manager opens long position. To reduce total volatility, hedge funds also extend their exposures to the investment-grade and risk-free fixed income securities.

Convertible Arbitrage strategy focuses on price disparities among subordinated convertible securities and underlying common equity. The position is designed as

a long position on convertible security with a simultaneous position in put options on the underlying stock.

Fund of Funds strategy is commonly treated as a passive one, since managers of such hedge funds construct their portfolio with an exposure to the hedge funds with the mentioned above strategies, weighting them in accordance with a risk profile.

As it was mentioned earlier, there exist lots of studies providing research of the hedge fund performance. Still, it would be reasonable to focus on two fundamental theoretical studies illuminating different approaches on the methodology and performance measurement models and three empirical studies, which also include the evaluation of augmented models' practical usage and rating measurements as well as analyzes the strategies performance in the different time periods.

To begin with, widely recognized research was provided by Eling and Schuhmacher (2007). The authors aimed to evaluate hedge funds' performance measurement, the study was based on previous researches provided by Sharpe (1966), Teynor (1965), Jensen (1968), Sortino (1999), Ackerman (1999), Brooks and Cat (2002). The core hypothesis of the study stated that commonly used Sharpe ratio used for evaluating investment fund returns is a weak proxy, in terms of its robustness, for the hedge funds performance measuring, according to the fact that hedge fund returns are not normally distributed. With reference on the mentioned above articles, authors stated that there exists an empirical fact of hedge fund returns being distributed asymmetrically according to the extensive usage of derivatives, also resulting in fat distribution tails, leading to the possible

underestimation of risk and, as a result, overestimating the performance. The authors have compared Sharpe ratio with 12 other performance measurements including Omega, Sortino ratio, Kappa 3, Upside potential ratio, Calmar ratio, Sterling ratio, Burke Ratio, as well as Excess Return on Value at Risk, Conditional Sharpe Ratio and Modified Sharpe Ratio and others. The authors have used the database of 2,763 hedge funds reporting monthly net of fee returns for 1985-2004 time period. As a result, the study shows that the average correlation of Sharpe ratio with the other 12 ratios equals 0.97. The main result of the study shows that the choice of performance measure does not affect the relative evaluation of funds, as well as their strategies. Moreover, the authors proved that hedge fund returns are elliptically distributed. As a result, the authors have concluded that from both theoretical and practical point of view, the Sharpe ratio is an adequate measurement for hedge fund performance. Still, according to the findings provided in the research, it could be reasonable to use not only the Sharpe ratio, but also Sortino ratio and the Excess Return on Value at risk for the statistical tests in our research.

The second fundamental paper, evaluating the methodological aspects of the hedge funds performance analysis was provided by Fung and Hsieh (2004). First of all, the authors analyzed and stressed the fit of the previously developed models conducted by Fama and French (1993) – extended CAPM three-factor model, Carhart (1997) – augmented Fama and French four-factor model. Moreover, the authors had criticized their own augmented models discovered earlier, Fung and Hsieh (1997, 2001). Fung and Hsieh (2004) had reviewed the difficulties of applying the mentioned above conventional models with ABS factors used in recent researches. The augmented version of the model has included the following independent risk factors variables: *S&P 500*: S&P500

return, *SML*: Russel 2000 Small cap return – Russel 1000 Large Cap return, *T10Y*: Monthly change in FED’s 10-year constant YTM, *Credit Spread*: month end-to-month end change in the difference between Moody’s Baa YTM and the FED 10-year constant YTM, *Bd. Opt.*: return of a portfolio of lookback straddles on bond futures, *FX Opt.*: return of a portfolio of lookback straddles on currency futures, *Com.opt.*: return of a portfolio of lookback straddles on commodity futures. The dependent variable was the monthly return of a weighted multistrategy hedge fund index. In terms of data, for the dependent variable, the researchers have used the HFR Fund of Funds index monthly returns which contained 500 weighted funds, the 1994-2002 time period was used. As a result, they have found 4 (2 equity factors and 2 fixed income) factors to be significant on the 99% confidence interval. The model has exhibited 0.9 value of R^2 . As a result, the authors have concluded that the model is to be the most suitable to evaluate the factors affecting the hedge fund performance in different time periods. Moreover, the research provides an opportunity for further examination of the suggested model’s fit with different hedge fund strategies.

In terms of the empirical study where different models were applied to evaluate the performance of the hedge funds, the most recent one by Metzger and Shenai (2019) incorporates the analysis of all eight hedge fund strategies performance. As a performance indicator, the authors evaluate the Sharpe ratio (Sharpe (1966)), Sortino and Upside Potential ratios (Sortino (1999)). To analyze the factors that have the most significant effects on a particular strategy returns in different time periods, the researchers applied augmented version of Fama and French model (Fama and French (1993)) provided by Carhart (1997). From the practical side, the authors provided the innovative methodology of the data usage reflecting the broader set of explanatory factors within the developed model.

To evaluate each strategy separately, the study suggests the usage of Hedge Strategy Index sponsored by Credit Suisse with the corresponding 10-strategy indices weighted by size of hedge funds included. As a result, the total number of funds observed equal to 9,500. The monthly net of fee returns of each index are used a dependent variable. Moreover, to analyze the strategies performance and significant risk-factors, Metzger and Shenai have divided the entire data into three time periods: Whole period (2007-2017), During Crisis (June 2007-March 2009), After the Crisis (April 2009-January 2017). Such division let them to proceed with practical inferences in terms of the ranking of strategies in accordance with the performance ratios as well as with significancy of factors affecting the hedge fund performance. Also, the authors have assessed the performance ratios for their robustness. The study illuminates the following findings: in crisis periods, as well as at the whole period, all seven strategies outperformed the S&P500 benchmark. At the same time, during the after-crisis period, only three of ten strategies performed better than the S&P500. In terms of the performance ratios, the authors concluded that Upside potential and Sortino ratios were more robust than the Sharpe ratio. In accordance with a model fit, the authors concluded that usage of Cahart's four factor model (Cahart (1997)) provided the adjusted R^2 of >0.6 for the 6 strategies, while for the Convertible Arbitrage, Fixed Income Arbitrage and Global Macro strategies, the usage of a model has not exhibited appropriate results, with the later lacking the coincidence with the real empirical observations on market data.

Other related studies include Brandon and Wang (2013) assessing the liquidity risk and hedge fund performance, Dudley and Nimalendran (2013) investigating an effect of margins on a probability of contagion, Ackermann, McEnally and

Ravenscraft (1999) and Huij and Verbeek (2009) examining the hedge funds strategy, risk and returns using different multifactor augmented CAPM models.

Given the broad variety of approaches conducted by the researches mentioned above, in our thesis, we decided to rely on one of the models, and variables selection, which are explicitly described within the Chapter 3. Following the popularity of the studied topic among the existing researches, we decided to bring some novel structure of work in the field of analysis of the historical performance of the hedge funds. The major points of how we attempted to make this study useful for both practical implications, and empirical research lay in two key points. First of all, the rational behind the selection of a particular set of hedge fund strategies, and their returns, as a performance measurement limiting the former to four. Secondly, the time framework. Surprisingly, but most of the works cited above does not devote a particular justification on the time frames, and the particular dates they use to define each period in the market, to address this issue, in our research we devoted some part of Methodology, Estimate Results and Conclusions sections to show our rational in picking particular timing for the data set, economic rational behind it, as well as our judgement of the obtained results, and hypothesis for further researches in this field.

In summary, the studies selected exhibit the dynamics of the hedge fund industry, with the approaches of evaluating the hedge fund performance differentiating, and changing rapidly during the past 3 decades. The variability of the approaches and existing intel within the researches granted us a flexibility to be selective in our methodology and approach to conduct this thesis. Within the next chapter, the methodology of evaluating the hedge fund performance, the statistical model, rational behind strategies selection and time frames are discussed.

Chapter 3

METHODOLOGY

Since the core goal of this work is to stress the hypothesis on whether the over different periods in financial markets, there exists a persistent pattern in significance, magnitude and sign of explanatory factors, which explain performance of a hedge fund, it is reasonable to begin with the model, explaining each variable and rationale behind using those one-by-one.

3.1 The model

To proceed with the analysis, and after studying the variability of the existing research papers we touched at Literature review section, we have decided to pick the by augmented five-factor Fama and French CAPM model designed by Fama in French in 2015. The model itself is the augmented version of the Capital Asset Pricing model, which allows to analyze the relation among market, or risk, factors on the particular investment. The rational behind the decision rely on two major factors: (i) given the empirical nature of our research, we aimed to select the model, the robustness of which was already proven on other data sets, and try to apply it for our set of dependent variables, and the time frames. Another factor that motivated us to proceed in this model, is the data accuracy and availability of the independent variables – the authors of the model, provide the most up-to-date data sets on their website, mentioned in the sources of this thesis.

3.2.1 Five-Factor augmented CAPM model

$$E(R) = R_f + \beta_1(R_m - R_f) + \beta_2 * SMB + \beta_3 * HML + \beta_4 * RMW + \beta_5 * CMA + e \quad (1)$$

Where:

R_f – intercept, risk free rate, defined as U.S. 10-year T-Bond YTM;

$R_m - R_f$ – excess market return, where R_m states for the S&P500 returns;

SMB – excess return of small cap over large cap stocks;

HML – excess return of value stocks over growth stocks;

RMW – excess return of stocks with robust and weak profitability;

CMA – excess return of stocks of conservative investment firms over aggressive investment firms;

$E(R)$ – returns of the particular hedge fund investment strategy.

The model allows us to pick several investment strategies, their returns, and analyze the significance and the effect of the same independent variables on them over different period of times to answer our hypothesis. Moreover, we may be able to compare different strategies among different periods to analyze whether there is a transition of the effects on the performance.

3.1.2 Dependent variable

As already mentioned, the dependent variable is the returns of the particular investment strategy of the hedge funds. Attempting to analyze not a separate hedge funds, but the hedge fund industry, the indices of the strategies were used.

While they are described in details in the data review section, it is worth mentioning that the strategy indices are composed by the estimated performance of the portfolios of 1,000 hedge funds registered in the US. To compose the universe, the hedge funds are broken down by strategies, and then pooled into the index. The data provided is the Hedge Fund Research.

As it was stated in the literature review section, there are more than 10 recognized strategies recognized in the industry. To make our analysis focused, we decided to pick four strategy indices, namely:

1. **Global Macro**
2. **Event Driven**
3. **Equity Market Neutral**
4. **Merger Arbitrage**

The rationale behind such choice is based on two factors:

1. **Data availability:** in comparison to other indices, the data for these four index strategies is available for the longest period of time – since 2003;
2. **Nature of the strategies:** The mentioned strategies, in particular, two of them: Global Macro and Event Driven are the strategies, implying which, the hedge funds are not restricted in asset classes, meaning that to perform, the one, attempting to generate alpha, may deploy capital into Equity, Debt, Derivatives, Commodity, FX or Real Estate Markets globally. Such a diversification allows the hedge fund to use all the market spectrum to perform, making them contingent on the market factors used in our model.

Considering two others: Equity Market Neutral and Merger Arbitrage, both impose the restrictions on the used asset classes, limiting the access of the hedge funds to Equity and Equity Derivatives markets only. Still, the intrinsic nature of these two is closely tightened to the upside-downs of the economic cycles, which allows us to presuppose that the effects of the independent variables have to be significant, allowing us to analyze them in different time horizons to answer the hypothesis.

Since the Hedge Fund Research provides the data in pooled indices, for the dependent variables' values, we simply used them to calculate the daily returns of the strategy indices:

$$E(R) = \frac{Index\ Value_t}{Index\ Value_{t-1}} \quad (2)$$

3.1.3 Independent Variables

The independent variables in the model represent five different market factors, each of them can indicate the current market environment considered in the research. The data for all the variables is provided by the authors of the model – researchers Fama and French, having the united data source for the universe of the variables contributes to the data accuracy, which, in turn, facilitate the accuracy of the model and the estimation results. The core features of the independent variables and the rationale behind using them is described below:

1. $R_m - R_f$ stands for the excess market return over the risk-free rate. Such a measurement points on the performance of the financial markets in the particular time period, in other words - having positive values of this variable indicates that in the observable period of time we are in the

growing (bullish market). The β_1 coefficient tells us how the particular strategy index returns are affected by the general stage of the market in the particular time frame, as well as points whether the chosen strategy's returns are exposed to the excess market returns, considering the level of significance;

2. *SMB* value represents the excess return of stocks of the companies with small market capitalization over the shares of the companies with large Mcap. Generally, in times when the value of this variable is positive and the small cap indices beat the large cap ones, it is concludable that the markets believe in the growth of a new sectors within the economy more, rather than in growth of the broad economy and the big, mature companies. The beliefs could be materializing in both, developed and emerging markets. The β_2 helps us to understand how such market beliefs are reflected in the returns among the selected strategies;
3. *HML* reflects the excess return of value stocks over the growth stocks. In case in particular period of time the value of this variable is positive, it is possible to conclude that in this time frame the transition of capital in the equity markets from the mature and cyclical companies to the growth-sector is happening in the market. The β_3 coefficient in the model tells us to which degree the returns of the particular hedge fund strategy index are explained by such behaviors of the markets in the particular period of time;
4. *RMW* exhibits the excess return of stocks with robust profitability over the stocks with weak earnings per share. In periods of time, in which the values of this variable turn negative indicates that investors become valuing risky investment approach more than value-investing. Such

behavior, in turn, points on the markets experiencing the slowdown in growth among the mature and cyclical sectors of the economy, pushing the market players to start seeking the alpha in growing, but less profitable sectors. The value and the significance of the β_4 shows how the strategy index of the hedge funds performance is affected by such capital transitions in the markets;

5. *CMA* variable values stand for the excess return of stocks of conservative investment firms over aggressive investment firms and measures the degree to which the acceptability of risks profiles alters within the markets. Periods in which, this variable demonstrates positive values shows that investors are rather follow the risk-averse than the risk-taker behavior, and vice versa when the variable values turn negative. The β_5 coefficients show the explanatory power of such market-factor on the performance of the hedge funds.

3.1.4 Selected time frames

As stated in the hypothesis, in this research we are aiming to examine the alterations of explanatory power of the independent variables over different periods of time, to understand whether there are some patterns laying in the relations among the market factors and the performance of the particular hedge fund strategies.

To address this issue, we decided to pick seven time frames scope for the data. To classify them and distinguish from each other, we selected the time period of 2003-2021 years, separating 'Pre-crisis' periods, which are associate with the time, during which no significant event occurred in the markets. Each of the 'Pre-crisis

period' ends at the day of the event, which turns market into the further downturn traction. The interim period of time among any of two 'Pre-crisis' periods is associated with the downturn cycles and heightened volatility within the markets. Such 'crisis' or 'volatile' period ending dates are selected manually, relying on the S&P500 index commencing to recover steadily. As a result, the following 7 time frames were selected for our analysis:

Table 1. Selected time frames.

Time period	Start Date	End Date
Pre-crisis period 1	February 2, 2003	September 15, 2008
Subprime Housing Bubble	September 16, 2008	February 1, 2010
Pre-crisis period 2	February 2, 2010	September 30, 2014
Stock Market Selloff	October 1, 2014	June 27, 2016
Pre-crisis period 3	June 28, 2016	February 24, 2020
COVID-19 Pandemic	February 25, 2020	October 9, 2020
Pre-crisis period 4	October 10, 2020	December 31, 2021

The rationale behind the manual selection and some distinguishing features of the selected periods is described below:

1. **Pre-crisis period (2003-2008)** – the start date of Feb 2nd, 2003 is the earliest date for which the daily data of both, dependent and independent variables become available, while the ending date is the date of the Lehman Brothers collapse, which is associated with the commencement of the broad market turmoil following the Subprime Housing Bubble crisis period.
2. **Subprime Housing Bubble (2008-2010)** – starting with the day after Lehman Brothers had filed to bankruptcy, the period is mostly associated of the stock market downturn, which with some lagging effects after the financial and real estate sectors collapsing had harmfully affected the

global financial markets. The ending date of that period was manually selected as Feb 1st, 2010, as of which the S&P500 index had not felt monthly by more than 10% for 3 months in a row;

3. **Pre-crisis period (2010-2014)** – the period starting at Feb 2nd, 2010 with the continuing trend of the financial markets’ recovery and growth after the financial crisis disruptions. The favorable market environment in this period interrupts with the on Oct 1st, 2014 becoming a commencement point for the future downturn.
4. **Stock Market Selloff (2014-2016)** – this period begins the day after Oct 1st, 2014 at which DOW30 index contracted by 28% and VIX index spiked by 80% in one day. This date became kind of a pivotal point at which the markets started pricing the revealing slowdown of the economy of the European countries, Ebola virus spreading in Africa, and the partial effect of the war in Ukraine causing the mounted volatility in soft commodities and oil prices, starting the further time frame recognized as “Stock market selloff”. The end of this ‘crisis’ period was manually picked as June 27th, 2016 – the day on which the ‘Brexit’ results emerged.
5. **Pre-crisis period (2016-2020)** – this period is associated with the growth in the financial markets despite the emerged slowdowns in the global economy. The bullish markets were mainly supported by the major countries central banks’ monetary policies, injecting the liquidity into the financial system. This period ends at Feb 25th, 2020.
6. **COVID-19 Pandemic (2020)** - this time frame begins on Feb 25th, 2020, the last day of the week during which the markets begun its downturn, with the investors beginning to price potential risks of Covid-19 spreading worldwide. The period ends at Oct 9th, 2020 with the broad market recovery, and beginning its rapid growth with the released QE

program by the FED in the US and the same policies completion in the EU markets and in the UK.

7. **Pre-crisis period (2020-2021)** – the period of market recovery after the COVID-19 outbreak. The period ends on Dec 31st, 2021.

Despite this work being finished in June 2023, the latest data past Feb-24th, 2022 (the date of Russia invasion of Ukraine, which produced a shock, associated with the commenced downturn cycle in broad financial markets) was not used, since as of the day of this research being published, the markets are still undergoing a transformation, with the fundamental shifts happening in risk and factors impacting the returns of a variety of financial instruments. Hence, we decided to stick to the time framework, with clear and justifiable start and end dates.

With the achieved balanced structure of four ‘Pre-crisis’ periods and three ‘crisis’ time sections, we can proceed with the data analysis section covered in Chapter 4, which shows empirical evidence backing our rational in selection of variables and time frames.

Chapter 4

DATA

Having the detailed breakdown of variables and the time periods used in the methodology section, in the data section the descriptive statistics of the variables is provided.

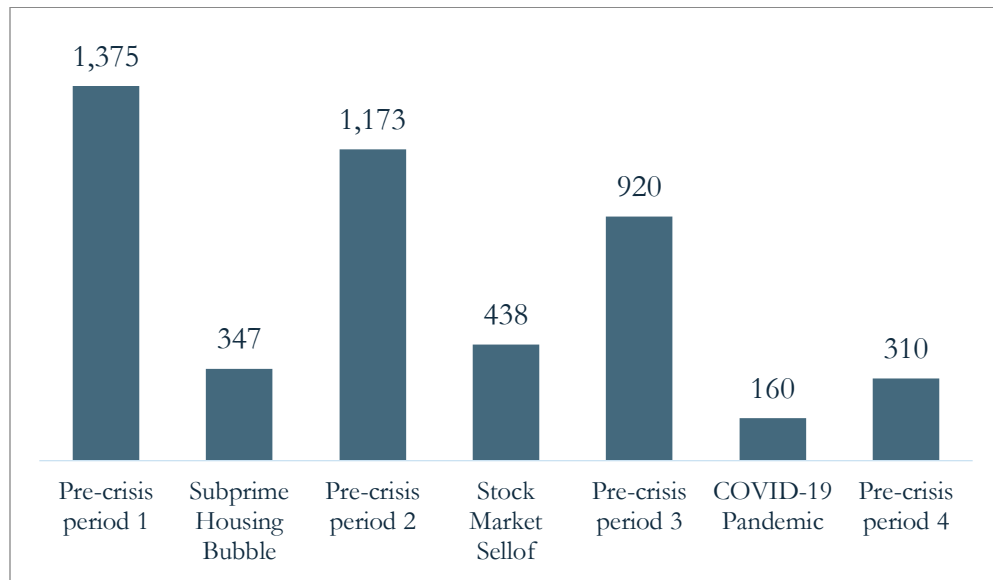


Figure 3. Number of observations of each selected time frame.

For all the variables the daily data is used totaling at 4,723 observations for the entire data set. For each time frame, the minimum number of observations is reached at 'COVID-19 Pandemic' period with 160 observations, while the largest period in term of the observations is the 1st pre-crisis period having 1,375 observations.

Considering the dependent variable, the data set was categorized by hedge fund strategies breakdown explained in the methodology section. However, in this

chapter we are focusing on the concrete methodology of which data pooling provider is selected for the dependent variable, and which methodology it uses to create the indices, which are used as proxy measures for the hedge fund industry performance for each particular employed investment strategy. The entire data set has daily, net of fee returns of the weighted hedge fund strategy indices provided by Hedge Fund Research. Each index tracks the portfolios of 760 hedge funds (as of 2021, for 2003-2021 period, exact number of the funds had been varying, but never fallen below 700), allocating them to the particular investment strategy, given the exposure of the selected hedge funds' portfolios. As a result, the index exhibits the daily net of fee return of a pooled investment portfolio, the value of which is calculated on a daily basis as weighted average of included instruments, the weight of each instrument is calculated as a proportion of sum of the positions in a particular instrument divided by the total AUM of the funds within the index. Composition of the portfolio is backwards-rebased on a quarterly basis following the 13-F form submitted by the funds included into the index. The other important criteria, is that all the 700+ of hedge funds pooled into the index, have reported their performance results via SEC 13-F form. This fact is important to mention because of two key points: first is of all, it means that the results of a particular fund can be pooled into the index, only if the combined value of assets under management of this fund, as of the reporting date was larger than US\$100 million; secondly, all the funds pooled are US-based. Both of the mentioned factors prevent the provider of the data – Hedge Fund Research – from including potential fake funds into the index. Consequently, given the approach used by the data provider, we might conclude that the indices should represent an approximated and well-distributed indicator of the performance of the broad variety of hedge funds implying a particular investment

strategy. Moreover, as a provider, Hedge Fund Research is used by the majority of the authors cited within the literature review section.

As already mentioned, daily returns of the indices were used. The rationale behind the usage of daily data mainly relies on three pillars. Firstly, to maximize the number of observations, from the statistical point of view, enhancing the robustness of the model. Secondly, having the financial data used for both dependent and independent variables, to address the dynamics of the financial, properly fitting the selected model five-factor Fama and French model, and thirdly, to precisely distinguish time-framing sub-groups, using the exact days for major events, like the collapse of Lehman Brothers, the first day of the broad stock market sell-off, end of first week of Covid-19 downturn.

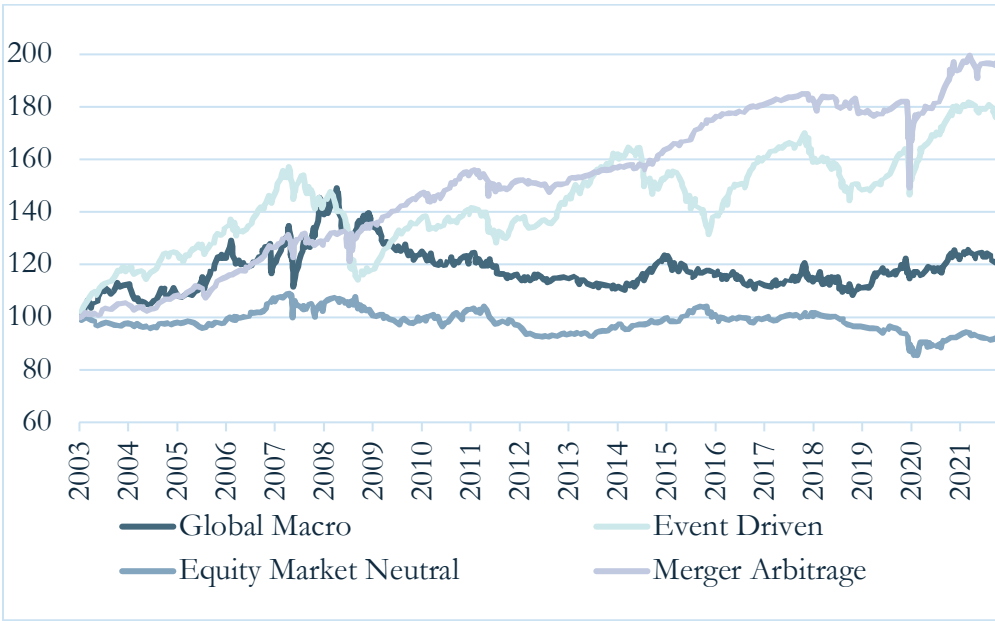


Figure 4. Historical performance of selected investment strategies used by Hedge Funds. Source: Bloomberg, HFR

Figure 4 represents the historical performance of the strategies used as dependent variable. For the visual simplicity, the variables are indexed as 100 at the beginning point.

As it is visually observable from the chart, each strategy index has been performing differently, during the different time frames. Such a volatile behavior observed on the chart, fits our initial intention to select four strategies, which undergo different patterns in daily returns across both, the entire sample of 2003-2021, and during the four pre-crisis and three crisis periods.

Looking on the dependent variables, as already mentioned, the authors of the model selected for this research provide the data at their web-site. The data was cross-checked using the Bloomberg terminal to ensure the correctness of the independent variables we used for our analysis.

As it is shown in Table 2, $R_m - R_f$ is the independent variable having the highest standard deviation among its peers, as well as the highest and lowest min and max values, respectively, among the peers, while *CMA* has posted the lowest standard deviation value among the independent variables of 0.325 (0.33%). However, having the daily data, and given the average standard deviation of 0.31% for dependent variables and 0.66% for independent, we end up with the dynamic, and highly volatile parameters used within the entire time frame selected for our research.

Given the empirical nature of this research, it is also reasonable to briefly review the overall, performance of each investment strategy during the selected time frames, and overall, within the entire data sample of daily index-pooled investment strategy returns during 2003-2021.

Table 2. Descriptive statistics of independent and dependent variables.

Statistic	N	Mean	St. Dev.	Min	Max
Market Rate Minus Risk-Free Rate	4,723	0.048	1.200	-12.000	11.350
Small Minus Big	4,723	0.007	0.614	-4.570	5.740
High Minus Low	4,723	-0.003	0.747	-5.020	6.740
Robust Minus Weak	4,723	0.011	0.419	-2.720	2.250
Conservative Minus Aggressive	4,723	0.002	0.325	-2.260	2.460
Global Macro	4,723	0.005	0.384	-3.646	2.006
Event Driven	4,723	0.013	0.298	-3.361	2.574
Equity Market Neutral	4,723	-0.001	0.253	-3.092	3.103
Merger Arbitrage	4,723	0.015	0.308	-6.223	5.738

Table 3. Net of fees total returns of selected investment strategies during selected time frames.

	<i>Global Macro</i>	<i>Event Driven</i>	<i>Equity Market Neutral</i>	<i>Merger Arbitrage</i>
Pre-crisis period 1	35.0%	34.3%	5.3%	30.0%
Subprime Housing Bubble	-9.6%	2.1%	-6.8%	11.5%
Pre-crisis period 2	-5.8%	17.9%	-0.8%	8.6%
Stock Market Selloff	-0.8%	-9.8%	0.9%	12.3%
Pre-crisis period 3	4.7%	14.1%	-5.2%	3.2%
COVID-19 Pandemic	-1.1%	4.6%	-4.2%	-0.1%
Pre-crisis period 4	2.8%	3.5%	3.1%	8.3%
Total (2003-2021)	21.6%	76.6%	-7.7%	97.0%

- **Equity Market Neutral**, as the worst performing strategy across our strategies universe with -7.7% overall return posted its highest return during the 1st pre-crisis period, and managed to tap 3.1% during the post-covid recovery of the broad markets. Given the nature of the strategy – to be simultaneously in long and short positions in stocks from the same industry with coherent business models of the underlying companies – highly exposures itself to the broad market risk, and, following the developments of passive equity investment strategies past-GFC, the strategy has substantially deteriorated in its performance compared to other. However, the only crisis period, during which the strategy achieved positive return was Stock Market Selloff in 2014. Following the capital rotation occurred in financial markets during this period, it will be

interestingly to look closely on *Small Minus Big (SMB)* and *High Minus Low (HML)* variables' significance and magnitude of the coefficients during the mentioned time period, and across the whole time frame as well.

- **Global Macro** strategy, being in-line with the underlying assumptions, reached its highest levels of return during the pre-crisis periods, and had 0 crisis periods managed with the positive net return. To check on our data set the well-recognized assumption of Global Macro strategy following the broad financial market, the key independent variables to look for their levels of significance and values of the coefficients will be $R_m - R_f$ and **RMW**. For the first one – to analyze the relationships of the Global Macro returns with the broad equity market behavior, and for the former – with the market views on the importance of the profitability within the available equities.
- **Event Driven**, as the strategy, which is the most differentiated and complex in terms of the broadest spectrum of financial instruments, positions, and assumptions implied, secured 76.6% in total return over the observable period. In contrast to the two mentioned above, this strategy had the only period of negative net return of the Stock Market selloff. Given the ascending trends of the returns during the low interest rates environment in the market, for this strategy, we decided to mainly focus on the significance (and presence of persistence) of $R_m - R_f$ to analyze the magnitude of contingency of this strategy on the broad equity market, and **CMA** to look on the coefficients behavior during the market downturns, with the former, indicating the market's perception of risk.
- **Merger Arbitrage** is an absolute leader within our set of strategies with 97% in overall return during the whole period. The most interesting

empirical fact, is that the returns achieved during the Subprime Housing Bubble and Stock Market Selloff are higher than during the following pre-crisis periods. Such a trend reflects underlying assumption stating that during the crisis periods, the number of irrational and high-risk profile ‘rescue’ M&A transactions increases, while the typical and long-term M&A processes are getting paused and postponed. With the former providing the arbitrage opportunities, for us, it should be reasonable to focus on **CMA** and **RMW** coefficients behavior over time, and, in particular, during the two crisis periods mentioned above.

With the explicitly described data, and with our core hypothesis being augmented for each selected hedge fund investment strategy, based on the structure of its returns over time, the following Chapter 5 is focused on a brief empirical description of the obtained results, and the key statistical implications observed for each strategy and time frame.

Chapter 5

ESTIMATION RESULTS

To proceed with the results estimation and to stress the stated hypothesis, we used the model described within the methodology section. To perform the statistical analysis, the model was built in R Studio, using the standard OLS 5 factor model, which is the standard statistical model used for Fama and French models (Metzger, Shenai, 2019).

After cleaning the data, to begin with the top-down analysis, we used the model for the entire data set of 4,723 observations - for the entire 2003-2021 time frame.

Table 4. Regression results and summary of coefficients for the entire data set based on Fama-French 5 Factor OLS Models

	Global Macro (1)	Event Driven (2)	Equity Market Neutral (3)	Merger Arbitrage (4)
Mkt-Rf	0.034*** (0.005)	0.143*** (0.003)	0.027*** (0.003)	0.123*** (0.004)
SMB	0.033*** (0.010)	0.038*** (0.006)	0.046*** (0.006)	0.025*** (0.007)
HML	-0.077*** (0.009)	-0.032*** (0.005)	-0.015*** (0.006)	0.026*** (0.006)
RMW	0.013 (0.014)	-0.045*** (0.009)	0.093*** (0.009)	0.007 (0.010)
CMA	0.062*** (0.019)	-0.024*** (0.012)	0.043*** (0.012)	-0.046*** (0.013)
Constant	0.003 (0.006)	0.006* (0.003)	-0.004 (0.004)	0.009** (0.004)
Obs.	4.723	4.723	4.723	4.723
R2	0.023	0.373	0.038	0.269
Adj R2	0.022	0.372	0.037	0.269
R. SE	0.380	0.236	0.249	0.263
F Stat.	21.885***	560.508***	37.353***	347.648***

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Relying on the output presented within the summary table, first of all, given the received R^2 and Adjusted R^2 , and F Statistic values, the selected model can be treated as robust for the entire data set, and, especially, for Event Driven and Merger Arbitrage strategies. In terms of the coefficients analysis, we may conclude that all the independent variables are statistically significant coefficients on the entire sample of data.

However, to proceed further with in-depth analysis of the results, stressing the core hypothesis of this thesis, as well as the additional empirical points described in Chapter 4, it is reasonable to interpret the coefficients, going through the possible economic rationale behind each one to draw the conclusions, we have analyzed the coefficients of independent variables for each strategy across the all the seven selected time frames. The analysis is presented within the Tables 5-8 below.

1. Event Driven investment strategy:

R_f or intercept has significant coefficients only during the 1st pre-crisis, and Stock Market Selloff time frames. During the 1st mentioned period, which was characterized by rising interest rates, and, thereafter the ascending trend in the intercept values, the rise of T-Bills YTM by 1% could lead to the increase in value of event driven portfolio of a hedge fund by 0.017%. Contrary, during the Stock Market Selloff Period, the period characterized by falling interest rates, and global slowdown of the economy, the risk-free rate variable has significant and negative explanatory effect on the returns of Event Driven strategy, meaning that rising interest rates may negatively impact the value of a dependent variable. However, having significant coefficients only for 2 time periods, which are in line with

general market trend cannot indicate any persistence or pattern in the intercept's effect on the Event Driven strategy return.

As proposed within Chapter 4, given the underlying nature of the Event Driven strategy, which is described within the literature review section, it should be reasonable to mainly focus on two variables: $R_m - R_f$ and CMA for the results interpretation for this particular strategy.

Considering the coefficient near $R_m - R_f$ variable, we can conclude that there exists a persistence trend in significant and positive coefficient, suggesting that Event Driven strategy might be positively affected by changes in growing risk-free market returns, as well as negatively affected by the downside trend within the broad financial markets.

With respect to CMA variable, it is quite interestingly to observe the consistently negative values of significant coefficients during the first three time periods. Moreover, the coefficients for GFC and COVID-19 time frames are both less than -0.1. The only time period having the positive coefficient is the 3rd pre-crisis period, characterized by lowering interest rates, slowing economy and low-inflammation framework. Such a behavior of a coefficient could potentially point on the Event Driven Strategy posting higher returns when investment firms with active and aggressive investment approach dominate the market in terms of their performance.

Despite no coefficients, apart from the coefficient of $R_m - R_f$ variable, demonstrating the consistent performance, there is one more interesting observation, which is worth mentioning: consistently negative, but not

consistently significant coefficients of *HML* and *RMW* variables can suggest that Event Driven strategy have been posting higher returns during the previous periods of capital rotation from yield to growth within the financial markets. Which, potentially, can point on an increased room of short-selling opportunities for Event Driven strategy. However, positive value of 0.033 of *HML* coefficient does not allow us to proof the persistency of the hypothesis mentioned above for all the time frames in our data set.

Table 5. Regression results and summary of coefficients for Event Driven investment strategy based on Fama-French 5 Factor OLS Models.

	<i>Dependent variable</i>						
	Pre-crisis 1 (1)	Housing Bubble (2)	Pre-crisis 2 (3)	Stock Market Selloff (4)	Pre-crisis 3 (5)	COVID- 19 (6)	Pre-crisis 4 (7)
Mkt-Rf	0.028*** (0.007)	0.137*** (0.009)	0.150*** (0.006)	0.276*** (0.013)	0.138*** (0.009)	0.081*** (0.014)	0.088*** (0.012)
SMB	0.070*** (0.013)	-0.063*** (0.020)	0.012 (0.011)	0.095*** (0.024)	0.058*** (0.014)	0.040 (0.036)	0.022 (0.017)
HML	-0.077*** (0.013)	-0.013*** (0.020)	-0.033** (0.014)	0.036 (0.028)	-0.018 (0.015)	0.030 (0.030)	0.033** (0.014)
RMW	-0.002 (0.019)	-0.243*** (0.045)	-0.040** (0.019)	-0.123*** (0.042)	-0.065*** (0.020)	-0.083 (0.062)	-0.041* (0.021)
CMA	-0.061*** (0.024)	-0.168*** (0.050)	-0.073** (0.022)	0.042 (0.057)	0.094*** (0.025)	-0.181** (0.086)	-0.070** (0.027)
Constant	0.017** (0.006)	0.007 (0.018)	0.005 (0.005)	-0.026** (0.012)	0.009 (0.007)	0.020 (0.033)	0.004 (0.010)
Obs.	1.376	347	1.174	438	920	160	308
R2	0.470	0.484	0.521	0.594	0.267	0.312	0.254
Adj R2	0.468	0.476	0.519	0.590	0.263	0.290	0.242
R. SE	0.212	0.335	0.159	0.244	0.205	0.406	0.179
F Stat.	242.559** *	63.911***	126.537** *	126.537** *	66.484** *	13.974** *	20.524** *

Note: * $p < 0.1$; ** $p < 0.05$; *** $P < 0.01$

2. Merger Arbitrage investment strategy:

Table 6. Regression results and summary of coefficients for Merger Arbitrage investment strategy based on Fama-French 5 Factor OLS Models.

	<i>Dependent variable</i>						
	Pre-crisis 1 (1)	Housing Bubble (2)	Pre-crisis 2 (3)	Stock Market Selloff (4)	Pre-crisis 3 (5)	COVID- 19 (6)	Pre- crisis 4 (7)
Mkt-Rf	0.111*** (0.007)	0.158*** (0.012)	0.120*** (0.006)	0.064*** (0.008)	0.048*** (0.008)	0.190*** (0.025)	0.042*** (0.013)
SMB	0.051*** (0.012)	-0.060*** (0.025)	-0.001 (0.011)	0.024* (0.014)	0.021* (0.012)	0.043 (0.066)	0.028 (0.019)
HML	0.004 (0.013)	-0.011*** (0.025)	-0.009 (0.015)	-0.005 (0.017)	-0.011 (0.013)	0.185*** (0.055)	0.034** (0.015)
RMW	0.013 (0.018)	-0.158*** (0.058)	-0.021 (0.019)	0.014 (0.025)	-0.021 (0.017)	-0.258*** (0.114)	-0.029 (0.023)
CMA	-0.041* (0.023)	-0.141*** (0.064)	0.108*** (0.023)	0.051 (0.034)	0.017 (0.021)	-0.551*** (0.158)	-0.074** (0.030)
Constant	0.015** (0.005)	0.034 (0.023)	-0.021 (0.005)	0.025** (0.007)	0.001 (0.006)	0.002 (0.060)	0.022** (0.011)
Obs.	1.376	347	1.174	438	920	160	308
R2	0.226	0.412	0.409	0.151	0.061	0.487	0.112
Adj R2	0.223	0.403	0.406	0.141	0.055	0.470	0.097
R. SE	0.201	0.426	0.161	0.145	0.173	0.743	0.195
F Stat.	80.120***	47.809***	161.526***	15.307***	11.797***	29.253***	7.629***

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Same as for the Event Driven strategy, we have an absolute consistency in sign and significance of the $R_m - R_f$ coefficients over time, which should be explained by the nature of a strategy, the core purpose of which is to generate alpha from arbitrage positions on the outcome of particular M&A transactions. With the broad markets following an upward cycle, the number of successfully closed M&A deals increases, as well as the number of opportunities within the market for the Hedge Funds employing the Merger Arbitrage strategy, and vice versa, during the broad market downturns and decline in global deal activity. For

instance, and as shown within the Table 6, during the GFC period and COVID-19 periods, the coefficients averaged 0.158 and 0.190, respectively. Meaning that with the risk-free returns decreasing by 1%, the return of a portfolio under Merger Arbitrage strategy could face a loss of $\sim 0.2\%$. Moreover, R^2 for GFC and COVID-19 periods reached the value more than 0.4, supporting the conclusion stated above.

Following the rationale expressed within the Chapter 4, for Merger Arbitrage strategy, it is reasonable to put our focus on *CMA* and *RMW* explanatory effects. While *RMW* coefficient being significant and having a negative sign for Housing bubble and COVID-19 time periods, we may conclude that during the downturn cycles of financial markets, capital rotation from stocks with robust profitability to stocks with low profitability negatively affects the returns of Merger Arbitrage investment strategy. However, given the insignificance of the coefficients for our time periods, we do not have any clear evidence to proceed with any further conclusions with the explanatory effects of *RMW* variable. Turning our attention to *CMA* variable, we also cannot observe any persistent pattern in the coefficients' explanatory power affecting the dependent variable. For example, during the 2nd pre-crisis period, the coefficient value is positive reaching 0.108 with the model resulting in 0.4 R^2 , while for 4th pre-crisis period, the coefficient value taps negative value of -0.074 with the R^2 of 0.1. Hence, the only persistent explanatory factor for the Merger Arbitrage strategy is the risk-free market return, indicating the Merger Arbitrage strategy's returns being mostly contingent on the state of the broad financial market.

3. Global Macro investment strategy:

Table 7. Regression results and summary of coefficients for Global Macro investment strategy based on Fama-French 5 Factor OLS Models.

	<i>Dependent variable</i>						
	Pre-crisis 1 (1)	Housing Bubble (2)	Pre- crisis 2 (3)	Stock Market Selloff (4)	Pre-crisis 3 (5)	COVID- 19 (6)	Pre-crisis 4 (7)
Mkt-Rf	0.048*** (0.016)	-0.012 (0.011)	0.029*** (0.011)	0.096*** (0.017)	0.106*** (0.016)	0.015* (0.009)	0.165*** (0.017)
SMB	0.073*** (0.029)	0.026 (0.023)	-0.013 (0.019)	-0.003 (0.031)	-0.020 (0.025)	0.086*** (0.024)	0.024 (0.019)
HML	-0.166*** (0.030)	-0.003 (0.024)	-0.088** (0.025)	0.135*** (0.037)	-0.061*** (0.027)	-0.106*** (0.020)	0.024 (0.019)
RMW	0.121*** (0.042)	0.010 (0.054)	-0.037 (0.034)	0.059 (0.056)	-0.083*** (0.036)	-0.042 (0.042)	-0.069** (0.030)
CMA	-0.008 (0.055)	0.250*** (0.060)	0.082*** (0.040)	0.057 (0.075)	0.148*** (0.045)	0.179*** (0.058)	0.033 (0.038)
Constant	0.022** (0.013)	-0.028 (0.021)	-0.007 (0.008)	-0.007 (0.015)	0.001 (0.012)	-0.023 (0.022)	-0.005 (0.014)
Obs.	1.376	347	1.174	438	920	160	308
R2	0.042	0.073	0.017	0.099	0.064	0.194	0.270
Adj R2	0.038	0.059	0.012	0.089	0.059	0.168	0.258
R. SE	0.475	0.399	0.283	0.319	0.366	0.272	0.250
F Stat.	11.898***	5.333***	3.947***	9.527***	12.434***	7.433***	22.383***

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Considering the $R_m - R_f$ and RMW variables we pointed on in Chapter 4, we can conclude that $R_m - R_f$ coefficient shows positive sign and significance during all times, except for Housing Bubble time-period, and RMW does not provide any persistent pattern, with the coefficients changing their sign and range of values over the course of different periods. However, given the output we obtained, there are two variables providing us with an insightful observation once considered in bundle: CMA and HML , with the coefficients of the former

variable exhibiting positive and significant values for all the periods, except for the 1st pre-crisis period, and *HML* coefficients being negative and significant for all the periods except for Housing Bubble and Pre-crisis 4. Such an inverse tendency across the 2 mentioned coefficients can point us on the following suggestion: hedge funds which employ Global Macro strategy, on average, tend to generate higher returns during the times when (i) conservative investment approach tend to generate alpha, superior to the one generated by aggressive investment approach, and (ii) portfolios of growth stocks beat the portfolios of value stocks. For example, during the 2nd pre-crisis period, *HML* coefficient of -0.088 could be interpreted as follows: if the returns of portfolio constituted by growth stock is higher than return of value stocks portfolio by 1%, then, on average, the performance of the Hedge fund investing under Global Macro strategy could generate additional 0.088% in daily return, and if conservative investment approach beats an aggressive one by 1%, the same hedge fund could generate additional 0.082% in daily return. However, further research is required to cross-check the conclusion stated above.

4. Equity Market Neutral investment strategy:

For Equity Market Neutral strategy, within the Chapter 4, it was suggested to focus on the coefficients of *SMB* and *HML* variables. However, neither *SMB*, nor *HML*'s coefficients ended up with showing any persistent pattern, as well as all the other coefficients changing their levels of significance, sign and magnitude across different periods, as it could be observable from Table 8. The only pattern which could be observed, is the *HML* factor changing its sign after the Stock Market Selloff crisis period. Moreover, the R^2 of the model across all the time periods, except for COVID-19, is lower than 0.2, indicating the weak robustness

of Fama and French 5-factor model for the analysis of factors, which explain performance of the Hedge Funds employing Equity Market Neutral investment strategy.

Hence, having described the key estimate results for each of four strategies, we can proceed with the summary of key findings, results of testing our hypothesis, and suggestions for future research to be done within the framework.

Table 8. Regression results and summary of coefficients for Equity Market Neutral investment strategy based on Fama-French 5 Factor OLS Models.

	<i>Dependent variable</i>						
	Pre-crisis 1 (1)	Housing Bubble (2)	Pre-crisis 2 (3)	Stock Market Selloff (4)	Pre- crisis 3 (5)	COVID -19 (6)	Pre- crisis 4 (7)
Mkt-Rf	0.018*** (0.009)	-0.006 (0.008)	0.064*** (0.007)	0.035*** (0.012)	0.068** (0.008)	0.022 (0.016)	0.015 (0.012)
SMB	-0.002 (0.016)	-0.020 (0.017)	0.069*** (0.013)	0.043*** (0.021)	0.018 (0.013)	0.075* (0.042)	0.004 (0.017)
HML	-0.033*** (0.017)	0.056*** (0.017)	-0.049*** (0.018)	-0.051** (0.025)	0.018 (0.014)	0.102*** (0.035)	0.027** (0.013)
RMW	0.146*** (0.024)	0.069* (0.039)	0.050** (0.023)	0.030 (0.038)	0.063** (0.019)	0.139*** (0.072)	-0.004 (0.021)
CMA	0.145*** (0.031)	0.070* (0.043)	0.063** (0.027)	-0.095* (0.051)	0.026 (0.023)	-0.093 (0.100)	0.012 (0.027)
Constant	0.002 (0.007)	-0.021 (0.015)	-0.006 (0.006)	0.0003 (0.010)	-0.009 (0.006)	-0.014 (0.038)	0.006 (0.010)
Obs.	1.376	347	1.174	438	920	160	308
R2	0.032	0.184	0.140	0.080	0.086	0.302	0.052
Adj R2	0.029	0.172	0.137	0.069	0.081	0.279	0.036
R. SE	0.268	0.285	0.195	0.217	0.186	0.471	0.174
F Stat.	9.088***	15.421** *	38.130***	7.515***	17.240** *	13.312* **	3.289***

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

Chapter 6

CONCLUSIONS

Within the framework of this research, it had been attempted to stress the hypothesis by examining the alterations in the explanatory power, or simply – coefficients, of the independent variables over different periods of time, to understand whether there are some patterns laying in the relations among the market factors and the performance of the particular hedge fund strategies. The data for 2003-2021 period was used, being broken down by seven different sections with 4 pre-crisis, and 3 crisis periods, including the Global Financial Crisis of 2008, Stock Market selloff of 2014, and COVID-19 shock occurred in 2020. To keep the focus of this research, and following the restrictions in data availability, the set of studied Hedge Funds strategies was narrowed to four. As a main tool to stress the hypothesis, and observe any additional tendencies, which could be useful for both practical and theoretical frameworks, the Fama and French five-factor model was used. In this chapter, the key results of the conducted hypothesis test, other observations, and implications for future research are covered.

The performed analysis has shown that there is only one factor, which has persistent effect on the performance across all the pre-crisis and crisis time periods, and only for Event Driven and Merger Arbitrage investment strategies – the excess market return over the risk-free rate. Such an observation leads to the conclusion that the performance of the hedge funds employing two investment strategies mentioned above could be explained by the direction of broad financial market. Our analysis suggests that the excess market return over

the risk-free rate changing, on average, by 1%, could lead to the changes in daily returns of Event Driven and Merger Arbitrage strategies of 0.14% and 0.12%, respectively, during 2003-2021 time frame. Any of the other factors used within the five-factor model had not exhibited any absolutely consistent pattern in terms of the explanatory power of Event Driven and Merger Arbitrage strategies' performance, as well as for Event Driven and Global Macro investment strategies.

However, few other observations of partially consistent behavior of explanatory factors were recorder.

Event Driven. As explicitly described within Chapter 5, our analysis suggests that the observed behavior of coefficients could potentially point on the Event Driven Strategy posting higher returns when investment firms with active and aggressive investment approach dominate the market in terms of their performance, and firms using conservative approach underperform. Additionally, it had been observed that Event Driven strategy have been posting higher returns during the previous periods of capital rotation from yield to growth within the financial markets, which, potentially, can point on an increased room of short-selling opportunities for Event Driven strategy during such tendencies occurring within the financial markets. However, both of the observations should be studied in details in further researches.

Merger Arbitrage. Given what was described within Chapter 5 for this strategy, we can draw a preliminary conclude that during the downturn cycles of financial markets, capital rotation from stocks with robust profitability to stocks with low profitability negatively affects the returns of Merger Arbitrage investment

strategy. However, given the insignificance of the coefficients for our time periods, we do not have any clear evidence to proceed further with this point.

Global Macro. The tendency observed across the 2 mentioned coefficients in Chapter 5 can point us on the following suggestion: hedge funds employing Global Macro strategy, on average, tend to generate higher returns during the times when (i) conservative investment approach tend to generate alpha, superior to the one generated by aggressive investment approach, and (ii) portfolios of growth stocks beat the portfolios of value stocks. However, further detailed research is required to progress with this conclusion.

Equity Market Neutral. With no persistence in coefficients' explanatory pattern identified, the only trend observed suggests that during 2003-2008, GFC, 2009-2014, and Stock Market Selloff crisis period, capital rotation from value to growth stocks could positively affect the returns of Equity Market Neutral investment strategy, but after the Stock Market Selloff crisis period the pattern has changed, and in times when growth stocks generate the returns higher than value stocks, the performance of Equity Market Neutral strategy was affected negatively. As well as for all the preliminary conclusions mentioned above, further research is required to progress with the in-depth explanations of the observed tendencies.

WORKS CITED

- Ackermann C., R. McEnally and D. Ravenscraft. 1999. "The performance of Hedge Funds: Risk, Return and Incentives". *The Journal of Finance*, Vol. 54, No3.
- Bollen N., J. Joenväärä, and M. Kauppila. 2021. "Hedge Fund Performance: End of an Era?". *Financial Analysts Journal*, Vol. 77, No3.
- Caglayan M. O. and S. Ulutas. 2014. "Emerging market exposures and the Predictability of Hedge Fund Returns". *Financial Management*, Vol. 43, No1.
- Dudley E. and M. Nimalendran. 2011. "Margins and Hedge Fund Contagion". *The Journal of Financial and Quantitative Analysis*, Vol. 46, No5.
- Eling M. and F. Schumacher. 2007. "Does the Choice of Performance Measure Influence the Evaluation of Hedge Funds?". *Journal of Banking and Finance*, vol. 31, No9.
- Fama, Eugene F., and K. R. French. 1993. Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, Vol. 33.
- Fung, William, and D. Hsieh. 1997. Empirical characteristics of dynamic trading strategies: The case of hedge funds. *The Review of Financial Studies*, Vol. 10, No4.
- Fung, William, and D. Hsieh. 2004. Hedge Fund Benchmarks: A Risk-Based Approach. *Financial Analysts Journal*, Vol. 60, No5.
- Phillips S. Kenneth and Ronald J. Surz. 2003. *Hedge Funds: Definitive strategies and techniques*. New Jersey: Wiley.
- Rosenberg M., J. F. Tomeo, and S.Y. Chuang. 2004. Hedge Fund of Fund Allocations Using a Convergent and Divergent Strategy Approach. *The Journal of Alternative Investments Summer*, Vol. 7.
- Metzger N. and V. Shenai. 2019. "Hedge Fund Performance during and after the Crisis: A Comparative Analysis of Strategies 2007–2017". *International Journal of Financial Studies*, Vol. 8, No6