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Does Size Have an Impact on Nordic Hedge Fund Performance?

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Abstract

The paper examines the potential relationship between hedge fund's size of assets under management and performance in the Nordic countries. We employ a modified version of the Fung and Hsieh's seven-factor model to estimate the different hedge funds risk adjusted alphas, as a proxy for performance. The Nordic hedge funds are divided into five different investment styles; Equities, Managed Futures & CTA, Funds of Funds, Fixed Income and Multi Strategy to compare each hedge fund to their own category. Each hedge fund in the sample have at least 24 months of monthly returns and at most 36 months of returns during the period 01/01/2018 – 31/12/2020. Thereafter, we run a panel regression to investigate the relationship between assets under management and performance.

The results convey insignificant results for Nordic hedge funds focused on Equities, Managed Futures & CTA, Funds of Funds and Fixed Income. The implication is therefore that no reliable conclusion can be drawn from the analysis for these four investment styles. However, we observe a concave relationship between performance and size of assets under management for Multi Strategy focused hedge funds. These results implies that Multi Strategy hedge funds in the Nordics, suffer from a diseconomy of scale scenario where performance of the hedge funds increase when size increase, up until a certain climax point. After the climax point is reached, performance instead decrease because of the hedge fund being too big. The economical magnitude of this relationship is although weak, which suggest that fund size does not impact performance in a larger scale.

Keywords: Nordic Hedge Fund Returns, Seven Factor Model, Excessive Returns, Risk Adjusted Alpha.

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1. Introduction

This section covers the thesis background including a problem description and problem analysis of the topic followed by the research questions that this thesis aims to answer. The final part of the section introduces the structure of this thesis and how it proceeds.

1.1 Background

It is generally believed that the first ever hedge fund was started in 1949 by Alfred W. Jones and pursued a strategy where the fund bought stocks and hedged their positions by short sales (Stulz 2007). Over the years has the hedge fund industry evolved and drawn criticism for their compensation structures and lack of performance (Financial Times 2016). In addition, famous investor Warren Buffet took a $1 million wager back in 2008 where he argued that a S&P 500 index fund over ten years would outperform five hedge funds chosen by Protégé Partners (CNN, 2018). As many times previously, Mr Buffet was right, ten years later the index fund had returned 125.8% while the average of the five hedge funds only had generated 36%. Besides being on the right side of the wager Buffet further highlighted the problems that surrounds the hedge fund industry: Are the hedge funds able to consistently generate abnormal returns?

It is important to not forget that this was a wager between five random hedge funds and one index fund, meaning that results perhaps would be different depending on which hedge funds were chosen. As well in defense of the hedge funds, could the performance targets of the funds differ from trying to generate excess returns compared to the S&P 500. The hedge funds could for an example instead had focused on generating returns but to a lower risk. Nevertheless, it emphasizes the difficulties of active asset management since many different factors are involved. To navigate the terrain of investing, this essay will try to address whether the performance of Nordic hedge funds partially could be explained by the amount of assets under management they have and thus, if there is an existing relationship between assets under management and performance.

There has been some research about the subject whether size of assets under management affects hedge fund's ability to generate attractive returns, such as Gao et al. (2019). When famous Swedish portfolio manager Wilhelm Gruvberg recently closed his successful hedge fund Alcur Select for new outside capital, he argued that he and his colleagues saw advantages of restricting additional capital intake over a certain level and thus, not letting the fund grow too big (Alcur 2020). Therefore, the aim of this thesis is to try to understand whether smaller hedge funds over time achieve excess returns compared to much larger hedge funds in the same category, ceteris paribus. Previous research has suggested that it could be of advantage to be smaller because hedge funds then can take positions that are far less liquid and that generate superior returns. This in contrast to larger hedge funds not being able to take on those types of positions because of the risk of impacting the short-term demand of the security (Gao et al. 2019, 5). Alpha will be used as the measurement of the risk adjusted excess returns or more easily explained as the hedge fund's ability to "beat" its respective benchmark, and/or its idiosyncratic risks.

1.2 Problem Description and Problem Analysis

The questions regarding how size of assets under management impacts performance have many different angles of approach. Many hedge fund managers talk about reaching a "critical mass" such as Sean George when describing his decision to act as an umbrella fund under Struktur Fondkommission. In the podcast Affärsvärlden Magasin (Rohstein, 2021) he argued that for funds to be economically logical, they need to reach a certain amount of assets under management to be effective both as a company and as an asset manager. Regardless of which size is optimal, and if there is an optimal size for that matter, one could make the argument that the size of the hedge fund is an important factor to consider when evaluating hedge funds performances. These questions, if answered, would be of great importance for potential investors when deciding which fund to invest in, but potentially also for the management of the hedge funds.

In the Nordics, financial markets are still seen by many as less developed than US-markets, and that also translates to the Nordic hedge fund industry. Brummer and Partners (2021) started the first Nordic hedge fund back in 1995 and according to the Hedgenordics index

there are 136 active hedge funds today (Hedgenordic, 2021). In contrast to global hedge fund research such as Melvy Teo (2009) and Gao et al. (2019) have focused on, this thesis aims to analyse whether the amount of the assets under management affect Nordic hedge funds performance. Since previous studies into the area have been dedicated to global and mostly American hedge funds, the Nordics hedge funds could be viewed as overlooked.

In addition, the same model for evaluating the risk adjusted alpha will be used as in previous research such as in Teo (2009) and Gao et al. (2019). However, as will be explained further in detail in the methodology section, the model is modified with Nordic factors to adjust for the Nordic hedge fund market. To our knowledge, this has not been done before and it will therefore provide greater information regarding how the size of assets under management impacts hedge funds performance. Besides previous master theses about the subject such as Andersen and Zakharova (2011) who investigated Nordic hedge fund's ability to generate alpha in different market conditions, the Nordic hedge fund market could be viewed as an unexplored territory. It will therefore be of interest to give an extensive outlook of the Nordic hedge fund industry and its potential differences compared to other markets such as the US. The size of Nordic hedge funds is in general expected to be smaller than US hedge funds, partly because of the difference in size of markets, but also because of the United States' substantially longer history of hedge funds. These differences in size and overall maturity of the markets, might therefore affect the potential relationship between size of funds and performance for Nordic hedge funds.

1.3 Purpose

The purpose of this thesis is to investigate whether there exists a relationship between size of assets under management and performance in Nordic hedge fund market. Furthermore, does the thesis aspire to answer the question whether it could be of advantage to be smaller in times when size otherwise is portrayed to "matter". One of the aspirations is that this paper in the future could be used for general educational purposes where investment strategies and decisions could benefit from taking this research into account. However, it should still not be viewed as any financial advice.

When Wilhelm Gruvberg at Alcur Select recently decided to close his fund for new outside capital, he did not refer to any specific study behind the decision. Instead, he pointed out that he along with his colleagues, had reached the conclusion that it was in the best interest of the fund (Alcur 2020). Therefore, it will certainly be interesting to see whether any relationship between size of funds and performance exist in the Nordics.

1.4 Research Questions

To address the aim of this study, this thesis is looking to answer the following research questions:

- Is there a negative relationship between assets under management and Nordic hedge fund performance for the investment styles individually?
- Is there a quadratic relationship between assets under management and Nordic hedge fund performance for the investment styles individually?

These questions if answered, could potentially benefit investors when navigating the terrain of hedge fund investing, in the Nordics. Assessing hedge funds risk adjusted returns will always be complicated but nevertheless could the results provide some clarity to whether the size of funds affects their performance.

1.5 Structure of the Study

This thesis consists of five sections followed by a reference list and one appendix with further figures and tables. The first section includes some context to the topic and provides a problem description which this thesis aspires to address. The second section presents a literature review and some further theoretical framework which the thesis relies upon. Furthermore, do second section also state the hypotheses of the thesis. Following, section three consists of the data and the choice of methodology to investigate the topic. The fourth section exhibits the empirical results along with a general discussion about the obtained results. Lastly, section five presents the conclusion and some advice for future research into the area.

2. Theoretical framework

This section of the thesis introduces a literature review which highlights the previous research into the topic. In addition, it entails further theoretical framework necessary when addressing the aim of this thesis.

2.1 Literature Review

There have been several studies with the purpose of understanding and portraying the potential relationship between assets under management and performance for hedge funds. Getmansky (2012) suggests that the relationship between hedge funds returns and assets under management is concave but varies between different investment styles. The findings of Getmansky insinuates that performance increase when size increase up until a climax point where performance instead decrease because the fund has grown too big. Hedge funds capital allocation abilities are therefore seen to diminish because of excess capital according to the paper. In addition, did Getmansky (2012) also highlight that the presence of these concave relationships is especially present in illiquid markets and thus, an optimal range of assets under management is attainable. Through the findings of Getmansky, one could make the argument that it grants additional insights to potential hedge fund investors. An investor could evaluate which hedge fund to invest in through peering them against each other and invest in those funds that is favorably positioned in regards of size and investment style.

However, the relationship between hedge fund performance and amounts of assets under management is a highly debated topic since there are other research disagreeing with the results from Getmansky (2012). Melvy Teo (2009) suggests that there instead is a negative and convex relationship between the size of the fund and the future risk adjusted returns. The convex relationship suggests that returns are diminishing when the size of assets under management increase. Similar to Getmansky, did Teo (2009) also find that the strength of the relationship was dependent on which investment style the hedge fund engaged in. These diminishing results can according to Teo (2009) party be derived from disagreements within

the fund which negatively affects the investing process.

In Teo's 2009 paper, smaller hedge funds outperformed larger ones by 2.75% annually when adjusting for different levels of risk, through the Fung and Hsieh seven-factor model. Gao et al. (2019, 5) further analysed other factors impacting hedge fund's ability to generate abnormal returns such as age and sought to examine the life cycle of hedge funds. Through conducting a modified Fama-MacBeth regression for every fund, they ran a time-series regression of the hedge funds performance and age and found that the cross-sectional average coefficient on the size of the fund, had a negative relation and was statistically significant. Furthermore, the authors found that when splitting funds into three different age categories; young, mid-age and old, and performed "horse racing" tests, their results indicated that small funds achieved superior returns compared to larger funds regardless which age group they were sorted in (Gao et al. 2019, 3).

As mentioned above, is the previous literature regarding the Nordic hedge fund market limited with the exception for some master theses. Therefore, has the methodology and approach to this thesis heavily relied on earlier papers such as Teo (2009), Getmansky (2012) and Gao et al. (2019) because of their thorough character. Even though there are some differences of opinion in the shape of the relationship between fund size and performance, the authors are unanimous in that there exists some form of economy and diseconomy of scale relationship in the hedge fund industry. The size of the assets under management seem to affect performance which highlights the call for investigating whether a similar relationship can be found in the Nordic hedge fund market.

2.2 Hypotheses

The topic of evaluating hedge funds returns is indubitably a well-covered area within finance. However, the conclusions behind the different papers on the topic varies where Teo (2009) and Gao et al. (2019) argues that that there exists a negative and convex relationship between the size of hedge funds, and their risk adjusted returns. The observed negative relationship imply that smaller hedge funds are to benefit performance-wise because of their smaller scale. Gao et al. (2019) also went on to analyse additional factors such as the age of the hedge funds and how it affects their performance. Regardless of which age, smaller hedge funds

demonstrate better performances which clearly underlines size as an important factor to evaluate.

Therefore, in line with previous research, it is expected that a relationship between Nordic hedge funds size of assets under management and performance will be established. If a negative relationship were to be found, it would insinuate that hedge funds performance decrease when their assets under management increase in accordance with the findings of Teo (2009) and Gao et al. (2019). Gao et al. (2019, 7) suggests that smaller and younger hedge funds can invest in more illiquid assets which larger hedge funds might not be able to, and through that can generate abnormal returns. However, if the relationship instead were to be found concave and in accordance with Getmansky (2012), it would suggest that performance for hedge funds increase when size increase up until a certain climax point. At this climax point, would instead performance start to decrease because of the fund being too big.

Regardless, whether a concave relationship or a negative relationship is found, are the expectations of the results that Nordic hedge funds in some ways are suffering from diseconomies of scale. The concept, which is explained further in detail in section 2.7, suggests that performance decrease when size of assets under management increase. Even though this paper examines a new geographical area, the results are expected to be in line with previous research. To investigate the potential relationship, the thesis will be tested through the following hypothesis:

$H_0 1$: There is not a quadratic relationship between assets under management and Nordic hedge funds performance.

$H_0 2$:There is not a negative relationship between assets under management and Nordic hedge fund performance.

These hypotheses will be tested for each of the five investment styles individually to address the aim of the thesis and find out whether there is a relationship between Nordic hedge funds size of assets under management, and performance.

2.3 Efficient Market Hypothesis

The theory behind the efficient market hypothesis is that an efficient capital market builds upon that prices at all times reflects all available information. If the theory was to be adopted in full, “beating the market” would therefore be considered impossible. According to Fama (1970) there are three different types of market efficiencies with the first one being the weak form, the second one being the semi-strong form and the last one being the strong form. The differences between the last two versions of the hypothesis are that in the strong form, all information regardless of whether its private or public, is accounted for in the equity’s share price. This while in the semi strong version, only all publicly known information is priced in the stocks share’s price. Given that the idea behind most hedge funds is to generate abnormal returns, meaning that fund managers outperform the market, significant results of abnormal returns would contradict the theory behind efficient markets (Fama 1970).

2.4 Alpha

Alpha is in financial terms often referred to abnormal returns or a strategy’s ability to “beat” the market. In other words, it could be when a hedge fund generates superior returns compared to their benchmark (Investopedia 2021). Alpha can also be calculated in different ways such as Jensen's Alpha which is constructed through taking the average return of a portfolio that exceeds the cost of equity, which is calculated by the capital asset pricing model (Investopedia 2021). This is followed by adjusting it for the portfolio beta and the average market return. Risk adjusted alpha can also be calculated through the Fung and Hsieh seven factor model which is recognized within the industry as the optimal model to analyse hedge fund returns through (Fung and Hsieh 2004, 5).

2.5 Risk Adjusted Returns and Style Adjusted Returns

Risk adjusted returns are the returns when analysing a certain investments rate of return but also taking the risk into perspective. There are multiple ways of measuring the risk that investments are associated with such as through volatility or by other words the Sharpe-ratio:

$$(R_p - R_f) \div \sigma_p$$

The Sharpe ratio is a classical way of measuring returns relative to risk where one takes the return of the portfolio and subtract the risk-free rate and then divide it by the standard deviation of the portfolios excessive returns (Investopedia 2021). However, the consensus that can be found when reading previous research about hedge funds returns such as Fung and Hsieh (2021), Teo (2009), and Gao et al. (2019), is that the Sharpe ratio is not optimal when calculating hedge funds risk adjusted returns due to hedge funds returns tends to not follow a normal distribution. Using standard deviation as a mean of adjusting for risk is therefore sub-optimal (Favre and Signer 2002, 5). Instead, as previously been mentioned, this thesis uses the seven-factor model to estimate the Nordic hedge funds risk adjusted returns.

In addition to risk adjusting returns through the seven-factor model, this thesis also adjusts for investment style to provide some context when comparing hedge funds performance. This thesis categorizes the style adjusted returns for Equities-hedge funds, Fixed Income-hedge funds, Managed Futures and CTA-hedge funds, Multi Strategy-hedge funds, and Fund of Fund-hedge funds. This because different types of hedge funds have different targets and positions for generating returns. It would therefore be misleading to compare an Equities-hedge fund to a Fixed Income-hedge fund due to that reason (Teo 2009, 4).

2.6 Fung-Hsieh Seven-Factor Model

The Fung-Hsieh seven-factor model is commonly used when evaluating hedge funds performances (Bloomberg 2015). Both Teo (2009) and Gao et al. (2019) uses the model when analysing hedge funds returns since it builds upon seven different risk factors which help explain a significant part of the hedge fund's returns. It is characterized by the following equation:

$$ALPHA_{im} = r_{iM} - (b_{iM}SNPMRF_m + c_{iM}SCMLC_m + d_{im}BD10RET_m + e_{im}PTFSFX_m + BAAMTSY_m + f_{iM}PTFSBD_m + g_{iM}PTFSFX_m + h_{iM}PTFSCOM_m$$

$$i = 1, \ldots, Number\ of\ Funds, m$$
$$= 1, \ldots, M, ALPHA_{im}\ is\ the\ Excess\ Return\ for\ Fund\ i\ for\ Month\ m$$

$$r_{im} \; is\ the\ Fund\ Return\ in\ Excess\ of\ the\ 1\ month\ T-bill\ for\ the\ entire\ duration.$$

The seven-factor models factors can take on different values depending on their associated betas. These betas are estimated through regressing the seven factors against the monthly excess returns for every individual hedge fund. When these coefficients are then estimated, they are used to create a benchmark or a prediction of the alpha. This prediction acts as the individual benchmark where the risk adjusted alpha is the residual between the predicted alpha and the observed monthly excess returns.

The different factors of the seven-factor model are described below:

SNPMRF is the S&P 500 return. This is used as a proxy for the market returns. The return on the S&P 500 is instrumental when it comes to modelling returns for equity focused hedge funds (Teo 2009, 9)

SCMLC is the "small minus big" factor. It demonstrates the difference in return between the Russell 2000 and S&P 500 returns. The Russell 2000 is an index consisting of the smallest 2000 stocks in the Russell 3000 index S&P 500 is an index consisting of 500 of the large US-listed companies (Teo 2009, 9). Hedge Funds focusing on equity investing can take positions in often riskier assets such as smaller equities. The SNPMRF factor demonstrates the difference in return between these two indexes and thus helps explain some of the return that equity focused hedge funds create with their dynamic trading strategies.

BD10RET is the yield spread of the US 10-year Treasury bond over the three-month Treasury bill. This is then adjusted for the duration of the 10-year bond and is an important metric when trying to understand and predict the future of the overall economy (Teo 2009, 9). A negative spread has historically been interpreted as a pre-sign of a recessionary period. This can be explained by the logical interpretation that if the short-term yields are higher than the long term, the direction of the economy is predicted to be negative.

BAAMTSY is the change in credit spread of the Moody's BAA bond over the US 10-year Treasury bond adjusted for the duration of the 10-year bond (Teo 2009, 9). This is an alternative to the previous factor "BD10RET". They share the same characteristics of them belonging to the asset class of bonds "No ownership of the underlying asset" The major

difference between them is that the Moody's BAA bonds are corporate bonds while the US Treasuries are government created notes. BAAMTSY also measures credit spreads but with a different benchmark.

PFTSFX is the excess return on portfolios of lookback straddles on currencies (Teo 2009, 9). It has been originally shown in Fung and Hsieh's (1997) and then developed further in Fung and Hsieh (2001), that the returns on trend-following funds had very close returns and high correlation to these option portfolios. Trend following hedge fund strategies thrive when the financial markets are distressed.

PFTSBD and **PFTSCOM** is also constructed as the excess return with the same method, creating a portfolio of lookback straddles (Teo 2009, 9). For PFTSBD, US bonds is the underlying asset and for PFTSCOM, commodities are the underlying asset.

2.6.1 Different Investment Styles

The seven-factor model is a model consisting of seven different factors. They are instrumental in the thesis due to their broad and extensive characteristics of explaining hedge fund returns (Teo 2009). Given that hedge funds also could be very different in their strategies, the different investments styles that this study will focus on are the following:

Equities - the most common hedge fund in the Nordics. These funds invest in equities through either taking a long or short position depending on their view of the company. Through their mandate of taking short positions, they can hedge for market risks associated with equity investing (Investopedia 2021). The number of observations used in the analysis are 760, consisting of monthly data from 22 different Equity focused hedge funds.

Managed Futures and CTA - generate returns through investing in different types of future contracts, foreign currencies, and commodities. These hedge funds generally have lower correlation to typical assets which provides diversification for investors (Investopedia 2021). The number of observations used in the analysis are 191 for Managed Futures and CTA and consist of monthly data from six different hedge funds.

Fixed Income - generate returns on fixed income securities and derivatives. This can be accomplished through for instance taking advantage of market discrepancies in these securities. Fixed Income hedge funds have historically had lower returns than other types of hedge funds (Investopedia 2021). The total number of observations concerning Fixed Income focused hedge fund in this thesis amount to 808, consisting of monthly data from 24 different hedge funds.

Multi Strategy - employs different strategies to generate attractive returns for investors and generally have a broader mandate when investing (Investopedia 2021). The total number of observations concerning Multi Strategy focused hedge funds in this thesis amount to 683, consisting of monthly data from 20 different hedge funds.

Fund of Funds - invests in other hedge funds which means that the portfolio consists of shares in other types of hedge funds (Investopedia 2021). In this thesis the number of observations for Funds of Funds are 140, consisting of monthly data from four different hedge funds.

Of the active Nordic hedge funds today, approximately 37% are classified as Equities, 25% as Fixed Income, 22% as Multi Strategy, 11% as Managed Futures and CTA, and 5% as Funds of Funds (Hedgenordic, 2021). Even though all factors contribute to the evaluation of hedge fund's performances, some factors within the model are more important than others since different investment styles is exposed to different risk profiles. According to Fung and Hsieh's (2004, 5), it is demonstrated that hedge funds with focus on equity investments tend to be taking a long position on small cap companies and taking a short position on large cap companies. Hedge funds that focus on equity investing will as well, according to the authors, therefore have a high correlation with the stock market and thus, their risks relate to it in various ways.

Fixed Income invests in different types of assets focusing on bonds where the interest rate spread is the most important factor to consider (Fung and Hsieh 2004, 23). According to the study, many Fixed Income hedge funds invest in treasuries with low credit ratings but also with lower liquidity. They hedge their risk by shorting treasuries with high credit ratings that are more liquid. The difference in return between the two assets is the so-called interest rate spread. Interest rate spread tends to move together, particularly in bear markets where the risk

of Fixed Income hedge funds can be explained as the interest rate spread according to the same study. Another important factor to consider is that most Fixed Income hedge funds have a very high debt ratio, and the cost of financing is also something they are exposed towards. The cost of financing is determined by the overall liquidity of the market which is a part of the credit spread variable in the seven-factor model.

Managed Futures and CTA invest in different derivatives such as for an example put and call options. However, they are also likely to be exposed towards both stock markets and commodities and currency markets (Fung and Hsieh 2001, 314). Funds investing in Managed Futures and CTA have one central style factor, which implies that there is one dominant trading strategy for all hedge funds in the same category. Multi Strategy and Funds of Funds have different approaches since they are both more diversified and do not have the same established niche. Funds of funds diversifies through owning different types of hedge funds and thus have a lower exposure towards one single factor. However, they are correlated with most factors, if not all the seven factors that Fung and Hsieh (2001, 5) present. Multi Strategy is similar to Funds of Funds in the way that the goal with investing is to return as much as possible without tampering with diversification. In similarity with Funds of Funds, are Multi Strategy hedge funds most likely to be exposed to multiple of the factors expressed in the seven-factor model, compared to other more niche investment styles such as Managed Futures and CTA (Fung and Hsieh 2001, 5).

2.7 Economies and Diseconomies of Scale

Economies of scale is a familiar topic within economics where the idea behind the theory is that when a company reaches a certain size, it can reap the advantages of being large and thus make the operation more cost efficient (Investopedia 2021). A clear example of an economics of scale scenario is when a producing company can increase their production and through that also lower their costs. Through dividing their costs over a larger amount of goods, the price per piece drops and consequently is the manufacturer more cost efficient. In this thesis however, is the term “economy of scale” instead used in the sense that hedge funds could benefit when their assets under management grow. It could for instance be through what Sean George previously described as reaching a “critical mass” (Rothstein 2021). The “critical mass” could be put in the terms that when a hedge fund reaches a certain amount of assets

under management, it enables them as a fund to operate more efficient.

Hedge funds traditionally make money through the 2 and 20 rule, where they charge 2% of the capital invested in the fund and they charge an additional 20% if certain performance targets are met (Corporate Finance Institute 2021). In the scenario where a hedge fund accumulates a “critical mass”, it would allow them to reap the advantages of being large and make the operations as adequate as possible. This could potentially both be viewed through their capital allocation being at its optimal point, but likewise through providing the firm with all its necessities to generate attractive returns. In other words, reaching an economy of scale scenario.

However, there is as well the other side of the coin where the amount of assets under management grows too big and instead causes problems for the hedge funds. In broader economic terms, are these scenarios categorized as diseconomies of scale and can be observed when producing companies grow so large, that the price per unit instead increase (Investopedia 2021) when production increase. Obviously do not diseconomies of scale have the same meaning in this thesis, instead the concept is used as a way of expressing negative relationships between hedge funds assets under management and their ability to generate abnormal returns. It could potentially occur when hedge funds size of assets under management grows too big for the firm to allocate in an effective matter and thus, negatively impact the overall performance. In other words, reaching a diseconomy of scale scenario.

Grasping the concept behind economies and diseconomies of scale is important when analysing which factors affects hedge funds performances. Previous research by Gao et al. (2019) and Teo (2009) both highlights that a disceconomy of scale scenario develops as hedge funds attract additional capital over time. These conclusions drawn by earlier researchers therefore contributes to why it would be of interest to investigate whether the same kind of relationship can be found in the Nordic hedge fund industry.

3. Data and methodology

This section covers how the data was collected and handled. Furthermore, it specifies the methodology and how the analysis was performed.

3.1 Data

Descriptive Statistics

	Obs.	Mean	Std dev.	Min	Max
Equities					
Monthly Excess Return	760	0.008	0.05	-0.184	-0.209
Assets Under Management	760	157.405	179.138	4	837
	Obs.	**Mean**	**Std dev.**	**Min**	**Max**
Managed Futures and CTA					
Monthly Excess Return	191	0	0.031	-0.154	0.082
Assets Under Management	191	399.7	453.226	1.5	1554
	Obs.	**Mean**	**Std dev.**	**Min**	**Max**
Funds of Funds					
Monthly Excess Return	140	0.001	0.019	-0.113	0.039
Assets Under Management	140	6639.393	10572.392	7	30620
	Obs.	**Mean**	**Std dev.**	**Min**	**Max**
Fixed Income					
Monthly Excess Return	808	0.002	0.028	-0.369	0.156
Assets Under Management	808	240.437	243.563	2.4	1110
	Obs.	**Mean**	**Std dev.**	**Min**	**Max**
Multi Strategy					
Monthly Excess Return	683	0.003	0.032	-0.219	0.157
Assets Under Management	683	414.294	647.38	1.3	3558

The table presents the descriptive statistics of the five different investment styles.

The data on which this thesis is built upon is taken from the Hedgenordic database and includes all currently active hedge funds in the Nordics. When this thesis was being developed there were 138 registered and active hedge funds in the Nordics which includes Sweden, Denmark, Norway, Finland, and Iceland (Hedgenordic, 2021). The Hedgenordic database includes information such as the hedge funds classification, monthly returns since inception, fee structure, and key personnel. The raw monthly hedge fund returns were each collected individually from the database and these raw returns are all net returns, meaning that performance and management fees already has been accounted for in the data.

The limitations consist of active Nordic funds with at least 24 months of data during the period 01/01/2018 – 31/12/2020. A two-to-three-year time span is commonly used amongst previous research such as in (Teo 2009). It makes the observations more objective since evaluating a hedge fund with less than two years of operations, could be a too short period of time. The decision to only include 36 to 24 months in the evaluation period is attributed to that performance older than that might be considered irrelevant when measuring a fund's ability to generate attractive returns today. An additional reason for the chosen period and time span is that it enables a comparison between performance data from funds operating under the same time frame. That would otherwise not be possible given that there are several funds that have been operating longer that 36 months. Through limiting the period between 2018 and 2020 it is possible to compare most hedge funds within the same period to each other and draw a conclusion regarding if size affects performance.

3.2 Methodology

After all raw monthly hedge funds returns were collected from the Hedgenordic database, the monthly excess returns were calculated by taking the raw monthly returns and subtracting the one-month T-bill yield adjusted for duration. To reduce the potential influence caused by outliers, these values are then made logarithmic. Winsorizing was not used due to the nature of the data and if it were to be used, it would greatly reduce the sample size since most of the outliers are derived from the same funds. Winsorizing would therefore greatly reduce the number of funds which already is limited and instead have a negative effect on the data.

The next step is to insert the Fung and Hsieh's (2004) seven factors to compute the risk adjusted alpha for each hedge fund. As previously mentioned, these factors consists of the S&P 500 return, the spread between the Russell 2000 and the S&P 500 returns, the change in credit spread of the Moody's BAA bond over the US 10 year Treasury bond adjusted for the duration of the 10 year bond, the yield spread of the US 10-year Treasury bond over the three month Treasury bill, the excess return on portfolios of lookback straddles on currencies, the excess return on portfolios of lookback straddles on US Bonds and, the excess return on portfolios of lookback straddles on commodities. The last three factors are calculated and updated by Fung and Hsieh and can be collected at their website (Fung and Hsieh 2001). All factors mentioned except the S&P 500 market return and the spread between the Russell 2000 and S&P 500 have also been adjusted for duration.

Since the seven-factor model explicitly uses US based factors, and this thesis is focusing on the Nordic hedge fund market, an additional modified seven-factor model was created with the OMX Nordic 40 index and the OMX Nordic Small Cap SEK PI. The OMX Nordic 40 index replaced the S&P 500 market return and the spread between the OMX Nordic Small Cap SEK PI and OMX Nordic 40 replaced the spread between the Russell 2000 and the S&P 500 returns. The purpose of this modification was to investigate whether the usage of US factors instead of Nordic would impact the hedge funds risk adjusted alphas. Consequently, these two versions of the seven-factor models were conducted separately. Due to large differences in assets under management between funds within investment styles and the limited sample size, the logarithmic versions of the assets under management were used to minimize the potential effects that the large discrepancies in asset under management could induce into the results.

To calculate the risk adjusted alpha, an estimation of the coefficients for the seven factors was necessary. These coefficients were estimated through regressing the monthly excess returns for every hedge fund individually against the seven factors. The next step was to predict the risk adjusted alpha. This "predicted alpha" would take on different values for every individual hedge fund and thus, act as the individual benchmark.
The risk adjusted alpha generated would then be the residual between the predicted alpha, the benchmark based on every funds individual risk factors, and the observed excess return. The monthly excess return was calculated as subtracting the risk-free rate from the monthly return adjusted for duration. The same methodology was used for calculating the risk adjusted

alphas through the modified seven-factor model. These steps were performed for every individual hedge fund in their respective hedge fund styles.

The next step after collecting the risk adjusted alphas was to insert the values into the final regression and investigate whether a statistical relationship between assets under management and risk adjusted alpha existed. The regression was as portrayed below, investigating if fund size and fund size-squared in fact have an effect on Nordic hedge funds performance.

$$(1)\, ALPHA_{im} = a + bFUNDSIZE_{im-1} + cFUNDSIZE^2{}_{im-1} + \varepsilon_{im}$$

Fund size is measured as the lagged assets under management due to its ability of reducing potential autocorrelation. The coefficient prior to the independent variables are the ones we are trying to investigate, whether those take on positive or negative values while being statistically significant. Due to the fact the data was treated separately between the investment styles and thus, the regressions were conducted independently of each other, no style dummy was used in the final regression.

Robust clustered standard errors were used for the analysis in this thesis. The purpose of robust clustered standard errors is to get a better approximation when the sample observations cannot be assured to be statistically independent of each other. Due to not using entire fund families, and the analysis of funds of funds, it is seemed appropriate to use the robust clustered standard errors. These will then be clustered by firm (ID).

4. Empirical Results

This part of the thesis presents the empirical results and is followed by an interpretation of the results and a general discussion.

4.1 Descriptive Statistics

The tables one to five below displays the input of all factors used in the seven-factor model adjusted for the duration of the specific hedge fund. It complies monthly data for each individual hedge fund from 2018 to December 2020 where the investment style Fixed Income provides the largest sample.

For all investment styles except Equities, the minimum of monthly excess return is greater in absolute terms than the maximum of monthly excess returns. The only investment style with a larger maximum than minimum for monthly excess returns in absolute terms, are hedge funds focusing on Equities investments. The spread between the worst and best performing months is largest for hedge funds focusing on Fixed Income while the smallest spread is demonstrated in Funds of Fund focused hedge funds.

Table 1 – *Descriptive Statistics for Equities*

Variable	**Obs.**	**Mean**	**Std dev.**	**Min**	**Max**
Monthly Excess Return	760	0.008	0.050	-0.184	0.209
OMXN40	760	0.007	0.042	-0.094	0.097
Equity Spread	760	-0.006	0.030	-0.059	0.066
US10yearover3month	760	0	0	0	0.001
Year Moodys	760	0.002	0.003	0.001	0.018

PTFSBD	760	0.060	0.255	-0.226	1.047
PTFSFX	760	0.013	0.245	-0.260	0.998
PTFSCOM	760	0.041	0.171	-0.193	0.754

Table 1 summarize the numerical values used in the seven-factor model when computing risk adjusted alpha for Equities. The Adjusted R-squared for the modified seven-factor model when applied to individual Equities hedge funds ranged from approximately 0.10-0.81, while the mean was 0.3.

Table 2 – *Descriptive statistics for Managed Futures and CTA*

Variable	**Obs.**	**Mean**	**Std dev.**	**Min**	**Max**
Monthly Excess Return	191	0	0.031	-0.154	0.082
OMXN40	191	0.008	0.043	-0.094	0.097
Equity Spread	191	-0.005	0.031	-0.059	0.066
US10yearover3month	191	0	0	0	0.001
Year Moodys	191	0.002	0.002	0.001	0.018
PTFSBD	191	0.065	0.261	-0.226	1.047
PTFSFX	191	0.011	0.247	-0.260	0.998
PTFSCOM	191	0.042	0.173	-0.193	0.754

Table 2 summarize the numerical values used in the seven-factor model when computing risk adjusted alpha for Managed Futures and CTA. The Adjusted R-squared for the modified seven-factor model when applied to individual Managed Futures and CTA hedge funds ranged from approximately 0.04-0.38, while the mean was 0.21.

Table 3 – *Descriptive statistics for Funds of Funds*

Variable	**Obs.**	**Mean**	**Std dev.**	**Min**	**Max**
Monthly Excess Return	140	0.001	0.019	-0.113	0.039
OMXN40	140	0.007	0.042	-0.094	0.097
Equity Spread	140	-0.006	0.030	-0.059	0.066
US10yearover3month	140	0	0	0	0.001
Year Moodys	140	0.002	0.003	0.001	0.018
PTFSBD	140	0.059	0.255	-0.226	1.047
PTFSFX	140	0.014	0.245	-0.260	0.998
PTFSCOM	140	0.04	0.171	-0.193	0.754

Table 3 summarize the numerical values used in the seven-factor model when computing risk adjusted alpha for Funds and Funds. The Adjusted R-squared for the modified seven-factor model when applied to individual Funds of Funds hedge funds ranged from approximately 0.62-0.88, while the mean was 0.711.

Table 4 – *Descriptive statistics for Fixed Income*

Variable	Obs.	Mean	Std dev.	Min	Max
Monthly Excess Return	808	0.002	0.028	-0.369	0.156
Equity Spread	808	-0.002	0.031	-0.090	0.080
OMXN40	808	0.011	0.054	-0.125	0.127
US10yearover3month	808	0	0	0	0.001
Year Moodys	808	0.002	0.003	0.001	0.018
PTFSBD	808	0.062	0.256	-0.226	1.047
PTFSFX	808	0.011	0.245	-0.260	0.998
PTFSCOM	808	0.042	0.172	-0.193	0.754

Table 4 summarize the numerical values used in the seven-factor model when computing risk adjusted alpha for Fixed Income. The Adjusted R-squared for the modified seven-factor model when applied to individual Fixed Income hedge funds ranged from approximately 0.09-0.831, while the mean was 0.39.

Table 5 – *Descriptive statistics for Multi Strategy*

Variable	Obs.	Mean	Std dev.	Min	Max
Monthly Excess Return	683	0.003	0.032	-0.219	0.157
Equity Spread	683	-0.005	0.030	-0.059	0.066
OMXN40	683	0.007	0.043	-0.094	0.097
US10yearover3month	683	0	0	0	0.001
Year Moodys	683	0.002	0.003	0.001	0.018
PTFSBD	683	0.061	0.256	-0.226	1.047

PTFSFX	683	0.012	0.244	-0.260	0.998
PTFSCOM	683	0.042	0.172	-0.193	0.754

Table 5 summarize the numerical values used in the seven-factor model when computing risk adjusted alpha for Multi Strategy. The Adjusted R-squared for the modified seven-factor model when applied to individual Multi Strategy hedge funds ranged from approximately 0.08-0.866, while the mean was 0.41.

4.2 Regression and Interpretation of the Results

The results from the regression analysis are that for hedge funds that focus on equities, neither FUNDSIZE or $FUNDSIZE^2$ is statistically significant at 1%, 5% or 10% level. However, the overall R-squared of the regression is close to zero, which implies that FUNDSIZE and $FUNDSIZE^2$ are incapable of catching the overall variance in the model. The interpretation of the first coefficient is that when FUNDSIZE increases, performance measured through alpha, decreases. For $FUNDSIZE^2$, the effect is the opposite when $FUNDSIZE^2$ increases, alpha increase.

Given that these factors are moving in the opposite direction, some resistance will occur when the assets under management changes. Since neither of the explanatory variables are statistically significant, the only conclusion that can be drawn is that the model has no reliable predictive power. No linear nor quadratic relationship can be drawn between assets under management and hedge fund performance measured by alpha for the sample.

The results from the regression analysis for Managed Futures and CTA demonstrates that the coefficient for the FUNDSIZE variable is negative and thus implying that an increase in assets under management should result in a decrease of performance, measured by alpha. The interpretation of $FUNDSIZE^2$ is that when $FUNDSIZE^2$ increase performance also increase. However, in accordance with equity focused hedge funds above, the R-squared of the regression is close to zero. Furthermore, neither of the explanatory variables not statistically significant at the 1%, 5% or 10% level. The conclusion that can be drawn from these results is that neither FUNDSIZE or $FUNDSIZE^2$ help predict alpha meaning that no linear or quadratic relationship can be found of statistical importance.

When interpreting the results from the regression for investment style for Funds of Funds, the coefficient for FUNDSIZE is positive which implies that an increase in assets under management also increase performance. The coefficient for $FUNDSIZE^2$ is negative which suggests that when $FUNDSIZE^2$ increase, performance should decrease. However once again, the R-squared of the regression is almost zero and the explanatory variables are not statistically significant at the 1%, 5% or 10% level. For Funds of Funds hedge funds in the Nordics, the conclusion is that neither FUNDSIZE nor $FUNDSIZE^2$ affects hedge fund performance. No linear or quadratic relationship can be found of statistical importance.

The regression for Fixed Income focused Nordic hedge funds the coefficient for FUNDSIZE takes on a negative value while the coefficient for $FUNDSIZE^2$ takes on a positive value. The negative value implies that when FUNDSIZE increase, the performance should decrease. In contrast, the positive coefficient for $FUNDSIZE^2$ should result in an increase in alpha when $FUNDSIZE^2$ increases. The conclusion to be drawn from this regression is that neither of the explanatory variables are statistically significant at the 1%, 5% or 10% level. These findings are in accordance with previous results for the prior investment styles and the R-squared for Fixed Income hedge funds are also close to zero. Once again, this translates to that no reliable relationship can be shown from the regression.

The results from the final regression for Multi Strategy funds demonstrates different results from the previous investment styles. The coefficient for the explanatory variable FUNDSIZE took on a positive coefficient translating to that performance should increase when assets under management increases. $FUNDSIZE^2$ took on a negative coefficient suggesting that alpha should decrease when $FUNDSIZE^2$ increase. The difference between the results from the Multi Strategy regression and the other investment styles, is that FUNDSIZE is statistically significant at 5% level and $FUNDSIZE^2$ is significant at 1% level.

The conclusion that can be drawn from these results is that there is a concave relationship between alpha and assets under management. Performance for Multi Strategy focused hedge funds in the Nordics initially increase when the assets under management increase. However, after a certain point, performance start to decrease since the assets under management has grown too big. Nonetheless, the coefficient is still small when investigating the economical magnitude of this relationship. The relationship is evident but not very strong meaning that

the size of assets under management does not affect performance in a large scale. However, after multiplying the coefficient for the $FUNDSIZE^2$ with the standard errors found in the descriptive statistic, the economical magnitude is calculated and close to zero.

The same regressions were run with the US market proxies as expressed in the original seven-factor model where they act as inputs in the regression investigating whether size of assets under management affects performance. These regressions along with their descriptive statistics can be found in appendix A.

Table 6 – *Regressions for each Hedge Fund Investment Style*

	Equities		**Managed Futures and CTA**		**Funds of Funds**		**Fixed Income**		**Multi Strategy**	
Variable	Coefficient (Std error)	Obs.	Coefficient (Std error)	Obs.	Coefficient (Std error)	Obs.	Coefficient (Std error)	Obs.	Coefficient (Std error)	Obs.
FUNDSIZE	-0.0159	760	-0.0003	191	0.0053	140	-0.0007	808	0.0016**	683
	(0.015)		(0.013)		(0.006)		(0.005)		(0.001)	
FUNDSIZE²	0.0002	760	0.0003	191	-0.0003	140	0.0002	808	-0.0009***	683
	(0.002)		(0.001)		(0.001)		(0.001)		(0.001)	

Table 6 presents the results from the panel regression.

(***) significant at the 1% level, (**) significant at the 1% level, (*) significant at the 10% level.

4.2.1 General Result Discussion

One of the potential reasons for these different and for some parts contradictory results, is that the data collected could be of lower quality. Hedge funds overall are secretive with their reporting due to the lack of regulation and the low voluntary transparency. This is a bias that Fung and Hsieh (2004, 6) mention as selection bias which can occur when analysing hedge fund performance. Since the data regarding hedge fund performance is collected from one database, Hedgenordic, and the sample being relatively small, potential misinformation could affect these results.

However, even though some of the results are contradictory with previous research, the concave relationship that was found for Multi Strategy focused Nordic hedge funds, is in accordance with previous research of Getmansky (2012). Getmansky, suggested that the

relationship between hedge funds returns and asset under management is concave but also varies between different investment styles. Getmansky also argues that this concave relationship is especially present in illiquid markets which might be of interest when analyzing the Nordic hedge fund market. Even though it would be wrong to categorize the whole Nordic market as illiquid, the liquidity is however most likely better in larger markets such as the US and, it could help explain why there is a concave relationship for Multi Strategy hedge funds here in the Nordics.

Furthermore, the findings of the thesis implies that economies and diseconomies of scale to some extent can be found in active asset management. The concave relationship between performance and assets under management for Multi Strategy focused hedge funds, suggests that performance is affected by the amount of capital hedge funds have available for investing. A parable can be drawn to the origins of the theory behind economies of scale where producing companies can benefit financially from when their price per product decreases, when quantity increases. In the hedge fund industry, that would translate to asset managers benefiting when their amount of capital to allocate increases, such as through different cost efficiencies. A larger amount of assets would also translate to a larger amount of fees, which could be used for hiring more analysts to do inhouse equity research for the fund, instead of spending more money on expensive external purchased research. Another potential reason to why a relationship for Multi Strategy hedge funds performance and asset under management was found, could be down to the specific investment style. Multi Strategy hedge funds employs various strategies to exploit market opportunities such as through different transactional situations. It could for instance be by taking positions in spin-offs or mergers and acquisitions (Teo 2009, 8). If then the fund assets were to grow too big, a problem to allocate the excess capital could emerge because of the limited amount of market discrepancies, and thus affect performance negatively.

However, the same thinking goes for the parable to diseconomies of scale. If the hedge fund were to grow too big, it could complicate hedge funds managers task to generate attractive returns. An example of that scenario could be seen if hedge fund managers due to the excess capital available, were required to change his or her strategy. Investing in smaller and more illiquid positions might not be possible anymore when having a larger amount of capital needing to be allocated. However, important to not forget is that the effect is still small when

investigating the economical magnitude of the relationship. Even though the relationship is evident, it is still not a strong one.

Another potential explanation for the insignificant results is that the Nordic hedge fund market is small, not only in the amount of active hedge funds, but also in the size of assets under management they manage. The median assets under management for hedge funds that invests in equities for the collected sample was 62MEUR with the mean being 157MEUR. For Managed Futures and CTA, the median assets under management were 153MEUR and the mean being 400MEUR. However, the biggest difference between mean and median assets under management values are for Funds of Funds where the median was 1300MEUR, but the mean was 6500MEUR. The effect of assets under management when comparing "small" with "less small" funds might not be as present which could explain parts of the results. Given that hedge funds do not have the same requirements to disclose their performance to databases, there might be incitements that fund managers do not report their returns when performance is poor. However, the same study suggests that this type of bias still should be considered limited. When calculating the results, it has become clear that not only successful funds have been included in the Hedgenordic database. Still, discrepancies in the data could be one explaining factor to the outcome of this thesis.

As mentioned previously, hedge funds are secretive and rather not share information regarding performance and their assets under management (Fung and Hsieh 2004, 6). This led to some difficulties when collecting the data. Since the seven-factor model did show results in line with previous research, the inputs in the first regression are believed to be of high quality. When using the seven-factor model and computing the risk adjusted alpha on equity focused hedge funds, the results were as expected: The market return spread and OMXN40 returns demonstrated statistically significant values at 5% significance level and the overall R-squared values derived from the seven-factor model were high as previously portraited. For the other investment styles, the results were the same. In accordance with previous research, not all factors within the seven-factor model were statistically significant for every investment style. Depending on which investment strategy were used, some factors were better at explaining the results than others.

Other known biases could be explanatory when analysing the results such as the survivorship bias that Fung and Hsieh (2004, 7) highlights in their paper. Survivorship bias occurs when

hedge funds that no longer exist do not appear in databases such as Hedgenordics. This could be because of multiple reasons, for example if a hedge fund had a publicly stated strategy to dissolve after a certain time. It could also simply be down to poor performance and owners withdrawing their capital. Therefore, databases such as Hedgenordics could skew results in general, since the unsuccessful ones that eventually closed their business, ultimately is removed and won't affect the sample.

5. Conclusion and Suggestions for Future Research

This section presents a conclusion of the study performed and states suggestions for future research into the area.

After analysing the regression for all the different investment styles, the conclusion is that there is no linear nor quadratic relationship between Nordic hedge fund performance and assets under management, for most of the investment styles. However, a concave relationship between assets under management and performance was found for Multi Strategy focused hedge funds. The regression displayed that both $FUNDSIZE$, and $FUNDSIZE^2$ were statistically significant suggesting that there is a relationship between performance and assets under management. After further investigation, a statistically significant concave relationship between performance and assets under management was found for that specific investment style. However, as mentioned previously, the coefficient for fund size squared, demonstrated as $FUNDSIZE^2$, was low and the concave relationship had a weak economic effect.

The results are therefore that the null hypotheses for hedge funds focused on Equities, Managed Futures and CTA, Funds of Funds and Fixed Income in the Nordics, not can be rejected. However, in contrast we reject the $H_0 1$ since we found sufficient evidence to conclude that there is a concave relationship between performance and assets under management for Nordic hedge funds focusing on Multi Strategy. This demonstrates that hedge funds benefit from economies of scale up to a certain amount of assets under management. However, after that optimal amount is reached, fund size starts to affect performance negatively and could be compared to a diseconomies of scale scenario where the larger amount of assets under management, affects hedge fund performance negatively. This conclusion is in accordance with the previous findings of Getmansky (2012) who in her paper found that the relationship between hedge funds returns and assets under management is concave.

Furthermore, are there different biases that needs to be considered when evaluating the results of this thesis. One of those is the survivorship bias that Fung and Hsieh (2004, 7) highlights in their paper. Given that the data, consisting of monthly returns and size of funds, exclusively originates from one sole database, Hedgenordic, the results could potentially be skewed since the database only provides data of active Nordic hedge funds. If previous hedge funds were to have been included, results might have been different. Therefore, are the conclusions we make of this thesis also heavily dependent of the chosen time period, as is the case with most studies.

Suggestions and advice regarding future research in the area is to first and foremost acknowledge that the Nordic hedge fund industry compared to many other markets still must be viewed as quite limited. This meaning that most of the active hedge funds are homogenous in their composition. Larger hedge funds such as Brummer and Partners are seen as outliers in the Nordic market which makes the comparison difficult since the purpose of this analysis was to compare smaller funds with larger ones. Instead, this thesis mostly compares small with “less small” hedge funds.

However, the results from previous research such as Teo (2009), did find a relationship between assets under management and performance even for smaller funds. Still, even though the data was sufficient to conduct an analysis of the Nordic hedge fund market, one must not forget that the data from previous studies consisted of thousands of hedge funds. This, while the Nordic hedge fund market with the limitations of this thesis, only contained 76 hedge funds in total. With that said, suggestions for future analysis using this methodology are to primarily focus on more mature markets with a larger amount of active hedge funds. Not only to get a larger base of data but also since the surrounding infrastructure regarding hedge fund analysis most likely are more developed elsewhere than in the Nordics. This could potentially be viewed through more websites and platforms regularly evaluating hedge fund performance and thus making the analysis easier.

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7. Appendix

Appendix A - Original Seven-Factor Model

Table A.1 – *Descriptive statistics for Equities*

Variable	Obs.	Mean	Std dev.	Min	Max
Monthly Excess Return	760	0.006	0.042	-0.157	0.209
Equity Spread	760	-0.003	0.03	-0.094	0.08
OMXN40	760	0.01	0.054	-0.125	0.127
US10yearover3month	760	0	0	0	.001
Year Moodys	760	0.021	0.007	0.001	0.035
PTFSBD	760	0.061	0.255	-0.226	1.047
PTFSFX	760	0.011	0.243	-0.26	0.998
PTFSCOM	760	0.041	0.171	-0.193	0.754

Table A.1 summarize the numerical values used in the original seven-factor model when computing risk adjusted alpha for Equities.

Table A.2 – *Descriptive statistics for Managed Futures and CTA*

Variable	**Obs.**	**Mean**	**Std dev.**	**Min**	**Max**
Monthly Excess Return	191	0	0.031	-0.154	0.082
OMXN40	191	0.008	0.043	-0.094	0.097
Equity Spread	191	-0.005	0.031	-0.059	0.066
US10yearover3month	191	0	0	0	.001
Year Moodys	191	0.002	0.002	0.001	0.018
PTFSBD	191	0.065	0.261	-0.226	1.047
PTFSFX	191	0.011	0.247	-0.26	0.998
PTFSCOM	191	0.042	0.173	-0.193	0.754

Table A.2 summarize the numerical values used in the original seven-factor model when computing risk adjusted alpha for Managed Futures and CTA.

Table A.3 - *Descriptive Statistics for Funds of Funds*

Variable	**Obs.**	**Mean**	**Std dev.**	**Min**	**Max**
Monthly Excess Return	140	0.001	0.019	-0.113	0.039
OMXN40	140	0.007	0.042	-0.094	0.097
Equity Spread	140	-0.006	0.03	-0.059	0.066
US10yearover3month	140	0	0	0	0.001
Year Moodys	140	0.002	0.003	0.001	0.018
PTFSBD	140	0.059	0.255	-0.226	1.047
PTFSFX	140	0.014	0.245	-0.26	0.998
PTFSCOM	140	0.04	0.171	-0.193	0.754

Table A.3 summarize the numerical values used in the original seven-factor model when computing risk adjusted alpha for Funds of Funds.

Table A.4 - *Descriptive Statistics for Fixed Income*

Variable	**Obs.**	**Mean**	**Std dev.**	**Min**	**Max**
Monthly Excess Return	808	0.002	0.028	-0.369	0.156
Equity Spread	808	-0.002	0.031	-0.09	0.08
OMXN40	808	0.011	0.054	-0.125	0.127
US10yearover3month	808	0	0	0	0.001
Year Moodys	808	0.002	0.003	0.001	0.018
PTFSBD	808	0.062	0.256	-0.226	1.047
PTFSFX	808	0.011	0.245	-0.26	0.998
PTFSCOM	808	0.042	0.172	-0.193	0.754

Table A.4 summarize the numerical values used in the original seven-factor model when computing risk adjusted alpha for Fixed Income.

Table A.5 - *Descriptive statistics for Multi Strategy*

Variable	**Obs.**	**Mean**	**Std dev.**	**Min**	**Max**
Monthly Excess Return	683	0.003	0.032	-0.219	0.157
Equity Spread	683	-0.002	0.031	-0.09	0.08
OMXN40	683	0.01	0.054	-0.125	0.127
US10yearover3month	683	0	0	0	0.001
Year Moodys	683	0.002	0.003	0.001	0.018
PTFSBD	683	0.061	0.256	-0.226	1.047
PTFSFX	683	0.012	0.244	-0.26	0.998
PTFSCOM	683	0.042	0.172	-0.193	0.754

Table A.5 summarize the numerical values used in the original seven-factor model when computing risk adjusted alpha for Multi Strategy.

Table A.6 – *Regressions for each Hedge Fund Investment Style*

	Equities		**Managed Futures and CTA**		**Funds of Funds**		**Fixed Income**		**Multi Strategy**	
Variable	Coefficient (Std error)	Obs.	Coefficient (Std error)	Obs.	Coefficient (Std error)	Obs.	Coefficient (Std error)	Obs.	Coefficient (Std error)	Obs.
FUNDSIZE	-0.0027	760	-0.0020	191	0.0033	140	-0.0001	808	0.0059**	683
	(0.003)		(0.013)		(0.006)		(0.005)		(0.004)	
FUNDSIZE^2	0.0013	760	0.0005	191	-0.0002	140	-0.0001	808	-0.0007***	683
	(0.009)		(0.001)		(0.001)		(0.001)		(0.001)	

Table A.6 presents the results from the panel regression.

(***) significant at the 1% level, (**) significant at the 1% level, (*) significant at the 10% level.