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Hedge Fund Style Analysis

Is an Index-Based Approach Viable?

The Department of Business Administration

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Abstract

This thesis aims to open the Pandora's Box of hedge fund styles through an index-based style analysis. This information asymmetry is due to both less strict disclosure requirements and inherent nature of hedge funds. We employ a multiple unconditional linear regression model wherein 23 Swedish hedge funds are regressed on 10 style indices. In addition to the increased interest in hedge funds and their performance drivers, our unique approach with regressing return on return motivates this study. The results show that this is indeed a viable approach to identify an individual hedge fund's investment style. The explanatory power (adjusted R^2) is 0.24, which in the case of hedge fund research is relatively high. Our model indicates some discrepancy between regressed result and alleged styles. Given the assumption that investment style has an impact on hedge fund performance, an investor will benefit from index-based style analysis.

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KEY WORDS	Hedge Fund, Return, Index, Style, Information-Asymmetry
PURPOSE	The aim of our thesis is to investigate whether index-based style analysis is a viable approach for identifying an individual hedge fund's investment style. The research will be conducted on the Swedish hedge fund market.
METHODOLOGY	We have performed a hedge style analysis by running a multiple unconditional linear regression of monthly historical returns, of the chosen hedge funds, on the different hedge fund indices. The funds selected were all the funds available to Swedish investors as of February 28th 2005 that had at least three years of monthly return data. The indices and classifications of hedge fund styles were provided by EDHEC.
THEORETICAL PERSPECTIVES	The theories used in this thesis are based on general theories about hedge funds, mainly general performance- and style-based theories.
EMPIRICAL FOUNDATION	Regression results of Swedish hedge funds monthly historical returns, on chosen hedge fund style-based indices, as well as the funds' expressed style.
CONCLUSIONS	Index-Based hedge fund style analysis is indeed a viable approach. In most cases our model is able to single out specific styles. The adjusted R^2 amounts to 0.24 and average R^2 amounts to 0.39. In only two regressions no significance could be found. We also found some discrepancies between expressed and regressed styles.

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1 INTRODUCTION

The hedge fund environment has dramatically changed in the recent couple of years, both in terms of size and fund assets under management. Hedge funds have become somewhat of a mystery due to the limited amount of information provided and their unique ability employ different investment styles. This introduction chapter provides a background on the hedge fund universe as well as discusses and delimits the underlying research problem of this thesis. Lastly, we will provide the reader with a thesis outline.

1.1 Background

Hedge funds have experienced intensified interest both in terms of media coverage and assets under management during the beginning of the 21st century. The first hedge fund was introduced by Alfred Winslow Jones in 1949. Loomis (1966) coined the term 'hedge fund' when he described Jones' investment philosophy as a combination of long positions in securities that Jones perceived as undervalued and short positions in overvalued securities. Brown and Goetzmann (2003) describe this as the 'hedge', and explain that the short positions were used to partially fund the long position and thereby enabling highly leveraged trades with limited resources.

The hedge fund market has undergone considerable change since then and has developed into global macro styles propelled by finance celebrities like George Soros and Julian Robertson (Brown & Goetzmann, 2003). Fostered by the increasing number of financial products and new technology that allows for sophisticated investment styles, the rapid growth the industry still is experiencing took off during the 1980s (Schneeweiss, 1998).

The Hedge Fund Association (2005) estimates global growth rate in net asset under management to average 20% per annum. Their approximation of active hedge funds during 2004 globally equals 8 350, together having $875 billion in asset under management. Other estimates of the hedge fund industry's total size ranges from 8 000 to 10 000 funds and $600 billion to $1 trillion in asset under management (Business Week, 2005; Schachter, 2004). Figure 1 below illustrates the number of hedge funds and assets under management from 1990 to 2004. Due to legislative

relaxations regarding the allowed number of investors in a hedge fund, each hedge fund has more assets under management from 2003 and on.

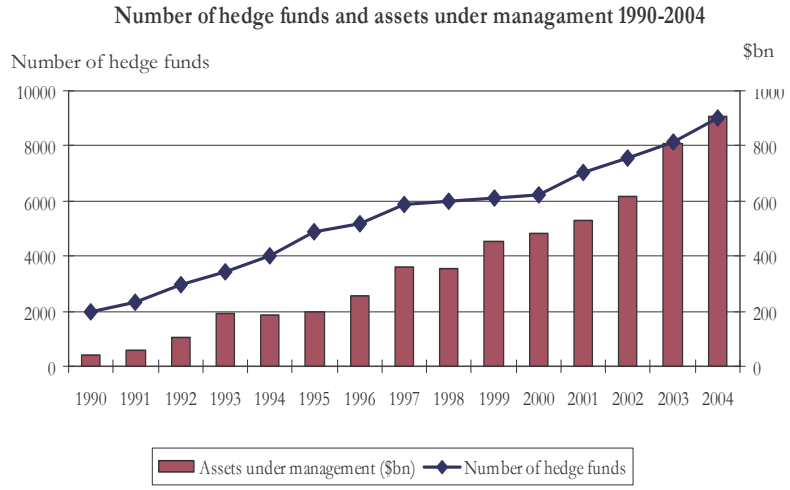

Figure 1. The number of hedge funds and assets under management 1990-2004
Source: The Hedge Fund Association, (2005)

The graph shows that the total assets have increased steeply since 1995, which was a time when the hedge fund industry began to attract a lot of attention. The major reasons for this elevated attention were relatively good returns and a couple of sensational events affecting the world economy. The hedge fund universe is surrounded by misconceptions and myths (Schneeweiss, 1998) and is sometimes criticized for acting unethically and without conscience (Liam, 2000). Even if not labeled as common actions of hedge funds, the dealings of the group of international investors led by George Soros, which speculated against the Swedish currency in 1992, is an example of questionable behavior of hedge funds. Hedge funds have become important market participants all over the globe and capable of moving markets (Brown & Goetzmann, 2003). Liam (2000) outlines several examples of major international hedge funds taking speculative positions in Asian foreign exchange markets and thereby contributed significantly to these countries' financial crisis and inevitably the Asian economic crisis during the second half of the 1990s.

The year of 1998 was a turbulent one in the hedge fund history. The hedge fund Long-Term Capital Management (LTCM) almost collapsed, the Russian financial crisis peaked when debt defaulted, and many other hedge funds suffered from severe losses (Agarwal & Naik, 2000b; Liang, 2001). According to Örn (1998) the two Nobel Prize winners Myron Scholes and Robert Merton, both members of the LTCM management team, cause the fund losses amounting to $3.5 billion. The LTCM fund was close to bankruptcy. But because a bankruptcy declaration would

have triggered series of grave disturbances in the financial markets all over the world, the US Central Bank Federal Reserve was forced to come to rescue Örn (1998) continues. For example, LTCM extensive positions in the Danish mortgage bond market would probably have had spillover effects on the Swedish financial system. Örn's explanation to the large losses is that the mathematical models developed by Merton and Scholes did not account for unexpected changes occurring at the same time. This explanation seems reasonable in the light of Fung and Hsieh's (1997) discussion about hedge funds' larger exposure to tail events, i.e. hedge funds face higher probability that unanticipated events will come about. Thus, they conclude, more research concerning hedge fund investment styles should have highest priority.

The first Swedish hedge funds were introduced in the middle of the 1990s (Nordnet, 2005). Brummer & Partners pioneered the Swedish hedge fund market with their Global Long/Short fund Zenit (Brummer, 2005). Up to 2005, Brummer & Partners had introduced another seven hedge funds and is the dominating provider of hedge funds on the Swedish market together with Hagströmmer & Qviberg and Alterum. Figure 2 below displays the growth of the number of hedge funds targeted towards the Swedish market. Note that out of roughly seventy funds, 37 are Sweden-based (Dagens Industri, 2005), while the rest are foreign-based. Some of them have changed name or even closed down their operations. The increased interest in Swedish hedge funds has encouraged Harcourt to introduce a Swedish hedge fund index comprising the Swedish funds at the beginning of June 2005 (Dagens Industri, 2005).

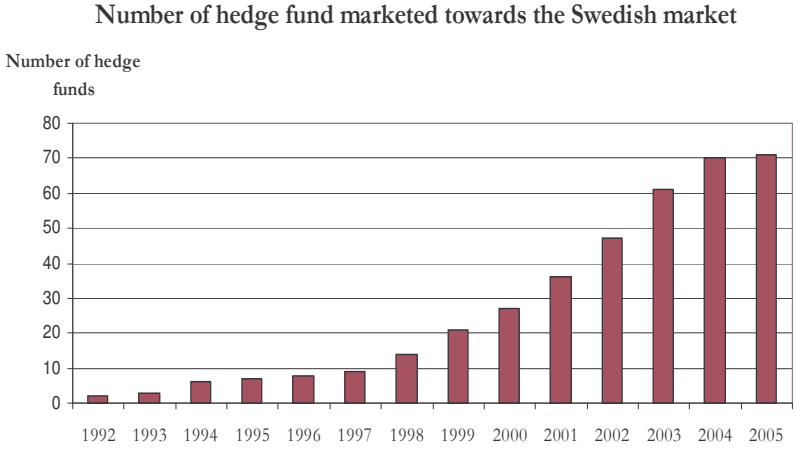

Figure 2. The number of hedge funds marketed towards the Swedish market 1992-2005
Source: Own calculations based on Information from SIX Trust, Morningstar.se, Alterum Fondförvaltning, Brummer & Partners, and Dagens Industri

In the US, most hedge funds are established as limited partnerships (Brown, Goetzmann & Ibbotson, 1999). These are denoted as onshore funds, while offshore hedge funds are set up in other countries to take advantage of tax-neutral jurisdiction (Liang, 1999). The US-based hedge funds are by far the most common. The regulatory controls governing the US onshore hedge fund industry are based on the Investment Company Act of 1940 (Harri & Brorsen, 2004). The Swedish Financial Supervisory Authority, Finans Inspektionen (FI), is the public authority governing the hedge fund industry in Sweden. The Swedish law regulating hedge funds is *Lagen om investeringsfonder (2004:46)*, see Appendix A for a more comprehensive description.

Ackermann, McEnally and Ravenscraft (1999) state that there is no simple definition of hedge funds. However, they identify a set of features that characterize hedge funds: a largely unregulated organizational structure, flexible investment styles, relatively sophisticated investors, substantial managerial investment, and strong managerial incentives. Gregoriou, Sedzro, and Zhu (2005) add absolute returns to the list of hedge funds' characteristics. Brown and Goetzmann (2003) argue that hedge funds are best defined by their freedom from regulatory control. They emphasize those hedge funds, in contrast to mutual funds, face lighter constraints when it comes to fund leverage, short selling, holding of shares of other investment companies, and holding more than 10 percent of the shares of any single company.

Schneeweiss and Georgiev (2004) describe hedge funds as a skill-based investment style where the return originates from the fund manager's unique skill or style. This implies that hedge funds are actively managed (Schneeweiss &Georgiev, 2004). Edwards and Caglayan (2001a) found evidence indicating that fund manager skill may partially explain a hedge fund's positive excess return. However, findings are inconclusive, Brown, Goetzmann and Ibbotson (1999) found no evidence for attributing performance differences to manager skill in their research of offshore hedge funds. Gupta, Cerrahoglu and Daglioglu (2003) conclude that a fund manager only can be considered having a potentially superior ability when she uses more information than is generally publicly available and is capable of generating outstanding returns.

Kat (2003) points out the hedge funds' increasing popularity among institutional investors. Brown and Goetzmann (2003) argue that the historical risk and return characteristics of hedge funds suggests they may be attractive as a portfolio asset. The benefits of hedge funds in portfolio investments are summarized by Schneeweiss and Georgiev (2004) to be threefold. Firstly, reductions of portfolio volatility risk. Secondly, enhancement of portfolio returns under economic conditions in which traditional investments like stocks and bonds offer limited

opportunities. Thirdly, allowance for the portfolio manager to invest within a wider range of financial products and markets. Both Fung and Hsieh (1997) and Agarwal and Naik (2000a) explain the potentially better risk-adjusted returns for portfolios inclosing hedge funds by the low correlation between hedge fund returns and the returns on traditional asset classes like bonds and stocks.

Fung and Hsieh (1997) identified dramatically different investment styles followed by mutual funds and hedge funds, statistic buy-and-hold and dynamic trading styles respectively. Ackermann, McEnally and Ravenscraft (1999) found that hedge funds deliver higher returns than mutual funds. Their result holds for risk-adjusted returns[1] as well. This is supported by Barés, Gibson and Gyger (2003) who conclude that there is no evidence that funds performing above the median are more risky than their peers.

The different styles represent different investment strategies. Agarwal and Naik (2000b) group the investment styles into two categories; non-directional and directional styles. The common feature of the directional styles is that they try to capitalize on market moves, either upwards (Global Macro and Long, typically) or downwards (Short Selling, typically) whereas the non-directional styles seek to exploit unique situations (Event Driven, Merger Arbitrage, Equity Market Neutral) not stemming from the general market conditions. That is, the directional styles have high correlation with the underlying markets while the non-directional styles have low correlation with the market (Harri &Brorsen, 2004).

In their study of monthly returns of hedge funds over the period 1989 through to January 2000, Brown and Goetzmann (2003) found that about 20 percent of performance variability among hedge funds is attributable to the different choice of investment style. Based on the conclusion that the choice of style has an impact on the performance, it is of importance to reveal what the hedge funds actually do. This has also been stressed by the increased interest in hedge fund investment, especially among institutional investors.

Agarwal and Naik (2000b) refer to hedge funds as black boxes to illustrate the limited information about actual actions outside investors often experience. Their Black Box metaphor aims to describe the lack of information due to the less strict disclosure requirements and the freedom granted to the fund manager about investment style. Brown and Goetzmann (2003) state that the self-classifications employed by many hedge funds sometimes are ambigoius and

[1] The Sharpe ratio, as proposed by Sharpe (1994), is often used as measure of risk adjusted returns; see for example Ackermann, McEnally and Ravenscraft (1999).

difficult to interpret. Brown, Goetzmann and Ibbotson (1999) conclude that there is little public information available about the styles followed by the hedge funds and the specializations of their managers. Even if there is publicly available information, Kohler (2003) stresses that it might not be true. He gives examples of occasions where hedge fund managers have altered their approach without revealing the change in style to their investors.

Kohler (2003) highlights the contradictory relationship between hedge fund investors and hedge fund managers. To be able to make an as informed investment decision as possible, the investor aims at complete information about the hedge fund and what positions it may initiate to achieve its performance targets. On the other hand, if the investor decides to invest in a particular fund, she does not want the hedge fund to disclose its investment style since once revealed it may no longer be exploitable in capitalizing on market anomalies. In their attempt to further explain the origins of this information gap existing between the hedge fund managers and the investors, Brown and Goetzmann (2003) append legislative restrictions implying that the hedge funds cannot publicize complete information about their activities even if they would like to.

The discrepancy in the desired level of information disclosure gives rise to the question if there is a plausible way to identify a particular hedge fund's general investment style without revealing the specific trades they are engaged in? Brown and Goetzmann (2003) stress the necessity of proper style analysis for investors looking to invest in the hedge fund market. Agarwal and Naik (2000b) suggest hedge fund style analysis to reveal the style without revealing the actions taken.

1.2 Problem discussion

Investors, who seek investment opportunities in different markets, are interested in having as much information on potential investments as possible, in order to examine whether or under what circumstances an investment is good or bad relative to a proper benchmark (Agarwal & Naik, 2000b). This includes information about expected return and risk level. Depending on the individual investors' risk aversion level, they will invest their money in different financial instruments.

Most financial markets are regulated where mutual funds and other financial actors are obligated to disclose information about their holdings and investment styles. In addition, there are many restrictions on how they can allocate their assets. Hedge funds, on the other hand, do not fall under this category. They have few restrictions in what securities they can invest in, nor are they obligated to provide the investors with information about their investment style or the risk

connected to it (Agarwal & Naik, 2000b; Brown & Goetzmann, 2003). Brown and Goetzmann (1997) ask for more formal classification procedures to assist the investor to better understand the behavior of future fund performance and provide ex ante or ex post benchmarks.

The hedge fund environment is very heterogeneous, in which the investment styles largely differ from each other. Brown and Goetzmann (2003) state that the hedge fund's choice of investment style will have an impact on both the performance and the risk. Based on this conclusion, it is essential for an investor, who wishes to directly manage an investment in hedge funds, to develop an analytical framework to assess the many different hedge fund styles (Fung & Hsieh, 2000).

The development of an analytical framework is however not an easy task. In addition, to the fact that hedge funds are not as regulated nor obligated to reveal as much information as mutual funds, they see it as part of their competitive edge to have their holdings and investment style kept in the dark from outside viewers in order to seek arbitrage opportunities (Fung & Hsieh, 1997). This leads to great information asymmetry between the investors and the managers of hedge funds and can be referred to as a 'Pandora's Box' of hedge fund styles.

The information asymmetry creates uncertainty for the investor. Though, some of the hedge funds may express an investment direction and its risk level, they do not need to update the investors in case that any changes occur (Agarwal & Naik, 2000b; Brown & Goetzmann, 2003). Based on the assumption that investors are risk averse, this might develop into a problem for the hedge funds because the uncertainty associated with hedge funds is too great. To take the discussion further, this might become a macroeconomic problem where no one is willing to invest. This misallocation could lead to societal losses. However, this is not a subject included in this thesis and will not be examined further.

The hedge fund universe reaches all over the world and many managers have a global perspective, though some funds may operate on a more selective geographic market. The world's financial markets are rapidly becoming more integrated (Oxelheim, 2003), i.e. investments and financial flows can move fairly unhindered all over the globe. Therefore, the international perspective of hedge funds will make it possible to draw more general conclusions even though the study is made within a more narrow geographic scope.

There have been several studies of hedge fund style analysis (e.g. Chan, Chen & Lakonishok, 2002; Agarwal & Naik, 2000b; Fung & Hsieh, 1997; Sharpe, 1992). Style analysis can be done using either data on holdings of the fund (e.g. Chan, Chen & Lakonishok, 2002) or the returns

realized by the fund (e.g. Agarwal & Naik, 2000; Fung & Hsieh, 1997; Sharpe, 1992). However, due to the less strict information disclosure requirements it is difficult to obtain useful data on holdings for hedge funds (Agarwal & Naik, 2000b). Still, even if monthly holdings data were readily available, it would, according to Fung and Hsieh (1997), not give a good picture of their inherent risks due to the dynamic trading styles employed by the hedge funds. In other words just looking at holdings will not reveal either long or short investment positions. Also, Brown and Goetzmann (1997) advocate a return-based classification system. Hence this study will focus on hedge fund style, and more explicit, investigate the possibility for an investor to pinpoint an individual hedge fund's chosen investment style by regressing the fund's historical returns on different hedge fund style indices.

1.3 Purpose

The aim of our thesis is to investigate whether index-based style analysis is a viable approach for identifying an individual hedge fund's investment style. The research will be conducted on the Swedish hedge fund market.

1.4 Delimitations

This study will exclusively focus on hedge fund style and the detection there of. Even though there are other things that may have an impact on hedge fund performance, they will not be investigated in this thesis.

This thesis is based on data of hedge funds marketed to Swedish investors. We have only included the ones, which presented available historical monthly returns dating at least three years back in time from the 28th of February, 2005.

The hedge fund indices and the styles used in the research are based on indices provided by EDHEC. Indices provided by other organizations or companies may give different results in a replicate study, however this is not further investigated in this thesis since our purpose does not include an evaluation of the different indices that are offered in the market today.

A multiple unconditional linear regression model is used to analyze the collected data. Other types of statistical models may produce different results, but we leave it up to future research to examine the alternatives at hand.

1.5 Thesis outline

The thesis outline is presented in Figure 3 below. Chapter two gives the reader an introduction to the hedge fund universe. The journey starts with an examination of the hedge fund performance drivers and performance measurement related issues. As hedge fund style singles out to be one of the major return drivers, 13 different investment styles are described. The third and last building stone is a depiction of hedge fund style indices and their merits and drawbacks. Chapter two closes up with the emergence of the frame of reference.

Chapter three is designated to the methodology used in the thesis. This includes research approach, research method, and a detailed description of the research process. Finally, methodological problems in terms of validity and reliability are discussed.

Chapter four presents the empirical findings. The result from the regression analysis is sketched and analyzed. The fifth and final chapter comprises conclusions and suggestions for further research.

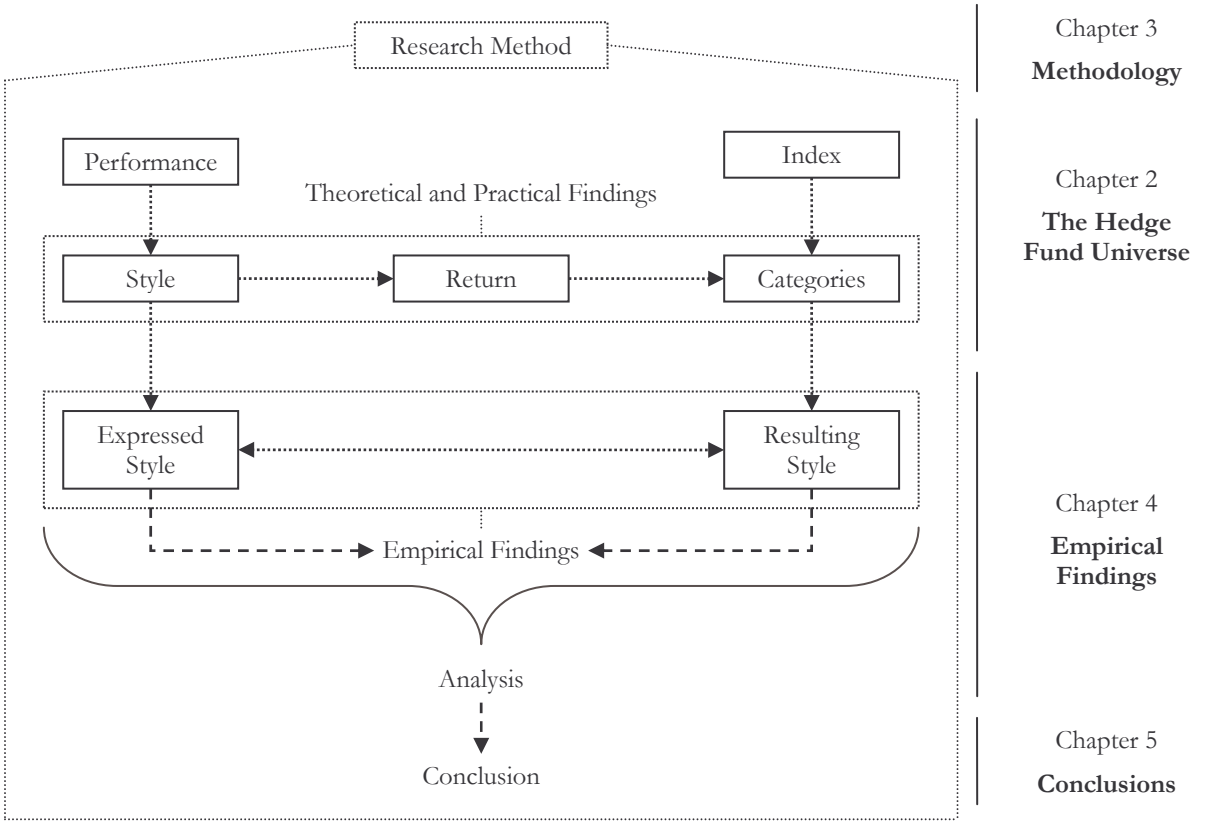

Figure 3. Thesis outline

1.6 Who is our audience?

Reading this thesis is facilitated by basic knowledge about the financial universe as well as quantitative and statistical methods. We presuppose no prior understanding of the alternative investment industry. Most important, however, is a keen interest in the dynamics of the hedge fund community. Hence, both academics, professionals in the finance industry, private persons, and business, economic and finance students striving to learn more about hedge funds benefit from turning the next pages.

2 THE HEDGE FUND UNIVERSE

In this thesis we regress monthly returns of individual hedge funds on the monthly returns of hedge fund style indices. It is therefore essential to understand what factors drive hedge fund return and how these underlying factors have been researched. Turning to the indices, it becomes obvious that their construction and merits as well as shortcomings need to be highlighted. Furthermore, a description of the investment styles pursued by hedge funds is important for two reasons: firstly, they outline the foundation for how the fund managers act to realize the returns, and, secondly, we use style indices in our regression model.

2.1 Hedge fund performance

One stream of hedge fund performance research elaborates on performance persistence, i.e. if some hedge funds consistently show higher return than others (Harri & Brorsen, 2004). More specifically, investors are interested in the fund manager's track record since it is believed that good and bad performance persists, that is past winners will continue to win and past losers will continue to loose (Harri & Brorsen, 2004; Kat & Menexe, 2003). This is a critical issue since it guides the investor when choosing where to invest, or, as Brown, Goetzmann and Ibbotson (1999) put it, hedge fund investing is more or less a 'pure bet on managerial skill'.

The persistence literature somewhat arrives at different conclusions, one stream find little or no evidence of performance persistence (Schneeweiss, Kazemi, & Martin, 2001; Peskin, Urias, Anjilvel, & Boudreau, 2000; Brown, Goetzmann & Ibbotson, 1999) while others find evidence for the existence of significant performance persistence (Harri & Brorsen, 2004; Agarwal & Naik, 2000c; Edwards & Caglayan, 2001a; Park & Staum, 1998). The somewhat contradictory results may be explained by the way performance is measured. For example, persistence might show up when the returns are incorrectly adjusted for risk.

Given that performance persistence exists, its time length becomes relevant for the investor. Barés, Gibson and Gyger (2003) find strong persistence over a one-month holding period. But the persistence diminishes rapidly and after twelve months there are no observable differences in

performance between previous losers and winners. Harri and Brorsen (2004) also find evidence for short-term persistence whereas Agarwal and Naik (2000b) report significant persistence on at least three-month basis. Edwards and Caglayan (2001a) extend the persistence period to be significant up to one year and even two years on occasion.

Incentive based fees and absolute returns are often added to the set of features differentiating hedge funds from other asset classes. The incentive based fees are often triggered when the return exceeds a pre-specified level[2]. In their research, Edwards and Caglayan (2001a) found that hedge funds that pay managers higher incentive fees have higher excess returns. Thus they confirmed previous work by Ackermann, McEnally and Ravenscraft (1999) who also found that increased total risk was not attributable to incentive fees. In order to further align the fund manager's personal interest with the investors', and thereby reduce the impact of potential principal-agent problem as identified by Ross (1973), the manager often has significant personal interest in the fund (Ackermann, McEnally & Ravenscraft, 1999). Absolute returns mean that the hedge fund should generate positive returns irrespective of market conditions, including when the underlying markets are declining (Gregoriou, Sedzro, & Zhu, 2005). If performance targets are not met during a certain time period, there often is a promise to add past unmet thresholds to current ones (Brown & Goetzmann, 2003).

2.1.1 Bull and bear markets

One of the primary reasons to invest in hedge funds is to diversify against falling markets (Edwards, & Caglayan, 2001b). Work by Brown and Goetzmann (2003) and Edwards and Caglayan (2001b) suggest that the investment styles show different performance in terms of risk-adjusted return during certain market conditions.

Edwards and Caglayan (2001b) stress the importance of investigating different hedge fund styles since they perform differently, especially during bear markets. They conclude that hedge fund returns are generally negative in bear markets. In addition, they found that, in their sample, almost all hedge fund styles exhibited significantly higher positive correlations with stock returns in bear markets than in bull markets. In general, this implies greater exposure towards downside risk. However, Edwards and Caglayan (2001b) found four hedge fund styles – Market Neutral, Event Driven, Global Macro, and Short Selling – that perform reasonably well also in bear markets. Except from Short Selling, they conclude that these styles are among the top performers

[2] The Treasury bill rate is common hurdle rate of return.

also in bull markets. Consequently, they argue that investing in these hedge fund styles, providing fairly good downside protection and top bull market performance, should grant for attractive returns over all markets.

2.1.2 Mutual funds vs. hedge funds

Fung and Hsieh (1997) identified dramatically different investment styles followed by mutual funds and hedge funds, static buy-and-hold and dynamic trading styles respectively. This spawned the research stream examining the performance of hedge funds relative to the performance of mutual funds. The results indicate that hedge funds deliver higher returns than mutual funds (Ackermann, McEnally & Ravenscraft, 1999; Liang, 1999). In some cases, though, the greater average return is achieved at higher risk (Liang, 1999) whereas some results show that also the risk-adjusted return[3] is higher (Ackermann, McEnally & Ravenscraft, 1999).

Fung and Hsieh (1997) seek the origins of the performance differences between hedge funds and mutual fund. They argue that a fund's return has three key determinants: firstly, the asset categories in which it invests; secondly, strategy or direction component (long/short); and thirdly, the use of leverage. According to Harri and Brorsen (2004), mutual fund managers usually utilize only the first component in their styles, while hedge fund managers, on the other hand, employ dynamic, leveraged styles that also involve the second and third component of the return. Although hedge funds generally have far less assets under management than mutual funds, Fung and Hsieh (1997) mean that they through leverage can take positions exceeding even the largest mutual funds.

2.1.3 Performance measurement

According to Christiansen, Christensen and Madsen (2004), there has been an increasing interest of and focus on hedge fund performance since the near collapse of Long-Term Capital Management in 1998. Many researchers (e.g. Amenc, El Bied & Martellini, 2003; Amin & Kat, 2002; Ackermann, McEnally & Ravenscraft, 1999; Carpenter & Lynch, 1999) have used different methods, both conditional and unconditional, attempting to predict and measure hedge fund performance.

[3] The Sharpe ratio, as proposed by Sharpe (1994), is often used as measure of risk adjusted returns; see for example Ackermann, McEnally and Ravenscraft (1999).

Ferson and Warther (1996) claim that unconditional measures are unable to capture potential changes in risk and expected returns related to the general state of the economy. As an example, they explain that unconditional measures do not account for the evidence suggesting that expected stock market returns are higher at the beginning of a period of economic recovery when interest rates are low.

2.1.4 Hedge fund style

The literature examining hedge fund styles has attracted a wide set of researchers (e.g. Christiansen, Christensen & Madsen, 2004; Gupta, Cerrahoglu & Daglioglu, 2003; Brown & Goetzmann, 2003; Edwards, & Caglayan, 2001b; Agarwal & Naik, 2000b; Brown, Goetzmann & Ibbotson, 1999; Fung & Hsieh, 1997). An important reason to identify a hedge fund's style is to be able to evaluate the fund's performance relative to a proper benchmark (Agarwal & Naik, 2000a).

In their study of monthly returns of hedge funds over the period 1989 through to January 2000, Brown and Goetzmann (2003) found evidence of about 20 percent of performance variability among hedge funds is attributable to the different choice of investment style. Brown, Goetzmann and Ibbotson (1999) found evidence for hedge fund performance attributable to style effects in the offshore hedge fund industry.

Agarwal and Naik (2000a) report varying performance persistence among hedge fund styles. Harri and Brorsen (2004) found strong performance persistence for the Market Neutral style and some performance persistence for Event-Driven and Global Macro.

2.2 Hedge fund styles

Christopher Woods (2004), CIO for Hedge Fund Strategies, SS Limited, say that "We've all been taught that there is "no such thing as a free lunch" in finance, but for hedge funds, lunch is being provided with the compliments of less active investors". Pursuing different investment styles, hedge fund managers are trying to put decent food on the table despite the ingredients at hand. The heterogeneity of the hedge fund universe has fostered the development of a wide set of styles.

There have been many attempts to try to identify different styles and put them into different classes, which have resulted in many different names describing the same category of hedge fund

style (e.g. Agarwal & Naik, 2000b; Fung & Hsieh, 1997). Another problem is that some funds have a multiple style approach and is therefore difficult place within a certain category.

The following definitions of hedge fund styles are commonly used classifications by hedge fund institutes and organizations (e.g. EDHEC[4], Hedge Fund Research[5], Hedge Fund Association[6], HedgeCo.net[7], etc.). However, aligned with the thoughts of Fung and Hsieh (1997), we are aware that the number of proposed styles is more or less sufficient to describe the myriad of hedge styles deployed.

2.2.1 Convertible Arbitrage

Funds that have Convertible Arbitrage as their primary style simultaneous purchase a portfolio of mispriced convertible securities, usually convertible bonds but also warrants and convertible preferred stocks, and hedge the risk by short sale of the underlying stock. This means identifying inefficiencies between the common stock and the convertible security issued by the same company. The right amount of shorting will make it possible to achieve a positive return at all times, as long as they manage to predict whether the market will take a bullish or bearish turn. (Amenc, El Bied & Martelli, 2003; Kat & Miffre, 2002; EDHEC, HFR; HedgeCo.net) Furthermore, Amenc, El Bied and Martelli (2003) explain that the convertible bond will behave like a stock in cases when the issuer does well and like a distressed debt in an opposite situation.

The equity hedge ratio can be very different between funds but can also shift at different times within a hedge fund. According to the HFR strategy definition, most hedge funds have a ratio in the range of 30 to 100 percent and have a leverage level ranging between zero and 6:1. Over-hedging can be appropriate in cases of 'concern about default as the excess short position may partially hedge against a reduction in credit quality' (Amenc, El Bied & Martelli, 2003).

[4] EDHEC Risk and Management Research Centre. Business School, Lille – Nice.

[5] Hedge Fund Research, Inc. (HFR) is a research firm specializing in the aggregation, dissemination and analysis of alternative investment information. The company produces HFR Database and a variety of other research products for the alternative investment industry.

[6] Hedge Fund Association (HFA) is an international not-for-profit association of hedge fund managers, service providers, and investors formed to unite the hedge fund industry and add to the increasing awareness of the advantages and opportunities in hedge funds.

[7] HedgeCo.net is an online hedge fund information portal that claims to house unbiased hedge fund data provided by hedge funs managers. Members of HedgeCo.net will also have access to the database.

2.2.2 CTA Global

Commodity Trading Advisers, commonly referred to as CTA Global funds or Managed Futures, focuses on long and short trading in the futures markets, including commodity markets and currency markets (Fung & Hsieh, 1999). There are many different sub-strategies under the CTA style. Most of them are trend-followers who bet on market momentum and use sophisticated models to find investment opportunities. Other sub-strategies are non-trend followers, with long-term or short-term perspective, that tend to have very low correlation with each other. (EDHEC)

Adlersson and Blomdahl (2005) write that the managers often take all the bets that their model suggests. The models used differ between funds, both in their approach and technique, i.e. quantitative, fundamental or technical analysis. By accepting all the bets and using leverage, the managers are able to catch major market movements and increase their exposure to trends and thereby increase the impact on their portfolio. This also leads to that bets, which contradict each other, are accepted. This is a big difference in comparison to the Global Macro style (see section 2.2.9).

According to EDHEC, the CTA Global fund style tends to offer a relatively good protection against market downturns. Though, Adlersson and Blomdahl (2005) add that there has to be a persistent shift for their models to notice the trends in the market. This reduced timing effect will have a negative impact on the profit in comparison to the Global Macro style.

2.2.3 Distressed Securities

Distresses Securities styles invest in, and may sell short, the securities of companies in financial distress. The distress may arise from bankruptcies, distressed sales, reorganizations and other corporate restructurings (Kat & Miffre, 2002; EDHEC; HFR; HFA; HedgeCo.net).

Hedge fund, in contrast to a mutual fund investor, has no limits on how low investment grades the securities in their portfolio can have (HFA). Mutual funds are many times obligated to sell below investment-grade bonds even though the company is a feasible one. At many times the funds are forced to sell at heavily discounted prices, which will lower the prices even more. These situations open up many great investment opportunities for hedge funds following the Distressed Securities style.

Agarwal and Naik (2000b) write that, depending on the hedge fund and the manager's style, the securities can range from senior secured debt to common stock. The HFR further specify the

different investment opportunities as bank debt, corporate debt, trade claims, common stock, preferred stock and warrants.

EDHEC states that the actual profits or losses will depend on the manager's ability to assess likelihood of success of the different restructuring options. According to Agarwal and Naik (2000b) the main source of risk of investments in financially distressed companies is the liquidation, or rather the lack of it. In order to increase the level of positive return, the HFR states that some managers use leverage. This will not reduce the risk of a specific investment but can help the fund to produce greater profits and thereby facilitating surviving situations with negative return.

According to HedgeCo.net, this style generally gives the fund a low correlation with the broader financial markets. But EDHEC on the other hand state that this style tend to offer a relatively high return and a significant correlation with major bond and stock indices.

2.2.4 Emerging Markets

The Emerging Markets style invests in less mature markets which normally are less efficient and liquid and therefore tend to have higher inflation and volatile growth (Amenc, El Bied & Martelli, 2003). Emerging Markets, defined by HRF and HedgeCo.net, includes countries in Latin America, Eastern Europe, the former Soviet Union, Africa and parts of Asia. The managers will try to identify the emerging financial markets' inefficiencies or undervalued assets, caused by the lack of information transparency.

There are several different positions and securities that managers can use to take advantage of the situation and reach a positive return. The funds can use the global approach (HRF) and invest in all of the emerging markets. They will shift their portfolio weights depending on market conditions and manager perspectives. Other funds will invest specifically in one or a few (HRF; EDHEC) of the defined emerging markets. The securities used range from debt to equity and are usually associated with greater risk than similar investments in developed markets.

Short selling is not permitted in many emerging markets and derivatives are not available (Amenc, El Bied & Martelli, 2003; Brooks & Kat, 2002; Kat & Miffre, 2002), which limits the option of effective hedging. Because of that, the managers are primarily forced to take a long position that limits the possibility to hedge against falling prices. .

2.2.5 Equity Market Neutral

Equity Market Neutral style aims to preserve capital through any of several methods and under any market conditions. Funds take at all times equally sized long and short positions in the equity market, in order to minimize the impact of the overall market (Amenc, El Bied & Martelli, 2003; Brooks & Kat, 2002; Kat & Miffre, 2002; EDHEC; HFA; HedgeCo.net). They select and identify the stocks using qualitative and quantitative models. The managers will take a long position in what they have identified as an undervalued asset and a short position in overvalued securities. The portfolio will have no or little correlation with the market direction (HFA), due to the balance of equally long and short positions. HFA points out that this style neutralizes market risk but enhances the stock selection risk. Agarwal and Naik (2000b) agree and make it clear that, 'the risk primarily pertains to the specific risk of the long and short positions'.

The managers can use several different approaches when hedging the market risk. Two main ways of reaching neutrality is described by Amenc, El Bied and Martelli (2003) as well as by EDHEC: the dollar strategy and the beta strategy. Using the dollar strategy, the managers invests equal dollar amount in long and short positions and provide a zero net investment (Amenc, El Bied & Martelli, 2003). The beta strategy targets a portfolio with a zero beta total; in other words the beta of the long side equals the beta of the short side (Amenc, El Bied & Martelli, 2003). The latter strategy will provide a lower correlation with the market return (EDHEC).

Many hedge funds that are using the Equity Market Neutral style, balance their investments in different geographical regions, certain sectors or industries with the intention to reduce the risks related to market swings (Amenc, El Bied & Martelli, 2003; Agarwal & Naik, 2000b). Market swings normally affects some sectors more than others and therefore may become an obstacle in predicting the portfolio performance (Amenc, El Bied & Martelli, 2003).

The approach of selecting both good and bad stocks, make it possible to perform well in all economic conditions. Though, as earlier mentioned, the performance will strongly depend on the manager's ability to identify investment opportunities and how well they are able to neutralize the factors. Theoretically this style can provide a positive return in as well down as up going market.

2.2.6 Event Driven

The style means identifying and investing in mispriced securities arising during a company's life cycle (Agarwal and Naik, 2000b). The transactional events could consist of spin-offs, mergers and acquisitions, bankruptcy, reorganizations, recapitalizations and share buybacks (HFR). The

managers will try to anticipate the outcome of certain events and take a position in an undervalued security that is thought to rise in value (Agarwal and Naik, 2000b). The investment opportunities are created by the uncertainty connected to the outcome. Depending on the situation of the company and the hedge fund specific style, HFR identifies the following instruments to be used: long and short common and preferred stocks, as well as debt securities and options.

EDHEC and Amenc, El Bied & Martelli (2003) have sub grouped the style into three main strategies developed from significant events. Deal Arbitrage opportunities are used in situations of hostile takeovers, mergers and acquisitions and liquidation. The manager use long and short equity securities in order to make a profit. In Bankruptcy/Distressed Security situations managers invest long in undervalued securities of companies going through bankruptcies, recapitalizations, restructurings or reorganizations. The last strategy is a Multi-Strategy where the manager deals with both Deal Arbitrage and Bankruptcy/Distressed Security styles and situations.

Because of great risk connected with trying to anticipate the outcome of different events, the manager tries to be very flexible and use their specific knowledge about certain markets. The manager will make a profit when the market's valuation of the company's equity and debt reaches the level of his or her anticipation. The main risk, according to Agarwal and Naik (2000b), is that the anticipated event will not be realized.

2.2.7 Fixed Income Arbitrage

Agarwal and Naik (2000b) as well as Amenc, El Bied and Martelli (2003) define Fixed Income Arbitrage style as a variety of styles involving investment in related sets of fixed income instruments, seeking to neutralize exposure to interest rate risk. The managers try to identify abnormalities in the market, using mathematical or historical pricing, which they believe will return to a normal level. In order to hedge out as much interest risk as possible, according to Amenc, El Bied and Martelli (2003) and EDHEC, the manager will take offsetting positions in similar securities (e.g. government bonds, corporate bonds, asset-backed securities).

EDHEC has identified two major categories of Fixed Income Arbitrage: Relative Value and Market Neutral. The latter explore differences between two or more sectors in the fixed income market, or between different securities in the same sector, while neutralizing exposure to interest risk. The Relative Value category contains funds that have constructed their portfolio in such a

way that they can take advantage of the pricing abnormalities detected without increasing their risk level.

According to Fung and Hsieh (2004) Fixed Income Arbitrage funds may achieve consistent returns and have been known to perform well in many different market conditions. The reason is that they make their profit from pricing disparities and not the timing of interest rate changes. The arbitraging of the relative mispricing of different securities will allow the funds to seek and obtain return with a low volatility (Agarwal and Naik, 2000b). This is also recognized by Fung and Hsieh (1999) who state that, Fixed Income Arbitrage Funds in general are short volatility, i.e. they perform at their best when markets are calm and poorly when markets are volatile. Amenc, El Bied and Martelli (2003) say that futures may be used to hedge out the risk connected to interest level movements. In addition, leverage is used to magnify profits since pricing spreads tend to be very small (Fung & Hsieh, 2004).

2.2.8 Fund of Hedge Funds

A Fund of Hedge Fund (F-o-HF), as the name inclines, invests in several other hedge funds (EDHEC; HFR; HFA; HedgeCo.net). The investor is offered exposure to a wide range of alternative investment styles. There are many different F-o-HF solutions. According to EDHEC, a normally diversified portfolio contains 15 to 30 different hedge funds. This enables the fund managers to produce consistent absolute returns at a low risk level. Though, a smaller number of funds may be used to achieve a specific level of return, level of risk and/or risk adjusted return through investing in particular hedge fund styles.

Investors in F-o-HF are able to limit the boundaries individual investors normally face, such as high minimum investments and restricted access to closed funds. The minimum investment in a F-o-HF may be lower than investing in an individual hedge fund (HFR). Though, the investor will be faced with double fees. The F-o-HF will charge its investors a fee for placing the investment at the same time as the fund is charged the fees for investing in the underlying funds (EDHEC; HFR; HFA). The latter is due to its potential large investment but may in some cases be negotiated down. The investors also gain access to experienced management and which enhance liquidity and less risk of default.

2.2.9 Global Macro

The Global Macro funds seek to anticipate broad trends in the global economy (Amenc, El Bied & Martelli, 2003), which makes this the broadest possible mandate a fund can have. Funds seek investment opportunities on country, regional or global basis in order to seek for events influencing securities, commodities, interest rates and exchange rates (Agarwal & Naik, 2000b). The event could arise from shifts in different markets due to changes in major economies, political fortunes or global supply and demand for resources, both physical and financial (HFR; EDHEC; HFA). Based on the managers' forecast of the event, they will use a wide variety of instruments, e.g. stocks, bonds, currencies, and commodities in order to make leverage bets on the anticipated price movements (Amenc, El Bied & Martelli, 2003; HFR; EDHEC; HFA; HedgeCo.net). In addition, the price movements are often magnified through exchange-traded and over-the-counter derivatives (Agarwal and Naik, 2000b; Amenc, El Bied & Martelli, 2003; EDHEC; HFR). Even though the funds utilize hedging, it is the leverage directional investments that tend to have the largest impact on the performance (Amenc, El Bied & Martelli, 2003).

The Global Macro style is in many ways closely related to the CTA style (see 2.2.2), but one factor sets them apart. The Global Macro managers do not accept contradictory bets. In cases where their models provide them with contradictory signals that make no sense to them, they wait out the market period instead of placing bets both ways.

The HFA states that the Global Macro style typically involves a medium-term holding period and normally produces high volatility. Since they are not limited to act in a specific market they can enjoy seeking and moving from one opportunity to the next. Agarwal and Naik (2000b) point out that the method and degree of hedging can vary significantly between different hedge funds using the Global Macro style. Therefore, the risk level and volatility could differ a lot in a comparison between the funds and one fund's return and risk over time. Most funds follow a top/down type management process (HFR; EDHEC), i.e. the geographic market or the industry is chosen before any specific stocks are picked. In order to dilute the risk further, managers frequently invest in other directional funds (EDHEC).

2.2.10 Long/Short Equity

Long/Short Equity funds invest in both long and short equity portfolios. The managers will buy stocks whose price they expect to rise and take short positions in securities they expect to fall (Harri & Brorsen, 2004; Brooks & Kat, 2002; Kat & Miffre, 2002; EDHEC; HFA). This style

does not seek a permanent neutral position such as the Equity Market Neutral style (see 2.2.5), though as EDHEC expresses, it might occasionally occur due to the managers temporarily lack of 'feel' for the market.

EDHEC states that hedge funds using this style can receive relatively high return on the investment. Most of the profit will be generated during bullish periods in the overall stock market thanks to their long bias. The short selling mainly serves as a source of capital protection in a falling stock market. The ability to switch between long net position and short net position allows the managers to 'carry out arbitrage between cyclical stocks and growth stocks, or large capitalization firms and more modest-sized firms, etc.' (EDHEC). The style is designed to mainly generate profits during bullish periods and at the same time reduce the losses during bearish markets (HedgeCo.net).

In most cases the positions will be within the same sector or sometimes within the same region, to minimize the risk of market fluctuations only affecting certain sectors. Long/Short Equity style greatly reduces market risk, but stock picking and effective analysis is crucial in order to produce a high positive return on the investment (Amenc, El Bied & Martelli, 2003). According to Agarwal and Naik (2000b) this is due to that the risk pertains to the specific risk of the long and short positions. This style has a significant correlation with major stock indices (Amenc, El Bied & Martelli, 2003; EDHEC).

2.2.11 Merger Arbitrage

The Merger Arbitrage style, also referred to as Risk Arbitrage or Deal Arbitrage style (EDHEC), involves investing in event driven situations such as leverage buy-outs, mergers and hostile takeovers (EDHEC, HRA, HRF). Fung and Hsieh (2004) claim that, the manager trades with companies that have announced acquisitions or are the targets of acquisitions. In other words, managers will not try to anticipate upcoming mergers and take their positions before the time of an announcement

EDHEC, as well as HFA and HFR, state that the core style is to buy the stock of the target company and simultaneously sell short the stock of the acquiring company. Managers also have the opportunity to use a low risk alternative to the outright purchase or sale of the common stock, by using equity options.

Normally, the stock of an acquisition target appreciates while the acquiring company's stock decreases in value, reflecting the markets expectations and the investors' uncertainty. Using the

positions earlier mentioned, the funds have the opportunity to make a profit of the price spread between the current market price of the targeted company and the price offered by the acquiring firm (EDHEC, HFR).

2.2.12 Relative Value

The style seeks to identify and take advantage of relative price difference between related instruments (EDHEC, HFR, HedgeCo.net). The instruments used range between equities, debt, options, and futures. Managers may use mathematical, fundamental, or technical analysis to determine the misevaluation relative to the underlying security, related securities, groups of securities or the overall market (HFR). The investment decision takes risk, liquidity and return into account. Many of the funds using this style use leverage and seek the investment opportunities globally (EDHEC).

The style usually includes the sub-indices Equity Market Neutral, Fixed Income Arbitrage and Convertible Arbitrage. Relative Value styles are generally characterized by low return at a low risk level with extremely low correlation with major stock and bond indices. (EDHEC)

2.2.13 Short Selling

Many of earlier mentioned styles use short selling, mainly as a hedging device to offset long-only portfolios or those who expects the market to enter a bearish cycle. The Short Selling specialists, however, uses only short selling in constructing their portfolio (EDHEC; HFR; HFA). The three organizations previously mentioned all agree in their description of the Short Selling style. The core style is to borrow overvalued securities from a third party in order to make delivery to the purchaser with the intention of repurchasing them back at a lower price (Harri & Brorsen, 2004; Amenc, El Bied & Martelli, 2003; Agarwal and Naik, 2000b). The managers will earn a profit if the market declines and have the opportunity to provide profit from both the stocks and from the fixed income. The decline can develop because of overvaluation of the securities, or the market, or in anticipation of earnings disappointments often due to accounting irregularities, new competition, change of management, etc. (Amenc, El Bied & Martelli, 2003; EDHEC; HFR; HFA).

Short Selling requires collateral, generally a liquid security, e.g. cash or U.S Treasury Bills, in order to be successful in their investments. The style is connected with high risk and volatility. In

contrast to long investment, short selling has infinite loss potential due to the risk of increasing value of the security and in cases of high divided yield (EDHEC; HFR; HFA).

2.3 Index

Hedge funds are not under the same formal obligation to reveal their performance characteristics, results or investment style as mutual funds[8] (Kat, 2003; Fung and Hsieh, 1997). Therefore investors have been forced to trust the limited information that the funds have chosen to provide the market with, without any kind of benchmark of their performance.

Hedge fund indices have evolved during the last couple of years in order to try to create a benchmark for the performance of an individual hedge fund or fund manager. The earliest indices did not take into consideration the heterogeneity existing among hedge funds, mainly because the number of hedge funds was not as great as it is today (Chambers, 2002). Though, as the hedge fund universe grew and more innovative styles developed, the request for diversified indices grew as well. Today there are several providers of hedge fund indices on the market, e.g. Van Hedge, Zurich, EDHEC, Barclay, CSBC (see 2.3.3).

Even though several researches within this field of finance, e.g. Kohler (2003), Kat (2003), Chambers (2002), Jaeger (2004) and Vaissié (2003), have expressed concern about the use of hedge fund indices as a comparative factor in measuring hedge fund performance, the development of hedge fund indices show no sign of decreasing interest, rather the opposite. Kohler (2003) writes in her article that indexing in hedge fund universe is not optimal because of the fact that the indexing method is not adapted to a non-traditional asset class. She refers the problems to be of both practical and theoretical reasons. Some examples that Kohler (2003) and other authors, e.g. Chambers (2002), Jaeger (2004), Kat (2003), Vaissié (2003), and Fung and Hsieh (1997), bring up are benchmark construction, performance biases and implementation.

2.3.1 Index construction

Constructing and providing hedge funds indices is still a pretty new phenomenon[9] which might to some extent explain why there is no clear determined rules regarding construction of hedge fund indices (Kat, 2003; Kohler, 2003). Though, another explanation is that it is extremely difficult to catch the diverse, dynamic and expansive nature of the hedge fund universe (Kat,

[8] Swedish law Lagen om investeringsfonder (2004:46
[9] Kat (2003) writes that the collection of hedge fund data began around the year of 1994

2003; Kohler, 2003; Chambers, 2002; Carpenter & Lynch, 1999; Fung & Hsieh, 1997). This means that in the process of constructing the indices, decisions regarding index constructing criteria for issues such as asset weighting, fund selection, style classification and chosen statistical adjustment are taken by the individual provider (Kohler, 2003; Chambers, 2002; Carpenter & Lynch, 1999; Kat, 2003; Fung & Hsieh, 1997).

Kohler (2003) ranks five different attributes that providers of hedge fund indices should simultaneously accomplish to fulfill in order to provide a complete representation of the hedge fund market: Completeness, Accuracy, Transparency, Investability, and Low Turnover. Though, because of the unique settings of the hedge fund universe, the benchmarking construction will include tradeoffs between the different objectives.

One important tradeoff that the providers have to decide on is the issue of fund selection. The number of funds included can vary quite a lot between different indices (Jaeger, 2004; Kat, 2003; Kohler, 2003; Chambers 2002). According to Chambers (2002) it is standard to construct hedge fund indices by basing it on the median manager's performance, even though this will lead to severe errors such as different bias effects (see 2.3.2). Other providers compose their indices by excluding hedge funds not fulfilling the specific requirement that the committee has put up. Some usual requirements regard the length of history or investability (Jaeger, 2004; Kat, 2003; Kohler, 2003; Chambers 2002). In other words, newly started hedge funds, hedge funds no longer open to new investments or hedge funds no longer existing are not included.

Fung and Hsieh (1997) writes that indices referring to the same category of style may differ from each other due to the use of different sources, the hedge funds included, and the difficult task of classify a manager investment style into one specific category. In addition, the constructors of the indices have to rely on the data provided by the hedge fund managers. The provider that includes a great number, several hundred or thousand, of hedge funds argue that this is the only way to truly get an indication of the aggregated performance of a particular style (Kohler, 2003; Chambers, 2002). On the other hand, providers that only use a small and selected group of hedge funds in their calculations, argue that the quality of the data increases, as the major players will be completely or partially removed. This will compensate for the reduced completeness and representation of the indices (Kohler, 2003; Chambers, 2002). Other ways of trying to reflect the true environment of hedge funds is by using weights in the construction process.

2.3.2 Performance biases

As earlier mentioned, it is very difficult to construct indices without any type of biases included. There are different kinds of biases, whereof survivorship bias is the mostly commented bias in passed studies (e.g. Jaeger, 2004; Kat, 2003; Kohler, 2003; Vaissié, 2003; Chambers, 2002; Fung & Hsieh, 1997) and may be the most valid concern, but effects due to self-selection bias and access bias is not to forget.

In order to create indices useful for benchmarking individual hedge fund performance, the providers need to create an accurate return series (Kohler, 2003). This is not an easy task, in fact Kohler continue to say that this is close to impossible, and all providers handle the issue differently. The difficulty lies in the fact that there are no regulations forcing the hedge funds to report information about their performance. Because of this self-selection bias, the providers have to rely on getting information from the hedge fund managers and trust its accuracy (Jaeger, 2004; Kohler, 2003; Chambers, 2002;). In addition, the difficulty in getting the information about the hedge funds will lead to access bias since the indices providers will only include the hedge funds that will provide them with data (Jaeger, 2004).

According to Brown, Goetzmann and Park (2001), the likelihood of a hedge fund surviving over five years is small. Many indices only include existing and open[10] hedge funds in order to fulfill the requirement of investability (Kohler, 2003), which instead create the problem with survivorship bias. Survivorship bias is a large problem in constructing hedge fund indices because the removal of these funds leads to an upward historical performance and a downward historical risk bias (Chambers, 2002).

2.3.3 Index used in research

In earlier research, the uses of indices have been different between the authors and in different studies. Kat and Miffre (2002) used the Zurich indices in their study. Kat (2003) has also looked at Zurich indices and compared it with Hennessee, HFR, CSFB/Tremont, Tuna and Altvest. His conclusion was that there was very low correlation among most of the providers. Kohler (2003) agrees with Kat's conclusion and outline differences in the trade-off of attributes of a good benchmark among 11 different providers, e.g. CISDM, CSFB/Tremont, HFR, Morgan Stanley Capital, Van Hedge Fund, S&P, Zurich, etc. Vaissie (2003) have also done a similar comparison but in addition outlined the providers' decision in handling the different trade-offs. Except for

[10] Hedge funds could be closed, either due to poor performance or capacity constraints.

the index providers already mentioned, he has looked at EACM, HF Net, LJH, CISDM, MSCI, Feri and EDHEC.

Despite the problems connected to hedge fund indices, it is frequently used in the research of hedge fund performance. The reason is not that the problems are not visible, but rather that even though it might not be suitable it is the best tool researchers have today to benchmark the performance.

2.4 Frame of reference

Based on the theoretical exposé, this section describes and motivates how hedge fund performance, hedge fund styles, and hedge fund indices merge into our analysis model; the emerged frame of reference.

2.4.1 Our choice of funds

The funds that lay the foundation for our investigation were the hedge funds that at the time of the thesis prevailed in the Swedish market. These funds together with the number of observations are presented in Table 1 to the right.

All together we found nearly seventy hedge funds in the Swedish market. However, to make our regressions worthwhile, we decided, in conjunction with several other studies, that our research period would at least stretch over three years. I.e. we set a threshold of at least 36 monthly observations. Since we intended to run regressions for every single fund, the numbers of observations vary throughout the

Table 1: Funds included in the study
Note: Our own composition

	Hedge Fund	#Obs.
F_1	Atlas Global Strategy Fund	48
F_2	Banco Hedge Inc	86
F_3	Cicero Hedge Inc	49
F_4	Eikos	48
F_5	FMG Bio-Med Hedge Fund EUR Acc	39
F_6	FMG Bio-Med Hedge Fund USD Acc	51
F_7	FMG Hi-Tech Hedge Fund EUR Acc	38
F_8	FMG Hi-Tech Hedge Fund USD Acc	60
F_9	Futuris	48
F_{10}	GAM European Hedge Open EURO Acc	73
F_{11}	GAM Japan Hedge Euro Acc	68
F_{12}	GAM Japan Hedge USD Acc	80
F_{13}	Handelsbankens Hedgefond Aktie Europa Inc	40
F_{14}	HQ Total A Acc	62
F_{15}	Lynx Inc	58
F_{16}	Manticore	48
F_{17}	Nektar	48
F_{18}	Nordea European Equity Hedge Fund Inc	36
F_{19}	SEB Hedgefond Equity Inc	62
F_{20}	Sector Hedge (Sector management)	48
F_{21}	Tanglin	48
F_{22}	Trevise Hedge Inc	71
F_{23}	Zenit	48

sample. That means that the regressions of hedge funds with several years of history may have a higher reliability than those with the fewer observations.

In addition we excluded funds that were expressing themselves as Fund of Hedge Funds. The underlying reason was that it would be nearly impossible to single out what type of style the fund had been following. This draws heavily on similar conclusions made by Fung and Hsieh (1997).

In their study Fung and Hsieh (1997) also excluded similar funds from the same management company. In our case, an observant reader would point to the inclusion of the funds of FMG and GAM and argue that it would be reasonable for us take a similar stand as Fung and Hsieh. However, our decision to include several funds from the same management company was mainly based on the notion that they were initiated at different times and show differing returns. If they are in fact more or less similar funds, this may be discovered when running our regressions.

Thus, on the basis of history and whether the funds where considered Funds of Hedge Funds the final number of funds included in the study amounted to 23.

2.4.2 Our choice of index

In his study, Vaissié (2003) tries to unravel the reasons behind the heterogeneity of the performances of the different hedge fund indices that are available in the market place. It leads him to question whether they are created in an equal manner and if they are not why it is of any significance. It was found that the indices do vary extensively in terms of; databases, construction methods, and management principles. The findings are supported by several authors (Jaeger, 2004; Amenc, Martellini, & Vaissié, 2003; Kohler, 2003; Brooks & Kat, 2001). However, in the study it is also concluded that indices should reflect the various and evolving needs of investors. The indices needed, depend on the individual investor; to track the market or a particular investment style, asset allocation, performance measurement, or acting as underlying assets for derivative instruments. Given the importance of indices in the investment process, it is alarming and even dangerous to in affect use discretionary or arbitrary indices.

The Alternative EDHEC indices have tried to come about the rather discomforting drawbacks with hedge fund indices discussed previously by constructing indices of already existing indices. The most prevalent in research is Credit Suisse First Boston/Tremont (CSFSB) as well as Hedge Fund Research Indices. The EDHEC indices and its components are shown in Table 2.

Through a factor analysis approach or a Principal Component Analysis EDHEC compute a more optimal combination of indices. This approach supposedly creates more representative and stable indices than the individual indices and with a lesser degree of information loss.[11] But, since the construction of indices and evaluation of the same is beyond the scope of our research we delve no further into the matter.

Table 2: Components of EDHEC Indices
Note: Our own composition

EDHEC indices	HFRI	CSFSB	EACM	Altvest	Hennessee	Van Hedge	CISDM	HF Net	Barclay	S&P
Convertible Arbitrage	X	X	X		X			X	X	
CTA Global		X					X	X	X	X
Distressed Securities	X	X	X	X	X	X		X	X	
Emerging Markets	X	X		X	X	X	X	X	X	
Equity Market Neutral	X	X			X	X	X	X	X	
Event Driven	X	X	X	X	X		X	X	X	X
Fixed Income Arbitrage	X	X			X	X		X	X	
Funds of Funds	X			X		X	X	X	X	
Global Macro	X	X		X	X	X	X	X	X	
Long/Short Equity	X	X		X				X	X	
Merger Arbitrage	X	X	X	X	X			X	X	
Relative value	X		X	X	X	X		X		X
Short Selling	X	X	X	X	X	X	X	X	X	

In Table 3 below we present the correlation matrix of the thirteen hedge fund indices. Some of the indices show very strong correlations, why we chose to exclude three of the indices: Event Driven, Funds of Funds, and Short Selling. Event Driven was excluded due to that several other indices could be treated as sub-indices to this style. Funds of Hedge Funds were eliminated due to the reasons discussed under the preceding section of choice of funds, where Funds of Hedge Funds were left out of the study in accordance with Fung and Hsieh (1997). Finally, Short Selling was excluded since its strong correlation with Long/Short Equity might pose a problem with distinguishing between the effects of the different styles when performing our regressions. In addition, Short Selling is likely to be roomed under Long/Short Equity due to their common directional character. However, we are aware of this simplification, which can lead to that funds that enjoy a short bias might not show any significant relationships.

In general it is clear that the indices are highly correlated. One might argue that we should have included fewer indices to avoid this problem but we saw the remaining indices as representing disparate styles. Even though the styles may be highly correlated, it does not necessarily imply that they follow the same style, rather as Gupta, Cerrahoglu and Daglioglu (2003) state, different styles may react in similar ways to changes in some specific market factors.

[11] For a more elaborate discussion see www.edhec-risk.com.

Table 3: Correlation matrix, hedge fund indices
Note: Our own composition

	Convertible Arbitrage	CTA Global	Distressed Securities	Emerging Markets	Equity Market Neutral	Event Driven	Fixed Income Arbitrage	Funds of Funds	Global Macro	Long/Short Equity	Merger Arbitrage	Relative Value	Short Selling
Convertible Arbitrage													
CTA Global	-0,11												
Distressed Securities	0,56	-0,15											
Emerging Markets	0,38	-0,08	**0,77**										
Equity Market Neutral	0,52	0,16	0,48	0,46									
Event Driven	0,56	-0,14	**0,89**	**0,80**	0,62								
Fixed Income Arbitrage	0,49	0,06	0,38	0,30	0,22	0,30							
Funds of Funds	0,49	0,03	**0,79**	**0,83**	**0,71**	**0,85**	0,32						
Global Macro	0,31	0,44	0,53	0,63	0,63	0,59	0,41	**0,78**					
Long/Short Equity	0,33	-0,05	0,66	0,72	0,68	**0,82**	0,14	**0,90**	0,68				
Merger Arbitrage	0,51	-0,11	0,61	0,56	0,67	**0,85**	0,16	0,67	0,43	**0,70**			
Relative Value	0,68	-0,17	**0,71**	0,66	0,61	**0,84**	0,45	**0,72**	0,52	**0,74**	**0,78**		
Short Selling	-0,25	0,16	-0,62	**-0,72**	-0,43	**-0,72**	0,04	**-0,74**	-0,43	**-0,82**	-0,53	-0,59	

2.4.3 Emerged frame of reference

In Figure 4 down below our emerged frame of reference is presented. It is based on a synthesis on the prior presented theory together with the choices made and how this analysis model will be employed later on in the thesis.

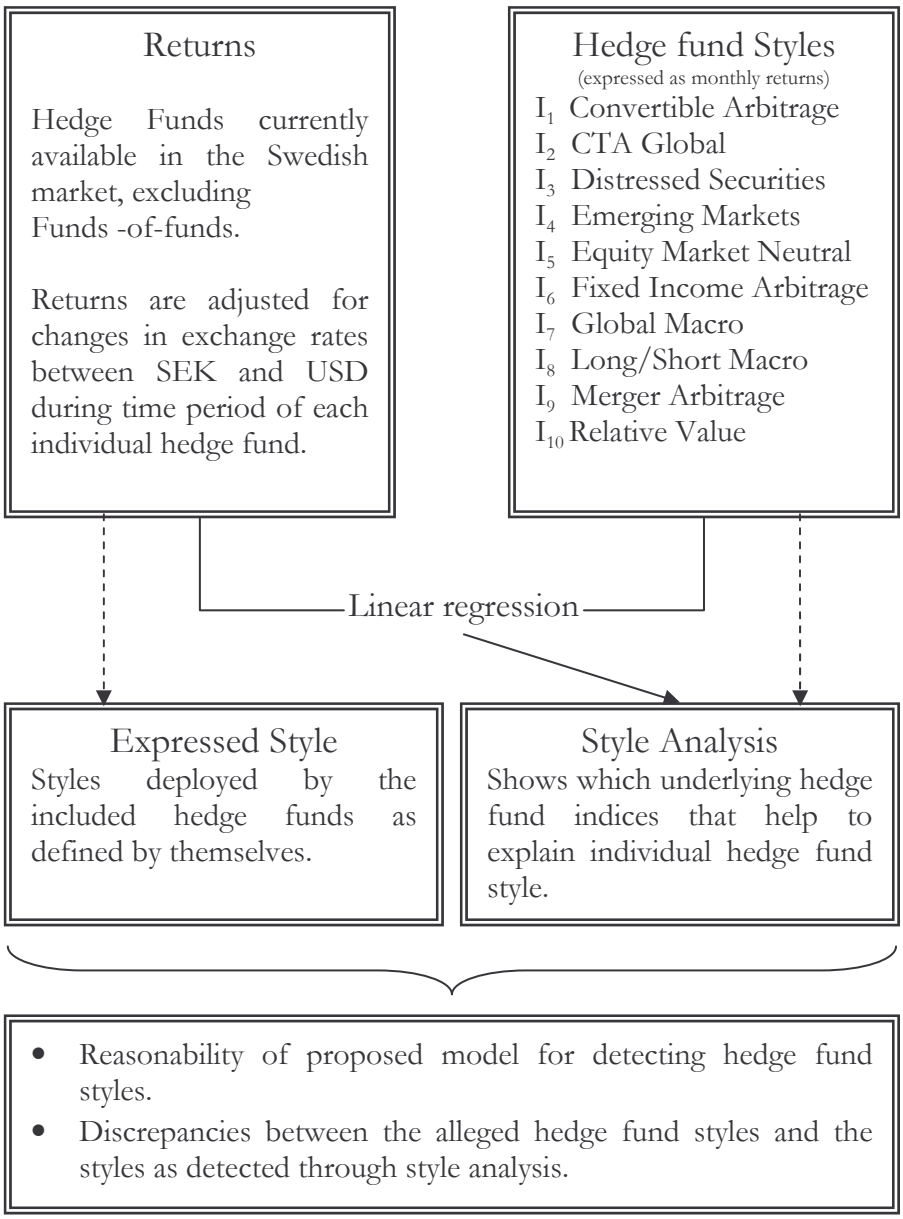

Figure 4: The emerged frame of reference

Note: Our own construction

2.4.4 The regression model

Sharpe (1992) was among the first to introduce return based style analysis. He set up a linear and unconditional model to assess whether the returns of a mutual funds could be replicated by using different classes of assets. In conjunction with the thoughts of Sharpe many other researchers have tried alike approaches (e.g. Harri & Brorsen, 2004; Agarwal & Naik, 2000b; Fung & Hsieh, 1997). In our thesis we apply a similar and fairly simple linear relationship. The thing that stands out with our approach is that we use Hedge Fund style Indices as regressors, instead of using different asset classes. The model is presented below.

$$R_{it} = \alpha_i + \sum_{k=1}^{K} \beta_k I_{kt} + \varepsilon_{it}, \quad i = 1, ..., n \quad ; \quad t = 1, ..., T$$

R_{it} = monthly returns of hedge fund i (in our case i ranges from 1 to 23)
α_i = intercept for hedge fund i
β_k = the factor loading of the hedge fund index k
I_{kt} = monthly returns of hedge fund index k at time t
k = hedge fund style (in our case k ranges from 1 to 10)
ε_{it} = residual term
t = time t

The relationships says that an individual hedge fund's monthly returns at time t, R_{it}, can be described by the monthly returns at time t of a number of linearly correlated hedge fund indices, I_{kt}. The β_k shows the factor loading of the hedge fund index k, i.e. the economic influence that the specific hedge fund style has on the monthly returns of the individual hedge fund.

When running our regressions, in attempt to answer our underlying research problem, we look for statistically significant relationships between the monthly returns of each individual hedge fund and the monthly returns of the ten hedge fund indices selected by us and provided by EDHEC. Significant relationships would imply that the particular fund of interest may follow or may previously have followed the style(s) at hand.

3 METHODOLOGY

In this chapter we present and motivate our research approach and research method. After delving into the research process, including the initial literature study, the choice of funds and indices, the construction of the employed frame of reference, and how the data was collected and analyzed, we discuss methodological issues and what we have done to enhance the credibility.

3.1 Research approach

Patel and Davidson (1991) give the researcher several different methodological issues to consider when studying a research problem. The first concern deals with the most basic distinction between the deductive approach and the inductive approach. Using the inductive approach the researcher studies the research object without basing it on existing relevant research or theoretical findings. Based on the collected observations, the empirical data, the researcher formulates new theory. Contrasting the inductive approach, the deductive researcher commences from general principles and acknowledged theories. Then conclusions about certain phenomenon are made.

This thesis has been created using an inductive research approach with the attempt to examine the possibility of detecting individual hedge fund styles by using hedge fund indices. We regressed observed hedge fund returns on return-based style indices, i.e. we have compared two sources of empirical findings to assess whether style indices can be used to ascribe an individual hedge fund an investment style.

In order to understand and analyze the empirical findings, we developed a theoretical frame of reference. This means that we have not used a strict inductive approach, but rather a combination of deductive and inductive approach. Patel and Davidson (1991) denote this mixed research approach abduction.

In this thesis we strive to reduce the information asymmetry between hedge fund managers and investors. As mentioned in the problem discussion, it is crucial for an investor not only to get

information but accurate information. This paper's approach is to enhance the investor's ability to make informed investment decisions, i.e. a normative approach.

3.2 Research method

In order to be able to address and answer the underlying research problem, identifying the styles of individual hedge funds, we have conducted a quantitative analysis. We have employed a non-conditional multiple linear regressions in order to seek correlations between hedge funds' return and the different indices' returns. In hedge fund performance and style research it is often claimed that hedge fund returns are non-linear, rather options-like (e.g. Agarwal, Fung, Loon & Naik, 2004). This suggests that our usage of a linear regression model could be wrong. What motivates a linear approach in our case is that we, in line with Brown and Goetzmann (2003), regress returns on returns, and not returns on a variety of asset classes that is common when measuring performance.

Conditional model specifications have gained popularity during recent years, (e.g. Kat & Miffre, 2002). Their aim is to capture changes stemming from new information by lagging the explanatory variables in the regression model (Gupta, Cerrahoglu, B & Daglioglu, 2003). Since our monthly returns are generated during the same period of time as the returns in the hedge fund indices, the same level of information should be available in the market for all. Hence, there is no need for lagged variables and a conditional approach.

In section 2.2 we have identified 13 hedge fund styles. Later on in section 2.4.2, they are reduced to the 10 styles used as explanatory variables in our regression model. That is, we have run a multiple regression. To test our model we ran tests for multicollinearity, misspecification, as well as tests for heteroskedasticity and autocorrelation among residuals. These tests are described more thoroughly in Appendix C.

3.3 Research process

Firstly we addressed the issue of finding indices that would suit our research problem. This meant that we examined the different major hedge fund indices (e.g. CSIDM, EDHEC, Tremont, and van Hedge) that were offered in the market, i.e. getting accustomed to the prevailing categorization of hedge fund styles utilized by the leading hedge fund index providers.

Lastly, we performed the hedge style analysis by running linear regressions of monthly historical returns, of the chosen hedge funds, on the different hedge fund indices. A significant linear relationship would imply that an individual hedge fund's returns could be explained by a certain hedge fund style index, i.e. the hedge fund was likely to have followed such a style in the past.

3.3.1 Literature study

Initially, we conducted a comprehensive literature study to orient the characteristics of hedge funds. The study included books, journal articles, working papers, market reports, and the regulations governing hedge funds. When searching literature, we used the Swedish national literature search engine LIBRIS to locate relevant books. The article search was concentrated to the online databases ELIN@Lund, Emerald and Business Source Elite (EBSCO). Search phrases used, alone and in combinations, include: hedge, fund, performance, measurement, persistence, bias, index, style, strategy, investment, alternative, dynamic, and trading. In addition, new literature was traced by scanning the reference lists of relevant articles. This often led us to the researchers' personal homepages and their libraries of published articles and working papers. On some occasions, we contacted the authors of potentially valuable but publicly unavailable articles in person to get their articles sent to us. We also delved into literature about statistics and quantitative methods.

3.3.2 Choice of funds

The reason behind limiting our research to the Swedish market was that we saw a need of providing Swedish investors with information on the investment alternatives offered to them. Even though, earlier research (Brown & Goetzmann, 2003) has been done within this field, we were not able to detect one with focus on the Swedish market. The fast paced growth of the Swedish hedge fund market, both in terms of number of available hedge funds and assets under management, further motivates this research.

We have selected all the hedge funds, though Funds of Hedge Funds have been excluded (see 2.4.1), available to Swedish investors as of February 28 2005 that have at least three years of monthly reported return data. We were able to detect 35 funds that fulfilled our set of different criteria. These were initially selected without in advance categorizing them into the different hedge fund styles. After looking at the fund's expressed investment style, direction and/or purpose, we eliminated those funds that were Funds of Hedge Funds.

3.3.3 Choice of indices

One obstacle to overcome in carrying out our study, were what indices to use. As research has shown (Jaeger, 2004; Amenc, Martenelli & Vaissié, 2003; Kohler, 2003; Vaissié, 2003; Fung & Hsieh, 2000), large discrepancies exist among the different index providers. These differences are translated into biases that we had to be aware of when running our regressions and undertaking the following analysis.

Amenc, Martenelli and Vaissié (2003) discuss the hardship when it comes to finding a benchmark that is representative of a particular management universe. They find that the different indices available on the market are constructed from different data sets, according to diverse selection criteria and methods of construction, and they evolve at differing paces. Hence, Amenc, Martenelli and Vaissié (2003) conclude, the implication of this heterogeneity is that investors cannot rely on competing hedge fund indices to obtain a true and fair view of hedge fund performance.

After contrasting available hedge fund indices and classifications of hedge fund styles we decided to use the thirteen hedge fund style indices as provided by EDHEC. EDHEC compute a more optimal combination of indices. This approach supposedly creates more representative and stable indices than the individual indices and with a lesser degree of information loss.

3.3.4 Construction of frame of reference

Based upon the literature study the set of useful theories was selected. The initial number of hedge fund style indices was reduced to only comprise relevant styles. Please refer to section 2.4.2 for a detailed description of how the choice of indices was made. The selected theories and models were formed into a comprehensive frame of reference incorporating the issues of the research area. We answered the research problem by comparing and analyzing the empirical data with our frame of reference. We then based our regression model on the emerged frame of reference. The frame of reference is presented in section 2.4.3.

3.3.5 Data collection

The hedge fund data has been taken from the Six Trust database and complemented with information from Morningstar. The Six Trust database was accessed via the finance society LINC's information room at Lund University. We retrieved the return data on the hedge funds

registered at Morningstar[12], directly from their internal database. We then collected additional information about these funds from the Morningstar homepage.

In some cases, when the provided information was scarce or even missing, we contacted the fund managers either via telephone or email. This was the case for Morningstar, Brummer & Partners[13], and Handelsbanken[14]. Most complementary information has been collected from the hedge funds' homepages. The collection of only publicly or readily available information is an important feature since this is a part of the information asymmetry a potential investor probably will face.

The return data was provided in SEK and was adjusted for dividends. We used at least 36 observations from each hedge fund. We are aware that the more observations included the better or more reliable our results will be. But since we have limited our study to hedge funds offered in Sweden, we are faced with the fact that quite few hedge funds that have a longer history than three years.

The indices data are collected from the EDHEC database. They are available the EDHEC homepage[15] and contains monthly return from a time period of 1997 to 2005. The indices are organized into different style categories. We have used EDHEC's definitions of the different styles and complemented them with other sources' definitions in order to provide the reader with greater understanding of the hedge fund strategies (see 2.2).

In order to be able to compare the different funds' returns with the indices' returns, we adjusted the returns for changes in exchange rates. We collected the exchange rates from the Reuters 3000Xtra database. We have used the average of the bid and ask rates at closing time the last day every month.

3.3.6 Interviews

On five occasions, we interviewed hedge fund providers and professionals dealing with hedge funds in their work. The interaction took place either via telephone or e-mail depending on the respondents' wishes.

[12] Ekberg, J., and Lundqvist, A., provided us with historical data for the hedge funds registered at Morningstar
[13] Borgeström, F., provided us with historical data for their funds that are included in this paper
[14] Larsson, F., provided us with information about their hedge fund, e.g. strategy, fund asset, etc.
[15] www.edhec-risk.com

Name: Borgeström, Filip
Company: Brummer & Partners
Title: Investor Relations
Date: 19th of May, 2005
Type of interview: Telephone and e-mail

Name: Ekberg, Johan
Company: Morningstar
Title: Analysis and method
Date: 21st of April, 2005
Type of interview: E-mail

Name: Larsson, Frank
Company: Handelsbanken Fonder
Title: Portfolio manager, Handelsbankens Hedgefond Aktie Europa
Date: 11th of May and 16th of May, 2005
Type of interview: Telephone and e-mail

Name: Lundqvist, Annica
Company: Morningstar
Title: Data collection
Date: 19th of May, 2005
Type of interview: E-mail

Name: Schaaf, Joakim
Company: Finansinspektionen
Title: Fund supervisor, Justice Department
Date: 23rd of May, 2005
Type of interview: E-mail

3.4 Methodological problems

Every choice of methodological approach has to be considered and evaluated in light of some quality criteria to give the study some substantial value as a contribution to the scientific development in the studied field. Validity and reliability are two important concepts in this context presented by Wiedersheim-Paul and Eriksson (1999). They define validity as the measuring method's ability to measure what it is supposed to measure. Reliability is defined as the measuring method's ability to give reliable and trustworthy data. That is, the measurement method repeats the same results every time it is applied. Körner and Wahlgren (2002) add that the researcher and the circumstances in which the research is conducted and the research object exists in also can influence the reliability.

3.4.1 Validity

It is important to raise the question whether is possible and relevant to regress Swedish hedge funds denoted in SEK on international hedge fund indices denoted in USD. We argue that there are two major reasons why this a passable way to approach the research problem: firstly, the international financial markets are tightly integrated (Oxelheim, 2003), and, secondly, the Swedish hedge funds operates more or less on a global basis and are therefore facing the same investment opportunities and risks. For example, the Global Macro and the Emerging Market styles are per definition global in scope.

We elaborate on the existence of biases in hedge fund indices in section 2.3.2. Unfortunately, they are inherent in all research comprising hedge fund indices. The possibilities to get rid of them are limited. Instead, you have to be aware of their existence and accept that they might alter your findings to some extent. In prior research, most researchers have found that the biases influence on the outcome of the analysis is relatively small and even neglectable (e.g. Agarwal & Naik, 2000b).

One should bear in mind that it is the hedge fund managers that, on voluntary basis, self report the monthly returns to both database providers like Six Trust and to the hedge fund index providers. The risk of a manager reporting false numbers is always present. This is beyond our control.

Our research is based on monthly return data, i.e. the fund managers report the performance once a month. There is an inherent risk that the manager, especially if return is poor, fixes the return to make it look more attractive by taking risky bets. Then, the true performance and risk is not reported. This "window-dressing" problem is inherent in almost every hedge fund research done.

We have adjusted the returns from exchange rate effects to find the true performance achieved by the funds and styles respectively. This is crucial since the reported returns may partly or entirely exist of exchange rate effect and not return attributable to style. We have not considered interest rates and inflation rates. In accordance with Oxelheim's (2003) discussion, these effects should not alter our findings.

Given the limited size of the Swedish hedge fund market, our analysis comprises several funds from each fund provider. Therefore, it could be reasonable to assume that our results suffer from some degree of provider bias. This may materialize if the fund managers of a single hedge fund

provider might be extremely good or extremely bad performers. This could then result in low correlation with the style indices. Hence, we should be somewhat careful when drawing general conclusions.

Before we set up the regression model, we discussed merits and drawbacks of different regression specifications with Associate Professor Hossein Asgharian at the Department of Economics at Lund University. This, and the fact that we use an often-employed model specification, should guarantee that the proper analysis model was applied.

3.4.2 Reliability

We have employed an array of generally accepted testing principles to test the reliability of the regression model (see appendix C for a detailed description of the test process). We tested our regression model for misspecification by employing Ramsey's RESET test to assess whether we have omitted any important variables, included irrelevant ones, chosen a faulty functional form, or have a model that violates the assumptions of the multiple regression model. In three cases, we found that a non-linear model may have given a higher level of explanation.

We tested the regression model for heteroskedasticity. In addition, a Durbin-Watson and a LM-autocorrelation test were conducted to make clear that there was no correlation between residuals across time. This testing procedure should grant for more reliable results. When heteroskedasticity or autocorrelation was found we corrected for this by using White's Robust estimator and Newey-West's Robust estimator respectively.

The reliability is dependent on the number of observations. We set 36 observations (i.e. monthly returns) as a lower qualification limit. We allow for hedge fund returns dating back to January 1997, the EDHEC style indices' start time. Clearly, the results for funds with short history may be less reliable than funds with long history. In research, style-based regressions usually are based on 36 to 48 monthly observations (Agarwal & Naik, 2000b).

We have consequently retrieved data from trustworthy sources, i.e. Reuters 3000Xtra, Six Trust, and Morningstar. The fact that we received the fund data from Morningstar as an excerption directly from their internal Excel database have reduced the probability of human mistakes when managing the data tables. This also holds for the information retrieved from Reuters 3000Xtra and Six Trust.

It is known that fond managers alter their styles without telling the stakeholders. Thus, a replicate off this study may lead to different results and conclusion due to style changes. A similar problem concerns the funds that are pursuing several styles at the same time. Even if the investor got to know which styles pursued, it will be very tricky to track the style weights over time.

4 EMPIRICAL FINDINGS

Bearing our emerged frame of reference in mind (see 2.4.3), this chapter presents the empirical findings. We start off at the aggregated level before we investigate each individual fund's results and its contribution to our model's overall ability to reveal individual hedge funds' investment style.

4.1 Aggregated analysis

The empirical evidence of our style analysis is summarized in Table 4 below. It shows which underlying hedge fund indices that help to explain the individual hedge funds' styles. The results have been varied in terms of explanation power and styles found to be significant. This will be examined further in the following three sections: discrepancy between alleged and detected style; the styles; and the reasonability of proposed model for detecting hedge fund styles.

The explanatory variables, i.e. the hedge fund indices, are denoted as follows:

I_1 = Convertible Arbitrage
I_2 = CTA Global
I_3 = Distressed Securities
I_4 = Emerging Markets
I_5 = Equity Market Neutral
I_6 = Fixed Income Arbitrage
I_7 = Global Macro
I_8 = Long/Short Equity
I_9 = Merger Arbitrage
I_{10} = Relative Value

Table 4: Regression results

INDEX	(I_1)	(I_2)	(I_3)	(I_4)	(I_5)	(I_6)	(I_7)	(I_8)	(I_9)	(I_{10})
FUND	β_1	β_2	β_3	β_4	β_5	β_6	β_7	β_8	β_9	β_{10}
(F1) Atlas Global	1.030	-0.048	-0.419	0.082	-1.256	3.310	0.569	1.794	1.074	-3.538
Strategy Fund	*0.054*	*0.838*	*0.355*	*0.314*	*0.329*	*0,005**	*0.445*	*0,004**	*0.196*	*0,004**
(F2) Banco Hedge Inc	0.156	-0.373	-0.627	0.116	1.265	-0.637	0.200	-0.741	-0.002	1.426
	0.770	*0,059***	*0.129*	*0.529*	*0.238*	*0.171*	*0.700*	*0.104*	*0.998*	*0.123*
(F3) Cicero Hedge Inc	0.540	0.189	-0.251	-0.036	-2.846	2.559	0.048	1.340	0.310	-1.955
	0.360	*0.459*	*0.639*	*0.713*	*0,047**	*0,058***	*0.955*	*0,066***	*0.754*	*0.207*
(F4) Eikos	0.575	-0.108	-0.182	0.021	-1.408	2.991	0.013	1.390	0.417	-2.257
	0.415	*0.732*	*0.764*	*0.845*	*0.415*	*0,054***	*0.990*	*0,082***	*0.706*	*0.155*
(F5) FMG Bio-Med	1.152	-0.026	-0.967	0.022	0.323	4.149	-0.681	2.550	0.506	-2.968
Hedge Fund EUR	*0.208*	*0.948*	*0.306*	*0.974*	*0.889*	*0,044**	*0.587*	*0,044**	*0.720*	*0.236*
(F6) FMG Bio-Med	-0.674	0.022	2.168	-0.271	1.188	-2.216	-1.676	-0.873	1.098	1.995
Hedge Fund USD	*0.467*	*0.957*	*0,007**	*0.632*	*0.563*	*0.230*	*0.144*	*0.348*	*0.436*	*0.353*
(F7) FMG Hi-Tech	0.185	0.020	0.019	-0.394	2.199	3.409	0.034	2.244	0.065	-3.485
Hedge Fund EUR	*0.833*	*0.958*	*0.983*	*0.579*	*0.326*	*0,086***	*0.977*	*0,073***	*0.965*	*0.166*
(F8) FMG Hi-Tech	0.773	0.096	0.482	1.124	2.144	-0.251	-1.576	0.205	0.570	-2.377
Hedge Fund USD	*0.292*	*0.752*	*0.417*	*0,008**	*0.145*	*0.852*	*0,086***	*0.759*	*0.597*	*0,090***
(F9) Futuris	0.729	-0.214	0.039	-0.114	1.574	1.533	0.701	1.366	-0.353	-3.183
	0.353	*0.509*	*0.950*	*0.842*	*0.367*	*0.328*	*0.536*	*0,086***	*0.751*	*0,092***
(F10) GAM European	0.510	-0.100	0.185	-0.295	0.364	0.650	1.415	1.011	-0.607	-2.104
Hedge Open EUR	*0.289*	*0.616*	*0.628*	*0.237*	*0.697*	*0.404*	*0,011**	*0,028**	*0.385*	*0,023**
(F11) GAM Japan	-0.477	-0.001	0.208	-0.578	-0.177	1.529	1.344	0.647	-0.146	-0.265
Hedge Eur	*0.416*	*0.996*	*0.662*	*0.101*	*0.877*	*0.166*	*0,080***	*0.246*	*0.871*	*0.821*
(F12) GAM Japan	-0.308	0.021	-0.267	0.194	0.949	0.826	-0.148	0.605	0.289	-0.944
Hedge USD	*0.452*	*0.900*	*0.405*	*0.253*	*0.243*	*0,029**	*0.754*	*0,097***	*0.563*	*0.204*
(F13) Handelsbankens	0.827	0.311	-0.865	-0.251	-0.980	2.038	0.200	1.586	-0.382	-1.081
Hedgef. Aktie Eur.	*0.276*	*0.236*	*0.233*	*0.674*	*0.518*	*0.180*	*0.841*	*0.117*	*0.808*	*0.660*
(F14) HQ Total A Acc	0.475	-0.011	-0.906	0.424	-3.501	2.078	-0.604	3.079	-0.893	0.970
	0.434	*0.964*	*0,081***	*0.263*	*0,003**	*0,073***	*0.423*	*0,000**	*0.350*	*0.465*
(F15) Lynx Inc	1.006	1.012	0.110	-0.339	-3.805	3.778	1.180	1.650	0.533	-3.475
	0.218	*0,004**	*0.866*	*0.502*	*0,024**	*0,022**	*0.245*	*0,050**	*0.665*	*0,073***
(F16) Manticore	1.016	0.241	-0.327	0.030	-1.760	2.039	0.323	1.864	0.529	-3.394
	0.118	*0.365*	*0.517*	*0.949*	*0.222*	*0.117*	*0.728*	*0,006**	*0.563*	*0,031**
(F17) Nektar	0.768	-0.138	-1.267	-0.063	-3.904	1.677	3.980	0.581	0.984	-2.425
	0.600	*0.820*	*0.274*	*0.953*	*0.234*	*0.566*	*0,066***	*0.691*	*0.637*	*0.487*
(F18) Nordea European	0.894	0.204	-0.807	-0.336	-0.822	2.355	0.164	1.068	0.565	-0.715
Equity Hedge	*0.272*	*0.465*	*0.296*	*0.640*	*0.609*	*0.147*	*0.877*	*0.362*	*0.755*	*0.782*
(F19) SEB Hedgef.	1.276	0.163	-0.238	-0.337	-0.672	1.243	-0.261	1.731	1.394	-2.291
Equity Inc	*0.138*	*0.556*	*0.680*	*0.464*	*0.695*	*0.308*	*0.744*	*0,017**	*0.314*	*0.253*
(F20) Sector Hedge	1.584	-0.119	-3.271	-1.209	-8.315	4.585	1.389	7.170	-2.521	1.068
(Sector managem.)	*0.141*	*0.861*	*0,001**	*0.212*	*0,014**	*0,091***	*0.490*	*0,000**	*0,078***	*0.709*
(F21) Tanglin	0.948	-0.210	-1.125	-0.250	-1.445	3.008	0.760	1.952	-0.280	-1.769
	0.147	*0.433*	*0,031**	*0.599*	*0.317*	*0,024**	*0.418*	*0,004**	*0.760*	*0.253*
(F22) Trevise Hedge Inc	-0.313	0.440	0.111	-0.427	-1.825	1.147	-0.678	1.401	-0.914	1.302
	0.534	*0,038**	*0.782*	*0.135*	*0,064***	*0.221*	*0.281*	*0,004**	*0.209*	*0.187*
(F24 Zenit	0.621	0.017	0.158	-0.241	1.320	1.884	0.904	0.646	0.247	-4.079
	0.377	*0.954*	*0.774*	*0.641*	*0.399*	*0.182*	*0.375*	*0.358*	*0.804*	*0,018**

βi : Coefficients from regression of Hedge Fund Indices on Individual Hedge Funds. i = 1, 2, ..., 13

* : Coefficient is statistically significant on 5%- level.

** : Coefficent is statistically significant on 10%- level.

Numbers written in italics represent the p-value of the coefficents.

4.1.1 Discrepancies between the alleged and detected styles

Research has shown that there are reasons to suspect self-reported style classifications to be ambiguous and at times even misleading. The funds' self classification may deviate from our style definitions (see 2.2) why the discrepancies in reality may be greater or lesser. Table 5 below displays the degree of discrepancy for each regression. We use three types of classifications: no discrepancy, i.e. expressed style equal to detected style; partial discrepancy, i.e. at least one of the detected styles is equal to expressed style; and yes, i.e. the expressed style is not detected. When the fund has not expressed its style or when the regression has not detected any significant style, the notation N/A is used. Note that this holds for the 5% significance level.

In eight of the cases we detect discrepancy whereas partial discrepancy occurs nine times. Only in two cases we have no deviation between expressed style and detected style. In four cases we are not able to draw any conclusions, whereof two of the cases are due to the lack of expressed style. That means that only in two cases our model fails to detect any significant styles, on both 5%- and 10%-level.

Table 5: Discrepancy between expressed and detected styles

	Hedge Fund	Expressed style(s)	Discrepancy
F_1	Atlas Global Strategy Fund	Global Macro	YES
F_2	Banco Hedge Inc	Multi-Style	YES
F_3	Cicero Hedge Inc	Equity Market Neutral	PARTIAL
F_4	Eikos	No clear style	N/A
F_5	FMG Bio-Med Hedge Fund EUR Acc	Long/Short Equity	PARTIAL
F_6	FMG Bio-Med Hedge Fund USD Acc	Long/Short Equity	YES
F_7	FMG Hi-Tech Hedge Fund EUR Acc	Long/Short Equity	PARTIAL
F_8	FMG Hi-Tech Hedge Fund USD Acc	Long/Short Equity	YES
F_9	Futuris	Long/Short Equity	PARTIAL
F_{10}	GAM European Hedge Open EURO Acc	Long/Short Equity	PARTIAL
F_{11}	GAM Japan Hedge Euro Acc	Long/Short Eq.: Fix.Inc.Arb.	YES
F_{12}	GAM Japan Hedge USD Acc	Long/Short Eq.: Fix.Inc.Arb.	NO
F_{13}	Handelsbankens Hedgefond Aktie Europa Inc	Long/Short Equity	N/A
F_{14}	HQ Total A Acc	Long/Short Equity	PARTIAL
F_{15}	Lynx Inc	No clear style	N/A
F_{16}	Manticore	Long/Short Equity	PARTIAL
F_{17}	Nektar	Equity Market Neutral	YES
F_{18}	Nordea European Equity Hedge Fund Inc	Long/Short Equity	N/A
F_{19}	SEB Hedgefond Equity Inc	Long/Short Equity	NO
F_{20}	Sector Hedge (Sector management)	Long/Short Equity	PARTIAL
F_{21}	Tanglin	Global Macro	YES
F_{22}	Trevise Hedge Inc	Multi-Style	PARTIAL
F_{23}	Zenit	Long/Short Equity	YES

4.1.2 The styles

Table 6 to the right presents the number of significant occurrences for each style. The styles classify into three major groupings; the lower group comprising Convertible Arbitrage, Emerging Markets, and Merger Arbitrage with zero or one single occurrence; the middle group comprising CTA Global, Distressed Securities, Equity Market Neutral, Global Macro, and Relative Value with two to seven occurrences; and the upper group comprising Fixed Income Arbitrage and Long/Short Equity with up to fifteen occurrences.

Table 6: Number of significant styles detected

	Style	# Significant 5%	# Significant 5% + 10%
I_1	Convertible Arbitrage	0	0
I_2	CTA Global	2	3
I_3	Distressed Securities	3	4
I_4	Emerging Markets	1	1
I_5	Equity Market Neutral	4	5
I_6	Fixed Income Arbitrage	5	10
I_7	Global Macro	1	4
I_8	Long/Short Equity	10	15
I_9	Merger Arbitrage	1	1
I_{10}	Relative Value	4	7

The styles in the lower group display almost no correlation with the examined hedge funds. Convertible Arbitrage shows no significance in any of the run regressions. Emerging Markets and Merger Arbitrage occur only once respectively. Relative Value shows another distinguishing characteristic; all its coefficients are negative.

4.1.3 Reasonability of proposed model for detecting hedge fund styles

As can be seen in Table 7 below, on average, our model explains 24% of the variation in returns, i.e. the adjusted R^2 is 0.24. The average R^2 amounts to 0.39. The explanation power varies considerably. For Eikos and Futuris, negative adjusted R^2 indicates that the model's explanation power in those cases is by mere chance.

In three cases, FMG High Tech Hedge Fund USD, GAM Japan Hedge USD, and SEB Hedge Fund Equity, the Ramsey's RESET test indicates that the linear model may not be optimal. A non-linear model might prove to be more suitable for these funds.

In the case of Sector Hedge, heteroskedasticity was found. This was adjusted for by applying White's Robust estimator. Autocorrelation was detected only in the case of SEB Hedgefond Equity. This was adjusted by applying Newey's Robust estimator.

In fifteen regressions, we found significant styles at the 5% significance level (see Table 6). By increasing the confidence interval to 90%, another six funds displayed significant explanatory

variables. In two cases, we found no evidence of significant styles on neither the 5%- nor the 10%-level.

Table 7: Number of significant styles detected

				Model testing		
	Hedge Fund	R^2	Adj. R^2	RESET	Heterosked.	Autocorr.
F_1	Atlas Global Strategy Fund	0.49	0.36	Ok	No	No
F_2	Banco Hedge Inc	0.18	0.07	Ok	No	No
F_3	Cicero Hedge Inc	0.28	0.08	Ok	No	No
F_4	Eikos	0.19	-0.03	Ok	No	No
F_5	FMG Bio-Med Hedge Fund EUR Acc	0.36	0.13	Ok	No	No
F_6	FMG Bio-Med Hedge Fund USD Acc	0.37	0.21	Ok	No	No
F_7	FMG Hi-Tech Hedge Fund EUR Acc	0.41	0.19	Ok	No	No
F_8	FMG Hi-Tech Hedge Fund USD Acc	0.34	0.21	Mispec.	No	No
F_9	Futuris	0.20	-0.01	Ok	No	No
F_{10}	GAM European Hedge Open EURO Acc	0.51	0.43	Ok	No	No
F_{11}	GAM Japan Hedge Euro Acc	0.37	0.26	Ok	No	No
F_{12}	GAM Japan Hedge USD Acc	0.30	0.20	Mispec.	No	No
F_{13}	Handelsbankens Hedgefond Aktie Europa Inc	0.40	0.19	Ok	No	No
F_{14}	HQ Total A Acc	0.77	0.73	Ok	No	No
F_{15}	Lynx Inc	0.62	0.54	Ok	No	No
F_{16}	Manticore	0.39	0.23	Ok	No	No
F_{17}	Nektar	0.30	0.11	Ok	No	No
F_{18}	Nordea European Equity Hedge Fund Inc	0.38	0.13	Ok	No	No
F_{19}	SEB Hedgefond Equity Inc	0.27	0.13	Mispec.	No	Yes
F_{20}	Sector Hedge (Sector management)	0.74	0.67	Ok	Yes	No
F_{21}	Tanglin	0.39	0.23	Ok	No	No
F_{22}	Trevise Hedge Inc	0.49	0.35	Ok	No	No
F_{23}	Zenit	0.29	0.17	Ok	No	No
	Average	0.39	0.24			

4.2 The funds

As a complement to the aggregated analysis, this section describes the regression results on individual fund basis. The origins of possible discrepancies or confirmations of expressed styles are examined. Note that the comments provided are not to be seen as conclusions but rather plausible explanations for why some styles may be significant or not.

Recall from section 2.4.2 Choice of Indices that Short Selling was excluded from the indices used as explanatory variables due to the strong negative correlation with Long/Short Equity. This means that we may face difficulties in identifying funds pursuing Long/Short Equity with short

bias. The reader may also find it beneficial to recapitulate the correlation matrix in the same section as well as referring to Appendix B.

Fund: Atlas Global Strategy Fund
Expressed Style: Global Macro
Geographic Market: Global
Regression Result: Fixed Income Arbitrage*, Long/Short Equity*, (Relative Value*)
Findings: Discrepancy exists

Fixed Income Arbitrage, Long/Short Equity and Relative Value are all significant at 5%-level. Long/Short Equity shows the weakest relationship. The adjusted R^2 is 0.36.

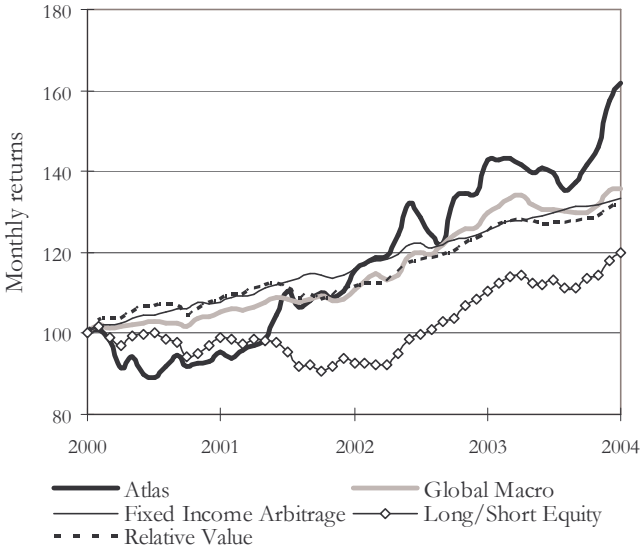

Figure 8. Atlas compounded returns.
Note: Our own calculations.

Global Macro shows no significance. This may be explained by the great variation of method and degree of hedging between funds following this style. However, Fixed Income and Long/Short Equity styles may be housed under the Global Macro style. The negative relationship with Relative Value may exist due to this style's extremely low correlation with major stock and bond indices. In Figure 8, actual return and the return of expressed and found styles are displayed.

Fund: Banco Hedge Inc
Expressed Style: Multi-Style, see Appendix B
Geographic Market: Mainly Sweden
Regression Result: (CTA Global**)
Findings: Discrepancy exists

CTA Global has a negative correlation and is only significant on the 10%-level. The adjusted R2 is low at 0.07. Hence, in this case our model seems inadequate.

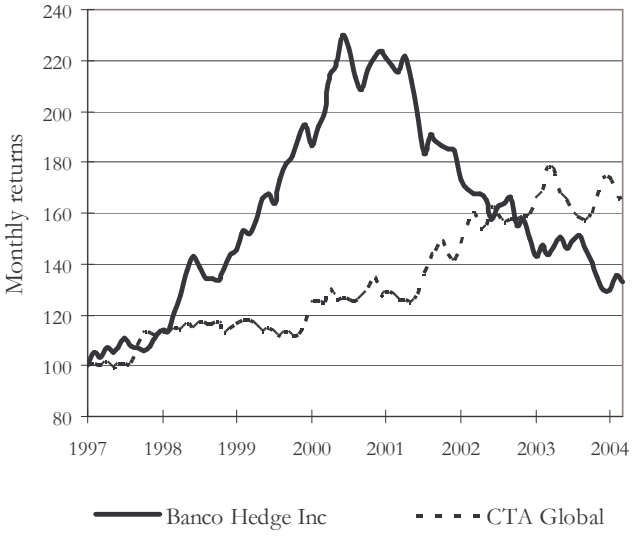

Figure 9. Banco Hedge Inc compounded returns.
Note: Our own calculations.

The fund's current multi-strategy was enacted in 2004. It includes four different styles, out of which Equity Market Neutral and Fixed Income Arbitrage can be extracted. However our observations date back to 1998, why the regression result may be interpreted as more an indication of the style followed previously. But, when looking at the fund's report on trading history, the former styles seem to be towards Equity Market Neutral or Long/Short Equity. In

addition, the focus of the fund is Sweden and to describe the returns using global indices might be faulty. In Figure 9, actual return and the return of expressed and found style are displayed.

Fund:	Cicero Hedge
Expressed Style:	Equity Market Neutral
Geographic Market:	Mainly Sweden
Regression Result:	(Equity Market Neutral*), Fixed Income**, Long/Short Equity**
Findings:	Partial discrepancy exists

Only Equity Market Neutral is significant at 5%-level. The adjusted R^2 is low at 0.08.

The negative correlation between expressed and found style may at first seem contradictory, but could be explained by the fund taking neutral but opposite positions. A more far-fetched explanation would be to say that even though the Swedish stock market is correlated with major foreign stock markets, a market neutral position in Sweden might not be positively correlated with global neutral positions. That is, the Equity Market styles have low correlation with their underlying markets respectively. In Figure 10, actual return and the return of expressed and found style are displayed.

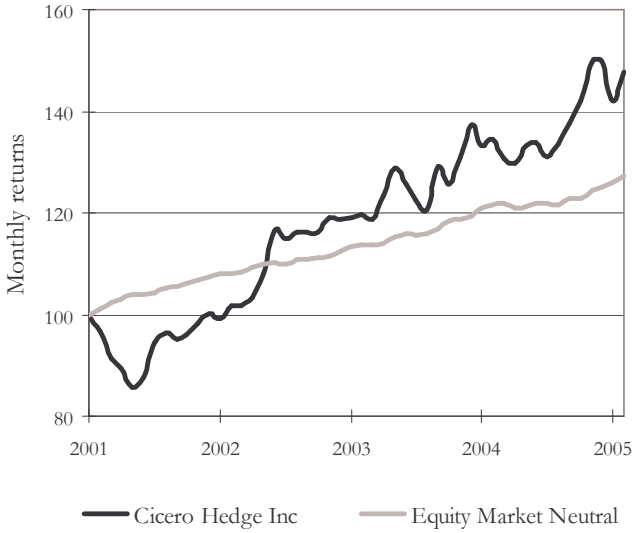

Figure 10. Cicero Hedge compounded returns.
Note: Our own calculations.

Fund:	Eikos
Expressed Style:	No information
Geographic Market:	Nordic countries, Estonia, Poland
Regression Result:	Fixed Income**, Long/Short Equity**
Findings:	Not applicable

Fixed Income Arbitrage and Long/Short Equity are only significant on 10%-level. The adjusted R^2 is very low. Hence, in this case our model seems inadequate.

There is no clearly expressed style but instruments used are stated as mainly equity. They further express that they use a bottom-up approach, i.e. they select individual stocks

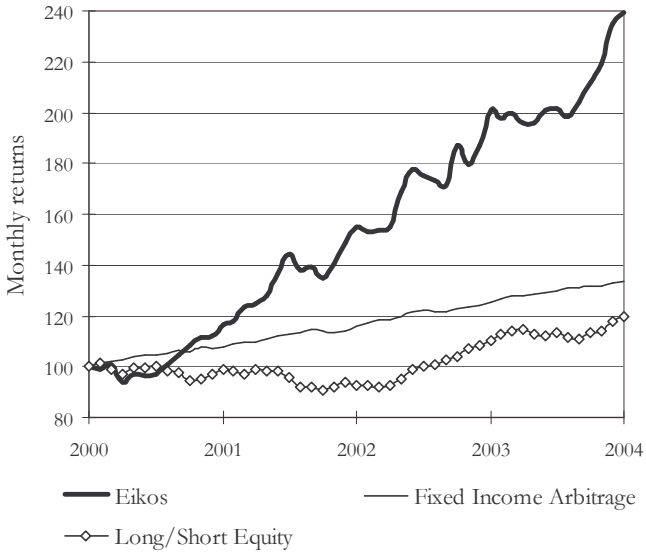

Figure 11. Eikos compounded returns.
Note: Our own calculations.

rather than investing in specific countries or industries. The vagueness of their investment style in addition with their geographic focus may be the cause of our model's failure to pick up any significant styles or factors. The indices are to be thought of as global why in this case they might not be suited for explaining the fund's returns. In Figure 11, actual return and the return of found styles are displayed.

Fund:	FMG Bio-Med Hedge Fund EUR
Expressed Style:	Long/Short Equity
Geographic Market:	Global with focus on US
Regression Result:	Fixed Income*, Long/Short Equity*
Findings:	Partial discrepancy exists

Fixed Income Arbitrage and Long/Short Equity are both significant on 5%-level and display strong positive correlation. However, the adjusted R^2 is merely 0.13.

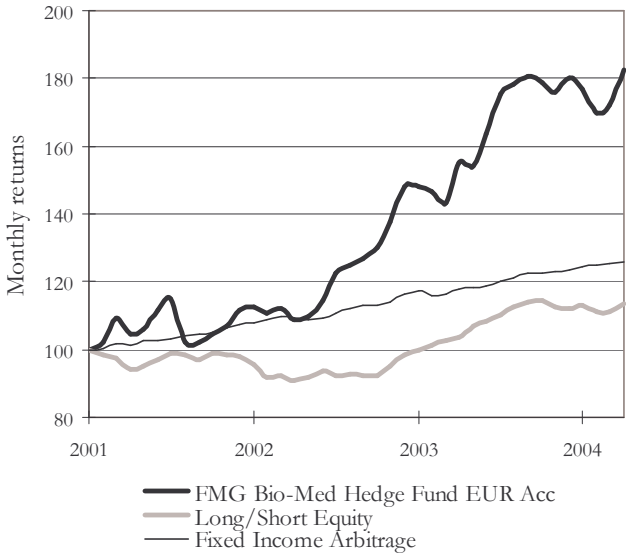

Figure 12. FMG Bio-Med Hedge Fund EUR compounded returns. Note: Our own calculations.

Our model is able to pick up Long/Short Equity style but also Fixed Income Arbitrage, which is not expressed by the fund. In section 2.4.1 we mentioned that Fung and Hsieh (1997) excluded similar funds from the same management company in their study to avoid that the same fund is included twice. However in the cases of FMG and GAM we chose to include all funds in our regression. The result shows that they are in fact different funds. In Figure 12, actual return and the return of expressed and found styles are displayed.

Fund:	FMG Bio-Med Hedge Fund USD
Expressed Style:	Long/Short Equity
Geographic Market:	Global with focus on US
Regression Result:	Distressed Securities*
Findings:	Discrepancy exists

Distressed Securities is found to be significant on 5%-level and displays a strong positive correlation. The adjusted R^2 is 0.21.

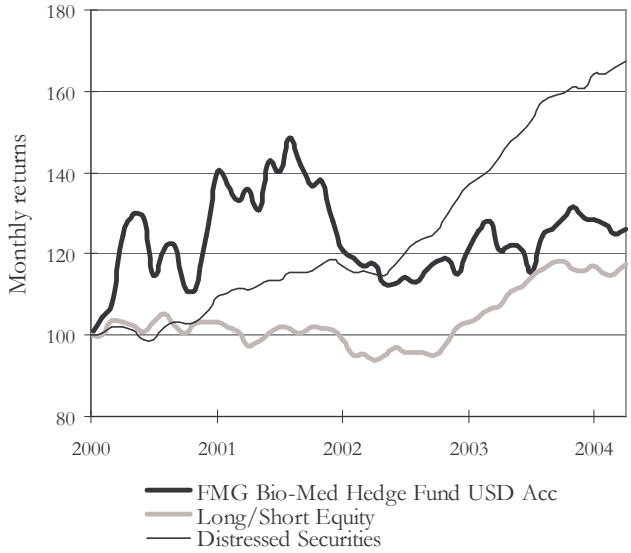

Figure 13. FMG Bio-Med Hedge Fund USD compounded returns. Note: Our own calculations.

Our model detects Distressed Securities rather than Long/Short Equity as the dominant style. But the discrepancy might not be that great, since both styles use long and short positions and have a correlation of 0.66. In Figure 13, actual return and the return of expressed and found styles are displayed.

Fund:	FMG Hi-Tech Hedge Fund EUR
Expressed Style:	Long/Short Equity
Geographic Market:	Global with focus on US
Regression Result:	Fixed Income**, Long/Short Equity**
Findings:	Partial discrepancy exists

Fixed Income Arbitrage and Long/Short Equity are both only significant on 10%-level. Correlations are positive and strong. The adjusted R^2 is 0.19.

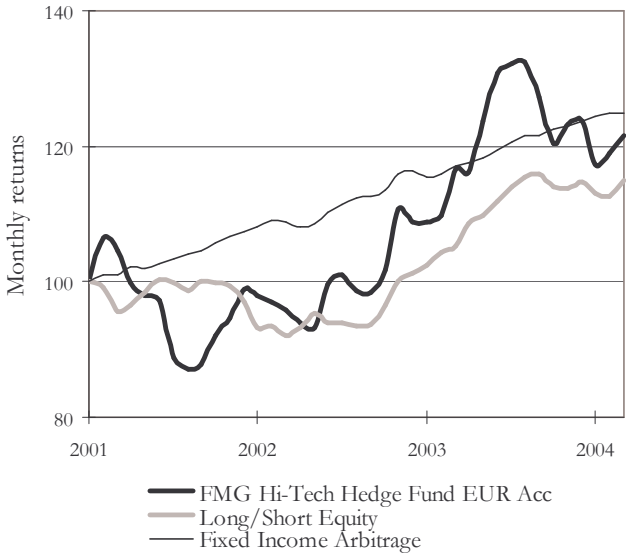

Figure 14. FMG High-Tech Hedge Fund EUR compounded returns. Note: Our own calculations.

Our model shows relationship between expressed style but only on 10%-level. The underlying reason for this might be attributed to that the fund focus on US companies and the indices are more global. In Figure 14, actual return and the return of expressed and found styles are displayed.

Fund:	FMG Hi-Tech Hedge Fund USD
Expressed Style:	Long/Short Equity
Geographic Market:	Global with focus on US
Regression Result:	Emerging Markets*, (Global Macro**), (Relative Value**)
Findings:	Discrepancy exists

Global Macro is found to be positively correlated on a 5% significance level. Global Macro and Relative Value are only significant on a 10%-level. All factors show somewhat strong relationships. The adjusted R^2 is 0.21.

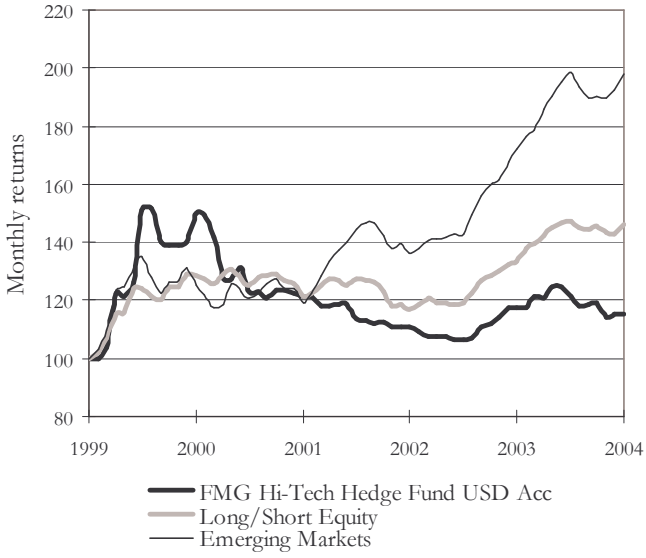

Figure 15. FMG High-Tech Hedge Fund USD compounded returns. Note: Our own calculations.

Our regression shows that the dominating style is Emerging Markets. However we keep in mind that correlation between Emerging Markets and Long/Short Equity is fairly high at 0.72. In addition, Emerging Markets index is global, which is in line with that the fund invests globally. In Emerging Markets you are not allowed to take short positions, hence the fund has a long bias, which also is commonly found in Long/Short Equity. When Performing Ramsey's RESET test we found that some underlying misspecification of the model may be prevailing. This might indicate that a nonlinear model would have been more appropriate in this case. In Figure 15, actual return and the return of expressed and found style are displayed.

Fund:	Futuris
Expressed Style:	Long/Short Equity
Geographic Market:	Europe and Nordic
Regression Result:	Long/Short**, (Relative Value**)
Findings:	Partial discrepancy exists

Long/Short Equity and Relative Value are found significant only on a 10%-level, with positive and negative correlation respectively. However, the R^2 is only 0.20 and the adjusted R^2 is extremely low, even showing a negative value. Hence, in this case our model seems inadequate.

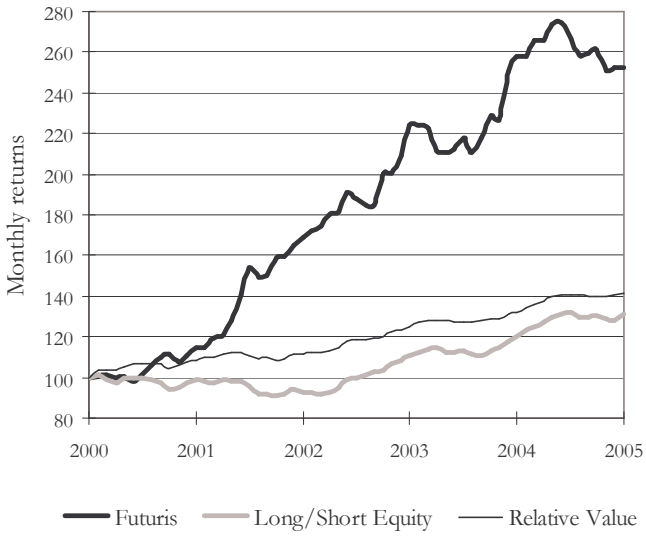

Figure 16. Futuris compounded returns.
Note: Our own calculations.

We find some evidence of the expressed style, but the significance is low. This might be explained by assuming that the geographic focus on Europe could lead to a lower fit with the global Long/Short Equity index. Furthermore the two styles are positively and highly correlated at 0.74. If we had a higher significance, the negative influence of Relative Value would seem interesting to explore in more detail. In Figure 16, actual return and the return of expressed and found styles are displayed.

Fund: GAM European Hedge Open
Expressed Style: Long/Short Equity
Geographic Market: Europe
Regression Result: Global Macro*, Long/Short Equity*, (Relative Value*)
Findings: Partial discrepancy exists

Global Macro, Long/Short Equity, and Relative Value are significant on the 5%-level. The first two styles are positively correlated whilst Relative Value has a negative correlation as well as being roughly two times as influential as each of the other two. The adjusted R^2 is high at 0.43.

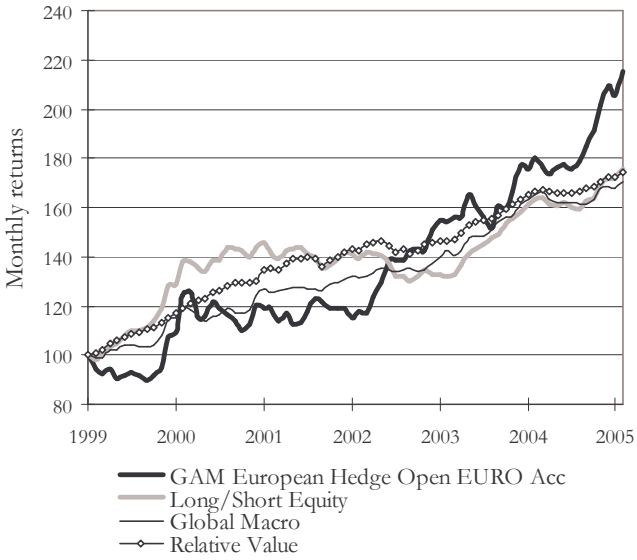

Figure 17. GAM European Hedge Open compounded returns. Note: Our own calculations.

The most influential style, Relative Value, has a negative impact on the fund's returns. This might be explained by the geographic focus on Europe. When an industry is booming globally or in the US, the opposite may occur in Europe. For instance, an American multinational company may be directly competing with a corresponding European company, hence when one gains the other one looses. We keep in mind that Global Macro and Long/Short Equity as well as Long/Short Equity and Relative Value have high correlations at around 0.70. This is why the significance of Global Macro might be somewhat ambiguous. The logic behind the opposite signs of Long/Short Equity and Relative Value could be sought in the fact that Long/Short Equity normally is more profitable in bullish stock markets, thanks to their long bias. Whereas Relative Value normally has an extremely low correlation with major stock indices. In Figure 17, actual return and the return of expressed and found styles are displayed.

Fund: GAM Japan Hedge, EUR
Expressed Style: Long/Short Equity, Fixed Income Arbitrage-*Relative Value*
Geographic Market: Japan
Regression Result: Global Macro**
Findings: Discrepancy exists

Global Macro is significant only on the 10%-level having a somewhat strong and positive correlation. The adjusted R^2 is 0.26.

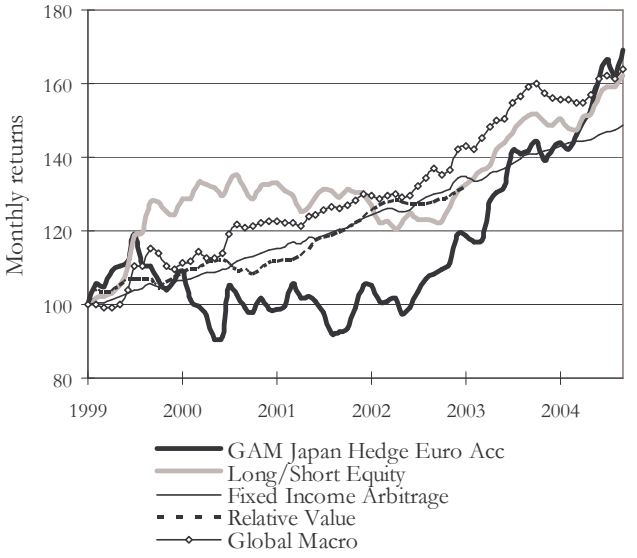

Figure 18. GAM Japan Hedge, EUR compounded returns. Note: Our own calculations.

Our findings differ from their expressed styles, but as have been previously shown, Global Macro and Long/Short Equity enjoy a relatively high correlation. The strong positive correlation with Global Macro might seem a bit strange since they expressively only invest in Japan. Though, this could be explained with the fact that the Japanese economy has an impact on the world's economy, being one of the largest economies in the world. In addition, we recognize that within Global Macro, also bonds and other financial instruments are used. In their fund's report they actually state that they use the instruments just mentioned, i.e. Fixed Income Arbitrages targeted at the sub-group Relative Value (see 2.2.7). But, our regression only recognizes the Global Macro style at a 10%-level of significance why we need not elaborate this further. In Figure 18, actual return and the return of expressed and found styles are displayed.

Fund:	GAM Japan Hedge, USD
Expressed Style:	Long/Short Equity, Fixed Income Arbitrage-*Relative Value*
Geographic Market:	Japan
Regression Result:	Fixed Income*, Long/Short Equity**
Findings:	No discrepancy exists

Fixed Income Arbitrage is significant on the 5%-level but Long/Short Equity only on the 10%-level. Both display a positive correlation and a relatively weak economic influence. The adjusted R^2 is 0.20.

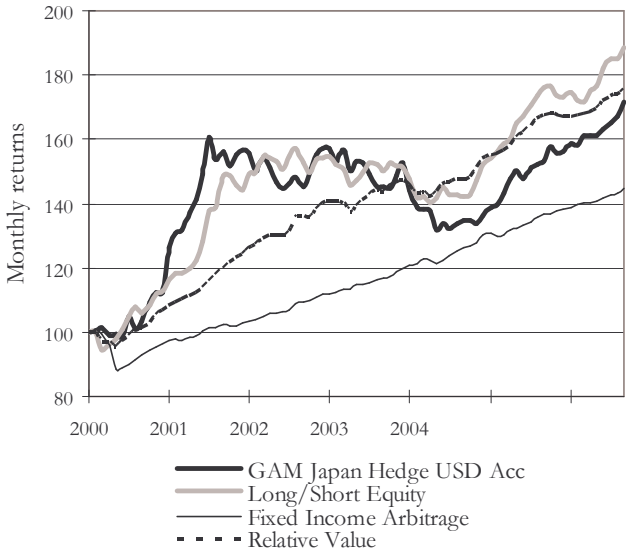

Figure 19. GAM Japan Hedge, USD compounded returns. Note: Our own calculations.

Our model actually detects both of the expressed styles but Long/Short Equity is not as significant as Fixed Income Arbitrage. As was previously mentioned, the Japanese economy can be assumed to move as the world economy in general. That means that no Japanese national interest rates can be seen in total isolation. When Performing Ramsey's RESET test we found that some underlying misspecification of the model may be prevailing. This might indicate that a nonlinear model would have been more appropriate in this case. In Figure 19, actual return and the return of expressed and found styles are displayed.

Fund:	Handelsbankens Hedgefond Aktie Europa
Expressed Style:	Long/Short Equity
Geographic Market:	Europe
Regression Result:	No significant styles
Findings:	Not applicable

We find no styles to be significant on neither 5%- nor 10%-level. The adjusted R^2 is 0.19. Our model is not able to detect any dominant styles. This may be due to the fact that the fund invests around 80% of fund assets in Sweden. This bias may make it difficult to use a global index. The expressed style is Long/Short Equity but they also state that they invest in bonds, derivatives, and other instrument (see Appendix B). Therefore it seems more appropriated to describe this fund as a multi-strategy fund. Such a fund could be troublesome to categorize into a specific style. In Figure 20, actual return and the return of expressed style are displayed.

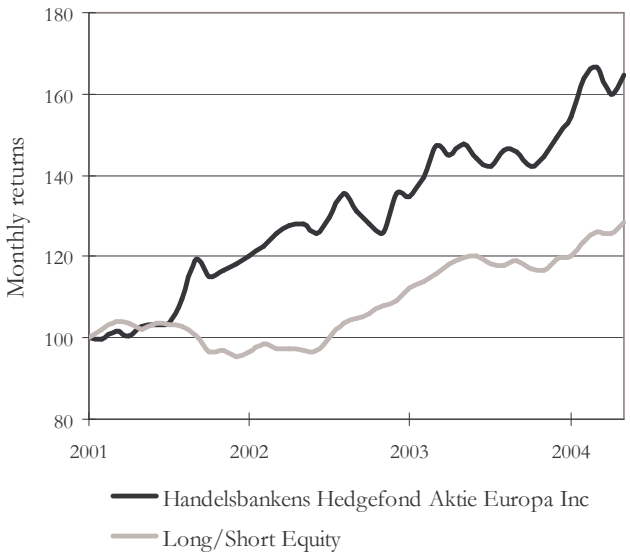

Figure 20. Handelsbanken Hedgefond Akie Europa compounded returns. Note: Our own calculations.

Fund:	HQ Total
Expressed Style:	Long/Short Equity
Geographic Market:	Global
Regression Result:	Long/Short Equity*, (Equity Market Neutral*), Fixed Income**, (Distressed Securities**)
Findings:	Partial description exists

Long/Short Equity and Equity Market Neutral are found significant. They are positively and negatively correlated, respectively, and have a strong economic influence. Fixed Income Arbitrage and Distressed Securities are found significant only on the 10%-level. The adjusted R^2 is very high at 0.73.

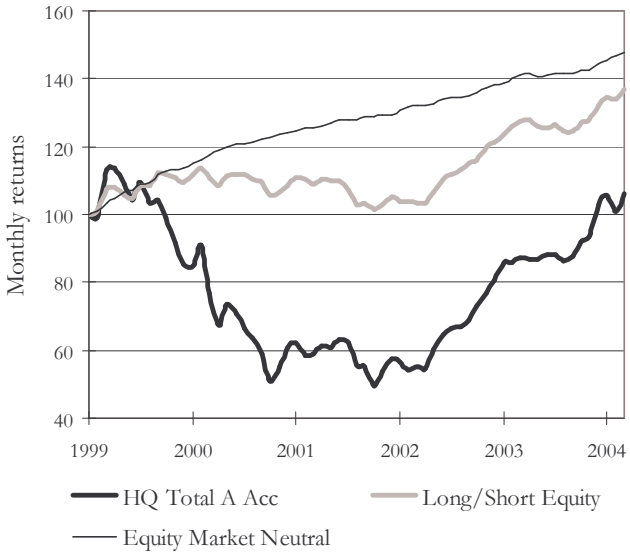

Figure 21. HQ Total compounded returns. Note: Our own calculations.

The result of the regression supports the expressed style. However we also have a negative correlation with Equity Market Neutral, which is hard to ignore since the adjusted R^2 is very high.

We recapitulate the strong positive correlation between Long/Short Equity and Equity Market Neutral. At the same time, we acknowledge that there may be factors that affect the different styles in opposite directions. In Figure 21, actual return and the return of expressed and found styles are displayed.

Fund: Lynx
Expressed Style: No information
Geographic Market: Global
Regression Result: CTA Global*, Fixed Income*, Long/Short Equity*, (Equity Market Neutral*), (Relative Value**)
Findings: Not applicable

CTA Global, Fixed Income Arbitrage, and Long/Short Equity as well as Equity Market Neutral are significant on the 5%-level. They are positively correlated to the fund's returns except for Equity Market Neutral. The strongest influence is exerted by Fixed Income Arbitrage and Long/Short equity. However, both CTA Global and the negatively correlated Equity Market Neutral both show relatively strong relationships. Relative Value is only significant on the 10%-level. The adjusted R^2 is as high as 0.54.

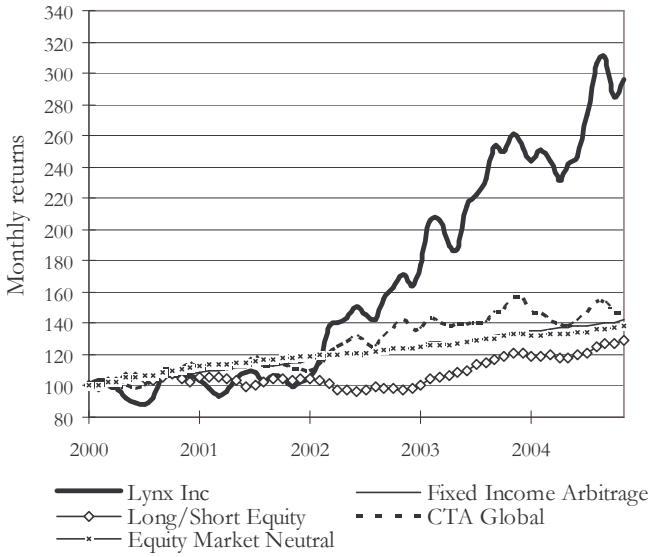

Figure 22. Lynx compounded returns.
Note: Our own calculations.

Since the fund does not express any specific investment style, it is difficult to assess whether a prevailing discrepancy exists. However, the fund states that they invest in futures, equities, bonds, interest rates, and currencies. This seems reasonable since futures and currencies are dealt with under CTA Global, also known as Managed Futures; interest rates are dealt with under Fixed Income Arbitrage; and equity is obviously dealt with under the remaining two significant styles. As before, the negative correlation with Equity Market Neutral might be explained with the fact that there are factors affecting Equity Market Neutral in an opposite direction than e.g. CTA Global. In Figure 22, actual return and the return of expressed and found styles are displayed.

Fund: Manticore
Expressed Style: Long/Short Equity
Geographic Market: Global
Regression Result: Long/Short*, (Relative Value*)
Findings: Partial discrepancy exists

Long/Short Equity and Relative Value are positively and negatively correlated respectively with the fund's returns and are both significant on the 5%-level. The adjusted R^2 is 0.23.

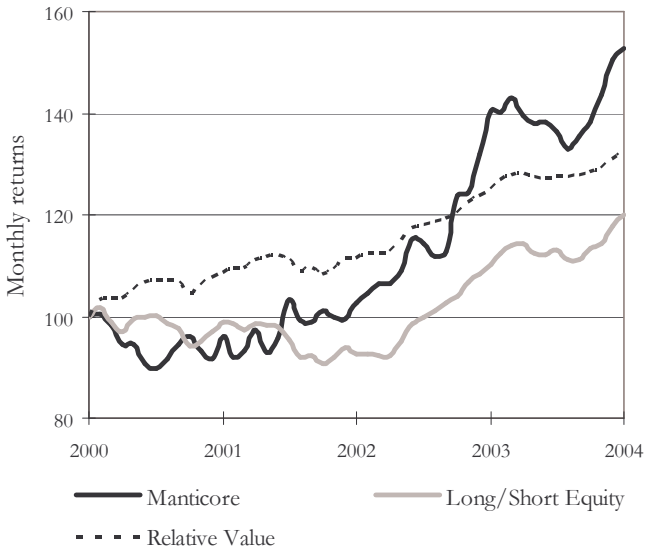

Figure 23. Manticore compounded returns.
Note: Our own calculations.

The fund's expressed style is Long/Short Equity within the industries information technology, media, and telecommunication. Our regressions result partially aligns with the expressed style, but also shows a negative correlation with Relative Value. This may be explained with the fact that the fund's return is regressed on global indices, and not sector based indices. The logic behind the opposite signs of Long/Short Equity and Relative Value could be sought in the fact that Long/Short Equity normally is more profitable in bullish stock markets, thanks to their long bias. Whereas Relative Value normally has an extremely low correlation with major stock indices. In Figure 23, actual return and the return of expressed and found styles are displayed.

Fund: Nektar
Expressed Style: Equity Market Neutral, Fixed Income Arbitrage-*Market Neutral*
Geographic Market: Global
Regression Result: Global Macro**
Findings: Discrepancy exists

Only Global Macro is found significant, but only on the 10%-level. It is positively correlated with the fund's returns. The adjusted R^2 is merely 0.11.

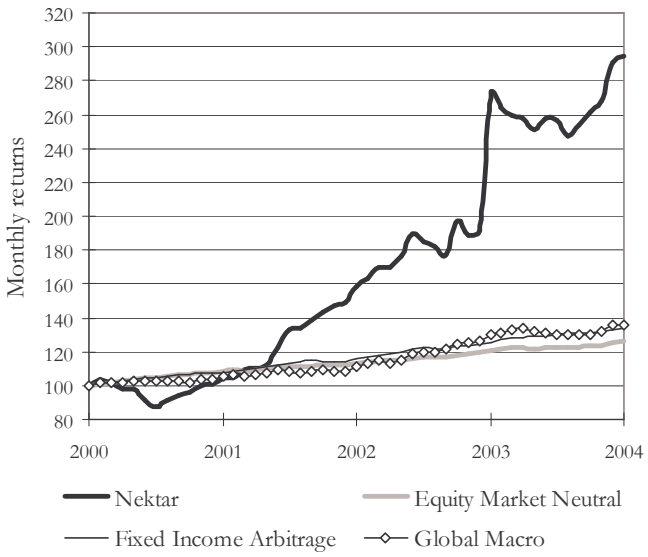

Figure 24. Nektar compounded returns.
Note: Our own calculations.

Global Macro means that, the fund look for events that affect securities, commodities, interest rates and currency rates. Thus, the style generates returns taking bets on the direction of the market. In turn, the neutral styles try to

minimize the impact of the overall market, i.e. they do not bet on direction. In Figure 24, actual return and the return of expressed and found styles are displayed.

Fund: Nordea European Equity Hedge Fund
Expressed Style: Long/Short Equity
Geographic Market: Europe
Regression Result: No significant styles
Findings: Not applicable

No significant styles are found.

One plausible explanation for why we are not able to find any significant styles may be the strong focus on European equity, in contrast to the global indices used in the regression. In Figure 25, actual return and the return of expressed are displayed.

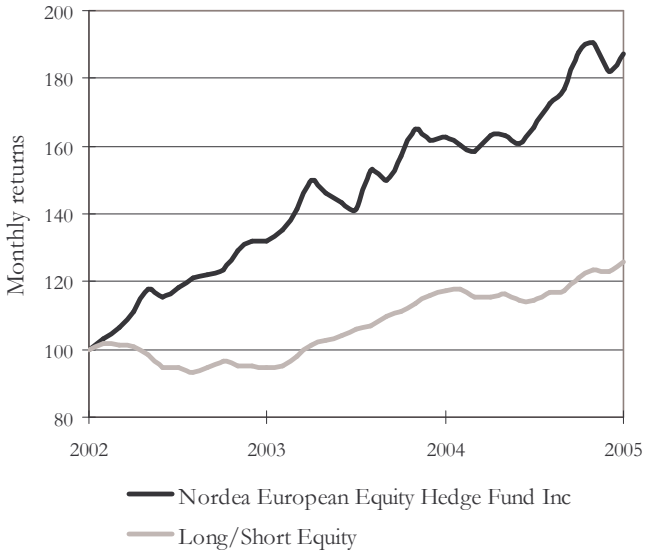

Figure 25. Nordea European Equity Hedge Fund compounded returns. Note: Our own calculations.

Fund: SEB Hedgefond Equity
Expressed Style: Long/Short Equity
Geographic Market: Europe
Regression Result: Long/Short Equity*
Findings: No discrepancy exists

Long/Short Equity is significant on the 5%-level. The correlation is strong and positive. The adjusted R^2 is 0.13.

The model seems to pin down the expressed style, but we are aware of the low adjusted R^2. The fund state that, most recently the fund has also started investing in fixed income. This may affect the adjusted R^2. When Performing Ramsey's RESET test we found that some underlying misspecification of the model may be prevailing. This might indicate that a nonlinear model would have been more appropriate in this case. In Figure 26, actual return and the return of expressed and found style are displayed.

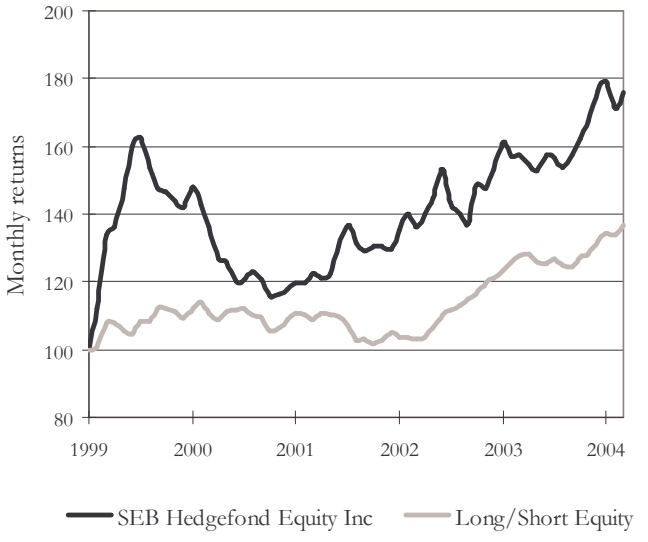

Figure 26. SEB Hedgefond Equity compounded returns. Note: Our own calculations.

Fund:	Sector Hedge
Expressed Style:	Long/Short Equity
Geographic Market:	Global with focus on Nordic countries
Regression Result:	Long/Short Equity*, (Distressed Securities*), (Equity Market Neutral*), Fixed Income**, (Merger Arbitrage**)
Findings:	Partial discrepancy exists

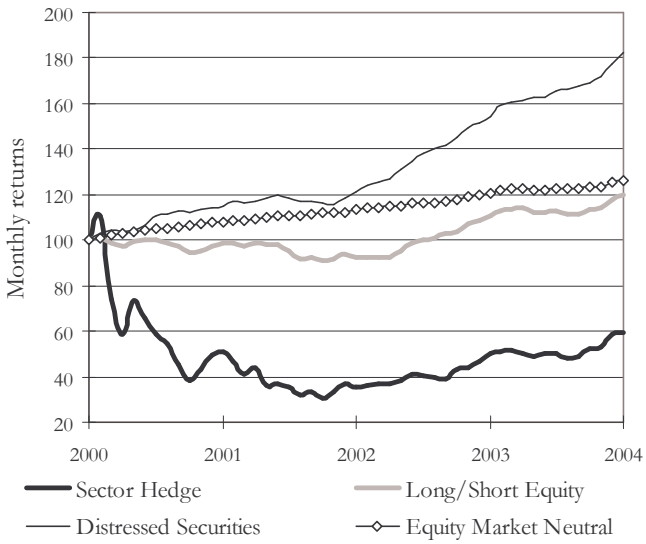

Figure 27. Sector Hedge compounded returns.
Note: Our own calculations.

Long/Short Equity, Distressed Securities, and Equity Market Neutral are significant on the 5%-level. Only Long/Short Equity has a positive correlation. Long/Short Equity and Equity Market Neutral are both more than two times more influential on the fund's returns than the Distressed Securities. The adjusted R^2 is a high 0.67.

As we stated earlier, the negative correlation of both Equity Market Neutral and Distressed Securities could be explained with the fact that there are factors affecting them in an opposite direction than Long/Short Equity. Further, the fund state that they focus on the Nordic countries and have a relatively high proportion of total assets invested in the same security. Potentially this can explain the negative correlation with the Equity Market Neutral and Distressed Securities since they are indeed global indices. The fund states that they have changed owner and manager twice since it was founded. This may also contribute to the many styles found significant. In Figure 27, actual return and the return of expressed and found styles are displayed.

Fund: Tanglin
Expressed Style: Global Macro
Geographic Market: Europe, USA (OECD)
Regression Result: Fixed Income*, Long/Short Equity*, (Distressed Securities*)
Findings: Discrepancy exists

Fixed Income Arbitrage and Long/Short Equity as well as the negatively correlated Distressed Securities are significant on the 5%-level. The economic influence of Long/Short Equity is two times as strong as Fixed Income Arbitrage and three times as strong as Distressed Securities. The adjusted R^2 is 0.23.

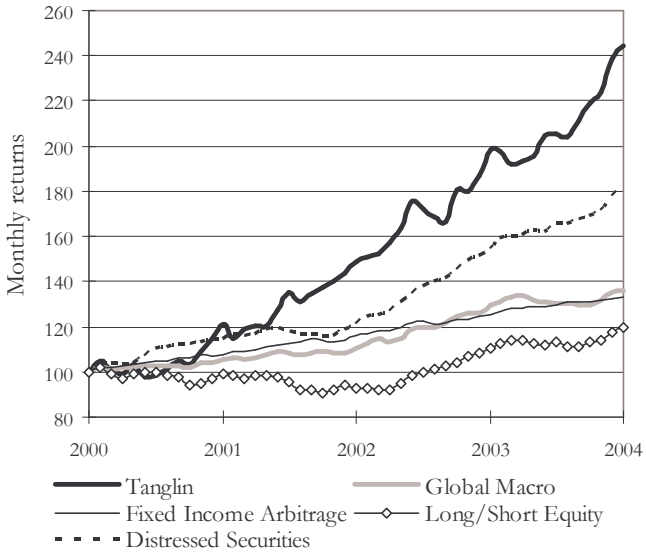

Figure 28. Tanglin compounded returns.
Note: Our own calculations.

In the expressed Global Macro style, the fund's ambition is to seek macro changes that affect securities, commodities, interest rates, and currency rates. The one style dubious in this context is the Distressed Security, which is also negatively correlated with the fund's returns. This style should display low correlation with broader financial markets. One might suspect that this style is less global than Global Macro, e.g. the opportunity to capitalize on companies in financial distress may differ between countries, regions, and industries. In Figure 28, actual return and the return of expressed and found styles are displayed.

Fund: Trevise Hedgefond
Expressed Style: Multi-Style
Geographic Market: Sweden
Regression Result: CTA Global*, Long/Short Equity*, (Equity Market Neutral**)
Findings: Partial discrepancy exists

CTA Global and Long/Short Equity are significant on the 5%-level. The latter has the strongest correlation with the fund's returns. Equity Market Neutral is significant only on the 10%-level. The adjusted R2 is relatively high at 0.35.

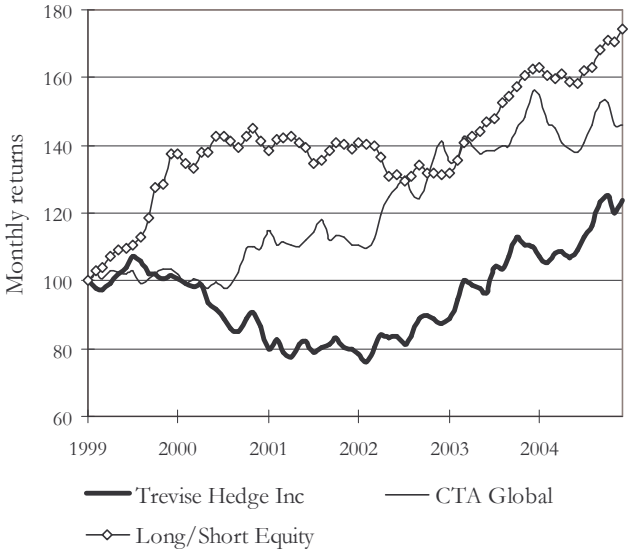

Figure 29. Trevise Hedgefond compounded returns.
Note: Our own calculations.

The fund states that they use equity, securities, bonds, options, futures, and debt. The CTA Global, also known as Managed Futures, takes on

long and short positions. Of the fund's assets, 65% are supposedly invested in major Swedish companies. Since these companies are likely to affect the Swedish stock market, which is assumed to be highly correlated with other major stock markets, it is reasonable to assume that the global Long/Short Equity index may actually help to explain the return of this fund with a Swedish emphasize. In Figure 29, actual return and the return of expressed and found styles are displayed.

Fund: Zenit
Expressed Style: Long/Short Equity
Geographic Market: Global
Regression Result: (Relative Value*)
Findings: Discrepancy exists

Only Relative Value is significant on the 5%-level. The relationship is negative and rather strong. The adjusted R^2 is 0.17.

The correlation between Long/Short Equity and Relative Value is very high at 0.74. Therefore it may be difficult to distinguish between the effects of these two styles. The logic behind the negative sign of Relative Value could be sought in the fact that Long/Short Equity normally is more profitable in bullish stock markets, thanks to their long bias, whereas Relative Value normally has an extremely low correlation with major stock indices. In addition, one might raise the question whether Relative Value is truly a global index? This style should display low correlation with broader financial markets. One might suspect that this style is less global than Long/Short Equity, e.g. the opportunity to capitalize on undervalued or overvalued companies may differ between countries, regions, and industries. The conclusion may be that the discrepancy between expressed style and the style found by the regression is not that severe. In Figure 30, actual return and the return of expressed and found style are displayed.

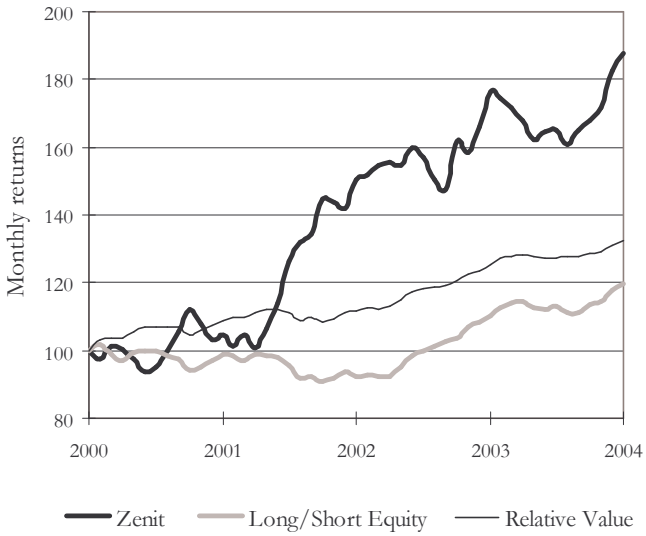

Figure 30. Zenit compounded returns.
Note: Our own calculations.

5 DISCUSSIONS AND PROPOSALS FOR FURTHER RESEARCH

Drawing on the empirical findings presented in chapter 4, we now turn to discussions about their credibility and implications. When examining a new field of interest you constantly come up with exciting ideas for future research. Hence, at the end, we highlight some topics of current interest that deserves further investigation.

5.1 Discussion

The aim of our thesis was to investigate whether it was possible to detect an individual hedge fund's investment style by running a regression on various hedge fund style indices. Our research has shown that it is indeed a viable approach. In most cases our model is able to single out specific styles.

Are the results reliable? By now it should be clear that examining hedge funds and benchmark indices is subject to innate biases. Though the usage of hedge fund indices may not be optimal, as of today it is still beneficial since some information is certainly better than no information at all.

Our approach is to our knowledge unique and hence, there could be no direct comparisons made when it comes to the results. But, when comparing the explanatory power of our approach with other similar studies, performed by renowned researchers within the area of hedge funds, it leaves us with the conclusion that our model performs well. We receive an average adjusted R^2 of 0.24, whereas Brown and Goetzmann (2003), who put a similar model to test, receive average adjusted R^2s ranging from 0.22 and downwards to 0.13.

The explanatory power may seem low with an adjusted R^2 of 0.24. However, as Fung and Hsieh (1997) point out, it is reasonable to assume that an asset-based style analysis for hedge funds produces high R^2 less frequently than the same analysis for mutual funds. An important distinction between our study and the one performed by Fung and Hsieh, is that we use an index-based style analysis where we regress hedge fund returns on hedge fund indices' returns and not hedge fund returns on a variety of asset classes. Yet another distinction between our study and

other recently conducted studies is that we do not use a conditional approach. We assumed that this was not necessary since our monthly returns are produced during the same period of time as the returns of the hedge fund indices.

EDHEC uses 13 style categories, which in this study were reduced into 10 styles. Other providers include more or sometimes fewer styles. The hedge fund universe, in reality, deploys a myriad of investment styles. There is off course the question about where to draw the line when defining the different investment styles at hand? The construction of specific categories may be more or less accurate. But as Fung and Hsieh (1997) point out, although style exposures are diverse, market exposures can converge. That is, different styles may respond in similar or opposite ways to the same changes in some market factor. This may be the reason behind why, when running our regressions, many funds seem to be following Long/Short Equity and Fixed Income Arbitrage.

Would different indices from other providers have produced different regression results? Brooks and Kat (2002) claim, that there is low correlation between indices reflecting the same type of styles. Implications, being investors' perceptions of hedge fund performance, will depend heavily on chosen benchmark indices. In our case, the same analysis using some other indices would likely have produced somewhat different results. However, an evaluation of different indices from different providers is beyond the scope of this thesis.

There is the issue with using global indices to categorize Swedish fund styles. In this study we show that it is feasible to regress geographical sub-sets on indices derived on a global basis. This is great help to Swedish investors wanting to benchmark investment opportunities in the alternative investment market. At the time of writing, no Swedish hedge fund indices were available for this purpose. The relevance and implication of this information lies in the fact that the investment style has an impact on the performance. Furthermore, investment styles might perform differently depending on the market condition.

There are reasons to believe that intentional style misclassifications of hedge funds exist. Being able to interpret the hedge fund style is therefore of great importance. It is widely known and intuitively easy to understand that hedge funds that perform better than their peers attract more capital. Recall that the hedge fund managers themselves report their performance, both to investors and index providers. The managers also state their investment styles on their own. There are supervising organizations monitoring the performance numbers but not the publicly communicated style. Thus, to conceal underperformance relative to top performers, a fund

manager might be tempted to classify her fund to a style where top performance is comparable to her own. This behavior improves ex post relative performance. The underlying argument concerns self-interest and prestige, i.e. many managers want to manage more assets than their competitors. In addition, some managers might have their compensation related to the amount of assets under management.

With an explanation power of 0.24, which in the context of hedge fund research could be considered rather high, this work has contributed to a greater understanding within the field of hedge fund style analysis. Our index-based approach appears to be a promising way to identify an individual hedge fund's investment style. However we have identified some issues that could provide further insights and deserves further research.

We are of the view that it is what fund managers do, not what they say they do, that determines the stylistic differences. This thesis may not have opened the Pandora's Box of hedge fund styles completely, but it contributes to the solving of the mystery and reducing the information asymmetry.

5.2 Recommendations for further research

The seeds for further research include calls for more sophisticated models, replicate studies altering the number of style indices regressed on, or the index provider, and studies of the new Swedish Harcourt hedge fund index.

5.2.1 Calls for more sophisticated models

One drawback of linear regression models, despite single or, as in our case, multiple, is that they are only absolutely accurate when factor loadings and the systematic risk of the managed assets remain constant through time. In the case of hedge funds, where active fund management is one of the cornerstones, it is implicated that this might not hold. Both holdings and risk level is expected to change over time. In our model this means dynamic exposure to the style indices. This calls for the application of models where the factor loadings are allowed to change from month to month.

It is also conceivable that model specifications including orthogonal variables and conditional approaches, i.e. lagged variables could achieve higher adjusted R^2. Moreover, it is possible that a generalized lest square method could surpass our ordinary least square approach.

Yet another way to improve our model could be to apply a moving time window, which, for example, embraces the last 24 monthly observations. Such a model could possibly better capture style changes. By regressing on a large number of observations spanning over long time, more recent events like style changes are smoothed out and their significance for current and future outcomes diminish. Even though the obvious drawback of this approach would be the fewer observations' weaker explanation power, it might still be a viable way.

5.2.2 Replicate study employing indices from other providers

The veritable jungle of hedge fund index providers out there calls for a study running the same return data on style indices from several different providers. It is fairly reasonable to believe that another index may display higher correlation with the economic conditions the hedge funds offered to the Swedish investors face.

5.2.3 Replicate study altering the number of style indices

We reduced the number of styles in our model from the initial thirteen to include ten in our analysis. Our findings in terms of high correlation between some style indices indicate that the inclusion of fewer indices may be a feasible approach for proper hedge fund classification. When regressing the same monthly hedge fund return data on eight and five styles respectively, Brown and Goetzmann (2003) achieved higher adjusted R^2 for the model comprising 8 styles. Thus, we suggest a replicate of our study where the number of explanatory variables ranges from five to ten.

5.2.4 Harcourt's new Swedish hedge fund index

Harcourt establishes the first Swedish hedge fund index in June 2005. This opens up for several new research areas. Although it initially is based on only 37 hedge funds and thereby will suffer from several weaknesses (e.g. one large fund or one style might dominate the index) it would be interesting to evaluate the index's role as a benchmark for the Swedish hedge fund market especially for Fund of Hedge Funds which constitute about one half of the Swedish hedge fund market. Furthermore, the index itself might be useful as an indicator of the Swedish hedge fund managers' skill and choice of style compared to the international competition.

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Databases

EDHEC
EBSCO
ELIN@Lund
Emerald Insight
LIBRIS
Reuters 3000Xtra
SIX Trust

Electronic sources

The information collected from on the following electronic websites was gathered during a time period of 8 weeks, because of this no single date can be mentioned. However, we entered each of the sites on the 27th of May in order to see that the information is still available.

The hedge funds

www.alterum.se	Alterum Fondkommission AB
www.banco.se	Banco Fonder AB
www.brummer.se	Brummer & Partners
www.cicerofonder.se	Cicero Fonder
www.fmg.se	FMG Fund Managers Limited
www.futuris.se	Futuris Asset Management AB
www.gam.com	GAM
www.handelsbanken.se/fonder	Handelsbanken Fonder
www.hlunden.se	H Lundén Kapitalförvaltning AB
www.hqfonder.se	HQ Fund Management Company S.A
www.lynxhedge.se	Lynx Asset Management AB
www.manticore.se	Manticore Capital AB
www.nordea.se/fonder	Nordea Fonder AB
www.seb.se/fonder	SEB Fonder AB
www.sectormanagement.com	Sector Management AB
www.tanglin.se	Tanglin Investment Management AB

Other

www.fi.se	Finans Inspektionen
www.thefa.org	Hedge Fund Association
www.hedgeco.net	HedgeCo.net
www.morningstar.se	Morningstar
www.aima.org	Alternative Investment Association
www.tremont.com/tass	Tass Reasearch
www.hedgefundresearch.com	HFR
www.edhec-risk.com	Edhec-risk Asset Management Research

Interviews

Borgeström, Filip, Investor Relations, Brummer & Partners, Telephone and e-mail interview, 19th of May, 2005.

Ekberg, Johan, Analys and method, Morningstar, E-mail interview, 21st of April, 2005.

Larsson, Frank, Portfolio manager, Handelsbankens Hedgefond Aktie Europa, Handelsbanken Fonder, Telephone and e-mail interview, 11th of May and 16th of May, 2005.

Lundqvist, Annica, Data collection, Morningstar, E-mail interview, 19th of May, 2005.

Schaaf, Joakim, Fund supervisor, Justice Department, FI, E-mail interview, 23rd of May, 2005.

7 APPENDICES

Appendix A – The Swedish law regulating hedge funds

Funds in Sweden are regulated by "Lagen om Investeringsfonder" (2004:46) (Translation: The Law concerning Investment Funds). This law replaced "Lagen om värdepappersfonder" (1990:1114) (Translation: The Law Concerning Security Funds), the 1 of April 2004.

The Swedish law is based on the EC regulation, more specifically on the UCITS directive (85/611/EEG). The EC directive regulates the EC harmonized funds, which in Sweden are referred to as "Värdepappersfonder" (Translation: Security Funds). The reason behind the update of the Swedish law was due to changes within the UCITS directive. The funds regulated by the EC directive have no restrictions on where within the EES they can market and seek investors. Though, they need to apply to be registered in that particular country.

In addition and in contradiction to the UCITS directive, the Swedish law regulates hedge funds. There is no clear definition of hedge funds. Instead they are classified as a particular category of Special fund. Special funds and Security funds are together referred to as Investment funds. Special funds however, in contrast to Security funds, are not harmonized and therefore not allowed to be marketed and sold within the EES without regulations.

All Investment funds, including hedge funds, have the same basic structure. They need to have permission to act on a market and are under The Swedish Financial Supervisory Authority, Finansinspektionen, (FI) supervision. In addition, every fund needs to have a deposit institute. The deposit institute will hold the assets and exerts some control over the fund's operation.

The main difference between special funds and mutual funds is the rules that regulate their investment opportunities. Hedge funds can apply for permission at FI to use short selling and non-traditional financial instruments and securities. However, the fund's regulations must state that it is possible. In addition, hedge funds are able to receive permission to have a higher investment grade in the same company (mutual funds, only 10%), though the fund regulation must specify to what degree

Foreign special funds that wish to sell to Swedish investors needs permission from the FI. Permission is granted if the fund could have been grounded in Sweden and are controlled by a recognized institute in their native country. The FI have not yet taken a decision on whether

offshore hedge funds, which usually are under no formal controle, will be permitted in the Swedish market.

Source: Schaaf, Joakim, Fund supervisor, Justice department, FI, 23rd of May, 2005

Appendix B – Fund fact sheet

	Atlas Global Strategy Fund	Banco Hedge	Cicero Hedge
Webpage:	www.alterum.se	www.banco.se	www.cicerofonder.se
Fund management:	Alterum Fondkommission AB	Banco Foder AB	Cicero Fonder
Interceptiondate:	30 June 1994	1997-12-29	2001-01-01
Fund asset:	USD 61.24 M	777,8 M SEK	No information
Minimum subscription:	$ 250,000	4000 SEK	100,000 SEK
Redemption frequency:	Monthly	No information	Monthly
Benchmark:	Balanced World Index	OMRX T-bill	90 days STIBOR
Purchase fee:	up to 4%	0,0%	1,0%
Management fee:	2%	1,1%	0,7%
Performance fee:	None	20,0% (max)	20,0%
Number of managers:	20-30	No information	No information
Geographical markets:	Global	Mainly Sweden	Mainly Sweden
Investment objectives:	Global Macro	Market neutral; tactical allocation between the stock- and intersetmarket; placements in stocks of mediumsized Swedish companies with low risk and stable cash flow; and active management of the interest portfolio.	Equity Market Neutral

	Eikos	FMG Bio-Med Hedge Fund (USD/EURO)	FMG Hi-Tech Hedge Fund
Webpage:	www.hlunden.se	www.fmg.se	www.fmg.se
Fund management:	H Lundén Kapitalförvaltning AB	FMG Fund Managers Limited	FMG Fund Managers Limited
Interceptiondate:	2000-01-01	2000-07-01	1999-10-01
Fund asset:	3548 M SEK	No information	No information
Minimum subscription:	500,000 SEK	USD 100,000 or EURO 100,000	USD 100,000 orEURO 100,000
Redemption frequency:	Quarterly	Monthly	Monthly
Benchmark:	SSVX 90	LIBOR	LIBOR
Purchase fee:	3,0%	Up to 5%	Up to 5%
Management fee:	1,0%	1,5%	1,5%
Performance fee:	20,0%	10,0%	10,0%
Number of managers:	ca 2-4	ca 10-15	8.
Geographical markets:	Nordic countries, Estonia and Poland	Global, focus on USA	Global, focus on USA
Investment objectives:	No clear information	Long/Short Equity, (Healthcare)	Long/Short Equity (Technology)

	Futuris	GAM European Hedge Open	GAM Japan Hedge (EURO)
Webpage:	www.futuris.se	www.gam.com	www.gam.com
Fund management:	Futuris Asset Management AB	GAM	GAM
Interceptiondate:	1999-10-15	1999-01-27	1999-06-30
Fund asset:	EURO 312 M	EURO 629,6 M	EURO 409,4 M
Minimum subscription:	EURO 100,000	EURO 5000	EURO 5000
Redemption frequency:	Quarterly	Mondays	Mondays
Benchmark:	LIBOR 90 days EURO	No information	No information
Purchase fee:	up to 5,0%	Up tp 5%	Up to 5%
Management fee:	1,0%	1,5%	1,4%
Performance fee:	20,0%	20,0%	20,0%
Number of managers:	4.	No information	No information
Geographical markets:	Europe and Nordic	Europe	Japan
Investment objectives:	Long/Short Equity	Long-Short Equity	Long-Short Equity and Fixed Income Arbitrage - *Relative Vale*

	GAM Japan Hedge USD	Handelsbankens Hedgefond Aktie Europa	HQ Total A and B
Webpage:	www.gam.com	www.handelsbanken.se/fonder	www.hqfonder.se
Fund management:	GAM	Handelsbanken	HQ Fund Management Company S.A
Interceptiondate:	1998-06-08	2000-10-31	1999-12-28
Fund asset:	USD 525,8 M	1,800 M SEK	90 M SEK
Minimum subscription:	USD 5000	50,000 SEK	No information
Redemption frequency:	Mondays	Monthly	No information
Benchmark:	No information	STIBOR 30	OMRX-TBILL
Purchase fee:	Up to 5%	0,0%	0,0%
Management fee:	1,4%	0,7%	0,75%
Performance fee:	20,0%	max 20,0%	20,0%
Number of managers:	No information	3.	4.
Geographical markets:	Japan	Europe, focus on Sweden	Global
Investment objectives:	Long-Short Equity and Fixed Income Arbitrage - Relative Vale	Long/Short Equity; bonds; derivatives; currencies; etc.	Long/Short Equity

	Lynx	Manticore	Nektar
Webpage:	www.lynxhedge.se	www.manticore.se	www.brummer.se
Fund management:	Lynx Asset Management AB	Manticore Capital AB	Nektar Asset Management AB
Interceptiondate:	2000-05-01	2001-01-01	1998-01-01
Fund asset:	1500 M SEK	998 M SEK	6352 M SEK
Minimum subscription:	500,000 SEK	500,000 SEK	500,000 SEK
Redemption frequency:	Monthly	Quarterly	Quarterly
Benchmark:	No information	SSVX 90	SSVX + 4 procentagepoints
Purchase fee:	0,0%	1% (max 25,000 SEK)	1% (0% in purchase over 2,5 M SEK)
Management fee:	1,0%	1,0%	1,0%
Performance fee:	20,0%	20,0%	30,0%
Number of managers:	3.	2.	13.
Geographical markets:	Global	Global	Global
Investment objectives:	Futures; Equity; Bonds; Interest rates; and Currencies	Long-Short Equity (technology; media; and telecommunication)	Equity Market Neutral; Fixed Income Arbitrage - Market neutral

	Nordea European Equity Hedge Fund	SEB Hedgefond Equity	Sector Hedge (Sector management)
Webpage:	www.nordea.se/fonder	www.seb.se/fonder	www.sectormanagement.com
Fund management:	Nordea Fonder AB	SEB Fonder AB	Sector Management AB
Interceptiondate:	2002-02-28	1999-11-01	1997-11-23
Fund asset:	ca 1370 M SEK	18,9 M SEK	No information
Minimum subscription:	10,000 SEK	250,000 SEK	25,000 SEK
Redemption frequency:	Monthly	The fund is not open to new investments	No information
Benchmark:	STIBOR 30	No information	Average of the latest 6 months SSVX 90
Purchase fee:	0%	0,0%	5,0%
Management fee:	1%	0,5%	1,5%
Performance fee:	20%	No information	20,0%
Number of managers:	2.	No information	2.
Geographical markets:	Europe	Europe	Global, focus on Nordic
Investment objectives:	Long/Short Equity	Long/Short Equity; and Interest rates	Long/Short Equity, The fund have changed owner and manager twice since it was founded, (1999 and 2002)

	Tanglin	Trevise Hedge	Zenit
Webpage:	www.tanglin.se	www.nordea.se	www.brummer.se
Fund management:	Tanglin Investment Management AB	Nordea Fonder AB	Zenit Asset Management AB
Interceptiondate:	2000-07-31	1999-03-01	1996-07-01
Fund asset:	3847 M SEK	8.6 M SEK	7151 M SEK
Minimum subscription:	500,000 SEK	10,000 SEK	500,000 SEK
Redemption frequency:	Monthly	Monthly	Quarterly
Benchmark:	STIBOR 30 days	SSVX 180 + 1 percentagepoint	Average SSVX 90 of one quarter
Purchase fee:	5,0%	0,0%	1,0%
Management fee:	1,0%	0,0%	0,75%
Performance fee:	20,0%	20,0%	20,0%
Number of managers:	4.	No information	5.
Geographical markets:	Europe, USA (OECD)	Mainly Sweden	Global
Investment objectives:	Global Macro	Equity and equity related instruments; deposit securities; bonds; options; futures and debt	Long/Short Equity

Appendix C – Statistical test of the proposed model

This section is based on general statistical methods. (For references see Wooldridge, 2003; Hill, Griffiths, & Judge; 2001a, 2001b; Campbell, Lo, & MacKinlay, 1997)

Recall our linear regression model:

$$R_{it} = \alpha_i + \sum_{k=1}^{K} \beta_k I_{kt} + \varepsilon_{it}, \qquad i = 1, ...,n; \qquad t = 1, ..., T$$

Before running our regressions we tested for multicollinearity among our independent variables, thus we made sure that our 13 indices were not displaying that high intercorrelation that it would cause problems later on. At this stage we excluded the hedge fund styles Funds of Funds, Event Driven, and Short Selling.

After controlling for correlation between the hedge fund indices we pressed on running our 23 regressions, one for each individual fund. To make sure that our regression analysis was correctly conducted we ran a series of statistical tests. Firstly, we ran our multiple regressions using EVIEWS. Secondly, we checked for normality by looking at the distribution of the residuals. Thirdly, we checked for heteroskedasticity by using White's test. Fourthly, we tested for serial correlation between the residuals by performing Breusch-Godfrey Serial Correlation LM Test. In addition we performed the Ramsey misspecification test.

Since in our study, we had included 23 different hedge funds, we needed to run the equivalent number of regressions and the associated tests just mentioned. Rather than displaying all of the complete regressions and tests we give three visual examples. If the interest does exist, we are more than happy to provide the reader with the files on all the tests.

Testing for multicollinearity

When there is an unacceptably high level of correlation between the independent factors, such that the effects of the independent factors cannot be separated, we have multicollinearity. This means that, estimates are unbiased but assessments of the relative strength of the explanatory variables and their joint effect are unreliable. More explicit this means that, our β weights or factor loadings and R^2s cannot be interpreted reliably, despite the fact that the predicted values

are still the best estimate using the given independent variables. A guiding principle or rule of thumb is to say that a problem with multicollinearity exists if the intercorrelation among the independents is above .80. Also, high multicollinearity could be prevalent if we receive a high R^2 and significant F tests of the model together with non-significant t-tests of coefficients.

Implications of high multicollinearity are large variances and covariances, large confidence intervals, and insignificant significance coefficients. Thus the explanation power is low and the chance of thinking you do not have a relationship when in fact one exists or failure to reject the null hypothesis that the coefficients are not different from zero is high..

Testing normality of residuals

If the sample includes few observations the residual terms need to be normally distributed. This is required to be able to construct confidence intervals and make hypothesis tests on the parameters of the model. Therefore our inference rests on this assumption of normally distributed residual terms. We test the reasonability of the assumption by performing a Jarque-Bera test, whereby we check if the skewness and the kurtosis of the distribution of the residual terms resemble the normal distribution.

Thus, the Jarque-Bera test means testing whether the series is normally distributed. The test statistic measures the difference of the skewness and kurtosis of the series with those from the normal distribution. The statistic is computed as:

$$JB = \frac{N-k}{6} * \left(S^2 + \frac{(K-3)^2}{4} \right)$$

Where S represents the skewness, K represents the kurtosis, and k represents the number of estimated coefficients used to create the series. When the residuals are normally distributed K is equal to 3.

A very large JB test statistic means the null hypothesis of normal distribution is rejected. The reported 'Probability' is the probability that the JB test statistic exceeds the observed value under the null hypothesis. A number of less than 0.05 means we would reject the null hypothesis of a normal distribution at the 5% level of significance.

Non-normally distributed residuals may be caused by several factors, e.g. functional form misspecification, heteroskedasticity, omitted variables, serial correlation, the presence of outliers (very large or very small observations in the data). If the residuals are not normally distributed it is necessary to adjust the model in some way, whereby the residuals are made approximately normal.

Testing for Heteroskedasticity

Homoskedasticity means that the variance of the error terms is constant, i.e. var(ε_i) = constant, and more explicit that the variance of ε_i is the same for all observations in the sample, and thus, the variance of R_i is the same for all observations in the sample. The uncertainty in R_i is the same amount when I_i is small as when I_i is a large. When heteroskedasticity prevails, the spread of the dependent variable R could depend on the value of I.

When heteroskedasticity prevails,

- Estimators, the coefficients, for both the initial regression and the regression with White's robust estimators are unbiased and consistent.
- Standard errors in standard results are wrong or incorrect, why we cannot use these for deciding whether the variables are significant or not.
- Standard errors in White results are correct, hence can be used for making correct inference.
- Estimators are not efficient, i.e. they don't have minimum standard errors. To do better we need to know the exact nature of the heteroskedasticity.

Testing for Autocorrelation

It is commonly found in time series regressions that the residuals are correlated with their own lagged values. This violates the standard assumption of that disturbances are not correlated with other disturbances. The implications of serial correlation are: OLS is no longer efficient among linear estimators; prior residuals help to predict current residuals, why this information can be taken advantage of to form a better prediction of the dependent variable; standard errors computed using the OLS formula are not correct and are generally understated; and if there are lagged dependent variables on the right-hand side, OLS estimates are biased and inconsistent. If, corr (ε_i, ε_j) = 0 for all $t \neq j$, there is no correlation between residuals across time.

The Durbin-Watson Test is used for large samples, and for testing if there is the correlation between the residual at period t and the residual at t-1. The value of DW ranges from 0 to 4. Values close to 0 indicate extreme positive autocorrelation; close to 4 indicates extreme negative autocorrelation; and close to 2 means that there is no serial autocorrelation prevalent. As a rule of thumb, DW ought to be between 1.5 and 2.5 to indicate independence of observations. Positive autocorrelation means standard errors of the ß coefficients are too small. Negative autocorrelation means standard errors are too large.

The rejection of the hypothesis of autocorrelation could also be decided on basis of the probability value of the DW. The DW value has an association probability value for various significance cutoffs, in our case 5%. For this given level of significance such as an upper and a lower DW value limit exist. If the computed DW value is more than the upper limit, the null hypothesis of no autocorrelation is not rejected and it is assumed that errors are serially uncorrelated. If the computed DW value is less than the lower limit, the null hypothesis is rejected and it is assumed that errors are serially correlated. If the computed value is in-between the two limits, the result is inconclusive.

The Breusch-Godfrey test is used for detecting serial correlation of higher order, ie. autocorrelation AR(p). It is based on a test-equation: the residuals are explained by its lagged values, where p is the number of lags included in the test-equation, and all exogenous variables of the original equation. The presence of AR(p) autocorrelation is tested by the use of a Chi-square-statistic. Under the null hypothesis the test statistic is asymptotically Chi-squared with degrees of freedom as given by the parameters. The starting values for the lagged residuals in the supplementary regression are chosen to be 0.

Testing for misspecification

Ramsey's general test of specification error of functional form is an F test of differences of R^2 under linear versus nonlinear assumptions. It is frequently used in time series analysis to test whether power transforms need to be added to the model. For a linear model that is properly functionally specified, nonlinear transforms of the fitted values should not be useful in predicting the dependent variable. It should be pointed out that it is a linearity test, not a general specification test, i.e. it tests if any nonlinear transforms of the specified independent variables have been omitted. It does not test whether other relevant linear or nonlinear variables have been

omitted. Output from the test reports the test regression and the F-statistic and log likelihood ratio for testing the hypothesis that the coefficients on the powers of fitted values are all zero.

As a rule of thumb, the lower the overall effect, e.g. R^2 , the more likely it is that we have omitted important variables from the model and that existing interpretations of the model would change when the model is correctly specified. The problem with specification grows smaller when the research task is to compare models, to see which has a better fit to the data, in contrast to when the research task is to justify one model and assess the relative importance of the independent factors.

Atlas Global

In Figure I, the normality test is displayed. We see that the residuals are normally distributed since kurtosis is close to 3 and the JB statistic is insignificant at probability 88%.

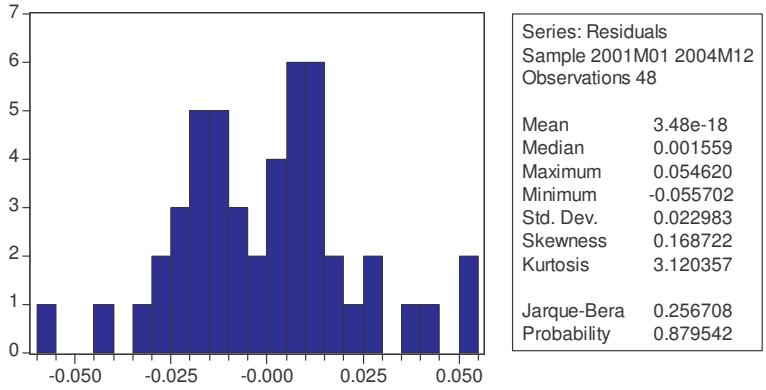

Figure I. Normality test.

In Table I, the regression result is displayed. We see that at the 5% significance level Fixed Income Arbitrage, Long/Short Equity, and Relative Value are significant.

Convertible Arbitrage is only significant at 10% level.

Table I. Regression output.

Dependent Variable: A_TLAS
Method: Least Squares
Sample: 2001:01 2004:12
Included observations: 48

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Convertible Arbitrage	1.029677	0.518092	1.987439	0.0543
CTA_Global	-0.047943	0.232544	-0.206166	0.8378
Distressed Securities	-0.418787	0.447384	-0.936080	0.3553
Emerging Markets	0.081565	0.079979	1.019833	0.3144
Equity Market Neutral	-1.256092	1.268607	-0.990136	0.3285
Fixed Income Arbitrage	3.309572	1.117820	2.960737	0.0053
Global Macro	0.569106	0.736498	0.772719	0.4446
Long/Short Equity	1.793754	0.577672	3.105142	0.0036
Merger Arbitrage	1.073914	0.814634	1.318278	0.1955
Relative Value	-3.537807	1.154126	-3.065356	0.0040
C	0.001733	0.007469	0.232052	0.8178

R-squared	0.494598	Mean dependent var	0.010585
Adjusted R-squared	0.358003	S.D. dependent var	0.032328
S.E. of regression	0.025903	Akaike info criterion	-4.270870
Sum squared resid	0.024826	Schwarz criterion	-3.842054
Log likelihood	113.5009	F-statistic	3.620901
Durbin-Watson stat	1.850438	Prob(F-statistic)	0.001974

We performed the White's heteroskedasticity test but as the F statistic shows, in Table II, we fail to reject the null of homoskedasticity.

Table II. Heteroskedasticity test.

White Heteroskedasticity Test:

F-statistic	0.999417	Probability	0.492238
Obs*R-squared	20.41869	Probability	0.432027

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Sample: 2001:01 2004:12
Included observations: 48

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000444	0.000312	1.424222	0.1658
CONV_ARB	-0.005229	0.018622	-0.280801	0.7810
CONV_ARBE^2	0.741187	1.101590	0.672834	0.5068
CTA_GLOBAL	-0.002850	0.008485	-0.335931	0.7395
CTA_GLOBAL^2	0.183563	0.163727	1.121152	0.2721
DISTRESS	-0.048968	0.033665	-1.454574	0.1573
DISTRESS^2	1.287181	0.937738	1.372644	0.1812
EMERG_MKTS	-0.001002	0.002927	-0.342335	0.7347
EMERG_MKTS^2	-0.011830	0.027651	-0.427834	0.6722
EQ_MKT_NEU	0.007769	0.069631	0.111577	0.9120
EQ_MKT_NEU^2	2.862516	5.901841	0.485021	0.6316
FIX_INC_ARB	0.022753	0.038993	0.583513	0.5644
FIX_INCE_ARB^2	-3.464876	3.200538	-1.082592	0.2886
GLOBAL_MACRO	0.039172	0.032123	1.219440	0.2332
GLOBAL_MACRO^2	0.009713	1.137533	0.008538	0.9933
LONG/SHORT_	-0.007225	0.020171	-0.358169	0.7230
LONG/SHORT^2	-0.491519	0.580921	-0.846103	0.4049
MERG_ARB	-0.016780	0.033557	-0.500048	0.6211
MERG_ARB^2	1.968476	2.224073	0.885077	0.3839
REL_VAL	0.022478	0.047946	0.468814	0.6430
REL_VAL^2	-2.037352	1.799401	-1.132239	0.2675

R-squared	0.425389	Mean dependent var	0.000517
Adjusted R-squared	-0.000248	S.D. dependent var	0.000761
S.E. of regression	0.000761	Akaike info criterion	-11.22376
Sum squared resid	1.56E-05	Schwarz criterion	-10.40511
Log likelihood	290.3703	F-statistic	0.999417
Durbin-Watson stat	1.588660	Prob(F-statistic)	0.492238

In Table III, the result of the autocorrelation test is presented. Looking at the probability of the F statistic makes it clear that no serial correlation between the residuals across time exists.

Table III. Autocorrelation test.

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.153798	Probability	0.858022
Obs*R-squared	0.418170	Probability	0.811326

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Convertible Arbitrage	0.034322	0.533964	0.064277	0.9491
CTA_Global	-0.073848	0.278300	-0.265355	0.7923
Distressed Securities	-0.051462	0.469688	-0.109567	0.9134
Emerging Markets	-0.001565	0.082019	-0.019081	0.9849
Equity Market Neutral	-0.076723	1.321375	-0.058063	0.9540
Fixed Income Arbitrage	0.011613	1.202251	0.009660	0.9923
Global Macro	0.187224	0.833996	0.224491	0.8237
Long/Short Equity	-0.003516	0.595733	-0.005903	0.9953
Merger Arbitrage	-0.025039	0.854467	-0.029303	0.9768
Relative Value	-0.076790	1.191701	-0.064437	0.9490
C	0.000584	0.007912	0.073876	0.9415
RESID(-1)	0.111860	0.209763	0.533269	0.5972
RESID(-2)	-0.024277	0.204409	-0.118768	0.9061

R-squared	0.008712	Mean dependent var	3.89E-18
Adjusted R-squared	-0.331158	S.D. dependent var	0.022983
S.E. of regression	0.026516	Akaike info criterion	-4.196287
Sum squared resid	0.024609	Schwarz criterion	-3.689504
Log likelihood	113.7109	F-statistic	0.025633
Durbin-Watson stat	2.019460	Prob(F-statistic)	1.000000

In Table IV, the result of the misspecification test is shown. We see no indication of model being misspecified, that is the linear model seems appropriate.

Table IV. Misspecification test.

Ramsey RESET Test:

F-statistic	0.363682	Probability	0.697708
Log likelihood ratio	0.987304	Probability	0.610393

Test Equation:
Dependent Variable: A_TLAS
Method: Least Squares
Sample: 2001:01 2004:12
Included observations: 48

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Convertible Arbitrage	1.105345	0.535080	2.065758	0.0463
CTA_Global	-0.068132	0.238359	-0.285839	0.7767
Distressed Securities	-0.454070	0.478435	-0.949074	0.3491
Emerging Markets	0.078142	0.081620	0.957389	0.3449
Equity Market Neutral	-1.303339	1.310868	-0.994257	0.3269
Fixed Income Arbitrage	3.668549	1.297869	2.826595	0.0077
Global Macro	0.765924	0.788758	0.971050	0.3382
Long/Short Equity	1.951654	0.650549	3.000011	0.0049
Merger Arbitrage	1.121865	0.841405	1.333323	0.1910
Relative Value	-3.888761	1.248427	-3.114928	0.0037
C	0.002131	0.008282	0.257282	0.7985
FITTED^2	-2.927439	12.52569	-0.233715	0.8166
FITTED^3	-19.01206	160.0711	-0.118773	0.9061

R-squared	0.504887	Mean dependent var	0.010585
Adjusted R-squared	0.335134	S.D. dependent var	0.032328
S.E. of regression	0.026360	Akaike info criterion	-4.208106
Sum squared resid	0.024320	Schwarz criterion	-3.701322
Log likelihood	113.9945	F-statistic	2.974246
Durbin-Watson stat	1.968013	Prob(F-statistic)	0.005895

SEB Hedgefond Equity

The result of the normality test is shown in Figure II. We see that kurtosis, K, has a value close to 3. Furthermore, JB statistic is insignificant with a probability of 68%. Thus, the residuals seem to be normally distributed.

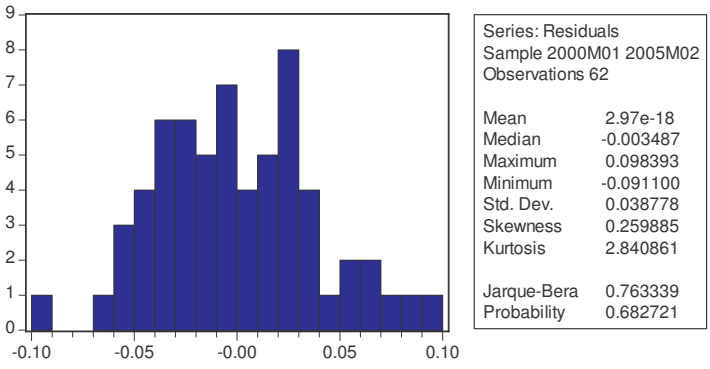

Figure II. Normality test.

The result of the autocorrelation test is shown in Table V. The Breusch-Godfrey F statistic is significant, indicating that the added lagged terms are indeed significant and serial correlation is prevalent. The probability is low at 0.6%

Table V. Autocorrelation test.

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	5.650703	Probability	0.006191
Obs*R-squared	11.61975	Probability	0.002998

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Convertible Arbitrage	-0.120019	0.716424	-0.167525	0.8676
CTA Global	-0.282429	0.301365	-0.937167	0.3533
Distress Securities	-0.027045	0.606233	-0.044612	0.9646
Emerging Markets	-0.398847	0.471837	-0.845306	0.4020
Equity Market Neutral	-0.816357	1.418884	-0.575351	0.5677
Fixed Income Arbitrage	-0.482100	1.359502	-0.354615	0.7244
Global Macro	1.048403	0.963875	1.087697	0.2821
Long/Short Equity	-0.188876	0.669532	-0.282102	0.7791
Merger Arbitrage	-0.330313	1.127717	-0.292904	0.7708
Relative Value	0.655786	1.587350	0.413132	0.6813
C	0.006458	0.010194	0.633475	0.5294
RESID(-1)	0.440632	0.150415	2.929442	0.0051
RESID(-2)	0.088500	0.157616	0.561493	0.5770

R-squared	0.187415	Mean dependent var	4.20E-18
Adjusted R-squared	-0.011585	S.D. dependent var	0.038778
S.E. of regression	0.039002	Akaike info criterion	-3.466371
Sum squared resid	0.074536	Schwarz criterion	-3.020359
Log likelihood	120.4575	F-statistic	0.941784
Durbin-Watson stat	1.822412	Prob(F-statistic)	0.514707

Thus, to adjust for the found autocorrelation we ran the regression with Newey West's robust estimator. The result is shown in table VI.

Table VI. Newey West's Robust Estimator

Dependent Variable: SEB Hedgefond Equity
Method: Least Squares
Sample: 2000:01 2005:02
Included observations: 62
Newey-West HAC Standard Errors & Covariance (lag truncation=3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Convertible Arbitrage	1.275557	0.846444	1.506960	0.1380
CTA Global	0.162820	0.274745	0.592621	0.5561
Distress Securities	-0.238275	0.573953	-0.415146	0.6798
Emerging Markets	-0.337307	0.456711	-0.738556	0.4636
Equity Market Neutral	-0.672444	1.703882	-0.394654	0.6947
Fixed Income Arbitrage	1.243108	1.206503	1.030340	0.3077
Global Macro	-0.260841	0.792872	-0.328983	0.7435
Long/Short Equity	1.731323	0.702707	2.463792	0.0172
Merger Arbitrage	1.393711	1.369853	1.017417	0.3138
Relative Value	-2.290748	1.982271	-1.155618	0.2532
C	0.003056	0.008195	0.372900	0.7108

R-squared	0.272330	Mean dependent var	0.010105
Adjusted R-squared	0.129649	S.D. dependent var	0.045459
S.E. of regression	0.042410	Akaike info criterion	-3.323352
Sum squared resid	0.091727	Schwarz criterion	-2.945957
Log likelihood	114.0239	F-statistic	1.908670
Durbin-Watson stat	1.114152	Prob(F-statistic)	0.065412

We performed the heteroskedasticity test and the result is displayed in Table VII. We notice that the F statistic is not significant. This means we fail to reject the null of homoskedasticity. However, probability is low at 6.7%, just above 5%.

Table VII. Heteroskedasticity test.

White Heteroskedasticity Test:

F-statistic	1.733572	Probability	0.067351
Obs*R-squared	28.40740	Probability	0.100101

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Sample: 2000:01 2005:02
Included observations: 62
Newey-West HAC Standard Errors & Covariance (lag truncation=3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001130	0.000424	2.665980	0.0109
CONV_ARB	0.023465	0.024241	0.968000	0.3387
CONV_ARB^2	2.813489	3.194065	0.880849	0.3835
CTA_GLOBAL	0.003997	0.012278	0.325503	0.7465
CTA_GLOBAL^2	-0.215410	0.237367	-0.907498	0.3694
DISTRESS	-0.048919	0.029793	-1.641968	0.1082
DISTRESS^2	-0.024405	1.116655	-0.021855	0.9827
EMERG_MKTS	0.007450	0.015694	0.474709	0.6375
EMERG_MKTS^2	-0.296973	0.547592	-0.542326	0.5905
EQ_MKT_NEU	-0.139585	0.093878	-1.486870	0.1447
EQ_MKT_NEU^2	14.85340	6.794070	2.186229	0.0346
FIX_INC_ARB	0.097108	0.051104	1.900220	0.0645
FIX_INC_ARB^2	-2.724361	4.928571	-0.552769	0.5834
GLOBAL_MACRO	0.008739	0.035561	0.245732	0.8071
GLOBAL_MACRO^2	-1.153472	1.166694	-0.988667	0.3286
LONG_SHORT_EQ	0.016361	0.027344	0.598342	0.5529
LONG_SHORT_EQ^2	-0.715988	0.697433	-1.026605	0.3106
MERG_ARB	-0.035090	0.061271	-0.572710	0.5700
MERG_ARB^2	7.520726	4.854715	1.549159	0.1290
REL_VAL	0.060137	0.089477	0.672098	0.5053
REL_VAL^2	-4.776719	3.210508	-1.487839	0.1444

R-squared	0.458184	Mean dependent var	0.001479
Adjusted R-squared	0.193883	S.D. dependent var	0.002024
S.E. of regression	0.001817	Akaike info criterion	-9.519435
Sum squared resid	0.000135	Schwarz criterion	-8.798954
Log likelihood	316.1025	F-statistic	1.733572
Durbin-Watson stat	1.676958	Prob(F-statistic)	0.067351

The Ramsey test is shown in Table VIII. Looking at the F statistic it is clear that we might have a non-linear relationship at hand since the probability is only 2%.

Table VIII. Misspecification test.

Ramsey RESET Test:

F-statistic	4.150340	Probability	0.021622
Log likelihood ratio	9.702517	Probability	0.007819

Test Equation:
Dependent Variable: SEB_
Method: Least Squares
Sample: 2000:01 2005:02
Included observations: 62
Newey-West HAC Standard Errors & Covariance (lag truncation=3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Convertible Arbitrage	0.493023	0.736169	0.669715	0.5062
CTA_Global	0.380318	0.321658	1.182368	0.2428
Distressed Securities	-0.228081	0.504027	-0.452517	0.6529
Emerging Markets	-0.238533	0.398704	-0.598270	0.5524
Equity Market Neutral	-1.535661	1.523487	-1.007991	0.3184
Fixed Income Arbitrage	0.638883	1.364635	0.468171	0.6417
Global Macro	-0.500264	0.847836	-0.590048	0.5579
Long/Short Equity	0.700391	0.779096	0.898979	0.3731
Merger Arbitrage	0.889761	1.257782	0.707405	0.4827
Relative Value	0.015446	2.193797	0.007041	0.9944
C	0.007081	0.007650	0.925731	0.3591
FITTED^2	-5.096726	13.22168	-0.385482	0.7015
FITTED^3	196.9415	127.8780	1.540074	0.1300

R-squared	0.377741	Mean dependent var	0.010105
Adjusted R-squared	0.225352	S.D. dependent var	0.045459
S.E. of regression	0.040010	Akaike info criterion	-3.415328
Sum squared resid	0.078440	Schwarz criterion	-2.969316
Log likelihood	118.8752	F-statistic	2.478783
Durbin-Watson stat	1.456632	Prob(F-statistic)	0.012735

Sector Hedge

When testing for whether residuals are normally distributed or not we turn to Figure III. We detect that the residuals take on a somewhat bell-shaped form. We also notice that K is nearly equal to 3 and the JB statistic is insignificant. Thus, the residuals seem to be normally distributed.

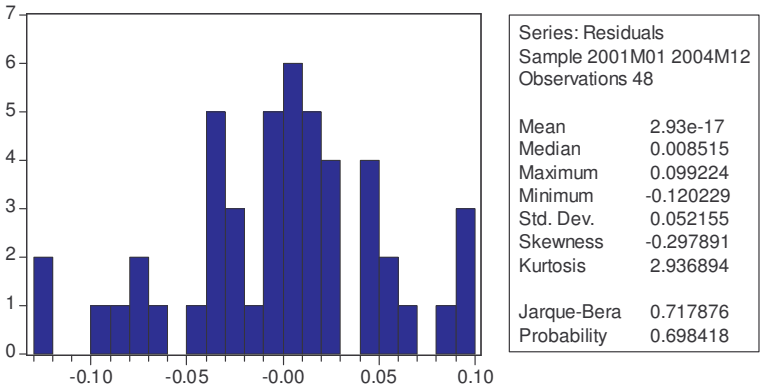

Figure III. Normality test.

Turning to Table IX, where the results of the performed heteroskedasticity test is displayed, we notice that the F statistic is significant and thereby indicating that the model suffers from heteroskedasticity. Probability is very low at 0.26%.

Table IX. Heteroskedasticity test.

White Heteroskedasticity Test:

F-statistic	3.211567	Probability	0.002627
Obs*R-squared	33.79435	Probability	0.027550

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 05/22/05 Time: 19:11
Sample: 2001:01 2004:12
Included observations: 48

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.000968	0.001142	-0.847643	0.4041
Convertible Arbitrage	0.015131	0.068475	0.220968	0.8268
CONV_ARB^2	0.633561	3.979563	0.159204	0.8747
CTA Global	-0.078139	0.030388	-2.571406	0.0160
CTA_GLOBAL^2	0.034088	0.535620	0.063642	0.9497
Distress	-0.093487	0.118809	-0.786865	0.4382
DISTRESS^2	2.532342	3.323957	0.761846	0.4528
Emerging Markets	0.035972	0.052269	0.688208	0.4972
EMERG_MKTS^2	0.869089	1.189552	0.730601	0.4713
Equity markets Neutral	0.205277	0.252568	0.812758	0.4235
EQ_MKT_NEU^2	15.12643	21.30371	0.710037	0.4838
Fixed Income Arbitrage	-0.047195	0.136496	-0.345761	0.7322
FIX_INC_ARB^2	28.41394	11.56831	2.456188	0.0208
Global Macro	0.206598	0.124527	1.659067	0.1087
GLOBAL_MACRO^2	-2.230445	4.046278	-0.551234	0.5860
Long/Short Equity	-0.090937	0.074017	-1.228586	0.2298
LONG_SHORT_EQ^2	5.809603	2.077491	2.796452	0.0094
Merger Arbitrage	-0.109532	0.111811	-0.979622	0.3360
MERG_ARB^2	-5.033253	7.932670	-0.634497	0.5311
Relative Value	0.009114	0.166302	0.054803	0.9567
REL_VAL^2	-12.20544	7.733579	-1.578239	0.1262

R-squared	0.704049	Mean dependent var	0.002663
Adjusted R-squared	0.484826	S.D. dependent var	0.003746
S.E. of regression	0.002689	Akaike info criterion	-8.699845
Sum squared resid	0.000195	Schwarz criterion	-7.881194
Log likelihood	229.7963	F-statistic	3.211567
Durbin-Watson stat	2.184733	Prob(F-statistic)	0.002627

To be able to make inference we ran another regression using the White's heteroskedasticity robust estimators, thus receiving the more correct standard errors and covariances. The result is shown in Table X.

Table X. White's Robust Estimators.

Dependent Variable: Sector Hedge
Method: Least Squares
Included observations: 48
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient (β)	Std. Error	t-Statistic	Prob.
Convertible Arbitrage	1.583659	1.053140	1.503749	0.1411
CTA Global	-0.118628	0.672749	-0.176334	0.8610
DISTRESS	-3.271116	0.871713	-3.752515	0.0006
Emerging Markets	-1.208875	0.952244	-1.269501	0.2122
Equity markets Neutral	-8.314519	3.230570	-2.573700	0.0142
Fixed Income Arbitrage	4.584727	2.640451	1.736342	0.0908
Global Macro	1.388841	1.991025	0.697551	0.4898
Long/Short Equity	7.170278	1.492056	4.805637	0.0000
Merger Arbitrage	-2.521178	1.389205	-1.814835	0.0777
Relative Value	1.067980	2.839967	0.376054	0.7090
C	0.017861	0.012092	1.477036	0.1481

R-squared	0.737458	Mean dependent var	-0.005400
Adjusted R-squared	0.666501	S.D. dependent var	0.101788
S.E. of regression	0.058782	Akaike info criterion	-2.631913
Sum squared resid	0.127847	Schwarz criterion	-2.203096
Log likelihood	74.16590	F-statistic	10.39298
Durbin-Watson stat	1.949959	Prob(F-statistic)	0.000000

The result of the autocorrelation test is shown in Table XI. We see that Breusch-Godfrey F statistic is insignificant, indicating that the added lagged terms are not significant and no serial correlation is prevalent. The probability is high at 97.3%

Table XI. Autocorrelation test.

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.026902	Probability	0.973477
Obs*R-squared	0.073674	Probability	0.963833

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Convertible Arbitrage	-0.073119	1.366229	-0.053519	0.9576
CTA Global	-0.025917	0.578500	-0.044800	0.9645
Distress	-0.015081	1.052406	-0.014330	0.9886
Emerging Markets	-0.068403	1.027259	-0.066588	0.9473
Equity markets Neutral	0.042525	2.965178	0.014341	0.9886
Fixed Income Arbitrage	0.055346	2.668623	0.020739	0.9836
Global Macro	0.069079	2.017656	0.034237	0.9729
Long/Short Equity	0.010792	1.331377	0.008106	0.9936
Merger Arbitrage	-0.058014	1.919086	-0.030230	0.9761
Relative Value	0.148240	3.227360	0.045932	0.9636
C	8.13E-05	0.017933	0.004533	0.9964
RESID(-1)	0.023000	0.186451	0.123354	0.9025
RESID(-2)	0.036735	0.183213	0.200503	0.8422

R-squared	0.001535	Mean dependent var	2.31E-17
Adjusted R-squared	-0.340796	S.D. dependent var	0.052155
S.E. of regression	0.060392	Akaike info criterion	-2.550115
Sum squared resid	0.127651	Schwarz criterion	-2.043332
Log likelihood	74.20277	F-statistic	0.004484
Durbin-Watson stat	1.983213	Prob(F-statistic)	1.000000

Furthermore, the last Table XII, shows the results of the Ramsey test. Looking at the F statistic we see that it is not significant with a probability of 16.3%. That is, a linear functional form seems appropriate.

Table XII. Misspecification test.

Ramsey RESET Test:

F-statistic	1.912509	Probability	0.162831
Log likelihood ratio	4.978404	Probability	0.082976

Test Equation:
Dependent Variable: Sector Hedge
Method: Least Squares
Sample: 2001:01 2004:12
Included observations: 48

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Convertible Arbitrage	1.662249	1.302821	1.275885	0.2104
CTA Global	-0.224622	0.533737	-0.420847	0.6764
Distress	-3.495375	1.111324	-3.145235	0.0034
Emerging Markets	-1.618238	0.987228	-1.639173	0.1101
Equity markets Neutral	-6.816309	3.308830	-2.060036	0.0469
Fixed Income Arbitrage	5.404588	2.988310	1.808577	0.0791
Global Macro	1.537375	1.868718	0.822690	0.4163
Long/Short Equity	7.204540	1.869034	3.854685	0.0005
Merger Arbitrage	-2.909704	1.887823	-1.541301	0.1322
Relative Value	1.745064	3.067588	0.568872	0.5731
C	0.022129	0.017416	1.270632	0.2122
FITTED^2	-1.669725	0.876236	-1.905566	0.0649
FITTED^3	-1.300365	6.118817	-0.212519	0.8329

R-squared	0.763323	Mean dependent var	-0.005400
Adjusted R-squared	0.682177	S.D. dependent var	0.101788
S.E. of regression	0.057384	Akaike info criterion	-2.652296
Sum squared resid	0.115251	Schwarz criterion	-2.145512
Log likelihood	76.65511	F-statistic	9.406764
Durbin-Watson stat	2.043131	Prob(F-statistic)	0.000000