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The Alleged Value of Active Management

A study of the alleged value added benefits from actively managed mutual funds in Sweden

Are Swedish all-equity mutual funds actively managed and do they provide superior returns for investors?

Pär Hugo-Persson[1] and Simon Lönnvik[2]

Abstract

The activity of Swedish all-equity mutual funds have been subject to widespread debate and even brought to court. This paper investigates the alleged value of Swedish all-equity mutual funds by performing a holding analysis, i.e. comparing the allocation of investments against index. We find that (1) funds have become more active since 2002; (2) fund managers tend to be less active when investing in their domestic market compared to when investing abroad; (3) during 2013, there was a strong relationship between activity and the amount charged by the fund managers; and (4) fund managers do not achieve abnormal returns, in comparison to the global market index, as found in prior research. In conclusion, the benefit that fund managers deliver to investors is a high degree of diversification, which could be achieved by replicating the performance of an index as well. Although a mutual fund does not have the same underlying holdings as an index, it offers an alternative way of pursuing a diversification strategy.

Tutor: Paolo Sodini

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[1] 22186
[2] 22455

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1. INTRODUCTION

Investors let fund managers handle their wealth, in order to leverage both their expertise and effort in evaluating potential investments for their mutual funds. However, there has recently been an ongoing debate in the media, driven by journalists such as *Joel Dahlberg*, concerning whether or not investors should be able to expect any added value from investing in actively managed funds, over index tracking funds. Their claim is that many of the allegedly actively managed funds are closet index funds (i.e. index tracking funds). Hence, these funds should not be able to charge a fee for being 'actively managed' as they do not provide any stock picking services. The debate culminated in *Aktiespararna*, which is an interest group for small investors, taking *Swedbank*, which is one of the big Swedish banks, to court.

The number of mutual equity funds has increased rapidly in Sweden during the last few decades.[3] This paper will only investigate all-equity mutual funds which, under Swedish law, are defined as funds with at least 85% of their assets in public equities. The debate in Sweden has been centred on these funds because they are the most common, 55% of the total Swedish fund assets were in all-equity mutual funds at the end of 2013, and it has been easy to benchmark them against an index.[4]

Equity mutual funds are generally categorized as either passive or active. The sole goal for a passive fund is to track a benchmark index. The fund manager's service is to make sure that the fund is weighted in accordance with its benchmark index. In general, the cost of investing in these types of funds is cheaper, since fund expenses are not driven by research costs or active investment selection.

An actively managed fund is a fund that does not track its benchmark index, for which the fund investor pays the manager to take an active position. There is a wide array of investment strategies and the spectrum of actively managed funds consist of a broad range of stock pickers, speculators and closet indexers. Actively managed funds are generally more expensive than passive funds, due to the fact that managers of actively managed funds have to analyse and select investments on their own. Despite the higher cost, there is no guarantee that the funds will yield a higher return than passively managed funds.

Papers such as *Jensen (1968)* and *Carhart (1997)* have shown that the average fund manager is not able to generate abnormal returns (i.e. beat the market), net of fees. Fund managers, on the other hand, argue in fund fact sheets and prospectuses that they, in fact, are able to provide abnormal

[3] The total number of equity mutual funds marketed to individuals in Sweden has increased from 289 in 1990 to 845 in 2013 according to quarterly statistics, provided by the Swedish investment fund association.
[4] Swedish investment fund associations report for 2013, published 2014-01-16.

returns, thereby justifying an investment in the fund. Evidence of managers actually beating the market can be found in *Daniel et al. (1997)* and *Cremers and Petajisto (2009).*

A number of journalists and researchers have tried to answer the question of whether actively managed funds add value. This study aims to take a closer look at actively managed funds and explain if and how, they add value. Academics argue about the definition of what being an active fund actually means and in the next section we will lay out the different definitions.

1.1 THE LEVEL OF ACTIVITY

There are several ways of measuring the level of activity in a fund and there are different definitions of activity. The two major definitions of activity are either when a fund yields a higher return compared to its benchmark index or a deviation in allocation of underlying assets compared to its benchmark index. Most of the previous research available has focused on fund performance, when evaluating activity.

Grinhold and Kahn (1999) suggest evaluating funds by analysing the volatility of the absolute difference between the fund return and its benchmark return. A deviation would indicate some sort of activity since fund managers ought to attempt to outperform the index. This measure is called tracking error. Given the *Capital Asset Pricing Model (CAPM)* a tracking error can be achieved in two ways, either by having a high leverage, which is not applicable to mutual funds in Sweden, producing a high beta or through superior skill, producing a high alpha. Managers want to maximise the expected return whilst minimising tracking error, since a high tracking error implies a larger risk of underperformance relative to the benchmark index, according to *Cremers and Petajisto (2009)*. Noteworthy is that tracking error by definition puts a large emphasize on systematic risk (i.e. risk that is increased by industry specific investing).

Cremers and Petjisto (2009) introduced a new measure called active share. It is a measure of the difference between the fund weights in the underlying assets and the benchmark index's constituent weights. Papers such as *Fama (1972)* and *Daniel et al. (1997)* have discussed the basic idea of active share, but they never developed the measure. Intuitively, active share for an all-equity fund can take values between zero and one, where zero indicates pure index tracking and one indicates perfect divergence from the index. This type of activity analysis is called holding analysis. In contrast to tracking error, active share does not capture systematic risk.

Cremers and Petajisto (2009) provides the theoretical framework for this paper. However, we have found new aspects and developed their method further. Firstly, this paper is based on Swedish all-equity mutual funds instead of American ones, since it is not clear that Swedish managers are

behaving in the same way as American ones. Secondly, this paper is using another approach when assigning benchmark indices. Thirdly, this paper presents some important variables that need to be controlled for that *Cremers and Petajisto (2009)* have not noticed when studying what affects activity, e.g. benchmark capitalization, number of index underlying assets and cash. Cash holdings are important since they too are holdings which affect the fund performance. Given a typical fund, with no derivative investments, cash holdings result in lower exposure to the market. Fourthly, we are using a measure called selectivity, introduced by *Amihud and Goyenko (2014)*, to study if it has an explanatory power on active share. Finally, this paper is, to our knowledge, the first to look at differences in active share and alpha depending on the funds' investment region.

In this paper, as well as in *Cremers and Petajisto (2009)*, both tracking error and active share are used to categorise active funds. Unfortunately, all active funds are not active in the same way and there are huge differences in trading strategies and performance amongst active funds. One can categorise active funds into the following groups, according to *Cremers and Petajisto (2009)*: diversified stock pickers, concentrated stock pickers, factor timers and closet indexers.

This paper has found that most funds are either diversified stock pickers or closet indexers. In general, actively managed funds have become more active between 2002 and 2013, since average active share has increased from 49% 2002 to 57% 2013. The tracking error volatility has been low, and decreasing, for the entire period. Our results indicate that the average actively managed fund is a closet index fund. We also note that the number of actively managed all-equity mutual funds has decreased by approximately 40% over the last two years.

One explanation for the decreasing number of funds and increasing activity level might be that the number of pure index funds has increased and that the savings market has become more mature. *Cremers et al. (2013)* are able to prove that actively managed funds active in a market with many cheap and passive investment products are more active, i.e. have higher active shares, than actively managed funds active on markets with less passive savings products.

1.2 FUND PERFORMANCE

This paper uses two different approaches to try to evaluate fund performance. First, standard alphas, (i.e. fund return minus the global index return) are calculated. Second, the Carhart four-factor model, presented by *Carhart (1997)*, is used to see if actively managed all-equity mutual funds are able to produce alpha. We will examine whether or not a higher alpha can be explained by a higher active share, which one might expect, since the only way to beat the index is to deviate from it. *Cremers and Petajisto (2009)*, as well as *Petajisto (2013),* find that the funds with the best performance, i.e. the highest Carhart alpha, are the funds with the highest active shares.

In contrast to previous literature, this paper finds that the highest alphas are not found at funds with the highest active shares. The Carhart four-factor model suggests that the funds with the highest alphas are to be found amongst funds with the lowest active shares. Funds with a high Carhart alpha generally have higher tracking errors. The average fund has a slightly positive Carhart alpha net of fees, 0.17%, per month over the entire period 2002-2013. Surprisingly, the average abnormal return is negative 1.88% per year.

1.3 EXPLANATION OF ACTIVE SHARE AND CARHART ALPHA

In addition, we will try to explain what affects active share and alpha. Finally, we try to explain the unexplained factor, i.e. alpha, from the Carhart four-factor model. Also the alpha results show good explanatory power and both the regression on active share and alpha is statistically significant. The regression results are presented in the results section, with a more in depth discussion in the analysis section.

2. THEORY

2.1 PREVIOUS LITERATURE ON THE LEVEL OF ACTIVITY IN MUTUAL FUNDS

Tracking error is a widely used measure of activity. Since *Grinhold and Kahn (1999)* introduced the measure, there have been various different definitions of tracking error. *Grinhold and Kahn (1999)* provide the most common version, i.e. the volatility of the absolute difference between the fund return and its benchmark. *Cremers and Petajisto (2009)* defined tracking error as:

$$R_{fund;t} - R_{rf;t=} = \propto_{fund} \beta_{fund;t}\left(R_{index;t} - R_{rf;t}\right) + \varepsilon_{fund;t}$$

$$Tracking\ error = \sigma\left[\varepsilon_{fund;t}\right]$$

(Equation 1)

They argue that this definition does not assume a market beta of one. Any fund beta deviating from one will result in a tracking error using the traditional definition. Furthermore, it is beneficial that this method allows for excluding the cash holding of the fund. However, it is important to notice that *Petajisto (2013)* used the common version of the measure. He argues that it better reflects the risks funds are exposed to as well as captures the important exposure to cash holdings.

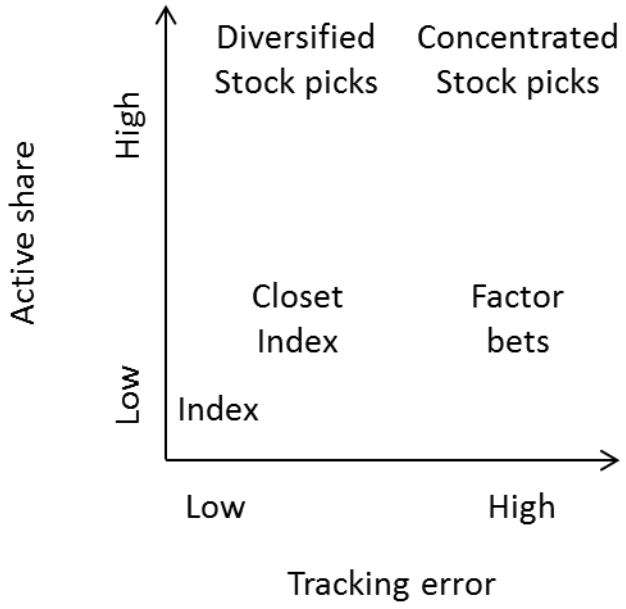
The two most relevant papers for this study are *Cremers and Petajisto (2009)* and *Petajisto (2013)*. In the first paper, the authors introduced a new measure called active share. Papers such as *Fama (1972)* and *Daniel et al. (1997)* have also evaluated funds by looking at their underlying assets, but primarily by looking at returns for the underlying assets. Previously, activity has been measured on the basis of standard deviation in returns between a fund and its benchmark, the so called tracking error. *Cremers and Petajisto (2009)* argue that tracking error is a bad measure of activity since well diversified stock pickers can have the same risk as the index, even though they have a completely different portfolio composition.

Nevertheless, tracking error is an important measure when one tries to categorise different levels of activity. A concentrated stock picker, for instance, can have the same active share as a diversified stock picker even though the concentrated stock picker has a much greater risk, since he is taking more concentrated positions. Another active strategy mentioned in *Cremers and Petajisto (2009)* is factor bets. A fund with such a strategy bets on systematic factors and can generate a large tracking error without having a large active share. Actively managed funds that are tracking their benchmark closely usually end up with a low tracking error and a low active share, 20-60%. They are therefore called closet indexers, see graph 1 below.

In order to calculate active share, one needs both the weightings for funds and their respective benchmark indices. With the data in place, one needs to determine how to assign benchmark indices for the funds. *Cremers and Petajisto (2009)* assigns benchmark indices based on which index that give the lowest active share for each fund. In contrast, *Petajisto (2013)* assigns benchmark indices based on the funds' pronounced benchmark indices and *Daniel et al. (1997)* constructs benchmark portfolios that are matched with the characteristics of the stocks held by mutual funds. It is possible to have a high active share and a low tracking error since a fund can have the same sector allocation as its benchmark index, even though it does not own shares in all companies in all sectors.

Both *Cremers and Petajisto (2009)* and *Petajisto (2013)* calculate tracking error. With both tracking error and active share, it is possible to group so called active funds into different types of active funds (see diagram below).

Graph 1



Based on these four types of actively managed funds, it is possible to draw conclusions about their returns. *Cremers and Petajisto (2009)* show that funds with a high active share also have high alphas. Also, the degree of tracking error has generally low impact on fund returns, but is rather a measure of the risk of the fund and a good way of distinguishing different strategies amongst fund managers.

Amihud and Goyenko (2014) propose a new way of predicting fund performance. By using the Carhart four-factor model, one can regress how much of a fund's return is due to tracking the benchmark index. The measure is called R-squared, which can take values between 0 and 1, where 0 indicates that none of the fund's return can be explained by the benchmark and where 1 indicates

that all the fund's return can be explained by the benchmark. *Amihud and Goyenko (2014)* are able to show that funds with high R-squared have strong negative correlation with fund alpha. It is quite intuitive that if the benchmark has high explanatory power, alpha cannot be large, either positive or negative.

In addition, *Amihud and Goyenko (2014)* present a measure called selectivity which is defined as:

$$Selectivity = 1 - R^2$$

(Equation 2)

High selectivity implies that the benchmark has low explanatory power, i.e. that the fund is active. The problem with active share is that it is difficult to measure for two reasons. First, it is difficult and time consuming to acquire all the data on fund holdings and index weights. Second, one needs to choose which benchmark index to compare the fund to.

Amihud and Goyenko (2014) discuss the important question of how activity ought to be defined. If activity is defined as a fund deviating from its benchmark index, active share is a proper measure since it compares fund holdings with index holdings. However, if activity is defined as a fund outperforming its benchmark index, R-squared is a more proper measure since it is calculated with any set of indices and it is therefore better at detecting funds that disguise as active even though they are doing passive multi-index investing, i.e. tracking different indices depending on which one performs the best.

Finally, *Amihud and Goyenko (2014)* study the relationship between R-squared and active share. The authors calculate the cross-fund correlation between R-squared and active share every month. The median correlation over the sample period is -0.45. It is expected that the correlation should be negative. To conclude, if fund return is to a large extent explained by the market, the active share should be low.

The discussion regarding active management is complicated due to a lack of consensus in academia on the definition of activity. Some argue that activity ought to be evaluated solely against divergence from an index whilst others focus on the diversification benefits to be had allocating investments differently than the index's allocation. Based on previous research, *Jones and Wermers (2011)* conclude that even though actively managed funds on average do not outperform their benchmark indices, they still add value. Value added when investing in actively managed funds means that an investor can have another asset allocation and/or risk than the index, according to the authors.

Jones and Wermers (2011) criticises *Cremers and Petajisto (2009)* on three areas: they do not control for market capitalisation, strong manager conviction is not always a good thing and the point of measuring tracking error, since differences in tracking error do not indicate any difference in return. It might seem kind of strange that *Petajisto (2013)* did not choose to control for market capitalisation, since it is believed to have an impact on active share. A small cap index would normally contain more stocks than a large cap index. Small cap funds would therefore be likely to obtain an unmerited active share due to the benchmark containing more investment opportunities.

Cremers et al. (2013) examine the relation between indexing and active management in the mutual fund industry worldwide. There are a couple of interesting thoughts and conclusions in the paper that are relevant for this paper. First of all, *Cremers et al. (2013)* try to examine what investors are actually looking for in actively managed funds and whether an increasing number of ETFs and index funds have put pressure on fees. The paper defines truly active funds as those with an active share over 60%. *Cremers et al. (2013)* find that in more mature markets, where index funds have higher market shares, there has been pressure on actively managed funds' fees and that the actively managed funds are forced to be more active, i.e. generate higher active shares, and/or generate higher returns to maintain their fees.

2.2 PREVIOUS LITERATURE ON FUND PERFORMANCE

There has been extensive research regarding whether or not investors can produce alpha, compared to their benchmark index. The first introduction and definition of alpha was *Treynor* (1961) and *Sharpe* (1964) where they developed the capital asset pricing model (CAPM). The model implies that the return on an investment can be predicted by knowing the risk-free rate, market risk premium and the beta of the investment, where the beta is the correlation with the market. CAPM model:

$$R_{fund;t} = R_{rf;t} + \beta_{fund;t}\left(vwretd_t - R_{rf;t}\right) + \propto_{fund;t}$$

(Equation 3)

Returns that cannot be explained by these factors are labelled alphas. This model has been developed further by *Fama and French (1993)*, in their three-factor model, and *Carhart (1997),* in the four-factor model. Instead of predicting alphas through the first three variables, *Fama and French (1993)* controlled for market capitalisation as well as book-to-market ratios. In addition, *Carhart (1997)* implemented the momentum strategy into the model. The momentum effect was first observed by *Jegadeesh and Titman (1993)*. The Carhart four-factor model is defined in Equation 4.

$$R_{fund;t} = R_{rf;t} + \beta_{fund;t}(vwretd_t - R_{rf;t}) + \beta_{SMB;t}SMB_t + \beta_{HML;t}HML_t + \beta_{MOM;t}MOM_t + \propto_{fund;t}$$

(Equation 4)

SMB, small minus big, times a β factor explains how much of a stock's return is explained by the size of the company. HML, high minus low, times β factor explains how much of that return is attributable to a company being a value stock or a growth stock. SMB is based on market capitalisation whilst HML is based on the book-to-market value.

Furthermore, by definition the market performance is the average performance of all assets constituting that specific market. Consequently, there will be assets that underperform as well as outperform the market during different time periods. Performance can be illustrated through using a normal distribution curve centred around an alpha of zero. *Carhart (1997)* found that few funds were able to generate large positive alphas and that the mean alpha is close to zero. *Daniel et al. (2010)* use a different measure of alpha and find that Carhart gives the lowest alphas, consistent with research suggesting that the four-factor model has high explanatory power (*Carhart (1997)*).

Lately there has been some criticism of the four-factor model. *Cremers et al. (2010)* find that when regressing benchmark indices on the four-factor model, the authors end up with quite substantial alphas, both positive and negative ones. This is important since academics usually evaluate funds using factor models, while practitioners just subtract the index return from the fund return. *Cremers et al. (2010)* finds that the problem with both the three-factor and four factor models are the SMB and HML factors. The authors modify the factors, which significantly reduces the alphas.

On the level of mutual funds, *Jensen (1968)* was the first paper to evaluate the performance of mutual funds with a risk-adjusted measure, called Jensen's Alpha. The paper do not find evidence that funds on average are able to outperform the market, nor that any individual fund was able to perform significantly better than the market. The results obtained by *Jensen (1968)* are consistent with those observed by *Malkiel (1995),* which suggests that, after looking at American all-equity mutual funds, fund managers in general fail to provide alpha net of fees as well as exclusive of fees.

Grossman and Stiglitz (1980) argued that traders need to obtain an information advantage in order to achieve abnormal returns. However this information will be expensive to obtain reducing the expected abnormal return. It is possible to draw two relevant conclusions from this paper: Firstly markets are not efficient, otherwise traders would not invest in more information. Secondly, managers might choose not to obtain the information and thereby reduce costs and become a closet index fund.

Moreover, *Jones and Wermers (2011),* summarise the findings from research on actively managed funds. They argue that past research shows that average active funds do not generate abnormal returns, abnormal returns being defined as:

$$Abnormal\ return = fund\ return_t - index\ return_t$$

(Equation 5)

Building on the findings of *Malkiel (1995)*, the average alpha of a large sample, without survivorship bias, should equal to zero. Though the average active fund does not generate alpha, *Jones and Wermers (2011)* sees huge differences amongst funds, depending on which strategy the fund has. Stock pickers are generally more likely to generate alpha than those focusing on factor timing.

Carhart et al (2002) discussed the implication of survivorship bias. Bad performing funds will in the long-run go out of business. Consequently researchers will, if not controlling for the survivorship bias, obtain a normal distribution curve shifted to the right, centred on a positive alpha. This effect is due to the fact that many negative alpha observations have been excluded from the sample.

Moreover, investors form beliefs about mutual funds partly by looking at historical returns. *Chevalier and Ellison (1997)* show that funds experience convexity in flow performance i.e. that funds which provide positive alphas will experience positive inflows. A high inflow or outflow might affect fund performance, since a fund with a high net inflow has to buy more shares, even though the manager might find all shares unattractively priced, and a fund with a high outflow has to sell shares in order to distribute money.

Also *Berk and Green (2004)* develop the argument further suggesting that there are skilled managers and that they experience fund inflows and increased compensation until they do not produce any more alpha. Consequently one might argue that managers are effective in extracting the benefits of their superior performance and thus investors should not expect to receive any alpha, which is consistent with *Carhart (1997)*. *Berk and Green (2004)* argue that investors are fully rational since they invest in the funds with the best historical returns. The problem is that the greater the inflow a fund experiences, the harder it is to generate any abnormal returns.

Cohen et al. (2010) argue that fund managers should hold more concentrated portfolios, due to the fact that they only favour some specific stocks in their portfolios, so called *Best Ideas*, and that these stocks tend to outperform the market. Most managers hold many stocks in their portfolios, but only really see the great potential in a few. The rest are just for diversification purposes. The conclusions in *Cohen et al. (2010)* support the findings by *Cremers and Petajisto (2009)* that the funds with the highest active shares have the highest alphas.

3. DATA

The data section is divided into two parts where the first discusses the initial datasets in order of origin and the second discusses important adjustments made thereunto.

3.1 DESCRIPTION OF INITIAL DATA SET

3.1.1 DATA SET OBTAINED FROM FINANSINSPEKTIONEN

Finansinspektionen is the Swedish financial supervisory body, equivalent to the Securities and Exchange Commission in the U.S. All Swedish mutual funds need to disclose their underlying assets to *Finansinspektionen*. The agency publishes the underlying assets of all funds quarterly on their homepage. The data includes observations on a quarterly basis from September 2000 to December 2013. However there are some missing quarters for which *Finansinspektionen*, for undisclosed reasons, could not provide the general public with data for: March 2001, June 2001, September 2001, March 2004, June 2004, December 2004, March 2005 and June 2005.

Each cross section of data includes observations on date of disclosure, institute name, *Finansinspektionens* classification number for each institute, fund name, *Finansinspektionens* classification number for each fund, market value of underlying assets per fund, total value per fund, value of each fund unit and information on leverage. The data from *Finansinspektionen* also include data on each underlying asset, such as: name, ISIN, listing, country, exchange rate, price per unit, number of units that each fund owns and total value of each underlying asset per fund.

In addition, Hans-Olof Berqvist at *Finansinspektionen* provided a list of all equity mutual funds. The list is on a yearly basis, this ensuring that all potentially dead funds are included. Moreover the segmentation enables an analysis regarding funds' alterations in their investment status e.g. changed from being a mutual fund to a hedge fund. The data sets mentioned above include, to our knowledge, all funds which are under the supervision of *Finansinspektionen.* In total, the dataset from *Finansinspektionen* consists of 625 funds.

3.1.2 DATA SET OBTAINED FROM MORNINGSTAR

Morningstar is an international company that collects data on mutual funds. Karl Marthon at Morningstar Sweden has provided return data for all-equity mutual funds, their ISIN-codes, Morningstar category, inception date, date, obsolescence date, geographic coverage and their benchmark indices. The data is from January 2000 to December 2013 and includes dead funds, as well as funds originating during the period. The data was given on a monthly basis and each fund is separated with regard to fund name, ISIN and organization number. The total number of funds in the Morningstar data set is 680.

3.1.3 DATA SET OBTAINED FROM BLOOMBERG

To be able to measure tracking error more precisely, data on fund returns per day were needed. Morningstar was unfortunately not able to provide daily data, so we downloaded the data from Bloomberg instead. The data downloaded from Bloomberg only includes all-equity mutual funds that are used in this study. The reason for using Bloomberg data instead of Morningstar data is that the Morningstar data set was not complete, e.g. returns for some months were missing, and we found that the Bloomberg data had a higher degree of completeness with regards to fund returns.

3.1.4 DATA SET OBTAINED FROM KENNETH FRENCH DATABASE

Kenneth French is a prominent economist and has, amongst other things, developed the Fama French three-factor model in collaboration with Eugene Fama. Mr. French has his own website with data on factor loadings for the Carhart four-factor model. The data sets include year, month, risk-free interest rates, market risk premia and factor loadings. For each region there is one specific file. We have downloaded data on factor loadings for the global index for the period 2002-2013.

3.2 ADJUSTMENTS TO THE INITIAL DATA SETS

The intention of the adjustments made to the original data sets is to make them more applicable to the research question. Hence we have in some cases disregarded analysing some data since it is not directly relevant to our study. A more in depth explanation concerning our adjustments follows below.

3.2.1 DATA SET OBTAINED FROM FINANSINSPEKTIONEN

Initially all observations not belonging to all-equity mutual funds were dropped, since all-equity mutual funds comprise our area of research. After an analysis of the lists of mutual funds obtained by *Finansinspektionen*, 451 funds were dropped since they were not classified as all-equity mutual funds. Furthermore, we merged all the annual files to be able to drop duplicates and to get an overall picture of the data.

Funds which have faults in their data have also been dropped, such as all-equity mutual funds with no net asset value, NAV, reported, no underlying assets, positions in underlying assets significantly larger than their NAV and funds with too large positions in derivative instruments[5]. Moreover, due to consolidations in the mutual fund industry, the same fund might be registered with two institutes during the same period. These duplicates were dropped. *Finansinspektionen* has also managed to

[5] According to Swedish law, *Lagen om Investeringsfonder* Chapter 5 12§ and 14§, a mutual fund is not allowed to hold more than 10% of its NAV in any single instrument.

record several underlying assets twice in some of the funds. Naturally this is adjusted for. Also some funds lack ISIN codes on underlying assets.

3.2.2 DATA SET OBTAINED FROM MORNINGSTAR

As previously mentioned, the data set from Morningstar is separated by fund name, ISIN and organization number. We used Microsoft Excel in order to match the data sets from Morningstar and FI. After selecting funds that are all-equity mutual funds and present in both datasets, we dropped all funds that were outside our geographic limitation (described in the method section). Some funds in the Morningstar data had to be dropped, for which the ISIN-codes were missing and for which their existence could not be verified in other databases. Note that *Finansinspektionens* data set has been the limiting factor when selecting the funds that are analysed.

4. METHODOLOGY

This chapter discusses how our study was conducted. It is divided into one section on sample selection and geographic limitation, index construction, definitions of activity and performance measures, course of action and one section explaining our robustness checks.

4.1 SAMPLE SELECTION

This study is conducted on all-equity mutual funds registered with the Swedish financial supervisory body *Finansinspektionen.* As mentioned in the data section, all funds not classified as all-equity mutual funds by *Finansinspektionen* were dropped. The rest of the data includes actively managed funds, passively managed funds and even some hedge funds. We have gone through the remaining funds to ensure that they are properly classified with regard to focus region, fund type and active vs. passive. The passively managed funds, i.e. index funds, are kept in the sample for the purpose of pooling together benchmark indices. Unfortunately, five additional funds had to be dropped from the selected sample due to missing information on fund returns. After all adjustments have been made, we end up with a final dataset of 217 unique all-equity mutual funds.

Due to lack of access to index data this study is limited to funds active on a theme or geography that does include enough funds able to be pooled together, and thus create a representative index against which our selection of funds can be evaluated. Therefore this paper analyses funds focusing on the following regions: Sweden, Sweden Small Cap, the Nordics, Europe, Global and the U.S. Due to a limited number of sector focused funds, those have been excluded as well. However our index construction method could also be an advantage since the relative position between the funds ought to have higher explanatory power, since the pooled benchmark indices take into account instruments, owned by funds, which might not be present in a standard benchmark index.

4.2 INDEX CONSTRUCTION

We have, when calculating active share, constructed our own indices that we have used to compare the funds with. They are constructed as value weighted indices in conformity with any normal value weighted index, described in *Newbold (2010)*. In addition, when developing our method we chose to look at equally weighted indices as well, but the pooled benchmark indices looked fairly equal for both methods and chose to use the value weighted one.

There are both advantages and disadvantages with creating our own benchmark indices. An advantage is that we capture all investments made by all funds, even if all investments are not made

in the funds' focus regions. A disadvantage is that the pooled benchmark indices will look differently depending on which funds are included.

4.3 DEFINITION OF ACTIVITY AND PERFORMANCE MEASURES

In this paper we define active management as the deviation in fund holdings compared to a benchmark index. An actively managed fund is supposed to diverge from its benchmark index, i.e. sector or country. Normally actively managed funds charge a higher fee than passively managed ones since the active fund manager will have to pick stocks on his own. A passively managed fund has just one objective: to follow its benchmark index, i.e. sector or country, and the fund manager's only task is to track the index.

In the beginning of this paper both tracking error and active share were introduced as the two important measures of activity used this paper. With the help of these measures we can classify funds into categories that will show how active they are. Tracking error is calculated as a six month average and active share is calculated quarterly. Below is the definition of tracking error:

$$Tracking\ error = \sigma|(R_{fund;t} - R_{Index;t})|$$

(Equation 6)

There are some other definitions of tracking error, but this paper is using the definition above since that is the definition introduced by *Grinhold and Kahn (1999)*. Notice that this paper is measuring the absolute value of tracking error, since it is irrelevant if the value is positive or negative, since we want to capture solely the deviation in fund return compared to its benchmark index.

The formula for active share is given below, where w is the weight in the underlying asset in either the fund or the index.

$$Active\ share = \frac{1}{2}\sum_{t=1}^{N}\left|w_{fund;t} - w_{index;t}\right|$$

(Equation 7)

The sum is calculated in order to obtain a measure for each specific fund. Intuitively, active share is simply the percentage of the fund's portfolio that differs from the fund's benchmark index. The sum of all differences is divided by two so that a fund with no overlap with its benchmark index will have an active share of 100%. If not divided by two, the active share can be as high as 200% because funds are assigned active share both for the differences in fund and index holdings as well as for stocks included in the index but not in the fund. For an all-equity mutual fund without leverage, the active

share will always be between 0% and 100%. A low active share implies that a fund is tracking its index whilst a high active share implies that a fund is deviating from its index.

In the regressions of this paper we use a measure called selectivity, presented in the literature part, to test if that measure has any explanatory power on active share and alpha. Selectivity is defined as one minus the explanatory power, R-squared, of the Carhart four-factor model. In other words, selectivity is the unexplained factor of the four-factor model.

To be able to compare the performance of different funds it is necessary to use some sort of performance measure. The standard way of evaluating a fund is to calculate the alpha of the fund. There are several methods to compute the alphas, but for the purpose of this paper we have chosen to use the Carhart four-factor model. The Carhart model is more sophisticated than other, similar models since it takes more variables into account and research has shown that the model has a higher explanatory power than other models.

Moreover, it is now possible to evaluate the impact and the explanatory power of each coefficient on the fund alphas. All factor loadings are taken from Kenneth French's database. Below you can find the model used in this paper, which gives an average monthly Carhart alpha for the entire period. For a more thorough explanation of the model please refer to the literature review section.

$$R_{fund;t} - R_{rf;t} = \beta_{market;t}(vwretd_t - R_{rf;t}) + \beta_{SMB;t}SMB_t + \beta_{HML;t}HML_t + \beta_{MOM;t}MOM_t + \propto_{fund;t}$$

(Equation 8)

This paper has defined two main regressions. First, we want to examine which variables impact active share. Secondly, we are running a regression to see if, and if so how much impact, active share and tracking error have on alpha. In other words, we want to see if the level of activity can explain the abnormal return in actively managed funds.

$$Active\ share_{fund;t} = \beta_0 + \beta_1(tracking\ error_{fund;t}) + \beta_2(selectivity_{fund;t}) + \beta_3(age_{fund;t}) +$$
$$\beta_4 \log(NAV_{fund;t}) + \beta_5 \log(NAV_{fund;t})^2 + \beta_6(underlying\ instruments_{fund;t}) +$$
$$\beta_7(quarterly\ fund\ return_{fund;t}) + \beta_8(return\ past\ 12\ months_{index;t}) +$$
$$\beta_9(return\ past\ 36\ months_{index;t}) + \beta_{10}(return\ past\ 12\ months_{fund;t}) +$$
$$\beta_{11}(return\ past\ 36\ months_{fund;t}) + \beta_{12}(change\ in\ weight) + \beta_{13}(underlying\ instruments_{index;t}) +$$
$$\beta_{14}(index\ capitalization) + \beta_i(region\ dummy) + \beta_i(quarter\ dummies)$$

(Equation 9)

$$Alpha_{fund;t} = \beta_0 + \beta_1(active\ share_{fund;t}) + \beta_2(selectivity) + \beta_3(tracking\ error_{fund;t}) + \beta_4(age_{fund;t}) + \beta_5 \log(NAV_{fund;t}) + \beta_6 \log(NAV_{fund;t})^2 + \beta_7(underlying\ instruments_{fund;t}) + \beta_8(quarterly\ fund\ return_{fund;t}) + \beta_9(return\ past\ 12\ months_{index;t}) + \beta_{10}(return\ past\ 36\ months_{index;t}) + \beta_{11}(return\ past\ 12\ months_{fund;t}) + \beta_{12}(return\ past\ 36\ months_{fund;t}) + \beta_{13}(change\ in\ weight) + \beta_{14}(underlying\ instruments_{index;t}) + \beta_{15}(index\ capitalization) + \beta_{16}(fraction\ of\ cash) + \beta_i(quarter\ dummies)$$

(Equation 10)

Both regressions are defined as panel data regressions, which gives more robust regressions. This paper is controlling for time fixed effects. In equation number nine (9) we also control for region fixed effects. This paper is not controlling for fund fixed effects, since that is what we want to capture in the regressions.

4.4 COURSE OF ACTION - ACTIVITY

The intention of this paper is to investigate whether or not active funds add value, in terms of diverging from their benchmark indices, and whether or not they are able to generate superior returns for their investors, defined as Carhart alpha and abnormal return. Data from March 2002 to December 2013 is examined on a quarterly basis starting by calculating each fund's weight in its different assets, both with and without cash. Before merging the FI quarterly files all observations that are not needed for the study are dropped, except for index funds.

The next step is to bring forward the benchmark indices. It has unfortunately been almost impossible to get hold of index weightings on a quarterly basis. To be able to compare the funds, we have pooled together all funds active in the same region to get benchmark indices. We sum up all positions for all funds in all assets per region, later we sum up total net asset values per region and finally we divide the sum of each asset by the total net asset values per region to get the index weights. This method is a fairly good approximation of an index. For the purpose of this pooling, the index funds are kept in the sample and included in the pooled indices. This paper is using a value weighted approach, but the difference between value weighted and equally weighted pooled indices is negligible. All underlying assets in the funds are dropped, after merging, to get as small a data set as possible.

After pooling together six benchmark indices, the index returns are calculated. By using index returns from the pooled indices and the fund returns from Bloomberg and Morningstar, it is possible to calculate tracking error. Tracking error is calculated on a six month rolling basis. Six month averages

are the common way of calculating tracking error, but it has one implication. For funds established during the research period, there will be a lag of two quarters before tracking error is captured. The implication is that our results include more observations on active share than on tracking error. We have tried to correct for this by including returns six months prior to the *Finansinspektionen* available data. However, there will still be a gap since some funds have an inception date after 2002.

In this stage, active share is calculated. The selected regions are classified with a number and pooled benchmark indices are assigned to each fund based on the region number. First, active share is calculated for each fund and for each holding. Second, we investigate how much of the index that is represented in the fund. A fund should thus gain active share if it doesn't invest in underlying assets that are represented in the index or if the fund's holding in an asset diverges from the index holding. Thereafter we sum up all active shares per fund and quarter and divide the sum by two.

Using active share and tracking error, the actively managed funds are divided into the following subgroups: closet indexers, diversified stock pickers, concentrated stock pickers and factor timers. Intuitively, a fund that has an active share of less than 50% is not very active, while a fund with an active share in excess of 60% is defined as active. It is hard to put a threshold on tracking error, since previous research has found quite small deviations in tracking error between funds. Furthermore, we have looked at the differences in active share depending on focus region of investment.

After categorising all funds into subgroups, it is time to see which variables have an impact on active share. To do this, we run a regression on active share. The regression is outlined in equation number nine (9).

4.5 COURSE OF ACTION – PERFORMANCE

The second mission of this paper is to see whether or not the activity level has any impact on the fund returns and if actively managed funds are able to generate alphas. This paper uses two measures to evaluate fund performance: the Carhart four-factor model and abnormal returns, defined in equation 8 and 5 respectively. We start by regressing fund excess returns, defined as fund return minus the risk free interest rate, on the Carhart four-factor model to see if there are any unexplained returns. The Carhart model is run on excess returns on a monthly basis and we regress all funds on the factor loadings of the global market, since we do not have factor loadings for all regions.

After generating the Carhart alpha, we split the funds into quintiles (5x5 matrix) based on active share and tracking error to see whether the most active funds generate a higher alpha than the more passive active funds. We also look at differences in alpha between the different investment regions.

To be able to observe if Carhart alpha and abnormal returns generate different results, we present results for abnormal returns by region and year as well.

The next step is to regress the alpha, generated by the Carhart four-factor model on active share to see if active share is positively correlated with the Carhart alpha. *Cremers and Petajisto (2009),* as well as *Petajisto (2013)*, do not control for cash or benchmark capitalisation, which we think might have a great impact on fund returns. Take, for instance, the financial crisis in 2008-2009: can the actively managed funds generate any alpha or are they, in fact, beating the market since they are holding a lot of cash? Benchmark capitalisation might have a quite substantial impact on active share since small-cap indices normally include a lot more companies than large-cap ones.

4.6 ROBUSTNESS OF RESULTS

We have undertaken a series of robustness validation techniques in order to validate our results. This has been done by firstly dropping data and running regressions on different time periods. It is not possible to divide our research period into several long time periods due to the already short time span since it would have a large effect on the significance level of the results obtained. We have therefore dropped smaller time periods in order to validate the results. Secondly, we have in going through our regressions chosen to add and drop variables in order to ensure that signs and magnitude of betas do not change when dropping or adding new dependent variables. The variables chosen for this part of the robustness checks are the ones that we find correlate the most with each other. Furthermore, we have undertaken tests for homoskedacity, autocorrelation as well as multicollinearity in order to ascertain that out results are valid.

5. RESULTS

The results section is devoted to the results obtained in this paper. We begin by presenting descriptive statistics with a discussion on the development over the research period for both activity and performance. The results section will end with results from regressions on both activity and alpha.

5.1 DESCRIPTIVES

5.1.1 THE LEVEL OF ACTIVITY

The level of activity is measured by active share and tracking error. By looking at the results, one can see that there are big differences in the level of activity amongst funds.

Table 1

Summary for variable active share

Variable	mean	median	N	sd	min	max
Active share	0.5278	0.5101	5503	0.2195	0.1389	1.0000

The table presents summary statistics (mean, median, number of observations, standard deviation, minimum and maximum) for active share for the period 2002-2013.

The descriptive statistics presented in table 1 were computed over the entire period studied. To begin with active share, we observe that the least active actively managed fund had an active share of just 14% whilst the most active fund had an active share of close to 100%. The average fund has an active share of just over 50% and both the mean and median values are more or less the same.

Table 2

Summary for variable active share by categories of year						
Year	**mean**	**median**	**N**	**sd**	**min**	**max**
2002	0.490	0.443	475	0.198	0.192	0.978
2003	0.483	0.431	534	0.204	0.187	0.980
2004	0.500	0.478	271	0.211	0.171	0.979
2005	0.528	0.526	271	0.220	0.158	1.000
2006	0.517	0.500	536	0.229	0.156	0.965
2007	0.528	0.520	532	0.232	0.150	0.970
2008	0.518	0.483	535	0.227	0.149	0.962
2009	0.515	0.483	516	0.216	0.148	0.955
2010	0.550	0.556	527	0.214	0.156	0.960
2011	0.568	0.578	537	0.216	0.167	0.957
2012	0.571	0.544	437	0.208	0.171	0.992
2013	0.570	0.584	332	0.198	0.163	0.999
Total	0.528	0.512	5503	0.217	0.148	1.000

The table presents summary statistics (mean, median, number of observations, standard deviation, minimum and maximum) for active share by year.

Table 2 summarises the mean active share for all funds by year. An interesting observation is that the mean active share increases by around 8 percentage points between 2002 and 2013. The median value increased even more, by over 14 percentage points. Another aspect worth noting is that the number of actively managed funds in our sample has decreased by almost 40% in the last two years. Note that the total number of funds also decreases rapidly between 2002 and 2003-2004. This is caused by lack of data on fund holdings from *Finansinspektion* for the two years mentioned, which results in fewer observations for those years.

The maximum active share is always close to one while the minimum value has been more volatile. In 2002, the minimum active share was 19.20% and the minimum value decreased constantly until it hit a bottom in 2009. Since then the minimum has stabilised in the range 16%-17%. The standard deviation of active share has been fairly stable. From 2002 to 2007 the standard deviation increased with 3.40 percentage points and since the peak in 2007, the standard deviation has gone back to 19.80%. We note that active share did not change significantly during the financial crisis of 2008 and 2009.

Tracking error is not nearly as volatile as active share. All funds have a tracking error in the range 0%-9%, see table 3. It is reasonable to expect quite low values for tracking error, since we have excluded

all industry focused funds that normally are the funds with the highest volatility. Note that there are lesser observations for tracking error than for active share since tracking error is calculated as a trailing six month value.

Table 3

Summary for variable tracking error

by categories of year

Year	mean	median	N	sd	min	max
2002	0.0236	0.0231	474	0.0087	0.0054	0.0633
2003	0.0262	0.0253	525	0.0099	0.0047	0.0528
2004	0.0134	0.0125	269	0.0047	0.0061	0.0336
2005	0.0152	0.0140	269	0.0060	0.0041	0.0444
2006	0.0184	0.0181	535	0.0049	0.0062	0.0372
2007	0.0177	0.0171	519	0.0067	0.0031	0.0464
2008	0.0237	0.0229	528	0.0087	0.0050	0.0697
2009	0.0329	0.0324	510	0.0109	0.0107	0.0720
2010	0.0219	0.0211	519	0.0087	0.0060	0.0535
2011	0.0197	0.0181	530	0.0075	0.0037	0.0608
2012	0.0187	0.0178	430	0.0083	0.0031	0.0747
2013	0.0127	0.0111	330	0.0059	0.0036	0.0368
Total	0.0212	0.0193	5438	0.0096	0.0031	0.0747

The table presents summary statistics (mean, median, number of observations, standard deviation, minimum and maximum) for tracking error by year.

Tracking error has developed in the opposite direction, compared to active share. As is evident in table 3, the mean tracking error amongst all funds has decreased since 2002. During the financial crisis in 2008 and 2009, tracking error increased quite rapidly but decreased again in 2010. The standard deviation in tracking error also increased during the financial crisis of 2008 and 2009, but has been fairly stable at a low level in the other years.

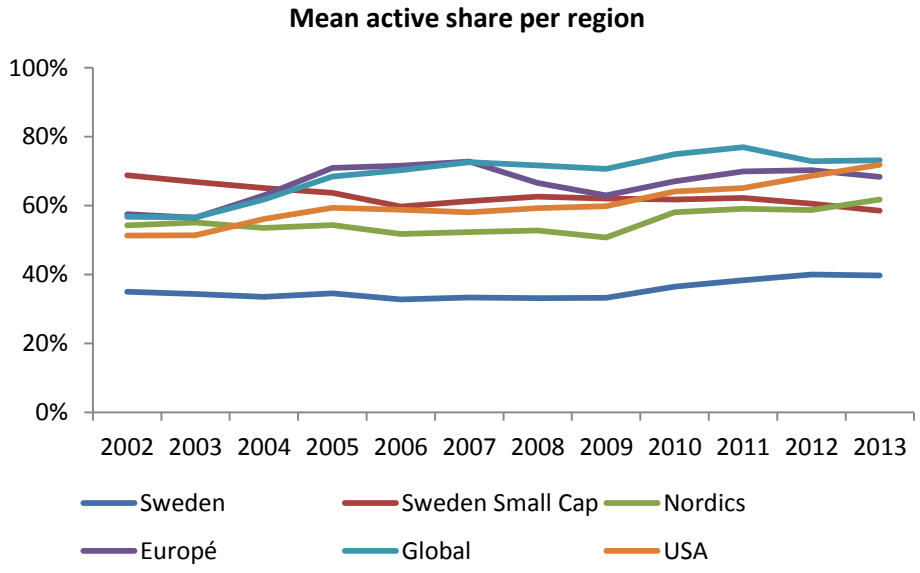
Table 4

Summary for variable active share by region						
Region	**mean**	**median**	**N**	**sd**	**min**	**max**
Sweden	0.3516	0.3225	2150	0.1557	0.1389	0.9867
Sweden S	0.6253	0.6302	782	0.1612	0.2016	0.9498
Nordics	0.5541	0.5666	426	0.1501	0.2478	0.9250
Europé	0.6620	0.6753	893	0.1747	0.2858	1.0000
Global	0.6915	0.6946	879	0.1810	0.2690	0.9999
USA	0.6020	0.5711	373	0.1723	0.3010	0.9992
Total	0.5278	0.5101	5503	0.2195	0.1389	1.0000

The table shows summary statistics (mean, median, number of observations, standard deviation, minimum and maxium) for active share by region. Sweden S stands for Sweden Small Cap.

Table 4 shows the different active shares across all regions studied. The highest mean active share of funds over the entire period, 2002-2013, is found amongst global funds (69.15%), but the standard deviations across all regions are big (between 15.00% and 18.10%). The least active region, on average, is Sweden large cap. The Swedish Large Cap segment includes significantly more observations than other regions and the mean active share is plainly the lowest amongst all regions at 35.16%.

Graph 2



The graph above shows mean active share by region over time.

Graph 2 shows the development of mean active share for funds in each specific region over time. The data suggests, as we have previously seen, that funds on average are becoming more active over time. The only region where funds on average experience a decreasing mean active share is Sweden Small Cap.

5.1.2 PERFORMANCE

Fund performance has been evaluated using two different metrics: abnormal return, i.e. fund return minus index return, and the Carhart four-factor model. We start by looking at results obtained from the Carhart model and then we move on to look at how the abnormal returns and Carhart alphas have developed per region and year.

Results from the regression on the Carhart four-factor model can be seen in table 10 in the appendices. R-squared for the Carhart model is equal to 45.07% and note that our results show a negative momentum variable at z=-16.00.

Table 5

Statistics on Carhart alpha

Variables	mean	median	N	sd	min	max
Alpha	.0017	.0021	38779	.0033	-.0929	.0120

The table presents summary statistics (mean, median, number of observations, standard deviation, minimum and maximum) for Carhart alpha over the period 2002-2013.

Descriptive statistics for alpha, produced under the Carhart four-factor model, are presented in table 5. The mean monthly alpha is fairly close to zero percent (0.17%) and the standard deviation is low, at 0.33%. There is a substantial difference between the highest alpha, 1.20%, and the lowest, -9.29%.

In table 6, we present data on average monthly Carhart alphas for the entire period 2002-2013, net of fees. Funds are divided into quintiles based on their average active shares and tracking errors over the entire period. The data indicate that the average fund has outperformed its pooled benchmark index by 0.19%. The worst performing funds are found within the fourth active share quintile and second tracking error quintile, with an average alpha of -0.19%.

We find the highest alphas in active share quintile one and tracking error quintile four (0.47%). The best performing funds, on average, are found within the least active quintile, i.e. quintile number one, and within the quintile with the second highest tracking error, i.e. quintile number four. Note that all fund returns in our paper are compared to the same global index.

Not so surprisingly, the highest standard deviations in alpha over the period are found within the highest active share quintiles and the highest tracking error quintiles. The student's t-test for the mean and standard deviation per quintile, table 11 in appendix, shows average values of 0.55 and 1.07 respectively. T-values for the highest active share quintile indicate very low statistical significance, with an average t-value of 0.28.

Table 6

Means and standard deviations of Carhart alpha

by quintiles of active share and tracking error

Quintiles active share	Quintiles tracking error					
	1	**2**	**3**	**4**	**5**	**Total**
1	0.0030	0.0022	0.0028	0.0047	0.0037	0.0033
	0.0027	0.0025	0.0026	0.0029	0.0018	0.0026
2	0.0019	0.0028	0.0032	0.0017	0.0040	0.0025
	0.0026	0.0032	0.0021	0.0024	0.0027	0.0026
3	-0.0009	0.0011	0.0021	0.0003	0.0027	0.0012
	0.0016	0.0037	0.0030	0.0041	0.0029	0.0033
4	0.0013	-0.0019	-0.0010	0.0005	0.0023	0.0006
	0.0013	0.0038	0.0022	0.0022	0.0031	0.0027
5	0.0024	0.0019	0.0033	0.0003	0.0008	0.0017
	0.0046	0.0021	0.0044	0.0075	0.0067	0.0054
Total	0.0017	0.0017	0.0019	0.0017	0.0022	0.0019
	0.0033	0.0031	0.0032	0.0039	0.0045	0.0037

The table above summarizes the average monthly Carhart alpha for the entire period (2002-2013) by active share and tracking error quintiles. The quintiles are constructed based on average active share and tracking error per fund over the entire period. The upper values are the average alphas and the lower values are the standard deviation of alpha.

Performance has not only been evaluated against activity. This paper has also looked at how funds, on average, perform depending on their focus region. The results are presented in table 12 and table 13. If we start by looking at the results in table 12 on abnormal returns per region and year, we find that all funds on average has negative alphas over the period studied. The worst performers, on average, are U.S. focused funds with an average alpha of -3.03%. Swedish Small Cap funds have been the best performers with an average alpha of -0.52%. The second highest alphas are found among Swedish focused funds. Note that, on average, the regions combined have just beaten the global index for two years, net of fees.

The results for Carhart alphas by region, found in table 13 indicate that funds with a Global and European investment focus have been the worst performers between 2002 and 2013. They have

generated average Carhart alphas of -0.07% and -0.16% respectively. The best performers, compared to the Global index, are Swedish Small Cap funds. These funds have on average generated an alpha of 0.41% over the period. Funds focusing on the U.S. have been the second best performers, with an alpha for the period of 0.40%.

5.2 REGRESSION RESULTS

5.2.1 EXPLANATION OF ACTIVITY

One measure that has proved hard to explain in the past is active share. *Cremers and Petajisto (2009)* tried but they were not able to find any good explanatory variables. Amihud and Goyenko (2014) argue that selectivity, 1-R^2, is a good approximation for active share. In the method section of this paper, your authors have laid out a regression to try to explain active share. The regression results, presented below in table 7, are for the entire research period. We have controlled for both year fixed effects and region fixed effects.

Table 7

Regression on active share						
Variables	**Coefficient**	**Robust std. errors**	**z**	**P**	**[95% conf.**	**intervall]**
Tracking error	0.0796	0.5432	0.15	0.8834	-0.9851	1.1443
Selectivity	-0.1427	0.0294	-4.85	0.0000	-0.2004	-0.0850
Age	0.0000	0.0000	4.33	0.0000	0.0000	0.0000
Lognav	0.1423	0.0213	6.69	0.0000	0.1006	0.1840
Lognav2	-0.0041	0.0006	-7.34	0.0000	-0.0052	-0.0030
# of underlyinginstruments	-0.0007	0.0001	-12.02	0.0000	-0.0009	-0.0006
Quarterly fund return	0.0178	0.0182	0.98	0.3282	-0.0178	0.0534
i12	0.0556	0.0209	2.66	0.0078	0.0146	0.0965
i36	0.0237	0.0167	1.42	0.1566	-0.0091	0.0564
r12	0.0371	0.0337	1.10	0.2711	-0.0290	0.1033
r36	0.0503	0.0189	2.66	0.0078	0.0132	0.0874
Change in weights	0.0776	0.0279	2.78	0.0054	0.0229	0.1322
# underlyinginstruments in index	0.0001	0.0001	2.26	0.0237	0.0000	0.0003
Pooled index marketcap	0.0000	0.0000	-1.05	0.2948	0.0000	0.0000
Region Sweden Small Cap	0.2797	0.0101	27.65	0.0000	0.2599	0.2995
Region Nordics	0.2306	0.0203	11.34	0.0000	0.1907	0.2704
Region Europé	0.2796	0.0506	5.53	0.0000	0.1805	0.3787
Region Global	0.2947	0.0865	3.41	0.0007	0.1253	0.4642
Region U.S.	0.2671	0.0538	4.96	0.0000	0.1616	0.3726
Constant	-0.8108	0.2054	-3.95	0.0001	-1.2133	-0.4083
R-squared	0.6059					
N	5021					

The table presents results for the regression on active share (equation number 9). This is a panel regression with robust standrad errors, quarterly fixed effects and region dummies. Lognav is the logarithm of net asset values, lognav2 is the logarithm of net asset values squared, quarterly fund return is the past quarters fund return, i12 is the past twelve month index return, i36 is the past 36 month index return, r12 is the past twelve month abnormal return of the fund over the global benchmark index, r36 is the past 36 month abnormal return, change in weights is the frequency of which a fund change instruments completely in its portfolio and pooled index market cap is the total market capitalisation of the pooled benchmark indices. Below follows results for region dummies, as well as for the constant. At the bottom you find the R-squared of the regression and the number of observations. Note that Sweden Large Cap is the "base case".

R-squared for the regression on active share is 60.59%. Our results indicate that selectivity is negatively correlated with active share at a z-score of -4.85. Both lognav and lognav2 are statistically significant at z-scores of 6.69 and -7.34 respectively. One is negatively correlated and one is positively correlated with active share and we are interested in the net effect. The setup suggests that the active share increases with fund size to some extent but when the fund gets too big, active share is negatively affected by size. The number of underlying instruments in a fund is negatively correlated with active share at a z-score of -12.02. This suggests that the statistical significance of number of

underlying instruments is very high. Fund age is positively correlated with active share, i.e. the older a fund is the more likely it is that the fund will be more active at z=4.33.

In contrast, tracking error is statistically insignificant. Except for tracking error, previous twelve month abnormal returns and previous 36 month benchmark index returns, are statistically insignificant. Benchmark index capitalisation, which is the total value of all assets on the funds' pooled benchmark indices, has also a statistically insignificant effect on active share.

Table 8

Regression on the impact of management fee on active share

by year 2013

Variables	**Coefficient**	**Robust std. errors**	**t**	**P**	**ci95**	
Management fee	0.1492	0.0115	12.95	0.0010	0.1125	0.1859
Constant	0.3751	0.0153	24.51	0.0001	0.3264	0.4239
R-squared	0.8560					

The table presents regression results on active share, with management fee as independent variable.

Due to lack of data, we have only been able to analyse the impact of the management fee on the level of activity during 2013. The results, shown in Table 8, indicate that the management fee is positively correlated with active share. R-squared for the regression is 8.56%, which suggests that the fee variable is statistically significant. The t-statistics of the test indicates high statistical significance. The management fee is significant at t=12.95.

5.2.2 EXPLANATION OF ALPHA

In the previous section the results indicated fairly small average alphas and small differences amongst the active share and tracking error quintile. In this section we will try to explain which variables affect alpha.

The regression presented in Table 9 has an R-squared of 45.24%. All the z-figures indicate that the regression is highly significant, except for the variables i12, i36 and number of underlying instruments. Fraction of cash is the percentage of a fund's total net asset value that is cash. The results indicate that fraction of cash in a fund is positively correlated with alpha. Selectivity is positively correlated with alpha at a high level of significance (z=20.73).

Table 9

Regression on Carhart Alpha						
Variables	**Coefficient**	**Robust std. Errors**	**z**	**P**	**[95% conf.**	**intervall]**
Active Share	-0.0009	0.0003	-2.96	0.0031	-0.0015	-0.0003
Selectivity	0.0079	0.0004	20.73	0.0000	0.0072	0.0087
Tracking error	0.0262	0.0086	3.05	0.0023	0.0094	0.0431
Age	0.0000	0.0000	11.09	0.0000	0.0000	0.0000
Fraction of cash	0.0016	0.0009	1.82	0.0691	-0.0001	0.0033
Lognav	0.0048	0.0003	15.33	0.0000	0.0042	0.0054
Lognav2	-0.0001	0.0000	-14.00	0.0000	-0.0001	-0.0001
# of underlying instruments	0.0000	0.0000	-1.51	0.1314	0.0000	0.0000
i12	-0.0001	0.0003	-0.19	0.8516	-0.0006	0.0005
i36	-0.0000	0.0002	-0.21	0.8326	-0.0004	0.0004
r12	0.0015	0.0005	2.82	0.0047	0.0005	0.0026
r36	0.0019	0.0003	6.24	0.0000	0.0013	0.0026
# of underlying instruments in index	0.0000	0.0000	-12.06	0.0000	0.0000	0.0000
Change in weights	-0.0010	0.0004	-2.14	0.0322	-0.0018	-0.0001
Pooled index marketcap	0.0000	0.0000	5.63	0.0000	0.0000	0.0000
Constant	-0.0508	0.0030	-17.09	0.0000	-0.0566	-0.0450
R-squared	0.4524					
N	5021					

The table presents results for the regression on Carhart alpha (equation number 10). This is a panel regression with robust standrad errors and quarterly fixed effects. Fraction of cash is the fraction of cash in the fund portfolios, lognav is the logarithm of net asset values, lognav2 is the logarithm of net asset values squared, quarterly fund return is the past quarters fund return, i12 is the past twelve month index return, i36 is the past 36 month index return, r12 is the past twelve month abnormal return of the fund over teh global benchmark index, r36 is the past 36 month abnormal return, number of underlying instruments in index is the number of instruments in the pooled benchmark indices, change in weights is the frequency of which a fund change instruments completely in its portfolio and pooled index market cap is the total market capitalisation of the pooled benchmark indices. Below follows results for the constant and at the bottom you find the R-squared of the regression and the number of observations.

Active share is negatively correlated with alpha at z=-2.96. This finding will be discussed in more detail in the analysis section of this paper. Furthermore, the number of instruments in an index is negatively correlated with alpha whilst benchmark index capitalisation is positively correlated with alpha. Both variables are highly significant with z-scores of -12.06 and 5.63 respectively.

We find that past 12 and 36 month abnormal returns are positively correlated with alpha, i.e. a fund that has beaten its benchmark index for the past twelve and/or 36 months is likely to generate a higher Carhart alpha.

6. ANALYSIS

In this section, the results presented in the previous section will be discussed and analysed into greater detail. For the avoidance of doubt, all Carhart alphas are calculated on average monthly bases.

6.1 THE LEVEL OF ACTIVITY

In contrast to newspapers and magazines, which argue that actively managed funds in reality are passive, our research finds that Swedish actively managed all-equity mutual funds are becoming more active, in terms of diverging from their benchmark indices. In the results section we presented findings that the mean active share for all funds in our study has increased steadily between 2002 and 2013. All focus regions, except Sweden Small Cap, experience increased active shares.

One explanation for increased activity might be that closet indexers have become index funds or simply been ousted from the market. In graph 3 we are able to show that the number of index funds in Sweden has increased rapidly between 2002 and 2013. Our results are consistent with the results obtained by *Cremers et al. (2013)*, i.e. that active share tends to increase when the competition from pure index products, e.g. exchange traded funds and index funds, increase.

The mean active share for all funds over the entire period is lower in our study than in *Cremers and Petajisto (2009).* We believe that this is caused by our method of constructing benchmark indices, which might be a better measure than just assigning already defined indices, since funds in general do not just invest in instruments found in their pronounced benchmark indices. Another potential explanation, with support from *Cremers et al. (2013),* is that the Swedish savings market is more underdeveloped than its American counterpart. The lower degree of competition might lead to less active funds. Both in this study and in *Cremers and Petajisto (2009)* the highest active share values are close to 100%. We have looked closer into this and found that the funds with the highest active shares are funds that are in liquidation and, for that reason, have few underlying assets left in their portfolios.

Both *Cremers and Petajisto (2009)* and *Petajisto (2013)* argue that funds with an active share below 60% are closet indexers and the theoretical minimum active share that an active manager can have is 50%. Based on the previous discussion, only funds focusing on Europe, Sweden small cap, Global and the U.S. have been active. Funds focusing on Sweden (in general) and the Nordics have on average been closet indexers, which imply that those funds have not added any value, in terms of diverging from their benchmark indices, to their investors. As noted earlier, the standard deviation in active

share amongst funds and regions is high and the reader shall not draw too big conclusions of the average results presented.

An interesting observation is that the number of funds has decreased rapidly lately. The fund industry has for some years experienced increased regulation from financial authorities. The burden has grown after the financial crisis and after the Madoff scandal was revealed. We are not able to prove whether or not this is the motivating cause and further research is required.

6.2 PERFORMANCE

In the results section we present results for two different measures of performance that give quite different results. The results obtained on Carhart alpha suggest that funds within the first, i.e. lowest, active share quintile are those with the highest alpha. We are quite surprised that the highest alphas can be found among funds with that are the least active. One explanation, probably the most likely, why the results turn out as day do is that the t-statistics for table 6 are very low, on average 0.55 (see table 11). There are in turn a number of reasons to the weak significance. First, our dataset of funds is fairly small and we are looking at a short time frame, eleven years. *Daniel et al. (1997)* criticises a paper that examines about 300 funds over a period of ten years for having a too small dataset and horizon. Also note that in our regression to obtain Carhart alphas we find that the momentum variable is negative, which should not be the case. Prior research, *Jegadeesh and Titman (1993)* and *Carhart (1997)*, suggests that pursuing a momentum strategy will earn an abnormal return.

Another potential explanation might be that the funds generating the highest active shares are those that are in liquidation. This implies that there is a big turnover in the highest, most active, active share quintile. The results obtained on alpha, both Carhart alpha and abnormal returns, are not consistent with the ones obtained by *Cremers and Petajisto (2009)*. We think that this is caused by the facts presented above.

We want to remind the reader of the criticism from *Cremers et al. (2010)*, where they criticise the four-factor model since it is possible for benchmark indices to have substantial, both positive and negative, alpha This is a likely reason why abnormal returns are substantially lower than Carhart alphas in this paper.

Our results regarding the relation between activity and performance are to some extent consistent with the results obtained by *Cohen et al. (2010)*. A fund manager that takes active positions in stocks that he really believes in, and follow the market with the rest of the money, should be able to outperform a manager that is just tracking is benchmark or taking large active positions just for the sake of being “active”.

One thing that distinguishes this paper from other, similar papers is that we study which focus regions the funds have to be able to see if there are any differences in performance and activity. As presented in the results section, there are big differences in fund performance depending on which region the fund is focused on. The fact that Swedish small cap funds on average have higher alphas is not surprising. *Grossman and Stiglitz (1980)* argued that managers need an information advantage to generate abnormal returns and it is not too farfetched to argue that Swedish small cap fund managers in general should be able to have more information on small companies in their proximity than Swedish managers focusing on global companies can obtain.

Finally, since all performance measures are compared against a global index, the results are not too relevant for all regions. The results on Carhart alpha on global funds, net of fees, are consistent with the results obtained in *Carhart (1997)*, i.e. mutual funds in general are not able to generate positive alpha, net of fees. However, when it comes to small cap stocks it is reasonable to think that the alpha would decrease if one would use factor loadings for a small cap index, since academics have been able to prove that small cap stocks on average outperform large cap stocks[6].

6.3 EXPLANATION OF ACTIVITY

Cremers and Petajisto (2009) had a very low explanatory power in their attempt to explain active share. This paper presents a somewhat different regression setup that generates higher explanatory power. The new variables added in this paper are selectivity, benchmark capitalization and the number of underlying instruments in the benchmark index. Selectivity turns out to have a high explanatory power on active share, as suggested by *Amihud and Goyenko (2014).*

Another thing worth mentioning is that tracking error lacks statistical significance in our regression, whilst it is significant in related papers. The reason that tracking error has a low explanatory power is hardly surprising for a number of reasons. First, by looking at graph 4 one can see that there seem to be no relationship between active share and tracking error. Second, our dataset excludes funds that might have a somewhat higher tracking error, i.e. sector focused funds, which might also give other results in a regression on activity.

We are also able to show that funds beating the index for the past 36 month are more inclined to take larger active positions. The results obtained for past 12 month abnormal returns are not statistically significant while the results for 36 month abnormal returns are. The results obtained show a positive correlation between the abnormal returns (for the past 36 months) and active share are consistent with previous research by *Cremers and Petajisto (2009)*. The results suggest that

[6] *McDermott and D'Auria (2014)* summarises the findings on research in this field.

managers need to have a quite long track record of good performance behind them before they dare to deviate from their benchmark indices.

In addition, we find evidence that a higher management fee entails a higher active share, see table 8. The results are relevant and statistically significant, but due to lack of data we have not been able to analyse the effects over the entire time period. However, when running the regression on active share presented in table 7 with management fee, the statistical significance is still adequate. Consequently, the fund investor pays the manager to diverge from the benchmark index. The more the investor pay, the more active will the manager be. Our results are coherent with previous research by *Cremers and Petajisto (2009).*

Finally, some comments about the impact of the total number of instruments in each index. This paper finds a positive correlation between the number of instruments in benchmark indices and active shares. These results are new and have not been tested in previous papers on the topic of active share (*Cremers and Petajisto (2009)* and *Petajisto (2013)*). The results are significant at z=2.26 and by looking at the coefficient we can see that for one more company in the benchmark index, the average active share of funds will increase by 0.01%. By looking at table 4 and table 14, the results are quite intuitive. The highest average active share is found in the region with most underlying assets to choose from.

6.4 EXPLANATION OF ALPHA

The funds with the highest active shares are not those that produce the highest alpha. Therefore it is not surprising that active share has a negative correlation with alpha, even if the negative effect is very modest. *Cremers and Petajisto (2009)*, as well as *Petajisto (2013)*, find that active share is positively correlated with alpha. Note that this is consistent with the results obtained in our regression on active share, table 7, where selectivity is negatively correlated with active share.

The fact that selectivity is positively correlated with alpha is hardly a surprise, since selectivity is defined as $1\text{-}R^2$, where R-squared is the explanatory power of the Carhart four-factor model. The reason for a positive correlation between selectivity and alpha is due to an overall positive Carhart alpha for our sample. Tracking error is also positively correlated with alpha, which is not the case in related articles.

Change in weights, i.e. how often a fund completely shift instruments, is negatively correlated with alpha and statistically significant (z=-2.14). The results are consistent with most of the previous research *(Carhart (1997)* and *Cremers and Petajisto (2009)*). *Wermers (2000)* studies more in detail

fund performance and expense ratios. The paper finds evidence that funds with a higher turnover on average generate higher returns before fees, but not net of fees.

Finally, the regression on alpha in this paper generates a higher explanatory power than in *Cremers and Petajisto (2009)*. There are some potential explanations for this divergence. First, we have included selectivity in the regression which, by definition, should have a high explanatory power on alpha. Second, we have included both the number of underlying instruments in the benchmark index and the benchmark index capitalisation in the regression. Both variables are highly significant and might therefore also be one explanation to an increased explanatory power.

7. ROBUSTNESS CHECKS

As mentioned in the method section, we are running different robustness checks to ensure that our results are valid. The correlation matrix, table 15 and table 16, in appendix, implicates that there is a correlation problem in the data set. Consequently there is a need for evaluating this problem further.

In table 15, we present a correlation test for the variables used in our regression on active share. We observe high correlations between the return variables quarterly fund return, i12, i36, r12 and r36. This is quite expected since, for instance, the past twelve month return will naturally have a large effect on the past 36 month return. Also, by construction quarterly fund return, r12 and r36 will take exactly the same value for the first three months of the time period. Consequently this will have a large effect on the correlation between them. Similar correlations between the return variables can be observed in table 16.

Furthermore, we observe a high degree of correlation between variables such as age/selectivity and the pooled index market capitalization/number of index instruments. Consequently, there is a need for testing the sample for collinearity. When running the collinearity test on the regression of active share, we obtain a mean VIF-score of 1.51. The mean VIF-score obtained indicates that the independent variables do not correlate to a large extent. The collinearity test on the regression of Carhart alpha gives a mean VIF-score of 1.57. Thus we can reject the possibility of having a collinearity problem in the data set. Also we test the data for heteroskedacity and autocorrelation and conclude that they do not occur to a worrying degree in the sample.

Finally, we have tested the regressions by removing independent variables to see if the coefficients change dramatically. The results obtained are satisfactory, however we can observe that when removing variables that are correlated to a higher degree, the coefficient of the variable left are affected more compared to when removing a variable with less correlation.

8. CONCLUSION

The purpose of this study has been to investigate whether Swedish all-equity mutual funds add any value in terms of (1) diverging from their benchmark indices and (2) generating abnormal returns.

Our results indicate that all-equity funds have become better at adding value, in terms of deviating from their benchmark indices over the period 2002 to 2013. The funds do provide alphas under the Carhart four-factor model but simultaneously do not provide abnormal returns. However, the funds do provide an increasing amount of diversification throughout the time period. Consequently, we conclude that funds have become more active in terms of deviating from index holdings. Additionally we find a strong relationship between active share and management fees during 2013. Thus our paper indicates that investors do not pay fund managers for beating the market but rather to provide an alternative way of diversification, instead of buying the index itself. Noteworthy is that we in our study compare fund performance with the global market index.

In contrast to what could be expected, we find that the active share of funds vary over regions. Swedish funds are less active when investing in their domestic market and most active when investing in a global portfolio, despite controlling for both the number of funds in each respective index and the market capitalization of the index. To conclude, we find that there is a significant relationship between the activity of funds and the management fees charged. However, it is important to notice that this analysis is only conducted on funds during 2013, since we do not have historical fees available.

It would be relevant for future research to conduct an analysis before fees were introduced, in order to study if fund managers did produce alphas, as prior research indicates, and investigate to what extent Swedish fund managers absorb that alpha, without distributing it to investors. Moreover, it would be interesting to investigate how fees affect the level of activity in funds over time. Unfortunately, historical fees were not available to us but if we had them available we would like to complement our study with this information. Unfortunately *Finansinspektionen* was not able to provide us with all the requested data. We believe that, given a larger data set over a longer time period, it would be possible to detect more long-term trends in active share. It would be interesting to see for how long the above mentioned trend has been developing.

9. REFERENCES

Amihud, Yakov, and Ruslan Goyenko, 2014, "Mutual Fund's R^2 as Predictor of Performance", *Review of Financial Studies* 26, 667-694.

Berk, Jonathan B., and Richard C. Green, 2004, "Mutual fund flows and performance in rational markets", *Journal of Political Economy* 112, 1269-1295.

Carhart, Mark, 1997, "On persistence in mutual fund returns", *Journal of Finance* 52, 57-82.

Carhart, Mark M., Jennifer N. Carpenter, Anthony W. Lynch, and David K. Musto, 2002, "Mutual fund survivorship", *The Review of Financial Studies* 15, 1439-1463.

Chevalier, Judith, and Glenn Ellison, 1997, "Risk taking by mutual funds as a response to incentives", *Journal of Political Economy* 105, 1167-1200.

Chen, Hsiu-Lang, Narasimhan Jegadeesh, and Russ Wermers, 2000, "The value of active mutual fund management: an examination of the stockholdings and trades of fund managers", *Journal of Financial and Quantitative Analysis* 35, 343-368.

Cohen, Randolph, Christopher Polk, and Bernhard Silli, 2010, "Best ideas", Working paper, *London School of Economics*.

Cremers, Martijn, and Antti Petajisto, 2009, "How active is your fund manager? A new measure that predicts performance", *Review of Financial Studies* 22, 3329-3365.

Cremers, Martijn, Miguel A. Ferreira, Pedro Matos, and Laura Starks, 2013, "The mutual fund industry worldwide: explicit and closet indexing, fees, and performance", Working paper, *University of Notre Dame*.

Cremers, Martjin, Antti Petajisto, and Eric Zitzewitz, 2010, "Should Benchmark Indices Have Alpha? Revisiting Performance Evaluation", Working paper, *EFA 2009 Bergen Meetings Paper, AFA 2010 Atlanta Meetings Paper.*

Daniel, Kent, Mark Grinblatt, Sheridan Titman, and Russ Wermers, 1997, "Measuring mutual fund performance with characteristic-based benchmarks", *Journal of Finance* 52, 1035-1058.

Ekholm, Anders G., 2011, "Portfolio returns and manager activity: How to decompose tracking error into security selection and market timing", Working paper, *Hanken School of Economics*.

Fama, Eugene, 1972,"Components of investment performance", *Journal of Finance* 27, 551–567.

Fama, Eugene, and Kenneth French, 1993,"Common risk factors in the return on bonds and stocks" *Journal of Financial Economics* 33, 3–56.

Grinhold, Richard C., and Ronald N. Kahn, 1999,"Active portfolio management", McGraw-Hill (New York, U.S.) 2nd edition, 47-52

Grossman, Sanford J., and Joseph E. Stiglitz, 1980,"On the impossibility of informationally efficient markets", *American Economic Review* 70, 393–408.

Jegadeesh, Narasimhan, and Sheridan Titman, 1993,"Returns to buying winners and selling losers: Implications for stock market efficiency", *Journal of Finance* 48, 65–91.

Jensen, Michael C., 1968, "The performance of mutual funds in the period 1945-1964", *Journal of Finance* 23, 389-416.

Jones, Robert C., and Russ Wermers, 2011, "Active management in mostly efficient markets", *Financial Analysts Journal* 67, 29-45.

Kacperczyk, Marcin, Clemens Sialm, and Lu Zheng, 2005, "On industry concentration of actively managed equity mutual funds", *Journal of Finance* 60, 1983-2011.

Malkiel, Burton G., 1995, "Returns from investing in equity mutual funds 1971 to 1991", *Journal of Finance* 50, 549-572.

McDermott, John B., and Dana D'Auria, 2014, "What do we (really) know about U.S. Small-Cap investing", *Journal of Financial Planning* 27, 46-52.

Newbold, Paul, William L. Carlson, and Betty Thorne, 2010, "Statistics for business and economics" (Pearson Education Inc., New Jersey, U.S.) 7th edition, 724-733.

Petajisto, Antti, 2013, "Active share and mutual fund performance", *Financial Analysts Journal* 69, 73-93.

Sharpe, William F., 1964, "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk", *Journal of Finance* 19, 425-442.

Treynor, Jack L., 1961, "Market value, time and risk", "*Rough Draft*" dated 1961-08-08, #95-209.

Wermers, Russ, 2000, "Mutual fund performance: An empirical decomposition into stock-picking talent, style, transactions costs, and expenses", *Journal of Finance* 55, 1655-1695.

White, Halbert, and Xun Lu, 2014, "Robustness checks and robustness tests in applied economics", *Journal of Econometrics* 178, 194-206.

10. APPENDIX

10.1 TABLES

Table 10

Regression on Carhart four-factor model						
Variables	**Coefficient**	**Robust std. errors**	**z**	**P**	**[95% conf. intervall]**	
MktRF	0.7539	0.0140	54.00	0.0000	0.7265	0.7812
SMB	0.0462	0.0214	2.16	0.0310	0.0042	0.0882
HML	-0.3019	0.0155	-19.52	0.0000	-0.3322	-0.2716
WML	-0.1111	0.0069	-16.00	0.0000	-0.1248	-0.0975
Constant	0.0018	0.0002	7.77	0.0000	0.0013	0.0022
R-squared	0.4507					
N	38608					

The table above shows the results from regressing our sample of fund returns on the Cahart four-factor model. The factor variables have been obtained from Mr French database. We can observe above that all the computed variables are significant at the 5% significance level. The beta value of the market risk-premium (MktRF) indicates a positve relationship with estimated fund return. In addition, a negative HML beta indicates that the growth vs value relatioship is reversed. Moreover, a negative WML variable indicates that pursuing a momentum strategy yields a negative return.

Table 11

Means and standard deviations of t-stat

by categories of active share and tracking error

Quintiles active share	Quintiles tracking error					
	1	**2**	**3**	**4**	**5**	**Total**
1	0.866	0.819	1.012	1.235	1.106	1.007
	0.780	0.858	0.848	0.554	0.377	0.697
2	0.637	0.929	1.117	0.496	1.202	0.812
	1.114	1.247	0.731	0.882	0.786	0.975
3	-0.104	0.471	0.699	0.364	1.008	0.540
	0.461	1.348	1.100	1.122	0.946	1.050
4	0.396	-0.366	-0.395	0.125	0.752	0.196
	0.428	0.993	0.927	0.887	1.120	0.958
5	0.351	0.745	0.576	-0.430	0.160	0.276
	1.232	0.774	0.993	1.861	1.531	1.322
Total	0.420	0.637	0.570	0.446	0.696	0.553
	0.975	1.058	1.038	1.090	1.185	1.068

The table presents t-statistics for the classification of the average monthly Carhart alpha (for the entire period) by mean active share and tracking error for the entire period. T-statistics for active share are the upper values and t-statistics for standard deviation are the values below.

Table 12

Means and standard deviations of abnormal returns

by categories of region and year

	Year												
Region	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**Total**
Sweden	-0.0709	-0.0200	-0.0237	0.0235	0.0047	-0.0364	-0.0078	0.0198	0.0112	-0.0354	-0.0134	-0.0139	-0.0144
	0.0921	0.0257	0.0403	0.0259	0.0473	0.0498	0.0652	0.0507	0.0568	0.0416	0.0232	0.0232	0.0570
Sweden S	-0.0557	0.0020	0.00403	0.0496	0.0202	-0.0488	-0.0297	0.0446	0.0232	-0.0371	-0.0215	0.0113	-0.0052
	0.0956	0.0598	0.0290	0.0350	0.0531	0.0451	0.0641	0.0622	0.0412	0.0458	0.0302	0.0348	0.0625
Nordics	-0.0494	-0.0249	-0.0303	0.0266	0.0063	-0.0136	-0.0296	0.0103	-0.0024	-0.0435	-0.0100	-0.0088	-0.0156
	0.0578	0.0322	0.0335	0.0293	0.0557	0.0440	0.0374	0.0560	0.0407	0.0351	0.0239	0.0199	0.0453
Europe	-0.0664	-0.0519	-0.0419	0.00173	-0.0139	-0.0127	-0.0014	-0.0225	-0.0440	-0.0265	-0.0184	-0.0193	-0.0274
	0.0474	0.0376	0.0361	0.0186	0.0431	0.0430	0.0706	0.0446	0.0528	0.0430	0.0353	0.0291	0.0493
Global	-0.0657	-0.0661	-0.0645	0.0008	-0.0414	-0.0184	0.0228	-0.0272	-0.0335	-0.0075	-0.0254	-0.0262	-0.0293
	0.0575	0.0272	0.0473	0.0266	0.0442	0.0292	0.0851	0.0734	0.0793	0.0622	0.0349	0.0361	0.0613
USA	-0.0884	-0.0713	-0.0727	-0.0255	-0.0602	-0.0231	0.0409	-0.0305	-0.0287	0.0143	-0.0201	-0.0113	-0.0303
	0.0893	0.0528	0.0684	0.0310	0.0506	0.0301	0.114	0.106	0.104	0.0761	0.0591	0.0583	0.0851
Total	-0.0672	-0.0340	-0.0337	0.0164	-0.0081	-0.0289	-0.0036	0.00536	-0.00638	-0.0271	-0.0176	-0.0119	-0.0188
	0.0787	0.0431	0.0467	0.0327	0.0530	0.0455	0.0742	0.0664	0.0663	0.0511	0.0322	0.0332	0.0595

The table presents the average abnormal returns and standard deviations of abnormal returns (fund return minus the global index return) by year and region. Mean values for abnormal returns are the upper values and the standard deviations are the values below.

Table 13

Means and standard deviations of Carhart alpha

by region and year

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Sweden	0.0030	0.0031	0.0031	0.0031	0.0031	0.0030	0.0028	0.0027	0.0029	0.0028	0.0027	0.0025	0.0029
	0.0023	0.0024	0.0022	0.00212	0.0021	0.0020	0.0018	0.0018	0.0017	0.0019	0.0020	0.0020	0.0020
Sweden S	0.0047	0.0045	0.0044	0.0044	0.0044	0.0042	0.0036	0.0038	0.0037	0.0036	0.0042	0.0046	0.0041
	0.0019	0.0021	0.0020	0.0020	0.0020	0.0023	0.0033	0.0036	0.0036	0.0034	0.0028	0.0026	0.0029
Nordics	0.0018	0.0015	0.0016	0.0016	0.0017	0.0015	0.0010	0.0009	0.0008	0.0013	0.0011	0.0012	0.0013
	0.0014	0.0017	0.0017	0.0017	0.0016	0.0020	0.0026	0.0027	0.0025	0.0019	0.0019	0.0019	0.0020
Europé	-0.0011	-0.0012	-0.0012	-0.0013	-0.0015	-0.0018	-0.0021	-0.0021	-0.0020	-0.0018	-0.0016	-0.0013	-0.0016
	0.0024	0.0023	0.0024	0.0024	0.0023	0.0023	0.0024	0.0024	0.0023	0.0022	0.0023	0.0023	0.0023
Global	-0.0006	-0.0006	-0.0007	-0.0007	-0.0007	-0.0012	-0.0011	-0.0010	-0.0009	-0.0005	0.0007	-0.0010	-0.0007
	0.0020	0.0022	0.0022	0.0022	0.0022	0.0028	0.0028	0.0027	0.0029	0.0034	0.0041	0.0135	0.0042
USA	0.0036	0.0036	0.0037	0.0037	0.0038	0.0043	0.0040	0.0039	0.0039	0.0039	0.0045	0.0052	0.0040
	0.0027	0.0027	0.0027	0.0027	0.0025	0.0019	0.0021	0.0021	0.0021	0.0021	0.0025	0.0029	0.0024
Total	0.0018	0.0018	0.0018	0.0019	0.0019	0.0017	0.0015	0.0015	0.0016	0.0017	0.0019	0.0018	0.0017
	0.0030	0.0031	0.0030	0.0030	0.0030	0.0032	0.0033	0.0033	0.0033	0.0032	0.0032	0.0061	0.0034

The table presents mean monthly Carhart alphas and standard deviations of alpha by region and year. The upper values are alphas and the values below are standard deviations.

Table 14

Summary for variable number of underlying instruments in index

by categories of region

Region	mean	median	sd	min	max
Sweden	555	655	163	297	728
Sweden S	304	320	47	147	347
Nordics	341	345	34	268	406
Europé	845	824	161	525	1092
Global	1494	1531	317	922	2205
USA	782	822	119	508	985
Total	720	685	435	147	2205

The table presents summary statistics (mean, median, number of observations, standard deviation, minimum and maximum) by region for the number of underlying assets in our pooled benchmark indices over the period 2002-2013. Sweden S stands for Sweden Small Cap

Table 15

Correlation analysis - Carhart alpha

	Active share	Selectivity	Tracking error	Age	Lognav	Lognav2	Number of underlying instruments	quarterly fund return	i12	i36	r12	r36	Change in weights	Number of underlying instruments in index	Pooled index market capitalisation
Active share	1														
Selectivity	0.1510	1													
Tracking error	0.0333	0.1650	1												
Age	-0.1420	0.2220	-0.0281	1											
Lognav	-0.2000	-0.0559	-0.0762	0.4460	1										
Lognav2	-0.2130	-0.0550	-0.0794	0.4490	0.9980	1									
# of underlying instruments	-0.0040	0.2780	0.0427	0.1670	0.1620	0.1600	1								
quarterly fund return	-0.0084	-0.0447	-0.0704	0.0256	0.0676	0.0701	-0.0139	1							
i12	0.0421	-0.0051	-0.3520	0.0301	0.0904	0.0927	-0.0026	0.4050	1						
i36	0.0667	-0.0413	-0.4170	0.0808	0.1250	0.1260	0.0337	0.2180	0.4410	1					
r12	-0.0354	-0.1170	-0.1700	-0.0182	0.0976	0.1010	-0.0286	0.3890	0.1150	0.3760	1				
r36	-0.0851	-0.1640	-0.0100	-0.1570	0.0432	0.0501	-0.1160	-0.0930	-0.1180	0.1080	0.4440	1			
Change in weights	0.0630	0.0453	0.0581	-0.0240	0.0347	0.0302	0.2530	-0.0781	-0.1270	-0.0353	-0.0200	-0.0463	1		
# of index underlying instruments	0.3620	0.3080	0.0637	0.0931	-0.0500	-0.0577	0.4930	-0.0340	0.0168	0.1230	-0.0396	-0.1590	0.0911	1	
Pooled index market capitalisation	-0.5190	-0.3400	-0.2130	0.0996	0.0550	0.0658	-0.2710	0.1490	0.1960	0.2400	0.2580	0.2670	-0.1750	-0.1960	1

The table above shows the correlation between the explanatory variables in regression nine (10). Lognav above is the logarithmic function of NAV and lognav2 is the same but squared. Moreover i12 and i36 are the index returns during prior 12 respectively 36 months. Similarly, r12 and r36 are the abnormal return during 12 respectively 36 months.

Table 16

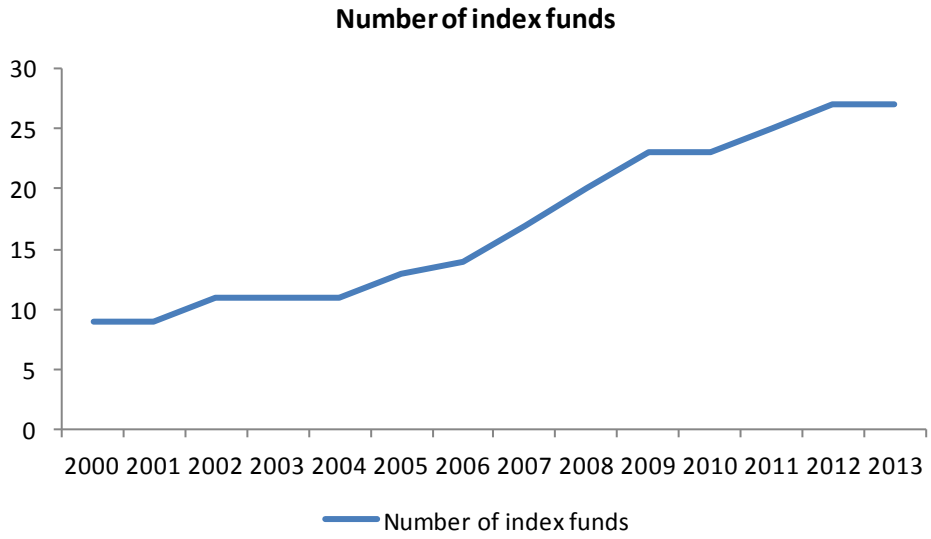
Correlation analysis - active share

	Selectivity	Tracking error	Age	Lognav	Lognav2	Number of underlying instruments	quarterly fund return	i12	i36	r12	r36	Change in weights	Number of underlying instruments in index	Pooled index market capitalisation
Selectivity	1													
Tracking error	0.1650	1												
Age	0.2220	-0.0281	1											
Lognav	-0.0559	-0.0762	0.4460	1										
Lognav2	-0.0550	-0.0794	0.4490	0.9980	1									
# of underlying instruments	0.2780	0.0427	0.1670	0.1620	0.1600	1								
quarterly fund return	-0.0447	-0.0704	0.0256	0.0676	0.0701	-0.0139	1							
i12	-0.0051	-0.3520	0.0301	0.0904	0.0927	-0.0026	0.4050	1						
i36	-0.0413	-0.4170	0.0808	0.1250	0.1260	0.0337	0.2180	0.4410	1					
r12	-0.1170	-0.1700	-0.0182	0.0976	0.1010	-0.0286	0.3890	0.1150	0.3760	1				
r36	-0.1640	-0.0100	-0.1570	0.0432	0.0501	-0.1160	-0.0930	-0.1180	0.1080	0.4440	1			
Change in weights	0.0453	0.0581	-0.0240	0.0347	0.0302	0.2530	-0.0781	-0.1270	-0.0353	-0.0200	-0.0463	1		
# of index underlying instruments	0.3080	0.0637	0.0931	-0.0500	-0.0577	0.4930	-0.0340	0.0168	0.1230	-0.0396	-0.1590	0.0911	1	
Pooled index market capitalisation	-0.3400	-0.2130	0.0996	0.0550	0.0658	-0.2710	0.1490	0.1960	0.2400	0.2580	0.2670	-0.1750	-0.1960	1

The table above shows the correlation between the explanatory variables in regression nine (9). Lognav above is the logarithmic function of NAV and lognav2 is the same but squared. Moreover i12 and i36 are the index returns during prior 12 respectively 36 months. Similarly, r12 and r36 are the abnormal return during 12 respectively 36 months.

10.2 GRAPHS

Graph 3



The graph above illustrates the number of index funds over time in our sample.

Graph 4



The graph above illustrates all the observations in our sample. Active share on the y-axis is graphed on tracking error on the x-axis. It is evident that a large part is centred around a tracking error of 0.02 but with varying active share.