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Active management, investment style and mutual fund performance

Evidence from the Nordic market

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Abstract

This thesis examines the impact of active management and investment style on mutual fund performance in the Nordic market. Both active management and investment style have been investigated separately in other markets, but in the Nordic context, little previous research exists.

The study builds on Cremers and Petäjistö (2009) and Petäjistö (2013) work, expanding the Cremers and Petäjistö work to incorporate the impact of investment style on mutual fund performance. The sample consists of Nordic funds domiciled in Finland, Sweden, Norway and Denmark with their investment area in the Nordic countries. The data is from 2000-2020.

The funds are sorted based on the mutual funds' active share and tracking error, following the methodology by Petäjistö (2013). The five categories used in the sorting are closet indexers, moderately active, factors bets, concentrated and stock pickers. Contrary to the Petäjistö (2013) findings, the best-performing funds in the Nordic sample are the concentrated funds, i.e. the funds that generally have an undiversified holding. In the original Petäjistö (2013) work, the best performing funds are the stock pickers. In the Nordic sample, the stock pickers do not offer superior performance compared to the other fund classes.

In addition to examining active management, this thesis investigates the mutual fund performance by sorting the funds based on style. The style is examined for all funds and separately for each Petäjistö (2013) fund class. Small-cap style, proxied by the Small-Minus-Big Carhart factor loading seems to provide an ability to generate positive abnormal returns. However, the value style, proxied by the HML factor loading, does not seem to yield a difference in risk-adjusted performance.

Within the Petäjistö classes, shifting weight onto the small-cap style seems to improve mutual fund performance in closet indexer and moderately active fund categories. This is measured proxying the style with the SMB factor loading. Moreover, the factor bets, concentrated and stock picker funds seek to earn returns by shifting weight onto small-cap stocks, based on the SMB factor loading.

This thesis contributes to the literature in two ways. First, it examines the active management in the Nordic market. Second, it provides evidence that active managers are able to improve their funds' performance by shifting weight onto small-cap stocks.

Keywords Active management, Investor style, Fund performance, Abnormal returns, Mutual funds

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Tiivistelmä

Tämä diplomityö tutkii aktiivisen salkunhoidon ja sijoitustyylin vaikutusta osakerahastojen tuottoihin Pohjoismaissa. Aktiivista salkunhoitoa ja sijoitustyylejä on aiemmin tutkittu muilla markkinoilla, mutta Pohjoismaissa aiempaa tutkimusta ei juurikaan ole.

Tutkimus pohjautuu Cremersin ja Petäjistön (2009) ja Petäjistön (2013) artikkeleihin. Lisäksi tutkimus laajentaa Cremersin ja Petäjistön tutkimusta selittämällä rahastojen suorituskykyä tyylin avulla. Tutkimuksen otos koostuu pohjoismaisista rahastoista, joiden kotimaa on Suomi, Ruotsi, Norja ja Tanska ja joiden sijoitusten sijainti on Pohjoismaissa. Data on vuosilta 2000-2020.

Rahastot on jaoteltu niiden aktiiviosuuden ja indeksipoikkeaman avulla Petäjistön (2013) metodologian mukaan. Jaottelussa käytetään viittä kategoriaa, jotka ovat piiloindeksoijat, kohtalaisen aktiivisuuden rahastot, faktorirahastot, keskittyneet rahastot ja osakkeiden poimijat. Vastoin Petäjistön (2013) tuloksia parhaiten suoriutuvat keskittyneet rahastot, jotka yleensä sijoittavat keskittyneesti välttäen sijoitusten hajautusta. Petäjistön (2013) tuloksissa parhaiten pärjäsivät osakkeiden poimijat. Pohjoismaisessa otoksessa osakkeiden poimijat eivät tarjoa ylivertaisia tuottoja muihin rahastokategorioihin verrattuna.

Aktiivisen salkunhoidon lisäksi tämä diplomityö selittää rahastojen suorituskykyä sijoitustyylin avulla. Tyylin vaikutusta tutkitaan kaikille rahastoille ja jokaiselle Petäjistön (2013) kategorialle. Pienen markkina-arvon yrityksiin sijoittaminen, tutkittuna Carhart-mallin small-minus-big-kertoimen kautta, näyttää tarjoavan keinon saavuttaa ylisuuria tuottoja. Kuitenkaan arvosijoittaminen, tutkittuna Carhart-mallin HML-kertoimen kautta, ei pysty tuottamaan eroa riskikorjattuihin tuottoihin.

Petäjistön luokkien sisällä pienen markkina-arvon osakkeiden painon lisääminen vaikuttaa tarjoavan keinon lisätä tuottoja piiloindeksoijien ja kohtalaisen aktiivisuuden rahastojen joukossa. Tämä nähdään SMB-kertoimen lisäyksestä. Lisäksi faktorirahastot, keskittyneet rahastot ja osakkeiden poimijat vaikuttavat etsivän lisätuottoja pienen markkina-arvon osakkeista näiden rahastojen SMB-kertoimen perusteella.

Tässä diplomityössä on uutta tietoa kahdella osa-alueella. Ensiksi se tutkii aktiivisen salkunhoidon vaikutuksia Pohjoismaissa. Toiseksi se näyttää, että salkunhoitajat pystyvät lisäämään rahastojensa tuottoja sijoittamalla pienen markkina-arvon osakkeisiin.

Avainsanat Aktiivinen salkunhoito, sijoitustyyli, rahastojen suorituskyky, ylituotto, osakerahastot

Prologue

Eight years is a long time.

Eight years ago, I thought that at this this point, I would have already graduated from somewhere else years ago. Fortunately, I did not.

Somehow, the final number of M.Sc. degrees accidentally doubled from planned and studies may not have been the only project in student life. Now, one adventure has now come to an end and a new one lies ahead. And what a journey it has been.

I would like to thank the dozens of people I have had the pleasure to work with during my eight years at Aalto University. Most of all, the largest gratitude goes to everyone involved in Fyysikkospeksi, KY-Speksi, JTMK15, Fyysikkokilta, KY and Kulttuurijaosto. Without you, my studies would not have been even half of what they ended up being.

Especially, I would like to thank Ruth and Ahti for all their valuable advice and guiding me through this thesis.

Finally, I would like to thank my friends and my family.

In Hämeenkyrö,
October 12th, 2021

Janne Vikelä

Contents

1. Introduction

Mutual fund managers' ability to add value to fund returns has been a debate over the years. Several articles, notably Jensen (1968), Carhart (1997), Cremers and Petäjistö (2009) and Petäjistö (2013), question the mutual fund managers' ability to add value.

Thus, a question arises: How can mutual fund managers add value and generate abnormal returns? Generally, fund managers have two different questions facing them. First, they have to select an appropriate level of activity. Second, they have to choose an investing style by which to select the stocks. Of course, activity is not free of charge. First, activity comes with a direct managerial cost. Second, the manager's ability is key to performance.

Cremers and Petäjistö (2009) and Petäjistö (2013) break the managerial activity into two components, which are the manager's stock selection and the manager's ability to exploit market timing. In the two articles, they sort US mutual funds based on their active share and tracking error, which measure the fund manager's active stock selection and market timing. Cremers and Petäjistö (2009) and Petäjistö (2013) find that only the most active managers, who deviate their fund holdings from a passive benchmark and have relatively high return deviation to the passive benchmark, are the ones to earn abnormal returns.

In addition to managerial activity, the investment style of a mutual fund is crucial to performance. The well-known model by Fama and French (1993) identifies two factors driving asset returns in addition to the market. These are the size and value factor. This means that small-cap stocks seem to outperform large-cap stocks and that high book-to-market stocks seem to outperform low book-to-market stocks.

A generally accepted model is to categorize funds into size and value style categories. The size style sorts funds based on their holdings' market capitalization and value style based on their holdings' book-to-market ratio. For example, Ot-

ten and Bams (2002) provide evidence that the best-performing funds in Europe are those that invest in small-cap stocks.

This thesis investigates the determinants of mutual fund performance in the Nordic market. First, this thesis classifies mutual funds based on their activity and then examines how the investment style is related to fund activity and fund performance. The funds examined are domiciled in the Nordic countries and investing in the Nordic market.

The active management research methodology is based on Cremers and Petäjistö (2009) and Petäjistö (2013). Moreover, this thesis adds the investment style into the determinants of active mutual fund performance. This thesis explores mutual fund performance by sorting funds by size and value style in order to see if the style is related to performance and the Cremers and Petäjistö activity classes.

This thesis has the following structure. The research questions are presented in Chapter 2. The literature review is in Chapter 3. Methodology and data are explained in Chapter 4 and Chapter 5, respectively. The results are in Chapter 6 and finally, conclusions are in Chapter 7.

In Chapter 6, the Cremers and Petäjistö activity class performance is examined in the Nordic market. Then, the Nordic funds are classified by style and the Cremers and Petäjistö categories' relationship to style is examined.

2. Research problem and research questions

This section constructs the two research questions in this thesis. The first one is focused on active management and fund performance. The second one is focused on managerial style and fund performance.

2.1 Mutual funds' active management and performance

Mutual fund managers' ability to add value to mutual fund returns has been a debate over the last few decades. A large selection of literature is skeptical on the benefits of active management and finds that active management mostly underperforms passive benchmarks or other risk-adjusted abnormal returns. The usual explanations for mutual funds' underperformance are the lack of managerial skills and the high cost of active management.

Notable studies by Cremers and Petäjistö (2009) and Petäjistö (2013) examine the active management of mutual funds by breaking the active management into two components. The first component is *active share* which measures the manager's own position and selection of stocks. The active share measures how much the fund's asset allocations differ from the fund's benchmark index. The second component is *tracking error* which measures the manager's tactical asset allocation or factor timing. The tracking error measures how much the fund returns varies over time compared to the fund's benchmark index.

In this thesis, active share and tracking error are used to classify funds into five activity categories based on the Petäjistö (2013) research. Then, the funds are pooled and their absolute and risk-adjusted performance is examined in each category. The methodology is more thoroughly explained in Section 4.2.

Much of the current literature focuses on studying active management in the US stock market. However, less attention has been paid to smaller markets, including the Nordic market. Therefore, it is reasonable to test if results from

the US market apply to the Nordic market. Thus, the first research question is:

1. How does mutual fund activity affect fund performance?

This thesis uses Cremers and Petäjistö (2009) and Petäjistö (2013) methodology to measure and classify the mutual fund activity.

2.2 Mutual funds' style and performance

Since the famous paper by Fama and French (1993), the industry has established a two-fold classification of fund styles. The high-level classification is based on classifying the funds first by the market cap of the fund holdings, and second by the relative valuation of the holdings. These styles are generally referred to as *size* and *value*.

According to Fama and French (1993), small-cap stocks seem to overperform large-cap stocks. This is referred to as the size anomaly. Also, high book-to-market stocks (value stocks) seem to overperform low book-to-market (growth stocks) stocks.

Several ways to classify funds by style exist. For example, the funds could be classified by investigating the holdings or looking at statistically the fund returns' relationship to known correlation structures in the market. In this thesis, the methodology by Davis (2001) is adopted. Davis uses a fund classification method that estimates the Carhart factors for each fund and sorts them based on the size and value factors. Again, the sorted funds are pooled and their returns are regressed against the Carhart factors to see if style affects absolute and risk-adjusted performance.

In addition to testing the Cremers and Petäjistö (2009) and Petäjistö (2013) results, this thesis also extends their results by examining style impact on the fund returns. This thesis uses classifying investment style by Carhart model small-minus-big (size style) and high-minus-low (value style) coefficients. Therefore, the second research question is:

2. How does fund style affect fund performance and what is style's relationship to active management?

The methodology is similar to Davis (2001) and explained in detail in Section 4.4.

3. Literature review

This section presents the literature related to mutual funds' active management, performance measurement and investment style.

3.1 Mutual fund active management puzzle

Mutual fund manager managers' ability to add value has been questioned in literature by several authors. Jensen (1968) was among the first to document the mutual fund puzzle. This means that according to Jensen (1968) most funds seem to underperform a simple buy and hold strategy as measured by the Capital Assets Pricing Model alpha.

The Jensen (1968) question remains relevant today. In a simple review of fund returns classified by Morningstar's own investment style categories, Bogle (1998) finds that in all categories the actively managed funds seem to underperform compared to the passive index funds on average. Moreover, Bogle (1998) results imply that the funds investing in small-cap stocks seem to offer a better return than the other categories.

Carhart (1997) introduces a model where mutual fund returns can be broken into systemic market components. The Carhart (1997) result is that most funds seem to underperform the market based on the risk-adjusted returns.

Gruber (1996) also confirms the active management puzzle. According to Gruber (1996), at least sophisticated investors are able to channel their funds into better performing funds. However, disadvantaged investors may keep investing in the underperforming funds. The disadvantaged investors include retail investors, institutionally disadvantaged investors who may have limitations in their investment plan and tax disadvantaged investors. The tax disadvantaged investors may find it inefficient to move money to other funds due to capital gains taxes. Gruber (1996) documents a phenomenon in which the funds with

the most inflow are the ones to perform best and vice versa. This is evidence of the possibility that sophisticated investors have an ability to direct money into better performing funds.

Malkiel (1995) is another study that shows the general underperformance of mutual funds. Also, Malkiel (1995) comments on the "hot hand" persistence of mutual funds. The "hot hand" means that funds with good performance in the past seem to achieve similar good performance in the future. Malkiel (1995) finds some evidence in favor of the persistence in mutual funds returns. However, Malkiel (1995) is somewhat cautious about the "hot hand" result as it may be caused by survivorship bias and that the persistence has decreased over time.

3.2 Fund size and performance

Generally, the literature has confirmed an inverse relationship between mutual fund performance and size. Pastor et al. (2015) conclude that the actively managed mutual fund industry has become more skilled over time. However, the amount of skill has not improved the aggregate performance. Also, Pastor et al. (2015) conclude that the fund performance and size have an inverse relationship. Moreover, the fund performance seems to erode by the fund age.

Chen et al. (2004) conclude that on average, fund size has an inverse relationship with the fund returns both before and after fees. They attribute the reason for the decline in returns to illiquidity. The mechanism according to Chen et al. (2004) is that by the increase in fund size the funds may have to invest in more illiquid stocks. Moreover, organizational diseconomies may also erode fund performance. This means that as the number of fund managers increases, the fund performance seems to decline.

3.3 Incentive based explanations for performance

Interestingly, Del Guercio and Reuter (2014) identify an incentive explanation to activity. Del Guercio and Reuter (2014) finds that funds that are directly sold to customers are more active than funds sold through a broker. Also, the abnormal returns measured by the Carhart alpha are higher among the directly sold funds. This suggests that the directly sold funds' managers have better incentives to manage the funds.

Cremers et al. (2016) document an interaction between explicit index funds and active mutual funds. Comparing countries with different market shares between explicitly index funds and active funds, Cremers et al. (2016) document a clear relationship. When the explicit indexers' market share is high, the active funds seem to generate better abnormal returns. Moreover, the high presence of explicit indexers seems to drive down the fees for active funds. Thus, according to Cremers et al. (2016), competitive pressure from explicit indexers drives active funds to perform better.

3.4 Performance measurement

This thesis uses two methods to measure mutual funds' abnormal returns. The first method used is a simple benchmark-adjusted return or a difference between fund and benchmark returns. The second method is using factor models. The most commonly accepted factor models are the Fama and French (1993) and its extension the Carhart (1997) model. The two models are presented here.

The literature generally accepts the concept that the asset and mutual fund returns can be decomposed into systemic market-wide components. One of the most famous systemic risk models is the Fama-French three-factor model. Fama and French suggest that the market return risk can be decomposed by three factors. The first factor is the exposure to systemic market risk. The exposure to market risk is already known from the Capital Assets Pricing Model presented by Sharpe (1964) among other authors. Additionally, Fama and French augment the model with two additional market-wide risk factors.

First, Fama and French (1993) add to the model the known anomaly that small caps stocks generally seem to overperform large cap stocks. This is known as the small-minus-big or SMB factor. Also, Fama and French expand the model with the value anomaly. The value or high-minus-low book-to-market anomaly describes the anomaly where the high book-to-market stocks seem to outperform the low ones.

Also, the Fama and French model contains the alpha term which indicates the abnormal return that cannot be explained by market-wide risk factors. Generally accepted way to measure the funds' abnormal returns in the literature is regressing the funds' excess returns against the Fama-French factors and seeing if the alpha, i.e. the regression intercept, is statistically significant.

Carhart (1997) adds a fourth factor - momentum - into the Fama-French model. Momentum, or up-minus-down, is the difference between the past best-

performing and worst performing stock returns. The interesting property in momentum is that the past performance seems to predict stocks' future performance. The best performing stocks continue their past performance and the worst the contrary. The Carhart (1997) model is thoroughly explained in Section 4.1.

3.5 Active management and performance measures

This thesis applies the methodology from Cremers and Petäjistö (2009) and Petäjistö (2013). Cremers and Petäjistö (2009) first claim that relatively few mutual fund managers are able to provide additional value. This view is shared by a large selection of literature, including Carhart (1997).

In investigating which types of funds are able to add value Cremers and Petäjistö (2009) form a two-way sort for the mutual funds. First, they construct a measure on how to measure the manager's deviation from passive benchmark holdings. This is the active share. The active share is a measure for *stock selection*.

Second, they form a measure to proxy how much the fund returns deviate from the passive benchmark. The measure is the tracking error. The tracking error also proxies the fund manager's ability to exploit *market timing* - or the ability to trade predictable changes in asset class returns. The active share and tracking error are explained in detail in Section 4.2.

The first article by Cremers and Petäjistö (2009) focuses on the relationship of active share and tracking error on the mutual fund performance. The conclusion in Cremers and Petäjistö (2009) is that active share seems to drive the abnormal returns and tracking tracking error on the other hand seems to hurt the mutual fund performance. However, Cremers and Petäjistö (2009) do not attempt to form any fund classification based on the active share and tracking error. In the Petäjistö (2013), a classification based on the active share and the tracking error is formed.

Petäjistö (2013) pool the mutual funds into five categories based on the active share and tracking error. These are *closet indexers*, *moderately active*, *factor bets*, *concentrated* and *stock pickers*. The former ones are the least active with their holding close to a passive benchmark. The latter show large deviations from the passive benchmark holdings and display large return deviations from the passive benchmark. According to Petäjistö (2013), on average the best-performing mutual funds are the stock pickers.

Interestingly, Kacperczyk et al. (2005) provide evidence that the best-performing funds seem to be those that concentrate on a relative small number of stocks. This is contrary to the generally accepted diversification principle. However, Kacperczyk et al. (2005) claim that the abnormal returns from concentrated funds are not compensation from idiosyncratic risk. Idiosyncratic risk is the asset's individual return risk that cannot be explained by the systemic market risk factors.

3.6 Stock selection

Literature tends to break the mutual fund managers' ability into two components. The first is the stock selection and the second is the market timing. Stock selection refers to the manager's portfolio composition decision.

According to Kent et al. (1997), several funds in the US market display stock selection capabilities. This is measured by Kent et al. (1997) characteristic selectivity measure. Thus, there is evidence that at least some fund managers are able to choose stocks to outperform the market.

Chen et al. (2000) investigate if funds have stock picking skills. Chen et al. (2000) conclude that funds do exhibit stock picking talent as measured by the difference between the market-wide returns of stocks bought and stocks sold by mutual funds. The result is that stocks with the largest mutual fund buying seem to yield positive abnormal returns and vice versa. Moreover, Chen et al. (2000) conclude that the aggressive growth funds have the best stock picking ability.

3.7 Market timing or tactical asset allocation

Market timing ability refers to the mutual funds' ability to change asset allocation over time to capture the impact from time-varying return changes between different assets. The results from mutual fund managers' market timing ability are somewhat contradictory.

The literature provides some evidence that mutual fund managers are able to time the market. Jiang et al. (2007) provide evidence that especially funds tilted to small-cap stocks and with high industry concentration are able to time the market.

However, Kent et al. (1997) claim that the mutual fund managers seem to be

unable to time the market, as measured by the characteristic timing measure. Thus, the managers' ability to add value seems to stem from the managers' ability to select stocks.

3.8 Investment style

The mutual funds' investment style is generally decomposed based on two axes which are *size* and *value*. Size style refers to the market cap of the mutual fund holdings. Value refers to the book-to-market value of the mutual fund holdings. Value companies are usually mature companies with stable cash flows and low book-to-market ratios. The opposite of value is growth. These companies are usually companies with high expected growth with low book value, usually combined with speculative valuations.

There is some research on the performance of the two styles. Davis (2001) performs a factor sort for US mutual funds based on the Fama-French model coefficient sorting. Davis concludes that none of the styles generates positive abnormal returns and that the value style generates negative abnormal returns. This indicates that the mutual fund managers' ability to add value is rather limited.

Otten and Bams (2002) perform a Carhart model regression on different European mutual funds in different style categories. They conclude that generally, some mutual fund managers have the ability to add value. Moreover, the best performing funds, with respect to the Carhart model, are small-cap funds.

Kent et al. (1997) provide evidence that the most aggressive growth fund managers are able to select stocks to generate abnormal returns.

4. Methodology

This section explains the methodology used in this thesis. First, measuring abnormal returns is explained. Then, measuring fund activity is defined. Finally, a method to classify funds based on style is presented.

4.1 Measuring abnormal returns

This section explains the methodology used for measuring mutual funds' abnormal returns. The first method is the Carhart model and the second method is the benchmark-adjusted return.

Carhart model

The main method used for measuring abnormal returns is the Carhart model presented by Carhart (1997). The model adds a fourth momentum - or Up-Minus-Down - factor in addition to the well known three Fama-French factors presented by Fama and French (1993). Carhart model is also used in Cremers and Petäjistö (2009) and Petäjistö (2013). Moreover, the Carhart model is perhaps the most widely accepted model for measuring abnormal returns.

The Carhart model is defined below with the α in the following equation measuring abnormal returns:

$$\begin{aligned} R_i - R_f = \alpha + \beta_{Mkt-Rf}(R_{Mkt} - R_f) + \beta_{SMB}SMB \\ + \beta_{HML}HML + \beta_{UMD}UMD, \end{aligned} \tag{4.1}$$

where the factors are:

- Mkt - Rf — Market excess return
- SMB — Small-minus-big (size)

- HML — High-minus-low (value)
- UMD — Up-minus-down (momentum)

and the other parameters are:

- R_i — Return of an asset
- R_f — Risk-free rate
- R_{Mkt} — Market return
- α — Excess return
- β_i — Coefficient for factor i.

Also, the Carhart model factors are later used to classify funds by their style according to the Davis (2001) methodology.

Benchmark-adjusted return

Benchmark-adjusted returns are another way to measure abnormal return, and is also used by Cremers and Petäjistö (2009) and Petäjistö (2013). The benchmark-adjusted return is simply defined as the difference between the fund and its benchmark's returns as in Equation (4.2).

Compared to the Carhart model, the benchmark-adjusted return is easier to calculate, and especially for a retail investor, more intuitive than the regression-based Carhart model abnormal return. The benchmark-adjusted return $R_{\text{Benchmark-adjusted}}$ is defined as:

$$R_{\text{Benchmark-adjusted}} = R_{\text{Fund}} - R_{\text{Benchmark index}}, \tag{4.2}$$

where R_{Fund} is the fund return and $R_{\text{Benchmark index}}$ is the benchmark index return.

4.2 Fund activity: Active share, tracking error and classification

This section describes the two variables used in the Petäjistö methodology to categorize funds' activity. The variables are the active share and the tracking error.

Active share

Active share defined in Equation (4.3) is the figure which measures the percentage by which a fund's holdings deviate from the benchmark index composition. Intuitively, the active share measures the fund manager's own position on the fund holdings.

Active share is defined as:

$$\text{Active share} = \frac{1}{2}\sum_{i=1}^{N} \left| w_{Fund,i} - w_{Index,i} \right|, \tag{4.3}$$

where $w_{Fund,i}$ is stock i weight in fund and $w_{Index,i}$ is stock i weight in the benchmark index with N denoting the total number of stocks.

Tracking error

Tracking error is a measure that according to Cremers and Petäjistö (2009) and Petäjistö (2013) quantifies the manager's market timing ability. Intuitively, the tracking error proxies the fund manager's trading frequency and attempts to capitalize individual stock price changes.

Tracking error is defined as the standard deviation of the difference between the fund return and the benchmark index return:

$$\text{Tracking error} = \text{Std. dev}\left(R_{Fund} - R_{Index} \right), \tag{4.4}$$

where R_{Fund} is the fund return and R_{Index} is the index return.

In this thesis, the tracking error definition is the same as in Petäjistö (2013). In the Cremers and Petäjistö (2009) paper, the tracking error is calculated from the residual volatility from the estimated regression of fund excess return on benchmark's excess return. These two excess returns are calculated against the risk-free rate.

Classifying funds by activity

The active share and tracking error defined in Section 4.2 are used to classify the funds into five categories in the spirit of Petäjistö (2013).

The funds are sorted independently based on the 2016-2020 average active

share and 2000-2020 tracking error. The active shares and tracking errors come from different time intervals as Morningstar only provides active share for the years 2016-2020. The funds are classified based on equal-sized quantiles for active share and tracking error. Then, the funds are pooled into five categories defined in Table 4.1.

In Table 4.1, the fund classes are formed by sorting funds based on active share and tracking error quantiles. The quantiles from lowest to highest are Q1 to Q5. For example, a stock picker fund (5) is defined as follows. If a fund belongs to the highest active share quantile Q5 and to the tracking error quantiles Q1-Q4, the fund is classified as a stock picker.

	Tracking error quantile						
Active share quantile	Q1 (Low)	Q2	Q3	Q4	Q5 (High)	Group	Label
Q5 (High)	5	5	5	5	4	5	Stock pickers
Q4	2	2	2	2	3	4	Concen-trated
Q3	2	2	2	2	3	3	Factor bets
Q2	2	2	2	2	3	2	Moderately active
Q1 (Low)	1	1	1	1	3	1	Closet indexers

Table 4.1. Fund classification. This table shows how funds are classified based on the active share and tracking error quantiles. The funds are sorted independently based on their active share and tracking error. Then, based on the active share and tracking error quantiles, the funds are sorted into five categories. In both sorts, the quantile Q1 is for the lowest and Q5 for the highest values. For example, if a fund belongs to the highest active share quantile Q5 and to any of the tracking error quantiles Q1 - Q4, the funds is classified as a stock picker or group 5. The classification is the same as used by Petäjistö (2013)

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Then, the fund returns are pooled together into an equally weighted portfolio and the returns are regressed against the Carhart factors. Also, equally weighted benchmark-adjusted returns are calculated within each fund class. The results are in Section 6.1. Further on, the funds within each class are classified based on style as explained in Section 4.4.

Original Petäjistö methodology

This section explains the methodology used by Cremers and Petäjistö (2009) and Petäjistö (2013). Most importantly, the funds' classification methodology in

Petäjistö (2013) is presented.

In Cremers and Petäjistö (2009), funds are sorted monthly in two dimensions based on the active share and tracking error. Cremers and Petäjistö (2009) find a positive association between abnormal returns and tracking error and a negative relation between abnormal returns and the tracking error. However, Cremers and Petäjistö (2009) do not attempt to form any classification criteria for the funds.

Further on, a formal classification is introduced in Petäjistö (2013). The classification of funds works as follows. First, the funds are calculated an active share and tracking error for the pooling. Then, the funds are sorted into the five activity classes each month and an equally weighted portfolio is formed for each class.

Samples

Regarding the samples in the two papers, the fund sample criteria is slightly different between Cremers and Petäjistö (2009) and Petäjistö (2013). In Cremers and Petäjistö (2009), the funds need to have either an equity holding of 80 % as reported by CRSP mutual fund database or 67 % as calculated from the CDA/Spectrum (Currently known as Thomson Reuters S12) holding data to be included in the sample. In the Petäjistö (2013), the thresholds are 70 % and 60 %, respectively. Cremers and Petäjistö use this criteria to exclude any other than non-index equity funds. Moreover, in both articles, the fund sample consists of funds with a minimum equity holding of USD 10 million. The Cremers and Petäjistö (2009) sample consists of 2647 funds in the years 1980-2003. Then, the Petäjistö (2013) sample consists of 2740 funds in the years 1980-2009.

Active share and tracking error

The active share is calculated from the quarterly Thomson Reuters S12 database holding data compared to the benchmark index. In the Cremers and Petäjistö (2009) paper, the benchmarks are selected from 19 alternatives of three families S&P/Barra, Russell and Wilshire and a benchmark yielding the lowest active share is used. In the later Petäjistö (2013), the self-reported benchmark is primarily used. The formula used in calculation of the active share is Equation (4.3).

The tracking error is calculated each month as the latest six month variation between the daily fund and the benchmark returns. The benchmarks are the same as with the active share. However, the tracking error measures are different in Cremers and Petäjistö (2009) and Petäjistö (2013). The Cremers and

Petäjistö (2009) article uses the residual volatility from a regression where the funds excess return against the risk-free rate is regressed against the benchmark's similar excess return. The Petäjistö (2013) article on the other hand uses a simple standard deviation of the daily difference between the fund and benchmark return as in Equation (4.4).

Sorting and classifying funds

In Cremers and Petäjistö (2009), the funds are sorted each month based on the active share and tracking error into a 5x5 table based on the active share and tracking error quantiles. A clear pattern exists in the table. The abnormal returns in the 5x5 sort are increasing by the active share and decreasing by the tracking error. Further on, Petäjistö (2013) maps the 5x5 sort into five formal categories.

The five category pooling of funds in Petäjistö (2013) is conducted each month. The funds are sorted each month by the latest active share, calculated from the most recent quarterly holding report, and the latest six months' tracking error. The sorting is conducted into equal-sized quantiles. Then, using the Table 4.1 the funds are sorted into five classes based on which active share and tracking error quantiles they belong to.

The abnormal returns in each Petäjistö (2013) class are measured first by the benchmark-adjusted returns and then by the Carhart alphas. The only class yielding statistically significant positive abnormal returns are the stock pickers, with an annualized benchmark-adjusted return of 2.62 % and a Carhart alpha of 2.10 % before fees. The post-fee benchmark-adjusted return and Carhart alpha were 1.26 % and 1.39 %, respectively. In the other four classes, the abnormal returns remain insignificant from zero.

Differences from the original Petäjistö research

Because the Nordic data is somewhat harder to obtain than US fund data, a number of changes have been made in this thesis to the original Petäjistö (2013) paper.

Calculation of active share

In the original Petäjistö (2013) paper, Petäjistö manually calculates the active share for each fund at the time each of holdings report. This is easy for the US data as it is available in the Thomson Reuters S12 database. However, the holding data for Nordic funds is less easily available as no centralized fund

holding database similar to S12 exists. Thus, in this thesis, self-reported active shares from Morningstar are used.

Also, the funds are calculated an average active share for years 2016-2020 based on which the funds are classified only once. This is contrary to the original Petäjistö (2013) methodology where funds are classified each month based on the latest active share and tracking error.

Calculation of tracking error

The original Petäjistö (2013) paper calculates the tracking error at each pooling point based on the last six months of daily returns with respect to the self-reported benchmark. This thesis, however, uses an annualized tracking error from the weekly returns with respect to the self-reported benchmark. The calculation interval is the entire available lifetime between 2000 and 2020. The calculation is done automatically in Morningstar direct.

Classifying funds

The funds are classified based on the active share and tracking error quantiles as in Petäjistö (2013). However, in this thesis, the funds are pooled only once based on the 2016-2020 active share and 2000-2020 tracking error. The active share period of 2016-2020 is intentionally shorter than the tracking error interval, as Morningstar only provides the active share data to years 2016-2020. In the original Petäjistö paper, the funds are pooled monthly based on the most recent active share and the latest rolling six months of daily tracking error.

Returns

The original Cremers and Petäjistö (2009) and Petäjistö (2013) paper use both pre- and post management fee returns. However, due to Morningstar direct not providing the pre-fee return, only post-fee return is used in this thesis.

4.3 Determinants of abnormal returns

As a robustness check, a panel regression is used to see if the abnormal return is related to fund type and characteristics. The regression is similar as in Petäjistö (2013).

Equation (4.5) shows the equation used in the panel regression. The abnormal return is examined in two ways: Annual Carhart alpha and the benchmark-adjusted return in year T. The abnormal returns are estimated from 12 months of data in the corresponding year.

In the case of Carhart alpha, the alpha is estimated from the 12 months excess returns regressed against the Carhart factors. The alpha is a monthly alpha. The benchmark-adjusted return is estimated from the 12 month mean benchmark-adjusted return.

Then, the abnormal return is regressed against the explanatory variables. They are: Active share, tracking error, turnover in percentage points, expenses in percentage points and log of total assets in the previous year. Also, dummies for fund type are used. Moreover, fixed effects are added for the year. The tracking error is estimated from the last six months of daily data each year and the active share is the most recent reported. The regression equation for abnormal returns is defined as:

$$\begin{aligned}\text{Abnormal return}_T = {} & \lambda_{AS} * AS_{T-1} + \lambda_{\text{Stock picker}} * I_{\text{Stock picker}} \\ & + \lambda_{\text{Concentrated}} * I_{\text{Concentrated}} \\ & + \lambda_{\text{Factor bet}} I_{\text{Factor bet}} \\ & + \lambda_{\text{Moderately active}} * I_{\text{Moderately active}} \\ & + \lambda_{\text{TE}} * TE_{T-1} + \lambda_{\text{Turnover}} * \text{Turnover}_{T-1} \\ & + \lambda_{\text{Expenses}} * \text{Expenses}_{T-1} \\ & + \lambda_{\text{Total assets}} * Log(\text{Total assets}_{T-1}),\end{aligned} \tag{4.5}$$

where parameters are:

- λ_i — Coefficient for regression term i
- AS_{T-1} — Active share
- $I_{\text{Fund type}}$ — Dummy for fund class
- TE_{T-1} — Tracking error
- Turnover_{T-1} — Fund turnover in %
- Expenses_{T-1} — Fund expenses in %
- $Log(\text{Total assets})$ — Logarithm of total assets.

The controls turnover, expenses and total assets are included in the panel regressions as each of them might have an inverse relationship between the fund performance. Carhart (1997) documents a negative relationship between both fund turnover or the value of transactions divided by the total fund assets. Also, Carhart (1997) finds that fund expenses deteriorate fund performance. Then, Pastor et al. (2015) and Chen et al. (2004) both find that mutual find size may inhibit performance.

4.4 Classifying funds by style

This section explains the fund classification by style. The classification is similar to Davis (2001). The classification is done in two parts: First, the whole fund universe is sorted by SMB and HML Carhart factors. Then, the funds are again sorted within each Petäjistö category. This is to see if style affects funds' risk-adjusted performance and if the style performance varies within each fund category.

Style classification within all funds

In the first classification part, the full sample of funds in this thesis is classified by the SMB and HML factor coefficients. The classifications are separate.

The SMB factor in Carhart represents the small-minus-big or size factor. The concept according to Fama and French (1993) and Carhart (1997) is that small firms seem to outperform big firms in the stock market. The HML factor, high-minus-low or value factor, measures the return difference between high and low book-to-market value stocks. The concept from Fama and French (1993) and Carhart (1997) is that value firms seem to outperform growth firms.

The sorting by SMB and HML factors works is explained here. First, each fund's returns are regressed against the Nordic Carhart coefficient for the available returns between 2000 and 2020. Then, the funds are sorted into five equal size quantiles based on the SMB and HML coefficients. Then, the funds are pooled into an equally weighted portfolio within each quantile. Finally, the mean fund returns are calculated and regressed against the Carhart factors.

The funds with the lowest SMB and HML coefficients are assigned into portfolio P1 and the highest into portfolio P5. Also, a long-short portfolio between P5 and P1 is examined to see if the difference between the fund abnormal returns is statistically significant.

Style classification within Petäjistö's activity classes

To examine if the styles on SMB-HML scale can explain the differences between fund returns, the funds are sorted by the SMB and HML factor coefficients within each of the five Petäjistö categories of funds. The differences between Carhart factor loadings between the five Petäjistö fund categories are examined to see if there is a statistical difference between the Carhart factors. This might reveal if some Petäjistö category systemically relies on a particular style.

5. Data

5.1 Mutual fund data and benchmarks

The data sample consists of mutual funds from four Nordic countries: Finland, Sweden, Norway and Denmark. The data sample runs from 2000 to 2020 and returns are examined on a monthly basis. The main data source is Morningstar direct. Morningstar direct provides both mutual fund returns and benchmark returns.

Fund universe

The fund sample is narrowed to those which invest in stocks listed in the Nordic region. The funds are equity-only funds, and for example, the sample excludes mixed funds. Two sub-samples are used.

Sample for active management

The sample for examining active management is selected so that the Cremers and Petäjistö (2009) and Petäjistö (2013) methodology can be applied. The sample used for examining active management consists of those funds which report their active share and have benchmark available to calculate the tracking error. The sample is further narrowed from the fund universe for two reasons. The first reason is that not all funds report their active share. The second reason is that several funds have no benchmark available to calculate the tracking error. This means that the sample narrows to 196 mutual funds for which can be analyzed with Petäjistö methodology.

Samples for style

This thesis also examines the effect of managerial style in the spirit of Davis (2001). The Davis methodology is explained in Section 4.2. Two different samples are used for classifying funds by style.

The first sample is independent of active management. The first style part examines the managerial style impact by sorting funds based on size and value factor quantiles based on Carhart factor coefficients. The sample consists of the full Nordic universe and includes all funds for which the Carhart model can be estimated. Altogether 896 funds are used.

The second sample applies the Davis (2001) methodology within each Petäjistö activity class. The idea is the same as with the full universe, but style classification is independent within each activity category. A sample of 196 funds is used.

Fund data

The pieces of data needed are:

1. Fund returns
2. Active share
3. Tracking error
4. Turnover percentage
5. Market capitalization
6. Management fee in percentage point.

Benchmark indices

Morningstar provides the benchmark index data. The benchmark indices used are the self-reported benchmarks. Obviously, some funds may have unavailable benchmarks and these funds are not included in examining the active management impact on fund returns. The benchmarks are used for calculating tracking error and benchmark-adjusted returns as explained in Chapter 4.

Active share and tracking error

The active share data used is self-reported by funds and tracking error is calculated with respect to the self-proclaimed benchmark index by Morningstar. Active share and tracking error are explained in Section 4.2.

The methodology slightly deviates from Cremers and Petäjistö (2009) and

Petäjistö (2013). The deviation is in the classification method used to classify the funds into Petäjistö categories. As a difference to the original methodology, funds are pooled into different activity classes only once based on the average active share between 2016 and 2020 and the fund's tracking error. The calculation of tracking error is performed on a weekly basis from 2000 to 2020.

The thesis methodology is different from Petäjistö (2013) where the funds are sorted each month based on the active share and tracking error. Also, in Petäjistö (2013), the active share is calculated from the latest reported holdings from the most recent quarterly report. Then, the tracking error is "rolling". This means the tracking error is calculated each month from the latest six months of daily return data.

	All	Closet indexers (1)	Moderately Active (2)	Factor Bets (3)	Concen-trated (4)	Stock Pickers (5)
Mean return (%, monthly)	0.927	0.86	0.91	0.92	1.146	0.81
Standard deviation (%, monthly)	5.064	4.93	5.08	5.18	4.962	5.51
Sharpe ratio	0.157	0.15	0.15	0.15	0.205	0.12
N of funds	196	38	99	18	22	19
Mean size (MEUR, 2020)	461.5	489.3	349.1	780.6	631.6	545.3
Mean management fee (%, 2016-2020 mean)	1.12	0.52	1.23	1.32	1.24	1.43
Mean active share (%, 2016-2020)	44.83	10.92	42.84	48.27	84.33	74.14
Mean tracking error (%, 2000-2020)	7.11	3.79	7.09	10.10	10.47	7.11

Table 5.1. Summary statistics

5.2 Factor data

Abnormal returns are measured by the Carhart factor model. The model is further explained in Section 4.1. The factor data used in the model comes from two sources. The main source used is AQR Asset Management. AQR provides a Nordic AQR factor set and a risk-free rate of return. AQR provides factors individually for Finland, Sweden, Norway and Denmark. Thus, a value weighted average of the factors is used in the Carhart model so that the factor represents each of the four countries. The value weighted average Nordic factor $R_T^{\text{Nordic factor}}$ is defined as:

$$R_T^{\text{Nordic factor}} = \sum_{i=1}^{N} \frac{Cap_{T-1}^{i}}{\sum_{i=1}^{N} Cap_{T-1}^{i}} * R_T^{\text{National factor i}}, \tag{5.1}$$

where Cap_{T-1}^{i} is the market capitalization of stocks and $R_T^{\text{National factor i}}$ is the national factor in country i with T representing time and N the number of countries.

The secondary source for factor data is Kenneth French's European Carhart factor set. This is used as a robustness check in Appendix A.

6. Results

This section examines the results. The results are in two parts. The first part in Section 6.1 covers the performance of the five Petäjistö fund categories. The second part in Section 6.2 covers the impact from style on the fund performance.

6.1 Performance by fund class

6.1.1 Benchmark-adjusted returns

Table 6.1 exhibits the benchmark-adjusted returns for each Petäjistö fund category. The notable conclusions are: First, the *closet indexers* perform poorly against their benchmark. Second, the *stock pickers* do not perform as well as in Petäjistö (2013). Third, on average the best-performing category seems to be the *concentrated* funds.

The closet indexers seem to earn a negative benchmark-adjusted return of -0.7 basis points. The result is in line with Petäjistö (2013). The stock pickers earn a statistically insignificant benchmark-adjusted return of 1.6 basis points which is significantly weaker results than in Petäjistö (2013). Also, the difference (5 - 1) between the closet indexers is statistically insignificant.

Contrary to Petäjistö (2013) results, the concentrated funds seem to perform best. Their monthly benchmark-adjusted return is 41 basis points and the difference to the closet indexers (4 - 1) is 42 basis points. Both the concentrated funds' benchmark-adjusted return and the difference to the closet indexers are statistically significant.

	All	Closet indexers (1)	Moderately Active (2)	Factor Bets (3)	Concentrated (4)	Stock Pickers (5)	4 - 1	5 - 1
Benchmark-adjusted return (%, monthly)	0.077	-0.007	0.031	0.111	0.414	0.016	0.422	0.024
T Stat	2.001	-0.276	0.948	1.144	3.927	0.215	3.993	0.335
P-value	0.0457	0.783	0.344	0.254	1.11 e-04	0.830	8.579 e-05	0.738
Significance	*				***		***	

Table 6.1. Benchmark-adjusted returns. Benchmark-adjusted returns are the monthly differences between fund return and fund's benchmark. The benchmark-adjusted returns are calculated when benchmark index is available. The funds are categorized into groups 1-5 based on 2000-2020 weekly tracking error and average 2016-2020 active share according to Petäjistö's methodology. 4 - 1 and 5 - 1 are long-short differences between their corresponding categories concentrated - closet indexers and stock pickers - closet indexers. Stars mark significance with levels . , * , ** and *** for 10 %, 5 %, 1 % and 0.1 %, respectively.

6.1.2 Abnormal returns

Table 6.2 shows the Carhart regression results for each Petäjistö category of funds. The results are very similar to Section 6.1.1. First, none of the Petäjistö categories except for the *concentrated* funds offer superior performance compared to the others. Also, the *stock pickers* do not yield similar results as in Petäjistö (2013). Interestingly, all funds seem to have a positive Carhart alpha against the Nordic Carhart factors.

The concentrated funds have a monthly Carhart alpha of 0.632 %. The difference between concentrated funds' and the closet indexers' alpha is 0.214 % and statistically significant at 10 % level. However, the stock pickers seem to offer a slightly worse performance than the closet indexers, which is contrary to the Petäjistö (2013) results.

Interestingly, the concentrated fund and the closet indexers seem to have slightly higher SMB factor loadings than the closet indexers. The difference is also statistically significant. Thus, this gives some indication that these classes may rely more on the small-cap stocks than the other categories.

Appendix A shows similar results to Table 6.2 using European factor data in regression. This is used as an additional robustness check.

		Alpha	Mkt-Rf	SMB	HML	UMD
Closet Indexers (1)	Coef.	0.418	0.643	0.18	0.0686	-0.116
	T Stat	2.56	24.4	2.81	1.61	-3.17
	P-value	0.0112	1.16e-67	0.00542	0.108	0.00171
	Signif.	*	***	**		**
Moderately Active (2)	Coef.	0.437	0.666	0.191	0.0647	-0.108
	T Stat	2.61	24.6	2.9	1.48	-2.88
	P-value	0.00973	2.41e-68	0.00409	0.14	0.00439
	Signif.	**	***	**		**
Factor Bets (3)	Coef.	0.453	0.651	0.243	0.108	-0.111
	T Stat	2.32	20.7	3.18	2.13	-2.54
	P-value	0.021	7.75e-56	0.00167	0.0345	0.0118
	Signif.	*	***	**	*	*
Concentrated (4)	Coef.	0.632	0.653	0.257	0.158	-0.0953
	T Stat	3.67	23.5	3.79	3.51	-2.47
	P-value	0.000301	6.93e-65	0.00019	0.00053	0.0142
	Signif.	***	***	***	***	*
Stock Pickers (5)	Coef.	0.329	0.72	0.283	0.00374	-0.102
	T Stat	1.84	25	4.02	0.0804	-2.56
	P-value	0.0668	1.84e-69	7.68e-05	0.936	0.0111
	Signif.	.	***	***		*
All	Coef.	0.448	0.663	0.211	0.0804	-0.108
	T Stat	2.72	25	3.26	1.88	-2.93
	P-value	0.00697	1.56e-69	0.00127	0.0617	0.00369
	Signif.	**	***	**	.	**
4-1	Coef.	0.214	0.0106	0.0765	0.089	0.0207
	T Stat	1.85	0.567	1.68	2.95	0.801
	P-value	0.0657	0.571	0.094	0.00347	0.424
	Signif.	.		.	**	
5-1	Coef.	-0.0886	0.0775	0.102	-0.0648	0.0135
	T Stat	-1.04	5.66	3.07	-2.93	0.713
	P-value	0.298	4.27e-08	0.00237	0.00368	0.477
	Signif.		***	**	**	

Table 6.2. Carhart regression results for different fund categories. Nordic factors are used. The funds are categorized into groups 1-5 based on 2000-2020 weekly tracking error and average 2016-2020 active share according to Petäjistö's methodology. The portfolios represent an equally weighted average of the fund returns within each category. 4 - 1 and 5 -1 are differences between their corresponding categories.

6.1.3 Fund performance determinants

Table 6.3 shows the results for a panel regression which examines the abnormal returns and their determinants. The panel regression is thoroughly explained in Section 4.3. The dependent variable is the abnormal return. In Panel A, the dependent variable is the annual Carhart alpha of an individual fund. In Panel B, the dependent variable is the annual benchmark-adjusted return of an individual fund.

The dependent variables are dummies indicating the fund's Petäjistö category and fund characteristics. The characteristics include active share, tracking error, turnover, expenses and log of total assets. The characteristics are from the preceding year of the abnormal returns.

The results in Table 6.3 give only weak evidence on the performance determinants. Panel A and Panel B do not give consistent evidence on the active share's and tracking error's relationship to the abnormal returns. According to Panel A, the active share is positively associated with abnormal returns with statistical significance. However, the result for active share in Panel B is statistically insignificant.

Interestingly, the coefficient for tracking error is negative in Panel A. This is somewhat contradictory to the finding that the concentrated funds, with a large tracking error, are the best performers. However, this may be due to the fact that only a few funds manage to take advantage on the factor timing or tactical asset allocation.

The common results between Panel A and Panel B are: First, none of the categorical indicators seems to bear a relationship with the abnormal returns. Also, the size and turnover do not seem to have a relationship to the funds' abnormal returns. Not so surprisingly, the funds' expenses have an inverse, statistically significant relationship to the abnormal returns.

	Variable	Coef.	T stat	P-value	Signif.
Panel A: Carhart Alpha					
	Active share	0.011	2.640	0.009	**
	Stock picker	0.085	0.347	0.729	
	Concentrated	0.237	0.842	0.400	
Fixed effect:	Factor bet	-0.031	-0.148	0.882	
Year	Moderately active	0.049	0.330	0.742	
	Tracking error	-0.080	-3.250	0.001	**
	Turnover (%)	-0.000	-0.496	0.620	
	Expenses (%)	-0.301	-3.130	0.002	**
	Log total assets	-0.008	-0.279	0.780	
	R^2	0.542			
	N	366			
Panel B: Benchmark-adjusted return					
	Active share	0.002	0.801	0.424	
	Stock picker	0.149	0.942	0.347	
	Concentrated	-0.026	-0.142	0.887	
Fixed effect:	Factor bet	-0.159	-1.170	0.242	
Year	Moderately active	-0.009	-0.092	0.927	
	Tracking error	0.021	1.330	0.185	
	Turnover (%)	0.000	0.216	0.829	
	Expenses (%)	-0.200	-3.280	0.001	**
	Log total assets	0.011	0.598	0.550	
	R^2	0.163			
	N	378			

Table 6.3. Panel regression on abnormal return and explanatory variables. The dependent variable is an individual fund's abnormal return in year T. In Panel A, dependent variable is the annual Carhart alpha and in Panel B the benchmark-adjusted return. The explanatory variables are Active share, Tracking error, turnover, next expenses and log of total assets int year T-1. A dummy indicating fund type is used and a fixed effect for year is added. Data is from 2016-2020

6.2 Investment style and fund performance

This section examines the relationship between investment style and fund performance with Davis (2001) methodology, or sorting by the funds' SMB and HML factor loading in Carhart model. The full sample of funds is used. The results for sorting based on size style or SMB factor are in Section 6.2.1 and for size style or HML factors are in Section 6.2.2.

The individual fund returns are first regressed against the Carhart factors for the available return data and then, the funds are sorted based on their factor loading. The sorting is carried out by forming equal size quantiles. Then, the funds are pooled into equally weighted portfolios within their factor quantile. The methodology is thoroughly explained in Section 4.4.

6.2.1 Size style and performance

This section examines the full fund universe and the impact on size style. The size style is measured by the fund's SMB factor loading in the Carhart model. The available fund returns are regressed against the Carhart factor. Then, all funds are sorted by the SMB factor into equal sized quantiles. Portfolio P1 is for the funds with the lowest SMB coefficient, and P5 is for the highest.

Coef.	All	P1	P2	P3	P4	P5
Alpha	0.463	0.449	0.345	0.380	0.495	0.647
Mkt-Rf	0.665	0.616	0.646	0.677	0.676	0.709
SMB	0.166	-0.302	-0.037	0.133	0.320	0.721
HML	-0.018	-0.022	-0.013	0.050	0.042	-0.148
UMD	-0.136	-0.090	-0.144	-0.111	-0.134	-0.202

Table 6.4. Mean pre-formation Carhart factor coefficients for portfolios sorted based on SMB factor

Table 6.4 shows the mean Carhart factor coefficients within each quantile. Table 6.5 displays the fund returns and Carhart alphas within each SMB quantile.

Sorting by the SMB factor in Table 6.5 reveals several interesting aspects. First, the returns are strictly increasing. Second, the Carhart alphas in the portfolios seem to be larger for P5 with 0.57 % than for P1 with 0.38 %. This indicates that the size style, or investing into small-cap stocks yields better investment returns. The difference in alphas is weakly significant with P-value of 0.148.

	All	P1	P2	P3	P4	P5	P5 - P1
Mean return (%, monthly)	0.833	0.643	0.712	0.787	1	1.01	0.371
Std. dev (%, monthly)	5.1	5.33	5.1	5.16	5.06	5.45	2.780
Sharpe ratio	0.138	0.0962	0.114	0.127	0.172	0.162	0.133
N funds *N months	112575	19712	25304	25069	25636	16854	
N funds	896	180	179	179	179	179	
Alpha	0.423	0.38	0.346	0.306	0.549	0.567	0.188
T stat	2.68	2.07	2.25	1.95	3.26	3.2	1.450
P-value	0.00786	0.0396	0.0256	0.0527	0.00129	0.00155	0.148
Signif.	**	**	**	.	**	**	

Table 6.5. Size factor and fund performance. Each fund is regressed against Carhart factors and based on SMB coefficients, funds are pooled into portfolios P1 to P5. P1 is for the lowest SMB coefficient and P5 for the highest. P5 - P1 is a long-short portfolio between portfolios P5 and P1. Equal sized quantiles are used. The portfolios are equally weighted between funds. Portfolio returns are regressed against the Carhart factors.

Therefore, it seems that investing in small-cap stocks yields more return from both SMB factor loading and a possibility to earn abnormal returns. This is most likely due to the fact that the asset managers are able to choose undervalued small-cap stocks into their portfolio.

6.2.2 Value style and performance

While Section 6.2.1 examined the size style, this section examines the value style. The Carhart model coefficients are used to sort the funds based on the HML coefficient. The portfolios are first regressed against the Carhart factors for the available returns. Then, the funds are sorted into equal sized quantiles based on the HML factor.

Table 6.6 displays the coefficients for each of the quantiles sorted by the HML factor. P1 is the portfolio with the lowest HML coefficients and P5 with the highest.

Coef.	All	P1	P2	P3	P4	P5
Alpha	0.463	0.654	0.393	0.391	0.442	0.366
Mkt-Rf	0.665	0.662	0.675	0.664	0.670	0.556
SMB	0.166	0.291	0.127	0.093	0.211	0.097
HML	-0.018	-0.406	-0.034	0.131	0.295	0.605
UMD	-0.136	-0.235	-0.115	-0.090	-0.115	-0.081

Table 6.6. Mean pre-formation Carhart factor coefficients for portfolios sorted based on HML factor

	All	P1	P2	P3	P4	P5	P5 - P1
Mean return (%, monthly)	0.833	0.743	0.763	0.837	0.938	0.937	0.195
Std. dev (%, monthly)	5.1	5.48	5.26	5.13	4.98	5.03	2.600
Sharpe ratio	0.138	0.112	0.12	0.138	0.162	0.16	0.075
N funds ∗N months	112575	13637	27962	23893	27685	19398	
N funds	896	180	179	179	179	179	
Alpha	0.423	0.45	0.409	0.424	0.461	0.395	-0.055
T stat	2.68	2.63	2.5	2.72	2.73	2.32	-0.495
P-value	0.00786	0.00907	0.0131	0.00706	0.00676	0.0211	0.621
Signif.	**	**	**	**	**	**	

Table 6.7. Value factor and fund performance. Each fund is regressed against Carhart factors and based on HML coefficients, funds are pooled into portfolios P1 to P5. P1 is for the lowest HML coefficient and P5 for the highest. P5 - P1 is a long-short portfolio between portfolios P5 and P1. Equal sized quantiles are used. The portfolios are equally weighted between funds. Portfolio returns are regressed against the Carhart factors.

Table 6.7 displays the returns and Carhart alphas for the portfolios sorted based on the HML factor. First, the difference in returns is flatter compared to the sort by SMB factor. Moreover, the risk-adjusted performances measured by

Carhart alphas seem to show no statistically significant difference. Thus, the value style does not seem to bring additional advantage to the funds.

6.3 Investment style and performance within fund classes

This section examines the investment style impact for each Petäjistö fund class. This section provides a similar examination on style impact on fund returns as in Section 6.2. The funds are sorted within each Petäjistö class based on the SMB and HML coefficients. Then, the returns and alphas are examined to see if notable differences exist.

Coef.	All	Closet indexers (1)	Moderately active (2)	Factor bets (3)	Concen-trated (4)	Stock pickers (5)
Alpha	0.463	0.451	0.428	0.426	0.644	0.403
Mkt-Rf	0.665	0.640	0.675	0.653	0.668	0.678
SMB	0.166	0.136	0.192	0.221	0.303	0.335
HML	-0.018	0.066	0.024	0.093	0.150	0.105
UMD	-0.136	-0.109	-0.105	-0.112	-0.095	-0.231

Table 6.8. Mean Carhart factor coefficients within each Petäjistö fund class.

Table 6.8 shows the pre-formation mean Carhart factor coefficients within each Petäjistö funds class. Two notable patterns are visible. First, the SMB factor loading is strictly increasing from the closet indexer to stock picker category. Second, the result is similar in the HML factor loading, which is the proxy for value style.

Now, it is reasonable to see if the differences in Carhart factor loading is reflected in the returns within each Petäjistö fund class. The following sections sort the funds within each category to see if the style can explain the performance differences.

6.3.1 Closet indexers

This section examines the closet indexers' performance and their investment style. Table 6.9 displays the pre-formation mean Carhart factor coefficients within the closet indexer category. In Panel A, the sort is done by SMB and in Panel B by HML factor. Portfolio P1 contains the funds with the lowest factor loading and P5 the ones with the highest.

Coef.	All	P1	P2	P3	P4	P5
Panel A: Closet indexers sorted by SMB						
Alpha	0.451	0.364	0.397	0.378	0.491	0.624
Mkt-Rf	0.64	0.63	0.683	0.701	0.628	0.556
SMB	0.136	-0.181	-0.0274	0.0635	0.268	0.555
HML	0.0662	-0.0253	0.0944	0.139	0.126	-0.00352
UMD	-0.109	-0.162	-0.109	-0.118	-0.101	-0.0544
Panel B: Closet indexers sorted by HML						
Alpha	0.451	0.495	0.403	0.504	0.392	0.459
Mkt-Rf	0.64	0.602	0.646	0.641	0.634	0.676
SMB	0.136	0.00992	0.246	0.168	0.163	0.092
HML	0.0662	-0.194	0.0724	0.101	0.138	0.214
UMD	-0.109	-0.109	-0.0884	-0.0865	-0.0718	-0.187

Table 6.9. Closet indexers' pre-formation coefficients. The closet indexers are sorted based on SMB and HML coefficients in the Carhart model. The mean coefficients within each equal size sorting quantile are in this table.

Table 6.10 displays the returns and Carhart alphas for each factor quantile within the closet indexer category. As with all funds, it is evident that the size style, proxied by the SMB factor, offer increasing returns and Carhart alphas. The difference in the alphas is statistically weak but reasonable.

However, the sorting by the HML factor does not yield a similar pattern in returns or alphas. So, the conclusion is that within the closet indexer category, size style generates better performance and value style does not seem to offer a significant difference.

	P1	P2	P3	P4	P5	P5 - P1
Panel A: Size style						
Mean return	0.517	0.45	0.722	0.888	0.719	0.202
Std. dev.	3.86	2.78	4.41	4.05	3.52	2.74
N funds ∗N months	1764	1764	1764	1764	1764	
N funds	7	7	7	7	7	
Alpha	0.189	0.0334	0.215	0.382	0.39	0.201
T statistic	1.38	0.271	1.53	2.44	2.49	1.32
P-value	0.169	0.787	0.127	0.0156	0.0133	0.187
Signif.				*	*	
Panel B: Value style						
Mean return	0.462	0.747	0.865	0.724	0.498	0.0364
Std. dev.	3.25	3.94	3.95	3.82	3.09	2.06
N funds ∗N months	1764	1764	1764	1764	1764	
N funds	7	7	7	7	7	
Alpha	0.22	0.297	0.355	0.225	0.112	-0.108
T statistic	1.95	2.1	2.37	1.64	0.936	-0.948
P-value	0.0521	0.0365	0.0188	0.102	0.35	0.344
Signif	.	*	*			

Table 6.10. Closet indexer funds and style. Each fund within the closet indexer category is regressed against Carhart factors and based on the SMB and HML coefficients, funds are pooled into portfolios P1 to P5. P1 is for the lowest factor coefficient and P5 for the highest. P5 - P1 is a long-short portfolio between portfolios P5 and P1. Equal sized quantiles are used. The portfolios are equally weighted between funds. Portfolio returns are regressed against the Carhart factors. Panel A is for sort by SMB and Panel B for sort by HML coefficient.

6.3.2 Moderately active funds

This section examines the closet indexer funds' performance and investment style. Table 6.11 displays the moderately active funds' sorted by their SMB and HML factors in Panel A and Panel B, respectively. The funds are sorted by the corresponding factors into equal size quantiles.

Table 6.12 displays the returns and Carhart alphas for the moderately active funds sorted by their SMB and HML coefficients. Both sorts yield increasing returns with respect to factor loading. However, only the SMB sort seems to order higher Carhart alphas. The result is statistically insignificant, yet the pattern is clear.

The result is similar to the closet indexers. This again shows that the best risk-adjusted returns are achieved by increasing the weight of small-cap stocks.

Coef.	All	P1	P2	P3	P4	P5
Panel A: Moderately active funds sorted by SMB						
Alpha	0.428	0.427	0.298	0.439	0.472	0.506
Mkt-Rf	0.675	0.637	0.732	0.695	0.625	0.687
SMB	0.192	-0.0837	0.0641	0.164	0.305	0.527
HML	0.0243	-0.0574	0.162	-0.0386	0.0318	0.0277
UMD	-0.105	-0.132	-0.102	-0.0873	-0.092	-0.11
Panel B: Moderately active funds sorted by HML						
Alpha	0.428	0.478	0.467	0.428	0.422	0.344
Mkt-Rf	0.675	0.646	0.66	0.678	0.7	0.692
SMB	0.192	0.19	0.182	0.214	0.174	0.201
HML	0.0243	-0.26	-0.0226	0.0763	0.135	0.208
UMD	-0.105	-0.0923	-0.129	-0.0876	-0.114	-0.102

Table 6.11. Moderately active funds' pre-formation coefficients. The moderately active funds are sorted based on SMB and HML coefficients in the Carhart model. The mean coefficients within each equal size sorting quantile are in this table.

	P1	P2	P3	P4	P5	P5 - P1
Panel A: Size style						
Mean return	0.617	0.757	0.645	0.722	0.763	0.145
Std. dev.	4.05	4.74	3.61	3.67	3.6	2.11
N funds ∗N months	5040	4788	4788	4788	4788	
N funds	20	19	19	19	19	
Alpha	0.242	0.197	0.227	0.298	0.36	0.118
T statistic	1.87	1.21	1.77	2.13	2.64	1.08
P-value	0.0631	0.228	0.0776	0.0344	0.00877	0.282
Signif.	.		.	*	**	
Panel B: Value style						
Mean return	0.481	0.677	0.793	0.809	0.75	0.269
Std. dev.	2.65	3.95	4.1	4.45	4.4	2.61
N funds ∗N months	5040	4788	4788	4788	4788	
N funds	20	19	19	19	19	
Alpha	0.236	0.255	0.307	0.32	0.206	-0.0296
T statistic	2.26	1.96	2.19	2.03	1.38	-0.242
P-value	0.0249	0.0507	0.0292	0.043	0.169	0.809
Signif	*	.	*	*		

Table 6.12. Moderately active funds and style. Each fund within the moderately active category is regressed against Carhart factors and based on the SMB and HML coefficients, funds are pooled into portfolios P1 to P5. P1 is for the lowest factor coefficient and P5 for the highest. P5 - P1 is a long-short portfolio between portfolios P5 and P1. Equal sized quantiles are used. The portfolios are equally weighted between funds. Portfolio returns are regressed against the Carhart factors. Panel A is for sort by SMB and Panel B for sort by HML coefficient.

6.3.3 Factor bets, concentrated funds and stock pickers

As the number of funds in factor bets, concentrated funds and stock pickers is relatively small, it is difficult to achieve any meaningful results via sorting by SMB and HML coefficients.

Table 6.13, Table 6.14 and Table 6.15 show the pre-formation Carhart coefficients for factor bets, concentrated funds and stock pickers, respectively. The clear pattern is that the SMB and HML factors seem to increase by the Petäjistö category's activity. This is best visible in Table 6.8. Thus, it seems that the concentrated funds and stock pickers seem to seek more returns by investing in small-cap stocks.

Table 6.16, Table 6.17 and Table 6.18 show the returns and Carhart alphas for factor bets, concentrated funds and stock pickers, respectively. No clear pattern between style and return impact is visible. However, as shown in Table 6.8, they all seem to tilt towards small-cap stocks, deducing by the SMB coefficient loading.

Coef.	All	P1	P2	P3	P4	P5
Panel A: Factor bet funds sorted by SMB						
Alpha	0.426	0.385	0.505	0.295	0.402	0.523
Mkt-Rf	0.653	0.628	0.621	0.702	0.657	0.663
SMB	0.221	-0.0091	0.222	0.235	0.325	0.36
HML	0.0926	-0.0982	0.131	0.179	0.227	0.0886
UMD	-0.112	-0.177	-0.0618	-0.0471	-0.133	-0.118
Panel B: Factor bet funds sorted by HML						
Alpha	0.426	0.413	0.522	0.508	0.291	0.406
Mkt-Rf	0.653	0.658	0.622	0.613	0.713	0.657
SMB	0.221	0.0556	0.265	0.273	0.203	0.325
HML	0.0926	-0.146	0.0966	0.133	0.186	0.227
UMD	-0.112	-0.188	-0.0747	-0.0781	-0.0537	-0.133

Table 6.13. Factor bet funds' pre-formation coefficients. The factor bet funds are sorted based on SMB and HML coefficients in the Carhart model. The mean coefficients within each equal size sorting quantile are in this table.

Coef.	All	P1	P2	P3	P4	P5
Panel A: Concentrated funds sorted by SMB						
Alpha	0.644	0.547	0.557	1	0.397	0.715
Mkt-Rf	0.668	0.606	0.629	0.63	0.69	0.784
SMB	0.303	0.0269	0.198	0.221	0.303	0.768
HML	0.15	0.219	0.162	0.124	0.162	0.0805
UMD	-0.0945	-0.205	-0.00673	-0.113	-0.0403	-0.108
Panel B: Concentrated funds sorted by HML						
Alpha	0.644	0.327	0.882	0.662	0.522	0.825
Mkt-Rf	0.668	0.703	0.653	0.646	0.608	0.728
SMB	0.303	0.495	0.3	0.126	0.161	0.435
HML	0.15	-0.143	0.0971	0.182	0.227	0.384
UMD	-0.0945	-0.0996	-0.0948	-0.204	-0.0555	-0.0186

Table 6.14. Concentrated funds' pre-formation coefficients. The concentrated funds are sorted based on SMB and HML coefficients in the Carhart model. The mean coefficients within each equal size sorting quantile are in this table.

Coef.	All	P1	P2	P3	P4	P5
Panel A: Stock pickers sorted by SMB						
Alpha	0.403	0.615	0.146	0.429	0.754	0.0759
Mkt-Rf	0.678	0.563	0.727	0.806	0.633	0.693
SMB	0.335	0.0682	0.191	0.312	0.383	0.716
HML	0.105	0.00898	-0.0381	0.206	0.187	0.186
UMD	-0.231	-0.242	-0.0976	-0.12	-0.331	-0.337
Panel B: Stock pickers sorted by HML						
Alpha	0.403	0.177	0.447	0.392	0.626	0.367
Mkt-Rf	0.678	0.715	0.722	0.756	0.59	0.628
SMB	0.335	0.182	0.305	0.23	0.366	0.566
HML	0.105	-0.263	-0.118	0.205	0.286	0.439
UMD	-0.231	-0.0555	-0.162	-0.106	-0.246	-0.555

Table 6.15. Stock pickers' pre-formation coefficients. The stock pickers are sorted based on SMB and HML coefficients in the Carhart model. The mean coefficients within each equal size sorting quantile are in this table.

	P1	P2	P3	P4	P5	P5 - P1
Panel A: Size style						
Mean return	0.398	1.03	0.769	0.901	0.837	0.439
Std. dev.	3.66	5.31	4.65	5.8	4.82	2.66
N funds ∗N months	1008	756	756	756	1008	
N funds	4	3	3	3	4	
Alpha	0.0639	0.505	0.198	0.402	0.377	0.313
T statistic	0.476	2.14	1.12	1.55	2.06	2
P-value	0.634	0.0331	0.262	0.123	0.0406	0.0469
Signif.		*			*	*
Panel B: Value style						
Mean return	0.583	0.86	0.966	0.534	0.905	0.323
Std. dev.	4.41	4.53	4.94	4.19	5.8	3.26
N funds ∗N months	1008	756	756	756	1008	
N funds	4	3	3	3	4	
Alpha	0.241	0.349	0.485	-0.00515	0.406	0.165
T statistic	1.66	1.9	2.31	-0.0296	1.56	0.833
P-value	0.0984	0.0583	0.0215	0.976	0.119	0.406
Signif	.	.	*			

Table 6.16. Factor bet funds and style. Each fund within the factor bet category is regressed against Carhart factors and based on the SMB and HML coefficients, funds are pooled into portfolios P1 to P5. P1 is for the lowest factor coefficient and P5 for the highest. P5 - P1 is a long-short portfolio between portfolios P5 and P1. Equal sized quantiles are used. The portfolios are equally weighted between funds. Portfolio returns are regressed against the Carhart factors. Panel A is for sort by SMB and Panel B for sort by HML coefficient.

	P1	P2	P3	P4	P5	P5 - P1
Panel A: Size style						
Mean return	0.91	0.977	1.47	1.02	0.606	-0.304
Std. dev.	5.09	4.42	5.49	5.02	3.73	3.68
N funds ∗N months	1008	1008	1008	1008	1008	
N funds	4	4	4	4	4	
Alpha	0.53	0.356	1	0.425	0.249	-0.281
T statistic	2.58	1.71	4.14	2.3	1.66	-1.26
P-value	0.0106	0.0884	4.73e-05	0.0222	0.0974	0.208
Signif.	*	.	***	*	.	
Panel B: Value style						
Mean return	0.724	1.37	1.06	1	0.828	0.104
Std. dev.	4	5.26	5.2	4.77	3.7	2.41
N funds ∗N months	1008	1008	1008	1008	1008	
N funds	4	4	4	4	4	
Alpha	0.288	0.882	0.669	0.472	0.252	-0.0358
T statistic	1.87	4.3	3.65	2.18	1.81	-0.251
P-value	0.0622	2.45e-05	0.000324	0.0304	0.0711	0.802
Signif	.	***	***	*	.	

Table 6.17. Concentrated funds and style. Each fund within the concentrated category is regressed against Carhart factors and based on the SMB and HML coefficients, funds are pooled into portfolios P1 to P5. P1 is for the lowest factor coefficient and P5 for the highest. P5 - P1 is a long-short portfolio between portfolios P5 and P1. Equal sized quantiles are used. The portfolios are equally weighted between funds. Portfolio returns are regressed against the Carhart factors. Panel A is for sort by SMB and Panel B for sort by HML coefficient.

	P1	P2	P3	P4	P5	P5 - P1
Panel A: Size style						
Mean return	0.321	0.541	1.04	0.456	0.201	-0.12
Std. dev.	2.75	5.14	6.7	2.63	1.88	1.89
N funds ∗N months	1008	1008	756	1008	1008	
N funds	4	4	3	4	4	
Alpha	-0.0109	0.0773	0.429	0.206	-0.0733	-0.0624
T statistic	-0.0945	0.522	1.52	1.62	-0.778	-0.622
P-value	0.925	0.602	0.129	0.107	0.438	0.534
Signif.						
Panel B: Value style						
Mean return	0.347	0.662	0.831	0.602	0.061	-0.286
Std. dev.	3.32	4.43	5.51	3.9	1.59	2.91
N funds ∗N months	1008	1008	756	1008	1008	
N funds	4	4	3	4	4	
Alpha	0.0241	0.32	0.242	0.116	-0.121	-0.145
T statistic	0.208	2.33	1.14	0.781	-1.21	-1.37
P-value	0.835	0.0206	0.257	0.436	0.227	0.172
Signif		*				

Table 6.18. Stock picker funds and style. Each fund within the stock picker category is regressed against Carhart factors and based on the SMB and HML coefficients, funds are pooled into portfolios P1 to P5. P1 is for the lowest factor coefficient and P5 for the highest. P5 - P1 is a long-short portfolio between portfolios P5 and P1. Equal sized quantiles are used. The portfolios are equally weighted between funds. Portfolio returns are regressed against the Carhart factors. Panel A is for sort by SMB and Panel B for sort by HML coefficient.

6.4 Summary of results for activity and investment style

Based on the evidence in Section 6.1, the best performing Petäjistö fund class is the concentrated funds. The result is in contrast with Petäjistö (2013) where the best performing fund class is the stock pickers. The concentrated fund category is the only category to offer significantly better performance than the closet indexer category as witnessed by the long-short portfolios. The result is similar in both Carhart alphas and benchmark-adjusted returns.

Section 6.2 provides evidence that in the full fund universe the size style can provide abnormal returns when shifting towards small-cap stocks. This is measured by sorting the funds based on their SMB factor loading. However, value style does not seem to provide an ability to generate abnormal returns.

Within the Petäjistö classes, it seems that size style has an ability to generate abnormal returns. In Section 6.3 the sorting within closet indexer and moderately active categories by the SMB coefficient shows an increasing abnormal return pattern. However, sorting by HML does not have a similar pattern. Moreover, based on the SMB factor loading within the factor bet, concentrated and stock picker categories, these seem to be naturally more tilted towards the size style. Therefore it seems that the fund managers' ability to select abnormal return generating stocks seems to be related to choosing undervalued small-cap stocks.

7. Conclusions and discussion

7.1 Implications on fund performance

This thesis investigated the impact of active management and investment style on mutual fund returns in the Nordic market. Two main results were achieved.

Regarding the active management impact, the concentrated mutual funds with the highest active share and tracking error seem to outperform the market in the Nordic sample. This result is in contrast with the results by Cremers and Petäjistö (2009) and Petäjistö (2013) research in the US market where the best performing mutual funds were the stock pickers.

In addition to examining active management, this thesis provides evidence that the most usable mutual fund style seems to be small-cap. This is supported by two arguments. First, among the funds sorted by the SMB Carhart factor, the small-cap funds are the ones to generate the best abnormal returns. Moreover, this is the style the most active fund managers use in seeking to outperform the market.

7.2 Limitations

This thesis has a number of limitations. The limitations mainly stem from the data availability and the modifications to Cremers and Petäjistö (2009) and Petäjistö (2013) methodology.

Sample selection

The sample is limited to the fund domiciled in Finland, Sweden, Norway and Denmark and investing in the Nordic countries. Thus, the sample size remains

relatively small and this affects the reliability of the results. Therefore, the evidence provided in this thesis may not be generalizable to a larger sample.

Additionally, the sample is limited to those mutual funds which have their data available on Morningstar direct. At least two problems arise from this: First, Morningstar does not provide comprehensive data on active share or benchmark indices to calculate the tracking errors. So, the sample is limited to the mutual funds which report their data. Second, Morningstar does not guarantee that the sample is survivorship-free.

Survivorship bias for small firms

It is possible that the Carhart alpha of the funds investing in small-cap stocks is related to survivorship bias. This is due to the fact that some small-cap firms contributing to the small-minus-big factor return have defaulted. Thus, the SMB factor return may be too small to be correctly used in estimation of the abnormal fund returns.

Methodology

The methodology is simplified from the original Cremers and Petäjistö (2009) and Petäjistö (2013) papers. Moreover, the choice of classifying mutual funds by the Davis (2001) methodology does not look into the fund holdings but the Carhart factor loadings. Thus, the results would perhaps change if the funds' style classification was conducted by classifying the stock holdings.

A clear weakness in this thesis is that the active share is calculated from the 2016-2020 mean average share and 2000-2020 weekly tracking error. The choice was made due to data availability limitation as Morningstar only provides active share form the years 2016-2020. Thus, the active share and the tracking error are to some extent anachronous and this may affect the reliability of the results obtained from the Petäjistö fund classes.

Market dynamics changes

The data sample time interval spans over two major financial market events. The first is the early 2000s dotcom bubble collapse and the second the 2007-2009 financial crisis. Both events have had known effects on both market regulation and the market participants' behavior. It is possible that the market mechanisms have changed and this has an impact on the results.

7.3 Further research

To overcome the limitations in this thesis, two improvements could be conducted for the Nordic market. First, the active share and tracking error data could be calculated from the fund holdings. Second, the style classification could be conducted by examining the mutual fund holdings.

To provide additional information on the topic, another interesting question would be to examine the funds' market timing abilities. Also, the concentrated funds' stock selection criteria is a topic in the interest of mutual fund managers who seek to outperform the market.

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A. Petäjistö fund class results with European factors

Table 1.1 displays the results for Carhart regression results for each Petäjistö fund class. The factor set consists of the European factor data provided by Kenneth French. The results are very similar to the ones with the Nordic factors in Section 6.1.2.

		Alpha	Mkt-Rf	SMB	HML	UMD
Closet Indexers (1)	Coef.	0.572	0.723	0.325	-0.257	-0.177
	T Stat	3.26	20.3	4	-4	-3.91
	P-value	0.00129	1.35e-54	8.36e-05	8.28e-05	0.00012
	Signif.	**	***	***	***	***
Moderately Active (2)	Coef.	0.574	0.758	0.38	-0.251	-0.161
	T Stat	3.24	21.1	4.65	-3.87	-3.53
	P-value	0.00135	2.78e-57	5.53e-06	0.000138	0.000498
	Signif.	**	***	***	***	***
Factor Bets (3)	Coef.	0.566	0.735	0.434	-0.192	-0.15
	T Stat	2.84	18.2	4.71	-2.63	-2.93
	P-value	0.00491	1.8e-47	4.2e-06	0.00897	0.00376
	Signif.	**	***	***	**	**
Concen-trated (4)	Coef.	0.745	0.728	0.491	-0.0963	-0.142
	T Stat	4.35	20.9	6.2	-1.53	-3.22
	P-value	2.01e-05	1.1e-56	2.42e-09	0.126	0.00146
	Signif.	***	***	***		**
Stock Pickers (5)	Coef.	0.445	0.824	0.495	-0.305	-0.169
	T Stat	2.34	21.4	5.63	-4.38	-3.45
	P-value	0.0199	4.21e-58	4.86e-08	1.72e-05	0.000664
	Signif.	*	***	***	***	***
All	Coef.	0.58	0.751	0.401	-0.225	-0.16
	T Stat	3.35	21.4	5	-3.56	-3.59
	P-value	0.000941	4.03e-58	1.07e-06	0.000452	0.000395
	Signif.	***	***	***	***	***
4-1	Coef.	0.174	0.00496	0.166	0.161	0.0347
	T Stat	1.56	0.219	3.22	3.94	1.2
	P-value	0.121	0.827	0.00144	0.000106	0.23
	Signif.			**	***	
5-1	Coef.	-0.126	0.101	0.17	-0.0477	0.00797
	T Stat	-1.51	5.95	4.41	-1.56	0.371
	P-value	0.131	9.28e-09	1.56e-05	0.119	0.711
	Signif.		***	***		

Table 1.1. Carhart regression results for different fund categories. European factors are used. The funds are categorized into groups 1-5 based on 2000-2020 weekly tracking error and average 2016-2020 active share according to Petäjistö's methodology. The portfolios represent an equally weighted average of the fund returns within each category. 4 - 1 and 5 -1 are differences between their corresponding categories.