

# Evaluation of performance and active management in Norwegian equity funds

---

– An empirical study of the period from January 2006 to December 2015

Author: Lars Martinsen

Actual Number of Pages: 80

Number of Characters: 180 221

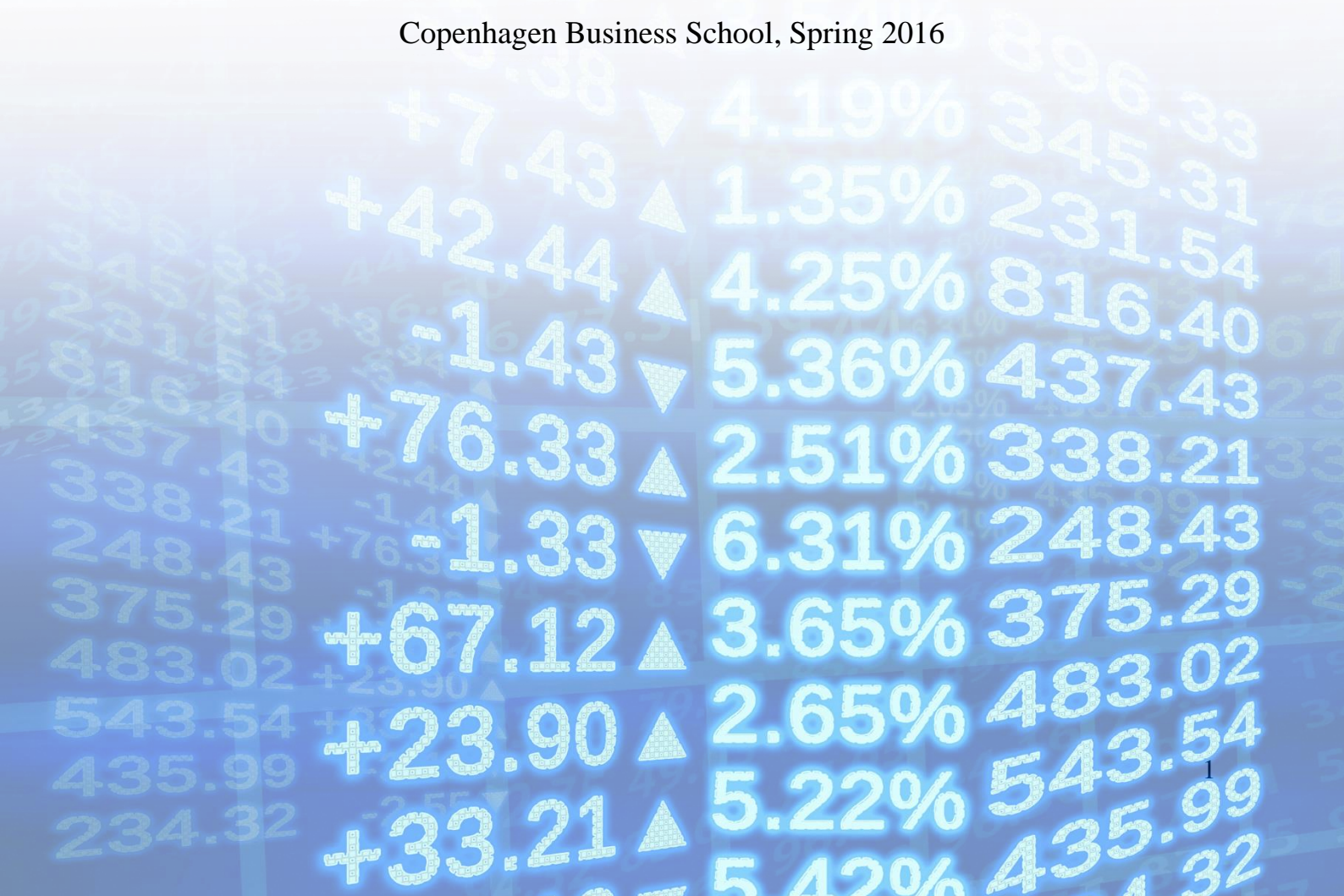
Hand-in date: 17.05.2016

Supervisor: Kenneth Lillelund Winther

Master's Thesis

Cand.Merc. Finance & Strategic Management

Copenhagen Business School, Spring 2016



## **Abstract**

This study examines the performance and active management of a survivorship bias free sample, consisting of 69 actively managed Norwegian equity funds, in the period from January 2006 to December 2015. The paper analyzes performance by adopting well known ex-post performance measures, which accounts for stock picking skills, market timing, and exposure to well-known factor premiums. Additionally, the study provides a comprehensive analysis of active management amongst the sample of funds, as well as discussing why active share may not be appropriate as a sole regulatory measure in Norway. Additionally, the study discusses why the recent criticism of active Norwegian equity funds appear to be justified.

The paper finds that the majority of the funds show no significant evidence of outperformance neither gross nor net expenses. However, certain fund products appear to significantly deliver outperformance net expenses, but only at an individual level. Moreover, the study finds that the average active share throughout the 10-year period is below the applied cut-off value of 50 percent, and that the majority of funds appear to follow a passive management strategy, whilst charging active management fees.

By examining the relationship between active share and alpha, the results suggest a positive, yet not significant, relationship for the sample as a whole. Whilst, separating the sample into quintiles based on active share, introduces a statistically significant positive relationship for two of the quintiles, representing funds with an active share between 30 and 65 percent.

## Table of contents

<b>1.0 Introduction.....</b>	<b>5</b>
1.1 Problem statement .....	6
1.2 Contribution.....	7
1.3 Delimitation.....	7
1.4 Methodology .....	8
1.4 Structure .....	9
<b>2.0 The Norwegian mutual fund universe.....</b>	<b>10</b>
2.1 Norwegian mutual funds .....	10
2.5 Market overview.....	11
2.2 Fund management .....	12
2.3 Rules and regulations .....	13
2.6 The debate of active management in Norway .....	14
<b>3.0 Literature review.....</b>	<b>15</b>
3.1 Findings in the active mutual fund industry .....	15
3.1.0 Historical performance .....	15
3.1.1 Persistence in performance .....	16
3.1.2 Luck versus skill .....	18
3.2 Previous findings in the Norwegian market .....	20
<b>4.0 Theory .....</b>	<b>22</b>
4.1 The Efficient Market Hypothesis .....	22
4.2 Active management.....	24
4.3 Risk adjusted performance measures .....	27
4.4 Additional risk-adjusted performance measures .....	28
4.6 Market timing ability.....	31
4.7 Hypothesis testing .....	32
4.8 Survivorship bias.....	33
<b>5.0 Methodology and Data.....</b>	<b>35</b>
5.1 Mutual fund data .....	35
5.2 Benchmark indices .....	36
5.3 Risk free rate of return.....	36
5.4 Computation of return series .....	37
5.5 Factor loadings in Carhart's 4-Factor model.....	37
5.6 Robustness.....	38

<b>6.0 Empirical findings &amp; analysis</b> .....	<b>42</b>
6.1 Testing hypothesis 1: analysis of active management.....	42
6.2 Testing hypothesis 2: analysis of performance .....	46
6.3 Testing hypothesis 3: combined analysis of performance and active share.....	59
6.4 Summary of the empirical findings .....	64
<b>7.0 Discussion</b> .....	<b>65</b>
7.1 Is active share a good measure for fund selection in Norway? .....	65
7.2 Are the majority of active Norwegian domestic equity funds overpriced?.....	69
7.3 Should investors champion active Norwegian equity funds over index funds?.....	73
7.4 Is the criticism of Norwegian equity funds justified? .....	76
<b>8.0 Conclusion</b> .....	<b>78</b>
<b>9.0 Future research</b> .....	<b>81</b>
<b>Bibliography</b> .....	<b>82</b>
<b>Appendices</b> .....	<b>88</b>

## 1.0 Introduction

---

With a market of only one Norwegian mutual fund prior to 1982, Norwegian mutual funds have established themselves as an important investment vehicle for Norwegian clients throughout the years. As of February 2016, there are approximately 281 000 clients invested in Norwegian domestic equity funds, representing approximately 478 327 million NOK in assets under management, whereas private households represent approximately 18 percent of these assets (VFF, 2016a; SSB, 2016a). Accordingly, the significant amount of clients invested in Norwegian equity funds, have in recent time resulted in great attention to the quality of the funds; in particular, the difference between active and passive management strategies.

Through mainstream media, several actively managed mutual funds in Norway have been heavily criticized for charging high management fees without delivering an equally high performance. In contrast, index funds charge lower management fees as they do not actively seek to outperform their benchmark. As the actively managed mutual funds charge higher fees for actively seeking out outperforming stocks, a wide array of clients have been dissatisfied when some funds in reality appear to heavily overlap the benchmark index. In particular, certain Norwegian equity funds have experienced lawsuits conducted on behalf of their clients, as they have been accused of following a passive investment strategy whilst charging active management fees. The most recent lawsuit involved the largest active Norwegian domestic equity fund, DNB Norge. The lawsuit was conducted in the aftermath of a rectification order filed by the financial supervisory authority of Norway (Finanstilsynet), notifying that DNB Norge had been following its benchmark index too close in the period from 2009 to 2014.

The discussion of active and passive mutual funds in Norway is a topic of broad and current interest, which serve as the fundamental motivation behind this study. Moreover, as will be presented in the literature review, the majority of previous research on active mutual fund performance argue that the funds on average do not outperform, especially when accounting for their expenses; however, empirical evidence from the Norwegian market is severely lackluster. Furthermore, the study of Cremers & Petajisto (2009) recently introduced a novel measure of active management, namely active share, suggested as a tool to quantify active management. Cremers & Petajisto (2009) also introduce a combination of active share and Tracking Error as a way of identifying four different categories of management, which in this paper will act as a tool to categorize the closet indexers apparent in the Norwegian market.

The goal of this study is to investigate if the criticism of actively managed Norwegian equity funds is durable, which is done by examining the performance and degree of active management of the funds. Consequently, the paper will both identify the fraction of truly active Norwegian domestic equity funds, and investigate the performance amongst the sample of funds. Hence, the paper seeks to contribute to an overall deeper insight in the industry of active Norwegian domestic equity funds, as well as investigate the durability of the claims published in mainstream media. Moreover, the paper primarily seeks to enlighten non-professional investors of the current outlook of the domestic equity fund market in Norway, and communicate important aspects to consider when selecting what fund to invest in.

## **1.1 Problem statement**

To examine the legitimacy behind the critique of active Norwegian domestic equity funds, the paper states the following hypotheses, which will be tested empirically.

- Hypothesis 1: The majority of active Norwegian domestic equity funds have in fact operated with a passive strategy throughout the 10-year period.
- Hypothesis 2: Throughout the 10-year period, the active Norwegian domestic equity funds have on average underperformed against their benchmark index after expenses.
- Hypothesis 3: Active share and fund performance are negatively correlated amongst active Norwegian domestic equity funds.

After testing the hypotheses, the paper seeks to answer the following objectives, which will be explored further in the discussion of chapter 7.

1. Is active share a good measure for fund selection in Norway?
2. Do the majority of active Norwegian equity funds appear to be overpriced?
3. Should investors champion actively managed equity funds over index funds in the Norwegian market?
4. Is the criticism of active Norwegian equity funds justified?

## **1.2 Contribution**

This study contributes with a comprehensive analysis of actively managed domestic equity funds in Norway, using a sample free of survivorship bias, in the period from January 2006 to December 2015; thus, presenting an updated outlook of the current market. The study applies several models when examining fund performance, which contributes to solid foundation for the analysis. By including an analysis of both stock picking skills, market timing ability, as well as bets on specific factor premiums, in a single study, the paper acquires the ability to examine the findings in light of each other, based on the same datasets and time period. This paper is, to the knowledge of the author, contrasting previous published studies on the Norwegian market, as it also examines the performance results in light of active share of the individual funds, as well as presenting a thorough discussion regarding the use of the active share measure across different markets. Furthermore, the selected time period makes it possible to examine the reasoning behind the recent rectification order, and lawsuit, issued towards the largest actively managed equity fund in Norway, DNB Norge. Additionally, the study emphasizes the need for skilled fund managers, in light of the increased dispersion of returns with higher levels of active share. By following this approach, the paper also seeks to elaborate on the use of active share, both as a regulatory measure by the financial supervisory agency of Norway, and as a source for vast criticism of active funds in mainstream media.

## **1.3 Delimitation**

This study only accounts for a highly specific selection of funds; namely, actively managed domestic equity funds in Norway, which ensure a homogenous sample of funds; however, a highly restricted sample limits the possibilities to draw conclusions and generalizations on behalf of the Norwegian equity fund market as a whole, including global funds. Moreover, the study is restricted to the 10-year period from January 2006 to December 2015. As the period includes the financial crisis of 2008, as well as the pre- and post-market conditions, the paper argues that the selected period accounts for an adequate variety of market conditions.

The performance evaluation is conducted based on monthly return series throughout the period, which is common practice amongst studies investigating fund performance. However, daily return series would increase the accuracy of the tracking error calculations, as the majority of the funds have different portfolio managers throughout the 10-year period, and therefore potentially different management styles in certain periods.

The calculations of active share were conducted on an annual basis, as Cremers & Petajisto (2009) suggest that the measure fluctuates marginally with time. However, the study acknowledges that active share calculated on a monthly basis may provide more accurate results. Regardless, annual calculations of active share is assumed to be sufficient for the purpose of this study.

This study carries out the performance analysis based on several models derived directly from the CAPM. Thus, in order to make conclusions based on the findings of the analysis, the underlying assumptions of the CAPM must be presumed to hold. However, as models perfectly consistent with the complexity of a real-life market cannot be solved, the paper evaluates the suitability of the models included in the study, as sufficient. Additionally, the models used in this study are unconditional, and therefore assume that the risk-level of a fund remains constant over time; hence, serving as a limitation, as over- or underperformance of a fund may potentially be misinterpreted.

Lastly, this study is not meant as a clear-cut guide for investors, with respect to specific fund selection. The study serves to present an investigation of the general industry for active domestic equity funds in Norway, and help to establish a clearer picture of the performance, and management, amongst the funds of this specific market.

## **1.4 Methodology**

This is a quantitative empirical study, revolved around three main hypotheses, which are examined throughout the analysis. Firstly, the active management of the funds are investigated by the measure of both active share and tracking error. Secondly, the performance of the funds are evaluated, both individually and as a group. Thirdly, the study combine the two measures in order to examine the relationship between active share and performance. Moreover, four specific objectives are examined throughout the discussion, seeking to complement the findings of the analysis, and further explore the overall goal of the paper.

To examine the active management of the funds, active share of each fund is calculated based on yearly holdings data retrieved from Morningstar Direct, and the Bloomberg terminal. Tracking error is calculated based on monthly return series retrieved from Morningstar Direct, and annualized in order to be comparable with the active share measures.

The performance of the funds are analyzed by ranking them against each other, by using the Sharpe Ratio, Treynor Measure, and Information ratio. Additionally, more comprehensive models are



introduced in order to test stock picking ability, market timing ability, as well as examine the cross-section of returns. In particular, the paper adopts the Jensen's alpha 1-factor model, the Treynor-Mazuy market timing model, and lastly Carhart's 4-factor model. All the performance measures are performed on monthly return series retrieved from Morningstar Direct, whilst the factor-input for Carhart's 4-factor model is retrieved through the database supplemented by Ødegård (2016a). A more comprehensive review of each performance measure will be informed in the theory section.

In order to examine the relationship between active share and performance, average alphas for each fund, and each individual year, are grouped together, and regressed against the respective active shares. Furthermore, the paper will also perform regressions where the individual funds have been grouped in four different quintiles based on average active share throughout the period.

A further, and more detailed, explanation of the computation and gathering of data will be conducted in chapter five.

## **1.4 Structure**

The paper continues by reviewing the mutual fund market in Norway, as well as a brief review of the ongoing debate of active management in the industry. Next, a review of previous literature found to be relevant for the study is presented. In section four, the theoretical foundation of the study is informed. Section five contains a thorough review of the data used, as well as the associated methodology. Section six presents the empirical findings and analysis, seeking to test the three hypotheses. Following the analysis, section seven discusses the implications of the empirical findings, as well as attempting to answer the four objectives informed in the problem statement. Lastly, section eight informs the conclusion of the study.

## 2.0 The Norwegian mutual fund universe

---

This chapter presents an overview of the mutual fund industry in Norway, including benchmark indices and the different types of mutual funds operating in the industry.

### 2.1 Norwegian mutual funds

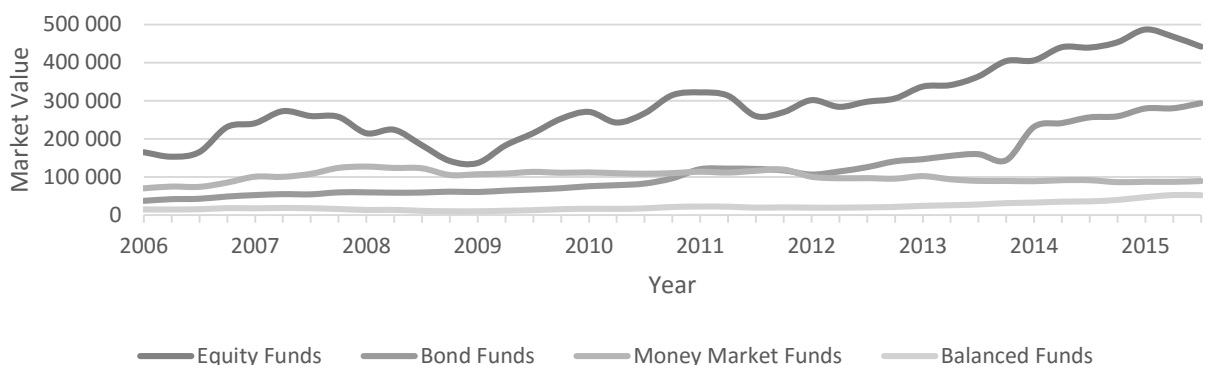
Mutual funds are the commonly used term for open-end investment companies, which currently represent the main investment company (Bodie et al., 2014). More specifically, mutual funds is the collectively used term of describing equity funds, bond funds, money market funds, and balanced funds, where equity funds are the dominating fund in the Norwegian market as can be observed in figure 1. The figure displays the growth of mutual funds in Norway the past 10 years, disregarding the downturn related to the financial crisis of 2008.

---

**Figure 1**

*Market value of Norwegian mutual funds in the period from the first quarter of 2006 to the third quarter of 2015. Numbers in million NOK.*

---



*Source: own construction based on historical data from Statistisk Sentralbyrå (SSB, 2016b).*

As this study only considers the category of equity funds, the paper will now present a brief background of equity funds, and their position in the Norwegian market.

#### 2.1.1 Equity Funds

Clearly, equity funds invest primarily in stocks; however, at the portfolio manager's discretion, they may also hold fixed-income or other types of securities. Typically, equity funds hold between four and five percent of total assets in money market securities as a means to provide liquidity. According

to the union for mutual funds in Norway, Verdipapirfondenes Forening (VFF), equity funds invest a minimum of 80 percent of their assets in the stock market (VFF, 2016b). Lastly, equity funds are commonly used as a long-term investment vehicle as the stock market may fluctuate immensely in the short-term, whilst the long-term price premium appear to be significantly consistent above the risk free rate (Dimson et al., 2006). As presented in table 1, equity funds account for approximately 50 percent of the total assets in the Norwegian mutual fund market.

**Table 1**

*Size of the Norwegian mutual fund market as of fourth quarter, 2015. Numbers in million NOK.*

Fund Type	Mutual fund balance	% of Total Assets
Equity funds	kr 455 564,00	50 %
Bond funds	kr 258 449,00	28 %
Money market funds	kr 86 231,00	10 %
Other bond funds	kr 63 492,00	7 %
Balanced funds	kr 40 847,00	5 %
Other funds	kr 2 999,00	0 %
SUM Assets	kr 907 582,00	100 %

*Source: own construction based on data from Statistisk Sentralbyrå (SSB, 2016b).*

Equity funds in Norway are divided into separate groups depending on what investment universe the fund invests in, which simplifies the process of analyzing comparable funds against each other. Commonly used fund groups in Norway are: Norwegian domestic funds, Nordic funds, European funds, and Global funds. Accordingly, each fund group will invest at least 80 percent of their capital in Norwegian-, Nordic-, European-, and Global equities respectively; whereas, this study will examine the group of actively managed Norwegian domestic equity funds (VFF, 2016b).

## 2.5 Market overview

As of February 2016, approximately 281 000 Norwegian clients were invested in Norwegian domestic equity funds (VFF, 2016a). Thus, emphasizing the importance of the domestic equity fund industry in Norway. Moreover, figure 1 displayed that the asset base operated by the Norwegian mutual funds has increased significantly in the period from 2006 to 2015, except a decline during the financial crisis of 2008.

By looking explicitly at domestic Norwegian equity funds, VFF (2016a) report that 263 883 clients are invested in actively managed funds as of February 2016. Simple calculations translate this into that approximately 94 percent of clients in Norwegian domestic equity funds, are paying for active

management, as displayed in table 2. Thus, it is evident that active fund management is by far the preferred investment strategy in the market for domestic Norwegian equity funds.

**Table 2**

*Simple calculation displaying the overweight of investments in active management.*

	Number of clients
Norwegian domestic equity funds	280 663
Active Norwegian domestic equity funds	263 883
Percentage under active management	94,02 %

*Source: own construction, based on market data collected from VFF (2016a).*

Consequently, in light of the recent displeasure amongst a vast amount of clients invested in actively managed domestic funds, the paper raises the question of whether or not the clients are actually invested in actively managed domestic equity funds as a result of an informed choice.

## 2.2 Fund management

With regards to equity funds, there are two main categories of management style; namely, active and passive management. Passive management entails a portfolio following its benchmark index with only minor deviations; conversely, active management entails that the portfolio manager construct a portfolio of stocks that differ from its reference index, trying to create a better risk-return relationship than a passive management strategy. Investing in actively managed funds entails higher fees than investing in passively managed funds; accordingly, investing in an actively managed fund requires expected excess returns compared to the benchmark index for it to be attractive.

Each equity fund are required to specify a benchmark index, which is commonly used as a benchmark for the fund's management and performance. Accordingly, a fund that deliver returns exceeding its reference index is commonly denoted as outperforming, whilst delivering returns below the index imply an underperforming fund. The following three benchmark indices will be considered in this paper.

**OSEBX:** This is often referred to as the main index in Norway, and represents the general development in the Oslo Stock Exchange.

**OSEFX:** A capped version of the OSEBX, following the rules of the UCITS directives.

**OSSESX:** A small-cap index consisting of the 10 percent lowest capitalized shares on Oslo Børs.

Only 2 funds in this study use the OSESX as a benchmark, whilst the majority use the OSEFX (57) and OSEBX (10).

## **2.3 Rules and regulations**

The management of mutual funds in Norway is regulated by the Norwegian securities act (Verdipapirloven), with all its rules and regulations. This law is continuously updated and seeks to facilitate a secure, structured and efficient trading environment in financial instruments (Finansdepartementet, 2007).

The majority of Norwegian mutual funds follow the UCITS regulations (Dillon Eustace, 2008), where UCITS stands for Undertakings for Collective Investments in Transferable Securities. Similar to the Norwegian securities act, the UCITS consists of a wide array of rules and regulations to be enforced by its members. However, the paper will argue that the most notable regulations to be considered in this study, are the following from chapter 3 in the official document (Dillon Eustace, 2008).

- The general “5/10/40” rule requiring that no more than 10 percent of the net assets of an UCITS regulated fund may be invested in transferable securities or money market instruments issued by the same body, with a further aggregate limitation of 40 percent of net assets on exposures of greater than 5 percent to single issuers.
- Index replicators can take exposures up to 20 percent of net assets to single issuers, with up to 35 percent to a single issuer in exceptional market conditions.

Thus, the UCITS regulations affect Norwegian domestic equity funds in several ways. In particular, these two regulations restrict an actively managed equity fund of investing more than 10 percent of their net assets in one single firm, and no more than 40 percent of net assets in stocks weighted above 5 percent. However, the UCITS regulations provides an important exception for index funds, as they can invest up to 20 percent of total assets to single issuers, and up to 35 percent in exceptional market conditions, ensuring that index funds in a market as concentrated as in Norway are still able to replicate the benchmark index.

## **2.6 The debate of active management in Norway**

Closet indexing describes a fund promoting itself as an actively managed fund, whereas it in reality follows the benchmark index very closely. The reason behind the bad reputation of closet indexing is that the investment companies charge substantially larger fees than a traditional index fund, as their actively managed fund advertise their ability to outperform the index. As deviation from the index is necessary to achieve outperformance, closet indexers charge higher fees without any realistic objective of significantly outperforming the index. Recently, this practice has received extensive attention in the media, as both regulatory authorities and individual investors have expressed their displeasure.

In particular, the Norwegian Customer Council (Forbrukerrådet) issued a lawsuit against DNB Norge on behalf of 137 000 private clients in the first quarter of 2016, arguing that the fund has operated as an index fund, whilst charging active fees. Furthermore, the financial supervisory authority of Norway issued two rectification orders throughout 2015, to DNB Norge and Nordea Avkastning, arguing that they had been following index too close in the period from 2009 to 2014. Consequently, this paper will present relevant empirical findings throughout the period from January 2006 to December 2015, and examine if the general criticism towards the active Norwegian equity funds appear reasonable. The next section will provide previous findings and literature regarding the mutual fund industry, as well as previous studies conducted specifically on the Norwegian market.

### **3.0 Literature review**

---

This section seeks to inform the rich stream of academic research conducted on the mutual fund industry, as well a section dedicated to the Norwegian market. The universal literature has been arranged into three categories, representing their main contribution, namely: historical performance, persistence in performance, and luck versus skill. The three categories are connected to the research question, whereas the first two categories present numerous empirical findings on mutual fund performance, and the last category revolves around active fund management. Lastly, findings in the Norwegian market are presented to supplement the universal stream of literature.

#### **3.1 Findings in the active mutual fund industry**

This section presents various studies performed on the mutual fund industry, combining both early and more recent contributions, mainly conducted on the U.S. market.

##### **3.1.0 Historical performance**

Jensen (1968) was one of the first academics to research fund managers' forecasting abilities. In doing so, he presented a new measure based on the theoretical results of the CAPM derived independently by Sharpe (1964), Lintner (1965) and Treynor (1962). Jensen used this measure to analyze the performance of 115 American open end mutual funds from 1945 to 1964, where the evidence suggested that active mutual funds on average were not able to outperform the benchmark index. Furthermore, he found only minor evidence suggesting that individual funds were able to do significantly better than what is expected from mere chance (Jensen, 1968). Similarly, Grinblatt & Titman (1989) investigated the gross quarterly returns in American mutual funds in the period 1975 to 1984, as there were yet to become a common consensus amongst academics about portfolio managers' ability to earn abnormal returns. Complementing the study of Jensen (1968), their main findings suggested that transaction costs amongst the investigated funds were large and inversely related to fund size, as well as an inverse relationship between abnormal performance and fund size (Grinblatt & Titman, 1989). However, their research conclude that gross returns suggest abnormal performance, and that evidence argues for it being partly generated through active fund management, contradicting the mere chance argument proposed by Jensen (1968). On the other hand, as investing in the best performing funds implied high costs, they acknowledge that the abnormal performance is neglected through the increase in expenses (Grinblatt & Titman, 1989).

By combining the work of Jensen (1968) and Grinblatt & Titman (1989), Cumby & Glen (1990) examined the performance of fifteen American internationally diversified mutual funds in the period from 1982 to 1988. Their performance analysis was conducted by using both the measure of Jensen (1968), and a positive period weighing measure presented by Grinblatt & Titman (1989); thus, neglecting some of the individual limitations of each measure. Their results are similar to those presented by Jensen (1968), and show no evidence that the funds, individually or as a group, offer performance that surpasses that of a broad, international equity index during their period of research (Cumby & Glen, 1990).

More recently, Fama & French (2010) performed an extensive analysis of American mutual funds in the period from 1983 to 2006. Conversely to prior studies they performed bootstrap simulations on mutual funds; however, arriving to similar conclusions as previously presented literature. Namely, suggesting that few active mutual funds' benchmark-adjusted expected returns are sufficient to cover their expenses (Fama & French, 2010). In addition to former studies, they emphasize what Sharpe (1991) refer to as the arithmetic of active management, accentuating that active investment is a zero sum game where outperformance of some active investors come at the expense of underperformance of other investors.

In conclusion, the reviewed studies on historical performance present no significant evidence suggesting outperformance by active mutual funds net expenses. However, Grinblatt & Titman (1989) argue that active management outperform when analyzing gross returns, although the outperformance is neglected through increased expenses of active management.

### **3.1.1 Persistence in performance**

In 1991, Hendricks et al. (1991) published a study reassessing the earlier findings of Grinblatt & Titman (1989) and Jensen (1968); namely, their inability to present statistical evidence of persistence in mutual fund returns over five-year periods. Accordingly, Hendricks et al. (1991) examine quarterly returns data from 1974 to 1988 in open-end no-load, growth-oriented, equity funds mitigating survivorship bias. Their strongest evidence was for a one-year evaluation horizon, whereas their study suggest that recent poor performers have 'icy hands', suggesting that they continue to perform significantly worse than standard benchmarks. Conversely, recent top performers appear to have 'hot hands', representing funds that deliver sustained short-run superior performance. However, the evidence suggesting the existence of hot hands were not statistically significant (Hendricks et al.,



1991). Supplementing the study of Hendricks et al. (1991), Grinblatt & Titman (1992) continued their research by investigating if past performance in fact is a useful guide for selecting a fund, building on their paper from 1989. In contrast to the 1989 paper they use a larger sample of funds and focus solely on the gross returns of the funds. The analysis was conducted on 279 funds from December 1974 to December 1984, and conversely to the paper of Hendricks et al. (1991), they present significant evidence that differences in performance between funds persist over time, and that it is in fact consistent with managers' ability to earn abnormal returns. Their paper concludes by recognizing the findings of Hendricks et al. (1991), suggesting that only the most recent past performance provides information about future performance (Grinblatt & Titman, 1992).

Also inspired by the findings of Hendricks et al. (1991), Jegadeesh & Titman (1993) continue the academic research, by suggesting that strategies of buying recent top performers and selling recent poor performers generate significant positive returns over 3- to 12-month holding periods; namely, identifying a momentum effect. Furthermore, they find that the profitability of these strategies are not due to systematic risk, nor delayed stock price reactions to common factors. Accordingly, one interpretation of their results is that investors who buy past winners and sell past losers move prices away from their long-run values temporarily, and cause prices to overreact (Jegadeesh & Titman, 1993). This interpretation is consistent with the study of DeLong et al. (1990), investigating the implication of so called 'positive feedback traders' on market price. Likewise, a highly acknowledged study by Carhart (1997) recognizes that the identification of 'hot hands' in Hendricks et al. (1991) is mostly driven by the 1-year momentum effect presented by Jegadeesh & Titman (1993). In the analysis, he investigates 1892 diversified equity funds over the time period of 1962 to 1993, where he similarly to previous studies (i.e. Jensen, 1968; Cumby & Glen, 1990) finds no evidence supporting the existence of skilled or informed mutual fund portfolio managers. On the other hand, he recognizes that the strong persistent underperformance of worst-return mutual funds is an anomaly. Lastly, Carhart (1997) concludes with presenting three rules-of-thumb for mutual fund investors: (1) Avoid funds with persistently poor performance; (2) funds with high returns last year have higher than expected returns next year, but not in years thereafter; (3) the investment costs in active funds all have a direct, negative impact on performance (Carhart, 1997). Evidently, the three rules heavily emphasize previous findings on both historical performance and performance persistence in active mutual funds.

The study of Chen et al. (2000) investigated the stock picking skills and performance persistence of active mutual funds using a different analytical approach than the aforementioned studies. Namely,

they examine the performance of stocks actively traded by the funds, in addition to the stocks held by the mutual funds. This approach is credited by Kothari & Warner (2001), suggesting that an event-study as such, is a more powerful tool when analyzing abnormal performance in active mutual funds. Kothari & Warner (2001) further argue that performance measures based on the Capital Asset Pricing Model (CAPM) commonly used in previous mutual fund research (i.e. Carhart, 1997 & Daniel et al. 1997) have little ability to detect economically large magnitudes of abnormal performance (Kothari & Warner, 2001). Regardless, the results presented by Chen et al. (2000) suggest that stockholdings passively carried over by ‘winning’ funds outperform holdings of ‘losing’ funds, similar to the findings of Hendricks et al. (1991) and Grinblatt & Titman (1993). Further, in contrast to former studies, Chen et al. (2000) find evidence suggesting that the outperforming funds possess stock selection skills. However, similar to Carhart (1997), they suggest that the outperformance may rather be a result of the momentum effect presented by Jegedeesh & Titman (1993), than the suggested stock picking skills.

In sum, the analysis of performance persistence amongst active mutual funds generally suggest that certain fund managers in fact consistently outperform their benchmark index, although some studies indicate otherwise (i.e. Carhart, 1997). Furthermore, a 1-year momentum was presented by Jegadeesh & Titman (1993), arguably explaining the consistent outperformance of past winners in a short period of time following their success. However, a common result across the studies is that past underperformers show a tendency of continuing to persistently do so.

### **3.1.2 Luck versus skill**

As presented, there is a vast stream of literature investigating both the performance and the persistency of active mutual funds. Accordingly, another stream of literature has also flourished since the 1960s, namely academic research examining the skill of mutual fund managers. In the 1960s Treynor (1966) reported a study of 57 mutual funds in the period from 1953 to 1962, investigating if mutual fund managers successfully anticipate major turns in the stock market, as a widely held belief during this period suggested that they were. His analytical approach consisted of testing for evidence that the volatility of a fund was higher when the market did well, than when it did poorly. Conducting this approach on the 57 funds, he found no evidence supporting the common belief that mutual fund managers could in fact outguess the market (Treynor, 1966).

Almost four decades after Treynor's study, Wermers (2003) similarly presented a study investigating active management, using tracking error as tool of measurement. His study was the most comprehensive at the time, by investigating the cross-sectional relation between returns and volatility in U.S. mutual funds from 1975 to 2000; thus, an approach similar to that of Treynor (1966). However, in contrast to the study of Treynor (1966), the results presented by Wermers (2003) suggest that funds with higher levels of volatility provided better performance, during the majority of the study. Furthermore, he argues that managers who take larger active management bets possesses better stock picking skills, although the average manager underperform against his benchmarks (Wermers, 2003). Accordingly, as opposed to Treynor (1966), Wermers (2003) suggests that active management do provide value. Likewise, a later study by Kacperczyk et al. (2005) argues that mutual fund managers deviating from a well-diversified portfolio perform better than the average well diversified portfolio. However, their study specifically examine the relation between industry concentration and fund performance, suggesting that investment ability is more evident amongst managers holding concentrated portfolios in a few industries (Kacperczyk et al., 2005).

As previous studies on active management mainly consisted of analyzing fund volatility in different market situations, and later introducing tracking error as a mean of measuring active management, the study of Cremers & Petajisto (2009) received a lot of attention when it was published. Their study informs a new measure of active portfolio management, active share, which represents the share of portfolio holdings that differ from the benchmark index holdings. Furthermore, as fund holdings can differ from the benchmark as a result of either stock selection, factor timing, or both, their paper proposes active share as good measure of active management to supplement tracking error, as the latter do not distinguish between the two approaches to active management. Hence, they argue that using both active share and Tracking error contribute to a more precise measure regarding the effects of active fund management (Cremers & Petajisto, 2009). Accordingly, Cremers & Petajisto (2009) present research conducted on 2647 funds in the period from 1980 to 2003, seeking to investigate the level of active fund management. Firstly, their results show a shift from active to passive fund management over the 1990s, including a large increase in the number of closet indexers. Secondly, their evidence suggests that funds with the highest active share outperform their benchmark both before and after expenses, whereas funds with the lowest active share underperform after expenses. On the other hand, tracking error does not appear to predict higher returns, contradicting the evidence proposed by Wermers (2003) (Cremers & Petajisto, 2009). Accordingly, by using both measures of active management, Cremers & Petajisto (2009) introduced the ability to identify the truly active

mutual funds, and therefore get a more precise analysis of active fund management. Lastly, their study concludes that funds with the highest active share, smallest assets, and best one-year performance seem very attractive through the lens of an investor; thus, supplementing previous studies suggesting performance persistence of mutual funds labeled as past winners (i.e. Grinblatt & Titman, 1992 and Jegadeesh & Titman 1993) (Cremers & Petajisto, 2009).

As a follow-up of the study of Cremers & Petajisto (2009), Petajisto (2013) presented a study of 2740 funds in the period 1980 to 2009, aiming to supplement previous literature by measuring active management of mutual funds during a sample period also including the financial crisis of 2008. In doing so, he examined active management with both tracking error and active share, in line with Cremers & Petajisto (2009). The findings displayed that the most active stock pickers outperformed their benchmarks even after fees, whilst closet indexers underperformed. These patterns also held during the financial crisis of 2008, as well as within different market-cap styles; interestingly, the results also presented that closet indexing has increased significantly since 2007 (Petajisto, 2013). Lastly, the study concludes that cross-sectional dispersion in stock returns positively predicts performance of stock pickers, which further strengthen the argument that outperformance of mutual fund managers may be related to their stock picking skills (Petajisto, 2013).

In sum, the discussion of luck versus skill amongst mutual fund managers has provided mixed results historically. Treynor (1968) presented a study providing no evidence supporting managers' ability to outguess the market, and was later accompanied by a study of Wermers (2003) whom suggested that active management do in fact provide value. Consequently, Cremers & Petajisto (2009) published an acknowledged study in 2009, arguing that the more active funds tend to outperform the market, as well as contributing the academic literature with the term active share. Furthermore, extant literature in this section appear to agree on both the existence of some degree of performance persistence, as well as the arithmetic of active management proposed by Sharpe (1991).

### **3.2 Previous findings in the Norwegian market**

Not many published studies on mutual funds have been conducted in the Norwegian market. However, there are a few studies providing some insight in the Norwegian mutual fund industry, and the performance of portfolio managers.

In the early 1990s, Gjerde & Sættem (1991) published a study evaluating the performance of Norwegian mutual funds in the period from 1982 to 1990, seeking to investigate Norwegian mutual

fund managers that claimed their individual funds to be subject to different investment policies. Their findings suggest that there were no significant difference in risk profile between the funds managed by the same company; although, the results indicated that the managers possessed market timing abilities, and that all the funds in the sample, on average before expenses, outperformed the market in the period from 1982 to 1984. Whilst, after 1984 the average performance were below the benchmark index (Gjerde & Sættem, 1991).

Following a different analytical approach, Che *et al.* (2009) investigated the performance of individual investors on the Oslo Stock Exchange (OSE) from January 1993 to June 2003, observing the month-end stock market portfolios. They argue that investigating individual investors strengthen their results, as it guarantees that portfolio returns are connected to the same decision maker throughout the sample period, and that returns are not influenced by fees and costs reacting to past performance. Furthermore, they argue that it is reasonable that a significant number of individuals hired as fund managers would possess some of the abilities observed during their study. The main finding of their study is that individuals whom have outperformed the index the past two to five years, continue to do so for as long as the next three years; hence, suggesting that a substantial number of investors exhibit significant performance persistence (Che *et al.*, 2009). Persistent outperformance for as long as three years is contradictory to the findings of performance persistence in the U.S. market (i.e. Grinblatt & Titman, 1992 and Jegadeesh & Titman, 1993).

The most recent study available is also the most comprehensive study to date on performance and persistence in Norwegian equity mutual funds; namely, the study of Sørensen (2009), examining a data set free of survivorship bias on Norwegian equity mutual funds listed on the Oslo Stock Exchange (OSE) from 1982 to 2008. Conversely to the findings of Che *et al.* (2009), Sørensen finds no statistically significant evidence of risk-adjusted abnormal performance for an equal-weighted portfolio of mutual funds. Furthermore, using bootstrapping methods to separate skill from luck, he finds only weak evidence of managers possessing stock picking skills, whilst evidence show several inferior fund products. Lastly, he concludes that there is no persistence in the performance of either winners or losers, hence further contradicting the study of Che *et al.* (2009) (Sørensen, 2009).

In sum, the findings in Norway are highly incongruous; namely, Gjerde & Sættem (1991) suggest that managers possess stock picking skills, whilst Che *et al.* (2009) argue for significant performance persistence among Norwegian mutual funds. Conversely, Sørensen (2009) finds no evidence supporting the views of neither of Gjerde & Sættem (1991), nor Che *et al.* (2009).

## 4.0 Theory

---

This section will supplement the literature review, by establishing the theoretical foundation for the empirical analysis.

### 4.1 The Efficient Market Hypothesis

In 1953, Market Kendall examined the stock market prices, and observed that prices appear to evolve randomly over time (Kendall, 1953). However, on further reflection, it became apparent that the random price movements indicated an efficient market, rather than an irrational one (Bodie *et al.*, 2014). If prices are determined rationally, they will only change as a result of new available information. Hence, predictability of stock prices describe an inefficient market, as the ability to predict would indicate that all available information were not already reflected in the market prices. Consequently, the notion that stocks already reflect all available information is referred to as the efficient market hypothesis (EMH) (Bodie *et al.*, 2014). The notion of the EMH is of great importance for both private investors and investment companies; namely, a private investor accepting the EMH would acknowledge that active management cannot outperform a passive investment strategy. Hence, implying that the investor should rather invest in a passive portfolio simply replicating the market. Conversely, as an investment company profits from fees related to actively managed portfolios, accepting the EMH would ultimately communicate that it charges fees on mutual funds that leave its investors without an increased chance of outperforming the market. Therefore, the EMH has been heavily examined by both academics and practitioners to evaluate its validity, since its introduction in 1970.

In 1970, Fama (1970) displayed extensive evidence in support of the efficient market model, whilst contradictory evidence was scarce. Moreover, he divided his empirical work into three sub-categories depending on the nature of the information subset of interest (Fama, 1970). These three categories are defined as different versions of the EMH (Bodie *et al.*, 2014).

Firstly, the weak-form hypothesis emphasizes that stock prices already reflect all information in the market trading data. Hence, the hypothesis implies that carrying out trend analyses is wasted, as past stock prices are publicly available and essentially costless to obtain. In short, the hypothesis holds that if public data ever produced reliable signals about future performance, all investors would already

have learned to exploit the signals; thus, the available data would immediately result in a price adjustment (Bodie et al., 2014).

Secondly, the semistrong-form hypothesis similarly state that stock prices already reflect all publicly available information regarding the prospects of a firm. Hence, if such information is publicly available, the hypothesis emphasizes that it will be reflected in stock prices; accordingly, exploiting the information will not lead to outperformance (Bodie et al., 2014).

Lastly, the strong-form version of the EMH further includes that stock prices reflect all information relevant to the firm, including information available only to company insiders. Hence, investors cannot beat the market, even if they possess inside information. Bodie et al. (2014) specifically emphasize that the strong-form is quite extreme, as few would argue against that corporate offices have access to relevant information long enough to profit from trading on the information.

As the EMH has a highly damaging implication on the practice of active investment funds and their managers, it has been subject to a vast array of critique. By the start of the twenty-first century, many financial economists and statisticians began to believe that stock prices are at least partially predictable. Specifically, economists emphasized the importance of psychological and behavioral elements of stock-price determination, and that stock prices are somewhat predictable on the basis of past price patterns and fundamental valuation metrics (Malkiel, 2003).

The study of Malkiel (2003) suggested that pricing irregularities and predictable patterns in stock returns can appear over time, and exist in shorter periods, as a result of less than rational market participants. Furthermore, in line with Grossman & Stiglitz (1980), he argues that the market cannot be perfectly efficient or professional investors would not possess any incentive to spend time and resources to analyze and uncover new information, as this would not generate higher expected returns (Malkiel, 2003; Grossman & Stiglitz, 1980).

There have been several empirical studies conducted with respect to testing the EMH (i.e. DeBondt & Thaler, 1985; Chan, 1988; Ball & Kothari, 1989; Zarowin, 1989; Jagadeesh, 1990). Hence, as a sequel to his 1970-paper, Fama (1991) published a modified EMH theory accounting for a vast array of research conducted on efficient markets. The new theory accounts for some temporary mispricing in the market, as suggested by Grossman & Stiglitz (1980), and that professional investors and fund managers can utilize their market research to gain a comparative advantage in the market. Hence, the

revised EMH theory emphasizes that fund managers can profit from temporary inefficiencies in the market, within the short period before they are ultimately eliminated (Fama, 1991).

The main obstacle to making a conclusion about the EMH is what Fama (1991) phrase as the joint-hypothesis problem, informing that the EMH cannot be accepted nor rejected as long as there is no exact method of pricing stocks; an asset pricing model. As long as the joint-hypothesis problem exists, it will be impossible to inform a precise inference of the EMH (Fama, 1991).

## **4.2 Active management**

This section will present extant theory on active portfolio management, and will act as the foundation for the analysis of active management amongst this paper's sample of funds. The traditional way to measure active management in funds, has been with the tracking error measure. However, the recent contribution of Cremers & Petajisto (2009) introduce active share as a new method for measuring how active mutual funds are, and has proven to be a popular addition to mutual fund theory. Accordingly, these two measures of active management will be presented, and later serve to quantify active management in the analysis.

### **4.2.1 Tracking Error**

Tracking error volatility (TE) is defined as the volatility of the difference between the return of a portfolio, and its benchmark index return (Cremers & Petajisto, 2009). Accordingly, it is commonly used as a measure of how close a mutual fund follows its benchmark index. A pure index fund should have a tracking error close to zero, whilst an active equity fund should display a higher tracking error. The traditional equation for tracking error is commonly defined by equation 1, and assumes a beta equal to 1 with respect to the benchmark index (Cremers & Petajisto, 2009).

$$\text{Tracking Error} = \text{Stdev} (R_{\text{fund},t} - R_{\text{Index},t}) \quad (1)$$

As emphasized by Cremers & Petajisto (2009), an active investor can outperform the index by either specific stock selection, or factor timing. Respectively, stock selection refers to picking individual stocks that the manager expects to outperform, whilst factor timing involves bets on systematic risk factors such as entire industries or sectors of the economy. These two approaches contribute very differently to tracking error; thus, tracking error may lead to incorrect conclusions about the degree of active management. For instance, the tracking error of a diversified stock picker is substantially



lower than that of a sector rotator, suggesting that the former is much less active. The reason is that individual stock picks allow for greater diversification, even while potentially contributing to a positive alpha, whereas alpha represents excess return relative to the benchmark index (Cremers & Petajisto, 2009).

#### 4.2.2 Active Share

Conversely to tracking error, active share compares the portfolio holdings of a fund to its benchmark index, as the percentage overlap between the benchmark index and the fund portfolio. As mutual funds almost never take actual short positions, their active share will always be between 0 and 100 percent (Cremers & Petajisto, 2009). Accordingly, as deviating from the benchmark index is required to be able to outperform the market, active share provides a very useful measure of a fund's ability to produce alpha. The active share of a fund will be calculated as defined by Cremers & Petajisto (2009) in equation 2.

$$\text{Active share} = \frac{1}{2} \sum |w_{fund,i} - w_{index,i}| \quad (2)$$

To illustrate active share with two extremes, a pure index fund will possess an active share of zero percent; thus, perfectly overlap the benchmark index. Conversely, an actively managed fund will have a higher active share, as it will deviate from the index. Table 3 provides a numerical illustration of the active share calculation of a pure index fund, and an active fund respectively. Cremers & Petajisto (2009) established a cut-off value for active management of 60 percent, whereas an active share below the cut-off value indicate that the fund operates passively. However, in a separate study, Petajisto (2013) emphasizes the difficulty of establishing exact cut-off values for active share, but suggests 50 percent as a theoretical minimum (Petajisto, 2013). Similarly, in an even more recent paper, Cremers *et al.* (2015) propose a cut-off value of 50 percent. In view of that, this study will adopt a cut-off value of 50 percent when examining the Norwegian market; accordingly, if more than half of the fund's assets are actively managed, the fund will not be considered passive.

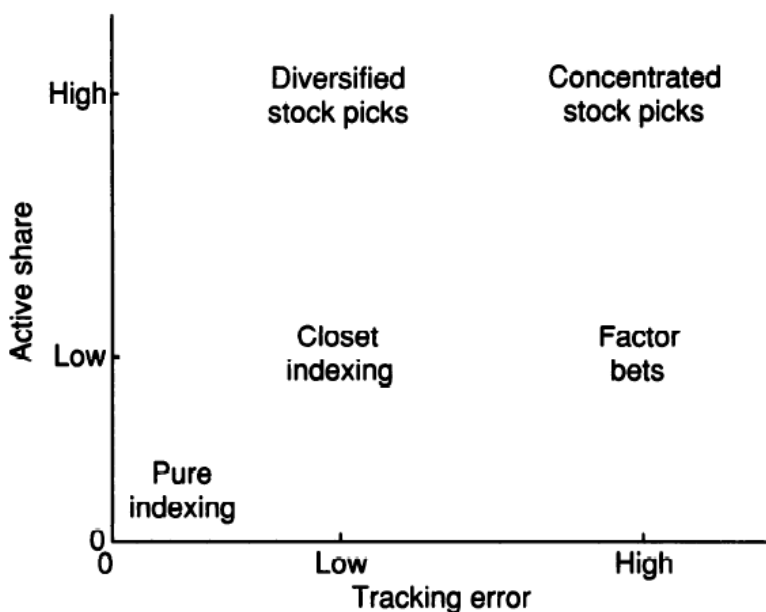
**Table 3***An illustrative example of the calculation of active share.*

Stock Holding	Index Fund	Pure Index Fund		Active Fund	Pure Active Fund	
		Benchmark Index	Difference		Benchmark Index	Difference
Stock A	40 %	40 %	0 %	0 %	40 %	40 %
Stock B	60 %	60 %	0 %	0 %	60 %	60 %
Stock C	0 %	0 %	0 %	100 %	0 %	100 %
Sum			0 %			200 %
Active share			<b>0 %</b>			<b>100 %</b>

*Source: own construction based on the theory of Cremers & Petajisto (2009).*

### 4.2.3 Combining active share with tracking error

Cremers & Petajisto (2009) further argue that the active share measure is useful in combination with tracking error; introducing a more comprehensive picture of active management, allowing to distinguish between stock selection and factor timing, as reflected in figure 3.

**Figure 3***Different management styles of active and passive management, based on active share and tracking error.**Source: Cremers & Petajisto (2009).*

Combining active share with tracking error capture the two dimensions of active management, namely stock selection and factor timing. As tracking error includes the covariance matrix of returns,

and therefore puts significantly more weight on systematic factors bets, it acts as a reasonable proxy for factor timing. Conversely, active share puts equal weight on all active bets, regardless of risk diversification, and therefore acts as a reasonable proxy for stock selection, which is illustrated in figure 3 (Cremers & Petajisto, 2009). The figure illustrates that pure indexing is a result of both zero percent active share and tracking error; whilst, concentrated stock picks score high on both proxies.

The benefits of combining both proxies is that tracking error is by far the most widely used measure of active management amongst practitioners, and allows measuring factor timing without making assumptions about how fund managers define factor portfolios at each point in time. In contrast, active share similarly does not require assumptions about the relevant factor portfolios, and acts as a convenient intuitive measure (Cremers & Petajisto 2009). Thus, in light of the problem formulation of this paper, the two-dimensional view in figure 3 enables the study to distinguish between different types of funds, and separate closet indexers from the truly active funds when seeking to test the hypotheses.

### **4.3 Risk adjusted performance measures**

In order to evaluate the performance of the funds, the rest of this chapter will present several performance measures. The capital asset pricing model (CAPM) will be presented first, as the additional performance measures are derived from this model. Thus, the additional measures have the same weaknesses and rely on the same assumptions as the CAPM; although, they seek to provide more comprehensive results, and may arrive at different conclusions.

#### **4.3.1 Capital Asset Pricing Model**

A fundamental question in finance is how the expected return of an investment is affected by its risk; accordingly, it has flourished a vast amount of research on the subject since the early 1960s. The first articulate framework providing an answer to the question, was the introduction of the CAPM developed by Sharpe (1964), Treynor (1962), Lintner (1965 a & b) and Mossin (1966). The idea behind the CAPM is that investors should be compensated for the amount of risk they undertake; namely, higher risk should equal higher expected return and vice versa, as presented in the CAPM-equation of expected return (3).

$$E(r_i) = r_f + \beta[E(r_m) - r_f] \tag{3}$$

Furthermore, the model is established based on several assumptions, as a model perfectly consistent with the full complexity for a real-life market cannot be solved (Bodie *et al.*, 2014).

Several of the assumptions behind the CAPM appear to be unrealistic (Mullins, 1982); for instance, taxation and transaction costs occur in most investments, as well as that different investors may have different risk preferences. Furthermore, the mean-variance criterion in the traditional CAPM equation (3), stating that the only explanatory factor for return is the market performance and risk level in the asset, has been challenged by several critics. For instance, Jensen *et al.* (1972) argue that expected excess return is not strictly proportional to its systematic risk; thus, suggesting that the CAPM as given in equation 3 should be rejected. Banz (1981) presents evidence of a size effect; namely, that small firms tend to have higher risk-adjusted returns, proposing that the CAPM is misspecified. Similarly, the size effect identified by Banz (1981) is further emphasized through the study of Fama & French (1993), suggesting that both a size- and value-factor have explanatory power on excess returns, as well as by Carhart (1997) suggesting that the 1-year momentum effect identified by Jegadeesh & Titman (1993) also succeeds in explaining excess returns. However, although the CAPM does not succeed in explaining all the aforementioned effects, this study will include numerous performance measures based on the model, as it provides a useful measure that quantifies risk and contribute with a highly applicable, fairly objective routine for translating risk measures into estimates of expected return (Mullins, 1982). However, the paper acknowledges that the CAPM, as with all financial models, is a simplification of reality and should not be interpreted as a precise measure.

#### **4.4 Additional risk-adjusted performance measures**

After establishing the CAPM, literature on performance measurement experienced vast development, and several new performance measures were introduced. The most significant early developments were those of Sharpe (1966), Treynor (1965), and Jensen (1968); which will be presented in the following section. Additionally, the Information Ratio commonly used by practitioners, will also be accounted for. Also included is a further extension of the performance measure presented by Jensen (1968), namely the 4-Factor model introduced by Carhart (1997), as an extension of the 3-factor model developed by Fama & French (1993). Lastly, this paper presents the Treynor-Mazuy model for measuring market timing ability.

#### 4.4.1 Treynor Measure

After the introduction of the CAPM, Treynor (1966) quickly proposed a new measure, namely the Treynor measure as defined in equation 4.

$$\text{Treynor measure} = \frac{(\bar{r}_p - \bar{r}_f)}{\beta_p} \quad (4)$$

As evident in the equation, the measure describes excess return per unit of systematic risk ( $\beta$ ), and recognizes that a fund manager who is delivering higher excess return, or the same excess return at a lower beta will provide a higher reward-to-risk ratio.

#### 4.4.2 Sharpe Ratio

Shortly after Treynor (1965) introduced the Treynor measure, Sharpe (1966) proposed the Sharpe ratio, which is also a reward-to-risk measure used to evaluate the performance of investment managers, as evident from equation 5.

$$\text{Sharpe Ratio} = \frac{(\bar{r}_p - \bar{r}_f)}{\sigma_p} \quad (5)$$

As with the Treynor measure, the Sharpe ratio describes the excess return as a proportion of the risk. However, the Sharpe ratio accounts for total risk ( $\sigma$ ) whereas Treynor only accounts for systematic risk ( $\beta$ ).

#### 4.4.3 Information Ratio

In addition to the relative performance measures derived directly from the CAPM, what is often referred to as a generalized version of the Sharpe ratio, the Information Ratio (IR), is frequently used by investors (Bodie et al., 2014). The IR is used to understand how much excess return is generated from the amount of excess risk taken relative to the benchmark (Kidd, 2011). In contrast to the Sharpe ratio and Treynor measure, the IR is calculated by dividing a fund's excess return relative to its benchmark, by its tracking error; namely, it measures excess return per unit of risk that in principle could be diversified away by holding the index portfolio (Bodie et al., 2014). As the benchmark index of an actively managed fund typically does not perfectly reflect the fund's composition, the paper emphasizes that the IR may be manipulated if a fund is benchmarked against an index not sufficiently reflecting its portfolio.

$$\text{Information Ratio} = \frac{r_p - r_b}{\sigma_{p-b}} = \frac{\alpha_p}{\sigma_{p-b}} \quad (6)$$

#### 4.4.4 Jensen's alpha

Another measure derived from the CAPM is Jensen's alpha, which in contrast to the three previous measures, examine absolute performance. Jensen's alpha measures a portfolio's deviation from the security market line, and is the most widely used measure in academic empirical studies on portfolio performance (Grinblatt & Titman, 1991; Bodie *et al.*, 2014). The measure is formally defined in equation 7.

$$R_{i,t} - r_{f,t} = \alpha_i + \beta_i(r_{m,t} - r_{f,t}) + \varepsilon_{i,t} \quad (7)$$

In the context of active mutual funds, a positive alpha indicate that the fund has outperformed its benchmark index, and thus delivered abnormal performance. Conversely, a negative alpha indicate that the fund managers have underperformed compared to the benchmark. Furthermore, as Jensen's alpha uses the market as a benchmark, it is seen as a superior performance measure compared to the Treynor measure and Sharpe ratio, which is mostly used to rank portfolios against each other (Jensen, 1968). Hence, a positive alpha indicates that the portfolio has produced returns higher than theoretically expected, given the level of risk, and indicate the portfolio manager's predictive ability, or stock picking skills (Jensen, 1968). Further, Jensen's alpha is a percentage measure of abnormal returns, which is easily communicated to investors and serve as an additional reason for its popularity.

Regardless of its popularity, Jensen's alpha also has its drawbacks; for instance, a positive alpha alone cannot guarantee a better Sharpe ratio for a portfolio. A mutual fund manager taking advantage of his predictive ability means deviating from full diversification, which again entails a cost in terms of unsystematic risk; hence, a mutual fund can produce a positive alpha, while simultaneously increase its total risk enough that its Sharpe ratio decreases.

#### 4.4.5 Carhart's 4-Factor Model

In 1993, Fama & French (1993) extended the previously presented Jensen's alpha 1-factor model. Namely, they constructed a 3-factor model seeking to improve the ability of previous models in explaining alpha. As can be seen from Equation 8, the 3-factor model is a direct extension of the 1-factor model (Fama & French, 1993).

$$R_{i,t} = \alpha_{i,T} + b_{i,T}RMRF_t + s_{i,T}SMB_t + h_{i,T}HML_t + e_{i,t} \quad (8)$$

Where RMRF is the excess return in the market portfolio (market risk premium), SMB is the small minus big effect which accounts for the spread in returns between large- and small-cap stocks, and lastly HML is the high minus low effect, seeking to account for the spread in returns between value and growth stocks. The reasoning behind adding the SMB factor was to account for a small firm effect, where small firms tend to outperform large firms. Similarly, HML was chosen to account for a value premium where stocks with high book-to-market ratios tend to outperform growth stocks with lower ratios (Fama & French, 1993). Moreover, Fama & French (1993) find evidence that the two proxies seem to successfully explain the cross-section of average stock returns. Hence, the model seeks to deliver a more comprehensive explanation of the return produced by a mutual fund.

As presented in the literature review, Carhart (1997) acknowledges the momentum effect identified by Jegadeesh & Titman (1993), namely a 3- and 12-month momentum effect where the price of securities show a persistent trend. As the 3-factor model of Fama & French (1993) is unable to explain cross-sectional variation in momentum-sorted portfolio returns, Carhart (1997) further extended the model with a fourth factor, namely a momentum factor (9).

$$R_{i,t} = \alpha_{i,T} + b_{i,T}RMRF_t + s_{i,T}SMB_t + h_{i,T}HML_t + p_{i,T}PR1YR_t + e_{i,t} \quad (9)$$

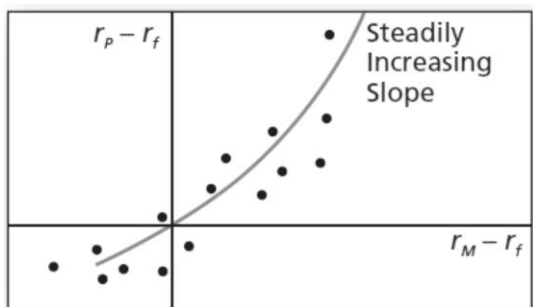
Where, the fourth term of equation 9, PR1YR, is a proxy for the one-year momentum effect in stock returns; thus, the 4-factor model is constructed to give an even more comprehensive explanation of returns than the 1- and 3-factor models (Carhart, 1997).

#### **4.6 Market timing ability**

In its purest form, market timing ability represents shifting between a market-index portfolio and a safe asset, depending on the current risk premium in the market (Bodie et al., 2014). Accordingly, through the lens of a mutual fund, market timing will be defined as increasing the beta of the portfolio during bull markets, and decreasing the portfolio's beta during bear markets. Hence, by possessing market timing ability, mutual funds will be able to further increase their returns in bull markets, whilst limiting their loss during bear markets, as graphically illustrated in figure 4.

**Figure 4**

*Graphical illustration of the characteristics line for a fund with market timing ability.*



*Source: Bodie et al. (2014).*

Evident from the figure, mutual fund managers whom possess market timing ability, have the possibility to outperform the market. Accordingly, Fama (1972) specifically emphasized that managers can outperform the market not only by stock selection skills, but also by timing skills regarding general market price movements. Furthermore, Treynor & Mazuy (1966) were the first to propose a slope similar to that of figure 4, by adding a squared term to traditional CAPM regression (10).

$$R_i - r_f = \alpha_i + \beta_i(r_m - r_f) + \gamma_i(r_m - r_f)^2 + e_i \quad (10)$$

Where  $\alpha$ ,  $\beta$ , and  $\gamma$  are calculated by regression analysis, and a positive  $\gamma$  indicates market timing ability, as this last term will make the slope from figure 4 steeper as the market risk premium grows larger. In their 1966 study, Treynor & Mazuy (1966) applied this test to 57 open-end mutual funds, finding no evidence supporting that mutual fund managers can outguess the market. As with all performance measures considering the skill of mutual fund managers, the existence of market timing ability among managers would not produce much if the financial market is truly efficient; as previously emphasized by the EMH.

#### **4.7 Hypothesis testing**

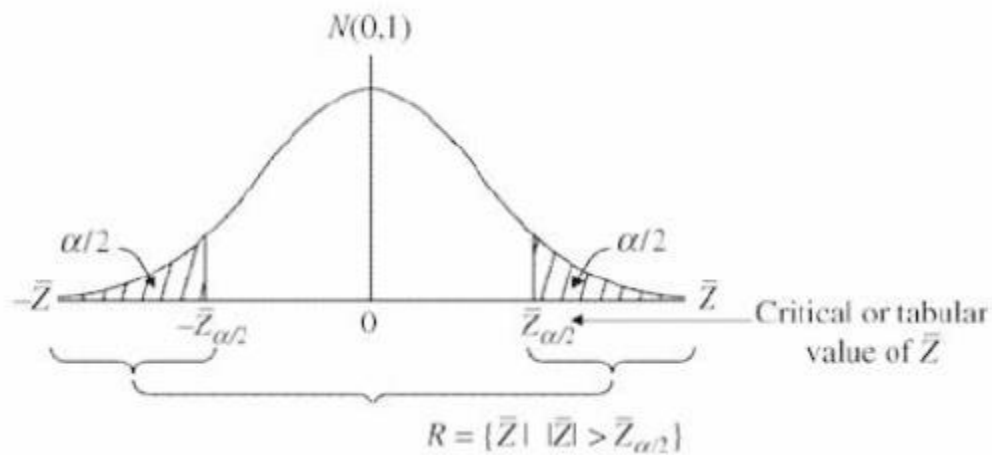
In order to investigate the statistical significance of the results in the analysis, the hypotheses examined must also be tested. Accordingly, as the factors investigated in their respective regressions are tested whether they are equal to zero or not, there are two ways of rejecting the null hypothesis; namely, both a coefficient significantly lower or higher than zero; hence, the regression test performed is two-sided. Furthermore, this study adopts the commonly used confidence level of 95 percent, and therefore accepting that in 5 percent of the cases the null hypothesis will be incorrectly



rejected. Incorrectly rejecting the null hypothesis is formally referred to as a type-I error, whilst a failure to reject a false null hypothesis is referred to as a type-II error (Panik, 2012). The two-sided regression test is graphically illustrated in Figure 5.

**Figure 5**

*Graphical illustration of the two-tailed critical regions of the regression test.*



Source: Panik (2012).

With a 95 percent level of confidence, a z-value below -1.96 or above 1.96 indicates a rejection of the null hypothesis; thus confirming the alternative hypothesis. However, it is important to emphasize that a rejection of the null hypothesis differs from disproving it. Namely, a rejection of the null hypothesis simply disproves the paper’s initial assumption at a probability level of 95 percent, based on evidence presented through the collection of data (Panik, 2012).

#### 4.8 Survivorship bias

As today’s investors are typically not interested in funds that no longer exists, commonly employed data sets of mutual fund returns tend to only show the past performance of existing funds (Malkiel, 1995). The obvious problem with doing empirical work with such data sets is that mutual funds taking on excessive risk trying to outperform the market, and fail, will ultimately lose popularity and exit the market. Conversely, mutual funds taking on excessive risk and succeed in outperforming the market, will gain an advantageous position in the market. Hence, a data sample considering only currently existing funds will tend to be upward biased, overstating the returns of mutual funds in the sample period. Furthermore, in a data set containing survivorship bias, the CAPM beta will fail to adequately measure risk (Malkiel, 1995). As highlighted by Malkiel (1995) numerous of the early empirical studies on mutual funds contain significant survivorship biases. However, some studies

argue for only minor survivorship bias in their sample (i.e. Grinblatt & Titman, 1989), whilst others examine a survivorship-bias free dataset (i.e. Sørensen, 2009). In sum, by excluding funds that have exited the market during the sample period, the study bears the risk of overstating returns when looking at the sample of funds as a group.

In particular, Sørensen (2009) emphasizes that Norwegian equity funds do not exit the market randomly, and that it is crucial to investigate a sample free of survivorship bias when assessing the skill of the average Norwegian mutual fund manager (Sørensen, 2009). In his study, Sørensen (2009) find statistical significant evidence of severe survivorship bias in the period from 1982 to 2008. Accordingly, this study acknowledges the importance of including both funds that have exited the market prior to December 2015, as well as funds with an inception date after January 2006. Consequently, this study adopts the selection criteria of Sørensen (2009); namely, including every fund with at least one year of returns available; however, an exception is made for Globus Norge A/I and Globus Norge II Acc, with only 10 months of return data available. The downside of including funds with only 10 observations is that the regressions will be imprecisely estimated; however, including the returns of short-lived funds is important to gain an accurate and survivorship bias free understanding of fund performance (Sørensen, 2009). Lastly, 4 funds were excluded from the sample, as they only provided between 4 and 5 months of return data.

## 5.0 Methodology and Data

---

This section will present the methodology and process behind the collection of data.

### 5.1 Mutual fund data

In order to make meaningful comparisons of mutual funds, they need to be classified as a homogenous group (Cesari & Penatta, 2002). Hence, this study follows the criteria below, when selecting the sample of funds, accentuating that the paper seeks to investigate active management and performance isolated to active domestic Norwegian equity funds.

- The fund must be listed as active.
- The fund must have an investment strategy of Norwegian domestic equity.
- The Prospectus benchmark must be a Norwegian index.
- The fund must have Norwegian Krone as base currency.

Of an initial list of 96 equity fund within the Norwegian equity domicile, 73 domestic equity funds fulfill the selection criteria of this study, whereas 69 funds have more than 10 months of return data available and will be accounted for throughout the performance analysis. In order to obtain a sample free of survivorship bias, the option of only including surviving investments were deselected in Morningstar Direct. Of the original sample of 73 funds, 43 funds have return data for the entire period, whilst 30 funds have either exited the market prior to December 2015, or entered the market post January 2006. The data span of the individual funds are displayed in Appendix I.

Additionally, 7 funds on the initial list of funds are feeder funds; namely, funds having all of its assets invested into the master fund, which holds the actual actively managed portfolio. Thus, a feeder fund will display the same holdings and gross returns as its master fund. Moreover, several funds on the initial list are different share classes of the same fund, which is the same fund product, targeted to different investors. As both feeder funds, and different share classes of the same fund, charge different management fees, each individual fund on the initial list is included throughout the performance analysis. However, when examining the relationship between active share and gross alpha, feeder funds are excluded, and only the fund with the oldest share class are included; thus, avoiding a bias in the regression output. Consequently, the final sample of funds fulfilling the criteria consists of 69 funds when evaluating fund performance, and 53 funds when examining the relationship between

active share and gross alpha. Additionally, 4 funds have no obtainable annual active share, and the average active share of the sample will therefore be conducted based on 65 funds.

## **5.2 Benchmark indices**

In order to calculate active share in line with Cremers & Petajisto (2009), both holdings for the individual mutual funds and for their benchmark indices are a necessity. As emphasized in the introduction, the three benchmark indices for the sample of funds are the OSEBX, OSEFX, and OSESX. Accordingly, portfolio weights and monthly returns are obtained for each index, and will serve as a benchmark for the individual funds in the sample. Furthermore, the indices will be used as benchmarks when calculating abnormal returns, as this process requires a benchmark for what is perceived as normal performance (Lehmann & Modest, 1987). Consequently, portfolio holdings for each benchmark index were collected through the Bloomberg database, whilst monthly returns for each benchmark were collected through Morningstar Direct. The holdings of each benchmark were imported into Morningstar Direct, and active share were calculated using the Morningstar Direct tool.

## **5.3 Risk free rate of return**

As the following analysis requires a dataset of fund- and benchmark returns in excess of the risk free rate, the paper needs to define a proxy for the risk free rate. In reality, only a default-free perfectly price-indexed bond will act as a truly risk-free asset (Bodie et al., 2014); namely, a condition implying zero risk which is impossible to accomplish in practice. Nonetheless, common practice is to view the return on short-term Treasury bills as a satisfactory proxy for the risk free rate, as the short-term nature makes their values insensitive to interest rate fluctuations, as well as negligible inflation uncertainty (Bodie et al., 2014). Accordingly, this study will adopt the 3-month NIBOR-rate (Norwegian Interbank Offered Rate) as a proxy for the risk free rate in Norway. The NIBOR is a daily published reference rate specifying the average interbank lending rate in Norway. The 3-month NIBOR is the most frequently used approximation for the risk-free rate in Norway, and should contribute to the most accurate estimation (Oslo Børs, 2014). The paper obtained the 3-month Treasury bill rates from the Norwegian National Bank (Norges Bank) and the Oslo Stock Exchange (Oslo Børs) from 2006 to 2015, and converted the rates from effective annual to continuous monthly terms by using equation 11.

$$\text{Monthly continuous } r_{f,t} = \frac{\ln(1 + r_t^{3M})}{12} \quad (11)$$

Consequently, the average annual continuous risk free rate of return during the 10-year sample period was 2.86 percent, translating into a monthly average of 0.24 percent.

## 5.4 Computation of return series

To compute the return series, this study adopts a geometric average model. The geometric average is conventionally preferred when evaluating historical performance, as it gives a more accurate and conservative estimate compared to an arithmetic average (Bodie *et al.*, 2014). The monthly returns for the sample of funds and benchmark indices in this paper are collected through Morningstar Direct, and converted into continuously compounded geometric return series.

## 5.5 Factor loadings in Carhart's 4-Factor model

In order to perform regressions using Carhart's 4-factor model, factor portfolios for SMB, HML and PR1YR from January 2006 to December 2015 are required. Common practice is to retrieve the factors portfolios through the online database provided by Kenneth R. French; however, using factors based on the general European market will not be as accurate as factors specifically dedicated to the Norwegian market. Accordingly, as of January 2016, factor portfolios using Norwegian data are available through the contribution of Bernt Arne Ødegård of the University of Stavanger, and Norwegian School of Economics (Ødegård, 2016a). Ødegård has constructed the factor portfolios for SMB and HML as calculated by Fama & French (1996), based on Norwegian data. The factor portfolio of the one-year momentum factor, PR1YR, was calculated as by Carhart (1997), also by using Norwegian data. A thorough description of the computation of the factor portfolios is available through Ødegård (2016b) and Ødegård (2016c). Hence, in this paper, monthly series of the factor portfolios from January 2006 to December 2015 are retrieved, in order to use the 4-factor model on the sample of fund data throughout the entire 10-year period.

Critics have proposed (i.e. Huij & Verbeekm, 2009) that failing to estimate the factor proxies correctly will lead to spurious alpha estimates. Hence, miscalculations of the factor premiums may lead to false inferences about relative fund performance, and the market as a whole. However, the paper evaluate the factor series presented by Ødegård (2016a) as the most accurate available input

for the 4-factor model, and assumes that the series are calculated correctly. This assumption is based on the available thorough description on the computation of the factor portfolios.

## 5.6 Robustness

Following Mills (2013), the regressions performed in this study follow the original least square approach (OLS), when identifying the unknown parameters in the models. This method is commonly used when identifying the unknown parameters in a linear regression model (i.e. Jensen, 1968). Furthermore, the OLS approach minimize the sum of squared residuals, explicitly the squared vertical distance between the returns predicted by the regression, and the observed return in the data sample. The OLS approach is said to be the best of unbiased linear estimators (BLUE); however, there are several assumptions necessary to be made in order for this to be true, whereas the two most important for performance measurement are presented in this paper; namely, autocorrelation and heteroscedasticity (Mills, 2013).

The presence of autocorrelation and heteroscedasticity lead to similar results; specifically, affecting the t-statistics of the regressions, which may possibly induce a type I error of falsely rejecting the null hypothesis. Thus, making the OLS a sub-optimal estimator of the unknown parameters (Mills, 2013). Accordingly, running tests on both assumptions are an important aspect when seeking to evaluate regression output.

### 5.6.1 Testing for autocorrelation

Acknowledging the possibility of spurious regression output when using economic time series, the paper will examine the residuals of the regressions in the analysis, to investigate if they are in fact uncorrelated. The existence of a pattern in the residuals indicate positive autocorrelation, and may induce a type I error. The most common test for autocorrelation is the Durbin-Watson test, and will also be adopted in this paper (Mills, 2013). The Durbin-Watson test for autocorrelation assumes that the residuals in the regression follow a first-order autoregressive process (12) (Kutner et al., 1996).

$$\varepsilon_t = p\varepsilon_{t-1} + u_t \tag{12}$$

Where  $\varepsilon$  denotes the residuals,  $p$  denotes the autocorrelation parameter (correlation between the residuals), and lastly  $u_t$  denotes a new disturbance term. The Durbin-Watson test consists of determining whether the autocorrelation parameter in equation 12 is zero or not. As correlated error

terms in economic analyses tend to show positive serial correlation, the common test alternatives considered are a one-sided hypothesis test (Kutner et al., 1996):

$$H_0: \rho = 0$$

$$H_a: \rho > 0$$

To test this hypothesis, the Durbin-Watson test statistic  $D$  is used, after calculating the ordinary residuals (13).

$$D = \frac{\sum_{t=2}^n (e_t - e_{t-1})^2}{\sum_{t=1}^n e_t^2} \quad (13)$$

Where  $n$  is the number of observations, and  $e$  denotes the residuals.

As critical values of  $D$  are difficult to obtain, Durbin and Watson have denoted upper and lower bounds  $d_L$  and  $d_U$  such that a value outside these bounds lead to a certain conclusion (Kutner et al., 1996). The decision rules are as follows.

If  $D > d_U$ , conclude  $H_0$

If  $D < d_L$ , conclude  $H_1$

If  $d_L \leq D \leq d_U$ , the test is inconclusive

The upper and lower bounds considered are presented in Appendix A, and are retrieved from Kutner et al. (1996). Further, when examining the existence of negative autocorrelation,  $D$  from the decision rule above is simply replaced by  $4-D$  (Mills, 2013).

As displayed in table 4, the majority of the funds do not suffer from autocorrelation, although 4 of the funds show minor positive autocorrelation, and 1 fund shows negative autocorrelation. Moreover, 3 funds have an inconclusive test, and the paper cannot immediately rule out the existence of autocorrelation. However, the paper will make the assumption that autocorrelation is not present for the funds displaying an inconclusive test. Following Doganis (2009),  $D$  values between 1.5 and 2.5 are no cause for concern; hence, based on the results displayed in Appendix D, the only fund identified with a need for autocorrelation adjustment is FORTE Norge, with a prominent negative autocorrelation. Accordingly, the paper will adjust FORTE Norge for autocorrelation, whilst the remainder of the funds are assumed to not significantly be affected by autocorrelation, and that the OLS is therefore still BLUE.

**Table 4***Durbin-Watson- and White's test results for autocorrelation and heteroscedasticity respectively.*

Fund name	Auto-correlation	Heteroscedasticity	Fund name	Auto-correlation	Heteroscedasticity
Alfred Berg Aktiv	YES	NO	KLP AksjeNorge	NO	YES
Alfred Berg Aktiv II	NO	NO	Landkreditt Norge	NO	YES
Alfred Berg Gambak	YES	NO	Landkreditt Utbytte	NO	NO
Alfred Berg Norge +	NO	NO	NB Aksjefond	NO	NO
Alfred Berg Norge Classic	YES	NO	Nordea Avkastning	NO	YES
Alfred Berg Norge Etisk	NO	NO	Nordea Kapital	NO	YES
Alfred Berg Norge Inst	NO	NO	Nordea Norge Pluss	NO	YES
Atlas Norge	NO	YES	Nordea Norge Verdi	NO	YES
Carnegie Aksje Norge	NO	YES	Nordea SMB	NO	YES
Danske Invest Norge I	NO	NO	Nordea Vekst	NO	NO
Danske Invest Norge II	NO	YES	ODIN Norge A	NO	YES
Danske Invest Norge Vekst	NO	NO	ODIN Norge B	NO	YES
Danske Invest Norske Aksjer Inst I	NO	YES	ODIN Norge C	NO	YES
Danske Invest Norske Aksjer Inst II	NO	YES	ODIN Norge D	NO	YES
Delphi Norge	NO	NO	ODIN Norge II	NO	YES
Delphi Vekst	NO	NO	Pareto Aksje Norge A	NO	YES
DNB Norge (Avanse I)	NO	NO	Pareto Aksje Norge B	NO	YES
DNB Norge (Avanse II)	NO	NO	Pareto Aksje Norge I	NO	YES
DNB Norge	NO	YES	Pareto Investment Fund A	NO	YES
DNB Norge (I)	NO	YES	Pareto Investment Fund B	NO	YES
DNB Norge (III)	NO	YES	Pareto Investment Fund C	NO	YES
DNB Norge (IV)	NO	YES	PLUSS Aksje	NO	YES
DNB Norge Selektiv	NO	NO	PLUSS Markedsverdi	NO	YES
DNB Norge Selektiv (II)	NO	NO	RF Aksjefond Acc	Inconclusive	NO
DNB Norge Selektiv (III)	NO	NO	Storebrand Aksje Innland	NO	YES
DNB SMB	NO	NO	Storebrand Norge	NO	YES
Eika Norge	NO	NO	Storebrand Norge H	NO	YES
Eika SMB	NO	NO	Storebrand Norge I	NO	YES
Fondsfinans Norge	NO	YES	Storebrand Norge Institusjon	NO	NO
FORTE Norge	YES	YES	Storebrand Optima Norge	NO	YES
FORTE Trønder	Inconclusive	NO	Storebrand Vekst	NO	YES
Globus Norge A/I	NO	NO	Storebrand Verdi	NO	YES
Globus Norge II Acc	NO	NO	Swedbank Generator	NO	NO
Handelsbanken Norge	YES	NO	Terra Norge	NO	YES
Holberg Norge	Inconclusive	YES			

*Source: own construction based on Durbin-Watson and White's test results for autocorrelation and heteroscedasticity. Complete numerical results is shown in Appendix D, for both DW-values and p-values for chi-squared.*

### 5.6.2 Testing for heteroscedasticity

The other main assumption behind the OLS being BLUE tested for in this paper is heteroscedasticity, which will determine if it is constant variance across the observations. This study will adopt the White's test for heteroscedasticity as it is somewhat straight forward and convenient to interpret (Mills, 2013). This test does not rely on normality assumptions, and a test value of  $\text{prob} > \chi^2$  above 0.05 will fail to reject the null hypothesis; namely, confirming homoscedasticity (variance across observations are constant), and rejecting heteroscedasticity from the observations (Gujarati,



2009). In the absence of heteroscedasticity in the data, the OLS estimators will still remain unbiased, but inefficient. Accordingly, the estimated variances of the coefficient estimators will be biased, and invalidate tests of significance, which will imply problems when concluding on the findings in the analysis (Mills, 2013).

As the chi-squared values displayed in Appendix D show evidence of severe heteroscedasticity, where the majority of the funds are significantly below the acceptance level of 0.05, correcting for the non-constant variance is necessary to be able to conclude on regressions performed using the data (Fox, 1991; Mills, 2013). Furthermore, the heteroscedasticity in the data is not surprising, considering the fluctuations of the stock market in Norway during the sample period (i.e. the financial crisis of 2008), where extreme values are bound to induce heteroscedasticity to the sample of data. Accordingly, the standard errors for the 40 funds affected by heteroscedasticity are corrected for, using White's heteroscedasticity consistent standard errors proposed by White (1980) (Fox, 1991). Accordingly, the paper obtained White's heteroscedasticity consistent standard errors by running the relevant robust regressions in Stata, and replace the initial standard errors and respective t-statistics of the manually computed non-adjusted regressions. This procedure only changes the standard errors, and therefore the t-statistics and p-values for the affected funds. Furthermore, FORTE Norge displays both heteroscedasticity and negative autocorrelation, and will consequently be adjusted for both; namely, the paper will adopt the Newey-West procedure in order to obtain robust standard errors in the absence of both autocorrelation and heteroscedasticity, as proposed by Newey & West (1986). Similarly to the White's heteroscedasticity consistent standard errors, the robust Newey-West standard errors were obtained through Stata. However, in order to obtain the robust standard errors, a lag variable needs to be specified, which donates the lag length up to which the residuals may be auto correlated (Hoechle, 2007). Accordingly, as Stata does not provide a specified lag length, this study will adopt the rule of thumb proposed by Hoechle (2007), for selecting the lag (14).

$$m(T) = \text{floor} \left[ 4 \left( \frac{T}{100} \right)^{\frac{2}{9}} \right] \quad (14)$$

Accordingly, FORTE Norge with 57 monthly observations (T=57), suggests the use of a lag equal to 3, which will ensure standard errors that are robust to both autocorrelation and heteroscedasticity. Hence, by adjusting the standard errors and t-statistics for the heteroscedastic return series of the relevant funds, as well as for FORTE Norge, the OLS will remain BLUE and the paper is able to conclude on the output from the regressions conducted in chapter 6.

## **6.0 Empirical findings & analysis**

---

This section will present the findings of the analysis, seeking to test the three hypotheses defined in the problem formulation.

### **6.1 Testing hypothesis 1: analysis of active management**

In order to test the first hypothesis of the paper, this section will present empirical findings from the market of Norwegian domestic equity funds in the period from 2006 to 2015. Seeking to examine if the majority of active Norwegian mutual funds have in fact operated with a passive investment strategy, the paper will present key figures mainly drawing from the study of Cremers & Petajisto (2009); in particular, active share as a measure of active management.

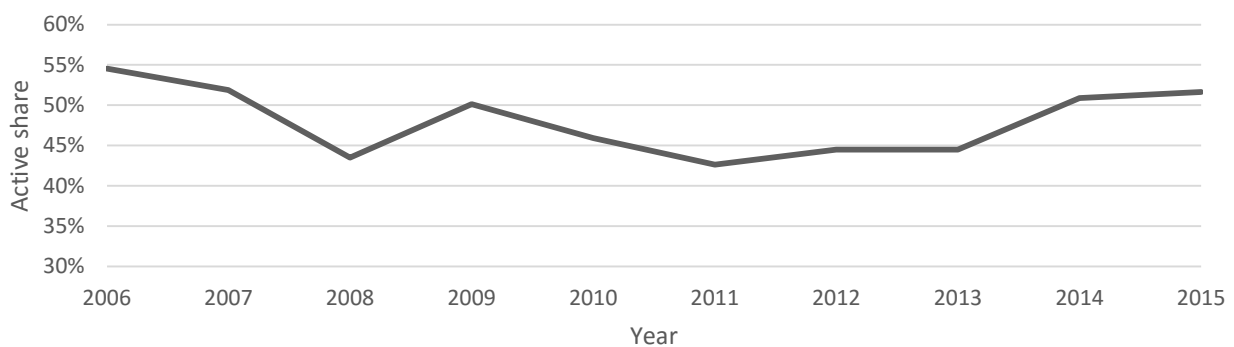
#### **6.1.1 Development of active share over the 10-year period**

As previous studies suggest that active share of an individual fund is extremely persistent over time, holdings data have been collected on a yearly basis for the 10-year period (Cremers & Petajisto, 2009). Following the theory of chapter 4, the annual active share is calculated for each fund, whereas the average development throughout the period can be observed in figure 6. The figure displays that active share appears to only have minor fluctuations throughout the period; although, a distinct drop can be observed during the financial crisis of 2008. The paper will argue that a drop during the bear market of the financial crisis is to be expected, as decreased confidence in the market will induce less risk taking and therefore smaller active positions. Moreover, it is evident that the average active share of Norwegian domestic equity funds in the wake of the financial crisis have remained at a level noticeably lower than pre-2008; however, the average active share appears to be on the rise from 2013 and onwards. On average amongst all funds, active share dropped by almost 3 percent throughout the period and represents an average active share of 51.66 percent in the end of 2015, in contrast to 54.54 percent in the beginning of 2006. A decrease in average active share may likely be the result of less confidence in the market, and therefore a reduced incentive for managers to take higher risk and larger active positions. However, a plausible explanation for the decrease in active share, is the vast reduction of average active share during the financial crisis of 2008 displayed in figure 6, where the average fund appears to be slowly increasing its active share, but is yet to reach the levels observed pre-2008.

Furthermore, the minority of the funds have delivered consistent active management above 50 percent throughout the period, whilst the majority of the funds are below the cut-off value of 50 percent (Appendix B). In line with Cremers & Petajisto (2009), the average active share appears to be persistent over time; although, arguably not extremely persistent as they phrase it. Nonetheless, this study will argue that the results suggest that active share this year, may serve as a reasonable estimation of the active share next year (Cremers & Petajisto, 2009).

**Figure 6**

*Average active share development amongst the sample of funds from January 2006 to December 2015.*



*Source: own construction based on active share results documented in Appendix C.*

As a group, the sample of funds have an average active share of 47.55 percent throughout the 10-year period, excluding multiple share classes and feeder funds; thus, the average Norwegian active domestic equity fund were in fact placing the majority of its capital in stocks replicating the index during the period. Accordingly, only 47.55 percent of the investments in the average actively managed fund were actually placed in stocks aiming to outperform the index. Moreover, 35 of the 65 funds with an obtainable active share, reported an average active share below 50 percent throughout their existence (Appendix C). By plotting the average active share of the funds from 2006 to 2015, as illustrated in figure 6, the reasoning behind the vast amount of critique of active Norwegian domestic equity funds becomes obvious. In particular, DNB Norge, being the fund receiving the most critique, have been persistently plotted below the cut-off value of 50 percent throughout the period (Appendix B), with an average of 29.45 percent over the 10-year period (Appendix C). A further and more thorough analysis of the performance of the funds given their level of active management will be conducted later in this chapter; however, to get a more complete picture of the sample of funds, the paper introduces tracking error as a second dimension of active management.

### 6.1.2 Two dimensions of active management

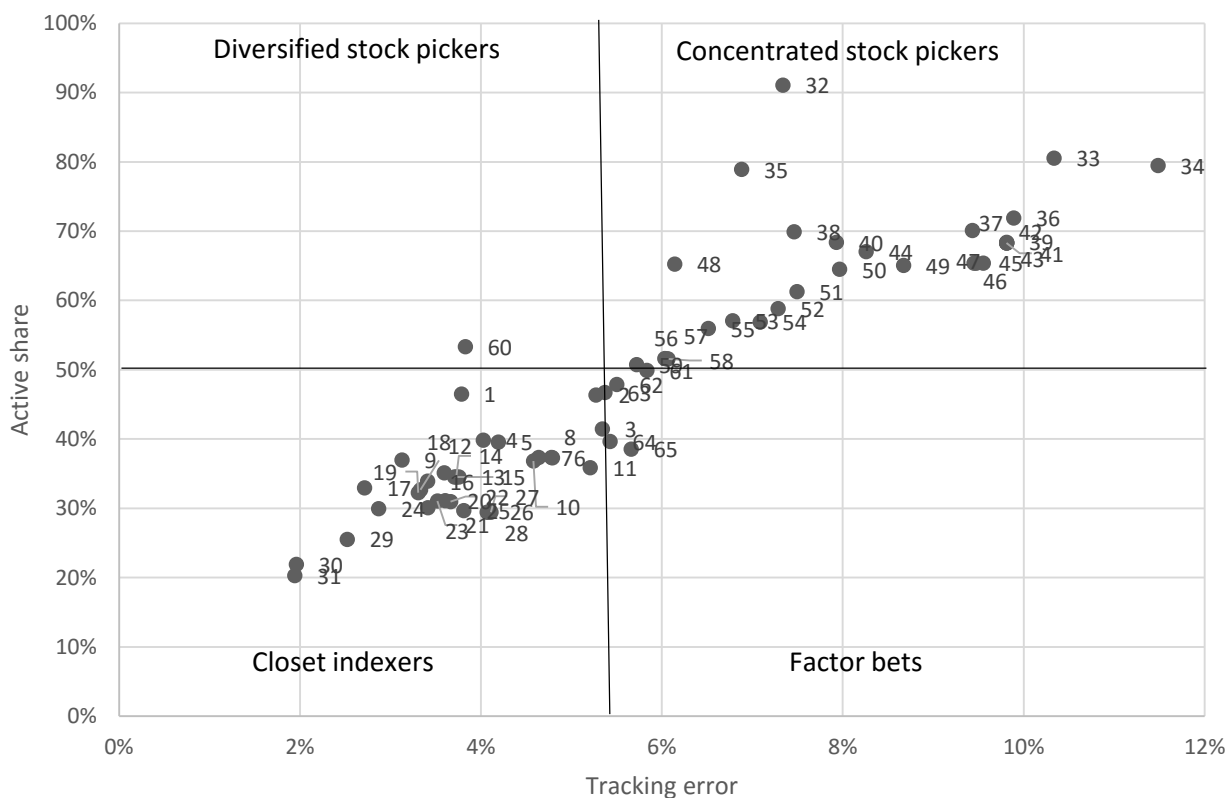
By introducing tracking error as a second dimension in addition to active share, the paper introduces a two-dimensional view, where tracking error serves as a reasonable proxy for a factor bet strategy, and active share as a proxy for a stock selection strategy (Cremers & Petajisto, 2009). As illustrated in figure 7, using both dimensions serves as a tool to separate the sample of funds in four different categories based on their management style; namely, diversified stock pickers, concentrated stock pickers, closet indexers, and factor bets. A graphical illustration is provided in figure 7.

As can be observed in the figure, complementing the findings presented when looking at the one-dimensional view, 31 out of the 65 funds are now described as closet indexers. Namely, 4 of the funds previously presented with an active share below 50 percent tend to deviate from a fully diversified portfolio by investing in certain factor bets. Similarly, of the 29 funds showing consistent active management, 28 fall into the category of concentrated stock pickers, whilst only 1 fund is categorized as a diversified stock picker. As the last section argued that the critique of active Norwegian domestic equity funds appear obvious, the two-dimensional view suggests a similar conclusion; in particular, by using the two funds that have received most criticism, both Nordea Kapital and DNB Norge are categorized as a closet indexers in figure 7.

Figure 8 displays that the dominant management strategy is closet indexing, containing approximately 47.7 percent of the funds, whilst the remaining funds below 50 percent active share show a deviation from the index by investing in bets on time-varying systemic factors, and will therefore be categorized as factor bets (Cremers & Petajisto, 2009). In a close second, concentrated stock pickers account for 43.1 percent of the funds. Figure 7 shows that only 1 fund with an active share above the cut-off value, are categorized as a diversified stock picker, thus, emphasizing that a fund with a low TE can be active; for instance, by picking large stock-specific active positions within an industry, whilst simultaneously diversify its position across all industries similar to the benchmark index (Cremers & Petajisto, 2009). Hence, a diversified stock picker serves as a good example of why tracking error alone is not a sufficient sole measure of active management. Lastly, concentrated stock pickers take positions in both individual stocks, as well as in systemic factors. Accordingly, in their 2009 paper, Cremers and Petajisto (2009) identify concentrated stock pickers as the top performers, followed by diversified stock pickers, whilst the closet indexers perform worst out of the four categories (Cremers & Petajisto, 2009). Further analysis of the individual performance of both funds and fund categories will be examined in detail when testing hypothesis 2.

**Figure 7**

Two-dimensional view of active management, as suggested by Cremers & Petajisto (2009). Cut-off value for active share is 50 percent. Cut-off value for tracking error is based on the median of the sample, equal to 5.37 percent (Terra Norge). Active share and tracking error denoted in annual terms.



Fund Name	#	Fund Name	#	Fund Name	#	Fund Name	#
Storebrand Norge H	1	Nordea Avkastning	17	Eika SMB	33	Holberg Norge	49
Alfred Berg Aktiv	2	Alfred Berg Norge Classic	18	Storebrand Vekst	34	Landkreditt Norge	50
Storebrand Optima Norge	3	Alfred Berg Norge +	19	Landkreditt Utbytte	35	Alfred Berg Gambak	51
Storebrand Verdi	4	PLUSS Markedsverdi	20	ODIN Norge II	36	DNB SMB	52
Nordea Vekst	5	Storebrand Norge I	21	Delphi Vekst	37	Delphi Norge	53
Danske Invest Norske Aksjer Inst II	6	Storebrand Norge	22	FORTE Norge	38	Danske Invest Norge Vekst	54
Danske Invest Norge I	7	Carnegie Aksje Norge	23	ODIN Norge C	39	Fondsfinans Norge	55
Danske Invest Norge II	8	Nordea Kapital	24	Swedbank Generator	40	Pareto Investment Fund A	56
RF Aksjefond Acc	9	Atlas Norge	25	ODIN Norge A	41	Pareto Investment Fund B	57
Danske Invest Norske Aksjer Inst I	10	DNB Norge (IV)	26	ODIN Norge B	42	Pareto Investment Fund C	58
KLP AksjeNorge	11	DNB Norge	27	ODIN Norge D	43	Eika Norge	59
Alfred Berg Norge Inst	12	DNB Norge (III)	28	Nordea Norge Verdi	44	Nordea Norge Pluss	60
DNB Norge Selektiv (II)	13	Storebrand Norge Institusjon	29	Pareto Aksje Norge I	45	NB Aksjefond	61
DNB Norge Selektiv (III)	14	Storebrand Aksje Innland	30	Pareto Aksje Norge A	46	Alfred Berg Aktiv II	62
DNB Norge Selektiv	15	DNB Norge (Avanse II)	31	Pareto Aksje Norge B	47	Terra Norge	63
Alfred Berg Norge Etisk	16	FORTE Trønder	32	Nordea SMB	48	Handelsbanken Norge	64
						PLUSS Aksje	65

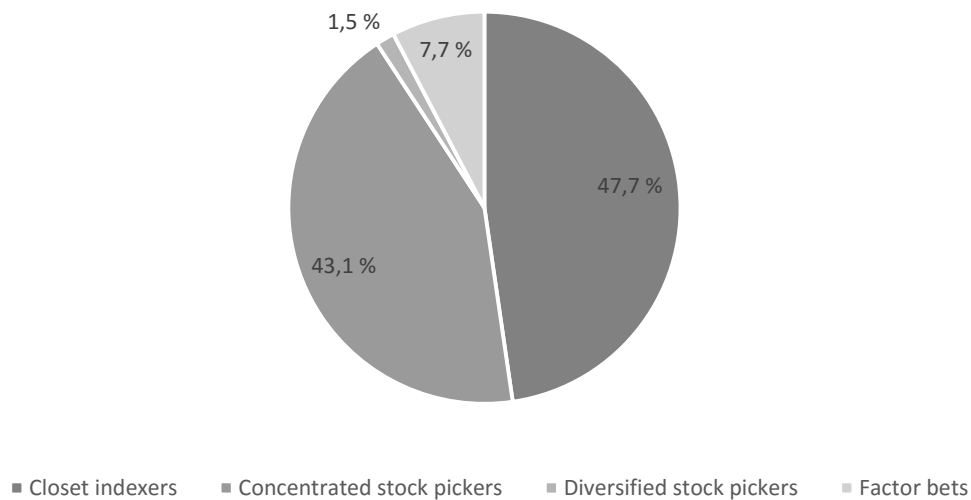
Source: own construction based on the results displayed in Appendix C and I.

In sum, hypothesis 1 claims that the majority of active Norwegian equity funds have in fact operated with passive investment strategy throughout the past 10-year period. By solely looking at active share, the paper confirms the hypothesis, as the majority of the funds consistently plot below the cut-off value of a 50 percent active share. Additionally, by introducing tracking error as a second dimension, the paper achieved a more comprehensive picture on the state of active management amongst the

sample of funds. Namely, by dividing the funds into four different categories depending on investment style; consequently, several of the funds below the cut-off value regarding active share were re-categorized as factor bets. Nonetheless, separating the funds into investment style categories further support accepting hypothesis 1, as closet indexers are in fact the dominant category, as graphically illustrated in figure 8.

**Figure 8**

*Management style categorization based on active share and tracking error from 2006 to 2015.*



*Source: own construction, based on the results of figure 7.*

Accordingly, by evaluating the degree of active management as proposed by Cremers & Petajisto (2009), the paper confirms the hypothesis; namely, that the majority of active Norwegian domestic equity funds have in fact been operating with a passive investment strategy in the past 10-year period.

## 6.2 Testing hypothesis 2: analysis of performance

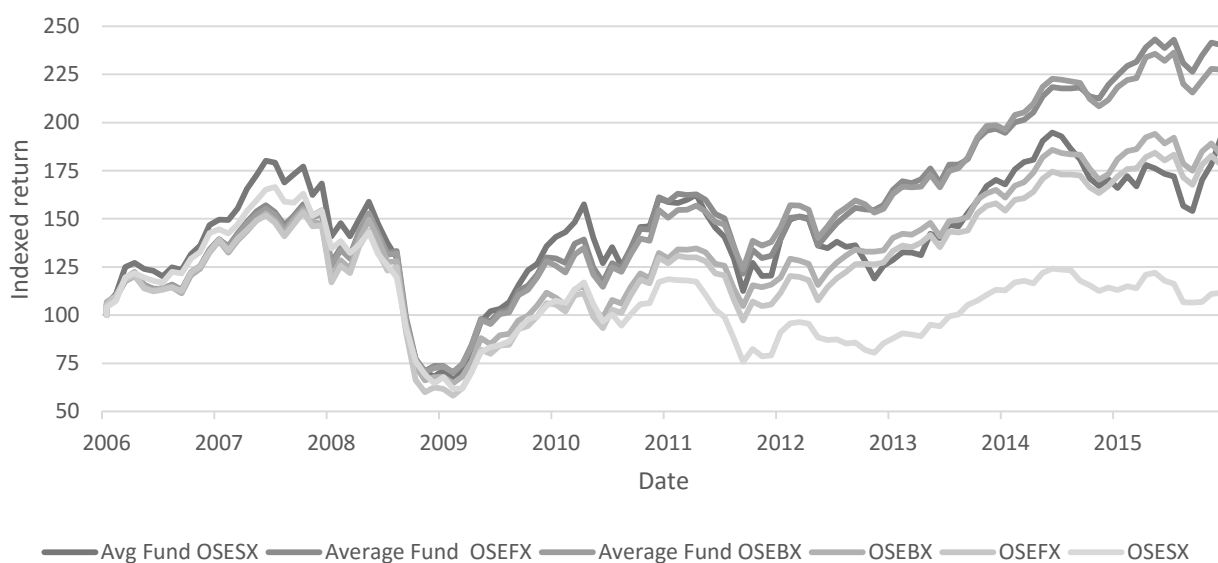
As a wide array of critics have condemned several active Norwegian equity funds for being closet indexers, which is supported through the findings regarding hypothesis 1, this section will investigate hypothesis 2; namely, whether or not the sample of funds have underperformed net expenses throughout the 10-year period. The ten-year period covers a variety of market conditions and levels of volatility (Appendix G).

### 6.2.1 Gross return series for the sample of funds

When comparing the average gross return series for the sample of funds against their respective benchmark indices as shown in figure 9, it is evident that the average fund has consistently delivered excess returns throughout the 10-year period, especially when considering the bull market in wake of the financial crisis. However, because these return series are computed with gross returns and not accounting for the level of risk in the individual funds, they do not serve as a rightful measure of the real performance of the funds; hence, to get a more comprehensive picture of performance, this section will start by presenting relative performance measures accounting for the level of risk in each fund, then introduce several absolute models seeking to measure how well the funds have performed throughout the period both net and gross expenses.

**Figure 9**

*Average indexed return development of the average fund for each benchmark, graphically illustrated against the indexed return of each respective benchmark index.*



*Source: own construction based on return series obtained through Morningstar Direct.*

### 6.2.2 Relative performance measures

Introduced by Sharpe (1966), the Sharpe ratio provides a reward-to-risk measure, seeking to display a clear picture of the return in excess of the risk-free rate for the funds, in light of their level of risk. Similarly, as the Sharpe ratio account for total risk ( $\sigma$ ), the Treynor measure is also included as it differs from the Sharpe ratio by presenting the returns in light of the systematic risk ( $\beta$ ) (Treynor, 1965). Furthermore, a third relative performance measure will be accounted for; namely, the Information Ratio (IR). In contrast to the other measures, IR uses active return ( $r_p - r_b$ ) in the numerator,

and tracking error in the denominator; thus, the paper anticipate that the ranks based on the IR will differ from the other measures. Accordingly, Appendix J displays the sample of funds including benchmark indices, ranked by these reward-to-risk ratios. Summary statistics based on the results are reported in table 5.

The overall trend that the sample of funds appear to outperform their benchmark indices still appear to hold after accounting for the level of risk, as displayed in table 5; namely, both the average Sharpe- and Treynor values are higher than that of all three benchmark indices. However, 13 funds deliver lower Sharpe ratio than OSEBX, whilst 11 funds report lower ratios relative to the OSEBX with regards to the Treynor measure (Appendix J). Furthermore, both the Sharpe ratio and Treynor measure for OSESX during the period are negative, implying an average negative risk premium on the small cap market throughout the 10-year period. Similarly, Nordea SMB appear to be the worst performer with respect to the two ratios, even underperforming OSESX, with monthly Sharpe- and Treynor ratios of -0.044 and -0.003 respectively.

Furthermore, the individual rankings with respect to Sharpe and Treynor are highly consistent, and differ only marginally throughout the sample. Funds with different rank by Sharpe and Treynor, implies that diversification has not successfully eliminated all unsystematic risk, as a perfectly diversified fund would have a Sharpe rank equal to its Treynor rank. Analogous for the 10 funds scoring highest with respect to the Sharpe ratio, is an average monthly return significantly higher than the average, whilst displaying a relatively low standard deviation, as can be observed in Appendix I. Moreover, the 6 funds displaying significantly higher Sharpe ratio than the rest, are funds with between 10 and 63 months of return data; thus, it may likely be that the indication of high performance rather is a result of a small set of observations. However, Alfred Berg Gambak show high relative performance, ranking 6 and 7 with regards to Sharpe and Treynor respectively, based on 120 months of return data.

Conversely, the ranks with respect to IR fluctuate significantly more; for instance, RF Aksjefond Acc ranking second highest with respect to Sharpe and Treynor, displays a rank of 65 with respect to IR. This example emphasize the weakness of using Sharpe- and Treynor ratio with a limited amount of observations; namely, RF Aksjefond Acc displays 14 months of return data, during the bull market of 2006, and appear to be a top performer. However, when calculating the IR, and examining returns in excess of the benchmark index, the fund show performance in the bottom bracket of the sample. Alfred Berg Classic, ranking 22 with regards to both Sharpe and Treynor, displays the second highest



rank with respect to the IR. Not surprisingly, the fund also displays a tracking error amongst the lowest of the sample.

**Table 5**

*Summary statistics of monthly Sharpe ratio, Treynor measure and Information ratio for the sample of funds. The column on the far left denotes the three worst- and best funds, as well as percentiles, ranked by Sharpe ratio. The remaining columns display the respective relative performance measures, with respective ranks in parenthesis.*

	Sharpe	Treynor	Information Ratio
<b>Worst</b>	-0,044	-0,003	-0,08
Nordea SMB	(72)	(72)	(66)
<b>2</b>	0,012	0,001	0,06
Alfred Berg Aktiv II	(70)	(70)	(49)
<b>3</b>	0,017	0,001	-0,06
Holberg Norge	(69)	(69)	(63)
<b>10 %</b>	0,023	0,002	-0,04
ODIN Norge D	(65)	(65)	(60)
<b>50 %</b>	0,064	0,004	0,14
DNB Norge (III)	(36)	(32)	(35)
<b>90 %</b>	0,121	0,009	0,26
Alfred Berg Gambak	(7)	(6)	(7)
<b>3</b>	0,429	0,013	0,72
Alfred Berg Norge Inst	(3)	(4)	(1)
<b>2</b>	0,459	0,018	-0,07
RF Aksjefond Acc	(2)	(2)	(65)
<b>Best</b>	0,538	0,021	0,26
Landkreditt Utbytte	(1)	(1)	(6)
Average (excl. Benchmarks)	0,087	0,005	0,112

*Source: own construction based on the Sharpe-, Treynor-, and IR results reported in Appendix J.*

In sum, the performance measures presented this far suggest that the majority of the sample outperform their benchmark indices during the period, also accounting for the reward-to-risk measures presented in table 5. However, the results of the reward-to-risk measures display obvious problems with ranking the sample of funds relative to each other, particularly when the measures are based on funds with return data of different lengths. Thus, the paper will now present several measures of absolute performance, starting with Jensen's alpha, which will examine abnormal performance of the funds (alpha), seeking to identify whether or not the funds succeed in significantly generating excess returns with respect to their benchmark indices. The reward-to-risk measures are a good method of obtaining an overall insight into the sample of funds; however, the paper will put more weight into the results presented by the more comprehensive, absolute performance measures.

### 6.2.3 Jensen's alpha

Seen as a superior measure of performance compared to the relative measures of last section, Jensen's alpha displays a manager's predictive ability; his stock picking skills. Furthermore, being a percentage measure of abnormal return, investors commonly champion Jensen's alpha as a measure of performance, due to it being intuitive and simple to communicate. Accordingly, the summarized results of the Jensen's alpha regressions are provided in table 6, whilst the regression output for the individual funds, corrected for both heteroscedasticity and autocorrelation, is provided in Appendix K. Furthermore, both gross and net results are presented, whereas Jensen's alphas gross expenses solely seeks to examine the stock picking skills, and the respective fund managers' ability to outperform. Whilst, Jensen's alphas net expenses displays the fund's ability to deliver outperformance to its investors, after accounting for expenses. Hence, the results based on net returns will provide valuable information of whether or not a fund succeeds in providing its clients with promised excess returns relative to the benchmark index.

The results reported in Appendix K suggest that 30 out of the 69 funds have delivered statistically significant abnormal performance with regards to gross returns, whilst the results of the remaining 39 funds show no significant out- or under performance relative to their respective indices. The summarized results displayed in table 6, suggest a non-significant monthly alpha for the average equity fund of 0.184 percent ( $t=1.54$ ) gross expenses. This translates into an annual alpha of 2.2 percent. However, turning to the net returns, 8 funds display significant alpha compared to their indices, with no significant average outperformance as a group ( $t=0.67$ ). None of the funds display significant negative alpha throughout the period, neither before nor after expenses; although, it is worth pointing out that DNB SNB and Globus Norge II Acc displays negative Jensen's alpha significant at a 90 percent level of confidence ( $t=-1.79$ ). In total, 24 funds display negative alpha net expenses, although not statistically significant at a 5 percent level.

Furthermore, in light of previous studies presented in the literature review, it is not surprising that the average actively managed domestic equity fund in Norway does not significantly outperform neither before nor after expenses. In fact, acknowledging the arithmetic of active management proposed by Sharpe (1991), the alpha results appear to be too high, as active investment is a zero sum game. Moreover, Sørensen (2009) found only weak evidence of stock picking skills net expenses in his study on actively managed domestic equity funds in Norway from 1982 to 2008, but several inferior fund products. The results of Sørensen (2009) also proposed more normally distributed alphas, compared to the results reported in table 6; thus, results more in line with the arithmetic of active

management. The alpha results of the Jensen's alpha regressions in this study appear to be curiously high, especially in a study considering a sample of funds free of survivorship bias. However, as Sørensen (2009) analyzed a sample of 97 funds, and a period of 26 years, ending in 2008, somewhat different, and less accurate, results are to be expected relative to this study. As similar performance studies conducted on the Norwegian market is scarce, especially when considering the period from 2006 to 2015, this study has restricted possibilities with respect to comparing the results to similar studies. However, as displayed in Appendix P, the average trailing 1-year alphas show that 2009 is an immense outlier, in the sense that the sample of funds on average delivered a staggering abnormal return against their benchmark indices. Accordingly, the sample of funds appeared to recover faster than the market in the wake of the financial crisis, and may seem as a plausible explanation for higher than expected alpha values throughout the 10-year period. Thus, the results suggest that the indicated positive abnormal performance of the sample of funds, rather comes at the expense of investors outside the Norwegian domestic mutual funds, as active investment is a zero sum game.

**Table 6**

*The table displays average monthly alphas, calculated with Jensen's alpha 1-factor model. The column on the far left denotes the three worst- and best funds, as well as percentiles. The remaining columns display the respective gross- and net alphas, with t-statistics in parenthesis.*

	Net Jensen's $\alpha$	Gross Jensen's $\alpha$	Beta
<b>Worst</b>	-1,08 %	-0,92 %	0,68
Globus Norge II Acc	(-1.79)	(-1.51)	
<b>2</b>	-0,71 %	-0,54 %	0,69
Globus Norge A/I	(-1.18)	(-0.90)	
<b>3</b>	-0,30 %	-0,14 %	0,99
Nordea SMB	(-1.79)	(-0.80)	
<b>10 %</b>	-0,15 %	-0,07 %	0,75
Odin Norge II	(-0.69)	(-0.33)	
<b>50 %</b>	0,07 %	0,14 %	0,96
DNB Norge Selektiv III	(0.75)	(1.45)	
<b>90 %</b>	0,30 %	0,47 %	1,10
DNB SMB	(1.65)	(2.56)	
<b>3</b>	0,41 %	0,58 %	0,69
FORTE Trønder	(1.22)	(1.72)	
<b>2</b>	0,69 %	0,82 %	0,55
Landkreditt Utbytte	(2.63)	(3.10)	
<b>Best</b>	0,76 %	0,82 %	0,77
Alfred Berg Norge Inst	(4.30)	(4.63)	
Average entire sample	0,063 %	0,184 %	0,90
	(0.67)	(1.54)	

*Source: own construction, based on the complete set of regression output presented in Appendix K. Corrected for autocorrelation and heteroscedasticity using both the Newey-West- and White's correction.*

In sum, the results of the Jensen's alpha regressions are somewhat surprising. In particular, although the funds as a group display no significant positive abnormal return, the results display an overweight of positive alphas. This result is not to be anticipated in a sample free of survivorship bias, in light of the arithmetic of active management proposed by Sharpe (1991). The results further contrast the findings of the relative performance measures, suggesting that the average fund does not significantly outperform its index benchmark neither before nor after expenses. The study will now continue the analysis by applying the 4-factor model introduced by Carhart (1997), and examine the results in light of the results this far.

#### **6.2.4 Carhart's 4-factor model**

A more comprehensive analysis of fund performance relative to Jensen's alpha 1-factor model, can be achieved by adding the two additional factors as proposed by Fama & French (1993), and a third factor making up the 4-factor model, as proposed by Carhart (1997). Accordingly, the paper will present the regression output from computing the 4-factor model, to examine whether the alpha can be partly explained by simple exposure to value and small-cap stocks, as well as the one-year momentum effect. Accordingly, fund performance significantly explained by these factors decrease the alpha of the fund, as investors can get exposure to these market factors without investing in the particular fund.

As presented in table 7, the 4-factor model is more successful in explaining returns than the 1-factor model, with an average R-squared of 0.929 compared to 0.915 achieved by the 1-factor model. Hence, the market factors in the 4-factor model successfully explain returns to a greater extent than the 1-factor model, and is therefore seen as a better fit for the data sample. Accordingly, the average net alpha has decreased slightly compared to the 1-factor model, from 0.063 percent to 0.055 percent, in monthly terms. This decrease is likely a result of several funds with positive factor loadings, which in turn decrease the amount of returns being explained by the alpha. Several funds display a lower alpha with the 4-factor model. For instance, Handelsbanken Norge demonstrated a significant monthly net Jensen's alpha of 0.30 percent in the 1-factor model ( $t=2.07$ ), whilst the 4-factor model suggests a non-significant net alpha of 0.18 percent ( $t=1.31$ ) (Appendix M). Not surprisingly, the returns of Handelsbanken Norge are partially explained by the factor loadings in the 4-factor model; in particular, a highly significant correlation with the SMB factor ( $t=3.78$ ). Moreover, both the HML and momentum factor show an average negative loading for the funds as a group, although not

significant, whilst the returns of the average fund tend to be somewhat positively correlated with the SMB factor ( $t=1.36$ ).

**Table 7**

*The table displays average monthly alphas, calculated with Carhart's 4-factor model. The column on the far left denotes the three worst- and best funds, as well as percentiles. The remaining columns display the respective gross- and net alphas, as well as the market beta, SMB, HML and momentum factors. The respective t-statistics are reported in parenthesis.*

	Net alpha	Beta	si	hi	pi	Gross alpha	R <sup>2</sup>
<b>Worst</b>	-1,57 %	1,00	0,46	-0,12	-0,12	-1,40 %	
Globus Norge II							0,89
Acc	(-2.61)		(1.59)	(-0.43)	(-0.45)	(-2.33)	
<b>2</b>	-1,17 %	1,10	0,38	-0,21	-0,28	-1,00 %	
Globus Norge A/I							0,91
	(-2.13)		(1.43)	(-0.85)	(-1.13)	(-1.82)	
<b>3</b>	-0,20 %	0,87	0,23	0,04	-0,07	-0,07 %	
Holberg Norge							0,90
	(-1.00)		(3.34)	(0.68)	(-1.42)	(-0.36)	
<b>10 %</b>	-0,12 %	0,85	0,26	0,04	-0,08	-0,04 %	
ODIN Norge II							0,86
	(-0.55)		(4.01)	(0.61)	(-1.73)	(-0.19)	
<b>50 %</b>	0,07 %	1,04	0,25	-0,08	0,14	0,34 %	
Alfred Berg							0,92
Gambak	(0.41)		(4.21)	(-1.69)	(3.17)	(1.92)	
<b>90 %</b>	0,31 %	0,91	0,02	0,03	0,01	0,38 %	
Danske Invest							0,97
Norske Aksjer Inst							
II	(2.49)		(0.58)	(0.94)	(0.50)	(3.00)	
<b>3</b>	0,41 %	0,72	0,25	0,14	0,06	0,54 %	
Landkreditt Utbytte							0,65
	(1.27)		(2.24)	(1.94)	(0.84)	(1.66)	
<b>2</b>	0,44 %	0,94	0,17	0,00	0,08	0,49 %	
Alfred Berg Norge							0,93
Inst	(1.82)		(2.14)	(-0.05)	(1.71)	(2.07)	
<b>Best</b>	0,89 %	0,59	-0,05	-0,11	-0,16	1,06 %	
FORTE Trønder							0,59
	(2.08)		(-0.34)	(-1.19)	(-1.91)	(2.47)	
Average	0,055 %	0,94	0,10	-0,01	-0,03	0,172 %	
entire sample	(0.58)		(1.36)	(-0.05)	(-0.37)	(1.46)	0,929

*Source: own construction following the theory of Carhart (1997). Based on the regression output from Appendix M, corrected for autocorrelation and heteroscedasticity using both the Newey-West- and White's correction.*

Examining average gross and net alpha, the 4-factor model concludes similar to the 1-factor model; namely, suggesting no statistically significant average outperformance at a 5 percent level of significance. The results still show curiously high alpha values in light of the anticipated results following Sharpe (1991). It is also worth noting that the two best performing funds only have 20 and 35 months of return data available, and therefore provide less accurate regressions, which may induce an upward-bias in the alpha measure (Sørensen, 2009). For instance, FORTE Trønder has 35 months

of return data, and an investment strategy of firms located in a specific geographic in Norway; thus, also lacks a suitable benchmark. This is evident when examining the beta and R-squared for the fund, which is 0.59 for both measures; hence, significantly lower than the average of 0.940 and 0.929. Moreover, several previous studies (i.e. Chen et al., 2009) have suggested that their findings of outperformance are better explained by the 1-year momentum effect proposed by Jegadeesh & Titman (1993). However, as the results of this study display 8 funds with significant outperformance after expenses, using the 4-factor model specifically accounting for the momentum effect, it appears not to be the case with respect to the individual outperformers of this study.

The results of the 4-factor model emphasize that Jensen's alpha as a sole measure of fund performance is inadequate; namely, 22 of the funds show significant outperformance before expenses with the 4-factor model, in contrast to 30 with the 1-factor model. Whilst, the 1-factor model displays 8 funds with significant net alpha, compared to 6 using the 4-factor model. The 4-factor model also identify Globus Norge II Acc and Globus Norge A/I with significant negative net alpha, compared to no identified significant underperformance with the 1-factor model. Returns that can be explained by the factor loadings may be seen as the return an investor could expect when taking a passive exposure the market beta, small-capitalization stocks, value stocks, and momentum. However, a fund with significant exposure to certain factor loadings does not necessarily indicate that the managers of the fund have less amount of skills, but merely that the returns can be explained by factors the investor may find exposure to elsewhere (Sørensen, 2009).

In sum, both individually, and as a group, the 4-factor model only finds 2 significant negative alphas amongst the sample of funds net expenses, whilst the average fund show neither significant over- nor underperformance, with respect to both gross and net results. Thus, the 4-factor model further support the notion that hypothesis 2 is likely to be rejected, as indicated by the Jensen's alpha results.

### **6.2.5 Market timing ability**

The last measure used to evaluate the performance of the funds in this study, is market timing ability. Namely, calculating gamma, which is a measure of the market timing ability of the individual fund, where a positive value represents the possibility to outperform the market. Fama (1972) specifically emphasizes that managers can outperform the market not only by stock selection skills (alpha), but also by anticipating general market price movements (gamma) (Fama, 1972). Accordingly, table 8 provides the summary statistics of the alpha- and gamma results amongst the sample of funds,

computed as proposed by Treynor & Mazuy (1966). Whilst, the complete regression output is displayed in Appendix N.

The model succeeds in explaining returns slightly better than the Jensen's alpha model, but worse than the 4-factor model, with an average R-squared of 0.918 compared to 0.915 and 0.929 respectively. Furthermore, the average alpha estimates of the model is lower than the findings of both the 1- and 4-factor model, which is likely a result of several significant gamma results that successfully explain fund performance; thus, a lower proportion of the outperformance is explained by alpha. However, the average alpha is not significant neither gross nor net expenses. Interestingly, the net alpha estimates of the Treynor-Mazuy model displays 8 funds with significant alpha, including FORTE Norge and Holberg Norge with a significant negative alpha. Moreover, the net alpha values produced by the Treynor-Mazuy model are more similar to those suggested by Sørensen (2009); namely, 38 out of the 69 funds show a negative alpha net expenses. Although the average fund does not show market timing ability, certain funds do; namely, 18 funds show significant positive market timing ability, whilst 3 funds show significant negative market timing ability. In particular, Landkreditt Utbytte displays the worst market timing of the group ( $t=-2.68$ ), whilst also displaying the highest alpha of the group. A plausible reason for this may be that the high alpha in this case is a result of the gamma's negative influence on returns; hence, the alpha increases in order to reflect how the fund has been able to outperform its benchmark, despite its bad market timing. Although, both the best- and second best performing fund have only 34- and 20 months of return data respectively; thus, inducing less accurate regression output. Appendix N reports that the 10 funds with the highest net alpha, all display a negative gamma, which further emphasize the effect negative market timing has on alpha.

**Table 8**

The table displays average monthly alphas, calculated with the Treynor-Mazuy market timing model. The column on the far left denotes the three worst- and best funds, as well as percentiles. The remaining columns display the respective gross- and net alphas, as well as their market timing ability, denoted as gamma. The respective t-statistics are reported in parenthesis.

	Net alpha	Gamma	Gross alpha	R <sup>2</sup>
<b>Worst</b>	-1,01 %	-0,49	-0,84 %	0,76
Globus Norge II Acc	(-1.24)	(-0.15)	(-1.03)	
<b>2</b>	-0,73 %	0,16	-0,57 %	0,77
Globus Norge A/I	(-0.90)	(0.05)	(-0.70)	
<b>3</b>	-0,64 %	2,06	-0,47 %	0,78
FORTE Norge	(-2.64)	(2.18)	(-1.95)	
<b>10 %</b>	-0,23 %	0,15	-0,06 %	0,85
Eika SMB	(-0.77)	(0.69)	(-0.20)	
<b>50 %</b>	-0,03 %	0,04	0,14 %	0,97
Storebrand Verdi	(-0.23)	(0.19)	(1.25)	
<b>90 %</b>	0,34 %	-0,12	0,38 %	0,94
Pareto Investment Fund C	(1.91)	(-0.49)	(2.15)	
<b>3</b>	0,54 %	-1,25	0,68 %	0,81
Swedbank Generator	(1.59)	(-1.29)	(2.03)	
<b>2</b>	0,96 %	-2,26	1,01 %	0,91
Alfred Berg Norge Inst	(4.43)	(-1.50)	(4.70)	
<b>Best</b>	1,17 %	-5,53	1,30 %	0,63
Landkreditt Utbytte	(3.90)	(-2.68)	(4.31)	
Average entire sample	0,03 %	-0,01	0,15 %	0,918
	(0.24)	(0.69)	(1.06)	

Source: Own construction based on robust regressions following the theory of the Treynor-Mazuy market timing model. Complete regression output is provided in Appendix N. Corrected for autocorrelation and heteroscedasticity using both the Newey-West- and White's correction.

In sum, the Treynor-Mazuy results of market timing ability confirm the previous findings suggesting that the average fund is not able to outperform its benchmark neither gross- nor net expenses; additionally, the model identify several inferior fund products, in line with Sørensen (2009). Furthermore, the results present individual funds with significant market timing ability; whilst, the average fund displays no evidence of market timing ability.

### 6.2.6 Performance of separate management categories

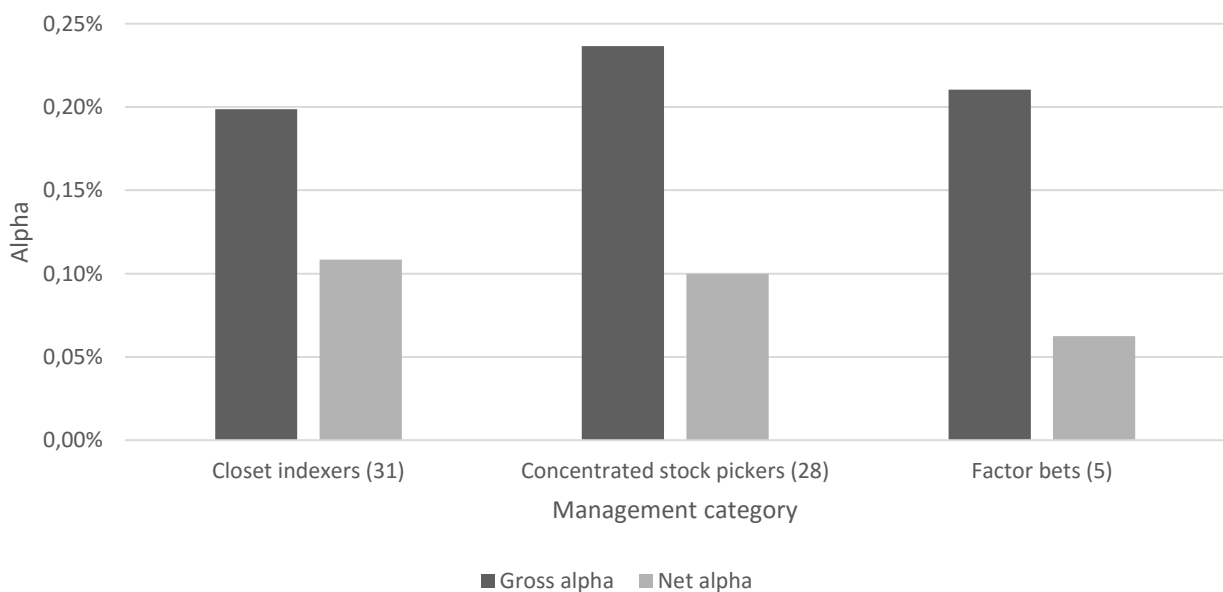
As the paper this far has presented both performance measures of the funds, and separated the funds into four categories with regards to active management, the paper will now briefly present how well each category on average have performed, as measured by Jensen's alpha. The diversified stock pickers are excluded, as the category consists of only 1 fund, and is therefore not suitable for



comparisons. As evident from figure 10, the illustration appear to be in line with the findings of Cremers & Petajisto (2009); namely, the results of this study also present the concentrated stock pickers as the category with highest alpha gross expenses. Interestingly, the dominant category of closet indexers appears to be performing better than the concentrated stock pickers net expenses. With only 5 funds, the factor bets appear to be performing worse than the concentrated stock pickers, but better than the closet indexers, gross expenses. However, factor bets perform worst out of the 3 categories net expenses. None of the categories in figure 10 show significant alpha at a 95 percent confidence level, neither gross nor net expenses. The graphs in figure 10 is anticipated by Cremers & Petajisto (2013), but is not necessarily anticipated to be prominent with a sample size of only 64 funds, as this study cannot be directly compared to the comprehensive study of Cremers & Petajisto (2009), researching 2647 funds throughout a 23-year period.

**Figure 10**

*Average net and gross alpha for each management category identified in the two-dimensional active share-tracking error matrix. Number of funds of each category is shown in parenthesis.*



*Source: own construction, based on alpha results from Carhart’s 4-factor model (Appendix M), and the management categories identified in the active share-tracking error matrix.*

By combining the alpha values produced by Carhart’s 4-factor model, with the abovementioned management categories, the paper identify 4 of the 6 funds with significant positive net alpha as closet indexers. The only fund having less than 120 months of return data amongst the 4 closet indexers, have 109 months of return data; hence, the regression output is not to be seen as inaccurate. A significant positive average alpha amongst 4 of the closet indexers is not to be expected over a ten-

year period; thus, the paper question whether the cut-off values specified by Cremers & Petajisto (2009) are suitable for mutual funds in the Norwegian market, as their benchmark indices differ significantly from those in the US. Intuitively, the expected results in figure 10 would be amongst the lines of Cremers & Petajisto (2009); namely, no indication of stock picking skills, and an average underperformance due to expenses for the closet indexers. Accordingly, the applicability of the given cut-off values will be thoroughly discussed in chapter 7.

In sum, this section has tested whether or not the paper can accept hypothesis 2, stating that the average active Norwegian equity fund has underperformed its benchmark index net expenses during the last ten-year period. To merely indicate how well the funds have performed whilst discarding costs, the paper presented the gross return development of the funds against the three benchmark indices, as well as ranking of the funds based on reward-to-risk measures. The results suggested that the sample of funds on average appeared to outperform their benchmarks, even when accounting for levels of risk. Furthermore, the paper introduced several absolute performance measures, seeking to get reliable and more comprehensive results as to how the funds have actually performed, both net and gross expenses. The 4-factor model was identified as the best model with regards to explaining returns, followed by the Treynor-Mazuy model, and lastly the Jensen's alpha 1-factor model. Accordingly, all three models are consequent in suggesting that the average actively managed fund does not show significant alpha net expenses throughout the ten-year period, presenting only a few individual funds with significant alpha net expenses. Specifically, the paper finds that out of the 6 funds that show significant alpha net expenses with the 4-factor model, 4 is categorized as closet indexers; thus, a highly counterintuitive result that will serve as a point of departure in the discussion of chapter 7. Only Carhart's 4-factor model identified funds with significant negative alpha net expenses. Hence, as the results suggest no significant under- or outperformance of the average fund net expenses, the paper confidently rejects hypothesis 2; namely, the sample of funds do not appear to underperform throughout the 10-year period. Furthermore, as the analysis this far has examined the degree of active management, as well as several performance measures for the sample of funds, the next section will combine both aspects when testing hypothesis 3.

### **6.3 Testing hypothesis 3: combined analysis of performance and active share**

Contrasting the majority of empirical findings (i.e. Cremers & Petajisto, 2009), this paper argues that there is reason to believe that active share may be negatively correlated with fund performance in the concentrated market of Norway. The benchmark indices are heavily invested in a small amount of large-cap stocks in Norway (top-heavy); for instance, the OSEFX has had the majority of its assets invested in only 8 stocks throughout the sample period (Appendix H). Hence, active funds are required to invest significant capital into small-cap stocks in order to obtain a high active share. Accordingly, as the small-cap market in Norway has significantly underperformed the last 5 years (Appendix F), a high active share and small-cap tilt would suggest a negative relationship; hence, the formulation of hypothesis 3. In order to investigate the hypothesis, this section will start by separating the funds into quintiles based on active share, and look for indicators supporting or contradicting the hypothesis. Furthermore, Jensen's alpha values for each fund will be regressed against their respective active shares, seeking to provide evidence accepting or rejecting the hypothesis. Moreover, the feeder funds, and multiple classes of the same fund products are not included in the regressions of this section, in order to prevent biased output. Consequently, the 10-year period will investigate 53 funds, whilst the 5-year period 52 funds.

#### **6.3.1 Rudimentary empirical findings**

In order to illustrate the relationship between active share and abnormal return, the sample of funds are separated into quintiles based on active share, where quintile 1 represent the highest, and quintile 4 the lowest active share (Appendix D). As hypothesis 3 was constructed based on a possible forced small-cap tilt induced by high active share, the paper will also present the results based on the past 5-year period from January 2011 to December 2015, as Norwegian small-cap stocks have continuously underperformed during this period (Appendix C). Moreover, the 5-year period will serve merely as a tool to gain further insight into the relationship between active share and alpha, in the period where small-cap stocks have performed the worst; whilst, final conclusions will be made solely on the results of the ten-year period, in order to keep consistency throughout the paper. Relevant data for each quintile is displayed in table 9.

**Table 9**

*Quintiles based on average active shares, displaying respective average gross Jensen's  $\alpha$  values and t-statistics.*

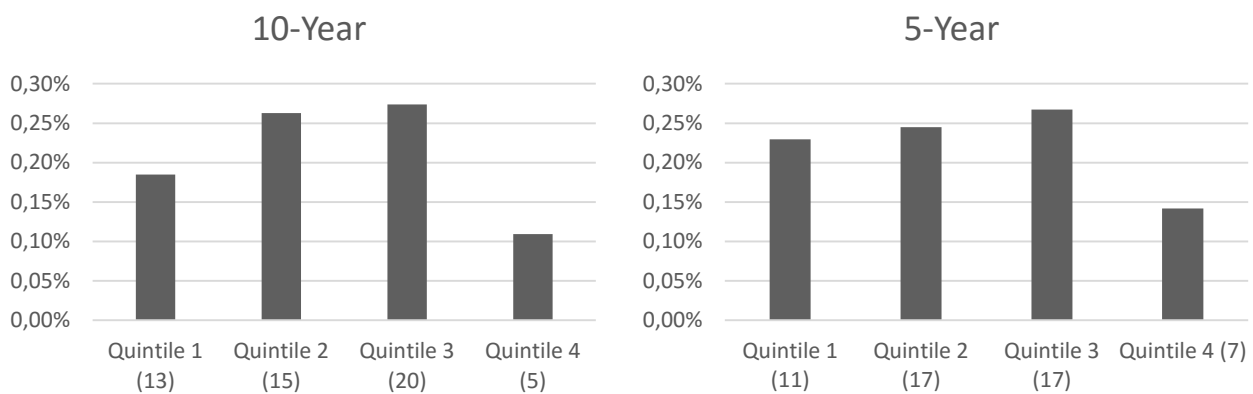
	10-Year				5-Year		
	Active share	Jensen's $\alpha$	t-stat		Active share	Jensen's $\alpha$	t-stat
Quintile 1 (13)	72,41 %	0,18 %	0,65	Quintile 1 (11)	73,67 %	0,23 %	0,82
Quintile 2 (15)	52,75 %	0,26 %	1,63	Quintile 2 (17)	52,99 %	0,24 %	1,54
Quintile 3 (20)	35,19 %	0,27 %	2,49	Quintile 3 (17)	33,60 %	0,27 %	2,50
Quintile 4 (5)	27,30 %	0,11 %	1,58	Quintile 4 (7)	24,07 %	0,14 %	1,76

*Source: own construction, based on the quintiles of Appendix E.*

Conversely to the results of Cremers & Petajisto (2009), the ten-year averages of table 9 indicate that both quintile 2 and 3 outperform the funds of quintile 1. However, quintile 4 with an average active share below 30 percent underperform the three other quintiles. Interestingly, Jensen's alpha during the 5-year period is only lower than for the 10-year period in quintile 2 and 3. The results are presented graphically in figure 11, and display no clear difference amongst the 3 most active quintiles, conversely to what the findings of Cremers & Petajisto (2009) would suggest. It is evident from the figure that quintile 4 displays a noticeably lower alpha than the rest. However, quintile 4 only consists of 5 and 7 funds in the 10- and 5-year period respectively, and is therefore more sensitive to outliers, which may affect the result. As previously stated, the sample size in this study is marginal compared to that of Cremers & Petajisto (2009), and is therefore generally more sensitive to outliers. Quintile 3 is the only quintile with an average significant alpha, both in the 10- and 5-year period ( $t=2.49$  and  $2.50$ ), whilst none of the remaining quintiles display significant average alpha during either period. Surprisingly, quintile 3 deliver the highest alpha of all four quintiles, both with respect to the 5- and 10-year period; hence, contrasting a positive relationship between active share and alpha, where quintile 1 would be expected to show the highest average alpha. Moreover, quintile 1 displays higher average abnormal performance throughout the 5-year period, compared to the 10-year period, which is counterintuitive with respect to the logic behind hypothesis 3, and is in support of rejecting the hypothesis.

**Figure 11**

*10- and 5-Year average gross alphas for the respective quintiles based on active share.*



*Source: Own construction*

Furthermore, the study of Cremers & Petajisto (2009) displays that the funds with the highest active share significantly outperform their benchmark both before and after expenses; conversely, only 1 of the funds in quintile 1 of this study deliver significant abnormal returns net expenses, whilst 8 of the 13 funds in the quintile display a negative abnormal return net expenses. Moreover, out of the 8 funds showing significant Jensen's alpha net expenses, the remaining 7 all fall into quintile 3; namely, funds with an active share between 30 and 40 percent. Hence, the results suggest that the presumption made by Cremers and Petajisto (2009) may not hold for active domestic equity funds in the Norwegian market.

### **6.3.2 Regression of alpha on Active Share**

The results this far are somewhat indecisive with respect to the relationship between active share and alpha. Namely, the results suggest that there may be a positive relationship; although, the quintile with the highest active share does not appear to deliver a higher alpha than the remaining quintiles, and 7 out of 8 funds presenting a significant Jensen's alpha net expenses, all fall into quintile 3. However, as the quintiles are separated in brackets of unequal size, where the majority of the funds fall into quintile 3 with an active share between 30 and 40 percent, the illustration of the previous section is not a very accurate estimate of the correlation between the two factors.

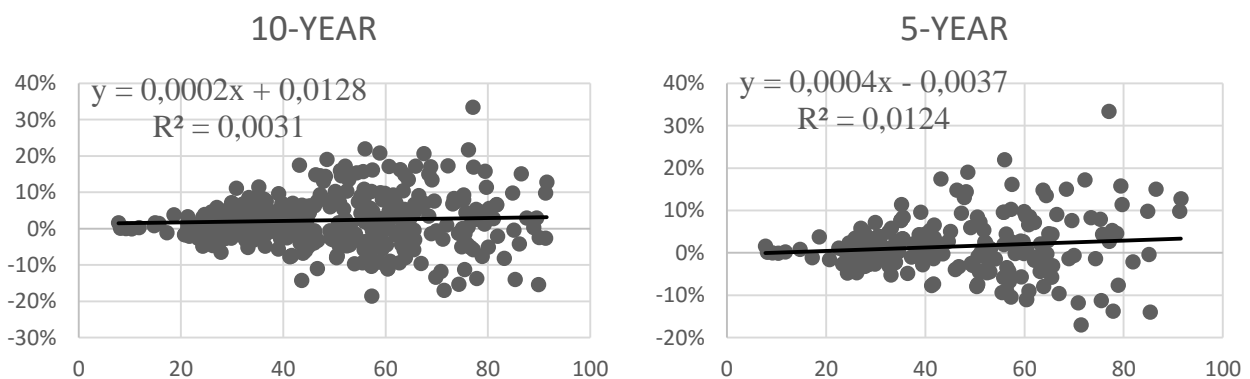
In order to obtain more adequate results, annual gross alphas were calculated throughout the entire ten-year period for each individual fund, and regressed against annual active shares of each fund respectively. This provides the paper with 445 observations amongst the 53 funds when examining

the 10-year period, and 221 observations for the 5-year period. Interestingly, the results presented in Figure 12 shows a positive, yet insignificant, relationship between alpha and active throughout both the 5- and 10-year period. In particular, the 5-year results display a positive relationship close to being significant at a 95 percent level of confidence ( $t=1.66$ ). The model is not particularly successful in explaining the alphas, with a  $R^2$  of 0.0031 and 0.0124 for the 10- and 5-year period respectively.

Nonetheless, the results display a clear indication of a possible positive relationship throughout both periods, which highly contrast the initial assumption of a possible negative relationship. Furthermore, it is evident from figure 12 that the variation in alpha is larger at higher levels of active share, suggesting more extreme instances of both out- and underperformance at higher levels of active share; namely, a higher dispersion of alphas with higher levels of active share.

**Figure 12**

*Regression output and illustration of the relationship between gross annual Jensen’s alpha and active share. 10-year results based on 445 observations, whilst the 5-year period is based on 221 observations.*



	<u>10-YEAR</u>		<u>5-YEAR</u>	
	Coef.	t-stat	Coef.	t-stat
Intercept	0,0128	1,48	-0,0037	-0,31
Active Share	0,0002	1,17	0,0004	1,66

*Source: own construction, based on Jensen’s alpha and active share results, presented in Appendix C and Q.*

By further examining the relationship between active share and alpha, the paper performed regressions of each individual quintile of table 9. Accordingly, the results of table 10 suggest that a significant positive relationship between alpha and active share is prominent in both quintile 2 and 3 when examining the 10-year period, whilst no significant relationship is identified by examining the individual quintiles of the 5-year period as previously anticipated. None of the quintiles display any indication of a negative relationship; thus, suggesting that hypothesis 3 should be rejected. Moreover,

the paper will argue that the results of the 10-year period may indicate that active share is positively correlated with alpha up to a certain threshold, as quintile 2 and 3 show a positive relationship significant at a 95 percent level of confidence. However, the paper acknowledges that the regressions performed on each quintile is less than optimal, due to the low sample size considered in this study compared to that of Cremers & Petajisto (2009). Hence, the paper will not make any final conclusion based on these results, but argue that the possibility of a said threshold of active share is an interesting result worth presenting.

**Table 10**

*Results from regressing individual alphas of each quintile against respective active shares in the 10-year period from 2006 to 2015, as well as the 5-year period from 2011 to 2015.*

	<u>10-year</u>			<u>5-year</u>		
	$\beta$	t-stat	R <sup>2</sup>	$\beta$	t-stat	R <sup>2</sup>
Quintile 1	0,0009	1,0004	0,0106	0,0024	1,5235	0,0562
Quintile 2	0,0013	2,2596	0,0381	0,0011	1,0549	0,0154
Quintile 3	0,0009	2,2824	0,0291	0,0006	0,9162	0,0112
Quintile 4	0,0002	0,3759	0,0034	0,0006	1,0106	0,0340

*Source: own construction, based on the presented Jensen's alpha and active share results.*

In sum, when the paper examines the rudimentary relationship between active share and alpha, the data is not confidently in favor of the hypothesis, nor confidently proposing a positive relationship between active share and alpha, as suggested by previous studies. Accordingly, the paper presents results of regressing 445 and 221 yearly observations of gross Jensen's alpha against active share, which produce a positive, yet not significant, relationship when examining both the 10- and 5-year period respectively. Hence, finding no indication of a negative relationship, the paper will reject hypothesis 3; namely, suggest that there is no negative relationship between active share and Jensen's alpha amongst active Norwegian equity funds. Conversely, the results indicate a possible positive relationship, as previously predicted by Cremers & Petajisto (2009). However, the empirical findings when examining at the individual quintiles, suggest a positive relationship between active share and alpha in quintile 2 and 3, thus arguably indicating that the relationship between active share and alpha may behave differently in the Norwegian market.

## **6.4 Summary of the empirical findings**

Firstly, the findings regarding hypothesis 1 present that the majority of the funds have an active share below the cut-off value of 50 percent; thus, appear to be passive when only accounting for their active share. Furthermore, by adding the second dimension of active management, tracking error, the paper categorize the funds by their management strategy, presenting the dominant category amongst the funds as being closet indexers. Thus, the empirical findings suggest that the majority of active domestic equity funds in Norway operate as closet indexers.

Secondly, examining the performance amongst the sample of funds, the relative performance measures suggest outperformance by the majority of the funds. Nonetheless, none of the models for absolute performance suggest that the average fund in the sample deliver significant alpha neither gross nor net expenses throughout the period, presenting only a few individual funds with significant positive alpha net expenses. Moreover, the paper questions that 4 out of the 6 funds showing significant alpha net expenses with the 4-factor model, are categorized as closet indexers.

Lastly, by combining active share and the performance measures, the study finds a positive, but not significant, relationship between active share and alpha throughout both the 10- and 5-year period. By further examining the relationship, and dividing the funds into four quintiles based on active share, the results suggest that there is only a significant positive relationship of funds in quintile 2 and 3 throughout the 10-year period. None of the results suggest a negative relationship between active share and alpha. Hence, as the results indicate a possible positive relationship in line with previous studies, and no indication of a negative relationship, the paper will reject hypothesis 3. Accordingly, the empirical findings result in accepting hypothesis 1, whilst rejecting hypothesis 2 and 3.

**Hypothesis 1:** Accepted

**Hypothesis 2:** Rejected

**Hypothesis 3:** Rejected

The paper emphasizes that rejecting or accepting a hypothesis does not prove or disprove it; namely, a rejection (acceptance) of the null hypothesis only disproves (approves) the initial assumption of the paper at a probability of 95 percent, based on the empirical evidence presented (Panik, 2012). Furthermore, the aspect of active share and performance amongst the sample of funds will be further examined in the following chapter, where the paper seeks to discuss the consequences of the empirical findings and attempt to answer the objectives presented in the problem statement.



## 7.0 Discussion

---

In this chapter, the paper seeks to examine the main objectives presented in the problem formulation. The findings of the analysis will be used as a point of departure when attempting to answer the objectives, as well as a more in depth discussion of how the Norwegian domestic equity fund industry is affected by the findings.

### 7.1 Is active share a good measure for fund selection in Norway?

Based on the findings of the analysis; in particular, that 4 out of the 6 funds showing significant positive net alpha with the 4-factor model were identified as closet indexers, this section seeks to discuss the background behind this counterintuitive result. Furthermore, possible implications by using active share as a tool for fund selection amongst domestic equity funds in the Norwegian market, and as a regulatory measure, will be discussed.

In section 6.1.1 the paper presented an average active share amongst the sample of funds below the cut-off value, namely an average of 47.55 percent throughout the 10-year period, which seem to be curiously low in a sample consisting of only active equity funds. Hence, the paper will investigate if there are any differences in the difficulty of achieving a high active share in the Norwegian market, compared to the US, which was the initial market Cremers & Petajisto (2009) examined when introducing the measure. In doing so, the paper will present an intuitive example investigating the highest active share attainable by investing in the S&P 500 and OSEFX respectively. In order to illustrate this, the paper obtained yearly stock holdings for both indices, and arranged the data in descending order from highest to lowest portfolio weight. Furthermore, restrictions in line with the previously presented UCITS regulations were added. Specifically, the “5/10/40” rule requiring that no more than 10 percent of the net assets of an UCITS regulated fund may be invested in transferable securities issued by the same body, with a further aggregate limitation of 40 percent of net assets on exposures of greater than 5 percent to single issuers. Thus, the four stocks with the lowest weight in both indices were individually weighted by 10 percent, whilst the 12 following stocks were weighted by 5 percent. Hence, maximum weighting in line with the UCITS were given to the lowest ranked index stocks, in order to illustrate the maximum obtainable active share, as displayed in table 11.

As shown in the table, there is a minor, but evident, difference between the maximum obtainable active share through solely investing in stocks of the S&P 500, relative to the OSEFX; hence,

indicating a bigger potential to achieve higher active share in the US market compared to the Norwegian domestic market. Furthermore, the paper emphasizes that this illustrative example is highly simplified and seeks to display an extreme scenario; namely, the maximum obtainable active share without investing outside the benchmark index. Weightings of exactly 10 and 5 percent respectively would not be reasonable if this was a real world example, as even minor movements in stock prices could result in a violation of the UCITS regulations. Therefore, weightings slightly below the maximum values could provide a more realistic illustration; however, by using the maximum weightings, the difference between the two indices are further emphasized.

**Table 11**

*Average maximum obtainable Active Share S&P 500 and OSEFX from 2006 to 2015.*

	S&P500	OSEFX
Max	99,85%	98,64%
Min	99,64%	95,11%
Average	99,74%	96,96%

*Source: own construction.*

Conversely, by constructing a portfolio with an extreme large-cap strategy (top heavy), the paper seeks to inform the vast differences in index concentration between the S&P 500 and the OSEFX. Accordingly, weightings that satisfy the UCITS regulations are placed in the stocks of each index with the highest market capitalization. In contrast to the extreme small-cap strategy, the 4 stocks with the highest market cap get individually weighted by 10 percent, whilst the following 12 highest ranked stocks are weighted by 5 percent each. Thus, each benchmark portfolio consists of 16 stocks, positioned in the highest market cap stocks in their respective indices. Accordingly, the paper calculated the maximum achievable active share in this extreme large-cap strategy scenario, as can be observed in table 12.

The results show that a fund using the OSEFX as a benchmark would be far below the cut-off value for active share, with an average active share of 25.63 percent during the 10-year period. Conversely, a fund benchmarked against the S&P500 would obtain an average active share of 73.35 percent during the same 10-year period, utilizing the exact same investment strategy. This result is not surprising, given that the portfolio of the S&P 500 has an average number of shares slightly above 500 throughout the period, whilst the average of the OSEFX is slightly above 61. Accordingly, a portfolio of 16 stocks located in the OSEFX are significantly more diversified than a portfolio of 16 stocks located in the S&P 500; namely, 16 stocks of the OSEFX account for approximately 26 percent of the index, whilst

16 stocks of the S&P 500 amounts to approximately 3 percent of the index. Thus, the higher active share of the top heavy S&P 500 portfolio will contain more unsystematic risk than that of the OSEFX.

**Table 12**

*Average active share of an extreme large-cap strategy for S&P500 and OSEFX respectively, computed based on data in the period from 2006 to 2015.*

	S&P 500	OSEFX
Max	76,50	30,25
Min	70,05	21,97
Average	73,35	25,63

*Source: own construction.*

In sum, the two examples illustrate that obtaining a high active share without producing a small-cap tilt in the portfolio, is easier to achieve for a fund benchmarked against the S&P 500, compared to a fund benchmarked against the OSEFX. Specifically, if a fund benchmarked against the OSEFX weights one of the top benchmark holdings with a weight similar to the benchmark, it will have a larger portion of its portfolio placed in a position that does not produce active share, than a fund with a more horizontal benchmark, for instance the S&P 500; thus, having less potential of achieving a high active share.

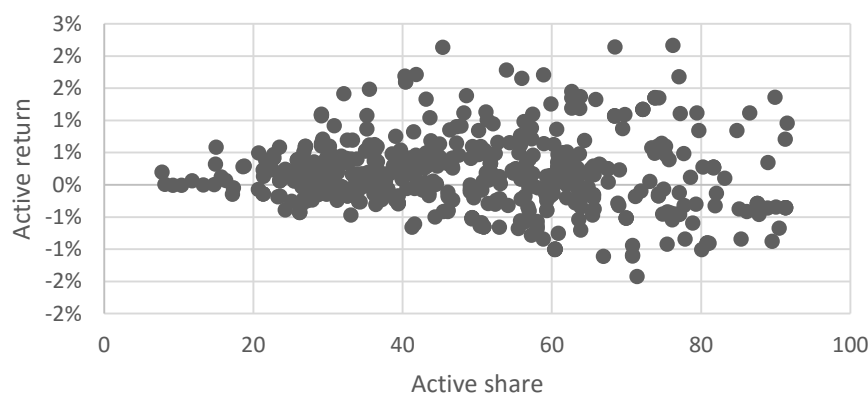
As underlined in the first example of this section, achieving a high active share comes at the cost of tilting the portfolio towards small-cap stocks. By heavily investing in stocks with small market capitalization, the fund will take on significant liquidity risk, which introduce another concern with using active share as measurement for fund attractiveness, namely that active share does not account for the level of risk. Accordingly, as previously suggested by figure 12, dispersion of alphas increase with the level of active share. The dispersion of active returns in excess of the benchmark with respect to active share is illustrated in figure 13, further emphasizing the clear relationship of higher variance with higher levels of active share, and accentuate that higher levels of active share increase a fund's possibility to outperform, in addition to increasing its downside risk.

---

**Figure 13**

*Annual gross active returns in excess of the benchmark for each individual fund plotted against respective annual active shares. Based on the period from January 2006 to December 2015. The figure is based on 567 annual observations amongst the 65 funds.*

---



*Source: own construction based return series from Morningstar Direct, and previously identified active shares.*

In sum, it is evident that active share may be highly useful measure when evaluating the active management of equity funds. However, as the vast majority of literature consider the US equity market, this study emphasizes that different markets have different prerequisites to achieve a high active share. For instance, the small top-heavy benchmark indices of Norwegian domestic equity funds induce a higher difficulty of obtaining a high active share, as illustrated in table 11 and 12. Accordingly, Petajisto (2013) specifically emphasizes that it may be difficult to determine exact cut-off values for active share; although, suggesting 50 percent as a theoretical minimum. As a certain degree of active management is a necessity to be able to outperform the benchmark index, this study suggests that active share should be amongst the criteria when selecting which fund to invest in. However, a high active share will also induce higher dispersion of returns, as well as liquidity risk if the fund is tilted towards small-cap stocks, which also needs to be accounted for when selecting a fund. Therefore, the paper will suggest that active share do provide a useful measure for fund selection in the market for Norwegian domestic equity funds; although, not as a sole determinant for identifying the best fund.

## 7.2 Are the majority of active Norwegian domestic equity funds overpriced?

Although active share may not provide the investor with accurate information about a fund's performance, it may serve as a useful tool for an investor to evaluate if the management fee of a company is justified; namely, the paper will follow the reasoning of Riksen (2015), and restrict the determinants of a good investment to only account for active share and management fees. Accordingly, an investor can ultimately choose to invest in a hedge fund with an active share of 100 percent, and a typical management fee of 2 percent, or an index fund, with an active share of zero percent, but with a low management fee of approximately 0.2 percent (i.e. KLP Aksje Norge Indeks). Additionally, a hedge fund typically charge 20 percent of the profits earned, as remuneration; thus, the expenses of hedge fund investments tend to exceed 2 percent, depending on its performance. For simplicity, the following example with discard the variable remuneration fee, in order to compute the necessary calculations; however, the suggested fair price will be somewhat understated if the hedge fund successfully deliver profits to its investors. These two fund alternatives will serve as two extremes in this example; hence, a management fee above 2 percent for a pure actively managed domestic equity fund indicates an overpriced fund, given that the fee only provides an investor with the possibility to invest in the fund portfolio, and no additional services. Therefore, an investor trying to determine whether or not to invest in an equity fund with an active share of a certain percent, may evaluate the cost of creating a portfolio of equal active share with the aforementioned hedge- and index fund, as illustrated in table 13. Accordingly, a fund with an active share of 40 percent should charge no more than 0.92 percent for their actively managed fund, discarding all services except the opportunity to invest in the fund. Hence, if the management fee exceeds 0.92 percent, the investor overpays for the degree of active management he obtains. Although this example discard all factors except active share and management fee, it provides a useful approximation in the sense that an investor should raise questions if a fund significantly exceeds the management fee indicated through the calculation in table 13, especially if the fund does not provide additional services.

**Table 13**

*A simplified illustration of determining fair price for an actively managed fund, based on active share.*

	Active share	Management fee
Hedge Fund	100 %	2 %
Index Fund	0 %	0,20 %
40% Portfolio	40 %	0,92 %

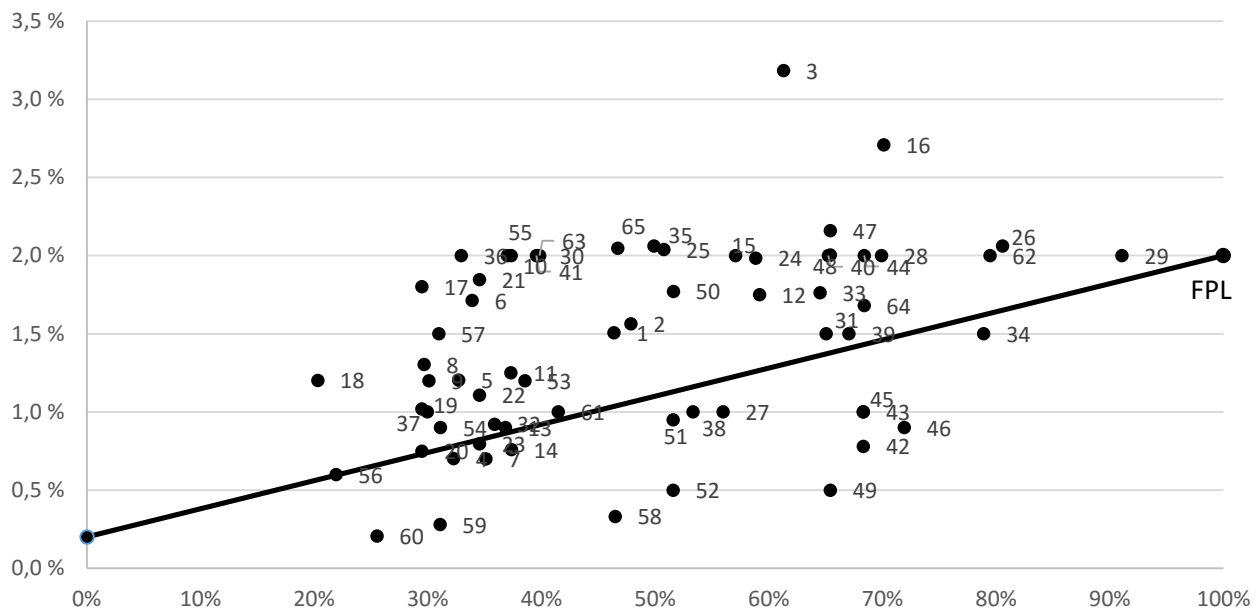
*Source: own construction, based on the reasoning of Riksen (2015).*

Furthermore, by plotting the theoretical management fees, calculated as in table 13, a linear relationship between management fee and active share will become evident. This linear relationship was presented as a “fair price line” (FPL) by Riksen (2015), arguing that funds plotting above or below the line is over- and underpriced respectively. However, the FPL only considers funds that does not deliver any additional services, despite allowing the client to invest in the fund. Figure 14 displays the average expenses of the 65 funds with an obtainable active share, against the FPL. Consequently, the figure identifies that the majority of the funds are overpriced with respect to the estimated fair price; however, multiple funds also display an average management fee below the line, suggesting that the fund is underpriced with respect to its active share. Alfred Berg Gambak appear as the most overpriced fund of the sample, with an average annual expense ratio of 3.19 during the 10-year period; however, the average expense ratio is heavily affected by high fees in the period from 2006 to 2010, whilst currently reporting an annual expense ratio of 1.8 percent. Moreover, DNB Norge is also significantly overpriced with regard to the FPL, and therefore supports the criticism claiming that the fund does not provide its investors with sufficient active management.

By examining the funds plotting below the FPL in figure 14, it is evident that 16 of the 17 funds denoted as underpriced, are targeted towards institutions. The only fund with a minimum investment amount less than 100 000 NOK is Landkreditt Utbytte, which is targeted towards non-professional investors with a minimum investment of merely 300 NOK. This distribution is to be anticipated, as investors binding up a lot of capital in a single fund should be compensated for the increased risk; for instance, by a lower management fee. Accordingly, it appears that the vast majority of funds targeted towards non-professional investors in this study, have been overpriced throughout their lifetime in the 10-year period, when following the reasoning behind the FPL. These results are however assuming that no additional services are provided by the fund, which is an aspect that should be further examined by the investor, before concluding that a specific fund is overpriced.

**Figure 14**

*Graphical illustration of the fair price line for equity funds.*



Fund name	#	Fund name	#	Fund name	#	Fund name	#
Alfred Berg Aktiv	1	DNB Norge	17	Landkreditt Norge	33	Pareto Aksje Norge I	49
Alfred Berg Aktiv II	2	DNB Norge (Avanse II)	18	Landkreditt Utbytte	34	Pareto Investment Fund A	50
Alfred Berg Gambak	3	DNB Norge (III)	19	NB Aksjefond	35	Pareto Investment Fund B	51
Alfred Berg Norge +	4	DNB Norge (IV)	20	Nordea Avkastning	36	Pareto Investment Fund C	52
Alfred Berg Norge Classic	5	DNB Norge Selektiv	21	Nordea Kapital	37	PLUSS Aksje	53
Alfred Berg Norge Etisk	6	DNB Norge Selektiv (II)	22	Nordea Norge Pluss	38	PLUSS Markedsverdi	54
Alfred Berg Norge Inst	7	DNB Norge Selektiv (III)	23	Nordea Norge Verdi	39	RF Aksjefond Acc	55
Atlas Norge	8	DNB SMB	24	Nordea SMB	40	Storebrand Aksje Innland	56
Carnegie Aksje Norge	9	Eika Norge	25	Nordea Vekst	41	Storebrand Norge	57
Danske Invest Norge I	10	Eika SMB	26	ODIN Norge A	42	Storebrand Norge H	58
Danske Invest Norge II	11	Fondsfinans Norge	27	ODIN Norge B	43	Storebrand Norge I	59
Danske Invest Norge Vekst	12	FORTE Norge	28	ODIN Norge C	44	Storebrand Norge Institusjon	60
Danske Invest Norske Aksjer Inst I	13	FORTE Trønder	29	ODIN Norge D	45	Storebrand Optima Norge	61
Danske Invest Norske Aksjer Inst II	14	Handelsbanken Norge	30	ODIN Norge II	46	Storebrand Vekst	62
Delphi Norge	15	Holberg Norge	31	Pareto Aksje Norge A	47	Storebrand Verdi	63
Delphi Vekst	16	KLP AksjeNorge	32	Pareto Aksje Norge B	48	Swedbank Generator	64
						Terra Norge	65

*Source: own construction, based on the FPL proposed by Riksen (2015).*

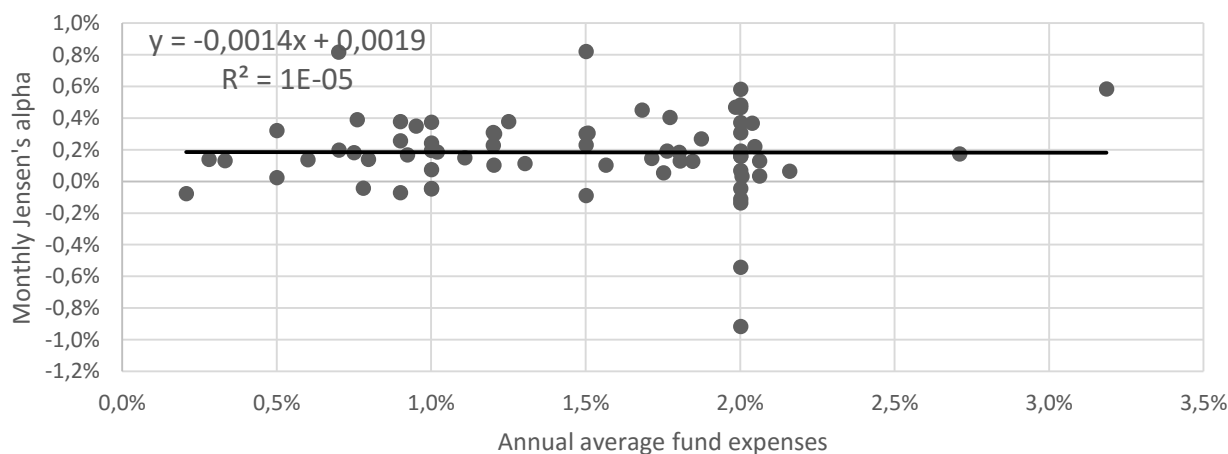
The expense ratio for Norwegian equity funds appears to have decreased on average, in recent years, which may be a result of increased attention towards active management, especially considering the vast amount of criticism of expensive equity funds throughout various media sources. Thus, to investigate whether the majority of funds are still considered overpriced, Appendix O displays the funds alive as of December 2015, plotted against the FPL. Consequently, Landkreditt Utbytte still plots below the FPL, combined with two other funds targeting non-professional investors; namely,

KLP AksjeNorge and Pareto Aksje Norge A. The remaining 12 funds identified as underpriced according to the FPL, are funds targeted towards institutional investors. Moreover, Alfred Berg Gambak no longer displays itself as a vastly overpriced fund, as its expenses has decreased immensely from January 2006 to December 2015. Evident from Appendix O, the majority of the funds considered in this study, are however still identified as overpriced when plotted against the FPL.

By regressing gross Jensen’s alpha against fund expenses, as illustrated in figure 15, the output suggests a minor negative, yet not significant ( $t=-0.027$ ), relationship between abnormal return and fund expenses. Hence, the paper finds no reason to believe that the more expensive funds on average will outperform the funds with lower expenses. Accordingly, the relationship displayed in figure 15 further emphasizes that investors may be smart to be re-consider investing in a Norwegian domestic equity fund identified as overpriced, depending on possible additional services provided by the fund. It is also worth noting that 6 out of the 8 funds with significant Jensen’s alpha net expenses, have below the average expenses amongst the sample of funds, namely 1.44 percent. The 2 funds of the 8, with expenses above the average, is Landkreditt Utbytte and Handelsbanken Norge with 1.5 and 2 percent respectively.

**Figure 15**

*The figure displays the relationship between monthly gross Jensen’s alphas, against yearly fund expenses.*



*Source: own construction, based on the individual fund expenses provided in Appendix L and the Jensen’s alpha results displayed in Appendix K.*

Despite the paper arguing that the FPL is a useful tool for non-professional investors, the results of the analysis emphasize that it may not be accurate as a tool to identify the best performing funds. Namely, only 3 out of the 8 funds showing significant positive net alpha with the 1-factor model plots



below the FPL in figure 14, whilst only 2 out of the 6 funds showing a significant positive net alpha with the 4-factor model are identified as underpriced with respect to the FPL. Accordingly, the paper suggests that the FPL should merely serve as a tool used to identify plausible overpriced funds, whilst further research should be conducted before making a final decision of whether or not to invest in the fund. The lack of evidence supporting a positive relationship between fund expenses and alpha, suggests that investors should conduct a thorough analysis before investing in a fund with above average expenses. Nonetheless, based on the logic behind the FPL, the paper argues that the majority of active Norwegian equity funds may be overpriced, in light of their level of active management.

### **7.3 Should investors champion active Norwegian equity funds over index funds?**

Another heavily debated question in both academic literature and through mainstream media sources, is whether to invest in active or passively managed equity funds. In particular, the question whether or not an actively managed fund with high management fees will succeed in delivering returns justifying their high expenses. Accordingly, this section will discuss this question in light of both the empirical findings, and previous studies.

Throughout the literature review, the paper informs the lack of studies suggesting that active equity funds on average significantly outperform net expenses. Furthermore, as actively managed funds charge high fees for operating the fund portfolio, Cremers & Petajisto (2009) introduced active share as a new influential measure seeking to quantify active management apparent in the individual funds. Accordingly, this novel measure has also been influential in Norway, and has been a big reason for the critique of actively managed domestic equity funds, as well as an important argument behind the rectification orders filed by the financial supervisory authority of Norway. Moreover, the findings of the empirical analysis of this study suggest that, individually, certain funds successfully outperform after expenses; although, the results show no significant net alpha for the sample of funds as a group.

Hence, purely based on the findings of the analysis, the paper suggests that active management on average neither provides significant outperformance net expenses, nor significant underperformance. Thus, an ultimate decision rather depends on the individual preferences of the client, as well as his knowledge about individual funds and their managers. As emphasized by Sharpe (1991), active investments are a zero-sum game, where the capital gains of one investor will come at the expense of a loss for another investor. Accordingly, including the management fees of active funds, active

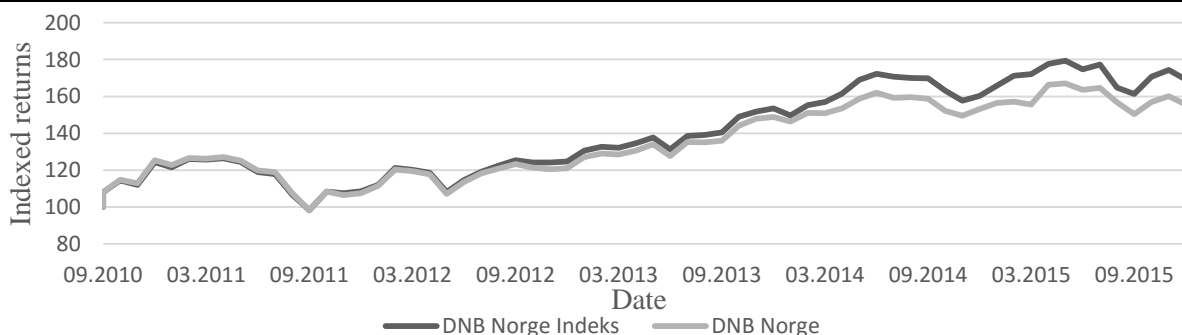
investment is in fact a negative-sum game; although, the net results of the analysis in this study does not display this negative-sum game.

Furthermore, the paper raises the question of whether or not fund clients are making an informed choice when investing in actively managed funds, which is the case for most investors in domestic equity funds in Norway. For instance, DNB Asset Management is by far the largest management company in Norway, with 115 720 clients invested in their actively managed domestic equity fund, DNB Norge; conversely, their passive domestic alternative, DNB Norge Indeks, only accounts for 7 573 clients as of February 2016 (VFF, 2016a). Furthermore, the performance analysis of DNB Norge suggests that the fund is far from delivering a significant positive net alpha throughout the 10-year period, despite the fund being the most popular domestic equity fund in Norway. The fund also appears to be significantly overpriced with regards to the previously introduced fair price measure.

However, the clients of DNB Norge have recently communicated their displeasure, including a lawsuit issued by the Norwegian Customer Council on behalf of the investors, which will be further explored in section 7.4. Figure 16 presents the net return development of DNB Norge Indeks, relative to DNB Norge, which clearly suggest that the index alternative have outperformed DNB Norge, since its inception in 2010; thus, proposing that the investors may not be making a fully informed choice when they champion DNB Norge over DNB Norge Indeks. A plausible reason for why the majority of customers are invested in actively managed funds, is that the investment companies have a larger incentive to advertise the funds with higher expenses. Furthermore, as DNB Norge has no redemption fee, and DNB Norge Indeks has no front-end-load, additional expenses resulting from a transition to the index alternative does not explain the vast difference in the number of clients amongst the two domestic equity funds.

**Figure 16**

*Net monthly return development of DNB Norge and DNB Norge Indeks, in the period from September 2010 to December 2015.*



*Source: own construction based on return data from Morningstar Direct.*

Another plausible explanation as to why DNB Norge has 15 times the number investors relative to DNB Norge Indeks, is the fact that most clients investing in equity funds, have a long-term investment horizon. Thus, as DNB Norge Indeks had its inception in late 2010, investors may be reluctant to move their investment.

Another interesting aspect in the discussion of whether investors are better off by investing in active than passive equity funds, is a somewhat novel fund product; namely, smart beta. Whilst passive investments in this paper has been defined as investing in an index fund replicating the value-weighted benchmark index, smart beta products target rewarded risk premiums through different weighting arrangements (Winther & Steenstrup, 2016). Furthermore, by actively investing in the 'smart universe', the investor has the possibility to generate excess returns relative to the value-weighted benchmark index, by investing in different risk premiums (i.e., value, size and momentum) (Winther & Steenstrup, 2016). Moreover, the smart beta products manage the portfolio passively, following pre-defined weighting arrangements; thus, a smart beta fund is usually priced in between an index- and an active equity fund. With lower expenses than active equity funds, and better risk-adjusted returns than an index fund, smart beta products seem to offer the best of all worlds (Winther & Steenstrup, 2016). Moreover, the study of Winther & Steenstrup (2016) suggests that actively managed funds seem to be a strong option for long term investment horizons, whereas smart beta strategies could have more relevance on shorter horizons.

In sum, the paper does not succeed in providing significant evidence suggesting one form of fund management over the other. Although, with respect to DNB Norge, the paper finds that its alternative index fund, DNB Norge Indeks, has delivered superior performance since its inception in late 2010. However, the paper is reluctant to suggest whether or not the index alternative is to be preferred, based on a period as short as 5 years. Moreover, the paper will emphasize that the individual investor needs to be informed in his choice of fund, as different funds have different prospects and portfolios varying in both active share and tracking error; thus, different management styles. The empirical results of the analysis display individual funds with both significant outperformance, as well as underperformance net expenses, combined with a positive, but not significant, outperformance with respect to the funds as a group. The paper further emphasizes that investments in smart beta products may be the preferred alternative to both actively managed equity funds, and their index alternatives. Through the performance analysis, this study suggests that the majority of the examined funds deliver a positive, yet not significant, alpha net expenses. Thus, in line with Winther & Steenstrup (2016), it may seem that the actively managed funds considered in this study is a strong option for long-term

investments, whilst other investment options may be preferred on shorter horizons; for instance, smart beta products.

#### **7.4 Is the criticism of Norwegian equity funds justified?**

The last objective the paper seeks to explore is the vast critique of the low active share amongst domestic Norwegian equity funds, as the critique has several implications for the funds in question, and their clients. Through the lens of a mutual fund, lawsuits and rectification orders may force the fund to adjust their investment strategy and take on more risk, for instance an increase in liquidity risk induced by an amplified weighting of small-cap stocks. Moreover, the rectification order directed to DNB Norge in 2015 does not specify a target active share, nor requirements as to how the fund achieves a higher active share; instead, they inform a simple calculation as to how much excess return the actively managed part of the portfolio must generate, in order to cover the management fee. For instance, a fund with a management fee of 2 percent, and an active share of 30 percent have to achieve an excess return of 7 percent with the 30 percent of the portfolio under active management, as 7 percent multiplied with 30 percent, approximately equals the management fee.

Firstly, the paper will argue that the reason for not specifying a distinct minimum active share may be in line with the argumentation of the first objective; namely, that the specified cut-off value between 50 and 60 percent does not seem to not be generalizable across vastly different markets and benchmark indices (Cremers & Petajisto, 2009; Petajisto, 2013). Secondly, the most efficient way of achieving a high active share is to invest in small-cap stocks outside the index portfolio; hence, increasing active share, as well as expected returns due to increased liquidity risk. Accordingly, this scenario will result in a worse fit between the fund and its benchmark, as the share of stocks outside the prospectus benchmark index increases; thus, making the fund less suitable for performance evaluations against the benchmark, as their portfolios are no longer uniform.

Moreover, the paper will argue that the answer to whether the criticism of Norwegian active funds are justified or not, is twofold; namely, concerning both financial and legal perspectives. From a purely financial perspective, critique of all active funds categorized as closet indexers, defined as in figure 7, may be unjustified. This argument is derived from the discussion of the first objective, as well as the empirical findings when testing hypothesis 2. For instance, Danske Invest Norge II with an average active share of 32.7 percent, and a tracking error of 4.79 percent is classified as a closet indexer; however, from the analysis section it is evident that Danske Invest Norge II in fact delivered

a significant positive alpha net expenses throughout the period with respect to the 4-factor model, suggesting that the fund has successfully outperformed its benchmark index. By computing the same equation as the financial supervisory authority of Norway, the fund has to deliver at least 3.4 percent return in excess of the benchmark with the 37.3 percent of the portfolio under active management, in order to justify the annual expenses of 1.25 percent, which appear reasonable given skilled portfolio managers. Accordingly, the fund has presented stock picking skills despite its low active share, and may arguably have performed worse with a higher active share, depending on whether or not it is achieved by a small-cap tilt.

Conversely, the paper will argue that the claims toward certain funds, as DNB Norge, are justified from a legal perspective. Explicitly, if the prospectus and investment strategy of a fund advertise the fund as actively managed, with a main priority of delivering excess returns against its benchmark, the fund is indulged to possess an active share high enough to provide the possibility of outperformance. This is also the argumentation used by the financial supervisory authority of Norway, where their analysis of DNB Norge displayed an average active share of 17 percent during their 5-year sample period from 2009 to 2014. Thus, requiring 10.6 percent active return of the 17 percent of their portfolio under active management, in order to cover the expenses of 1.8 percent, and equal the performance of the benchmark index. Hence, a highly unlikely scenario, suggesting that the rectification order filed against DNB Norge appear to be justified.

In sum, this study suggests that an actively managed fund with an active share below 50 percent, not necessarily underperform with respect to its benchmark index. Conversely, the fund may in fact create excess returns for each its clients, if the fund has skilled managers. Nonetheless, as a low active share limits a fund's potential for outperformance, the paper agrees with the financial supervisory authority of Norway in their argument, that certain funds have left their clients with zero, or limited, potential to receive excess returns. Hence, the paper suggests that the criticism of Norwegian domestic equity funds appear to be justified; however, emphasizing that active share alone is not a sufficient determining measure, especially not by uncritically following the cut-off values suggested by Cremers & Petajisto (2009) and Petajisto (2013).

## 8.0 Conclusion

---

By using a dataset free of survivorship bias, containing 69 actively managed Norwegian domestic equity funds in the period from January 2006 to December 2015, the paper analyzed the degree of active management amongst the individual funds, by using both active share and tracking error. Furthermore, the paper used several well-known ex-post performance measures in order to analyze the performance of the funds, both individually and as a group. Lastly, the paper discussed the implications of the findings, in light of the criticism regarding active management amongst the active domestic equity funds in Norway; in particular, the use of active share as a tool for fund selection and whether the vast criticism of active domestic equity funds in Norway appear to be justified.

By examining the active share development of the funds as a group, the paper finds that the average throughout the 10-year period is slightly below the established cut-off value of 50 percent, suggesting that the average fund has the majority of its portfolio in positions equal to the benchmark index. Moreover, by combining active share and tracking error, the paper seeks to achieve a more comprehensive insight into the active management of each fund; namely, by separating the funds into four categories as proposed by Cremers & Petajisto (2009). The results suggest vastly different management strategies amongst the funds; most noticeable, closet indexers with an active share below 50 percent, and tracking error below 5.4 percent, is the dominant quadrant, representing approximately 48 percent of the sample. Hence, an anticipated result in light of the vast criticism of low management amongst domestic equity funds in Norway, concluding that the dominant management strategy amongst the sample of funds is closet indexing.

By investigating the performance of the funds, the paper reports that the majority of the funds successfully deliver higher Sharpe and Treynor values than their respective benchmark indices; however, 13 funds display lower Sharpe ratio than the OSEBX, whilst 11 funds display a lower Treynor ratio. Moreover, with respect to the Information Ratio, the relative performance of the funds display different ranking of the funds relative to each other; for instance, RF Aksjefond Acc with the second highest Sharpe- and Treynor value, decrease to rank 65 with respect to the IR.

Furthermore, by examining the performance of the funds, both net and gross expenses, all three models applied in this study consequently suggest that the average fund does not show significant alpha throughout the period, neither gross nor net expenses. However, on an individual level, the paper identified a few fund products with significant alpha net expenses, whilst several funds

displayed significant alpha gross expenses. Interestingly, the analysis identifies 4 of the 6 funds that display a positive net alpha with the 4-factor model, as closet indexers, contrasting the common notion that closet indexers are bound to underperform net expenses.

When investigating the relationship between performance and active share, the findings suggest a positive, yet not significant relationship during the 10-year period, based on the entire sample as a group. However, by separating the funds into quintiles based on active share, quintile 3 with an active share between 30 and 40 percent, and quintile 2 with an active share between 40 and 65 percent, displays a significant positive correlation between alpha and active share; thus, suggesting that there may be a positive correlation up to a certain threshold. Moreover, the relationship between alpha and active share was also examined for the period from 2011 to 2015, as a possible negative relationship may be more prominent in this period; although, the findings conclude similarly to the 10-year period, with no significant results at a 5 percent level of significance.

In an attempt to answer the objectives, the paper finds that active share may reflect active management to a lesser extent in smaller markets; namely, as the Norwegian market is both highly concentrated and top-heavy, the difficulty of obtaining a high active share increases. Accordingly, the paper argues that active share may not be a good stand-alone measure in the Norwegian market, but serves as a useful measure for evaluating the price paid for a certain degree of active management. In particular, the paper suggest the use of the fair price line, in order to investigate whether or not a particular fund appear to be overpriced, when only accounting for the degree of active management.

The paper does not present sufficient evidence to confidently suggest either active- or passive management as the superior investment alternative. Although, the findings suggest that the average active fund does neither deliver significant under- nor outperformance. The paper further proposes that actively managed equity funds may be a solid option for an investor with a long-term investment horizon, whilst other options may be preferred on shorter investment horizons; for instance, smart beta products.

Lastly, the paper concludes that the criticism of active Norwegian domestic equity funds appear to be reasonable. However, certain funds with a relatively low active share may in fact succeed in delivering alpha, as emphasized in this study; hence, the paper stresses that the active share of a fund should be exceedingly low in order to justify legal action, as for instance a rectification order.

Therefore, with regards to the overall goal of the paper, the criticism of actively managed Norwegian equity funds appear to be justified; however, a few individual funds appear to significantly outperform net expenses. It is however evident that the average active share of the sample is considerably lower than is to be expected from a sample containing only actively managed funds. Furthermore, the overall industry outlook regarding active domestic equity in Norway, appear to consist of funds with a low degree of active management, combined with neither significant under- nor outperformance. This study further suggests that non-professional investors should carefully examine the degree of active management and services they receive, in light of the expenses they pay. In line with the majority of previous studies, the results of this study also emphasize that actively managed equity funds may seem not to be worth the increased expenses, compared to a passive index alternative.



## 9.0 Future research

---

This study is of limited scope, and therefore excludes several aspects that otherwise would be an interesting addition to the study. Accordingly, the paper suggests that studies seeking to a construct specific cut-off values based on the Norwegian domestic equity market, would serve as a valuable and interesting addition to the mutual fund literature conducted in the Norwegian market. Moreover, it would be interesting to see a thorough empirical study investigating how certain manager characteristics affect performance, across different management styles, which could further enlighten investors in their choice of fund and fund managers. Lastly, empirical studies of smart beta products serve as an interesting area of broad and current interest, suggested as a topic for future research. In particular, a comprehensive performance analysis, examining whether the smart beta products are in fact ‘the best of all worlds’, appear as an especially interesting area of research.

## Bibliography

---

- Ball, R., & Kothari, S. P. (1989). Nonstationary expected returns: Implications for tests of market efficiency and serial correlation in returns. *Journal of Financial Economics*, 25(1), 51-74.
- Banz, R. W. (1981). The relationship between return and market value of common stocks. *Journal of financial economics*, 9(1), 3-18.
- Bondt, W. F., & Thaler, R. (1985). Does the stock market overreact?. *The Journal of finance*, 40(3), 793-805.
- Brown, S. J., Goetzmann, W., Ibbotson, R. G., & Ross, S. A. (1992). Survivorship bias in performance studies. *Review of Financial Studies*, 5(4), 553-580
- Carhart, M. M. (1997). On persistence in mutual fund performance. *The Journal of finance*, 52(1), 57-82.
- Cesari, R., & Panetta, F. (2002). The performance of Italian equity funds. *Journal of Banking & Finance*, 26(1), 99-126.
- Chan, K. C. (1988). On the contrarian investment strategy. *Journal of Business*, 147-163.
- Che, L., Norli, O., & Priestley, R. (2009). Performance persistence of individual investors. *Available at SSRN 1107795*.
- Cremers, K. M., & Petajisto, A. (2009). How active is your fund manager? A new measure that predicts performance. *Review of Financial Studies*, 22(9), 3329-3365.
- Cremers, M., Ferreira, M. A., Matos, P. P., & Starks, L. T. (2015). Indexing and active fund management: International evidence. *Journal of Financial Economics (JFE)*, *Forthcoming*.
- Cumby, R. E., & Glen, J. D. (1990). Evaluating the performance of international mutual funds. *Journal of Finance*, 497-521.
- Daniel, K., Grinblatt, M., Titman, S., & Wermers, R. (1997). Measuring mutual fund performance with characteristic-based benchmarks. *Journal of Finance*, 1035-1058.
- Dimson, E., Marsh, P., & Staunton, M. (2006, April). The worldwide equity premium: a smaller puzzle. In *EFA 2006 Zurich Meetings Paper*.

- Durbin, J., & Watson, G. S. (1950). Testing for serial correlation in least squares regression: I. *Biometrika*, 37(3/4), 409-428.
- Doganis, R. (2009). *Flying Off Course IV: Airline Economics and Marketing*. Routledge.
- Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work\*. *The journal of Finance*, 25(2), 383-417.
- Fama, E. F. (1972). Components of investment performance. *The Journal of finance*, 27(3), 551-568
- Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of financial economics*, 33(1), 3-56.
- Fama, E. F., & French, K. R. (1996). Multifactor explanations of asset pricing anomalies. *The journal of finance*, 51(1), 55-84.
- Fama, E. F., & French, K. R. (2010). Luck versus skill in the cross-section of mutual fund returns. *The Journal of Finance*, 65(5), 1915-1947.
- Gjerde, Ø., & Sættem, F. (1991). Performance evaluation of Norwegian mutual funds. *Scandinavian Journal of Management*, 7(4), 297-307.
- Grinblatt, M., & Titman, S. (1989). Mutual fund performance: An analysis of quarterly portfolio holdings. *Journal of business*, 393-416.
- Grinblatt, M., & Titman, S. (1992). The persistence of mutual fund performance. *The Journal of Finance*, 47(5), 1977-1984.
- Grossman, S. J., & Stiglitz, J. E. (1980). On the impossibility of informationally efficient markets. *The American economic review*, 393-408.
- Hendricks, D., Patel, J., & Zeckhauser, R. (1993). Hot hands in mutual funds: Short-run persistence of relative performance, 1974-1988. *Journal of finance*, 93-130.
- Hoechle, D. (2007). Robust standard errors for panel regressions with cross-sectional dependence. *Stata Journal*, 7(3), 281.
- Jegadeesh, N. (1990). Evidence of predictable behavior of security returns. *Journal of Finance*, 881-898.

Jegadeesh, N., & Titman, S. (1993). Returns to buying winners and selling losers: Implications for stock market efficiency. *The Journal of finance*, 48(1), 65-91.

Jensen, M. C. (1968). The performance of mutual funds in the period 1945–1964. *The Journal of finance*, 23(2), 389-416.

Jensen, M. C., Black, F., & Scholes, M. S. (1972). The capital asset pricing model: Some empirical tests.

Kacperczyk, M., Sialm, C., & Zheng, L. (2005). On the industry concentration of actively managed equity mutual funds. *The Journal of Finance*, 60(4), 1983-2011.

Kendall, M. G., & Hill, A. B. (1953). The analysis of economic time-series-part i: Prices. *Journal of the Royal Statistical Society. Series A (General)*, 116(1), 11-34.

Kidd, D. (2011). The Sharpe Ratio and the Information Ratio. *Investment Performance Measurement Feature Articles*, 2011(1), 1-4.

Kothari, S. P., & Warner, J. B. (2001). Evaluating mutual fund performance. *The Journal of Finance*, 56(5), 1985-2010.

Kutner, M. H. (1996). *Applied linear statistical models* (Vol. 4, p. 318). Chicago: Irwin.

Lintner, J. (1965). The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. *The review of economics and statistics*, 13-37

Lintner, J. (1965b). Security Prices, Risk, and Maximal Gains from Diversification\*. *The Journal of Finance*, 20(4), 587-615.

LONG, J. B., Shleifer, A., Summers, L. H., & Waldmann, R. J. (1990). Positive feedback investment strategies and destabilizing rational speculation. *the Journal of Finance*, 45(2), 379-395

Malkiel, B. G. (1995). Returns from investing in equity mutual funds 1971 to 1991. *The Journal of finance*, 50(2), 549-572.

Malkiel, B. G. (2003). The efficient market hypothesis and its critics. *Journal of economic perspectives*, 59-82.

Mossin, J. (1966). Equilibrium in a capital asset market. *Econometrica: Journal of the econometric society*, 768-783.

Mullins, D. W. (1982). Does the capital asset pricing model work. *Harvard Business Review*, 60(1), 105-114.

Newey, W. K., & West, K. D. (1986). A simple, positive semi-definite, heteroskedasticity and autocorrelation-consistent covariance matrix.

Panik, M. J. (2012). *Statistical Inference: A Short Course*. John Wiley & Sons.

Petajisto, A. (2013). Active share and mutual fund performance. *Financial Analysts Journal*, 69(4), 73-93.

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk\*. *The journal of finance*, 19(3), 425-442.

Sharpe, W. F. (1966). Mutual fund performance. *Journal of business*, 119-138.

Sharpe, W. F. (1991). The arithmetic of active management. *Financial Analysts Journal*, 47(1), 7-9.

Sørensen, L. Q. (2009). Mutual fund performance at the Oslo Stock Exchange. Available at SSRN 1488745.

Treynor, J. L. (1962). *Toward a theory of market value of risky assets*. Unpublished Manuscript

Treynor, J. L. (1965). How to rate management of investment funds. *Harvard business review*, 43(1), 63-75.

Treynor, J., & Mazuy, K. (1966). Can mutual funds outguess the market? *Harvard business review*, 44(4), 131-136.

Wermers, R. (2003). *Are Mutual Fund Shareholders Compensated for Active Management" bets"?*. publisher not identified.

White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica: Journal of the Econometric Society*, 817-838.

Winther, K. L., & Steenstrup, S. R. (2016). Smart Beta or Smart Alpha?. *The Journal of Investing*, 25(1), 85-94.

Zarowin, P. (1989). Does the stock market overreact to corporate earnings information?. *Journal of Finance*, 1385-1399.

Ødegård, B. A. (2016b). Empirics of the Oslo stock exchange. Basic, descriptive, results 1980-2015. *Descriptive analysis, working paper*

Ødegård B. A. (2016c). Empirics of the Oslo stock exchange. Asset pricing results. 1980-2015. *Descriptive analysis, working paper*

### **Books:**

Bodie, Z., Kane, A., & Marcus, A. (2014). *Investments*, 10th Global ed.

Fox, J. (1991). *Regression diagnostics: An introduction* (Vol. 79). Sage.

Grinold, R. C., & Kahn, R. N. (2000). *Active portfolio management*.

Gujarati, D. N. (2009). *Basic econometrics*. Tata McGraw-Hill Education.

Terence C. Mills (December 2013). *Analysing Economic Data* . Retrieved from <http://www.palgraveconnect.com/pc/doi/10.1057/9781137401908.0001>

### **Web:**

Dillon Eustace (2008). A guide to UCITS in Ireland. Retrieved March 24, 2016, from <http://www.dilloneustace.ie/download/1/DE%20UCITS%20Brochure%20FA%20Web.pdf>

Finansdepartementet (2007). Lov om verdipapirhandel (verdipapirhandelloven). Retrieved February 18, 2016, from <https://lovdata.no/dokument/NL/lov/2007-06-29-75>

Oslo Børs (2014). Laveste Nibor-rente noensinne. Retrieved February 18, 2016, from <http://www.oslobors.no/Oslo-Boers/Om-Oslo-Boers/Nyheter-fra-Oslo-Boers/Laveste-Nibor-rente-noensinne>

Riksen, T. (2015). Hva er fair pris på aksjefond? [Blog post]. Retrieved April 12, 2016, from [http://riksen.blogg.no/1433103875\\_hva\\_er\\_fair\\_pris\\_p\\_ak.html](http://riksen.blogg.no/1433103875_hva_er_fair_pris_p_ak.html)

SSB (2016a). Familier og husholdninger, 1.januar 2014. Retrieved March 22, 2016, from <https://www.ssb.no/statistikkbanken/selectout/ShowTable.asp?FileformatId=2&Queryfile=201656233638937194087VPfondAndKapEier&PLanguage=0&MainTable=VPfondAndKapEier&potsize=8>

SSB (2016b). Verdipapirfond, kvartalstall. Retrieved March 22, 2016, from <https://www.ssb.no/statistikkbanken/selecttable/hovedtabellHjem.asp?KortNavnWeb=vpfondk&CMSSubjectArea=bank-og-finansmarked&checked=true>

VFF (2016a). Norske personkunder Februar 2016. Retrieved March 22, 2016, from <http://vff.no/assets/Statistikkfiler-i-Excel/2016/02-2016/Norske-personkunder-februar-2016.xlsx>

VFF (2016b). Aksjefond. Retrieved March 22, 2016, from <http://vff.no/hvilke-fond-passer-for-meg>

Yahoo (2016). Historical prices Oslo exchange all share index. Retrieved April 24, 2016, from <http://finance.yahoo.com/q/hp?s=%5EEOSEAX&a=00&b=1&c=2006&d=11&e=31&f=2015&g=d>

Ødegård (2016a). Monthly pricing factors. Retrieved March 13, 2016, from [http://finance.bi.no/~bernt/financial\\_data/ose\\_asset\\_pricing\\_data/pricing\\_factors\\_monthly.txt](http://finance.bi.no/~bernt/financial_data/ose_asset_pricing_data/pricing_factors_monthly.txt)

# Appendices

## Appendix A: Durbin-Watson test bounds

### Appendix A

*The table displays upper and lower Durbin-Watson test bounds, based on a 5 percent level of significance, and the respective amount of observations listed in the far left column.*

	dL	dU
n = 10	0,879	1,32
n = 14	1,045	1,35
n = 20	1,201	1,411
n = 34	1,393	1,514
n = 35	1,402	1,519
n = 37	1,419	1,53
n = 56	1,5322	1,604
n = 57	1,5364	1,607
n = 63	1,5598	1,6238
n = 81	1,6136	1,6638
n = 93	1,641	1,6838
n = 98	1,6504	1,6912
n = 99	1,6522	1,6926
n = 101	1,64518	1,68714
n = 105	1,6459	1,6877
n = 109	1,64662	1,68826
n = 115	1,6477	1,6891
n = 118	1,64824	1,68952
n = 120	1,6486	1,6898

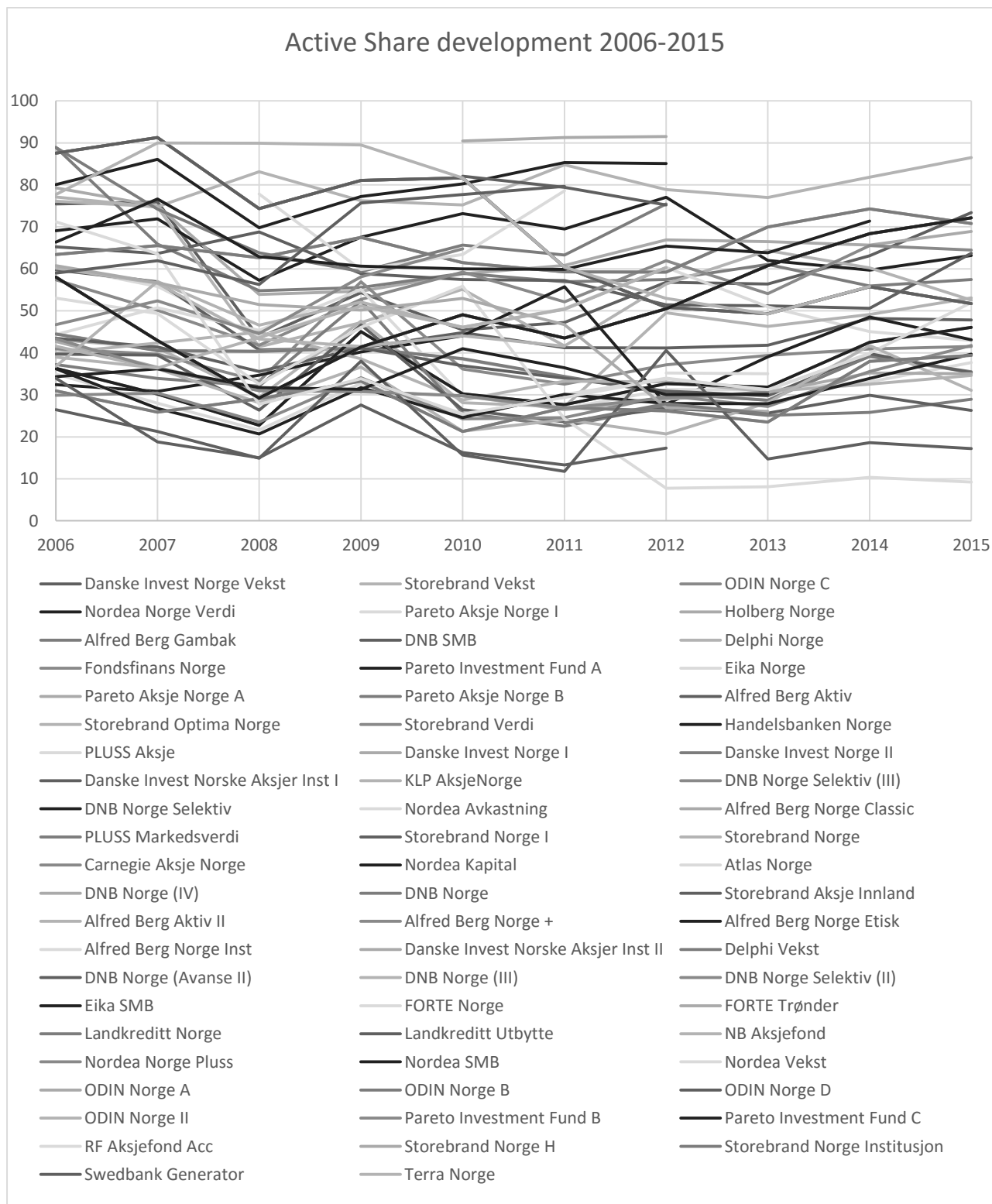
*Source: Test bounds retrieved from Kutner et al. (1996)*



## Appendix B: Active share development

**Figure 7**

Active share development of the sample of funds from January 2006 to December 2015.



Source: own construction based on annual active share results amongst the sample of funds.

## Appendix C: Active share development of the individual funds

### Appendix C

Annual active share for each individual fund. Individual averages and annual averages displayed in the far right column and bottom row respectively.

Name	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	Avg.
Alfred Berg Aktiv	47,8	48,2	41,8	41,1	41,2	44,8	41,2	40,7	56,9	59,8	46,4
Alfred Berg Aktiv II					41,6	44,1	41,5	43,3	56,6	60,2	47,9
Alfred Berg Gambak	57,4	55,9	61,0	57,4	56,9	58,9	55,6	54,8	65,9	88,9	61,3
Alfred Berg Norge +			30,7	29,3	26,8	29,8	30,8	31,0	36,2	43,4	32,2
Alfred Berg Norge Classic	35,0	35,2	30,6	29,0	26,5	29,7	30,7	30,9	36,6	42,7	32,7
Alfred Berg Norge Etisk			30,1	30,1	36,4	41,0	31,3	31,7	36,2	34,3	33,9
Alfred Berg Norge Inst	35,0	35,2									35,1
Atlas Norge	9,2	10,4	8,1	7,8	24,3	55,9	46,1	32,6	49,3	53,0	29,7
Carnegie Aksje Norge	41,8	35,5	27,2	29,7	24,6	24,3	34,1	23,5	30,4	29,9	30,1
Danske Invest Norge I	35,3	39,2	28,7	30,5	34,2	38,5	41,2	40,4	40,5	44,5	37,3
Danske Invest Norge II	35,5	39,2	28,7	30,4	34,4	38,6	41,0	40,3	40,5	44,5	37,3
Danske Invest Norge Vekst	73,4	63,1	56,4	56,8	47,2	45,4	54,3	43,6	75,9	75,5	59,2
Danske Invest Norske Aksjer Inst I	35,3	39,8	29,8	30,9	34,0	36,9	41,1	35,5	41,4	43,4	36,8
Danske Invest Norske Aksjer Inst II	35,5	38,7	28,7	30,4	34,5	36,9	40,9	40,4	41,4	46,1	37,3
Delphi Norge	52,5	60,2	64,4	56,4	41,6	55,1	47,2	41,5	74,7	77,1	57,1
Delphi Vekst				75,4	63,3	65,6	59,3	63,8	74,2	88,9	70,1
DNB Norge	39,4	38,0	23,5	26,2	27,0	21,3	33,3	29,1	25,9	31,0	29,5
DNB Norge (Avanse II)				17,3	13,3	16,3	27,6	15,0	18,8	34,0	20,3
DNB Norge (III)	39,4	38,0	23,5	26,2	27,0	21,3	33,3	29,1	25,9	31,0	29,5
DNB Norge (IV)	39,4	38,0	23,5	26,2	27,0	21,3	33,3	29,1	25,9	31,0	29,5
DNB Norge Selektiv	46,0	42,5	31,9	32,6	27,7	30,3	45,1	22,7	30,2	36,3	34,5
DNB Norge Selektiv (II)	46,0	42,5	31,9	32,6	27,7	30,3	45,1	22,7	30,2	36,3	34,5
DNB Norge Selektiv (III)	46,0	42,5	31,9	32,6	27,7	30,3	45,1	22,7	30,2	36,3	34,5
DNB SMB	63,7	50,6	51,2	51,5	57,2	57,4	58,9	68,8	63,7	65,2	58,8
Eika Norge	42,9	45,1	51,0	60,3	50,5	46,0	51,3	43,8	55,8	60,6	50,7
Eika SMB				85,1	85,3	80,2	77,2	69,8	86,1	80,1	80,5
Fondsfinans Norge	64,5	65,5	54,1	61,9	52,2	59,2	52,7	41,8	50,2	57,4	56,0
FORTE Norge	78,6	63,4	59,8	77,8							69,9
FORTE Trønder	91,5	91,2	90,4								91,1
Handelsbanken Norge	43,1	48,5	39,1	27,8	55,8	44,1	40,2	34,6	30,8	32,4	39,6
Holberg Norge	68,9	65,7	66,5	66,9	60,8	58,8	54,7	53,9	75,0	79,3	65,0
KLP AksjeNorge	34,6	32,6	30,8	33,1	33,2	28,7	38,6	44,9	42,4	39,9	35,9
Landkreditt Norge	63,9	55,8	64,8	57,2	55,5	61,9	55,8	68,4	73,8	87,7	64,5
Landkreditt Utbytte	75,2	79,4	82,0								78,9
NB Aksjefond				60,3	50,4	46,1	52,1	46,6	57,0	36,8	49,9
Nordea Avkastning	52,0	39,9	31,1	33,9	30,1	25,1	32,7	21,6	28,0	35,0	32,9
Nordea Kapital	39,7	33,9	27,9	27,9	30,1	24,6	31,7	20,7	26,7	36,2	29,9
Nordea Norge Pluss	64,8	58,1	44,6	52,4	46,7						53,3
Nordea Norge Verdi	63,2	59,7	62,0	77,1	69,5	73,1	67,6	57,3	71,9	69,1	67,0
Nordea SMB		71,4	63,8	65,4	59,9	60,0	60,6	62,9	76,6	66,4	65,2
Nordea Vekst		39,7	31,2	33,8	29,3	25,4	33,9	27,8	63,6	71,2	39,6
ODIN Norge A	51,7	55,7	49,3	50,8	60,4	81,7	80,8	73,8	91,3	87,5	68,3
ODIN Norge B	51,7	55,7	49,3	50,8	60,4	81,7	80,8	73,8	91,3	87,5	68,3
ODIN Norge C	51,7	55,7	49,3	50,8	60,4	81,7	81,0	74,3	91,3	87,5	68,4
ODIN Norge D	51,7	55,7	49,3	50,8	60,4	81,7	80,8	73,8	91,3	87,5	68,3
ODIN Norge II		55,8	49,3	53,0	60,4	81,7	89,5	89,9	90,0	77,7	71,9

Pareto Aksje Norge A	70,8	74,3	69,9	59,2	59,3	61,5	67,5	62,7	65,5	63,4	65,4
Pareto Aksje Norge B	70,8	74,3	69,9	59,2	59,3	61,5	67,5	62,7	65,5	63,4	65,4
Pareto Aksje Norge I	70,8	74,3	69,9	59,2	59,3	61,5	67,5	62,7	65,5	63,4	65,4
Pareto Investment Fund A	72,2	68,4	60,8	50,5	43,5	49,0	41,4	29,3	42,9	58,0	51,6
Pareto Investment Fund B	72,2	68,4	60,8	50,5	43,5	49,0	41,4	29,1	42,9	58,0	51,6
Pareto Investment Fund C	72,2	68,4	60,8	50,5	43,5	49,0	41,4	29,1	42,9	58,0	51,6
PLUSS Aksje	37,7	33,1	31,2	31,3	26,7	29,7	55,1	45,3	50,7	44,3	38,5
PLUSS Markedsverdi	29,0	25,8	25,1	27,4	22,5	25,7	52,4	32,1	33,9	37,2	31,1
RF Aksjefond Acc										37,0	37,0
Storebrand Aksje Innland	17,2	18,6	14,7	40,6	11,8	15,7	38,1	14,9	21,3	26,4	21,9
Storebrand Norge	31,1	41,8	28,1	20,7	24,1	21,3	36,6	28,1	36,2	41,6	31,0
Storebrand Norge H			26,1	26,9	46,7	52,9	50,2	51,5	56,7	60,8	46,5
Storebrand Norge I	26,3	29,9	25,6	26,8	23,5	26,5	46,6	26,4	39,5	39,7	31,1
Storebrand Norge Institusjon			25,5	27,9	23,3						25,5
Storebrand Optima Norge	53,1	49,1	46,3	49,5	27,1	28,1	47,5	29,4	41,1	43,1	41,5
Storebrand Vekst	86,5	81,9	77,0	78,9	84,8	75,2	76,2	83,2	74,8	76,1	79,5
Storebrand Verdi	41,5	40,9	39,4	37,2	32,5	36,1	56,9	33,3	39,7	40,9	39,8
Swedbank Generator	79,7	77,7	75,7	56,3	61,9	59,0					68,4
Terra Norge				60,3	50,4	46,1	51,2	43,6	36,4	39,0	46,7
<b>Average</b>	<b>51,7</b>	<b>50,9</b>	<b>44,5</b>	<b>44,5</b>	<b>42,6</b>	<b>45,9</b>	<b>50,1</b>	<b>43,4</b>	<b>51,9</b>	<b>54,5</b>	<b>48,6</b>

*Source: own construction based on active share calculations.*

## Appendix D: Two-dimensional matrix of active share and tracking error

### Appendix D

The table displays the D- and chi-squared results, based on the Durbin-Watson and White's test respectively.

Fund name	#Obs	D	4-D	D > dU	(4-D) > dU	D < dL	(4-D) < dL	Prob > $\chi^2$	Heteroscedasticity
Alfred Berg Aktiv	120	1,51	2,49		X	X		0,19	NO
Alfred Berg Aktiv II	81	1,69	2,31	X	X			0,16	NO
Alfred Berg Gambak	120	1,59	2,41		X	X		0,28	NO
Alfred Berg Norge +	99	1,74	2,26	X	X			0,31	NO
Alfred Berg Norge Classic	120	1,63	2,37		X	X		0,31	NO
Alfred Berg Norge Etisk	99	1,84	2,16	X	X			0,06	NO
Alfred Berg Norge Inst	20	1,93	2,07	X	X			0,30	NO
Atlas Norge	120	2,09	1,91	X	X			0,00	YES
Carnegie Aksje Norge	120	2,02	1,98	X	X			0,00	YES
Danske Invest Norge I	120	2,15	1,85	X	X			0,06	NO
Danske Invest Norge II	120	2,12	1,88	X	X			0,03	YES
Danske Invest Norge Vekst	120	2,06	1,94	X	X			0,18	NO
Danske Invest Norske Aksjer Inst I	120	2,12	1,88	X	X			0,02	YES
Danske Invest Norske Aksjer Inst II	109	2,00	2,00	X	X			0,00	YES
Delphi Norge	120	1,96	2,04	X	X			0,72	NO
Delphi Vekst	93	1,97	2,03	X	X			0,38	NO
DNB Norge (Avanse I)	98	1,83	2,17	X	X			0,17	NO
DNB Norge (Avanse II)	105	1,83	2,17	X	X			0,23	NO
DNB Norge	120	2,03	1,97	X	X			0,00	YES
DNB Norge (I)	98	1,97	2,03	X	X			0,00	YES
DNB Norge (III)	120	2,03	1,97	X	X			0,00	YES
DNB Norge (IV)	120	2,03	1,97	X	X			0,00	YES
DNB Norge Selektiv	120	2,14	1,86	X	X			0,15	NO
DNB Norge Selektiv (II)	120	2,12	1,88	X	X			0,16	NO
DNB Norge Selektiv (III)	120	2,14	1,86	X	X			0,15	NO
DNB SMB	120	1,88	2,12	X	X			0,47	NO
Eika Norge	120	1,91	2,09	X	X			0,28	NO
Eika SMB	93	1,97	2,03	X	X			0,67	NO
Fondsfinans Norge	120	2,14	1,86	X	X			0,00	YES
FORTE Norge	57	2,51	1,49	X			X	0,02	YES
FORTE Trønder	35	2,54	1,46	X				0,08	NO
Globus Norge A/I	10	2,19	1,81	X	X			0,40	NO
Globus Norge II Acc	10	2,61	1,39	X	X			0,53	NO
Handelsbanken Norge	120	1,57	2,43		X	X		0,33	NO
Holberg Norge	120	1,67	2,33		X			0,00	YES
KLP AksjeNorge	120	2,24	1,76	X	X			0,00	YES
Landkreditt Norge	115	1,95	2,05	X	X			0,00	YES
Landkreditt Utbytte	34	2,43	1,57	X	X			0,10	NO
NB Aksjefond	93	2,12	1,88	X	X			0,62	NO
Nordea Avkastning	120	2,08	1,92	X	X			0,00	YES
Nordea Kapital	120	2,15	1,85	X	X			0,00	YES
Nordea Norge Pluss	56	2,13	1,87	X	X			0,01	YES
Nordea Norge Verdi	120	2,02	1,98	X	X			0,00	YES
Nordea SMB	109	1,91	2,09	X	X			0,03	YES
Nordea Vekst	109	1,89	2,11	X	X			0,38	NO
ODIN Norge A	120	1,82	2,18	X	X			0,03	YES
ODIN Norge B	120	1,82	2,18	X	X			0,03	YES
ODIN Norge C	120	1,82	2,18	X	X			0,03	YES
ODIN Norge D	120	1,82	2,18	X	X			0,03	YES
ODIN Norge II	118	1,82	2,18	X	X			0,03	YES
Pareto Aksje Norge A	120	1,98	2,02	X	X			0,00	YES
Pareto Aksje Norge B	120	2,00	2,00	X	X			0,01	YES
Pareto Aksje Norge I	120	2,01	1,99	X	X			0,02	YES
Pareto Investment Fund A	120	1,85	2,15	X	X			0,00	YES
Pareto Investment Fund B	120	1,84	2,16	X	X			0,00	YES
Pareto Investment Fund C	120	1,83	2,17	X	X			0,00	YES
PLUSS Aksje	120	2,25	1,75	X	X			0,00	YES
PLUSS Markedsverdi	120	1,94	2,06	X	X			0,00	YES
RF Aksjefond Acc	14	1,21	2,79		X			0,90	NO
Storebrand Aksje Innland	120	2,28	1,72	X	X			0,00	YES
Storebrand Norge	120	2,27	1,73	X	X			0,00	YES
Storebrand Norge H	101	2,20	1,80	X	X			0,00	YES
Storebrand Norge I	120	2,01	1,99	X	X			0,00	YES
Storebrand Norge Institusjon	37	2,21	1,79	X	X			0,39	NO
Storebrand Optima Norge	120	2,13	1,87	X	X			0,00	YES
Storebrand Vekst	120	1,85	2,15	X	X			0,00	YES
Storebrand Verdi	120	2,03	1,97	X	X			0,00	YES
Swedbank Generator	63	2,34	1,66	X	X			0,56	NO
Terra Norge	93	2,08	1,92	X	X			0,03	YES

Source: own construction, based on Durbin-Watson and White's test results.

## Appendix E: Sample of funds separated in quintiles based on active share

### Appendix E

The sample of funds separated in quintiles, based on average active share for the 10- and 5-year period respectively.

10-Year			5-Year			
Fund Name	Active share	Quintile	Fund Name	Active Share	Quintile	
FORTE Trønder	91,060	Quintile 1	FORTE Trønder	91,060	Quintile 1	
Eika SMB	80,533		Eika SMB	85,192		
Storebrand Vekst	79,453		Storebrand Vekst	81,805		
Landkreditt Utbytte	78,897		Landkreditt Utbytte	78,897		
ODIN Norge II	71,904		Swedbank Generator	70,251		
Delphi Vekst	70,093		FORTE Norge	69,909		
FORTE Norge	69,909		Delphi Vekst	69,367		
ODIN Norge C	68,385		Pareto Aksje Norge I	66,699		
Swedbank Generator	68,369		Nordea Norge Verdi	66,281		
Nordea Norge Verdi	67,034		Holberg Norge	65,762		
Pareto Aksje Norge I	65,403		Nordea SMB	65,138		
Nordea SMB	65,223		Fondsfinans Norge	59,641		
Holberg Norge	65,044		Landkreditt Norge	59,451		
Landkreditt Norge	64,483		Danske Invest Norge Vekst	59,378		Quintile 2
Alfred Berg Gambak	61,285	Pareto Investment Fund A	59,066			
Danske Invest Norge Vekst	59,162	Alfred Berg Gambak	57,747			
DNB SMB	58,823	Terra Norge	55,349			
Delphi Norge	57,076	NB Aksjefond	55,334			
Fondsfinans Norge	55,952	Delphi Norge	55,032			
Nordea Norge Pluss	53,307	DNB SMB	54,847			
Pareto Investment Fund A	51,596	ODIN Norge II	54,599			
Eika Norge	50,743	ODIN Norge C	53,601			
NB Aksjefond	49,894	Nordea Norge Pluss	53,307			
Alfred Berg Aktiv II	47,864	Eika Norge	49,973			
Terra Norge	46,708	Storebrand Optima Norge	45,044			
Storebrand Norge H	46,473	Alfred Berg Aktiv	44,046			
Alfred Berg Aktiv	46,364	Handelsbanken Norge	42,846			
Storebrand Optima Norge	41,459	Alfred Berg Aktiv II	41,603			
Storebrand Verdi	39,841	Storebrand Verdi	38,304	Quintile 3		
Handelsbanken Norge	39,639	Nordea Avkastning	37,399			
Nordea Vekst	39,554	DNB Norge Selektiv (III)	36,140			
PLUSS Aksje	38,521	Alfred Berg Norge Inst	35,111			
Danske Invest Norske Aksjer Inst II	37,348	Danske Invest Norske Aksjer Inst I	33,951			
Danske Invest Norge I	37,317	Danske Invest Norge II	33,621			
Danske Invest Norge II	37,304	Danske Invest Norge I	33,600			
RF Aksjefond Acc	36,977	Danske Invest Norske Aksjer Inst II	33,549			
Danske Invest Norske Aksjer Inst I	36,818	Nordea Vekst	33,535			
KLP AksjeNorge	35,871	Storebrand Norge H	33,233			
Alfred Berg Norge Inst	35,111	KLP AksjeNorge	32,838			
DNB Norge Selektiv (III)	34,525	Alfred Berg Norge Etisk	32,206			
Alfred Berg Norge Etisk	33,897	PLUSS Aksje	31,999			
Nordea Avkastning	32,944	Nordea Kapital	31,902			
Alfred Berg Norge Classic	32,693	Carnegie Aksje Norge	31,771			
Alfred Berg Norge +	32,246	Alfred Berg Norge Classic	31,257			
PLUSS Markedsverdi	31,111	DNB Norge (IV)	30,809			
Storebrand Norge I	31,073	Storebrand Norge	29,141	Quintile 4		
Storebrand Norge	30,954	Alfred Berg Norge +	28,930			
Carnegie Aksje Norge	30,100	Storebrand Norge I	26,420			
Nordea Kapital	29,945	PLUSS Markedsverdi	25,969			
Atlas Norge	29,654	Storebrand Norge Institusjon	25,532			
DNB Norge (IV)	29,454	Storebrand Aksje Innland	20,565			
Storebrand Norge Institusjon	25,532	Atlas Norge	11,939			
Storebrand Aksje Innland	21,922					

Source: own construction, based on average active share results.

## Appendix F: Performance of benchmark indices

### Appendix F

Base date return development of subtracting the index value of the OSESX from the OSEFX, highlighting the poor performance of OSE SXLS Small-cap index the past 5-year period.



Source: own construction, based on return series obtained through Morningstar Direct.

## Appendix G: Development of the Norwegian stock market

---

### Appendix G

*The development of the Norwegian stock market from January 2006 to December 2015, illustrated with daily closing prices of the OSEAX.*

---



*Source: own construction based on historical prices retrieved from Yahoo Finance (Yahoo, 2016).*

## Appendix H: Holdings OSEFX

### Appendix G

*Top eight holdings of OSEFX in the period from 2006 to 2015.*

2015		2014		2013		2012		2011		2010		2009		2008		2007		2006	
NAME	W	NAME	W	NAME	W	NAME	W	NAME	W	NAME	W	NAME	W	NAME	W	NAME	W	NAME	W
Telenor	9 %	Norsk Hydro	9 %	Statoil	9 %	Statoil	9 %	Seadrill Ltd	9 %	Yara	9 %	Telenor	9 %	Orkla	9 %	DNB	9 %	Norsk Hydro	9 %
DNB	9 %	Telenor	9 %	DNB	9 %	DNB	9 %	Telenor	9 %	DNB	9 %	Statoil	9 %	Yara	9 %	Orkla	9 %	DNB	9 %
Yara	9 %	Statoil	9 %	Telenor	9 %	Telenor	9 %	DNB	9 %	Statoil	8 %	DNB	9 %	Statoil	9 %	Telenor	9 %	Telenor	9 %
Statoil	9 %	DNB	8 %	Yara	7 %	Yara	9 %	Statoil	9 %	Telenor	8 %	Yara	9 %	Telenor	8 %	Statoil	9 %	Statoil	9 %
Marine Harvest	5 %	RCC Ltd	5 %	Norsk Hydro	5 %	Orkla	5 %	Yara	5 %	Norsk Hydro	5 %	Orkla	5 %	Norsk Hydro	4 %	Norsk Hydro	5 %	Orkla	5 %
RCC Ltd	5 %	Marine Harvest	5 %	Schibsted	5 %	Norsk Hydro	5 %	Orkla	5 %	Subsea 7	5 %	Norsk Hydro	5 %	DNB	4 %	Yara	5 %	Yara	4 %
Orkla	5 %	Schibsted	5 %	Orkla	4 %	Subsea 7	5 %	Norsk Hydro	5 %	Orkla	4 %	Seadrill Ltd	5 %	REC Silicon	4 %	Seadrill Ltd	4 %	Petroleum Geo-Services	4 %
Norsk Hydro	5 %	Yara	4 %	Subsea 7	4 %	Seadrill Ltd	4 %	Subsea 7	5 %	Seadrill Ltd	4 %	Subsea 7	4 %	Seadrill Ltd	3 %	REC Silicon	4 %	Seadrill Ltd	3 %
SUM	54 %		54 %		52 %		53 %		55 %		52 %		54 %		51 %		54 %		51 %

*Source: own construction based on holdings obtained from the Bloomberg Terminal.*



## Appendix I: Descriptive statistics for the sample of funds

### Appendix I

*Average monthly gross return, standard deviation, beta, and tracking error for the sample of funds. Calculated with continuously compounded gross returns.*

Fund Name	Date Span	Avg. Return(m)	Stdev (m)	Beta	Tracking Error (m)
RF Aksjefond Acc	200601-200702	0,0199	0,0374	0,9424	0,0090
Landkreditt Utbytte	201303-201512	0,0132	0,0220	0,5680	0,0199
Swedbank Generator	201010-201512	0,0127	0,0511	1,1111	0,0229
FORTE Trønder	201302-201512	0,0119	0,0277	0,7063	0,0212
Alfred Berg Norge Inst	201405-201512	0,0116	0,0243	0,8074	0,0104
Alfred Berg Gambak	200601-201512	0,0104	0,0662	0,9254	0,0216
Storebrand Vekst	200601-201512	0,0097	0,0674	0,9243	0,0331
Handelsbanken Norge	200601-201512	0,0095	0,0703	1,0081	0,0157
Globus Norge A/I	200601-200610	0,0091	0,0341	0,7681	0,0212
Pareto Investment Fund A	200601-201512	0,0087	0,0671	0,9553	0,0174
Danske Invest Norske Aksjer Inst I	200601-201512	0,0083	0,0629	0,9107	0,0132
Danske Invest Norge II	200601-201512	0,0083	0,0621	0,8982	0,0138
Fondsfinans Norge	200601-201512	0,0083	0,0641	0,9079	0,0188
Danske Invest Norge I	200601-201512	0,0083	0,0627	0,9071	0,0134
Eika Norge	200601-201512	0,0083	0,0636	0,9090	0,0165
Pareto Investment Fund B	200601-201512	0,0082	0,0671	0,9552	0,0175
Pareto Investment Fund C	200601-201512	0,0079	0,0671	0,9552	0,0175
Alfred Berg Aktiv	200601-201512	0,0077	0,0664	0,9523	0,0152
Alfred Berg Norge Classic	200601-201512	0,0077	0,0659	0,9605	0,0096
Delphi Norge	200601-201512	0,0076	0,0627	0,8858	0,0196
PLUSS Aksje	200601-201512	0,0075	0,0583	0,8410	0,0163
Storebrand Optima Norge	200601-201512	0,0074	0,0648	0,9874	0,0154
DNB Norge (I)	200601-201402	0,0073	0,0681	0,9126	0,0118
Nordea Norge Verdi	200601-201512	0,0073	0,0552	0,7702	0,0238
Storebrand Norge H	200601-201405	0,0072	0,0690	1,0012	0,0109
PLUSS Markedsverdi	200601-201512	0,0072	0,0630	0,9188	0,0104
Danske Invest Norske Aksjer Inst II	200612-201512	0,0070	0,0642	0,9027	0,0138
Storebrand Norge	200601-201512	0,0070	0,0667	0,9695	0,0106
Carnegie Aksje Norge	200601-201512	0,0070	0,0660	0,9620	0,0099
Alfred Berg Norge +	200601-201403	0,0067	0,0718	0,9678	0,0095
Nordea Kapital	200601-201512	0,0066	0,0651	0,9520	0,0083
Nordea Avkastning	200601-201512	0,0066	0,0658	0,9626	0,0078
Storebrand Verdi	200601-201512	0,0066	0,0634	0,9777	0,0116
DNB Norge Selektiv (II)	200601-201512	0,0064	0,0625	0,9660	0,0108
DNB Norge (III)	200601-201512	0,0064	0,0627	0,9119	0,0118
DNB Norge	200601-201512	0,0064	0,0627	0,9116	0,0119
DNB Norge (IV)	200601-201512	0,0064	0,0629	0,9145	0,0117
Storebrand Norge I	200601-201512	0,0064	0,0639	0,9893	0,0102
Storebrand Aksje Innland	200601-201512	0,0064	0,0628	0,9817	0,0057
DNB Norge Selektiv (III)	200601-201512	0,0064	0,0629	0,9723	0,0108
KLP AksjeNorge	200601-201512	0,0063	0,0654	0,9391	0,0150
Nordea Norge Pluss	201105-201512	0,0063	0,0416	0,9941	0,0110
DNB Norge Selektiv	200601-201512	0,0062	0,0627	0,9706	0,0107
Alfred Berg Norge Etisk	200601-201403	0,0062	0,0736	0,9920	0,0098
DNB Norge (Avanse II)	200601-201409	0,0062	0,0704	0,9810	0,0056
Terra Norge	200601-201309	0,0061	0,0747	0,9692	0,0155
DNB Norge (Avanse I)	200601-201402	0,0060	0,0726	0,9797	0,0057
Atlas Norge	200601-201512	0,0058	0,0659	0,9577	0,0110

Landkreditt Norge	200606-201512	0,0056	0,0611	0,8421	0,0230
Nordea Vekst	200601-201501	0,0055	0,0682	0,9545	0,0121
Delphi Vekst	200601-201309	0,0054	0,0665	0,8249	0,0272
DNB SMB	200601-201512	0,0054	0,0691	1,1140	0,0210
Globus Norge II Acc	200601-200610	0,0052	0,0336	0,7538	0,0216
NB Aksjefond	200601-201309	0,0051	0,0713	0,9221	0,0168
Danske Invest Norge Vekst	200601-201512	0,0050	0,0607	0,8545	0,0205
Pareto Aksje Norge A	200601-201512	0,0049	0,0568	0,7693	0,0276
Pareto Aksje Norge B	200601-201512	0,0046	0,0581	0,7866	0,0273
Pareto Aksje Norge I	200601-201512	0,0045	0,0585	0,7911	0,0273
Storebrand Norge Institusjon	201101-201401	0,0045	0,0428	1,0183	0,0073
FORTE Norge	201104-201512	0,0042	0,0437	0,9538	0,0215
Eika SMB	200601-201309	0,0040	0,0668	0,8150	0,0298
Alfred Berg Aktiv II	200601-201209	0,0039	0,0790	0,9663	0,0159
ODIN Norge A	200601-201512	0,0038	0,0560	0,7551	0,0283
ODIN Norge C	200601-201512	0,0038	0,0560	0,7552	0,0283
ODIN Norge D	200601-201512	0,0038	0,0560	0,7551	0,0283
ODIN Norge B	200601-201512	0,0038	0,0560	0,7552	0,0283
ODIN Norge II	200601-201510	0,0036	0,0563	0,7536	0,0285
Holberg Norge	200601-201512	0,0034	0,0568	0,7834	0,0250
Nordea SMB	200601-201501	-0,0002	0,0638	1,0032	0,0177
OSE BXLTL Benchmark Index		0,005	0,0643	1,00	0,00
OSE FXLT Mutual Fund Index		0,005	0,0685	1,00	0,00
OSE SXLS Small Cap Index		0,001	0,0598	1,00	0,00
Average (excl. Benchmarks)		0,0068	0,0603	0,9049	0,0166

*Source: own construction, based on gross return series obtained through Morningstar Direct.*

## Appendix J: Relative performance measures

### Appendix J

*Monthly Sharpe ratio, Treynor measure, and Information ratio. Calculated based on monthly gross returns in excess of the risk free rate, monthly standard deviation, and beta. The IR is calculated based on monthly gross active returns, and monthly tracking errors.*

Fund Name	#Obs	Sharpe	Rank	Treynor	Rank	IR	Rank
Landkreditt Utbytte	34	0,538	1	0,021	1	0,26	6
RF Aksjefond Acc	14	0,459	2	0,018	2	-0,07	65
Alfred Berg Norge Inst	20	0,429	3	0,013	4	0,72	1
FORTE Trønder	35	0,383	4	0,015	3	0,17	27
Swedbank Generator	63	0,215	5	0,010	5	0,22	16
Globus Norge A/I	10	0,194	6	0,009	7	-0,51	68
Alfred Berg Gambak	120	0,121	7	0,009	6	0,26	7
Nordea Norge Pluss	56	0,112	8	0,005	29	0,06	50
Storebrand Vekst	120	0,107	9	0,008	8	0,14	34
Handelsbanken Norge	120	0,100	10	0,007	9	0,30	3
Danske Invest Norge II	120	0,095	11	0,007	11	0,25	9
Danske Invest Norske Aksjer Inst I	120	0,094	12	0,006	12	0,27	5
Pareto Investment Fund A	120	0,094	13	0,007	10	0,22	13
Danske Invest Norge I	120	0,093	14	0,006	14	0,26	8
Eika Norge	120	0,091	15	0,006	15	0,21	21
Fondsfinans Norge	120	0,091	16	0,006	13	0,19	25
Nordea Norge Verdi	120	0,087	17	0,006	16	0,10	44
PLUSS Aksje	120	0,087	18	0,006	17	0,16	29
Pareto Investment Fund B	120	0,086	19	0,006	18	0,19	23
Delphi Norge	120	0,082	20	0,006	19	0,14	32
Pareto Investment Fund C	120	0,081	21	0,006	20	0,18	26
Alfred Berg Norge Classic	120	0,080	22	0,005	22	0,30	2
Globus Norge II Acc	10	0,080	23	0,004	46	-0,68	69
Alfred Berg Aktiv	120	0,080	24	0,006	21	0,19	24
Storebrand Optima Norge	120	0,077	25	0,005	25	0,15	30
PLUSS Markedsverdi	120	0,075	26	0,005	23	0,23	12
Danske Invest Norske Aksjer Inst II	109	0,072	27	0,005	24	0,28	4
Carnegie Aksje Norge	120	0,069	28	0,005	28	0,22	14
Storebrand Norge	120	0,069	29	0,005	27	0,21	20
DNB Norge (I)	98	0,067	30	0,005	26	0,21	19
Storebrand Norge H	101	0,066	31	0,005	30	0,12	42
Storebrand Verdi	120	0,065	32	0,004	36	0,13	39
Nordea Kapital	120	0,064	33	0,004	31	0,22	15
DNB Norge Selektiv (II)	120	0,064	34	0,004	37	0,13	40
Nordea Avkastning	120	0,064	35	0,004	34	0,23	10
DNB Norge (III)	120	0,064	36	0,004	32	0,14	35
DNB Norge	120	0,063	37	0,004	33	0,14	37
DNB Norge (IV)	120	0,063	38	0,004	35	0,14	36
Storebrand Aksje Innland	120	0,062	39	0,004	42	0,23	11
DNB Norge Selektiv (III)	120	0,062	40	0,004	40	0,12	41
Storebrand Norge I	120	0,062	41	0,004	41	0,13	38
Storebrand Norge Institusjon	37	0,061	42	0,003	60	-0,11	67
DNB Norge Selektiv	120	0,060	43	0,004	43	0,11	43
KLP AksjeNorge	120	0,059	44	0,004	38	0,10	45
FORTE Norge	57	0,058	45	0,003	58	-0,06	64

Alfred Berg Norge +	99	0,056	46	0,004	39	0,20	22
Atlas Norge	120	0,051	47	0,004	47	0,09	46
Landkreditt Norge	115	0,051	48	0,004	44	0,07	47
DNB Norge (Avanse II)	105	0,050	49	0,004	45	0,17	28
Alfred Berg Norge Etisk	99	0,047	50	0,004	48	0,14	31
DNB Norge (Avanse I)	98	0,045	51	0,003	50	0,22	17
Terra Norge	93	0,044	52	0,003	49	0,14	33
DNB SMB	120	0,043	53	0,003	56	0,21	18
Nordea Vekst	109	0,043	54	0,003	53	0,05	52
Pareto Aksje Norge A	120	0,043	55	0,003	52	0,00	55
Danske Invest Norge Vekst	120	0,042	56	0,003	54	0,01	53
OSEBX	120	0,041	57	0,003	59	X	X
Delphi Vekst	93	0,040	58	0,003	51	0,06	51
Pareto Aksje Norge B	120	0,037	59	0,003	55	-0,01	56
Pareto Aksje Norge I	120	0,036	60	0,003	57	-0,01	57
OSEFX	120	0,035	61	0,002	62	X	X
NB Aksjefond	93	0,032	62	0,003	61	0,07	48
ODIN Norge A	120	0,024	63	0,002	63	-0,04	58
ODIN Norge C	120	0,024	64	0,002	64	-0,04	59
ODIN Norge D	120	0,023	65	0,002	65	-0,04	60
ODIN Norge B	120	0,023	66	0,002	66	-0,04	61
ODIN Norge II	118	0,020	67	0,001	68	-0,05	62
Eika SMB	93	0,019	68	0,002	67	0,00	54
Holberg Norge	120	0,017	69	0,001	69	-0,06	63
Alfred Berg Aktiv II	81	0,012	70	0,001	70	0,06	49
OSSESX	120	-0,026	71	-0,002	71	X	X
Nordea SMB	109	-0,044	72	-0,003	72	-0,08	66

*Source: own construction based on the equations for Sharpe ratio, Treynor measure and Information ratio. Input data are obtained through Morningstar Direct.*

## Appendix K: Regression output for Jensen's alpha 1-factor model

### Appendix K

The table displays gross and net regression output for Jensen's alpha. The number of observations account for the number of months of available return series for each individual fund.

1) White's adjusted standard errors    2) Standard errors corrected with Newey-West

Fund name	#Obs	Gross Returns		Net returns			Beta
		Jensen's $\alpha$	t-stat	Jensen's $\alpha$	t-stat	R <sup>2</sup>	
Globus Norge II Acc	10	-0,92 %	-1,51	-1,08 %	-1,79	0,757	0,68
Globus Norge A/I	10	-0,54 %	-0,90	-0,71 %	-1,18	0,765	0,69
Nordea SMB <sup>1</sup>	109	-0,14 %	-0,80	-0,30 %	-1,79	0,924	0,99
FORTE Norge <sup>2</sup>	57	-0,11 %	-0,48	-0,28 %	-1,19	0,762	0,94
Holberg Norge <sup>1</sup>	120	-0,09 %	-0,49	-0,22 %	-1,16	0,880	0,78
ODIN Norge C <sup>1</sup>	120	-0,05 %	-0,22	-0,21 %	-1,02	0,841	0,75
ODIN Norge II <sup>1</sup>	118	-0,07 %	-0,33	-0,15 %	-0,69	0,841	0,75
Eika SMB	93	0,03 %	0,12	-0,14 %	-0,52	0,851	0,81
Pareto Aksje Norge B <sup>1</sup>	120	0,03 %	0,15	-0,14 %	-0,64	0,849	0,78
ODIN Norge B <sup>1</sup>	120	-0,05 %	-0,22	-0,13 %	-0,62	0,841	0,75
ODIN Norge D <sup>1</sup>	120	-0,05 %	-0,22	-0,13 %	-0,62	0,841	0,75
Pareto Aksje Norge A <sup>1</sup>	120	0,06 %	0,30	-0,12 %	-0,57	0,848	0,76
ODIN Norge A <sup>1</sup>	120	-0,04 %	-0,21	-0,11 %	-0,52	0,841	0,75
Nordea Vekst	109	0,07 %	0,61	-0,10 %	-0,90	0,972	0,95
Storebrand Norge Institusjon	37	-0,08 %	-0,64	-0,10 %	-0,79	0,971	0,99
Danske Invest Norge Vekst	120	0,05 %	0,34	-0,1 %	0,927	0,917	0,85
Delphi Vekst	93	0,17 %	0,71	-0,05 %	-0,22	0,879	0,82
NB Aksjefond	93	0,13 %	0,79	-0,04 %	-0,28	0,954	0,91
Alfred Berg Aktiv II	81	0,10 %	0,60	-0,03 %	-0,16	0,962	0,95
DNB Norge Selektiv	120	0,13 %	1,33	-0,03 %	-0,28	0,973	0,98
DNB Norge (Avanse I)	98	0,13 %	2,43	-0,02 %	-0,41	0,995	0,97
Pareto Aksje Norge I <sup>1</sup>	120	0,02 %	0,11	-0,02 %	-0,08	0,847	0,79
Nordea Norge Pluss <sup>1</sup>	56	0,07 %	0,48	-0,01 %	-0,07	0,930	0,98
RF Aksjefond Acc	14	0,16 %	0,71	-0,01 %	-0,04	0,962	0,87
Storebrand Verdi <sup>1</sup>	120	0,16 %	1,50	-0,01 %	-0,07	0,968	0,97
Alfred Berg Norge Etisk	99	0,14 %	1,46	0,00 %	0,01	0,983	0,98
DNB Norge (Avanse II)	105	0,10 %	2,02	0,00 %	0,05	0,995	0,97
Atlas Norge <sup>1</sup>	120	0,11 %	1,14	0,00 %	0,04	0,976	0,95
Nordea Avkastning <sup>1</sup>	120	0,19 %	2,86	0,03 %	0,37	0,988	0,95
DNB Norge <sup>1</sup>	120	0,18 %	1,98	0,03 %	0,36	0,976	0,95
Landkreditt Norge <sup>1</sup>	115	0,19 %	1,01	0,04 %	0,23	0,895	0,83
Terra Norge <sup>1</sup>	93	0,22 %	1,39	0,05 %	0,31	0,959	0,96
DNB Norge Selektiv (II)	120	0,15 %	1,55	0,06 %	0,60	0,972	0,98
DNB Norge Selektiv (III)	120	0,14 %	1,45	0,07 %	0,75	0,972	0,96
Storebrand Aksje Innland <sup>1</sup>	120	0,14 %	2,58	0,09 %	1,63	0,993	0,97
KLP AksjeNorge <sup>1</sup>	120	0,17 %	1,19	0,09 %	0,64	0,953	0,93
DNB Norge (III) <sup>1</sup>	120	0,18 %	2,00	0,10 %	1,08	0,976	0,95
Storebrand Norge H <sup>1</sup>	101	0,13 %	1,10	0,10 %	0,87	0,975	0,99
Storebrand Norge <sup>1</sup>	120	0,23 %	2,40	0,11 %	1,09	0,977	0,96
DNB Norge (I) <sup>1</sup>	98	0,27 %	2,77	0,11 %	1,15	0,982	0,90
Nordea Kapital <sup>1</sup>	120	0,19 %	2,83	0,11 %	1,62	0,987	0,94
Storebrand Norge I <sup>1</sup>	120	0,14 %	1,41	0,12 %	1,17	0,975	0,98
DNB Norge (IV) <sup>1</sup>	120	0,18 %	1,96	0,12 %	1,29	0,976	0,91
Carnegie Aksje Norge <sup>1</sup>	120	0,23 %	2,59	0,13 %	1,46	0,980	0,95

Delphi Norge	120	0,31 %	1,87	0,14 %	0,85	0,921	0,88
Alfred Berg Norge +	99	0,20 %	2,17	0,14 %	1,53	0,984	0,96
Storebrand Optima Norge <sup>1</sup>	120	0,24 %	1,65	0,16 %	1,08	0,944	0,98
Nordea Norge Verdi <sup>1</sup>	120	0,30 %	1,84	0,17 %	1,07	0,900	0,77
Alfred Berg Aktiv	120	0,30 %	2,23	0,18 %	1,31	0,951	0,95
PLUSS Markedsverdi <sup>1</sup>	120	0,26 %	3,24	0,18 %	2,29	0,982	0,91
Eika Norge	120	0,37 %	2,66	0,20 %	1,43	0,945	0,90
Alfred Berg Norge Classic	120	0,30 %	3,59	0,20 %	2,39	0,981	0,95
Danske Invest Norge I	120	0,37 %	3,50	0,20 %	1,92	0,967	0,90
PLUSS Aksje <sup>1</sup>	120	0,31 %	2,75	0,21 %	1,86	0,960	0,83
Pareto Investment Fund A <sup>1</sup>	120	0,40 %	2,55	0,26 %	1,62	0,936	0,95
Pareto Investment Fund B <sup>1</sup>	120	0,35 %	2,20	0,27 %	1,70	0,936	0,95
Danske Invest Norge II <sup>1</sup>	120	0,38 %	3,50	0,27 %	2,53	0,966	0,89
Pareto Investment Fund C <sup>1</sup>	120	0,32 %	2,00	0,28 %	1,74	0,936	0,95
Fondsfinans Norge <sup>1</sup>	120	0,37 %	2,27	0,29 %	1,77	0,926	0,90
Handelsbanken Norge	120	0,47 %	3,23	0,30 %	2,07	0,951	1,00
Danske Invest Norske Aksjer Inst I <sup>1</sup>	120	0,38 %	3,54	0,30 %	2,84	0,967	0,90
DNB SMB	120	0,47 %	2,56	0,30 %	1,65	0,916	1,10
Swedbank Generator	63	0,45 %	1,55	0,31 %	1,07	0,806	1,09
Storebrand Vekst <sup>1</sup>	120	0,48 %	1,58	0,31 %	1,03	0,767	0,92
Alfred Berg Gambak	120	0,58 %	3,02	0,32 %	1,64	0,902	0,92
Danske Invest Norske Aksjer Inst II <sup>1</sup>	109	0,39 %	3,48	0,33 %	2,91	0,968	0,89
FORTE Trønder	35	0,58 %	1,72	0,41 %	1,22	0,523	0,69
Landkreditt Utbytte	34	0,82 %	3,10	0,69 %	2,63	0,546	0,55
Alfred Berg Norge Inst	20	0,82 %	4,63	0,76 %	4,30	0,900	0,77
Average	103,029	0,18 %	1,54	0,06 %	0,67	0,915	0,90

*Source: own construction based on the theory behind the 1-factor model for calculating Jensen's alpha. Based on return series obtained through Morningstar Direct.*

## Appendix L: Average annual fund expenses

### Appendix L

The table displays average annual expenses for the individual funds. The values are calculated as the average difference between gross and net returns in the return series. The expenses include management-, administrative-, and 12b-1 fees.

Fund name	Expenses	Fund name	Expenses
Alfred Berg Gambak	3,19 %	Nordea Norge Verdi	1,50 %
Delphi Vekst	2,71 %	Holberg Norge	1,50 %
Pareto Aksje Norge A	2,2 %	Storebrand Norge	1,50 %
NB Aksjefond	2,06 %	Atlas Norge	1,30 %
Eika SMB	2,06 %	Danske Invest Norge II	1,25 %
Terra Norge	2,05 %	Pareto Aksje Norge C	1,25 %
Eika Norge	2,04 %	Alfred Berg Norge Classic	1,20 %
Pareto Aksje Norge B	2,0 %	DNB Norge (Avanse II)	1,20 %
RF Aksjefond Acc	2,00 %	Carnegie Aksje Norge	1,20 %
RF Plussfond Acc	2,00 %	PLUSS Aksje	1,20 %
ODIN Norge C	2,00 %	DNB Norge Selektiv (II)	1,11 %
FORTE Trønder	2,00 %	DNB Norge (III)	1,02 %
FORTE Norge	2,00 %	Storebrand Optima Norge	1,00 %
Nordea Vekst	2,00 %	Nordea Kapital	1,00 %
Globus Norge A/I	2,00 %	ODIN Norge D	1,00 %
Storebrand Vekst	2,00 %	ODIN Norge B	1,00 %
Storebrand Verdi	2,00 %	Nordea Norge Pluss	1,00 %
Delphi Norge	2,00 %	Fondsfinans Norge	1,00 %
Danske Invest Norge I	2,00 %	Pareto Investment Fund B	0,95 %
Nordea Avkastning	2,00 %	KLP AksjeNorge	0,92 %
Nordea SMB	2,00 %	Danske Invest Norske Aksjer Inst I	0,90 %
Handelsbanken Norge	2,00 %	ODIN Norge II	0,90 %
Globus Norge II Acc	2,00 %	PLUSS Markedsverdi	0,90 %
DNB SMB	1,98 %	Globus Aktiv Acc	0,80 %
DNB Norge (I)	1,87 %	DNB Norge Selektiv (III)	0,80 %
DNB Norge Selektiv	1,8 %	ODIN Norge A	0,78 %
DNB Norge (Avanse I)	1,81 %	Danske Invest Norske Aksjer Inst II	0,76 %
DNB Norge	1,8 %	DNB Norge (IV)	0,75 %
Pareto Investment Fund A	1,77 %	Pareto Aksje Norge D	0,75 %
Landkreditt Norge	1,76 %	Alfred Berg Norge +	0,70 %
Danske Invest Norge Vekst	1,75 %	Alfred Berg Norge Inst	0,70 %
Alfred Berg Norge Etisk	1,71 %	Storebrand Aksje Innland	0,60 %
Swedbank Generator	1,68 %	Pareto Investment Fund C	0,50 %
Alfred Berg Aktiv II	1,57 %	Pareto Aksje Norge I	0,50 %
Alfred Berg Aktiv	1,51 %	Storebrand Norge H	0,33 %
Landkreditt Utbytte	1,50 %	Storebrand Norge I	0,28 %
Average expenses all funds	1,44 %	Storebrand Norge Institusjon	0,21 %

Source: own construction based on the return series obtained through Morningstar Direct.

## Appendix M: Carhart's 4-factor model results

### Appendix M

Gross and net regression output from Carhart's 4-factor model.

1) White's adjusted standard errors    2) Standard errors corrected with Newey-West

Fund name	#Obs	Gross									Net		R <sup>2</sup>
		Alpha	t-stat	$\beta$	si	t-stat	hi	t-stat	pi	t-stat	Alpha	t-stat	
Globus Norge II Acc	10	-1,40 %	-2,33	1,00	0,46	1,59	-0,12	-0,43	-0,12	-0,45	-1,57 %	-2,61	0,89
Globus Norge A/I	10	-1,00 %	-1,82	1,10	0,38	1,43	-0,21	-0,85	-0,28	-1,13	-1,17 %	-2,13	0,91
Holberg Norge <sup>1</sup>	120	-0,07 %	-0,36	0,87	0,23	3,34	0,04	0,68	-0,07	-1,42	-0,20 %	-1,00	0,90
ODIN Norge C <sup>1</sup>	120	-0,02 %	-0,11	0,86	0,27	4,08	0,04	0,56	-0,08	-1,74	-0,19 %	-0,92	0,86
Nordea SMB <sup>1</sup>	109	-0,02 %	-0,13	0,95	-0,09	-1,94	-0,04	-0,86	-0,10	-2,03	-0,19 %	-1,10	0,93
FORTE Norge <sup>2</sup>	57	0,03 %	0,08	0,89	-0,09	-0,92	-0,02	-0,34	-0,07	-0,60	-0,14 %	-0,38	0,77
ODIN Norge II <sup>1</sup>	118	-0,04 %	-0,19	0,85	0,26	4,01	0,04	0,61	-0,08	-1,73	-0,12 %	-0,55	0,86
ODIN Norge B <sup>1</sup>	120	-0,02 %	-0,11	0,85	0,27	4,07	0,04	0,56	-0,08	-1,74	-0,11 %	-0,52	0,86
ODIN Norge D <sup>1</sup>	120	-0,02 %	-0,11	0,85	0,27	4,07	0,04	0,56	-0,08	-1,74	-0,11 %	-0,52	0,86
Nordea Vekst	109	0,06 %	0,55	0,96	0,04	1,07	-0,01	-0,46	-0,01	-0,22	-0,10 %	-0,88	0,97
Storebrand Norge Institusjon	37	-0,08 %	-0,58	1,03	0,08	1,56	0,00	-0,12	-0,05	-1,11	-0,09 %	-0,71	0,97
ODIN Norge A <sup>1</sup>	120	-0,02 %	-0,10	0,85	0,27	4,07	0,04	0,56	-0,08	-1,74	-0,09 %	-0,42	0,86
Alfred Berg Aktiv II	81	0,04 %	0,27	1,00	0,11	1,95	-0,07	-1,39	0,06	1,42	-0,09 %	-0,51	0,97
Eika SMB	93	0,10 %	0,43	0,95	0,39	4,98	0,07	1,10	-0,19	-3,14	-0,07 %	-0,30	0,89
Delphi Vekst	93	0,17 %	0,71	0,93	0,25	3,30	0,09	1,28	-0,03	-0,55	-0,06 %	-0,26	0,89
Atlas Norge <sup>1</sup>	120	0,07 %	0,70	0,98	0,05	1,13	0,03	1,23	0,03	1,02	-0,04 %	-0,34	0,98
Alfred Berg Norge Etisk	99	0,12 %	1,17	0,99	0,01	0,30	-0,02	-0,81	0,03	1,02	-0,02 %	-0,24	0,98
Storebrand Vekst <sup>1</sup>	120	0,14 %	1,42	0,98	0,00	-0,01	0,10	2,98	0,03	1,12	-0,02 %	-0,24	0,80
NB Aksjefond	93	0,15 %	1,07	1,01	0,24	5,09	0,07	1,79	-0,08	-2,21	-0,02 %	-0,14	0,97
DNB Norge (Avanse I)	98	0,15 %	2,72	0,96	-0,01	-0,55	0,01	0,98	-0,02	-1,32	-0,003 %	-0,06	1,00
Pareto Aksje Norge A <sup>1</sup>	120	0,15 %	0,78	0,83	0,22	3,39	-0,04	-0,73	-0,14	-3,13	-0,002 %	-0,15	0,87
Pareto Aksje Norge B <sup>1</sup>	120	0,14 %	0,71	0,85	0,23	3,46	-0,03	-0,47	-0,15	-3,44	-0,002 %	-0,14	0,87
Nordea Norge Pluss <sup>1</sup>	56	0,08 %	0,43	1,02	0,10	1,65	-0,01	-0,21	-0,03	-0,72	0,001 %	0,01	0,94
RF Aksjefond Acc	14	0,18 %	0,66	1,03	0,04	0,37	-0,13	-1,25	-0,20	-2,12	0,01 %	0,04	0,98
DNB Norge Selektiv	120	0,17 %	1,70	0,96	0,01	0,18	-0,01	-0,45	-0,04	-1,69	0,01 %	0,15	0,97
DNB Norge <sup>1</sup>	120	0,17 %	1,68	0,88	-0,07	-2,08	0,00	0,05	0,03	1,09	0,02 %	0,15	0,98
DNB Norge (Avanse II)	105	0,12 %	2,35	0,97	-0,01	-0,53	0,01	0,52	-0,02	-1,55	0,02 %	0,44	0,99
Nordea Avkastning <sup>1</sup>	120	0,19 %	2,76	0,96	0,02	0,64	0,00	-0,28	0,00	-0,26	0,02 %	0,36	0,99
Terra Norge <sup>1</sup>	93	0,20 %	1,17	1,02	0,14	2,83	0,03	0,61	0,00	0,00	0,03 %	0,17	0,96
Alfred Berg Aktiv	120	0,22 %	1,22	0,99	0,06	3,30	-0,02	-1,55	0,05	2,65	0,03 %	0,26	0,96
Storebrand Norge <sup>1</sup>	120	0,17 %	1,54	0,97	0,02	0,50	-0,01	-0,50	0,05	1,90	0,04 %	0,38	0,98
Carnegie Aksje Norge <sup>1</sup>	120	0,15 %	1,83	0,95	-0,04	-1,23	-0,02	-0,63	0,07	3,69	0,05 %	0,65	0,98
DNB Norge (I) <sup>1</sup>	98	0,23 %	2,56	0,88	-0,08	-2,37	0,01	0,45	0,09	3,28	0,07 %	0,79	0,99
Alfred Berg Gambak	120	0,34 %	1,92	1,04	0,25	4,21	-0,08	-1,69	0,14	3,17	0,07 %	0,41	0,92
Delphi Norge	120	0,24 %	1,45	0,95	0,15	2,71	0,05	1,12	0,03	0,72	0,07 %	0,45	0,93
DNB Norge (III) <sup>1</sup>	120	0,17 %	1,70	0,88	-0,07	-2,07	0,00	0,04	0,03	1,08	0,08 %	0,83	0,98
Storebrand Norge I <sup>1</sup>	120	0,14 %	2,52	0,98	0,01	0,73	0,00	-0,30	0,00	-0,30	0,09 %	1,60	0,98
Pareto Aksje Norge I <sup>1</sup>	120	0,13 %	0,65	0,86	0,23	3,47	-0,03	-0,44	-0,15	-3,39	0,09 %	0,44	0,87
DNB Norge Selektiv (II)	120	0,19 %	1,90	0,95	0,01	0,17	-0,01	-0,33	-0,04	-1,61	0,10 %	0,99	0,97
DNB Norge (IV) <sup>1</sup>	120	0,16 %	1,67	0,88	-0,07	-2,08	0,00	0,03	0,03	1,07	0,10 %	1,04	0,98
Alfred Berg Norge +	99	0,16 %	1,74	0,98	0,05	1,81	-0,02	-0,65	0,03	1,06	0,10 %	1,11	0,99
Storebrand Norge H <sup>1</sup>	101	0,14 %	1,16	1,02	0,06	2,18	0,00	0,12	-0,04	-1,16	0,11 %	0,93	0,98
Landkreditt Norge <sup>1</sup>	115	0,26 %	1,33	0,88	0,13	2,06	0,06	1,13	-0,08	-1,44	0,11 %	0,58	0,90
DNB Norge Selektiv (III)	120	0,18 %	1,80	0,96	0,01	0,15	-0,01	-0,42	-0,04	-1,65	0,11 %	1,14	0,97
Nordea Kapital <sup>1</sup>	120	0,20 %	2,77	0,95	0,01	0,28	-0,01	-0,42	-0,01	-0,40	0,12 %	1,61	0,99
KLP AksjeNorge <sup>1</sup>	120	0,20 %	1,34	0,95	0,05	0,81	0,01	0,18	-0,04	-1,09	0,12 %	0,82	0,95
Alfred Berg Norge Classic	120	0,16 %	2,67	1,01	0,14	2,30	-0,06	-0,71	0,08	2,50	0,12 %	1,46	0,98
Storebrand Optima Norge <sup>1</sup>	120	0,15 %	1,36	1,01	0,06	2,30	0,00	-0,05	-0,02	-0,87	0,13 %	1,14	0,95
Storebrand Aksje Innland <sup>1</sup>	120	0,23 %	1,48	1,03	0,11	2,61	-0,01	-0,26	-0,02	-0,54	0,15 %	0,94	0,99
Handelsbanken Norge	120	0,35 %	2,49	1,08	0,18	3,78	-0,06	-1,59	0,05	1,50	0,18 %	1,31	0,96
PLUSS Markedsverdi <sup>1</sup>	120	0,27 %	3,34	0,89	-0,06	-2,34	0,01	0,45	0,01	0,37	0,19 %	2,39	0,98



Danske Invest Norge Vekst	120	0,36 %	3,00	0,93	0,06	1,51	0,03	0,92	0,00	-0,03	0,19 %	1,61	0,92
Danske Invest Norge I	120	0,11 %	3,28	0,88	0,10	1,57	-0,05	0,89	-0,08	-0,03	0,19 %	1,76	0,97
Pareto Investment Fund A <sup>1</sup>	120	0,35 %	2,17	0,95	0,01	0,19	-0,05	-1,11	0,04	0,98	0,20 %	1,24	0,94
PLUS Aksje <sup>1</sup>	120	0,31 %	2,74	0,80	-0,11	-2,68	0,02	0,57	0,03	1,11	0,21 %	1,84	0,96
Pareto Investment Fund B <sup>1</sup>	120	0,29 %	1,82	0,95	0,01	0,18	-0,05	-1,10	0,04	1,01	0,21 %	1,32	0,94
Pareto Investment Fund C <sup>1</sup>	120	0,26 %	1,62	0,95	0,01	0,18	-0,05	-1,09	0,04	1,03	0,22 %	1,36	0,94
Eika Norge	120	0,40 %	3,15	0,99	0,23	5,30	0,05	1,51	-0,08	-2,44	0,23 %	1,82	0,96
Danske Invest Norske Aksjer Inst I <sup>1</sup>	120	0,37 %	3,01	0,92	0,05	1,37	0,03	0,94	0,00	-0,02	0,26 %	2,16	0,97
Danske Invest Norge II <sup>1</sup>	120	0,35 %	2,96	0,92	0,02	0,43	0,03	1,04	0,02	0,83	0,28 %	2,33	0,97
Nordea Norge Verdi <sup>1</sup>	120	0,42 %	2,73	0,83	0,17	3,17	0,11	2,60	-0,13	-4,11	0,29 %	1,91	0,92
Danske Invest Norske Aksjer Inst II <sup>1</sup>	109	0,38 %	3,00	0,91	0,02	0,58	0,03	0,94	0,01	0,50	0,31 %	2,49	0,97
Fondsfinans Norge <sup>1</sup>	120	0,42 %	2,48	0,94	0,12	1,82	0,01	0,19	-0,07	-1,62	0,34 %	1,99	0,93
DNB SMB <sup>1</sup>	120	0,52 %	2,81	1,05	-0,15	-3,02	-0,06	-1,10	-0,04	-0,85	0,35 %	1,91	0,92
Storebrand Verdi <sup>1</sup>	120	0,56 %	1,93	0,98	0,24	2,35	-0,25	-2,77	-0,17	-2,28	0,40 %	1,36	0,97
Swedbank Generator	63	0,53 %	1,65	1,15	0,13	1,12	0,09	0,97	-0,06	-0,74	0,40 %	1,24	0,81
Landkreditt Utbytte	34	0,54 %	1,66	0,72	0,25	2,24	0,14	1,94	0,06	0,84	0,41 %	1,27	0,65
Alfred Berg Norge Inst	20	0,49 %	2,07	0,94	0,17	2,14	0,00	-0,05	0,08	1,71	0,44 %	1,82	0,93
FORTE Trønder	35	1,06 %	2,47	0,59	-0,05	-0,34	-0,11	-1,19	-0,16	-1,91	0,89 %	2,08	0,59
Average	103,03	0,172 %	1,46	0,94	0,10	1,36	-0,01	0,05	-0,03	-0,37	0,055 %	0,58	0,929

*Source: own construction based on the theory behind Carhart's 4-factor model. Based on return series obtained through Morningstar Direct.*

## Appendix N: Regression out for the Treynor-Mazuy market timing model

### Appendix N

Gross and net regression output for the Treynor-Mazuy model for market timing ability.

1) White's adjusted standard errors    2) Standard errors corrected with Newey-West

Fund name	#obs	Gross			Net			R <sup>2</sup>
		Alpha	tstat	Gamma	tstat	Alpha	tstat	
Globus Norge II Acc	10	-0,84 %	-1,03	-0,49	-0,15	-1,01 %	-1,24	0,76
Globus Norge A/I	10	-0,57 %	-0,70	0,16	0,05	-0,73 %	-0,90	0,77
FORTE Norge <sup>2</sup>	57	-0,47 %	-1,95	2,06	2,18	-0,64 %	-2,64	0,78
Holberg Norge <sup>1</sup>	120	-0,28 %	-1,43	0,38	1,45	-0,41 %	-2,07	0,89
Nordea SMB <sup>1</sup>	109	-0,13 %	-0,66	-0,02	-0,09	-0,30 %	-1,52	0,92
Landkreditt Norge <sup>1</sup>	115	-0,11 %	-0,54	0,60	4,04	-0,26 %	-1,28	0,91
Eika SMB	93	-0,06 %	-0,20	0,15	0,69	-0,23 %	-0,77	0,85
ODIN Norge C <sup>1</sup>	120	-0,05 %	-0,21	0,01	0,04	-0,22 %	-0,91	0,84
Nordea Vekst	109	-0,05 %	-0,41	0,22	2,28	-0,22 %	-1,80	0,97
Atlas Norge <sup>1</sup>	120	-0,07 %	-0,73	0,37	3,05	-0,18 %	-1,78	0,98
ODIN Norge II <sup>1</sup>	118	-0,08 %	-0,33	0,02	0,08	-0,16 %	-0,64	0,84
DNB Norge <sup>1</sup>	120	0,00 %	0,05	0,36	3,10	-0,15 %	-1,65	0,98
NB Aksjefond	93	0,03 %	0,18	0,16	1,20	-0,14 %	-0,78	0,95
Pareto Aksje Norge B <sup>1</sup>	120	0,03 %	0,13	0,00	0,01	-0,14 %	-0,58	0,85
ODIN Norge B <sup>1</sup>	120	-0,05 %	-0,21	0,01	0,04	-0,13 %	-0,57	0,84
ODIN Norge D <sup>1</sup>	120	-0,05 %	-0,21	0,01	0,04	-0,13 %	-0,56	0,84
Danske Invest Norge Vekst	120	0,01 %	0,08	0,08	0,55	-0,13 %	-0,74	0,92
ODIN Norge A <sup>1</sup>	120	-0,05 %	-0,20	0,01	0,04	-0,11 %	-0,48	0,84
DNB Norge Selektiv	120	0,04 %	0,39	0,19	1,88	-0,11 %	-1,05	0,97
Terra Norge <sup>1</sup>	93	0,06 %	0,37	0,26	1,44	-0,11 %	-0,64	0,96
Alfred Berg Aktiv II	81	0,03 %	0,17	0,11	0,78	-0,10 %	-0,50	0,96
Pareto Aksje Norge A <sup>1</sup>	120	0,09 %	0,38	-0,05	-0,16	-0,09 %	-0,39	0,85
DNB Norge (I) <sup>1</sup>	98	0,07 %	0,76	0,34	2,88	-0,09 %	-0,94	0,99
DNB Norge (III) <sup>1</sup>	120	0,01 %	0,11	0,35	2,99	-0,08 %	-0,85	0,98
Delphi Vekst	93	0,14 %	0,53	0,05	0,24	-0,07 %	-0,27	0,88
DNB Norge (Avanse I)	98	0,08 %	1,35	0,09	1,95	-0,07 %	-1,24	1,00
Nordea Norge Pluss <sup>1</sup>	56	0,02 %	0,10	0,33	0,41	-0,07 %	-0,42	0,93
DNB Norge (IV) <sup>1</sup>	120	0,01 %	0,06	0,35	2,96	-0,06 %	-0,64	0,98
Nordea Avkastning <sup>1</sup>	120	0,11 %	1,51	0,16	1,98	-0,06 %	-0,75	0,99
KLP AksjeNorge <sup>1</sup>	120	0,02 %	0,15	0,29	0,70	-0,05 %	-0,37	0,96
DNB Norge (Avanse II)	105	0,05 %	0,96	0,09	2,04	-0,05 %	-0,84	0,99
DNB Norge Selektiv (II)	120	0,06 %	0,55	0,21	2,00	-0,04 %	-0,34	0,97
PLUSS Aksje <sup>1</sup>	120	0,06 %	0,58	0,48	2,73	-0,04 %	-0,32	0,97
Storebrand Verdi <sup>1</sup>	120	0,14 %	1,25	0,04	0,19	-0,03 %	-0,23	0,97
Alfred Berg Norge Etisk	99	0,13 %	1,14	0,03	0,38	-0,02 %	-0,16	0,98
DNB Norge Selektiv (III)	120	0,05 %	0,49	0,20	1,89	-0,02 %	-0,14	0,97
Pareto Aksje Norge I <sup>1</sup>	120	0,03 %	0,14	-0,02	-0,07	-0,01 %	-0,04	0,85
Storebrand Norge Institusjon	37	0,02 %	0,11	-0,52	-1,17	0,00 %	-0,01	0,97
Nordea Kapital <sup>1</sup>	120	0,10 %	1,37	0,19	2,20	0,02 %	0,24	0,99
PLUSS Markedsverdi <sup>1</sup>	120	0,12 %	1,53	0,26	2,62	0,05 %	0,61	0,98
Delphi Norge	120	0,22 %	1,26	0,16	1,10	0,06 %	0,32	0,92
Carnegie Aksje Norge <sup>1</sup>	120	0,18 %	1,90	0,09	0,54	0,08 %	0,86	0,98
Danske Invest Norge I	120	0,25 %	2,23	0,24	2,53	0,09 %	0,75	0,97
Fondsfinans Norge <sup>1</sup>	120	0,17 %	1,00	0,40	1,56	0,09 %	0,52	0,93
Storebrand Aksje Innland <sup>1</sup>	120	0,15 %	2,56	-0,03	-0,17	0,10 %	1,69	0,99

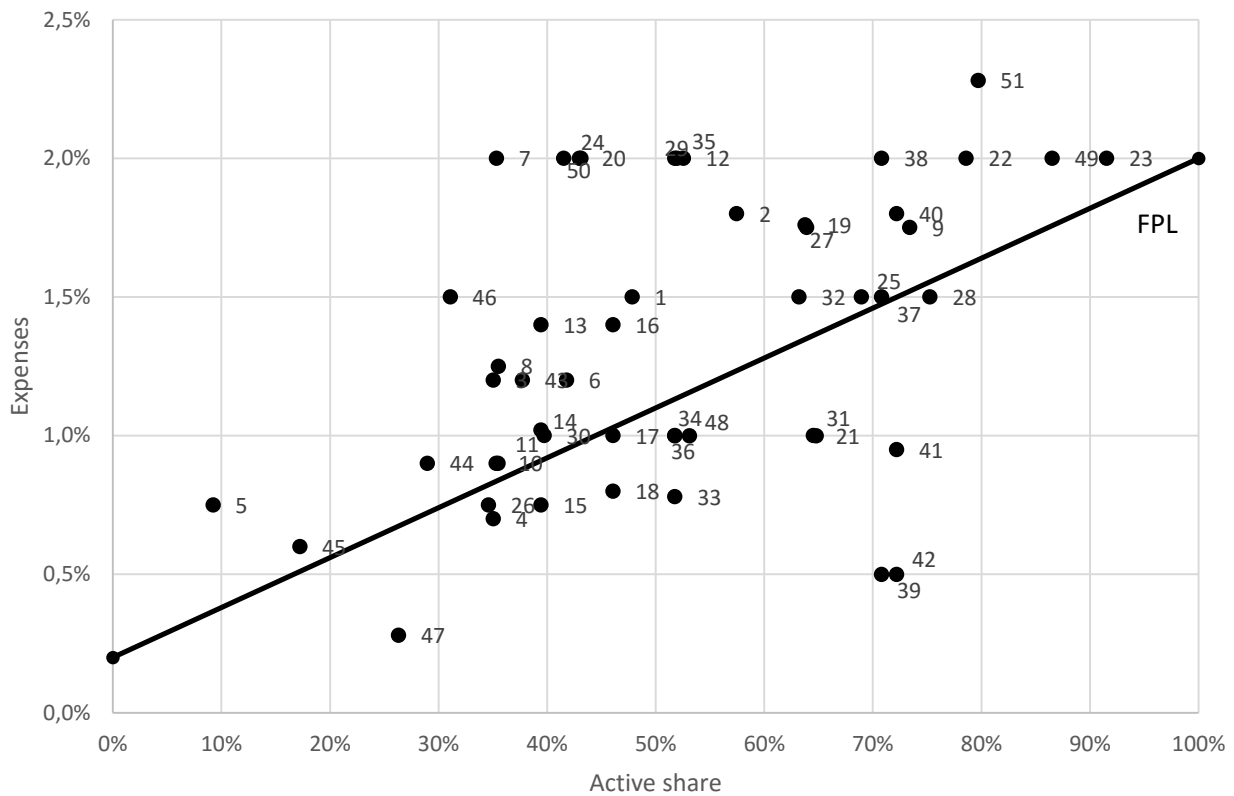
RF Aksjefond Acc	14	0,27 %	0,90	-0,73	-0,58	0,11 %	0,35	0,96
Storebrand Norge <sup>1</sup>	120	0,25 %	2,59	-0,05	-0,27	0,13 %	1,32	0,98
Eika Norge	120	0,30 %	1,98	0,13	1,05	0,13 %	0,86	0,95
Danske Invest Norge II <sup>1</sup>	120	0,24 %	2,22	0,27	2,59	0,14 %	1,25	0,97
Danske Invest Norske Aksjer Inst II <sup>1</sup>	109	0,22 %	2,02	0,34	3,09	0,15 %	1,41	0,97
Danske Invest Norske Aksjer Inst I <sup>1</sup>	120	0,23 %	2,16	0,29	3,08	0,16 %	1,47	0,97
Storebrand Norge H <sup>1</sup>	101	0,19 %	1,52	-0,11	-0,36	0,16 %	1,29	0,98
Alfred Berg Norge +	99	0,22 %	2,16	-0,04	-0,49	0,16 %	1,59	0,98
Nordea Norge Verdi <sup>1</sup>	120	0,30 %	1,72	0,00	0,00	0,17 %	1,00	0,90
Storebrand Norge I <sup>1</sup>	120	0,20 %	1,95	-0,14	-0,50	0,18 %	1,72	0,98
Alfred Berg Aktiv	120	0,31 %	2,11	-0,02	-0,17	0,19 %	1,27	0,95
Storebrand Optima Norge <sup>1</sup>	120	0,32 %	1,99	-0,17	-0,48	0,23 %	1,47	0,95
Alfred Berg Norge Classic	120	0,34 %	3,73	-0,08	-1,06	0,24 %	2,63	0,98
FORTE Trønder	35	0,43 %	1,02	1,77	0,61	0,26 %	0,63	0,53
Pareto Investment Fund A <sup>1</sup>	120	0,46 %	2,68	-0,11	-0,80	0,31 %	1,83	0,94
Pareto Investment Fund B <sup>1</sup>	120	0,41 %	2,32	-0,12	-0,48	0,33 %	1,87	0,94
Pareto Investment Fund C <sup>1</sup>	120	0,38 %	2,15	-0,12	0,49	0,34 %	1,91	0,94
DNB SMB	120	0,57 %	2,80	-0,30	-1,17	0,41 %	1,99	0,92
Handelsbanken Norge	120	0,60 %	3,86	-0,27	-2,09	0,43 %	2,79	0,95
Storebrand Vekst <sup>1</sup>	120	0,67 %	1,93	-0,42	-0,76	0,50 %	1,45	0,77
Alfred Berg Gambak	120	0,76 %	3,63	-0,35	-2,01	0,51 %	2,43	0,91
Swedbank Generator	63	0,68 %	2,03	-1,30	-1,34	0,54 %	1,59	0,81
Alfred Berg Norge Inst	20	1,01 %	4,70	-2,26	-1,50	0,96 %	4,43	0,91
Landkreditt Utbytte	34	1,30 %	4,31	-5,53	-2,68	1,17 %	3,90	0,63
Average	103	0,15 %	1,06	-0,01	0,69	0,03 %	0,24	0,92

Source: own construction based on the theory behind the Treynor-Mazuy market timing model. Based on return series obtained through Morningstar Direct.

## Appendix O: The fair price line as of December 2015

### Appendix O

The 51 existing funds in the sample as of December 2015, plotted against the fair price line. Expenses are in annual terms.



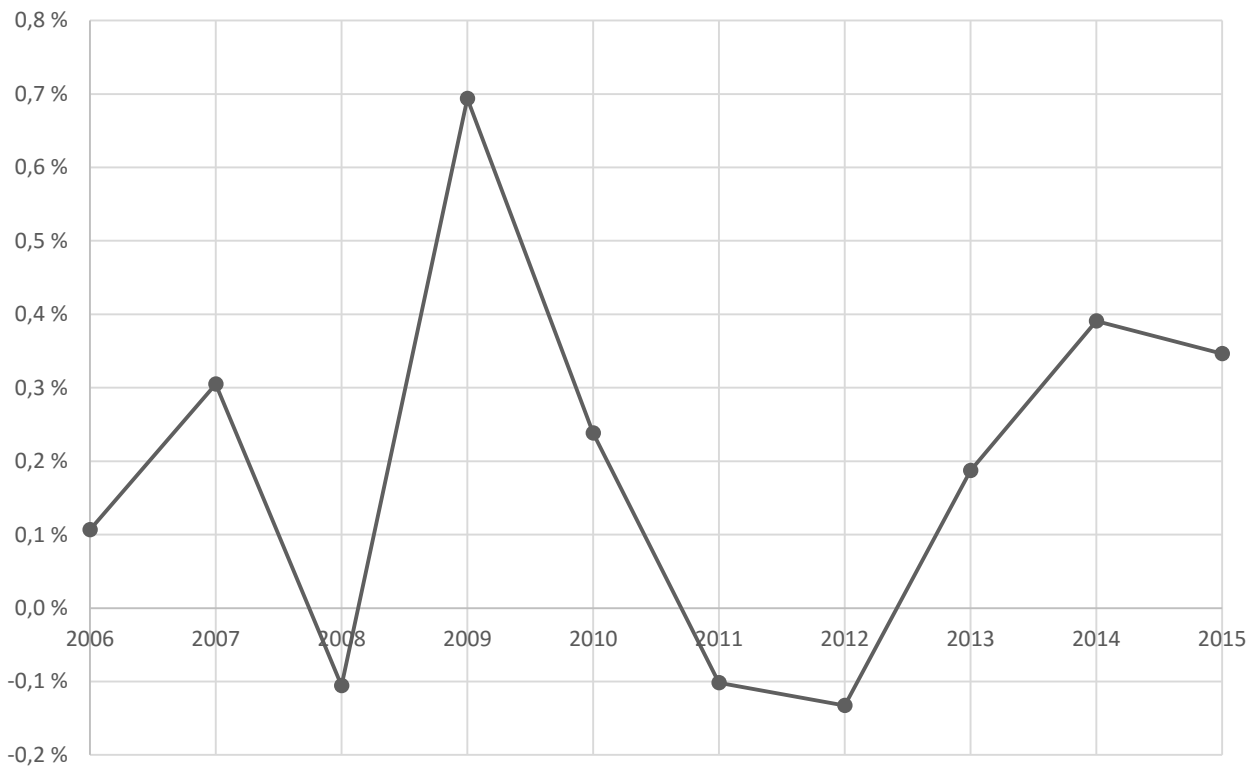
Fund name	#	Fund name	#	Fund name	#
Alfred Berg Aktiv	1	DNB Norge Selektiv (III)	18	ODIN Norge C	35
Alfred Berg Gambak	2	DNB SMB	19	ODIN Norge D	36
Alfred Berg Norge Classic	3	Eika Norge	20	Pareto Aksje Norge A	37
Alfred Berg Norge Inst	4	Fondsfinans Norge	21	Pareto Aksje Norge B	38
Atlas Norge	5	FORTE Norge	22	Pareto Aksje Norge I	39
Carnegie Aksje Norge	6	FORTE Trønder	23	Pareto Investment Fund A	40
Danske Invest Norge I	7	Handelsbanken Norge	24	Pareto Investment Fund B	41
Danske Invest Norge II	8	Holberg Norge	25	Pareto Investment Fund C	42
Danske Invest Norge Vekst	9	KLP AksjeNorge	26	PLUSS Aksje	43
Danske Invest Norske Aksjer Inst I	10	Landkreditt Norge	27	PLUSS Markedsverdi	44
Danske Invest Norske Aksjer Inst II	11	Landkreditt Utbytte	28	Storebrand Aksje Innland	45
Delphi Norge	12	Nordea Avkastning	29	Storebrand Norge	46
DNB Norge	13	Nordea Kapital	30	Storebrand Norge I	47
DNB Norge (III)	14	Nordea Norge Pluss	31	Storebrand Optima Norge	48
DNB Norge (IV)	15	Nordea Norge Verdi	32	Storebrand Vekst	49
DNB Norge Selektiv	16	ODIN Norge A	33	Storebrand Verdi	50
DNB Norge Selektiv (II)	17	ODIN Norge B	34	Swedbank Generator	51

Source: own construction, based on the FPL introduced by Riksen (2015).

## Appendix P: Trailing average 1-year Jensen's alphas

### Appendix P

The figure shows trailing monthly gross alphas for each year, in the period from January 2006 to December 2015. Calculated with Jensen's alpha 1-factor model. Each data point displays the average monthly alpha for the entire sample of funds, in the respective year.



Source: own construction, based on return series retrieved from Morningstar Direct.

## Appendix Q: Trailing 1-year Jensen's alphas

### Appendix Q

The table displays gross annual Jensen's alpha results for every fund, in each respective year. In the period from January 2006 to December 2015.

Fund Name	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006
Alfred Berg Aktiv	0,13	0,14	0,02	0,02	-0,08	0,06	0,05	-0,03	0,05	-0,04
Alfred Berg Aktiv II	X	X	X	X	-0,07	0,06	0,06	-0,04	0,05	-0,04
Alfred Berg Gambak	0,16	0,22	0,08	0,02	-0,07	0,10	0,16	-0,03	0,17	0,00
Alfred Berg Norge +	X	X	0,01	0,02	-0,01	0,06	0,04	0,00	0,08	-0,02
Alfred Berg Norge Classic	0,08	0,11	0,01	0,02	-0,01	0,06	0,06	0,00	0,08	-0,02
Alfred Berg Norge Etisk	X	X	0,01	0,02	-0,05	0,04	0,03	0,04	0,07	-0,03
Alfred Berg Norge Inst	0,08	X	X	X	X	X	X	X	X	X
Atlas Norge	0,00	0,00	0,00	0,02	-0,05	-0,04	0,06	-0,03	0,07	-0,02
Carnegie Aksje Norge	0,03	0,08	-0,02	0,00	0,02	0,03	0,00	0,01	0,05	0,01
Danske Invest Norge I	0,03	0,04	-0,03	0,04	0,02	0,04	0,04	0,06	0,05	0,01
Danske Invest Norge II	0,03	0,04	-0,03	0,04	0,02	0,05	0,04	0,06	0,05	0,01
Danske Invest Norge Vekst	0,08	-0,04	-0,09	-0,04	0,09	-0,02	0,15	-0,14	-0,04	-0,01
Danske Invest Norske Aksjer Inst I	0,03	0,04	-0,03	0,04	0,02	0,02	0,06	0,06	0,05	0,05
Danske Invest Norske Aksjer Inst II	0,03	0,04	-0,03	0,04	0,02	0,04	0,03	0,05	0,05	X
Delphi Norge	-0,01	0,09	0,13	-0,03	-0,01	0,04	0,14	-0,08	0,08	-0,06
Delphi Vekst	X	X	X	-0,11	-0,01	0,07	0,08	-0,05	0,08	0,02
DNB Norge (IV)	-0,03	-0,01	0,01	-0,05	0,06	0,00	0,08	0,02	0,05	0,00
DNB Norge Selektiv (III)	-0,04	0,00	-0,02	-0,03	0,05	0,03	0,04	-0,02	0,07	0,01
DNB SMB	0,15	-0,01	0,00	-0,04	0,10	0,05	0,21	0,17	0,05	-0,01
Eika Norge	0,02	0,05	0,07	0,01	-0,07	-0,01	0,15	-0,07	0,08	0,17
Eika SMB	X	X	X	0,00	-0,14	0,06	0,17	-0,13	-0,04	-0,05
Fondsfinans Norge	0,00	0,04	-0,02	-0,01	0,02	0,02	0,13	0,07	0,10	-0,01
FORTE Norge	0,05	-0,01	0,00	-0,14	X	X	X	X	X	X
FORTE Trønder	0,13	0,10	X	X	X	X	X	X	X	X
Handelsbanken Norge	0,17	0,19	0,10	0,00	-0,06	0,01	0,03	0,04	0,11	0,05
Holberg Norge	-0,01	-0,03	0,09	-0,10	-0,09	-0,09	0,07	-0,10	0,00	0,01
KLP AksjeNorge	0,00	0,05	-0,01	-0,05	0,00	0,04	0,02	-0,05	0,05	0,00
Landkreditt Norge	-0,02	0,02	0,04	-0,10	-0,09	0,03	0,11	0,03	0,07	X
Landkreditt Utbytte	0,08	0,16	X	X	X	X	X	X	X	X
NB Aksjefond	X	X	X	0,01	-0,08	-0,01	0,17	-0,11	0,01	0,03
Nordea Avkastning	0,03	0,02	0,01	-0,02	0,03	0,03	0,06	-0,02	0,03	0,01
Nordea Kapital	0,03	0,02	0,01	-0,02	0,03	0,04	0,06	-0,02	0,03	0,02
Nordea Norge Pluss	0,03	0,00	0,03	-0,05	X	X	X	X	X	X
Nordea Norge Verdi	0,02	0,03	0,07	0,03	0,08	0,07	0,07	-0,19	0,01	0,13
Nordea SMB	X	-0,17	-0,08	-0,06	0,10	0,00	0,05	0,16	-0,05	0,06
Nordea Vekst	X	0,02	0,02	-0,02	0,02	0,03	0,08	-0,07	-0,06	-0,03
ODIN Norge C	0,05	0,10	-0,03	-0,04	-0,11	0,07	0,03	-0,15	-0,03	0,03
ODIN Norge II	X	0,10	-0,03	-0,05	-0,11	0,06	0,03	-0,15	-0,03	0,03
Pareto Aksje Norge I	-0,12	-0,01	-0,01	0,03	-0,06	0,09	0,21	-0,09	0,00	0,10
Pareto Investment Fund A	0,17	0,15	0,07	0,08	0,00	-0,01	0,00	0,04	0,05	-0,02
PLUSS Aksje	0,02	0,06	0,00	-0,01	0,04	0,02	0,09	0,06	0,02	-0,06
PLUSS Markedsverdi	0,02	0,03	-0,02	0,00	0,01	0,02	0,10	0,07	0,00	0,01
RF Aksjefond Acc	X	X	X	X	X	X	X	X	X	0,03
Storebrand Aksje Innland	-0,01	0,04	0,01	-0,01	0,00	0,01	0,04	0,02	0,03	0,04
Storebrand Norge	0,00	0,07	0,04	-0,02	0,01	0,01	0,07	0,00	0,05	0,04
Storebrand Norge H	X	X	0,01	-0,03	-0,03	0,01	0,09	-0,01	0,04	0,05
Storebrand Norge I	-0,03	0,07	0,01	-0,03	-0,03	0,01	0,07	0,00	0,04	0,06
Storebrand Norge Institusjon	X	X	0,01	-0,03	-0,03	X	X	X	X	X
Storebrand Optima Norge	0,01	0,06	0,15	-0,03	-0,03	0,02	0,08	0,00	0,03	0,05
Storebrand Vekst	0,15	-0,02	0,33	-0,08	0,10	0,09	0,22	-0,08	-0,05	0,00
Storebrand Verdi	0,03	0,05	0,00	-0,01	-0,02	-0,02	0,06	0,07	0,07	0,01
Swedbank Generator	0,11	0,05	0,04	0,04	-0,02	X	X	X	X	X
Terra Norge	X	X	X	0,01	-0,08	-0,01	0,16	0,06	0,00	-0,06

Source: own construction, based on return series retrieved from Morningstar Direct.