Master's thesis

NTNU
Norwegian University of Science and Technology
Faculty of Economics and Management
NTNU Business School

Hakar Gilli

Do Norwegian equity funds manage to create excess returns beyond the market?

An emperical study of the Norwegian equity fund market

Master's thesis in Economics and Business Administration - Major in Finance
Supervisor: Stein Frydenberg
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Preface

This thesis amounts to 30 credits and is the last and final part of the master's program in economics and business administration with major in finance at NTNU Business School in Trondheim. I started investing in equity funds in 2016, and since then this has been a very interesting field for me. Therefore, I choose to immerse myself in the Norwegian fund market. I knew a lot about equity funds before I wrote this thesis but have learned an incredible amount where I have gained a deeper professional understanding of equity funds. The process of writing the assignment has at times been very demanding, but at the same time incredibly fun, educational, and exciting.

I would like to thank my supervisor Stein Frydenberg, who has been a very competent and skilled supervisor who has been available and supportive, as well as come up with good objections to improving this thesis.

The content of this thesis is at the author's expense.

Hakar Gilli

Abstract

The purpose of this thesis is to investigate whether Norwegian active equity funds manage to create excess returns beyond the market, whether any excess returns are due to skill or luck, see how active Norwegian equity funds are, and which funds are the best as of 2021. The analysis contains 26 actively managed equity funds with domestic investments in the period 28.02.2016-28.02.2021.

The results from the descriptive statistics show that only 11 of the total 26 funds have managed to create a higher return than the market. In the analysis section, linear regression is used to examine the funds' alpha values. The results from the CAPM show that 12 of the funds have positive alpha values, which tells that they have an excess return adjusted for systematic risk. In the Fama & French three-factor model and Carhart's four-factor model, the results for the abnormal returns are similar to those in CAPM. Only 2 funds have significant SMB values, which means some of their returns can be explained by tilting towards small companies. The rest of the funds have SMB factors close to zero, none of which are significant. The HML and PR1YR shows non-significant values close to zero, which indicates that tilting towards value companies and momentum investments cannot explain any of the returns to the funds.

To investigate whether the excess returns is caused by the managers 'capabilities or risky investments, the funds' performance is evaluated through risk-adjusted performance targets sharpe ratio, information ratio and treynor ratio. Only 9 funds have a higher sharpe ratio than the benchmark index. The information ratio shows that 12 funds have managed to create an excess return beyond the market in relation to active risk. The Treynor ratio explains how well the managers' investments compensate for the risk. Only 11 funds have a higher treynor ratio than the market, whereas none of these are particularly high, while the sample on average performs the same as the market. Active share, tracking error and adjusted R^2 show that there are indications of closet indexing in the sample.

The majority of the funds has done worse than the market, but the funds in average still manage to create excess returns beyond the market. Taking the risk adjusted measures to consideration, the funds underperform the market on average. The funds that have performed the best during the period are Forte Norge, followed by Holberg Norge A and Delphi Norge A. The funds that have performed the worst are Pareto Investment Fund A, followed by First Generator S and Pluss Aksje Fondsforvaltning.

Sammendrag

Oppgaven tar utgangspunkt i hvorvidt norske aksjefond klarer å skape meravkastning utover markedet. Analysen inneholder 26 aktive aksjefond med innenlandske investeringer i perioden 28.02.2016-28.02.2021. Hensikten er å undersøke om norske forvaltere klarer å skape meravkastning utover markedet, om en eventuell meravkastning skyldes dyktighet eller flaks, se hvor aktive norske aksjefond er, og hvilke fond som er de beste pr. 2021.

Resultatene fra den deskriptive statistikken viser at kun 11 av totalt 26 fond har klart å skape høyere avkastning enn markedet for perioden. I analysen blir det benyttet lineær regresjon for å undersøke fondenes alfaverdier. Resultatene fra kapitalverdimodellen viser at 12 av fondene har positive alfaverdier, og med dette en meravkastning justert for systematisk risiko. I Fama & French trefaktormodell og Carharts firefaktormodell er resultatene for den unormale avkastningen tilsvarende lik som for kapitalverdimodellen. Kun to fond har signifikante SMB verdier, og noe av deres avkastning kan derfor forklares av tilting mot små selskaper. Resten av fondene har SMB verdier nær null, hvor ingen av disse er signifikante. HML og PR1YR gir ikke signifikante verdier nær null, noe som tyder på at tilting mot verdiselskaper og momentumsinvesteringer ikke kan forklare noe av avkastningen til fondene for perioden.

For å undersøke om meravkastningen er forårsaket av forvalternes evner eller risikofylte plasseringer, evalueres fondenes prestasjoner gjennom de risikojusterte prestasjonsmålene sharpe ratio, information ratio og treynor ratio. Kun 9 av fondene har en høyere sharpe ratio enn referanseindeksen. Informasjonsraten viser at 12 av fondene har klart å skape en meravkastning utover markedet i forhold til aktiv risiko. Treynor ratioen forklarer hvor godt forvalternes investeringer kompenserer for risikoen. Kun 11 fond har høyere treynor ratio enn referanseindeksen, mens utvalget i gjennomsnitt presterer likt som markedet. Aktiv andel, tracking error og justert R^2 viser at det finnes fond som kan settes i kategori for skapindeksering.

Majoriteten av fondsutvalget har gjort det dårligere enn markedet, men utvalget har i gjennomsnitt klart å skape meravkastning utover markedet. Tar vi de risikojusterte avkastningsmålene i betraktning, viser disse at fondsutvalget i gjennomsnitt ikke klarer å prestere bedre enn markedet. De fondene som har prestert best for perioden er Forte Norge, etterfulgt av Holberg Norge A og Delphi Norge A. Fondene som har prestert dårligst er Pareto Investment Fund A, etterfulgt av First Generator S og Pluss Aksje Fondsforvaltning.

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1.0 **Introduction**

1.1 **Background**

In recent years, the Norwegian fund market has experienced a major expansion (VFF, 2021h). More new and complex types of funds are being created and introduced to the market. According to the Norwegian Association of Mutual Funds (2021h) so far this year, as of 14 April, Norwegian retail customers have invested more than NOK 8.9 billion in equity funds, and there has never been as high a subscription in equity funds as in the first quarter of this year (VFF, 2021h). This shows that savings in equity funds are increasing at record speeds.

Furthermore, record low interest rates in recent years and especially now during the ongoing corona pandemic have resulted in Norwegians looking for other alternatives to bank deposits for saving money, as Oslo stock exchange had a year with record growth in new shareholders (DN, 2020). This despite the fact Bessembinder, Chen, Choi and Wei (2020) recently proved that 56.6% US stocks and 61.3% non-US stocks under-perform one-month U.S. Treasury bills in terms of compound returns over the full sample. I work in investment banking, and as a fund enthusiast, I constantly get questions from family, friends and acquaintances: “which fund is the best?” or “which fund should I invest in?”.

When it comes to equity funds, the most central question is often whether it is most profitable to invest in actively or passively managed equity funds. In active funds, the manager of the fund tries to create excess returns through its own analyses, while passive funds try to follow the general development in a market. Active funds can cost more than 10 times as much as passively managed funds, and Norwegian banks traditionally recommend their customers to invest in actively managed funds, as they earn more on their active funds compared to their passively managed funds. A survey conducted by Forbrukerrådet (2018) shows that 54% of customers choose an active fund after a conversation with the bank, and about 94% of retail customers' equity funds at the time were in actively managed equity funds. In addition to this, Norwegians spend big amounts of their tax money every single year on financing active management of e.g., the Government Pension Fund Global (NBIM, 2018). It will therefore be very interesting to investigate and get answers on whether active management in Norway pays off, or whether it is "wasted" money.

We are only going back six years, to 2015, when the Norwegian Financial Supervisory Authority conducted investigations of the equity fund DNB Norge (Forbrukerrådet, 2021).

The investigations revealed that DNB Norge was managed as a cheap index fund, when in reality they pretended to be an actively managed fund. This means that they presented and marketed the fund as an actively managed fund, took six times as high management fees as the bank's corresponding Norwegian index fund, but managed it as a passive index fund. According to Forbrukerrådet (2021), they have been very close to the fund's benchmark index for the period 2010-2014. This is a typical case of what we call closet-indexing. Forbrukerrådet hereby sued DNB, claiming to have over-charged approx. 137,000 small investors who in total are said to have lost approx. NOK 750 million by having paid too high fees for managing their savings. On 27 February 2020, DNB lost in the Supreme Court and was sentenced to repay NOK 350 million to its investors (Forbrukerrådet, 2021).

This makes the topic “closet indexing" interesting, as there is generally little media attention around this, at the same time as it occurs. As this appears in one of Norway's largest fund providers, there is little to suggest that this is not happening in other funds with other providers as well.

The aim of this study is to be able to provide an answer to whether active managers in Norway are able to create excess returns beyond the market. Because even though there are several studies on the topic before, it will be interesting to investigate which active fund is the best as of 2021 and which funds one should stay away from, or whether one should not choose active funds at all. Furthermore, it will be interesting to do a recent study to see if the excess return the active manager creates is due to luck or good skills to pick out the right stocks as of today, and compare this to other studies and see if there are any changes in funds performances from the past. Finally, it will be interesting to see if there are more Norwegian closet index funds, or if the Norwegian active funds in fact are what they set out to be.

1.2 **Problem**

Through this paper I want to answer the following question:

"Do Norwegian actively managed equity funds manage to create excess returns across the market?"

To answer the problem, I will analyse the net return, risk, and various performance targets for the equity funds, to see whether any excess return can be explained by luck or good skills among the managers, and whether the return is in line with the risk they have exposed to the fund. By analysing whether the funds manage to create excess returns beyond the market, I

can conclude whether actively managed funds perform better than the market or not. The purpose of this is to be able to see whether it pays off for investors to invest in an actively managed fund, or whether one should rather choose a passively managed equity fund. At the same time, I want to see which Norwegian equity funds have performed best as of 2021 and who has performed the worst. This way, investors will know which fund to aim for and which to stay away from as of 2021. I also want to find out how active Norwegian actively managed equity funds are, and whether there are closet indexers among the Norwegian funds.

1.3 **Main findings**

Only 11 of 26 funds have managed to create excess returns beyond the market for the period, but these funds have done so well that the entire sample has, on average, managed to create excess returns beyond the market. Furthermore, the regression models show that only 12 of the funds have positive alpha values. Only two funds have significant SMB factors, which indicates that some of these two funds' returns can be explained by tilting towards small companies. Otherwise, none of the funds have significant PR1YR and HML values, which indicates that none of the funds' abnormal returns can be explained by momentum strategies or tilting towards value companies. The risk-adjusted return targets are also in favour of passive management. Only 9 of 26 funds have a higher sharpe ratio than the market. The information ratio shows that only 12 funds have managed to create excess returns beyond the market in relation to active risk. Only 11 funds have a higher treynor ratio than the market, none of which are particularly high. Active share, tracking error and adjusted R^2 show that we have several funds in Norway that can fall into the category for closet indexing.

1.3.1 **Take away for investors**

The results from the analysis show that most Norwegian actively managed equity funds are not able to perform better than the market. But this does not necessarily mean that one should choose index funds over actively managed funds. The analysis shows that some funds are doing very well, beating the market year after year. The managers of these funds are skilled and through their own analyses they can find investments that create excess returns beyond the market. If you as an investor disregard the funds that perform poorly, and rather choose the funds that do best, active management will trump passive management if the goal is to get the most excess return possible. The answer is then, "yes", active management pays off, but only if you choose the right funds.

By looking at the analysis and results in this paper, one can easily distinguish which funds are the bad funds and which are the best funds overall. Of the funds analysed in this paper, Forte Norge is the one that has done performed the best, followed by Holberg Norge A and Delphi Norge A. The funds that have done the worst are Pareto Investment Fund A, followed by First Generator S and Pluss Aksje Fondsforvaltning.

1.4 **Structure**

The paper consists of a total of 11 sections. Section 2 defines the main types of funds, provides a brief explanation of active and passive management, closet indexing, gives a picture of the Norwegian fund market, and finally provides a review of the various regulations related to the fund market. In Section 3, the present research, both internationally and for Norway, which is relevant to the thesis, is presented. In Section 4, relevant theory is introduced. First, the theory of efficient markets is presented, then different types of risk-adjusted return measures, before concluding with the different factor models. In Section 5, the methods used for this paper are described. Here I will explain the research design of the thesis, hypothesis testing, significance tests, regression, and how data is collected. Section 6 provides a more detailed description of the data used, assumptions for the sample, criticism of the sample and briefly about how the various calculations are made. In Section 7, the results will be presented and analysed. In section 8 results and findings are compared and discussed against findings in other articles and papers. In Section 9, findings from the analysis are discussed, and the papers' problem is answered. Section 10 provides an overview of limitations and suggestions for further research. Finally, all the references will be listed.

2.0 **Short brief of the fund market**

In this section, I want to review the most basic elements related to the fund market, to be sure that the reader fully understands the content of this paper, in addition to introducing the Norwegian fund market. Finally, I will review the various regulations related to the fund market.

2.1 **Mutual funds**

The Norwegian Mutual Funds Association (hereinafter VFF) provides a clear definition of what a mutual fund is: "A mutual fund is a collective investment where many savers come

together to invest their money in the securities market" (VFF, 2021a). Each individual fund consists of one or more traders, called managers. These have the task of managing the investments in such a way that the customer achieves the best possible return. The managers make the investments they think are the best, and they have two options: they can either try to beat the market, which is called active management, or they can follow the market, which is called passive management or better known as index funds (VFF, 2021a). Furthermore, the manager's job according to The Act on Securities Funds is to have a fund portfolio of complex financial instruments that provides an appropriate spread of the risk of loss (Finanstilsynet, 2011). Investments of holdings to the same issuer shall not exceed 10% and the total value of holdings that amount to more than 5% shall not exceed 40% of the fund's total value (Finanstilsynet, 2011).

Investors saving in funds do not need much prior knowledge, nor stay up to date on the market, as the managers take care of this job. This makes savings in equity funds a simple, but at the same time attractive as saving method.

2.1.1 **Main types of funds**

VFF (2021a) defines three main types of mutual funds: Fixed income funds, equity funds and combination funds. In addition to these three, we also have other types of mutual funds that do not fall into the same category as the three above. These can for example be funds with hedge fund properties that use derivatives to a large extent. The type of fund that is suitable for the individual depends to the greatest extent on the time horizon for the savings and the desired risk. Historically, one can say that the longer one saves, the greater the chances of getting a relatively good return (VFF, 2021g)

Fixed income funds are funds that invest available total assets in fixed income securities such as bonds and certificates (VFF, 2021b). There are three subcategories within fixed income funds: bond funds, money market funds and other fixed income funds. The bond funds invest their total assets in everything from relatively short-term to more long-term fixed income securities (4+ years). The money market funds are the fund group with the lowest risk. Here, the money must be available at short notice, and they must therefore not be exposed to major changes in value. Other fixed income funds are fixed income funds that do not satisfy the requirements for being classified in the other two main categories (VFF, 2021b).

Equity funds are funds that must invest a minimum of 80 % of the fund's total assets in the stock market. This type of fund does not normally invest in fixed income securities. In

Norway, we have a minimum requirement that stipulates that equity funds are required by law to spread their portfolio to at least 16 listed companies (VFF, 2021c). Usually, the portfolios in most equity funds consist of far more companies than the statutory minimum requirement, in order to achieve a well-diversified portfolio. Furthermore, we can divide equity funds into different groups based on where the fund's assets are invested. These groupings can for example be geographically limited, which means that they limit their investments to a limited geography such as Norway, Scandinavia, Europe, etc. Or they can be industry-specific, which means that they limit their investments to specific industries such as technology, healthcare, finance, etc. Mutual funds are well suited for long-term savings. By long-term savings it is meant that one has a time horizon of at least 5 years (VFF, 2021c). The reason for this is that in the stock market there are large value fluctuations, which means that the value of your savings can periodically go down, but of course also go up.

Combination funds are mutual funds that are composed of both fixed income and equity funds. For example, there may be funds that invest 70% of the funds in fixed income securities and 30% in stocks. The distribution between stocks and fixed income securities varies between the different combination funds and they can also vary in the same combination fund over time (VFF, 2021d). Return and risk in combination funds depend on the distribution between stocks and fixed income securities in the fund's portfolio. The larger the share of fixed-income securities, the lower return and risk can be expected, whereas it is the opposite for a higher proportion of stocks.

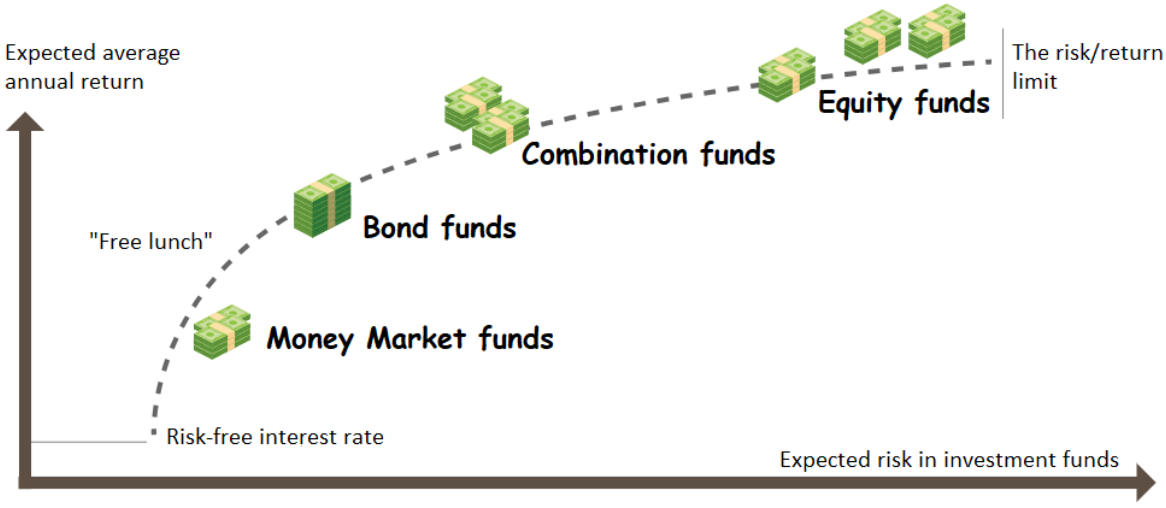

Figure 1: Risk profile for the different fund types (Source: VFF, 2021e).

Figure 1 provides an illustration of risk and expected return for the various fund types. It shows the risk profile of funds, taken from VFF (2021e). Here, the Y-axis represents the expected annual average return, while the X-axis represents the expected risk. Based on this figure, we can see that equity funds are the type of fund with the highest risk, but at the same time also the one that can potentially provide the most return.

2.2 **Active and passive funds**

As previously mentioned, I will examine whether actively managed equity funds are able to achieve a higher return than the market. Thus, it's important to be aware of the differences between active funds and passive funds. The main difference between active funds and passive funds is that active funds have an active management strategy where the managers of the fund select stocks regardless of the benchmark, while a passive fund has a passive management strategy which aims to follow the developments in the benchmark index slavishly. As active management requires more of a manager, the actively managed funds also cost more than the passively managed funds.

In the textbook of Bodie, Kane and Marcus (2011), an active manager is defined as: «a manager who tries to achieve a high return that is compatible with risk, either by forecasts or by identifying incorrectly priced industries». This definition explains to us that active funds aim to create the highest possible return on total assets combined with risk, compared with the general development in the market in which the fund operates. Furthermore, Bodie et. al. (2011) convey that passive managers will keep well-differentiated portfolios that represent a broad market index without trying to find incorrect pricing in industries. Based on this, we understand that active managers must take a risk in the attempt to achieve a higher return than the market index in which the fund operates in. This requires high competence and a lot of analysis work. This justifies why actively managed funds charge higher management fees than passively managed funds.

One of the analyses carried out by active managers is the analysis of market trends, better known as market timing. Here, the manager will invest in the market when they expect the market to rise in value and sell out when it is expected that the market will decline. Timing of the market can also be done by adjusting the systematic risk to be high when the market is expected to rise, and vice versa if one believes that the market will decline. The manager also deals with picking stocks. This is mainly about finding incorrectly priced stocks, i.e.,

underweighting or overweighting the various shares in relation to the benchmark index. In short, the principle here is to buy cheap and sell expensive.

Regardless of which of these two management options you choose, you as an investor must pay an annual management fee. This is stated as an annual percentage and is a payment to the company to manage the funds in the fund (VFF, 2021e). In addition to this annual fee, some equity funds also have a subscription and redemption fee for the purchase and sale of equity funds. Some mutual funds also have variable costs, such as success fees. This involves additional costs and is calculated based on the extent to which the fund manages to achieve a higher return than the benchmark index or the fund's absolute goal (VFF, 2021e).

In terms of cost, there is a significant difference between choosing an index fund or an actively managed fund. An index fund is cheaper with an average fee of 0.25 percent (Finansportalen, 2021a). Here, the fees range from anything between 0 and 0.3 percent. The actively managed funds have an annual average fee of 1.4 per cent. Here, the fees range from just under 1 percent to 3 percent (Finansportalen, 2021a). As the actively managed funds have a significantly higher cost than the index funds, an active manager must also achieve a higher return in relation to the index fund for it to be profitable to invest in.

2.3 **Closet indexing**

All funds have a strategy. While the strategy for an index fund is to stay as close to the benchmark index as possible, we have several different strategies within active funds. You pay more money for active funds versus index funds, and then you also expect the manager to do a good job and create excess returns beyond the market. For this to be done, the managers of the active funds must, as previously mentioned, carry out analyses and pick stocks, in order to achieve a higher return than the benchmark index. There are funds that are marketed as active funds and claim to be engaged in stock picking but stay close to the benchmark index when it comes to returns. This is called closet indexing. The manager lies close to the benchmark index without copying it completely (Investopedia 2019). Motivation for closet indexing can be a fear of performing poorly and ending up below the benchmark index, along with great pressure from cheap index funds. As an investor, you do not want to invest in a closet index fund, as you want to get what you pay for. Then you could save yourself some money and rather invest in a cheaper index fund.

It can be difficult to know if a fund practices closet indexing, but there are several tools that measure this, such as tracking error, which measures statistical deviations from the benchmark index, or active share, which I will come back to later in this paper.

2.4 **The Norwegian fund market**

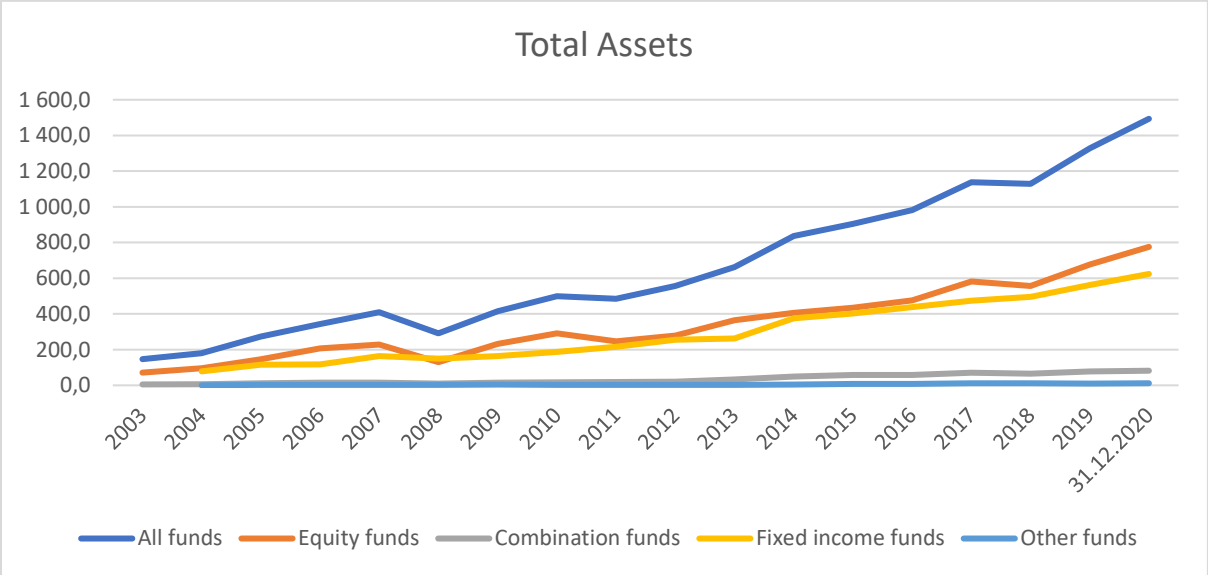

Figure 2: Total assets for the whole Norwegian market for various fund types in the period 2003-2021. (Source: VFF, 2021f)

Figure 2 shows the development in total assets by type of fund between 2003 and 31. December 2020 for the Norwegian total market. The figures used to create the chart are taken from VFF's (2021f) database. From 2003 total assets in equity funds increased from NOK 71.3 billion to NOK 228.9 billion in 2007. From 2007 this capital fell by almost NOK 100 billion to NOK 129.5 billion in 2008. Large parts of this reduction can probably be explained by the financial crisis that hit the world in 2007. From 2008 to 31 December 2020, total assets for equity funds have increased to NOK 775.8 billion. Total assets for equity funds have increased by an average of NOK 50.3 billion a year since 2003. This tells us that in Norway the popularity of using equity funds as a savings and investment alternative is rising, and more money is being invested in these funds over the years.

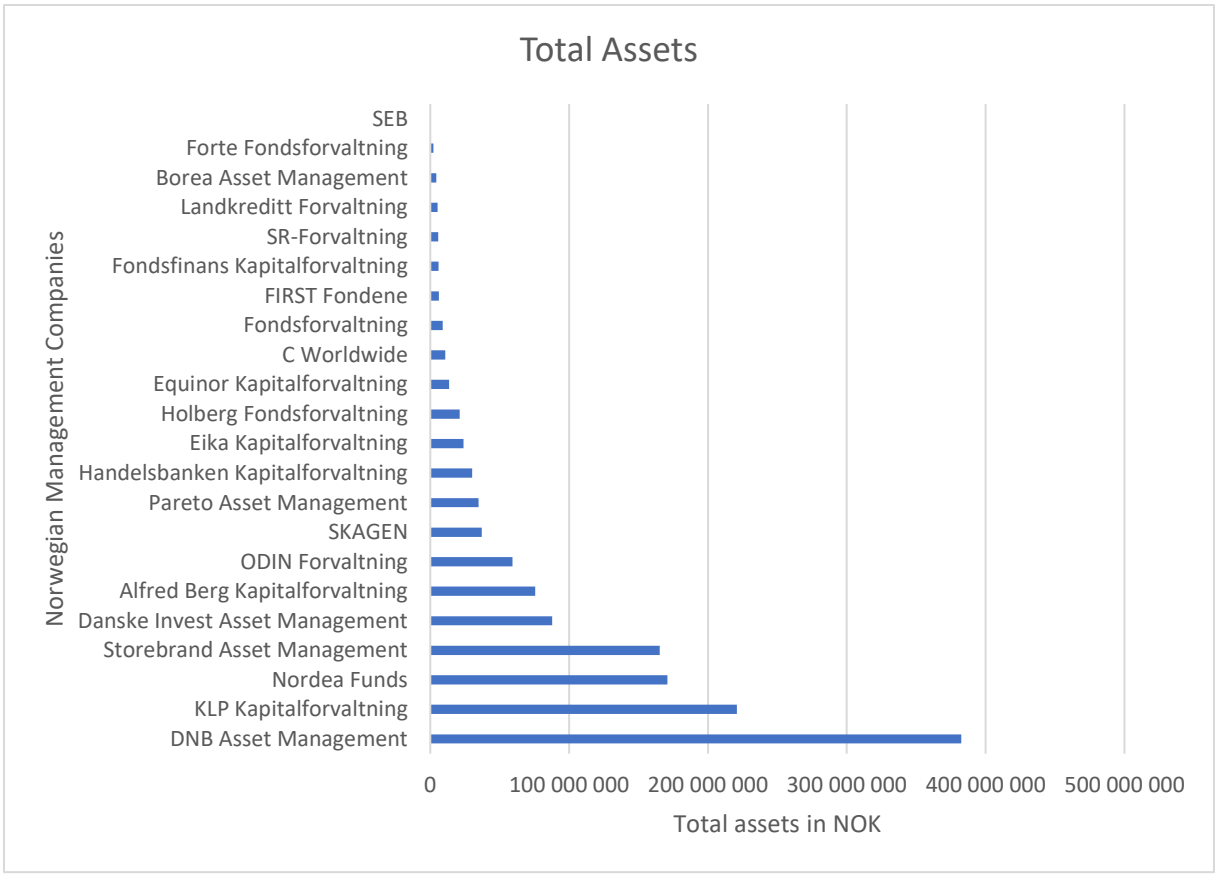

Figure 3: Total assets of Norwegian management companies as of 31.01.2021. (Source: VFF, 2021f)

Figure 3 shows an overview of the total assets of Norwegian management companies as of December 2020. The figures used to create the chart are taken from VFF's (2021f) database. It also says who are the largest fund providers in the Norwegian market and who are the smallest. The management company DNB Asset Management has by far the largest total assets, with NOK 382 billion, followed by second place KLP Kapitalforvaltning with total assets of NOK 221 billion. The lowest is SEB with total assets of NOK 407 million.

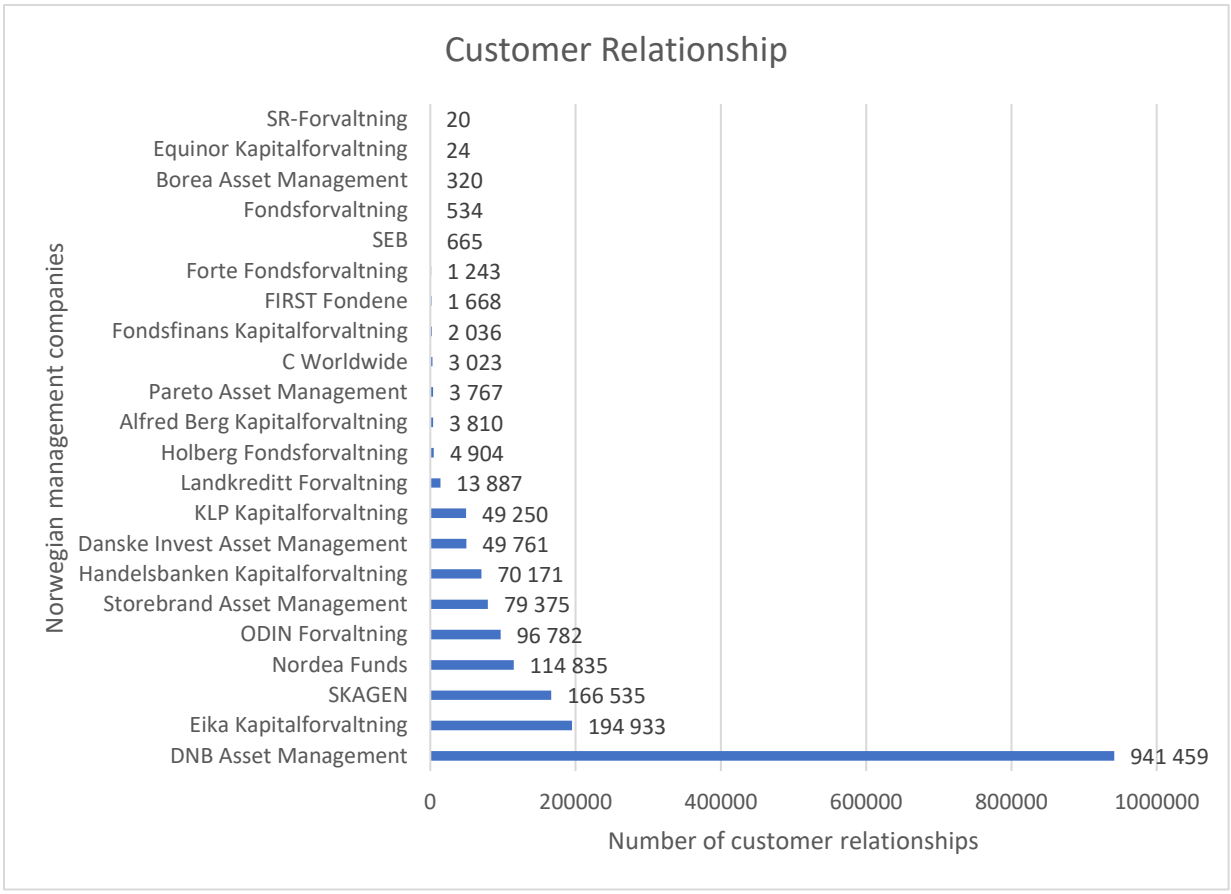

Figure 4: Number of customer relationships Norwegian management companies have within different types of equity funds. (Source: VFF, 2021f)

Figure 4 shows an overview of the number of customer relationships with Norwegian management companies as of December 2020. The figures used to create the figure are taken from VFF's (2021f) database. DNB Asset Management is also here the largest with its 941,459 customer relationships, followed by Eika Kapitalforvaltning with its 194,333. SR-Forvaltning is the lowest with 20 customer relationships. Having been in contact with VFF, it is worth pointing out that customer relationships are not the same as the number of customers. A customer can have several customer relationships with the same company, and some customer relationships can consist of many customers due to nominee structures. However, they do not have good figures that show the number of customers in the fund market, but their annual opinion poll shows that the number of Norwegians who save in equity funds is around 1.5 million.

2.5 **Regulations**

All EEA countries have a coordinated financial supervision system consisting of the national financial supervisors in addition to four EU institutions. The European Securities and Market

Authority (hereinafter ESMA) applies to securities and introduced its first directive "Undertaking for Collective Investment in Transferable Securities Directives (hereinafter UCITS)" in 1985. The current directive is valid from 2014 with UCITS V (Finanstilsynet, 2019). The idea behind the directive is to be able to make it easier for funds to trade across national borders and to protect investors. If you are an authorized UCITS member, you can operate freely in the EEA which will provide opportunities for collective investment schemes. Like the rest of Europe, most Norwegian funds must follow the UCITS's directive. There are several requirements that must be met when one is a UCITS member, and only UCITS members are allowed to market themselves freely in Europe (Muller & Ruttiens 2013, 21).

A fund can be divided into either UCITS funds or special funds. UCITS funds are funds established in accordance with the UCITS Directive, while special funds are funds that are not subject to the UCITS Directive's investment restrictions. Regardless of whether Norwegian funds comply with the UCITS Directive or not, they are nevertheless obliged to comply with the Mutual Funds Act (2011), which exists to protect fund investors.

One of UCIT's main concepts is that funds should consist of liquid investments. This requirement is made on the basis that investors must at any time be able to convert their holdings into real values (Muller & Ruttiens 2013, 23). In practice, this requires the manager to put together a portfolio of investments that can easily be sold if investors so wish. According to Muller & Ruttiens (2013, 24), they can allow investments to include:

1. Transferable securities listed in regulated markets, such as equities, bonds and closed-end funds
2. Bank deposits and listed derivatives
3. Money market instruments with a maturity of less than 397 days
4. Other UCITS funds (only 10 percent of the funds can be invested in non-UCITS funds)

In addition, UCITS funds may not borrow more than 10 percent of the net value of the fund, and the loan shall only be on a temporary basis.

Through its directives, UCITS encourages reducing the portfolio's overall risk by diversifying its portfolio. UCITS funds must invest in a minimum of 16 securities. Each security may not exceed 10% of the fund's total value. The sum of the securities with a weighting of more than 5% may not exceed more than 40% of the fund's total value.

Being a UCITS member brings several benefits. In Norway, we pay tax on value increase / gain in funds. Some of these gains are protected against tax deductions, a so-called shielding deduction, which in practice means that parts of the gain are tax-free. The percentage of the shielding deduction varies from year to year but is normally close to the risk-free interest rate you would receive in a bank. Gains in addition to this will be subject to the ordinary tax of 22% in 2021, multiplied by a factor of 1.44, when one chooses to realize the gain. In practice, this means you must pay 31.68% tax on stock incomes. Any loss will be deductible (Skatteetaten, 2021).

The UCITS regulations are especially important for us as investors as it creates a standard for funds and ensures quality in terms of return and risk. The UCITS directive is international, thus the rules apply to all countries. This means that all countries are affected in different ways. Funds that operate in a relatively small market such as Norway will be affected in a completely different way than a fund that invests in larger markets, such as in the United States.

3.0 **Present research**

In this section, I will present both international and Norwegian current research which I find relevant to this paper. First, studies on equity fund performance are presented internationally, then for Norway, before I finally end with the present studies and criticism on active share.

3.1 **International – equity funds achievements**

In 1997, Carhart conducted an analysis of US funds and their persistence for the period 1962 to 1993. The dataset Carhart used in this analysis was free of survival bias. Fama and French (1993)'s three-factor model were used in addition to Jagdeesh and Titman (1993)'s one-year momentum abnormality, better known as the momentum effect. The combination of these two constituted Carhart's four-factor model, which is a popular model that is still used in research to this day.

Carhart (1997) found evidence that fund managers managed to achieve a persistent excess return by using Jagdeesh and Titman's one-year momentum effect. When he tried to remove the momentum effect, he no longer found any evidence of persistence among the funds. Furthermore, he could not provide strong evidence of persistent excess returns over the next

two to five years among fund managers. In addition to this, he found little evidence that there were skills for stock picking among the managers. It emerged from the analysis that the top quantity among the funds recouped the investment costs associated with the fund. Nevertheless, most of the funds underperformed around twice the funds' respective investment costs. The bottom quantity of the funds underperformed about twice the funds' respective investment costs. Carhart concluded his study with the following three rules of thumb to maximize wealth as an investor:

1. Steer clear of funds with persistent poor performance.
2. Funds with high excess returns in the previous year can expect higher returns than average next year, but not more years after this.
3. Transaction costs and investment costs of the expense ratio type both have a negative effect on a fund's performance.

Kosowski, Wermers and White (2006) developed a new statistical bootstrap method that made it possible to map the funds' performance and determine whether these came from pure luck or stock-picking skills among managers. The dataset used in the method consisted of 1788 funds from the United States in the period 1975 to 2002. They saw that the performance of the worst and best funds was not a result of luck. This tells us that the performance of the funds cannot be explained by mere luck. Furthermore, they found a large difference in the funds' performance based on their investment objects. For example, using a test for significance, strong evidence of both skills and persistence was found among the managers of growth-oriented funds, where no evidence of this was found among income-oriented funds. The conclusion of the study was that a significant minority of managers only manage to choose shares well enough to cover their expenses, but that such performance was only persistent for a maximum of three years.

Cuthbertson, Nitzsche and O'Sullivan (2008) did a similar study in 2008 for the UK mutual fund market where they looked at the managers' ability to choose winning stocks. The dataset consisted of more than 900 funds with the same time period used in Kosowski et. al. (2006)'s study, 1975 to 2002. They tested several models, including Carhart's four-factor model. However, they concluded that Fama-French's three-factor model is the one best suited to describe the excess return on British equity funds. Cuthbertson. et. al. (2008) concluded that between 5% and 10% of the performance of the best funds could not be explained by luck alone, which is in line with the findings of Kosowski et. al. (2006). Regarding the bad performing funds (those with the lowest returns), the study by Cuthbertson et. al. (2008)

shows that most of these funds showed signs of poor stock picking skills, which is largely consistent with Kosowski et. al. (2006)’s findings. The hypothesis that the performance of the worst performing funds came because of bad luck was therefore rejected.

Fama & French (2010) conducted an analysis of the US equity fund market with monthly returns from 3156 funds in the period 1984 to 2006. They modified Kosowski et. al. (2006)'s bootstrap method for determining whether the funds 'returns came as a result of pure luck or the managers' skills. They looked at both gross and net returns, using their own three-factor model, the CAPM and Carhart's four-factor model to perform performance analysis and measure alpha estimates. Strong evidence was found that there were both positive and negative skills among the managers when using all three models, when using gross returns. In the same analysis, but using net returns instead of gross returns, Fama & French (2010) found that the funds generally underperformed and that only a few of the funds managed to cover their expenses. Despite the findings, Fama & French (2010) would not rule out the possibility that there are managers who achieve a higher risk-adjusted return than the market, but these disappear in the amount of all managers who perform worse than the market. Unlike Kosowski et. al. (2006), Fama & French (2010) did not find evidence of stock picking skills among the best funds, but both studies found evidence of poor stock picking skills among the worst performing funds. Fama & French (2010) compare the results of their study with Kosowski et. al. (2006)’s results and finds evidence of a reduction in overperformance in the dataset when cross-correlation is taken into account.

3.2 **Norway – equity funds performance**

A comprehensive study was conducted by Sørensen (2009) which dealt with actively managed equity funds in the Norwegian market. The dataset used consisted of 97 funds with monthly returns in the period 1982 to 2008, exempt from survival bias. He tested the managers' stock-picking skills and how persistent these were. Using Kosowski et. al. (2006)'s bootstrap method with Fama & French's (2010) modifications, Sørensen (2009) used CAPM, Fama-French three-factor model and Carhart's four-factor model to perform the performance analysis. No statistically significant evidence was found that the managers were able to deliver a risk-adjusted excess return. In other words, there was no evidence of the presence of stock picking skills in the market. The bootstrap method, which aims to distinguish between skill and luck, found some faint signs of positive stock picking skills in the right tail of the cross-sectional distribution of the alphas. Several funds were found in the left tail, which

indicates poor stock picking skills among the managers of the worst performing funds. Furthermore, Sørensen (2009) found no evidence of persistence among the funds' performance, neither among the best nor the worst funds. Based on this, we can say that a winner from a period does not necessarily have a greater chance of doing better than the market for the coming period, and vice versa. Sørensen's (2009) study indicates that risk-adjusted excess returns that exist among actively managed funds in the Norwegian market are more due to luck than skill.

Recently, Gallefoss, Hansen, Haukaas and Molnár (2015) published a study from the Norwegian equity fund market. The dataset used in the study consisted of daily returns from 64 actively managed funds from the period January 2000 to December 2010. They performed a performance analysis of all funds and further investigated whether the performance was persistent. If it turned out that there was evidence of skills among the managers, it should be investigated whether this was a result of stock picking skills or market timing. Carhart's four-factor model was used as a reference, and Kosowski et. al. (2006)'s bootstrap method together with Fama & Frenchs (2010) modification were used to analyse the funds' performance. Overall, the funds underperformed their benchmark index by approximately their fees. Nevertheless, funds were found that performed both superior and inferior, which indicates that there are skills among managers for both stock picking and market timing.

The risk-adjusted return for the top quantity of the funds was 4.5% per year, while the bottom quantity achieved -12.5% per year. It emerged from the bootstrap method that these returns were too large to be explained by luck and bad luck. These findings contradict what Sørensen (2009) concluded in his study. The annual gross alpha was estimated at 1.90%, which almost went to 0 measured by net alpha when running costs for the funds were around 1.70% per year. Furthermore, they found evidence that there was persistence among the performance in the market, but only up to one year. The strongest persistence was found in the worst performing funds. The conclusion of the study was that one could choose both winners and losers based on previous achievements, but that the persistence of the achievement only extended to one year. However, it was argued that this was not a profitable investment strategy, as transaction costs would exceed any profit.

3.3 **Active share**

The concept of "active share" was introduced by Cremers and Petajisto (2009) as a new way to measure active management, to along with tracking error detect closet indexing. The active

share is a measure that looks at the differences in the units in the fund and its benchmark index. Cremers and Petajisto (2009) describe the active share as "a percentage of a portfolio that deviates from the benchmark index". For example, what we call index funds, have an active share close to or equal to zero.

Cremers & Petajisto (2009) present two main advantages of measuring active share. One is that the active share can be used either alone or together with tracking error to provide a more comprehensive view of active fund management, as well as a more nuanced view of the level of alpha in different portfolios. The other advantage is that it provides information about an equity fund's ability to exceed its benchmark index. To “beat” the index, the fund must have holdings that deviate from the benchmark index. They conclude that funds with an active share of less than 60% are considered passively managed funds, and funds with an active share of 60% or more are actively managed funds.

An important contribution they made was their matrix (See Figure 5 below). Here, they divided all funds into five categories based on the level of active share and tracking error, which reflects the funds' investment strategy.

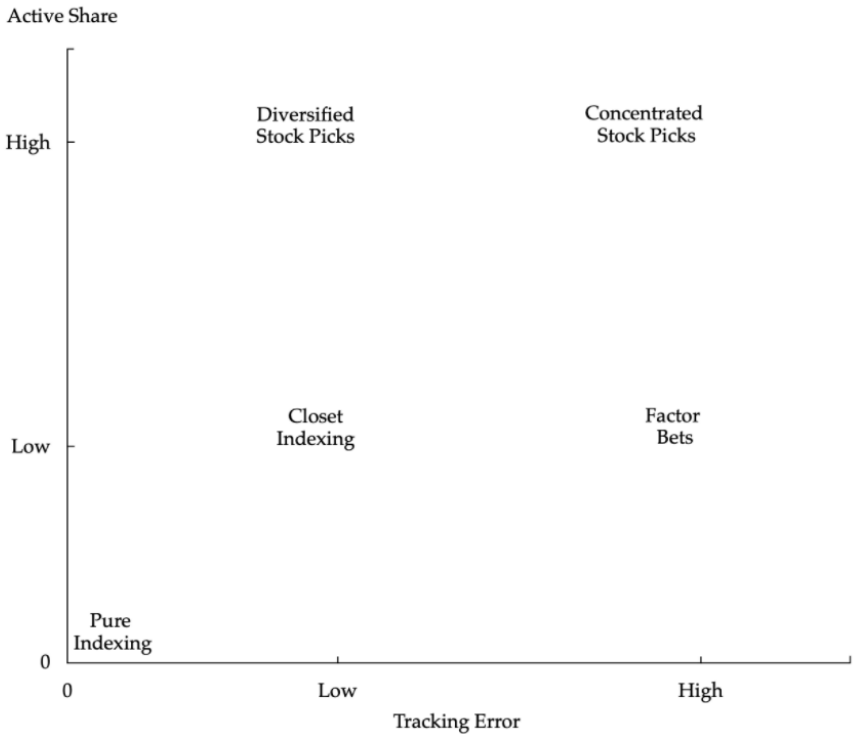

Figure 5: This figure is an excerpt from Cremers & Petajisto (2009) and shows how they categorize funds based on the level of active share and tracking error

Petajisto (2013) focused his research on the dynamics between active share and tracking error, but also researched the level of active share and tracking error among some of the largest mutual funds in the US market. Using the fund categories (in Figure 5) developed by Cremers and Petajisto (2009), he examines whether funds in the different categories perform differently from each other and whether any of the five forms of managing funds surpass the others. One of his main findings in this area was that only funds with diversified stock picking (high active share and tracking error) give a positive adjusted net return against the benchmark index. He also finds evidence that small cap funds on a general basis have a higher active share than other types of funds, and that the active share is strongly correlated with future returns among small cap funds.

The level of the active share in several countries was examined by Cremers & Ankur (2015). Here they find evidence that actively managed equity funds have a higher active share as well as lower running costs in those countries where there is great competition from index funds with low running costs. Furthermore, they saw that the average alpha provided by the actively managed funds is higher in countries that have few closet index funds and several index funds.

The average country in their dataset consisted of 22% index funds, 20% closet index funds (consisting of less than 60% active share) and 58% actively managed equity funds (of homeland and as a percentage of total net assets).

Before the concept of active share was introduced, Kacperczyk et al. (2005) did a similar study where they tried to see if the equity funds' industrial concentration had any effect on the return. Here it emerges that a high level of industrial concentration will result in less diversification, which in turn will lead to an increase in the idiosyncratic risk and expected return. Cremers and Ankur (2016) compare this measurement with active share.

Kacperczyk et al. (2005) find evidence that funds that are more concentrated deliver a higher risk-adjusted return than funds that are less concentrated, and they can prove this relationship statistically. The abnormal return on the concentrated equity funds can be deduced from a higher ability among the managers to pick out stocks. The conclusion of Kacperczyk et al. (2005) is that equity funds that perform better than the market after the costs for the fund have been deducted, usually have significantly different proportions than the benchmark index. This conclusion is in line with Martijn Cremer's many research articles on active share.

Cremers and Ankur (2016) further investigate the differences between different equity funds with high active share. Their main finding is that among equity funds that are traded frequently, there is no significant difference between equity funds with high and low active share, and both underperform. However, when comparing equity funds that trade less frequently, they find evidence that equity funds with a low active share generally underperform, while equity funds with a high active share beat their benchmark index by 2% on average. This tells us that even though active share is an important measurement, one should not exclude other characteristics and factors of the funds, as these may have explanatory values.

3.3.1 **Critique to active share**

Frazzini, Friedman and Pomorski (2016) did a study where they used the same data as Cremers & Petajisto (2009), and they replicate their results, but come to a different conclusion. Their main finding was that equity funds with a high active share generally have small cap benchmarks, while funds with a low active share tend to have large cap benchmarks. Hence, sorting of active share is equivalent to sorting of the type of benchmark index.

They found no statistical evidence that equity funds with a high active share have a higher return compared to equity funds with a lower active share. In addition to this, they could not conclude that equity funds with a high active share could beat equity funds with a low active share given the same benchmark index.

Petajisto (2015) responded to this criticism, arguing that Frazzini et al. (2016) had excluded large and crucial parts of the original research articles, and argued that this is the reason why they have come to a different conclusion. In detail, they summarized the results by benchmark index, which led to popular indexes such as the S & P500 being weighted as heavily as less popular indexes, such as small cap indexes. This was one of the main reasons why they came to a different conclusion.

4.0 **Theory**

In this section I will present relevant theory that forms the basis for results and analysis. I will start by going into detail on what the efficient market hypothesis says, and then present the

risk-adjusted performance measures that have been used, then present the factor models before I finally present the measures for active management.

4.1 Market efficiency hypothesis

In 1970, Eugene Fama introduced the Market Efficiency Hypothesis (hereafter MEH). From this hypothesis, we get a definition of market efficiency. Here it emerges that prices in an efficient market will always reflect all available information (Reilly & Brown 2015, 72-73). It will therefore not be possible for a manager to find over- or under-priced shares if the market is efficient. Fama (1970) presents three degrees of market efficiency: weak, semi-strong and strong. The degree of market efficiency tells us something about how fast, to what extent and what kind of information market prices reflect.

In the event of a *weak degree* of market efficiency, price changes will be random and independent. All available information stored in price and sales data is reflected here (Ross, Westerfield, Jaffe & Jordan, 2018, 393). It will be impossible to predict when new information will arrive, and when the information arrives it will already be reflected in the prices. In this state, any kind of technical analysis will be unnecessary.

When the degree of market efficiency is *semi-strong*, one will see that prices reflect all public information, as well as the information that can be found in historical price and turnover data (Ross et. al. 2018, 398). Examples of public information can be market trends, news, annual reports, etc. It may be interesting to make technical analyses and look at price changes up against the publication of information in this state. Here you can e.g., see what effects information has on price after and before the announcements.

In the event of a *strong degree* of market efficiency, prices will reflect the same as the two conditions above in addition to all private information. In short, this means that no investors have monopolistic access to information that can affect prices in the market (Reilly & Brown 2015, 74). Under this condition, it will be impossible to beat the market and insider trading will be considered. It will be pointless to take advantage of incorrect pricing in stocks as the prices in the market reflect all information. It is uncertain whether such cases exist, as this condition is considered an extreme case. Given that the extreme case of strong market efficiency had taken place, there would be no over- or underpricing of shares, as all information would be available. This means that it is not possible to achieve an excess return as no managers can beat the market. This is not the case, as it is a fact that some managers create excess return beyond the market.

The Norwegian market can be classified as a semi-strong efficient market (Simonsen, 2012). As mentioned above, it will not be possible to achieve excess returns in highly efficient markets. This is not the case for Norway, as shown by Norang and Agustsson (2018).

4.1.1 **The efficiency paradox**

Whether a market is efficient or not is an empirical question. The hypothesis nevertheless has its theoretical weaknesses, as Grossman and Stiglitz (1980), among others, pointed out through the efficiency paradox. In an efficient market, it is impossible to beat the market, which results in all forms of technical analysis intended to detect over- and under-priced shares being a waste of time. There will then be no incentive to perform such analyses as they will not give the managers increased profits. That said, it is in fact these analyses that ensure that information becomes available and reflects correct stock prices, and without these, the market would not be efficient. Without such analyses, stocks will be priced incorrectly, and managers will be able to achieve excess returns, which means that more people will analyse and find over- and under-priced stocks, which ultimately leads to the profit slowly but surely disappearing.

The efficiency paradox says: For a market to be efficient, there must be enough investors who believe that the market is not efficient (Grossman & Stiglitz, 1980). Otherwise there will not be sufficient turnover, and it is also these traders who then lead to the market eventually becoming efficient.

4.2 **Risk-adjusted return measures**

There are many different methods for evaluating portfolio management in an equity fund. As previously mentioned, Fama introduced MEH in the 1960s, and William Sharpe's (1966) capital asset pricing model (hereinafter CAPM) came a few years later. One of the most important things CAPM is based on is that one can expect a higher return if one is willing to take on a higher risk. This means that a manager can choose to take on more risk in the attempt to achieve a higher return. It is important to note that not all managers who achieve excess returns are skilled stock pickers. It can be difficult to distinguish between a manager who has achieved excess returns because of market timing, luck or his skills in picking stocks. In the early 1960s, the portfolio theories of the time only showed how investors could quantify risk in relation to variation in returns. CAPM created a framework for assessing how to adjust returns for the portfolio's risk. At this time, there were no return targets that combined both return and risk, until a number of studies were published in the late 1960s

concerning managers' performance. Based on these studies, several methods for risk-adjusted measurements based on Sharpe's (1966) CAPM were proposed. In the next subsections, I will explain some of the most well-known methods, and the ones I use in my thesis.

4.2.1 **Treynor ratio**

Following the introduction of CAPM, Treynor (1965) came up with one of the risk-adjusted measurement methods for performance analysis, the Treynor ratio. Treynor ratio uses market risk (beta), where higher ratio explains higher performance from the managers. This measurement method attempts to measure how well an investment compensates for a given risk for the investor. The Treynor ratio is calculated by taking the portfolio's average risk-adjusted return and dividing it by beta. Here, the beta value will constitute a measurement of the risk based on the systematic risk of the portfolio. The Treynor ratio is found as follows:

$$Treynor = \frac{r_p - r_f}{\beta_p}$$

Formula 1: Treynor ratio

Here, r_p is the return on the portfolio, r_f is the risk-free interest rate and β_p is the portfolio's beta value. Out of this risk-adjusted target, we receive a risk premium per unit of risk. As mentioned earlier, we only include the systematic risk, and not the total risk as we do in the Sharpe ratio. The reason for this is that Treynor (1965) believed that one did not need to compensate for the unsystematic risk, as this could be eliminated by means of diversification. When using this method, it is assumed that the individual portfolio is well diversified, so that one only gets paid for the systematic risk. A low Treynor value indicates that a fund has a lower risk-adjusted return compared to a fund with a high Treynor value. This method is also relatively easy to both calculate and understand, which makes it often used as an indication of a fund's performance compared to another fund's performance.

4.2.2 **Sharpe ratio**

Sharpe came in 1966 with a new performance measurement called Sharpe Ratio (hereafter SR). He believed that Treynor's (1965) model was not sufficiently diversified, and rather wanted to divide the portfolio's average risk-adjusted return on the standard deviation of the portfolio. We find SR by using the following formula:

$$Sharpe\ ratio = \frac{r_p - r_f}{\sigma_p}$$

Formula 2: Sharpe ratio

Where r_p is the return of the portfolio, r_f is the risk-free interest rate and σ_p is the standard deviation of the portfolio. SR gives us a measure that shows the expected risk premium per unit of the total risk. The value we get from this formula will give us an indication of how high the return is, seen in relation to how much risk the portfolio has. A high SR tells us that the fund has performed well in relation to the risk they have taken. Nevertheless, one cannot say that a high SR is not equivalent to low volatility, but can be considered an improvement on the ratio between return and risk.

According to Investopedia (2021), an annual SR below 1.0 is considered suboptimal. An annual SR of 1.0 and higher is for most investors considered a good SR. An annual ratio of 2.0 is rated very good, while an annual ratio of 3.0 and above is considered excellent.

4.2.3 **Information ratio**

The information ratio (hereinafter IR) is a measure that says something about whether a fund has overperformed or underperformed in relation to its benchmark index. Using IR, one can see if a manager has managed to create excess returns in relation to their respective benchmark index, in addition to seeing how persistent this performance is (Treynor & Black, 1973). This is a measure of abnormal return per unit of corporate risk. IR is a ratio, which means that one cannot use this measure to determine to what extent the fund has done better or worse in relation to the market. One can find IR by the following formula:

$$IR = \frac{r_p - r_b}{\sigma_{p-b}} = \frac{ER}{\sigma_{p-b}}$$

Formula 3: Information ratio

Here, r_p is the return on the portfolio, r_b is the return on the benchmark index and σ_{p-b} is the standard deviation of $r_p - r_b$. Another expression for $r_p - r_b$ is excess return (ER). A high IR gives an indication that the manager is skilled and selects the correct stocks for his portfolio. As with all historical figures, a historically high IR does not necessarily mean that the manager is able to recreate the good performance in the future. However, it tries to identify how persistent the manager is in beating the market (Treynor & Black, 1973).

The higher the IR, the better. If the IR is less than zero, it means that the active manager has failed to outperform the market, thus, active funds with negative IR's should be eliminated from an investor's portfolio. In general, an IR of between 0.40-0.60 will be considered quite good (Informa Investment Solutions, 2021a).

4.2.4 **Jensen's alpha**

Jensen's alpha, also known as the one-factor model, was defined by Jensen (1968) and is an absolute risk-adjusted target for return. This model is part of one of several risk factor models, and I will explain this in the next section.

4.3 **Models for risk adjusted returns**

In this section, the factor models will be presented. First Jensen's one-factor model, then Fama & French three-factor model and finally Carharts four-factor model.

4.3.1 **Jensen's one-factor model**

The one-factor model is based on the CAPM of Sharpe, Lintner and Mossin (Bodie et. al. 2011, 291), and was developed by Jensen (1968). The CAPM provides a description of the relationship between return and risk for a given portfolio. It's based on its exposure to the market and consists of a set of assumptions that relate to the expected return on risk-exposed assets and market equilibrium. Through the publication of his study in 1968, Jensen came up with an extension of the CAPM in which he added an alpha (α) variable - also known as Jensen's alpha. This new model provides a risk-adjusted measure that represents the average return for a given portfolio, which is neither captured nor explained in the traditional CAPM. We get an explanation of how much of the return is explained by the market factor and how much is explained by the managers. Returns that cannot be explained by the market, then become an abnormal return for a portfolio.

At market equilibrium, alpha will be equal to 0. If the market is not in equilibrium, i.e., not efficient, you will get a negative or positive alpha. With a negative alpha (α <0), the fund does worse than the model suggests, and you run a deficit. Contrary to a positive alpha (α> 0), the fund does better than the model suggests. This occurs when returns exceed risk. Jensen's one-factor model is calculated as followed:

$$r_t^e = r_{i,t} - r_{f,t} = \alpha_i + \beta_{i,M}\left(r_{M,t} - r_{f,t}\right) + \varepsilon_{i,t}$$

Formula 4: Jensen's alpha

Where r_t^e is the expected excess return on the portfolio for time *t*. $r_{f,t}$ is the risk-free interest rate for time *t* and α_i is Jensen's alpha. As previously mentioned, Jensen's alpha is the abnormal return. This say how funds have performed after risk has been taken into account. $\beta_{i,M}\left(r_{M,t} - r_{f,t}\right)$ is the beta value of the market, and say how much portfolio *i* will change in

value if the market changes in value. In relation to the market, beta will be the portfolio's sensitivity. $r_{M,t}$ is the market's expected return, $(r_{M,t} - r_{f,t})$ is the market's risk premium and $\varepsilon_{i,t}$ are the residuals, an error term. This is the unsystematic risk (corporate risk). This can be removed by means of diversification, and you will then only be left with the systematic risk (market risk).

4.3.2 **Fama-French three-factor model**

As the name suggests, Jensen's One-factor model (1968) includes only a single factor to predict a portfolio's expected return. Jensen's alpha is not very suitable for using in analysis and evaluation of managers' ability to pick stocks as it does not consider the abnormal conditions of the stock market. Managers often take advantage of the known abnormal conditions in the stock market, and it is therefore important to take these into account. Besides, anyone can take advantage of these abnormalities, and they will therefore not be considered stock-picking skills. It was only through research on the behaviour of the expected return to the stock market that the background for the multifactor models took place.

Fama and French (1993) developed the three-factor model by adding two new factors to the one-factor model, and the model can therefore be considered an extension of Jensen's one-factor model. This model is based on empirical findings and captures two other anomalies, which gives a better explanatory ability to the one-factor model. Fama and French (1993) found evidence that companies with high market value usually gave lower returns than companies with low market value. They also found evidence that companies with high book value gave lower returns than companies with low book value. It is based on these two pieces of evidence that the two new additional factors were added to the one-factor model, of which SMB (Small minus big) and HML (High minus low). This then constitutes the three-factor model which is as followed:

$$r_{i,t}^{e} = r_{i,t} - r_{f,t} = \alpha_i + \beta_{1i} MKT + \beta_{2i} SMB_t + \beta_{3i} HML_t + \varepsilon_{i,t}$$

Formula 5: Three-factor model

Here SMB_t represents the size factor between large and small companies. HML_t represents the value factor between high and low book value. $\beta_i SMB$ and $\beta_i HML$ represent "factor loadings» respective beta values, SMB and *HML r*espectively.

HML is book value, while SMB are considered market capitalization. Fama and French (1993) developed an investment portfolio equal to net zero which consisted of size factors

with equities where one took a long position in stocks with a low market capitalization and a short position in stocks with high market capitalization. The return on this portfolio is what constitutes the SMB factor (Bodie et. al. 2011, 427). Here, the market is sorted by size, where the median is the distinction between small and large. Everything larger than the median is considered large and everything below the median is considered small. Fama and French (1993) used the same procedure in constructing the HML factor. They created a new net zero investment portfolio that consisted of a long position in stocks with a high book value and a short position in stocks with a low book value. The market is also sorted here, from low- to high book value. One takes a long position with 30% of the stocks with the highest book value and a short position in 30% of those with the lowest book value (Bodie et. al. 2011, 427).

4.3.3 **Carharts four-factor model**

Through the three-factor model, Fama and French (1993) had now included and considered the value- and size anomalies. Something they had not considered was the momentum effect, another known anomaly found by Jegadeesh and Titman (1993). To also consider the momentum effect anomaly, Carhart (1997) implemented the momentum effect into the three-factor model and had thereby developed the four-factor model. The momentum effect can be understood as meaning that there is a greater probability of obtaining a higher risk-adjusted return by buying stocks that have outperformed over a longer period than those that have underperformed. Jegadeesh and Titman (1993) came with evidence that stocks that had increased / decreased in value in the previous period (from 3-12 months), also tended to continue to increase / decrease more in value in the following period (Bodie et al. 2011, 432). When analyzing historical prices, they concluded that it was possible to beat the market by buying the stocks that had delivered the best returns in the last 3 to 12 months and selling the stocks that had performed poorly in the same period. Carhart's four-factor model is as follows:

$$r_{i,t}^{e} = r_{i,t} - r_{f,t} = \alpha_i + \beta_{1i} MKT + \beta_{2i} SMB_t + \beta_{3i} HML_t + \beta_{4i} PR1YR_t + \varepsilon_{i,t}$$

Formula 6: Four-factor model

Where $PR1YRt$ is the momentum effect, which is constructed by creating a portfolio that consists of winning shares (30% highest return) and losing shares (30% lowest return) from 1-12 months back in time. Furthermore, winners are deducted from losers (WML - Winners minus losers) to capture the price momentum in stock prices (Bodie et. al. 2011, 433).

4.4 **Measures for active management**

In this section, measures used to analyse the degree of active management is introduced.

4.4.1 **Tracking Error**

Tracking Error (hereinafter TE) is one of the oldest ways of measuring fund activity and it focuses on the differences between the return and its benchmark index (Maubossin, 2012). It is used extensively for an investor to see to what extent the fund's volatility is the same as the volatility in the fund's benchmark index. Ex-post tracking error, i.e., tracking error based on the actual results, is what the actual tracking error is, and it is measured after the "event". I will therefore refer to ex-post tracking error when I talk about tracking error in this thesis. Tracking error can also be called active risk and says something about how closely a fund follows its benchmark, but it can also be used to compare two funds. It consists of time series with standard deviations of the difference between return from the fund and return from the index, defined as followed:

$$Tracking\ Error = \sigma\left[R_{fond,t} - R_{benchmark,t}\right]$$

Formula 7: Tracking error

Where $R_{fond,t}$ is the average fund return while $R_{benchmark,t}$ is the average return for the benchmark index. A low TE means that the fund is close to its benchmark in terms of return, while a high TE means the opposite.

What a good TE is depends on the investor's preferences. If the investor believes that the markets are efficient and that it is difficult for active managers to create added value, then the investor will prefer a lower tracking error (Informa Investment Solutions, 2021b). If the investor believes that smart active managers can create significant excess returns and should not be tied to a benchmark index, the investor will tolerate a higher TE. Theoretically, an index fund should have a TE of 0. Enhanced index funds are typically between 1% -2%. Most active equity funds have a TE of 4% -7% (Informa Investment Solutions, 2021b).

4.4.2 **Active Share**

As previously mentioned in the thesis, active share was introduced by Cremers & Petajisto (2009) where they defined the measure as "a percentage of a portfolio that deviates from the benchmark index". We can find an equity fund's active share by using the following formula:

$$Active\ share = \frac{1}{2}\sum_{i=1}^{N} |\, Wfund_i - Wbenchmark_i|$$

Formula 8: Active share

Where $Wfund_i$ and $Wbenchmark_i$ are the portfolio's weight of assets in the fund and in the benchmark index respectively. Only stocks are included in these calculations and no other assets, such as fixed income securities. The active share is the sum of the absolute value of the difference between the weight in the benchmark index and the weight in the fund, divided by two. Funds that are identical to their benchmark indices will have an active share of 0%, while funds that stand out completely from the benchmark index will have an active share of 100%. Of this, we get that the active share will always be between 0% and 100%, except for hedge funds where the active share may be greater than 100% as shorting is permitted. According to Cremers & Petajisto (2009), funds with an active share of 60% or more can be considered an actively managed fund. If the fund has an active share of 60% or less, it is considered a passively managed fund.

ESMA (2016) has developed a matrix in which they describe three different scenarios within analysis of actively managed funds, which indicate whether a fund may be closet indexing.

1. Active share lower than 60% and Tracking error lower than 4%, (this scenario is based on academic research)
2. Active share less than 50% and Tracking error lower than 3%
3. Funds with an active share lower than 50%, tracking error lower than 3% and R2 higher than 0.95.

Where the 3rd scenario is the one with the most criteria, and the one that gives the most certain analysis of those three.

5.0 **Method**

In this section, I will explain the methods and procedures used to test whether Norwegian actively managed equity funds manage to perform better than the market, talk about how the data has been collected, and how various calculations have been made and tested.

5.1 **Research design**

The research method used to answer the problem in this paper is a quantitative method, including a hypothetical-deductive approach. The method is based on moving from a hypothesis to a testable implication based on economic theory, which will determine whether the hypothesis is retained or rejected. Here I have prepared the following two hypotheses:

Hypothesis 0: Norwegian actively managed equity funds are unable to create excess returns beyond the market.

Hypothesis A: Norwegian actively managed equity funds manage to create excess returns beyond the market.

5.2 **The least square method**

To estimate the regression coefficients, I have used the least square method (OLS). Calculation of the coefficients is done by the regression analysis based on the squared residuals (ε^2). If you square the residuals for all observations and sum this, we get the square sum of the residuals which is usually referred to as SSE (sum and squares due to errors):

$$SSE = \sum \varepsilon_i^2 = \sum (Y_i - \alpha - \beta_1 X_{1i})^2$$

Formula 9: Least square method test

Using the least squares method, the regression analysis can calculate the coefficients that make the residual square sum (SSE) as small as possible. The regression coefficients give the regression line that is best adapted to the observations in the data material (Johannessen, Christoffersen and Tufte 2011).

5.2.1 **Prerequisites for the least square method**

When using the least squares method, various preconditions must be met for me to be able to say with certainty that the statistical tests that have been performed in the analysis have been carried out in a correct manner. If the conditions are not met, this can lead to misleading results in the analysis. Not all prerequisites can be tested. Tests have been performed to measure whether the residuals are normally distributed (Jarque-Bera test), whether the residuals are independent (DurbinWatson test) and whether the variance of the residuals is constant (Breusch-Pagan test).

5.2.2 **Test whether the residuals are normally distributed**

One of the prerequisites for OLS is that the residuals must be normally distributed. One reason for this is that t-tests are based on a normal distribution when the number of observations goes to infinity. If the residuals are not normally distributed, this may reduce the validity of the t-test. In this thesis, I have used the Jarque-Bera test to test whether the residuals are normally distributed:

$$JB = T(\frac{S^2}{6} + \frac{(K-3)^2}{24})$$

Formula 10: Jarque-Bera test

Where T is the number of observations, S is skewness and (K - 3) is excess kurtosis. Skewness measures whether the residuals are normally distributed, left-distributed or right-distributed. Excess kurtosis indicates whether the residuals have a pointed curve, flat curve or are normally distributed. A normal distribution will have a skew and excess kurtosis of 0 (Brooks 2014). A Jarque-Bera value lower than the critical value in the chi-square distribution indicates normally distributed residuals.

5.2.3 **Test whether the residuals are independent**

Another prerequisite is that the residuals in the regression model are independent. If the residuals correlate with each other, it means that the model contains autocorrelation (Brooks 2014). Autocorrelation means that the residual at time *t* correlates with the residual at time *t-1*. To investigate whether autocorrelation exists in the residuals, the Durbin-Watson test has been used. The test is performed as follows:

$$DW = \frac{\sum_{t=2}^{T}(\varepsilon_t - \varepsilon_{t-1})^2}{\sum_{t=2}^{T}\varepsilon_t^2}$$

Formula 11: Durbin-Watson test

The value of DW will vary between 0-4. According to Brooks (2014), a value of 2 indicates that no autocorrelation exists. Furthermore, a value of 4 indicates perfect negative correlation, while a value equal to 0 shows a perfect positive autocorrelation. To determine if DW is statistically significant, the test depends on the critical values d_L and d_U. The values are published in Savin and White's (1997) article, where the number of observations and explanatory variables to the regression model are necessary to calculate lower and upper critical value.

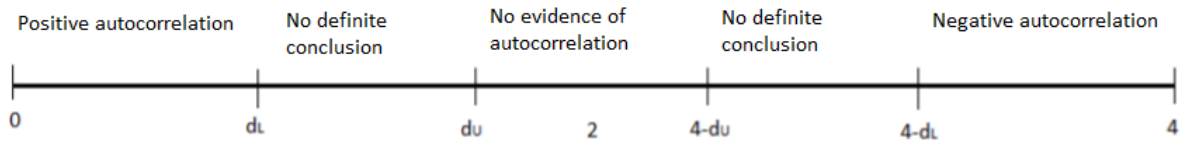

Figure 6: Critical values for Durbin-Watson test (Brooks 2014)

Figure 6 shows the critical values for determining whether there is autocorrelation in the residuals. A test observer (DW) between d_U and $4 - d_U$ means that we can keep the null hypothesis that there is no autocorrelation. If the value is between 0 and d_L or $4 - d_L$ and 4, there is a positive or negative autocorrelation, and the null hypothesis must be rejected.

5.2.4 **Test whether the variance of the residuals is constant**

The last condition is that the variance of the residuals must be constant (homoskedasticity). If this is not true, the residuals are heteroskedastic. If the assumption of homoskedasticity is not met, the validity of the analysis will be weakened. OLS will continue to be a consistent estimator but will no longer be the best linear estimator. This means that OLS is not the estimator with the lowest variance. If OLS is used when the variance of the residuals is not constant, the coefficients' standard errors can be estimated incorrect or misleading (Brooks 2014).

To test whether the variance of the residuals is constant, the Breusch-Pagan test is used. The null hypothesis for the test is that the residuals are homoscedastic, and the alternative hypothesis is that the residuals are heteroskedastic (Breusch & Pagan, 1979). A t-value greater than the critical value will result in the null hypothesis being rejected.

5.3 **Significance test**

Significance tests have been used for the alpha values and the performance measures to see if there is statistical uncertainty, and to be able to answer the hypothesis. A two-sided test has been used for the alpha values, so that I can see which funds have performed significantly better than the market and which funds have performed significantly worse than the market. If it turns out that alpha is significantly different from zero, I can reject the null hypothesis that actively managed funds fail to create excess returns beyond the market.

A two-sided t-test with a significance level of 5% and a critical value of 1.96 has been used to determine whether the funds' alpha values are significantly different from zero. Brooks' (2014) test statistics have been used to test the null hypothesis and are as follows:

$$t - value(alpha) = \frac{\alpha_i - \alpha_{H0}}{SE(\alpha_i)}$$

Formula 12: t-value alpha

Where α_i is the abnormal return, α_{H0} is the null hypothesis, (H_0: α_i= 0) and $SE(\alpha_i)$ is the standard error of alpha. According to Cohen (1992), two types of errors can occur in hypothesis testing. The first error means that one rejects a null hypothesis that is true, while the second means that one fails to reject an untrue null hypothesis.

When deciding whether the information ratio is significantly different from zero, Goodwin (1998)'s method is used, which is as follows:

$$t - stat = \sqrt{N} x IR$$

Formula 13: t-value information ratio

Where N is the number of observations of the equity fund.

For testing the Sharpe ratio, Jobson and Korkie's (1981) z-test were used, and are as follows:

$$z - value = \frac{\sigma_a(\mu_b - r_f) - \sigma_b(\mu_a - r_f)}{\sqrt{\theta}}$$

Formula 14: z-test sharpe ratio

Where μ_a and μ_b are the average returns of the fund and the benchmark index, respectively. σ_a and σ_b are the standard deviation of the excess return of the fund and the benchmark index respectively, beyond the risk-free interest rate (r_f), while θ is the asymptotic variance for the difference in the Sharpe ratio and has been calculated using the following formula:

$$\theta = \frac{1}{T}[2\sigma_a^2\sigma_b^2 - 2\sigma_a\sigma_b\sigma_{ab} + 0{,}5\mu_a^2\sigma_b^2 + 0{,}5\mu_b^2\sigma_a^2 - \frac{\mu_a\mu_b}{2\sigma_a\sigma_b}(\sigma_{ab}^2 + \sigma_a^2\sigma_b^2)]$$

Formula 15: Asymptotic variance

Where T is the number of observations and σ_{ab} is the covariance between the fund's excess return and the benchmark index.

It was confirmed by Jobson and Korkie (1981) that the static power of the test is low, especially with small sample sizes. Stevenson & Lee (2005), on the other hand, argue that a significantly different z-value is good enough evidence of the difference in risk-adjusted return between two portfolios.

5.4 **Regression**

Regression has been used as the calculation method for this thesis. The regression method that has been used is linear regression. Specifically, regression is an analysis technique that is used when one wants to examine how the mean value of a dependent variable varies with the independent variables (Brooks, 2014). Briefly explained, regression shows us the relationship between one dependent variable and one or more independent variables. The regression model can be expressed as follows:

$$Y_t = a + \beta_1 X_{1,t} + \beta_2 X_{2,t} + \ldots + \beta_n X_{n,t} + \varepsilon_t$$

Formula 16: Regression model

Where Y_t is the dependent variable, a is the constant, β_i is the regression coefficient of the independent variable, X_i is the independent variable and ε_t is the model error. Regarding this thesis, excess returns to the funds beyond the risk-free interest rate will be the dependent variable, while the market's excess return beyond the risk-free interest rate, PR1YR, HML and SMB are the independent variables.

When the regression analysis is done and the estimates for the coefficients are found, one has in practice found an explanation for the variation in the dependent variables. To find out how well this model fits the dataset, the measure "adjusted R-squared" has been used. R^2 shows how much the spread in the dependent variable is due to the variation in the independent variable and is found by calculating the proportion of the variance in the dependent variable that the regression model can account for (Frost, 2020). The number varies between 0 and 1, where at an R^2 of 0, the independent variable does not explain any of the variation in the dependent variable, while at an R^2 equal to 1, the independent variable explains all the variation in the dependent variable (Frost, 2020). The regression model shows both R^2 and adjusted R^2. Unlike R^2, adjusted R^2 includes correction for the number of explanatory variables, thus, adjusted R^2 will be used in this thesis.

5.5 **Data collection**

The funds and their information, such as minimum deposits, current expenses, benchmark index and total assets, which are used in the analysis have been found and retrieved from the mutual funds' association and morningstar's websites. The dataset for the funds is taken from Datastream, where I have retrieved daily NAV observations for the entire period for each individual fund and processed and calculated these separately using Excel, where I have

primarily used Excel Analysis ToolPack to do regression. To increase the reliability of the figures, I have compared these against figures I find for the funds on their own websites, Oslo Børs, Morningstar, and VFF's websites to see if there are any major differences. 3-year government bonds have been used to calculate risk-free interest rates, which are taken from Norges Bank's website. Data used to calculate the factor models have been obtained from Eikon. All figures in this paper have finally been annualized.

5.6 **Return**

The paper contains a total of 32,860 daily observations of net asset value (NAV). NAV is calculated daily for the vast majority of mutual funds and states the market value of a single fund unit. It is calculated by summing the market value of all the securities within which the fund has placed its investments. Furthermore, all the costs that have been incurred for the fund on the relevant day are deducted, so the amount is divided by the number of issued units in the fund (VFF 2019e).

When I have calculated the return on the equity funds in this thesis, I have used logarithmic return as a calculation basis. The logarithmic return has been calculated as follows:

$$r_t = ln\left(\frac{NAV_t}{NAV_{t-1}}\right)$$

Formula 17: Logarithmic return

Where r_t is the fund's return at time t, ln is the natural logarithm, NAV_t is the net asset value at time t and NAV_{t-1} is the net asset value at time $t - 1$.

6.0 **Data**

In this section, I will present the data sample, time period, the risk-free interest rate, the benchmark index used for the funds, and the weakness of the data.

6.1 **Data selection and choice of period**

The dataset used in the paper consists of a total of 26 actively managed Norwegian equity funds. The funds have been chosen based on the fact they have an active management strategy, a return history for the entire period (28.02.2016 - 28.02.2021), and that they invest a minimum of 80% of the total assets in the Norwegian stock market, which by definition

becomes a “Norwegian” equity fund. This has been done with regard to risk exposure and the choice of one benchmark index, as it will be possible to obtain a more accurate benchmark return when calculating risk-adjusted returns.

There is a total of 52 actively managed Norwegian equity funds available in Norway (Finansportalen, 2021b). By selecting 26 different equity funds from 20 different providers, I believe this selection is representative for the entire Norwegian actively managed equity fund market. The funds have been selected by random draw from the entire selection of 52 existing funds. By choosing a period of five years, we have a long enough time horizon to draw conclusions about the managers and the funds' performance. When choosing a longer time period, such as 10-20 years or more, there is a high probability that significant changes have occurred in the fund's management style, such as a change of fund manager or changes in the fund's investment and risk profile. After some research, I can see that several funds in the sample have changed managers when choosing a time period of 10 years, therefore it will be more correct to choose a time period of five years, as the goal is to to look at the current manager's performance, and not mix these with the performance of previous managers.

Equity funds	Minimum deposit	Annual fee	Total assets (in million NOK)	Benchmark
FORTE NORGE	100	2,05 %	289	OSEFX
Delphi Norge A	1 000	2,01 %	1 521	OSEFX
Storebrand Verdi A	100	2 %	609	OSEFX
Handelsbanken Norge	1 000	2 %	2 934	OSEFX
Danske Invest Norge I	1 000	1,85 %	576	OSEFX
Arctic Norwegian Equities A	250 000	1,99 %	2 460	OSEFX
Holberg Norge A	1 000	1,50 %	1 472	OSEFX
Storebrand Norge A	100	1,50 %	1 005	OSEFX
First Generator S	100 000	1,50 %	481	OSEFX
C Worldwide Norge	1 000	1,38 %	398	OSEFX
Danske Invest Norge II	50 000	1,25 %	1 512	OSEFX
Fondsfinans Norge	10 000	1,00 %	1 155	OSEFX
KLP Aksjenorge	3 000	0,75 %	6 226	OSEFX
Alfred Berg Gambak	25 000	2,00 %	9 150	OSEFX
Pareto Aksje Norge A	500	3,00 %	5 785	OSEFX
Nordea Avkastning	100	1,51 %	4 225	OSEFX
Alfred Berg Aktiv	25 000	1,51 %	2 811	OSEFX
Odin Norge C	3 000	1,50 %	8 986	OSEFX
Eika Norge	300	1,50 %	2 301	OSEFX
Pluss Aksje fondsforvaltning	50 000	1,20 %	143	OSEFX
DNB Norge A	100	1,34 %	9 185	OSEFX
Alfred Berg Norge C	25 000	1,20 %	6 428	OSEFX
Pareto investment fund A	500	1,80 %	1 581	OSEFX
Odin Norge B	1 000 000	1,00 %	9 125	OSEFX
Arctic Norwegian Value Creation C	1 000 000	0,86 %	3 276	OSEFX
Nordea Norge Pluss	500 000	1,00 %	1 956	OSEFX

Table 1: A overview of minimum deposits, annual fees, total assets, and benchmark indices for all the funds analysed.

Table 1 provides an overview of the selected equity funds to be analysed in this paper. It shows minimum deposits, running costs, total assets in NOK million and the funds' associated benchmark index. The equity funds' total assets vary from NOK 143 million to NOK 9,185 million, while the minimum deposits vary between NOK 100 and NOK 1 million. The running costs range from 0.75% to 3.00% (excluding success fees) where all funds on average makes running costs of 1.55%. Pareto Aksje Norge A has the highest running costs with 3.00% while KLP Aksjenorge is the one with the lowest costs of 0.75%.

6.2 **Risk-free interest rate**

Risk-free interest rate is the interest rate one can expect to get on an investment without taking risk, often compared to putting the money in the bank (Harvey, 2012). The interest rate chosen as a risk-free interest rate should not include short maturities. An important reason for this is that interest rates can be affected by unforeseen shocks in the market, which contributes to it being quite volatile during such periods (Harvey, 2012). The literature usually uses Treasury bills to find risk-adjusted returns. As this thesis deals with equity funds in the Norwegian market, it will be natural to use Norwegian government bonds as the risk-free interest rate. Based on this, I have chosen to use Norwegian 3-year government bonds as a risk-free interest rate.

6.3 **Benchmark index**

To answer the problem in this thesis, I will need a benchmark which the funds can be measured against. A benchmark index is often used to see developments in a market and is a useful tool when looking at whether a fund achieves excess returns beyond the market (Chen, 2020). Most equity funds that invest domestically in Norway use the Oslo Stock Exchange's Mutual Fund Index (hereinafter OSEFX) as a benchmark index. All equity funds to be analysed in this thesis have OSEFX as their benchmark index, thus this index will be used further in this thesis. OSEFX is a weight-adjusted version of the Oslo Stock Exchange's main index and is designed to satisfy the specific regulations and requirements included in the UCITS directive (see the section on UCITS 2.5).

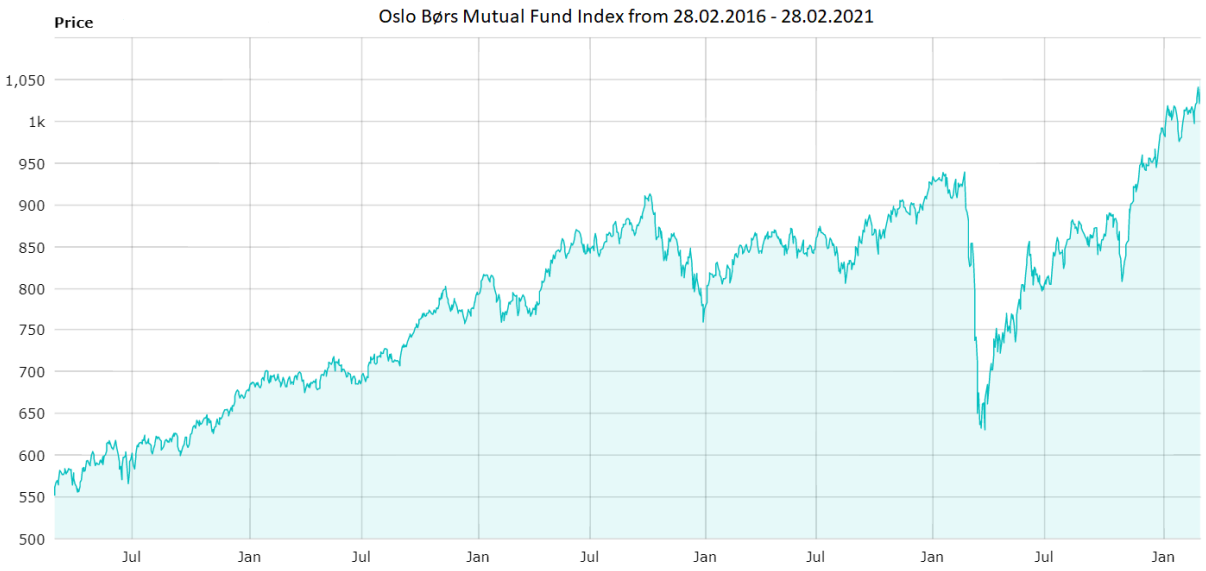

Figure 7: Shows the price development for the benchmark index (OSEFX) for the selection period 28.02.2016-28.02.2021. (Source: Euronext, 2021)

6.4 **Weaknesses in the data sample - selection bias**

There are several characteristics of sample bias in previous studies of equity fund performance that can yield biased results. As the thesis is based on funds that have existed throughout the whole selection period, it may be that the average return on the funds is prone to survival bias. By consistently excluding discontinued funds in the sample, the average return may appear to be better than what it actually is. This is because funds that are merged or closed down, often are associated with poor returns or unprofitable operations. According to Elton et. al. (1996, 1118-1119) there are two reasons why funds disappear, whereas the first reason is poor performance, and the second reason is that management believes it is not profitable to have the fund, whereas the second reason is a result of the first one.

In their study of the US market, Brown, Goetzmann, Ibbotson and Ross (1992) argued for the fact that survival bias creates misleading results between return and risk. We will thus have a positive bias and exaggerated results for the funds' average returns by excluding the closed-down funds. In the period 1982-2008, the survival bias in the Norwegian market was demonstrated by Sørensen (2009). It emerged from his survey that there was an annual average difference of 0.84% between all funds and dead funds. I still defend the data sample by arguing that the survival bias will not affect the analysis of each individual fund in this paper, but only the fund selections average performance measured against the market.

7.0 **Results and Analysis**

In this section, I will present the results and analyse the different funds based on descriptive statistics. Furthermore, the results for CAPM with Jensen's alpha, the three-factor model, the four-factor model and the risk-adjusted performance measures will be presented and analysed, before I finally present the results for active share and analyse these. The tables include only the most important and relevant figures for analysis. Complete tables with regression results and significance tests are available upon request.

7.1 **Descriptive statistics**

Equity funds	5 year return	Volatility
FORTE NORGE	19,61 %*	23,75 %*
Holberg Norge A	18,57 %	24,34 %*
Delphi Norge A	18,24 %	24,80 %
Alfred Berg Gambak	15,67 %*	22,02 %*
Fondsfinans Norge	15,21 %	23,46 %*
Nordea Avkastning	15,10 %*	23,57 %*
First Generator S	14,96 %	36,49 %*
Arctic Norwegian Value Creation	14,94 %	21,63 %*
Nordea Norge Pluss	14,68 %	24,05 %*
Storebrand Norge A	14,37 %	21,97 %*
Odin Norge B	13,11 %	20,18 %*
KLP Aksjenorge	12,67 %	22,60 %*
Odin Norge C	12,44 %	20,15 %*
Pareto Aksje Norge A	12,20 %	22,60 %*
Alfred Berg Aktiv	12,14 %	21,55 %*
Storebrand Verdi A	12,01 %	19,63 %*
C Worldwide Norge	11,81 %	20,49 %*
Alfred Berg Norge C	11,76 %	20,34 %*
Danske Invest Norge II	11,22 %	20,43 %*
Arctic Norwegian Equities A	11,08 %	20,73 %*
Danske Invest Norge I	11,01 %	20,43 %*
DNB Norge A	10,49 %	22,50 %*
Pareto investment fund A	10,36 %	28,60 %
Handelsbanken Norge	9,99 %	21,51 %*
Eika Norge	8,75 %	20,59 %*
Pluss Aksje fondsforvaltning	8,40 %	19,73 %*
OSEFX	12,72 %	20,82 %

*Table 2: Annualized net return and standard deviation for the funds and the benchmark index for the period 28.02.2016-28.02.2021. * Shows significantly different returns and standard deviations from the benchmark index. Difference in return is tested by t-test.*

Table 2 shows the annual return and standard deviation for the funds and the benchmark index in the period 28.02.2016 - 28.02.2021. During the period, the benchmark index (OSEFX) has an annual return of 12.72% while the equity funds on average have an annual net return of

13.11%. The funds have an average standard deviation of 22.62% where OSEFX has a standard deviation of 20.82% for the period.

All the funds delivered a positive annual return for the period, with Forte Norge delivering the highest return of 19.61%. Holberg Norge A and Delphi Norge A follows with 18.57% and 18.24%, respectively. With the lowest annual return of the sample is Pluss Aksje with 8.40%, followed by Eika Norge and Handelsbanken Norge with annual returns of 8.75% and 9.99%, respectively. Only Alfred Berg Gambak, Nordea Avkastning and Forte Norge have a significantly different return from the benchmark index. During the period, 11 of the 26 funds delivered a higher return than the benchmark index. Three of these are significant, while 15 of the 26 funds delivered lower returns than the benchmark index, where none of these are significant.

In total, 24 funds have a significantly different standard deviation from the benchmark index. The funds' standard deviation varies between 19.63% and 36.49%, with Storebrand Verdi A having the lowest standard deviation of 19.63% while First Generator S has the highest standard deviation of 36.49%.

7.2 **Test of OLS' prerequisites**

Eqiuty funds	Jarque-Bera	Durbin-Watson	Breusch-Pagan
FORTE NORGE	2,89	1,84	6,19*
Holberg Norge A	1,63	1,69	1,23
Delphi Norge A	37,88*	1,99	0,95
Alfred Berg Gambak	9,25*	2,15	8,94*
Arctic Norwegian Value Creation	101,33*	1,91	9,93*
Odin Norge B	2,89	2,21	0,12
Storebrand Norge A	4,64	1,61*	2,17
Fondsfinans Norge	34,51*	1,78	3,38
Odin Norge C	3,82	2,14	7,9*
Nordea Avkastning	29,58*	2,01	5,43*
Storebrand Verdi A	5,23	2,03	0,31
Nordea Norge Pluss	1,32	1,78	1,17
Alfred Berg Norge C	27,34*	2,09	1,89
Alfred Berg Aktiv	341,4*	1,96	2,6
Pareto Aksje Norge A	2,16	2,2	7,44*
C Worldwide Norge	2,56	1,89	3,01
Danske Invest Norge II	8,91*	1,67	1,75
Arctic Norwegian Equities A	220,43*	1,85	9,59*
KLP Aksjenorge	255,63*	2,14	0,78
Danske Invest Norge I	5,72	2,04	0,17
Handelsbanken Norge	4,13	1,77	2,01
DNB Norge A	3,36	2,26	4,48*
Pluss Aksje fondsforvaltning	23,5*	2,38*	6,42*
Eika Norge	4,64	1,7	2,63
First Generator S	114,84*	1,93	6,39*
Pareto investment fund A	2,84	1,9	2,72

*Table 3: Test of the prerequisites for OLS when performing CAPM. Jarque-Bera test: * Indicates that the residuals are not normally distributed with a critical value of 5.99. Durbin-Watson test: * Indicates that the residuals are autocorrelated, with a lower critical value of 1,654 and an upper value of 2,346. Breusch-Pagan test: * Indicates that the residuals are heteroskedastic with a critical value of 3,841. All tests are performed at a 5% level.*

Table 3 show various tests to examine whether the prerequisites for OLS are met. To check whether the residuals are normally distributed, the Jarque-Bera test has been used. The null hypothesis is that the residuals are normally distributed, where the critical value is 5.99. From the table we can see that 12 funds have residuals that are not normally distributed. Based on this, it may be necessary to interpret some of the t-tests with caution.

The Durbin-Watson test has been used to examine whether the residuals are independent. The assumption of no autocorrelation is met if the values are between 1,654 and 2,346. Storebrand Norge A has elements of positive autocorrelation, while Pluss Aksje fondsforvaltning shows signs of having a negative autocorrelation in the residuals. Consequences of this is that the OLS estimator will still be consistent and linear, but no longer be the most efficient estimator.

The last prerequisite is whether the variance of the residuals is constant. If this is not the case, the residuals are heteroskedastic. Here, the Breuch-Pagan test is used, where the critical value is 3,841. The test show that 10 of the funds have cases of heteroskedasticity, and the premise is thus broken. The consequences are largely the same as in the event of a breach of the presumption of independent residuals.

Testing of the prerequisites has also been made for the three-factor model and the four-factor model. None of the regressions have met all the conditions. This indicates that some of the results are not unbiased.

7.3 **CAPM with Jensen's Alpha**

Eqiuty funds	Alpha	Beta	R2
FORTE NORGE	5,44 %*	1,11*	83,81
Holberg Norge A	3,73 %*	1,20*	86,30
Delphi Norge A	3,28 %*	1,22*	84,50
Alfred Berg Gambak	2,86 %*	1,01*	87,53
Arctic Norwegian Value Creation	1,78 %*	1,06*	90,63
Odin Norge B	1,37 %	0,94*	91,35
Storebrand Norge A	1,20 %*	1,06*	94,25
Fondsfinans Norge	0,84 %*	1,19*	87,96
Odin Norge C	0,74 %	0,93*	91,39
Nordea Avkastning	0,71 %	1,18*	93,90
Storebrand Verdi A	0,60 %	0,91*	93,36
Nordea Norge Pluss	0,25 %*	1,20*	91,42
Alfred Berg Norge C	-0,28 %	0,97*	96,87
Alfred Berg Aktiv	-0,52 %*	1,03*	93,98
Pareto Aksje Norge A	-0,85 %	1,08*	87,32
C Worldwide Norge	-0,98 %*	1,00*	95,10
Danske Invest Norge II	-1,07 %*	1,00*	94,74
Arctic Norwegian Equities A	-1,28 %	0,98*	91,80
KLP Aksjenorge	-1,47 %*	1,18*	96,93
Danske Invest Norge I	-1,68 %	1,00*	94,72
Handelsbanken Norge	-2,60 %*	1,05*	94,43
DNB Norge A	-3,10 %	1,14*	95,78
Pluss Aksje fondsforvaltning	-3,40 %*	0,98*	93,66
Eika Norge	-3,41 %*	1,01*	93,53
First Generator S	-5,88 %*	1,96*	84,39
Pareto investment fund A	-6,29 %*	1,51*	90,10

*Table 4: The one-factor model in the period 28.02.2016 - 28.02.2021. * show significantly different alpha- and beta values from the benchmark on a 5% level. The significance tests were performed with t-test.*

Table 4 shows beta, alpha and adjusted R^2 for all funds in the period 28.02.2016-28.02.2021. The funds' beta values vary between 0.91 and 1.96 where Storebrand Verdi A stands out with the lowest market risk of 0.9,1 while First Genrator S has the highest market risk with a beta value of 1.96. All funds have significant beta values, where 6 funds have a significantly lower beta different from 1. This indicates that these funds are less exposed to fluctuations than the market. 3 of the funds have a significant beta equal to 1, which indicates that these funds are

exposed to fluctuations corresponding to fluctuations in the market. The majority, and 17 of the funds have a significant beta higher than 1, which indicates that these funds are more exposed to fluctuations than the market.

Adjusted R^2 for the funds show us that the benchmark index has a good explanatory power on the model. The explanatory power varies from 84% to 97%, where 7 of the funds have an explanatory power of less than 90% and have a relatively low explanatory power compared to the other funds. The average explanatory power for the model is 91.5%. This may be an indication that several factors should have been included in the model to increase its explanatory power.

The annual average alpha measured by the return on the funds is -0.385%. With an alpha of 5.44%, Forte Norge has been the fund that has delivered the highest excess return adjusted for market risk, followed by Holberg Norge A and Delphi Norge A with alpha values of 3.73% and 3.28%, respectively. Pareto Investment Fund A is the fund that has delivered the lowest return adjusted for market risk with an alpha of –6.29%, followed by First Generator S and Eika Norge with alpha values of –5.88% and –3.41%, respectively. In total, 12 of 26 funds have a positive alpha, of which 8 are significant. This means that 46% of the funds have managed to create an excess return beyond the market adjusted for market risk, of which 67% of these can be proven statistically. The remaining 14 funds have a negative alpha, of which 9 of these are significantly different from 0. This means that 54% of the funds have achieved a return lower than the benchmark index and failed to create excess return for their investors when considering market risk, where 64% of these can be proven statistically.

7.4 **Fama & French three-factor model**

Equity Funds	Alpha	Beta	Beta(SMB)	Beta(HML)	Adjusted R2
FORTE NORGE	5,55*	1,11*	0,03	0,02	84,21
Holberg Norge A	3,92*	1,17*	0,10	0,04	84,79
Delphi Norge A	3,05*	1,26*	-0,04	0,03	93,58
Alfred Berg Gambak	2,17*	1,01*	0,11*	0,03	94,88
Arctic Norwegian Value Creation	1,78*	1,04*	0,02	0,09	94,98
Storebrand Norge A	1,46*	1,05*	0,05	0,08	88,40
Odin Norge B	1,37	0,94*	0,08	0,01	86,35
Odin Norge C	0,84	0,92*	0,04	0,05	94,44
Nordea Avkastning	0,81	1,20*	0,03	0,04	84,48
Storebrand Verdi A	0,79	0,90*	0,02	0,01	95,25
Fondsfinans Norge	0,74*	1,21*	0,03	0,04	94,93
Nordea Norge Pluss	0,24*	1,22*	0,01	0,05	88,05
Alfred Berg Norge C	-0,33	0,98*	0,03	0,01	96,98
Alfred Berg Aktiv	-0,55*	1,04*	-0,05	0,02	87,85
Pareto Aksje Norge A	-0,89	1,09*	-0,03	0,01	87,52
C Worldwide Norge	-0,99*	1,01*	0,02	0,01	94,03
Danske Invest Norge II	-1,16*	1,00*	0,10	0,09	93,99
KLP Aksjenorge	-1,19*	1,17*	0,07	0,01	91,42
Arctic Norwegian Equities A	-1,24	0,99*	0,03	0,02	93,55
Danske Invest Norge I	-1,74	1,00*	0,01	0,05	93,78
DNB Norge A	-3,12	1,16*	0,07	0,06	95,87
Handelsbanken Norge	-3,17*	1,03*	0,06*	0,07	96,91
Eika Norge	-3,33*	1,01*	-0,03	0,07	90,13
Pluss Aksje fondsforvaltning	-3,42*	0,98*	0,01	0,04	91,36
First Generator S	-6,13*	1,98*	0,03	0,02	90,70
Pareto investment fund A	-6,27*	1,51*	-0,03	0,02	91,45

Table 5*: Results from Fama & French's three-factor model for the period 28.02.2016-28.02.2021. * Displays significant alpha and beta values for the risk factors at a 5% level. The significance tests were performed with a t-test.*

Table 5 shows the results from Fama & French's three-factor model for the period 28.02.2016- 28.02.2021. During the period, the funds have an average net alpha of -0.42%. 8 of the funds still have a significant positive alpha different from zero, while 9 of the funds still have a significant negative alpha different from zero. It can be statistically proven that 31% of the sample has created excess returns, while 35% have not managed to create excess returns for their investors. Forte Norway has the highest abnormal return with its 5.55%, followed by Holberg Norge A with its 3.92%.

The beta values of the funds vary between 0.90 and 1.98, all of which are still significant. Among the SMB factors, only Alfred Berg Gambak (0.11) and Handelsbanken Norge (0.06) are statistically significant. This indicates that some of the abnormal returns to these funds can be explained by tilting towards small companies. This may be an explanation for why Alfred Berg Gambak's alpha has been reduced from 2.86% to 2.17% and Handelsbanken Norge from -2.60% to -3.17%, when using the three-factor model instead of CAPM with Jensen’s Alpha.

Furthermore, none of the HML factors were significant, so we cannot say that part of the abnormal return comes from tilting towards value companies. The average explanatory power for the funds in the three-factor model is 92% and has increased by approx. 0.5% compared to CAPM with Jensen's Alpha. This indicates that funds on average gets a small but fairly insignificant increase in explanatory power by adding more factors.

7.5 **Carhart's four factor model**

Equity Funds	Alpha	Beta	Beta(SMB)	Beta(HML)	Beta (PR1YR)	Adjusted R2
FORTE NORGE	5,56 %*	1,11*	0,03	0,02	0,00	84,37
Holberg Norge A	3,99 %*	1,17*	0,10	0,04	0,03	84,95
Delphi Norge A	3,03 %*	1,25*	-0,04	0,03	-0,04	93,76
Alfred Berg Gambak	2,17 %*	1,01*	0,11*	0,03	0,00	95,06
Arctic Norwegian Value Creation	1,78 %*	1,05*	0,02	0,09	0,04	95,16
Storebrand Norge A	1,44 %*	1,05*	0,05	0,08	0,02	88,57
Odin Norge B	1,39 %	0,94*	0,08	0,01	0,00	86,51
Odin Norge C	0,82 %	0,93*	0,04	0,05	0,05	94,62
Nordea Avkastning	0,81 %	1,19*	0,03	0,04	0,03	84,64
Storebrand Verdi A	0,79 %	0,91*	0,02	0,01	0,01	95,43
Fondsfinans Norge	0,74 %*	1,21*	0,03	0,04	0,00	95,11
Nordea Norge Pluss	0,25 %*	1,22*	0,01	0,05	0,01	88,22
Alfred Berg Norge C	-0,33 %*	0,97*	0,03	0,01	0,01	97,16
Alfred Berg Aktiv	-0,55 %	1,05*	-0,05	0,02	0,00	88,02
Pareto Aksje Norge A	-0,91 %	1,09*	-0,03	0,01	0,02	87,69
C Worldwide Norge	-0,99 %*	1,00*	0,02	0,01	-0,01	94,21
Danske Invest Norge II	-1,16 %*	1,00*	0,10	0,09	0,00	94,17
KLP Aksjenorge	-1,19 %*	1,17*	0,07	0,01	0,00	91,59
Arctic Norwegian Equities A	-1,21 %	0,99*	0,03	0,02	0,05	92,01
Danske Invest Norge I	-1,74 %	1,01*	0,01	0,05	0,01	93,96
DNB Norge A	-3,12 %	1,16*	0,07	0,06	0,00	96,05
Handelsbanken Norge	-3,19 %*	1,02*	0,06*	0,07	-0,01	97,09
Eika Norge	-3,33 %*	1,01*	-0,03	0,07	0,00	90,30
Pluss Aksje fondsforvaltning	-3,44 %*	0,98*	0,01	0,04	-0,02	91,53
First Generator S	-6,13 %*	1,98*	0,03	0,02	0,00	90,87
Pareto investment fund A	-6,26 %*	1,50*	-0,03	0,02	0,02	91,62

*Table 6: Results from Carhart's four-factor model for the period 28.02.2016 - 28.02.2021. * Displays significant alpha and beta values for the risk factors at a 5% level. The significance tests were performed with a t-test.*

Table 6 show the results from Carhart's four-factor model in the period 28.02.2016-28.02.2021. For the momentum factor (PR1YR), none of the funds have significant values. This tells us that momentum strategies cannot explain some of the returns of the funds. None of the HML factors are significant either, so tilting towards value companies cannot explain parts of the abnormal return either. Two of the funds still have significant SMB factors. Furthermore, the explanatory power of the model has an insignificant change in relation to the CAPM and the three-factor model. The same applies to the beta values, these have also changed marginally and affect the funds to the same extent as in the CAPM and the three-factor model.

As for the one-factor model and the three-factor model, 8 out of 12 funds still have positive alpha values that are significantly different from zero, while 9 of the 14 negative alpha values are significantly different from zero. Forte Norge has the highest significant alpha value of 5.56%, followed by Holberg Norge A and Delphi Norge A at 3.99% and 3.33%, respectively. For the period, Pareto Investment Fund A had the lowest significant alpha of -6.26%, followed by First Generator S and Pluss Aksje fondsforvaltning of -6.13% and -3.44%, respectively.

7.6 **Risk adjusted measures**

Equity funds	Treynor ratio	Sharpe ratio	Information ratio
FORTE NORGE	0,169*	0,87	0,96*
Delphi Norge A	0,143*	0,79	0,69*
Storebrand Verdi A	0,123	0,67*	-0,10*
Handelsbanken Norge	0,087*	0,54*	-0,64*
Danske Invest Norge I	0,102	0,58*	-0,55*
Arctic Norwegian Equities A	0,105*	0,59	-0,39*
Holberg Norge A	0,148*	0,82	0,79*
Storebrand Norge A	0,128	0,71	0,48
First Generator S	0,072*	0,54*	0,10
C Worldwide Norge	0,110	0,61*	-0,35
Danske Invest Norge II	0,104*	0,61	-0,36*
Fondsfinans Norge	0,121*	0,71	0,39*
KLP Aksjenorge	0,100*	0,63*	0,05
Alfred Berg Gambak	0,147*	0,76	0,56*
Pareto Aksje Norge A	0,105*	0,61*	-0,04*
Nordea Avkastning	0,121	0,71	0,50*
Alfred Berg Aktiv	0,110*	0,63*	-0,08*
Odin Norge C	0,125*	0,67*	-0,01
Eika Norge	0,078*	0,50	-0,94*
Pluss Aksje fondsforvaltning	0,077*	0,50*	-1,08*
DNB Norge A	0,085	0,55	-0,48*
Alfred Berg Norge C	0,113*	0,64	-0,27*
Pareto investment fund A	0,063*	0,48*	-0,20*
Odin Norge B	0,131*	0,70	0,16*
Arctic Norwegian Value Creation	0,133	0,74	0,48*
Nordea Norge Pluss	0,115	0,68*	0,36*
OSEFX	0,119	0,69	0

Table 7: The treynor ratio, sharpe ratio and information ratio of the various funds in the period 28.02.2016 - 28.02.2021 measured against the benchmark index (OSEFX).

7.6.1 **Treynor ratio**

Table 7 shows the annual Treynor ratio for the funds in the period 28.02.2016-28.02.2021. TR measures excess returns beyond the risk-free interest rate, adjusted for systematic risk. Here, the funds want to have a higher TR than the benchmark index, which means that the fund has a greater excess return than the benchmark index beyond the risk-free interest rate. Given that the benchmark index's beta is 1, it has had an annual TR of 0.119 during the period.

Forte Norway has the highest TR for the period with 0.169, followed by Holberg Norge A and Alfred Berg Gambak with TRs of 0.148 and 0.147, respectively. Pareto Investment Fund A has the lowest TR for the period with 0.063, followed by First Generator S and Pluss Aksje fondsforvaltning, with TRs of 0.072 and 0.077, respectively. The average TR for the funds in the period is 0.112. This shows that the funds' average performance is very close to the market. In total, 11 of the funds have a higher TR than the benchmark index, of which 7 of these are significantly higher than the benchmark index. 15 of the funds have a lower TR than the benchmark index, of which 11 of these are significantly lower than the benchmark index. This means that most of the funds in the sample have a lower excess return adjusted for systematic risk than the benchmark index.

7.6.2 **Sharpe ratio**

Table 7 shows the funds' annual sharpe ratio in the period 28.02.2016-28.02-2021. Forte Norge has the highest SR for the period with 0.87, followed by Holberg Norge A and Delphi Norge A with SRs of 0.82 and 0.79, respectively. Pareto Investment Fund A has the lowest SR for the period, with an SR of 0.48, followed by Pluss aksje fondsforvaltning and Eika Norge with SRs of 0.50. In total, 9 of the funds have a higher SR than the benchmark index, but none of these figures are significant. 17 of the funds have a lower SR than the benchmark index, of which 12 of these have a significantly lower SR than the benchmark index. This means that these funds have delivered a lower excess return compared to the benchmark index adjusted for the total risk. Furthermore, the funds have an average SR of 0.65 against OSEFX's SR of 0.69. This means that the funds on average have not been able to create excess returns beyond the benchmark index, adjusted for the total risk.

All funds have an SR that is suboptimal. Only Forte Norge is close to having an SR which for most investors is considered a good SR. Thus, none of the funds has an SR that is considered particularly good by most investors, but rather a more acceptable SR according to Investopedia (2021).

7.6.3 **Information ratio**

Table 7 shows the funds' annual information ratio in the period 28.02.2016-28.02.2021. As previously mentioned, IR is a risk-adjusted measure of whether the fund has delivered excess returns across the market in relation to the standard deviation between the fund and the market (tracking error). The funds' average IR is 0.001, i.e., almost equal to zero, which tells us that the funds on average make the same returns as the market when considering the standard

deviation between the fund and the market. Forte Norge has the largest IR of 0.96, followed by Holberg Norge A and Delphi Norge A with IRs of 0.79 and 0.69, respectively. Pluss Aksje fondsforvaltning has the lowest IR of -1.08, followed by Eika Norge and Handelsbanken Norge with IRs of -0.94 and -0.64, respectively.

12 of the funds have a positive IR. Of these, 9 of the funds have a significantly higher IR than the benchmark index in relation to TE. This means that these funds have performed better than the market during the period and that the managers of these funds have made good decisions in the composition of the portfolio. 14 of the funds have a negative IR, of which 12 of these have a significantly lower IR than the benchmark index. This means that these funds have performed worse than the market during the period, and the managers of these funds have done a poor job when it comes to the composition of the portfolio.

The 14 funds with IRs below 0 should be eliminated from investors' portfolios, and as long as they have a negative IR, one should stay away from these. 4 of the funds have IRs between 0.40-0.60, which most investors consider to be quite good. The three funds with the highest IR that is above 0.60 have done very well, and if you take only IR as a base for which fund you should choose, then the choice would land on these three.

7.7 TE, R^2 and Active Share

Equity funds	Tracking error	Aktiv share	R2
Delphi Norge A	8,00 %	51,60 %	84,50
Pareto Aksje Norge A	7,68 %	57,00 %	87,32
Holberg Norge A	7,40 %	84,51 %	86,30
Alfred Berg Aktiv	7,29 %	65,11 %	93,98
FORTE NORGE	7,17 %	47,34 %	83,81
Storebrand Verdi A	7,13 %	35,75 %	93,36
Pareto investment fund A	7,02 %	65,22 %	90,10
Fondsfinans Norge	6,38 %	53,01 %	87,96
Odin Norge C	5,98 %	74,05 %	91,39
Nordea Norge Pluss	5,44 %	53,03 %	91,42
Alfred Berg Gambak	5,26 %	84,64 %	87,53
Nordea Avkastning	4,75 %	46,26 %	93,90
DNB Norge A	4,65 %	82,58 %	95,78
Arctic Norwegian Value Creation C	4,62 %	78,32 %	90,63
Handelsbanken Norge	4,27 %	45,46 %	94,43
Eika Norge	4,23 %	51,39 %	93,53
Arctic Norwegian Equities A	4,20 %	83,17 %	91,80
Danske Invest Norge II	4,18 %	35,14 %	94,74
Pluss Aksje fondsforvaltning	4,00 %	39,92 %	93,66
Alfred Berg Norge C	3,57 %	77,65 %	96,87
First Generator S	3,54 %	89,77 %	84,39
Storebrand Norge A	3,44 %	38,23 %	94,25
Danske Invest Norge I	3,12 %	35,85 %	94,72
C Worldwide Norge	2,61 %	29,50 %	95,10
Odin Norge B	2,42 %	76,88 %	91,35
KLP Aksjenorge	1,06 %	30,60 %	96,93

Table 8: Tracking error, active share and adjusted R^2 for the funds in the period 28.02.2016 - 28.02.2021.

Table 8 shows annual TE, active share and Adjusted R^2 for the equity funds in the period 28.02.2016-28.02.2021. The average TE, active share and adjusted R^2 for the funds are 4.98%, 58% and 0.92, respectively. On average, the data sample is therefore not within the category for closet indexing if we follow ESMAS 3. criteria, as TE is above 3%, active share is above 50% and adjusted R^2 is below 0.95. Delphi Norge is the fund with the highest TE with 8.00%, followed by Pareto Aksje Norge A and Holberg Norge A with TEs of 7.68% and 7.40% respectively. The fund with the lowest TE is KLP Aksjenorge with a TE of 1.06%, followed by Odin Norge B and C Worldwide Norge with TE values of 2.42 and 2.61, respectively.

19 of the funds have a TE that is between 4% and 8%, which is normal for an actively managed equity fund. On average, the sample falls within the category in which most active equity funds fall, but we see that some funds stand out negatively. KLP Aksjenorge has a TE as low as 1.06%. This falls within the category of what normally enhanced index funds lie.

Odin Norge B and C Worldwide Norge also have low TEs for being actively managed funds with TEs below 3%.

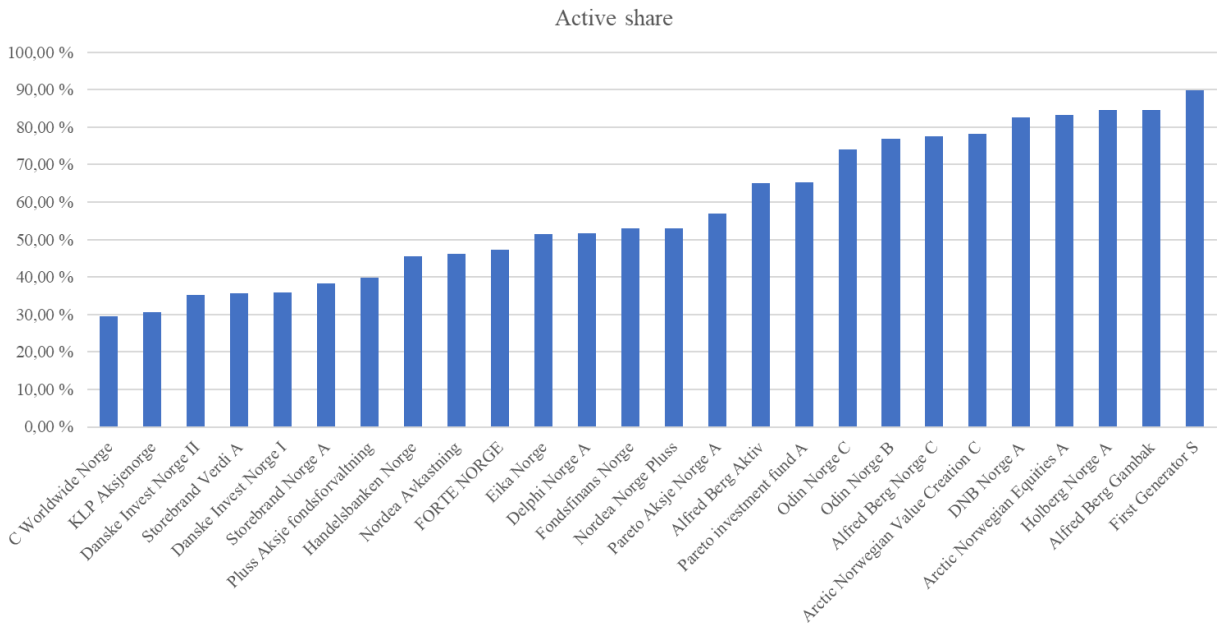

Figure 8: Active share for the funds from 28.02.2016-28.02.2021.

Figure 8 illustrates the active share for the funds in the period 28.02.2016-28.02.2021 in ascending order. The fund with the lowest active share is C Worldwide Norge with an active share of 30%, followed by KLP Aksjenorge and Danske Invest Norge II with active shares of 31% and 35% respectively. The fund with the highest active share for the period is First Generator S with an active share of 90%, followed by Holberg Norge A and Alfred Berg Gambak with active shares of 85% and 84%, respectively.

Holberg Norge is one of the funds in the sample with the highest active share, and one of the funds that has generated the most excess return beyond the market. This indicates that the managers in this fund have done a good job and picked out the right stocks for their portfolio. Furthermore, DNB Norge A is also one of the funds with the highest active share but are one of the funds with the lowest excess return. This, on the other hand, gives an indication that the managers of this fund have done a bad job and not been able to pick out the right stocks.

Based on Cremers and Petajisto's (2009)'s conclusion that equity funds with an active share of less than 60% can be regarded as passively managed funds and that actively managed funds have an active share of 60% or more, 58% of the fund selection is managed passively, while the remaining 42% are categorized as actively managed according to this definition. If we

look at ESMA's requirement for a minimum of 50% active share to be considered actively managed, 38% of the fund selection falls in the category of passively managed funds.

If we follow ESMAS's criteria from the first scenario, which is based on academic research, four of the funds, C Worldwide Norge, KLP Aksjenorge, Danske Invest Norge I and Stroebrand Norge A, are within the category for potential closet indexing. If we rather follow the criteria from the second scenario, which is based on countries with relatively small stock markets, which is well suited for Norway, two of the funds, C Worldwide Norge and KLP Aksjenorge, are within the category for potential closet indexing. If we use the calculations from their third scenario, which is also the one with the most criteria, there are the two same funds, C Worldwide Norge and KLP Aksjenorge, which fall into the category of potential closet indexing.

7.7.1 **Comparison of TE, active share and R^2**

R^2 shows to what extent the fund returns correlates with the benchmark portfolio's return. A high R^2 indicates that an equity fund invests similar to its benchmark, while a lower value can be associated with a greater degree of independent stock picking and active management. Passively managed funds usually have an R^2 between 85% and 100%, while funds below 70% are described as active (Investopedia, 2020). These limits are based on research done on American funds and can therefore be strict values for Norwegian funds. The analyses show that if we take these limits as our starting point, only two of the funds will be active. The rest of the funds' R^2 is considered a clear sign of passive management. This makes it difficult to separate the funds from each other based on R^2. This indicates that US limits must be adjusted before it can be used on Norwegian market.

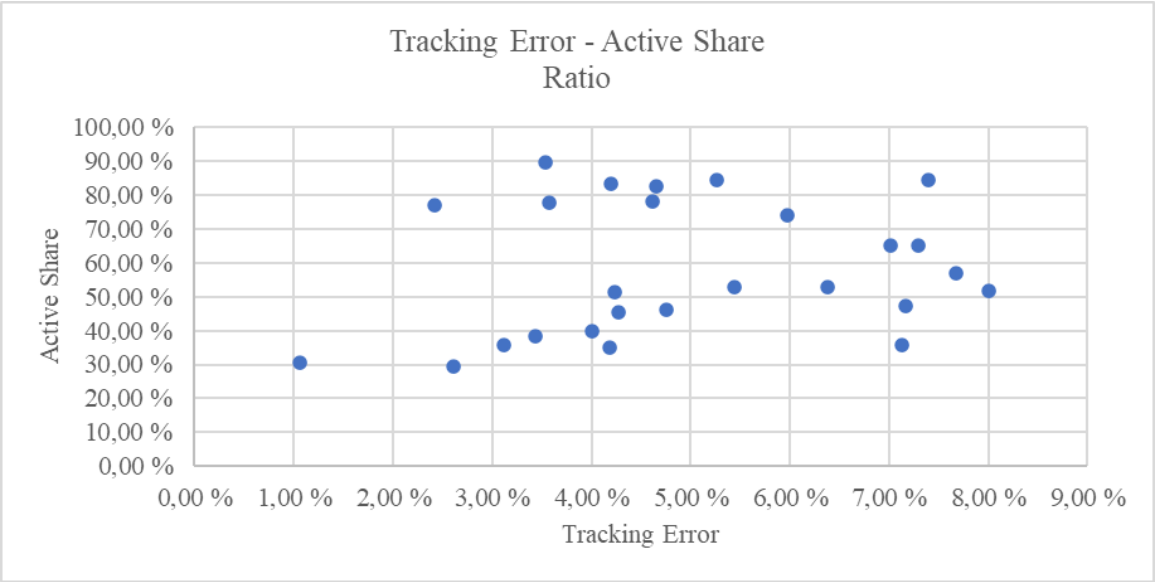

Figure 9: Shows the relationship between active share and tracking error when we set these up against each other.

Tracking error shows to what extent the fund's active return varies. A high proportion of active risk implies that the fund manages actively, while lower values indicate passive management. As mentioned, active funds will often have TE values of between 4 and 7%. If we rank the funds based on the various measures for active management, we see that R^2 and tracking error give relatively similar results. Ranking in terms of active share on the other hand, gives a different order and differs from the two previous measures. As we see in figure 9, it is difficult to see a connection / correlation between tracking error and active share. Funds with high active share may as well have a high tracking error as a low one, and it seems that these provide different answers to what is considered active management when we set these up against each other. They are contradictory for several funds, where funds with high tracking errors have a low active share. For example, First Generator S which has a high active share of 90% but a relatively low TE of 3.54, or Odin Norge B which has an active share of 77% and TE of 2.42%.

Previous research done on Norwegian equity funds has largely focused on R^2 and tracking error, while the active share has been used to a lesser extent. This is probably because the first two measures have been academically valid for a longer time than the active share. Active share has been used as a measure for how active the funds are in this thesis, as this is a clear and intuitive method for explaining the level of active management (Myhrvold, 2015). TE is still being used in addition to the active share as a supplement, as this combination makes it possible to identify different management strategies (Cremers and Petajisto, 2009).

7.7.2 **Active share and alpha – Tracking error and alpha**

Equity funds	Active share	Alpha
First Generator S	89,77 %	-5,88 %
Alfred Berg Gambak	84,64 %	2,86 %
Holberg Norge A	84,51 %	3,73 %
Arctic Norwegian Equities A	83,17 %	-1,28 %
DNB Norge A	82,58 %	-3,10 %
Arctic Norwegian Value Creation C	78,32 %	1,78 %
Alfred Berg Norge C	77,65 %	-0,28 %
Odin Norge B	76,88 %	1,37 %
Odin Norge C	74,05 %	0,74 %
Pareto investment fund A	65,22 %	-6,29 %
Alfred Berg Aktiv	65,11 %	-0,52 %
Pareto Aksje Norge A	57,00 %	-0,85 %
Nordea Norge Pluss	53,03 %	0,25 %
Fondsfinans Norge	53,01 %	0,84 %
Delphi Norge A	51,60 %	3,28 %
Eika Norge	51,39 %	-3,41 %
FORTE NORGE	47,34 %	5,44 %
Nordea Avkastning	46,26 %	0,71 %
Handelsbanken Norge	45,46 %	-2,60 %
Pluss Aksje fondsforvaltning	39,92 %	-3,40 %
Storebrand Norge A	38,23 %	1,20 %
Danske Invest Norge I	35,85 %	-1,68 %
Storebrand Verdi A	35,75 %	0,60 %
Danske Invest Norge II	35,14 %	-1,07 %
KLP Aksjenorge	30,60 %	-1,47 %
C Worldwide Norge	29,50 %	-0,98 %

Equity funds	Tracking error	Alpha
Delphi Norge A	8,00 %	3,28 %
Pareto Aksje Norge A	7,68 %	-0,85 %
Holberg Norge A	7,40 %	3,73 %
Alfred Berg Aktiv	7,29 %	-0,52 %
FORTE NORGE	7,17 %	5,44 %
Storebrand Verdi A	7,13 %	0,60 %
Pareto investment fund A	7,02 %	-6,29 %
Fondsfinans Norge	6,38 %	0,84 %
Odin Norge C	5,98 %	0,74 %
Nordea Norge Pluss	5,44 %	0,25 %
Alfred Berg Gambak	5,26 %	2,86 %
Nordea Avkastning	4,75 %	0,71 %
DNB Norge A	4,65 %	-3,10 %
Arctic Norwegian Value Creation C	4,62 %	1,78 %
Handelsbanken Norge	4,27 %	-2,60 %
Eika Norge	4,23 %	-3,41 %
Arctic Norwegian Equities A	4,20 %	-1,28 %
Danske Invest Norge II	4,18 %	-1,07 %
Pluss Aksje fondsforvaltning	4,00 %	-3,40 %
Alfred Berg Norge C	3,57 %	-0,28 %
First Generator S	3,54 %	-5,88 %
Storebrand Norge A	3,44 %	1,20 %
Danske Invest Norge I	3,12 %	-1,68 %
C Worldwide Norge	2,61 %	-0,98 %
Odin Norge B	2,42 %	1,37 %
KLP Aksjenorge	1,06 %	-1,47 %

Table 9: Shows active share and tracking error up against alpha

If we look at active share up against alpha, we see that it is not the case that a high active share means better performance from the manager. On the contrary, we can see from Table 9 that a higher active share can just as well lead to poorer performance as better performance. First Generator S with the highest active share, is at the same time one of the funds with the lowest alpha. This indicates that the managers of this fund have to a large extent selected stocks outside their benchmark index, but that these stocks have not given a particularly good return in relation to the risk they have taken. In other words, indication of poor stock picking skills.

Holberg Norge on the other hand is opposite. A high active share, with one of the largest alphas for the period. This indicates that the managers in this fund have been very active and made good decisions. Forte Norge on the other hand has the largest alpha for the period, but a relatively low active share. This strengthens the claim that a higher active share does not necessarily give a higher risk-adjusted return, as it also can give a lower one.

Tracking Error set up against alpha shows much of the same as active share set up against alpha. Higher TE which also indicates a higher degree of active management can lead to negative risk-adjusted excess returns as well as positive risk-adjusted excess returns. Delphi Norge A, Holberg Norge A and Forte Norge are the three funds with the largest alphas with

one of the highest tracking errors for the period. If we look at Pareto Aksje Norge A and Pareto investment fund A, they are also two of the funds with the highest tracking errors for the period, but both have negative alpha values.

8.0 **Discussion and comparison of results**

In this section, the results and findings based on the analyses are discussed and compared with what other recent studies have found.

The results from my analysis are largely the same as those of Gallefoss et. al. (2015). As mentioned in section 3.2, Gallefoss et. al. (2015) analysed Norwegian equity funds in the period 2000-2010. The dataset was free of survival bias, and they used, among other measures, Carhart's 4-factor model. They conclude that managers of the best-performing funds have good stock picking skills, while the worst fund managers have both poor market timing and poor stock picking skills. One of the main differences between their results and the results in this thesis, is that their results show that the funds, on average, fail to create excess returns beyond the market when deducting management costs. The results in this thesis on the other hand show that the funds on average manage to create excess returns beyond the market. One of the reasons for why there is different results, may be that they use a dataset without survival bias, where this thesis have consistently chosen to only include funds that have survived for the entire selection period. Another reason for different results may be that managers in Norway today (2016-2021) probably have access to more advanced analysis tools than managers had back in year 2000-2010.

Hovstad and Langedal (2018) did a similar study to this one, where they used the same factor models in addition to the 5-factor model, the same measurements for active management and the same risk-adjusted targets, except for treynor ratio where they have rather included appraisal ratio. The purpose of their study was to look at the relationship between the degree of active share and performance in Norwegian equity funds. They find no evidence that funds with a higher active share achieve a higher differential return than funds with a low active share. This is in line with the results of this study, as it shows that a higher active share doesn’t necessarily lead to better performance. Like Hovstad and Langedals (2018), the results of this study show that a higher active share can just as easily lead to poorer performance and lower returns, as good performance and excess returns. The results from the

analysis provide a good example of just this. If we look at Holberg Norge A, it is one of the funds with the highest active share and excess return, while DNB Norge A, on the other hand, has almost as high an active share but is one of the funds with the lowest return for the period.

As mentioned in section 3.3, Cremers and Ankur (2016) did a study in which they looked at different types of equity funds with a high active share. From this study we get that although active share is an important measure, one should also include other characteristics of the funds, as these can have explanatory value. The findings for active share agrees with this. An example from the results: if we only look at the active share, we can see that First Generator S is the fund with the highest active share in the sample, and they have managed to create excess returns beyond the market. If we take the factor models and risk adjusted measures into account, the fund, on the other hand, is one of the funds that has performed the worst overall, despite the high level of active share. Thus, its important to include several factors when analysing funds' performance.

In section 3.2 we mentioned Sørensen (2009) who dealt with the Norwegian actively managed equity fund market, where he used a data set free of survival bias, including 97 funds in the period 1982 to 2008. Like Sørensens (2009) results, the findings show that the managers of the best funds have positive stock-picking skills, while the managers of the funds that do the worst make poor decisions when picking stocks. Furthermore, like Sørensen (2009), we find no evidence of the persistence of the funds' performance through momentum strategies, as none of the funds had significant PR1YR values in the four-factor model.

The findings in this thesis on the other hand, speak against Sørensen (2009) when it comes to his results saying Norwegian funds generally fail to create risk-adjusted excess returns beyond the market, and the few who succeed are due to luck rather than skills. Here, my results show that the risk-adjusted excess returns created by the best funds indicates skilled managers rather than lucky ones. The reason why we may have different results may be the same reason as mentioned earlier in this section, that Sørensen (2009) uses a different selection period. It is reasonable to assume that as far back as to the 1980s, market conditions may have been different from what they are today. Also, the managers probably did not have access to as modern and effective analysis tools as managers have today. However, the fact that he has a sample free of survival bias should not affect the performance of each individual fund, but only the average of all the funds.

Furthermore, my results agree with Kosowski et. al. (2006) and Cuthbertson et. al. (2008) results saying that the performance of the best and worst funds could not be explained by luck, but the ability to pick out winning stocks, or select losing stocks. Furthermore, the results are partly consistent with Fama & French (2010) which came to evidence that there were managers who managed to create risk-adjusted excess returns, but these disappear in the amount of all managers who perform worse than the market. The results of this thesis show that most of the sample are not able to create risk-adjusted returns, but this proportion is not so large that they dilute the funds that are able to create risk-adjusted excess returns. If, on the other hand, all Norwegian funds had been included in the sample, including closed and merged funds, one would assume that the proportion of funds that fail to create risk-adjusted excess returns would have increased considerably, and the results would probably show the same. Furthermore, findings agree with their results which proved that there were poor stock picking skills among the funds that performed worst.

9.0 **Conclusion**

Through this thesis, 26 actively managed equity funds with domestic investments in the period 28.02.2016-28.02.2021 has been analysed. All funds are analysed for whether they manage to create excess returns beyond the market, whether the excess returns come from luck or skills, and how active the various funds are. The purpose of this paper was to see if Norwegian actively managed equity funds manage make excess returns beyond the market, and then to be able to answer whether it is most profitable for investors to invest in active- or passively managed equity funds, as well as to see which funds do best as of 2021.

The initial analysis shows that 11 of the total 26 funds have a higher annual return for the period than the market, where 3 of these have significantly higher returns. The remaining 15 funds have delivered a lower return than the market. Based on these results, where risk is not considered, only 42% of the sample give reason to invest in an actively managed fund rather than a passively managed fund. However, the funds who performed the best has made so much excess return that even though the majority of the fund sample has performed worse than the market, the sample on average has made excess returns beyond the market.

The results from the regression models show that 12 of the funds have positive alpha values, where 8 of these are significantly different from zero. This means that 46% of the funds has

managed to beat the market, and the managers of these funds have made good investment choices for the period. The risk factor SMB shows that two of the funds' excess returns can be explained by partly tilting towards small companies. No significant values were found for the factors PR1YR and HML, which means that none of the funds' abnormal returns can be explained by momentum strategies or tilting towards value companies. For the period, 14 of the funds have negative alpha values, of which 9 of these are significantly different from zero. Most of the fund selection (54%) thus performs worse than the market adjusted for market exposure.

For the information ratio, it appears that 12 of the funds have a positive IR higher than for the benchmark index, while 14 of the funds have had a negative IR. This tells us that the managers in 46% of the funds have made good choices, while the managers in 54% of the funds have made poor choices in the composition of the portfolios. This shows us that most of the funds is unable to beat the market, which is an argument for picking index funds over active equity funds. On average, the entire sample has a lower sharpe ratio than the benchmark index. 9 of the funds have a higher sharpe ratio than the benchmark, while 17 of the funds have a lower sharpe ratio. This tells us that 65% of the fund selection has done worse than the market adjusted for the total risk, and it cannot be proven statistically that the funds manage to create excess returns adjusted for total risk. This too is results which can be used to argue for index funds being the better choice for Norwegian equity funds. The results from the Treynor ratio show us that the funds have on average performed worse than the market, where 58% of the sample have underperformed the market. The treynor ratio also argues that active managers on average fail to outperform the market.

The analysis of potential closet indexing measured by active share, based on Cremers & Petajisto´s (2009) conclusion shows that 15 of the funds (58%) are passively managed. If we follow ESMA's third scenario instead, which provides the sharpest analysis; Active share <50%, TE <3, R2> 0.95, only two funds, C WorldWide Norge and KLP Aksjenorge, fall into the category for closet indexation. These funds have also performed significantly worse than the market, considering all factors in this analysis, which may be a result from lying to close to the index. However, this is not certain, as the results show that a higher active share can just as well lead to poor- as to good performance. Anyway, the show that we have several funds in Norway that can be categorized as closet index funds.

Based on results from the descriptive statistics, the risk-adjusted performance measures, and the factor models, it can be seen that the majority of Norwegian actively managed equity

funds are unable to create excess returns beyond the market. But it is still wrong to conclude that Norwegian actively managed equity funds are not able to perform better / make excess returns beyond the market. Because even though most of the funds fail to do better than the market, we also see that several of the funds in the sample have managed to crush the market year after year. The risk adjusted measures show that the good performance is not due to luck, but skilled managers who through independent analyses are able to find investments that create excess returns. At the same time, the analyses indicate that poor performance cannot be due to bad luck, but repeated poor choices made by the manager. The conclusion is that Norwegian actively managed equity funds manage to create excess returns beyond the market, as we se the funds do so on average.

If we look at the whole equity fund markets average performance, passive management will beat active management in the long run, but it is reasonable to assume that any rational investor opts out of funds that perform poorly, and if one then chooses the best funds, active management will pay off, as my analyses show that managers of these funds manage to beat the market year after year. Therefore, active management will pay off, if one as an investor manages to select the right funds. One can easily determine which funds are the bad funds, by looking at the results in this thesis, and determine which funds are best.

Based on the analyses done in this paper, the best funds overall for the selection period are Forte Norge, followed by Holberg Norge A and Delphi Norge A. The funds that have done the worst overall are Pareto Investment Fund A, followed by First Generator S and Pluss Aksje Fondsforvaltning. Furthermore, the results from active share, tracking error and adjusted R^2 gives ground to conclude that it exists closet indexers in the Norwegian market for equity funds.

10.0 **Further research**

Section 6.4 mentioned some limitation and weaknesses of the data. This study could have been expanded and made much more advanced, but as this is a master's thesis that takes place over one semester, the time limit sets limits on how comprehensive the study can be. Based on this, it will be discussed how one could have expanded this study for future research.

It would have been interesting to do an extended survey where you look at what have been done in this thesis, but for a longer time period and also analyse rolling numbers along the way. Like for example how the funds performed during different periods, such as the financial crisis in 2008 and the corona crisis in 2020. Here we could have seen what separates the funds that perform well and those that do poorly. What do performance targets look like before, during and after such shocks that are inflicted on the market? How do active share change in such situations? Look at what is right, to take high risk / low risk, increase active share or decrease active share under different market conditions? This are some questions one could try to answer by extending this thesis.

It would also be interesting to include the portfolio of each individual fund and see what actions the managers of each individual fund make to secure investors' interests along the way when changes occur in the market. Furthermore, to see to what extent the portfolio changes in step with changes in the market. By having an insight in the funds' portfolios and how these change, we may perhaps see even more clearly which managers are skilled and have made good analyses and decisions, and which managers who may have been lucky and hit on "lottery stocks" or performed poorly.

Furthermore, it would be interesting to include all Norwegian actively managed equity funds that have existed. In this way, we eliminate the possibility of sample bias, and the average for the sample will be more correct as we also include all funds that have been closed down and merged due to poor results. Here we will get an even better picture and a ratio of how many active funds manage to beat the market, and how many fails in the attempt to create excess returns beyond the market. Analyses performed on equity funds' performance are based on historical figures, and although some funds do well year after year, there is no guarantee that this success will continue in the future. It will therefore be interesting to see how many of the active funds actually manage to beat the market overall, and whether it is worth taking the risk of an active fund that has done well in all years, or whether the statistics indicate that one should choose a passive fund in the long run.

11.0 **References**

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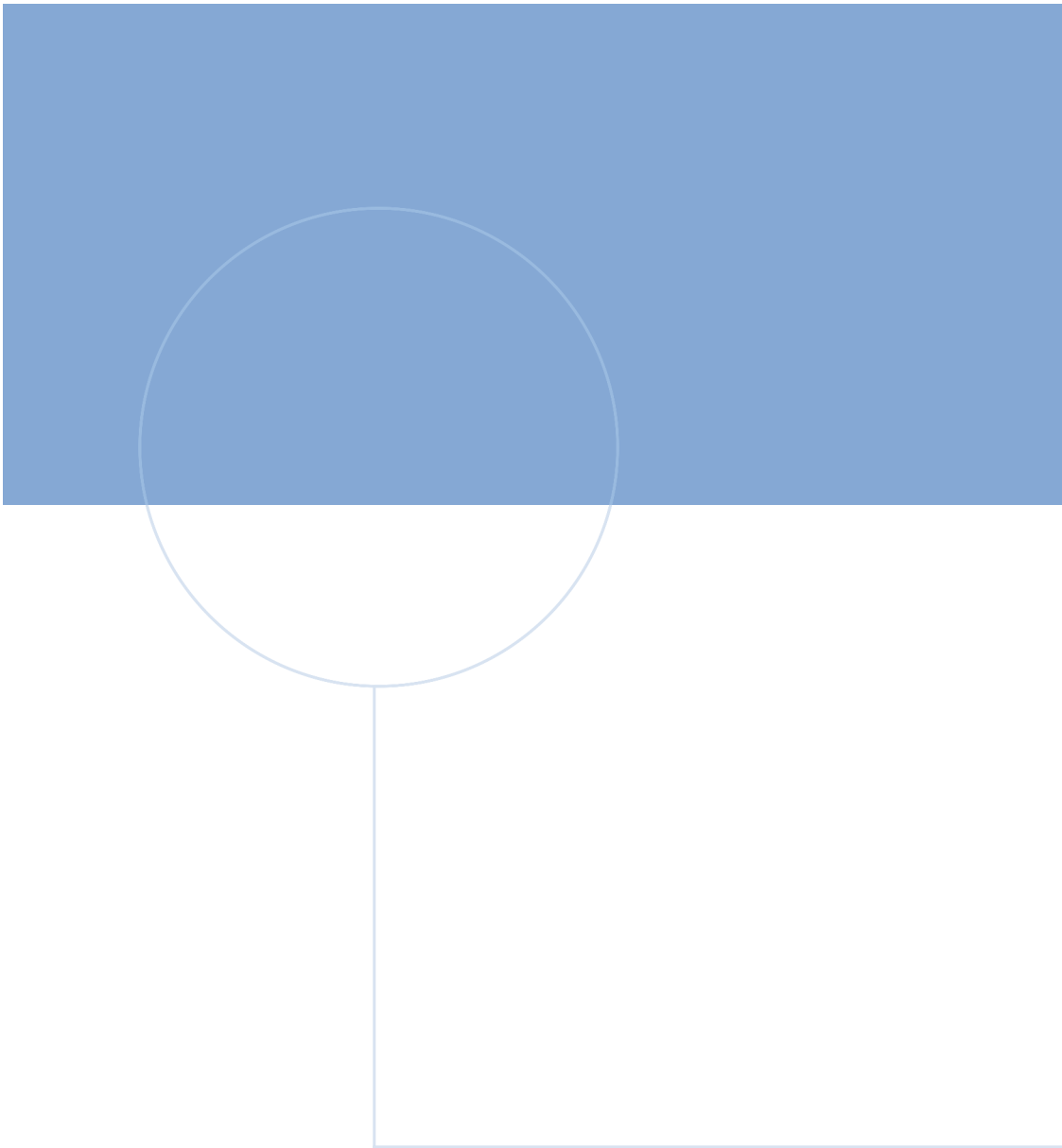

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