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# Performance and Characteristics of Danish Mutual Funds


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# Abstract

In this study the performance and persistence of 66 Danish mutual funds was assessed in the period from 2006 to 2018, using both the Jensen alpha model and the Treynor and mazy market timing model. Furthermore, was the relationship between the excess return of the funds and their characteristics examined using a pooled cross-sectional regression.

The results show that the Danish mutual fund as a group do not possess stock-picking skills, nor do they possess market timing. However, the group of funds investing in the Danish market did showed some signs of market timing ability, and they generate positive alphas more often than the funds investing in European and Global stocks. There is no evidence supporting persistence among the Danish mutual fund's performance. This is both when examining the funds year over year and using subperiods of 3 years.

Evidence from a cross-sectional regression, with Jensen's alpha as independent variable, and various fund attributes as dependent variable, shows that costs have a significant negative effect on the risk adjusted return of Danish mutual funds. The results also showed evidence of significant positive relation between the return of a fund and the inflow of money into the fund, documenting the existence of the smart money effect on the Danish mutual fund market. Furthermore, is the level of front-end and back-end loading fees found to have significant effect on the return of funds investing in the Danish market.

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# 1. Introduction

*This section contains a short introduction to the topic of performance evaluation, along with a general overview of the structure of this thesis. Furthermore, will this section introduce the research questions to be examined, along with a delimitation and a description of the study's contribution to extant literature.*

## 1.1 Background

The mutual fund industry has experienced a significant growth in recent years, both in assets invested and in total number of funds. Since 2010 the total assets of open-end mutual funds have increased with more than 50% and now exceeds more than 46 trillion dollars globally, which corresponds to approximately 25% of the total equity worldwide (ICI factbook, 2019). With roughly half of the investments in open-end mutual funds coming from private households, these numbers support what a huge importance the mutual fund industry is for the private investors (ICI factbook 2019). Mutual funds give the private investor easy access to diversified portfolios, on a range of different markets, and under the control of professional portfolio managers (Bodie, Kane and Marcus, 2014). Even though the mutual funds are professional managed, not all funds perform equally well and with the large offering of different funds, it can be extremely difficult for the private investor to single out the good performing fund from the bad performing ones.

Since the revolutionary development of the framework of Capital Asset Pricing Models, in the 1960's, researchers have worked energetically with the examination of the performance of mutual funds, and several methods have been developed to try and identify the best performing funds (Fama and French, 2004). The development of the Sharpe Ratio, by William Sharpe (1966), gave investors a relative measure which could be used to rank the performance of funds up against each other. This was followed by the development of the Jensen's Alpha, an absolute measure of the risk adjusted return generated in excess of a selected benchmark (Jensen, 1968).

Even though a vast amount of research has been conducted about the topic, there is still no unanimous conclusion among researchers and practitioners, on whether active managed funds can outperform their benchmark. Some studies have found evidence that some individual funds are able to outperform the market and doing so over several years, but they also conclude that the funds delivering abnormal returns are difficult to identify beforehand, and only outperform in shorter periods at the time. (Grinblatt and Titman 1992; Otten and Bams, 2002; Christensen, 2013). Other studies have found trading strategies that clearly outperform the market and can be used by the fund managers to generate higher returns (Fama and French, 1993, 2015; Carhart, 1997). However, when examining the return of mutual funds over longer periods and accounting for trading strategies, there is a predominance of empirical evidence suggesting that fund managers on average do not outperform their benchmark when accounting for costs (Jensen, 1968; Carhart 1997, Wermers, 2000, Otten and Bams 2002, Christensen, 2013).

The effect that costs have on the return of a mutual fund, have been the basis for many studies, this both in relation to returns of active and passive managed funds, and as an attribute that could explain returns. The active strategy of a mutual fund needs to generate sufficient returns to cover the expenses, otherwise the passive index fund would be a better alternative. Ippolito (1989) found evidence of active mutual funds generating superior return over the passive funds. Wermers (2000), and Lobão and Gomes (2015), found a positive relationship between cost and the return of US mutual funds, though this was only gross of expenses. Dahlquist, Engström and Söderlind (2000) found that cost had a negative effect on the return of Swedish mutual funds, a result also found by Bechmann and Rangvid (2007) when examining Danish mutual funds. Besides cost, several other fund specific characteristics have been examined for their relation with the risk adjusted return of the funds, though the results here are also mixed. For each characteristic it is possible to find studies that conclude both positive negative and nonexistent effects on performance, depending on the market examined (Lobão and Gomes, 2015).

For Danish investors to draw use of the findings in the performance literature, they need to relate on studies carried out using Danish mutual funds, as conclusions varies depending on market. Christensen (2013), conclude that Danish investors need to be extremely carefully when they choose mutual funds to invest in, as he finds huge differences in their performance. This study will try to expand the literature concerning performance evaluation of Danish mutual funds, by focusing on two main areas. Namely, the performance of Danish mutual funds investing in equity, and the relation between the mutual fund characteristics and their risk-adjusted return. The results from the performance evaluation generated from an updated time period, along with the examination of fund characteristics, will hopefully help investors to be more meticulous when choosing a fund to invest in.

## 1.2 Problem statement

The main objective of this study is to examine the performance and persistence of Danish mutual funds and try to identify if any fond characteristics could be used to explain the return of the fund. In order to elucidate the topic of examination thoroughly, two sub-questions were introduced.

1) *Do Danish mutual fund managers possess the ability of stock-picking and market timing, and can they exploit these skills to generate abnormal return in consecutive years?*
2) *Which characteristics of Danish mutual funds have a significant relation with their risk-adjusted return?*

## 1.3 Contribution

This study will contribute with an updated assessment of the performance and persistence of Danish mutual funds, along with insights of the relation between specific fund characteristics and the risk-adjusted return of the fund. The evaluation will use the most recent data and cover a 12-year period. The evaluation will focus both on performance over long periods but also examine performance over several subperiod of one to three years. The performance of the funds will be carried out by using three different groups of funds, defined by their investment focus. Combined with an evaluation of persistence this will give a more thorough assessment of the Danish mutual funds.

Additional to the evaluation of performance and persistence, this study also examines various fund attributes and their relationship with the risk-adjusted return of the fund. Through a multivariate regression this study will bring insight of an area not yet evaluated in a Danish context and bring new knowledge about potential characteristics that can have significant effect on the return of Danish mutual funds and add to the additional research about fund characteristics carried out in other markets. The finding of this study will hopefully help private investors in making a more meticulous choice when selecting a fund to invest in. The results from the performance evaluation generated from an updated time period, along with the examination of fund characteristic, will hopefully help investors to be more meticulous when choosing a fund to invest in.

## 1.4 Delimitations

In Denmark there is presently more than 600 UCITS licensed mutual funds which invest in either stock, bonds or a combination of the two. In order to properly examine the performance, and characteristics of the funds a range of selection criteria was set up to reduce number of funds, to a more manageable amount for a study of this size. A more thoroughly presentation of the selection process is made in the methodology section, though brief description of the main criteria will be reviewed here. The funds included in the final sample, must be open ended funds, have a self-defined benchmark, and have an investment focus being either the Danish, European or the Global equity market. To have sufficient data to analyze, the fund must have four years of full data. Due to the difficulties in gathering information about closed funds, these were not included in the final sample. A total of 66 funds was included in the final sample. The use of selection criteria has made the sample more homogenous but is now only including around 25% of the mutual funds and total asset managed in those categories. This can have resulted in the exclusion of funds that could have contributed to more insight into the subject.

Two models are chosen to test the performance, the Jensen’s model (1968) and the Treynor and Mazuyz (1966) market timing model, which is both using the CAPM framework. The models are one of the most used performance evaluation models in the finance literature, and the precision of them are well documented (Fama and French, 2004). Though it has also been advocated by researchers as Fama and French (1993) and Carhart (1997) that the inclusion of additional factors could improve result from the models, this has not been done in this study. This is justified by the use of the funds own self-defined benchmark and a reasonable high $R^2$ of the data. Besides this, Christensen (2005, 2013) is using these two models as well when examining Danish mutual funds, and this will make a comparison of the results easier.

The models can be tested in two states an unconditional and a conditional setting. The unconditional setting assumes constant risk level and a stationary beta throughout the whole time period, while the conditional model accounts for variations in risk level and allow a non-stationary beta. Like the founders of the original models, Treynor and Mazuy (1966) and Jensen (1968), the models in this study will only be tested in the unconditional state.

Additional characteristics of the funds could have been included in the dataset and could have contributed to more insights into the effect of characteristics on return. An example could be the funds use of a bucket, meaning investments outside their original investment scope. Vague description by the funds like "we strive to invest within our benchmark", and "the majority of our investments will be within equities in the selected country or benchmark", has made it difficult to quantify by how much their investment could deviate from their benchmark, so this characteristic was not included.

## 1.5 Structure

This study is divided into 8 sections, with the first one ending at this paragraph. The remainder of the report is structured in the following sections. Section 2 gives a short presentation of the mutual fund industry both globally and for the Danish market. This is followed by a review of the existing literature and the findings in evaluations of performance, persistence and fund characteristics. Section 4 provides an overview of the underlying theory of performance evaluation along with the theoretically background for the models used. Section 5 presents the methodical considerations for the choices made in the data collecting process and the subsequent handling of the data. This section also includes a description of the two datasets, and a robustness check of the data and of the models. Several of the paragraphs in this section, will be split into two sections which address first the time-series dataset used for performance evaluation, and then the cross-sectional dataset used for examining of characteristics. In section 6 the empirical findings of the models are presented and analyzed. This is done in several subsections for each model and for each different time period. Each subsection will end with an intermediate conclusion, containing an overview of the most relevant findings and how they relate to extant literature. Section 7 contains the overall conclusion of the empirical findings. The final section will address relevant suggestion for further research.

## 2. The Danish mutual fund industry

The interest of Danish investment funds has increased rapidly during the last 20 years. In 1999 the amount of assets managed by investment funds was 130 DKK billion, a number that has increased to more than 2.250 DKK billion in 2019. Looking only at mutual funds the value is 1.030 DKK billion as of June 2019, of which 394 DKK billion, corresponding to 40%, is invested only in equity. Mutual funds investing in bond stands for around 45% while mutual funds investing in a combination of bonds and equity stands for the remaining 15%.

***Table 2.1 - Total number and total asset value of mutual funds in Denmark (DKK mio.)***

| | Total | | | Active funds | | | Passive funds | | |
|---|---|---|---|---|---|---|---|---|---|
| | Assets | No. Funds | Avg. Size | Assets | No. Funds | Avg. Size | Assets | No. Funds | Avg. Size |
| Total | 1,029,949 | 673 | 1,530 | 959,150 | 614 | 1,562 | 70,560 | 57 | 1,238 |
| Equity | 393,962 | 312 | 1,263 | 329,340 | 265 | 1,243 | 64,383 | 45 | 1,431 |
| Bonds | 459,195 | 229 | 2,005 | 454,643 | 225 | 2,021 | 4,552 | 4 | 1,138 |
| Mixed | 169,730 | 129 | 1,316 | 168,106 | 121 | 1,389 | 1,625 | 8 | 203 |

*Source: The Statbank of Danmarks Nationalbank Table DNIFSUM*

The mutual fund industry is an important investment vehicle for the private investors in Denmark, and around 35% of the assets in UCITS funds is own by private investors.[1] The shares of open-end mutual funds can be traded at the stock exchange Nasdaq Copenhagen, just like regular shares. This gives the private investor easy access to a wide selection of funds with different investment focus, and highly diversified portfolios under the control of professional fund managers (Bodie et al., 2014). The majority of the Danish equity funds invest in global equities, which make up more than 55% of total assets. The north American market counts for 10%, and around 7% of assets is invested in the Danish equity market.

***Table 2.2 -Value and investment focus of equity funds in Denmark, January 2018 (DKK mio.)***

| | Assets | % of total |
|---|---|---|
| Total Equity | 976,700 | 100.0% |
| Denmark | 68,800 | 7.0% |
| Global | 563,300 | 57.7% |
| Europe | 68,400 | 7.0% |
| North Amerika | 97,200 | 10.0% |
| Emerging markets | 64,500 | 6.6% |
| Other markets | 114,500 | 11.7% |

*Source: The Statbank of Danmarks Nationalbank Table DNIFAM*
*Note: Table 2.1 and 2.2 differ as a result of different data collection methods and the inclusion of both AIF, UCITS and non UCITS investment funds in this table.*

[1] http://www.nationalbanken.dk/en/statistics/find_statistics/Documents/Investment%20funds/Investment%20funds%2020180731.pdf#search=ucits

The debate about whether active managed investment funds, are able to outperform the passive index fund, has flourished in many years. Though the discussion hasn't been settled yet, the focus on passive investment is rising. The investments in passive equity funds globally, have increased every year since 2008, and is especially driven by the popularity of exchange trade funds (ICI, 2019). In the US investments in index mutual funds and Exchange Traded Funds (ETF's) now accounts for more than 36% of the total assets in long term funds, a duplication since 2008 (ICI, 2019).

For the Danish market, the value of investments in passive mutual only accounts for a small part of the total asset value, but it is increasing. The value of the asset invested in passive equity funds made up around 5% of the total value invested in equity funds in 2015[2], but has now increased to more than 16% of the value invested in equity funds, as of June 2019[3], though mutual funds with an active strategy is still the preferred type of fund in Denmark.

Danish mutual funds are regulated by the Danish Financial Supervisory Authority (FSA) Finanstilsynet, which monitor the funds and make sure they meet the financial legislation and solvency requirement for taking on risk. Finanstilsynet is also the legal institution which approve funds complying with the Undertakings for the Collective Investment in Transferable Securities Directives, abbreviated UCITS. UCITS is an EU directive created as a regulatory framework, made to create a uniform legislation across borders in the European union. UCITS is among other things, made to make sure investors are protected, and that mutual funds are properly diversified and follow a specific set of rules for their investments. For example, is a UCITS fund not allowed to invest more than 10% of their assets in a single security. Furthermore, is the accumulated value of investments that exceed 5% of the funds' assets, but is less than 10%, not allowed to be more than 40% of total fund assets.[4] This rule entails that UCITS funds must invest in at least 16 different securities. The FSA in each member state is responsible for the approval and monitoring of UCITS funds in their country.

[2] https://www.finanstilsynet.dk/~/media/Tal-og-fakta/2017/Markedsudvikling-2016-kollektive-investeringer-final-pdf.pdf?la=da

[3] http://www.nationalbanken.dk/da/statistik/find_statistik/Documents/Investeringsforeningsstatistik/Investeringsfonde%2020190801.pdf

[4] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02009L0065-20140917&from=EN

# 3. Literature review

## 3.1 CAPM

The theoretical foundation of asset pricing was paved by the development of the Capital Asset Pricing Model (CAPM) by Jack Treynor (1961), William Sharpe (1964) and John Lintner (1965), in the mid 1960's. The CAPM is based on the portfolio theory of minimum variance portfolios by Harry M. Markowitz (1952, 1959), and gave a solution to one of that times central problems in finance, namely the relationship between risk and expected return. Prior to the development of CAPM, academics and practitioners struggled to describe the relationship between risk and return, though there existed a general understanding that, investors were risk averse, and higher risk was compensated with a risk premium. But to evaluate performance of different portfolios, one needs to control for the different risk levels of the portfolios, which is the essence of the CAPM.

With the new theoretically framework of risk return relationship, Treynor (1965) and Sharpe (1966) both developed measures to compare the performance of mutual funds. Both used the CAPM-relation hence a portfolio manager which takes on more risk, is also expected to generate a higher return. Treynor used the relationship between the systematic risk of a fund and its excess return over the risk-free rate per unit of market risk. The Treynor-ratio can therefore be used to rank the portfolio managers up against each other in accordance to how good the manager is to provide risk adjusted return (Treynor, 1965).

Sharpe (1966) argued that not only systematic risk should be taking into account, as a portfolio different from the market portfolio would be less diversified and therefore riskier. He then created a measure which in contrary to the Treynor-ratio, takes on all the risk of a fund into account. The measure is called the Sharpe-Ratio, and can likewise the Treynor-ratio, be used only to rank the funds up against each other and not as an absolute measure. The ratio shall be seen as a guide of how good the fund manager is of creating excess return per unit of total risk.

## 3.2 Components of a fund managers skills

Fama (1972) formalized the component when examining a fund manager performance and reasoned that it is important to distinguish between both the managers skill in selecting the best securities given a certain level of risk (Selectivity), and their ability in prediction the general market movements (Timing).

### 3.2.1 Jensen's Alpha

The breakthrough of absolute measures came when Jensen (1968) extended the CAPM formula, with the term α, later to be called Jensen's Alpha, and tested the CAPM empirically through a time-series regression. Jensen reasoned that if the CAPM holds the additional alpha would be zero as all returns should be explained by the beta. If the fund manager did possess stock-picking skills and was able to exploit them to generate abnormal return in proportion to the market, then not all return could be explained by the beta, and alpha of the model would therefore be positive and significantly different from zero.

Jensen (1968) examined the performance of 115 active managed mutual funds using both net and gross returns. Jensen found very little evidence of forecasting skill among the individual funds and concluded that on average, funds were not capable of outperforming a naïve buy-the-market-and-hold strategy. Only three of the funds in the sample were able to significantly outperform a naïve buy-the-market-and-hold strategy, though he stated that this could be due to mere chance as one would expect 5-6 funds outperforming at a 5% significant level. His conclusion holds even when he looked gross of cost, and almost 20% of the examined funds actual performed significantly worse than a naïve buy-the-market-and-hold strategy. Since Jensen presented his study, a countless number of researchers has adopted his method. Grinblatt and Titman (1989) found evidence of significant positive alpha amongst growth-funds and funds with low net asset value when using gross returns and conclude superior performance for some mutual fund managers. Though these funds were also those with highest expense ratio so net of expenses these funds did not deliver return higher than their benchmark. Similar finding was presented by Malkiel (1995) which found that US mutual funds outperformed their benchmark significantly. However, this was only before accounting for expenses, and he concluded that the fund managers could not beat the market net of returns.

In contrast to these result Ippolito (1989) found that US mutual funds was able to outperform their benchmark even net of expenses. However, his findings were criticized by Elton, Gruber, Das, and Hlavka (1993), for not using a proper benchmark. They argued that Ippolito had included non-SP&500 stocks in his sample, and when correcting for this, Elton et al. (1993) found that the conclusion made by Ippolito was the other way around. Despite of Jensen's Alpha was a major contribution to the performance literature, the sensitivity of the choice of benchmark have been subject to some criticism. Furthermore, was the Jensen model criticized for the use of a constant Beta in the model. The alpha in the model only capture the stock-picking skill of the manager, and not the market timing. Kon and Jen (1978) therefore argued that active managed portfolios should have a changing level of risk, as the fund manager expectations to market movements should make her change the systematic risk of the portfolio to benefit hereof.

### 3.2.2 Treynor and Mazuy's market timing model

As Fama (1972) suggest also market timing should be taken into consideration wen measure performance of mutual fund managers. Such a model was developed by Treynor and Mazuy (1966). They added a quadratic term to the single index model, which they postulated would capture the fund managers ability to foresee and exploit fluctuation in the market. They argued that a skilled manager with the ability to foresee the directions of the fluctuations in the market, would be able to adjust the exposure of the portfolios systematic risk to the market accordingly. If expectations were that market goes up, the fund manager would increase volatility of the portfolio towards the market and decrease it if she expected that the market goes down. When plotting the return of the fund with return of the market, it will form an upward sloping convex curve, which is almost flat at the bottom where market return is low, and steep when market return is high. Mazuy tested their theory using 57 us mutual funds. They found no evidence of the fund managers possess market timing ability as only on fund in the sample, could significantly time the market. This evidence is supported by many other studies, which all find no market timing ability among fund managers (Daniel, Grinblatt, Titman, and Wermers, 1997; Goetzmann, Ingersoll and Ivkovic, 2000; Christensen 2005, 2013)

## 3.3 Persistence of performance

Besides the interest in performance evaluations, several researchers also focused on the persistence in performance of mutual funds. Grinblatt and Titman (1992) tested for persistence among funds using two subperiod of five years and found evidence of positive persistence among the funds. Goetzmann and Ibbotson (1994) used the median of the funds yearly return to sort the funds as either winners(losers) if their return was above(below) the median. Using this method, they found that the percentage of consistently winners were significantly above the 50% expected when using the median to sort the funds. These findings were also supported by Malkiel (1995) using the same method over US mutual funds.

## 3.4 Factor models

Though CAPM is one of the most used asset pricing models, and still the main theory used in economic classes today, it fails to be proved empirical across many markets (Fama and French 2004). During the late 70's, critics of the CAPM started to argue that much of the variation in excess return is not linked to the market beta, but that and other factors play a role. Basu (1977) found that stocks which were sorted after a Price/Earnings ratio generated a higher future returns than estimated by the CAPM. Banz (1981) found evidence of a size factor, where average small stocks have higher return than larger stock. Subsequent of this, several academics presented similar findings (Fama and French 2004).

In the footstep of these findings Fama and French (1992) presented their 3-factor model, which have become one of the most known factor models in modern time. They extended the original CAPM model with two additional factors. A size factor (SMB) and a book-to-market factor (HML), as they found that they added to the explanation of expected return provided by the beta. This model was later extended with a momentum factor (WML) by (Jegadeesh and Titmann, 1993). Recently Fama and French themselves, added two more factors to their model, namely profitability (RMW) and investment (CMA) (Fama and French, 2015).

## 3.5 Fund characteristics

The use of multifactor models to examine performance, made it possible to include other fund characteristics into the models, and examine their relationship with returns. Several characteristics such as, size, costs, fees, age, net flows and portfolio turnover have been examined for their relationship with returns. Cost is one of the most examined characteristics and in general said to have negative effect on returns. If two funds have the same portfolio the on with lowest cost, will have the highest return. The negative effect of costs has been found by Carhart (1997), Dahlquist et al. (2000) and Otten and Bams (2002) among others. Some studies have found a positive relation between cost and returns, but only when using gross returns. When accounting for expenses, the excess return generated is not high enough to cover the expenses of the fund, so an investor would not gain higher return by choosing a fund with higher costs (Wermers, 2000; Lobão and Gomes 2015). Besides cost several other characteristics have been found to have significant effect on returns. Dahlquist et al., (2000) test several fund attributes for their relationship with the risk-adjusted return of a fund, by using a sample of Swedish mutual funds. They find that both portfolio turnover and the inflow of money have a positive relation with the return of the funds. The existence of a positive relationship between turnover and return has also been documented by Grinblatt and Titman (1994) which found superior performance among fund in the sample with the highest turnover, compared with the funds with the lowest turnover. These findings are in line with the general claim by fund managers, which argue that higher trading activities and cost will not impact returns. Investors pay for the quality of the managers information, and the manager will only trade to increase return (Bodie et al., 2014). Carhart (1997) on the other hands find a strong negative relationship between turnover and the return of mutual funds. He finds that the return generated does not fully cover the costs due to higher trading actives.

There is a general consensus in the literature that the net flow of money into a fund, have a positive effect on return. Several studies have found evidence of the so called so called “smart money” described by Gruber (1996). The rationale behind is that open-end funds is traded at net asset value, so superior performance of a manager is not reflected in the priced. If some investors are aware of this an act on it, then money will flow into funds that will perform well in the future, and flow out of those which will perform bad. This has been proven by Grinblatt and Titman (1989) Zheng (1999) and Dahlquist et al., (2000) among others.

Dahlquist et al., (2000) also found that size have a strong and negative relation with the return of Swedish Mutual funds. They showed that a trading strategy of buying large funds and selling small funds, underperformed by 2.33% per year, and therefor concluded that size had a negative effect on returns. Indro et al., (1999) found that funds below a certain size, are too small to generate sufficient returns to cover their costs. They also found that economies of scale are only sufficient up to a certain size, as the largest funds tends to overinvest, and therefore becomes inefficient. Their overall conclusion of an examination of 683 US mutual funds, was that size actually had a significant negative effect on return. Their findings are supported by Grinblatt and Titman (1989), Chen et al. (2004), and Pollet and Wilson (2008) who all finds same negative effect un US mutual funds. However, findings are contradicted by Otten and Bams (2002), which finds that size has a significantly positive effect on returns for mutual funds in both Germany, France, UK and the Netherlands.

As seen above, the empirical evidence about the fund characteristics effects on returns, are in many cases mixed, though a vast amount of research has been conducted about this topic. The empirical evidence for each characteristics effect on return has been proved to be both positive, negative and non-existing, depending on the market, time period or type of funds examined.

## 3.6 Empirical evidence from the Danish market

Due to the size of the market, the research done on the Danish fund market is very limited, compared to many other markets. Christensen (2005). Using a sample of 44 mutual fonds investing in either equities or bonds from 1994 to 2002, he concludes that on average, the Danish mutual funds have not been able to outperform their benchmark. Some had positive alphas, but none was significant. Using the market timing model by Treynor and Mazuy (1966), he found that one fund had a significant positive alpha, and 2 funds had significant positive gamma, suggesting that they are able to time the market. But he concluded that the fund managers overall could not time the market. Using more recent data Christensen (2013) did found almost similar result. He investigated performance of Danish mutual funds from 2001 to 2010, using the Treynor and Mazuy market timing model. Compared to his earlier result he now found 5 funds who had significant positive alpha. Though there was a large variation in the performance of the funds as 57 (80%) of the funds had a negative alpha and 30 of these was significant. Furthermore, did he found that 10 out of 71 funds was able to time the market, and of these did 7 of them invest in Danish equities.

Bechmann and Rangvid (2007) created a cost-based indicator for rating Danish mutual funds. Using data from 1994 to 2003 they sorted mutual funds in 5 different groups according to the costs of the fund and tested if cost was able to predict future return. They found that the cost-based rating did have some predictive power over a long period 8-10 years. An investor would gain an annual excess return of 3-4% if investing in the 10% with lowest cost, compared to investing in the 10% of funds with highest cost.

# 4. Theory

## 4.1 Efficient Market Hypothesis

If the price of a given stock reflect all available information, and only moves because of news, markets is said to be informationally efficient. The theory is known as the Efficient Market Hypothesis (EMH) and was formalized by Malkiel and Fama (1970) (Munk, 2017).

The EMH states that no risk adjusted profit can be gained, using trading strategies based on information. When markets are informationally efficient, prices cannot be predicted, as the information used to predict the prices already will be included in the price. Therefore, news affecting the price of a stock will be unpredictable as well, since news that could be predicted would be part of the information today, and therefore already priced in. If the EMH holds, prices would only move when new information becomes available. If new information becomes available indicating that a stock is either under- or overpriced, investors will act on the new information and immediately trade the stock either up or down, until the price is at a fair level. Competition amongst analyst to uncover new information, to help dem decide whether they should buy or sell, before rest of the market becomes aware should lead to information efficiency in the market (Munk, 2017).

The EMH has been tested empirically and it is to are large extent supported that the prices reflect all available information. But exactly what "all available information" includes varies (Munk, 2017). Malkiel and Fama (1970) divided the results of the empirical test, into three versions of the EMH depending on how well the prices fully reflect specific subset of available information.

**First version is the weak form efficiency**, where stock prices reflect all historical information, which include historical prices, trading volume and other trading information. This means that all information about past prices cannot be used to predict future prices, as it will already be priced in.

The second version is the **Semi-strong-form efficiency** where stock prices reflect all publicly available information in addition to the historical prices included in the weak form efficiency. This is for example, annual reports, press releases, changes in legalization. When a market is semi-strong efficient information form publicly available sources cannot be used to predict future prices, and information from example press releases will immediately be priced in by investors and can therefore not be exploited to generate excess return.

The final version is the **strong-form version of the EMH** where prices reflect all available information. This includes non-public information both private and insider information e.g. management who have monopolistic access to information relevant in affecting price movement.

If the EMH was fully true, the effort of fund managers and other practitioners' in generating abnormal returns would be without benefit, as no excess return could be made by gathering information. As for this reason the EMH has been analyzed by many researchers, and some anomalies have been found through time.

Jegadeesh and Titman, (1993) found a momentum effect, where good performance was followed by good performance, and bad performance was followed by bad performance. They concluded that a portfolio created of the best performing stocks in recent past, would outperform market in the following future, at least well enough to create a profit opportunity (Bodie et al, 2014). This effect contradicts the weak-form version of the EMH, as past performances explain future performance.

Other studies have found similar anomalies such as Fama and French (1992) which discovered that when grouping companies according to their book to market ratio, those with highest book-to-market ratio would also generate highest average annual return. This contradicts the semi-strong version as annual reports used to generate these portfolios are public available and therefore should already be priced in.

Grossman and Stiglitz (1980), challenged the EMH saying perfectly efficient markets are impossible. They argue that if you are willing to spend time and money on gathering information, at some point you will find information overlooked by other investors. But the effort in doing so, must be compensated with a higher return, otherwise no incentive exists in gathering the new information. It can therefore be said that market is efficient to an extent so that cost and benefits for gathering information are balanced. Furthermore, a reasonable assumption can be made, that the degree of efficiency differs across markets. It can be assumed that the US equity market is more covered by analyst than some emerging markets, and the possibility for information not found by the whole market is larger here. The same assumption can be made for large companies as they must be assumed to be covered by more analyst than small cap firms (Bodie et al., 2014). With several anomalies in the financial markets it cannot be concluded that the markets are fully efficient.

## 4.2 CAPM

Prior to the Capital Asset Pricing Model (CAPM), no theory existed that explained the relationship between expected return and risk of an asset. Those working in this area was forced to adopt models of price behavior to, describe the relationship (Sharpe 1964). The CAPM gave a simple an intuitive solution to this problem and have since its creation become a centerpiece in the financial economy. Continuing the work of Harry M.

Markowitz (1952, 1959), on minimum variance portfolio theory, Treynor (1961), William Sharpe (1964) and John Lintner (1965) derived the CAPM in the mid 1960's.

The CAPM describes a linear relationship between risk and expected return, and an investor taking on more risk should be compensated by doing so. The idea behind CAPM is that higher risk should be rewarded with higher return. But only systematic risk should be rewarded, as unsystematic risk can be diversified away by holding a large enough portfolio of well diversified assets. The CAPM formula is

$$E[r_i] = r_f + \beta_i[\mathrm{E}(r_{mkt}) - r_f]$$

*(Equation 4.1)*

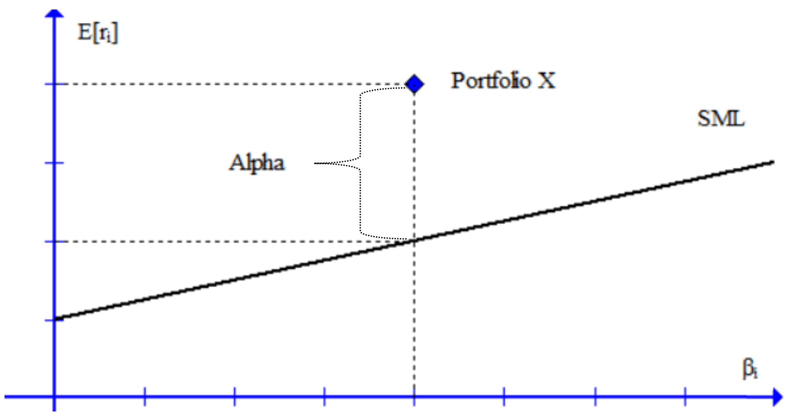
Where $E[r_i]$ is the expected return of portfolio $i$ and $r_f$ is the risk-free rate, and $\mathrm{E}(r_{mkt})$ is the expected return on the market portfolio. The $\beta_i$ is a measurement of the systematic risk of the portfolio, in relation to the market portfolio and can be described as the sensitivity of the return of portfolio $i$ in relation to changes in return of the market portfolio (Fama and French 2004). The formula for beta is derived directly from the CAPM and is

$$\beta_i = \frac{Cov[r_i, r_{mkt}]}{Var[r_{mkt}]}$$

*(Equation 4.2)*

The expected return-beta relationship of an asset is linear and when graphically portrayed a straight line with the slope equal to $\mathrm{E}(r_{mkt}) - r_f$ and intercepting the vertical axis at the risk-free rate. (see figure 4.1).

***Figure 4.1 - The Security Market Line***



This line is referred to as the Security Market Line (SML). Under the assumption of CAPM, it follows that all securities that are traded at equilibrium should plot along the SML. If a security is overvalued (undervalued) it would lie above (below) the SML and is seen as an investment opportunity. When investors act on the opportunity the asset would move towards the SML line again until it is traded at equilibrium once more. For the CAPM to hold there is a set of underlying assumption that needs to be satisfied. All asset must be publicly traded, and investors can trade with no transaction costs and no taxes. All investors can take a short position in the traded securities, and they can borrow and lend at the risk-free rate. Furthermore, is it assumed that all investors have homogeneous expectations to the market and are rational mean-variance optimizers with an investing horizon on a single period (Bodie et al., 2014).

Several of these assumptions are not fully met and must be assumed in order to use the model. In example is not all investors able to take short position and they can hardly trade without any costs. Furthermore, is the mean variance assumption only satisfied if returns are normally distributed, as a normal distribution are fully explained by the mean and variance. Returns have been proven not to be normally distributed, but it is not a bad approximation of the return distribution. Therefore, the general assumption is that returns are normally distributed (Munk, 2017).

The strict assumptions underlying CAPM, can limit its practical use in a real world setting and has been the base of some of the criticism the model has received through time. Never the less, is the model a well approximation for the risk return relationship of the real capital market, and many models have been created following inspiration from the CAPM.

## 4.3 Performance measures

### 4.3.1 Jensen's Alpha

Simultaneous with the creation of the CAPM and widely inspired hereof, several risk-adjusted performance measures were created. Treynor (1965), Sharpe (1966) and Jensen (1968) all came up with measures of which one could compare the risk-adjusted return of mutual fund managers in relation to each other. Based on the work of Sharpe (1964), Lintner (1965) and Treynor (1965), Jensen (1968) presented a way to measure the fund managers stock-picking ability. Jensen extended the CAPM formula with an alpha $\alpha$, called the Jensen's Alpha, and used the formula in a time-series regression test. The formula is

$$E[r_i] - r_f = \alpha_i + \beta_i(r_{mkt} - r_f) + \varepsilon_i$$

*(Equation 4.3)*

Where $E[r_i]$ is the expected return of portfolio $i$ and $r_f$ is the risk-free rate. $\mathrm{E}(r_{mkt})$ is the expected return on the market portfolio and $\beta_i$ is a measurement of the systematic risk of portfolio $i$. The last term in the expression is the error term $\varepsilon_i$ which is expected to be zero on average. The final term $\alpha$ is the intercept of the regression which capture the return unexplained by the systematic risk of the portfolio and can be interpret as the risk adjusted historical performance of the portfolio. Jensen (1968) argue that a naïve buy-the-market-and-hold strategy would have a zero alpha, according to the CAPM. So, to test if a manager possesses any stock picking ability, one must test the return of the fund, up against the market which the manager attempts to outperform.

A manager that is successful in selecting misprices stocks, will generate a return higher than one would expect given the portfolios level of systematic risk, and the manager would therefore have a positive alpha. Though if the manager generates an average return lower than the benchmark she is trying to outperform, then the alpha would be negative. Though to generate a return lower than the naïve buy-the-market-and-hold strategy could sounds unlikely, it can happen both because the manager is without skill or that the cost in identifying the right stocks is not covered by the return gained in doing so (Jensen 1968). The alpha can be illustrated graphically by plotting the return and the beta of the portfolio with the SML. Portfolios with a positive alpha would lie above the SML and the distance between the SML and the portfolio corresponds to the alpha. (See figure 4.1).

Results from the regression is highly sensitive to the choice of benchmark used to measure the performance up against and is one of the few drawbacks of the alpha measurement. It is therefore crucial to identify the correct benchmark before testing (Carhart et al. 1993; Grinblatt and Titman, 1994).

### 4.3.2 Treynor and Mazuys market timing model

Jensen (1968) outline that the evaluation of a mutual fund managers performance has at least two distinct dimensions, which have to be taken into account. One is the fund managers ability to correctly predict the price movement of individual stocks. The other dimension is the portfolio managers ability to sufficient minimize risk of the portfolio through efficient diversification. This is done by increasing the beta of the portfolio when market moves upwards and decreasing the beta of the portfolio when market moves down. Treynor and Mazuy (1966) successfully devised a model to test if a portfolio manager had market timing. By adding the quadratic term $\gamma_i(r_{mkt} - r_{rf})^2$ to the single index model, it would now capture the timing ability of the manager. Treynor and Mazuy argued that to find evidence of market timing, one must plot the return of the fund against the return of the market portfolio or a suitable benchmark, and fit a line through, called the characteristic line. If the return of the fund fluctuates similar as the market, the characteristic line would be straight. When the portfolio manager was trying to predict those market fluctuations, they will lower the volatility of their portfolio when market goes down and increase it when it goes up. If done so with success this will make the characteristic line sloping upwards making a convex line. If the manager fails in timing the market, the characteristic line will be slightly concave instead. The formula for the market timing model is

$$r_i - r_{rf} = \alpha + \beta_i(r_{mkt} - r_{rf}) + \gamma_i(r_{mkt} - r_{rf})^2 + \epsilon_i$$

*(Equation 4.4)*

The terms are the same as in the CAPM where $r_i$ the return of portfolio $i$ and $r_f$ is the risk-free rate. $r_{mkt}$ is the return on the market portfolio and $\beta_i$ is a measurement of the systematic risk of portfolio $i$. $\epsilon_i$ is the error term which on average is expected to be zero. Alpha is as in the Jensen formula an estimate for selectivity. The *gamma* $\gamma_i$ is the measure for the ability to time the market. If a manager possesses market timing ability the gamma will be positive and significant, while if the manager mistimes the market it would be negative and significant.

## 4.4 Performance persistence

When evaluating performance, one thing is the mutual fund managers ability to outperform the benchmark one year, another is if they are capable of outperforming the market in consecutive periods. Persistency among mutual funds managers, have been proven empirically by many researchers (Grinblatt and Titman 1992; Goetzmann and Ibbotson, 1994; Malkiel, 1995). Persistency, meaning a fund that outperforms the market in several consecutive years, is often referred to as the "Hot Hands" effect, while the opposite, a fund that underperforms in consecutive years is referred as the "cold hands" effect (Malkiel, 1995)

The evaluation of persistence can be carried out in many different ways. Grinblatt and Titman (1992) used a sample of mutual fund data covering a ten-year period. They split the sample into two portfolios, each representing a subperiod of 5 years. They then calculated the abnormal return of the funds, represented by the alpha, and tested if return in the last period was related to return in the first period.

Goetzmann and Ibbotson (1994) had a different approach where they each year sorted the funds as winners and losers, using the median of the funds return as the sorting variabel. Based on the yearly return of the fund, they then defined the funds as either winners or losers, depending on wheatear the return of the fund was higher or lower than the median of the sample. When sorting the funds by using the median, a fund will each year have a 50% chance to end up either a winner or a loser. If significantly more than 50% of the funds which were defined as winners one year, ends up as winners the following year there is evidence of persistence of performance. This method was also adopted by Malkiel (1995), which besides yearly returns also used the Jensen's alpha to divide the funds into winners and losers, again done by using the median of the sample.

Otten and Bams (2002), used a sample of European mutual funds of several different countries, for an eight-year period, and tested another method. After the first year, they calculated the return of each fund. Then they divided the funds with highest 12-months past returns into one equally weighted portfolio and the funds with lowest 12-months past returns into another portfolio. These portfolios were held for 12 months, and then rebalanced according to their 12-months performance. This continued throughout the sample period, after which they tested for significance difference between the two portfolios. If there was significance difference between the two portfolios, it proved persistency amongst the funds.

## 4.5 Mutual fund characteristics and their relationship with returns

Within the last 30 years, numerous fund characteristics have been examined for their relationship with risk-adjusted returns. Some of the more examined fund attributes is Costs, Size, Flow and Portfolio turnover (Lobão and Gomes, 2015). Several different methods have been used to examine the characteristics. Ippolito (1989) used cross sectional data of fund expenses and added a term to CAPM model representing the expenses of the funds. As in the test performed using the Jensen model, Ippolito then tested if the term was significantly different from zero. As the term was significant for several of the funds, he then concluded that cost had a positive relation with the return of the fund.

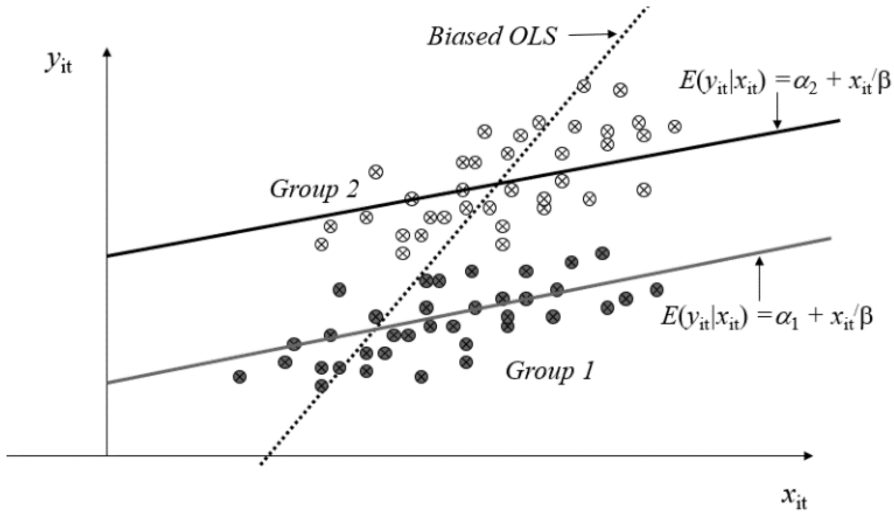
Another method practiced by Dahlquist et al., (2000) is the use of a fixed effect model. They created a cross sectional dataset of various fund characteristics calculated at a yearly basis and combined it with the yearly alpha of the funds, calculated from weekly returns. They then regressed each characteristic on the alpha of the fund, while allowing for fixed effect in the model.

Similar methodology was used by Lobão and Gomes (2015), however instead of making a regression for each variable and testing them one by one, they created a multivariate regression with several characteristics and tested their combined effect on the risk-adjusted return of the fund. Similar to Dahlquist et al., (2000), they used a model which allowed for fixed effect in the model. They argued that the use of a regular multivariate Ordinary Least Squared (OLS) regression would lead to biased estimates of the error term and could result in wrong conclusion. Both Dahlquist et al., (2000) and Lobão and Gomes (2015) states that the use of pooled regression could be justified if no fixed effect was detected when testing the model. This reasoning is also supported by Wooldrigde (2016).

### 4.5.1 The fixed effect model

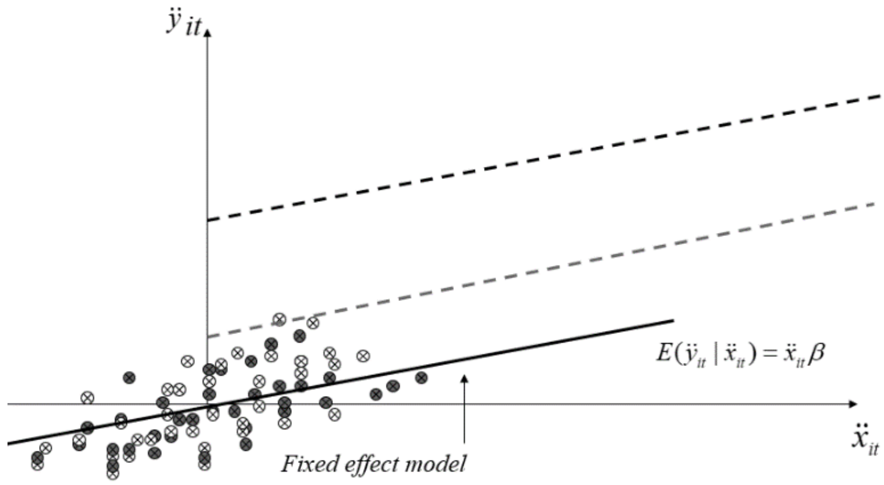
The fixed effect model explores the variation of the dependent variable for each entity, in this case each fund. If there is a fixed effect each individual fund has different intercept with the y-axis, but the slope of the coefficient is the same across all funds. Using pooled-regression when fixed effect is present, will cause bias of the OLS estimates. This is illustrated in figure 4.2, which shows data of two funds, and the biased OLS estimated if calculated as a pooled regression.

**Figure 4.2 - Illustration of the biased OLS estimate when fixed effects are present**




Bias of the OLS estimates is caused when each fund has some specific characteristics which are constant through time, and which influence performance. This could in example be the investment strategy, investment focus or the use of financial instruments. But it could also be specific agreement between the fund and broker, or that the fund have had the same manager throughout the entire period of examination. If these characteristics influence the dependent variable but is not included in the regression, it would lead to omitted variable bias of the model, as the $\alpha$ will capture this effect instead. The fixed effect model corrects for this by only using the variation of the variable from the mean, within each fund. This is done by subtracting the funds mean of each variable for each observation. This is illustrated in the graph below.

**Figure 4.3 - Illustration of the adjusted groups after subtracting the mean of the variable for each observation**




The following equations shows the creation of the fixed effect model. For simplicity, only one independent variable is used in the example. To create the time fixed model and adjust for the effect of time-invariant characteristics, the mean of the variables stated in equation 4.6 is subtracted each observation stated in equation 4.5.

$$y_{i,t} = \alpha_i + \beta_1 COST_{i,t} + u_{i,t}$$

*(Equation 4.5)*

$$\overline{y_i} = \alpha_i + \beta_1 \overline{COST_i} + \overline{u_i}$$

*(Equation 4.6)*

Subtraction the two equation will first lead to equation 4.7, and when reducing the expression, we will get equation 4.8 which is the fixed effect model with one independent variable. The procedure just described will remove the effect of all time-invariant characteristics. Both those which could be, and those which could not be controlled for.

$$y_{i,t} - \overline{y_i} = \alpha_i - \alpha_i + \beta_1 (COST_{i,t} - \overline{COST_i}) + u_{i,t} - \overline{u_i}$$

*(Equation 4.7)*

$$\ddot{y}_i = \ddot{\beta}_1 COST_i + \ddot{u}_i$$

*(Equation 4.8)*

# 5. Data and methodology

This section describes the general data collection process, sample construction and methodology carried out in this study. First a description of the sample construction, followed by a description of the variables used in the two models. This will be followed by the reflections regarding choice of benchmark, the survivorship bias effect.

## 5.1 Data description

Data has been gathered from many different sources and put together to form two larger datasets. One dataset which consist of monthly returns for funds and indices and is used in the performance evaluation of the mutual funds. Another dataset which consist of the characteristics of each fund on a yearly basis, which combined with the output form the first dataset will be used to examine the fund characteristics effect on returns.

## 5.2 Mutual funds and sample construction

As this thesis is focusing on the performance of open ended Danish mutual funds, the sample construction process started with acquiring a list from the website of Finans Danmark[5], containing all Danish mutual funds which have been active between December 2005 and December 2018. This resulted in a list of more than 800 Danish funds, which included both open and closed ended funds, investing in both equity bonds or a combination of the two. To Create a more homogenous group of funds to examine, a range of selection criteria was set up to reduce the number of funds to the final sample group. The process of narrowing down the sample group, and the effect of each criteria is illustrated in the table 5.1.

**Table 5.1 - Steps in the sample creation process**

| | Denmark | Europe | Global | Total |
|---|---|---|---|---|
| Total number of funds | | | | 823 |
| Wrong investment fokus | | | | -575 |
| Starting Number of funds | 47 | 50 | 151 | 248 |
| Inception date (later than 2014) | 7 | 8 | 24 | -39 |
| Class (W-shares) | 6 | 12 | 21 | -39 |
| Insufficient Benchmark | 11 | 5 | 68 | -84 |
| Insufficent data | 2 | 2 | 6 | -10 |
| Small cap or Momemtum strategy | 1 | 7 | 2 | -10 |
| **Total - Final sample** | **20** | **16** | **30** | **66** |

[5] https://finansdanmark.dk/toerre-tal/investeringsfondsstatistikker/afkast-risiko-og-omkostninger/

Firstly, all funds which did not have an investment focus being either the Danish, European or the Global equity market, was excluded. This discarded around 70% of the funds and left 248 funds divided on the three markets. Secondly, to have sufficient data to examine for each fund, a requirement of at least 4 years of complete data was set. This excluded all funds with inception date later than December 2014.

Thirdly, all funds which representing class-w shares, was removed from the sample. The reasoning for this is first of all that most class-w shares is not traded publicly, and this paper focus only in open ended funds traded at the stock exchange Nasdaq Copenhagen. Secondly, due to regulation of MIFID Solvency II in 2017, funds with agency fee within their agreement needed to remove this part. As a result, many ended up splitting the fund into two asset classes, normally a A-class and a W-class share. In cases of a split, the A-class share have been included in the analysis part. If both classes were included, then the figures up to the split would be similar, and the fund would therefore weight higher in the analysis and create a bias.

One of the main focuses of this paper is to assess the performance of the Danish mutual funds. To do so one needs a proper benchmark to examine the return of the funds up against. A correct choice of benchmark is essential for generating correct results. Elton et al. (1993) and Grinblatt and Titman (1994), all proves that performance evaluation models based on the CAPM framework, is very sensitive to the choice of benchmark, and wrong conclusion can be drawn if not comparing the fund up against a suitable benchmark. To avoid the risk of selecting a wrong benchmark, the prospectus of each mutual fund was examined, and all funds without a self-defined benchmark was excluded from the sample. Finally, all funds with insufficient data was removed from the sample.

The steps resulted in a sample of 76 funds which used a total of 11 different benchmarks. It turned out when going over the data, that six of the benchmarks was used only by one fund, and one benchmark was used by four funds. Similar for these ten funds and their benchmarks was that they invested in either small-cap or momentum stocks. As these deviated from the broader investment focus used by the other funds and benchmarks, it was decided to remove these ten funds and seven benchmarks from the sample. A total of 66 funds then met all criteria. Though not all funds were active in the full period, so the number of funds varies in each year, but the examination of the fund performance will not be affected hereof, as only absolute measures is used.

**Table 5.2 - Overview of the number of funds included in the final sample**

| | 2018 | 2017 | 2016 | 2015 | 2014 | 2013 | 2012 | 2011 | 2010 | 2009 | 2008 | 2007 | 2006 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total | 66 | 66 | 66 | 66 | 64 | 63 | 56 | 53 | 50 | 49 | 48 | 38 | 36 |
| DK | 20 | 20 | 20 | 20 | 20 | 20 | 19 | 18 | 17 | 17 | 17 | 12 | 12 |
| EU | 16 | 16 | 16 | 16 | 15 | 15 | 14 | 13 | 12 | 12 | 12 | 9 | 8 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Global | 30 | 30 | 30 | 30 | 29 | 28 | 23 | 22 | 21 | 20 | 19 | 17 | 16 |

## 5.3 Data selection

After the final sample of mutual funds was constructed, the data gathering process could begin. Monthly return data was gathered for all the mutual funds along with return data for all the indices, using the Bloomberg Terminal Database. As the sample of funds consist of both dividend paying funds and accumulating funds the Net Asset Value (NAV) was not a suitable figure to be used to calculate returns, as one would experience huge drop in NAV each time a fund paid out dividend. Instead of using NAV, the Total Net Return Index (TNRI) was gathered for all funds as it has the advantage of accounting for dividend payouts and reflect the total net return generated to investors. All data for mutual funds and indices is in Danish kroner, and already calculated when retrieving the data from the Bloomberg terminal.

### 5.3.1 Return data

The fund data extracted from the Bloomberg terminal is the Total Net Return Index, which accounts for dividend payouts. When calculating the return, it is common in the literature to use continuously compounded return, as it is easier to work with, rather than the arithmetic return (Bodie et al., 2014).

$$Geometric\ net\ return = \ln\left(\frac{TNRI_t}{TNRI_{t-1}}\right)$$

*(Equation 5.1)*

The performance evaluation of the mutual funds will be conducted using both the net and gross return. As the TNRI is net of expenses, the monthly expense ratio of the fund must be added back to generate the gross return of the fund. All expenses are collected from the annual report of each fund. Since the expense ratio of the funds is an annual figure, these was recalculated to a monthly figure. The monthly expense ratio was then added to the net return to generate gross return. Some funds did not state the cost rate for the year 2006, if that was the case the cost for the year 2007 was used instead.

$$Monthly\ continously\ compounded\ TER = \frac{\ln(1 + TER_{year})}{12}$$

*(Equation 5.2)*

$$Geometric\ gross\ return = Geometric\ net\ return + TER_{month}$$

*(Equation 5.3)*

### 5.3.2 Risk free rate

The risk-free rate used in performance evaluation models have to reflect a riskless investment made on the corresponding market. As this study uses mutual funds investing in three different market, namely the Danish, European and Global stock market, it was therefore a matter of course to use three different risk-free rates. As the return in the model are calculated at a monthly basis, it was chosen to use a monthly risk-free rate for all three markets. For the Danish market the choice ended on the 1-month Copenhagen Interbank Offered Rate. The Copenhagen Interbank Offered Rate (CIBOR) is the benchmark rate of interest, and is the rate used by banks when they offer short term loans of Danish kroner to other banks. A corresponding rate of return exist on the European market call the Euribor which stand for the European Interbank Offered Rate. The 1-month EURBOR was chosen as the risk-free rate here. The use of interbank rates is also suggested by Dahlquist et al. (2000). There is no corresponding rate for covering the global market. But since the United States make up more than 55% of the MSCI All Country World Index, the American interest rates have huge impact on the world index, and it seems therefore suitable to use the US 1-month Treasury bill as a proxy for the risk-free rate for global investments.

### 5.3.3 Expenses

In the evaluation of the performance of Danish mutual funds, there will be distinguished between net and gross returns. To do so the expenses of the fund must be added back to the TNRI as it is already deducted when data was collected. The expenses included here is the administration cost, transactions cost and the general costs associated with operating a mutual funds. These costs are in line with those used by the mutual fund when they report returns and can be found in the latest prospectus for the fund. Expenses used in this study is, like all other fund characteristic, from the annual report from each fund. In the performance evaluation they are recalculated to illustrate a monthly figure, as described above. In the examination of characteristics, the annual figure will be used.

Besides the operating expenses, all funds in this sample also charge a front-end loading fee when an investor is purchasing shares of the mutual fund, and a back-end loading fee when the investor is selling the shares again. The loading fees is used to cover trading expenses and will therefore lower the overall costs for the current investors. This fee is therefore not part of the regular costs stated by the mutual funds and will not be included when analyzing fund performance. However, the back-end and front-end loading fees are part of the fund's annual percentage rate (ÅOP), which is usually stated in the annual report. The loading fees informed by the mutual fund is stated as a percentage of the invested funds, assuming an investor with a holding period of seven years. The fees vary from 0.1% to 1.6% and is the maximum amount being charged, if an investor holds the shares for seven years. The fee is usually constructed so that it declines the longer an investor holds the shares, so the actual fee paid by the individual investor can be both less and more than the figure stated by the fund.

### 5.3.4 Creation of stock indices

The index for Denmark is created by Nasdaq while the other three indices are created by MSCI. Though there are some differences between the construction of the indices the overall methodology of index creation are the same. The indices are calculated as an index, with starting point equals 100, and represent the total return of the index since inception date. The return includes both capital gains and dividends which is reinvested. The indices are all free-float weighted, meaning that it is not the total market value of the outstanding shares that is used to weight the company’s contribution to the index, but only shares that are held by the general public. Shares owned by insiders, government or other companies are not included in the calculation of market value.

The four indices are all in Danish kroner. This have no influence for the group investing in Denmark, as all stocks are traded in Danish kroner, and therefore no currency risk. But for the three indices MSCI Europe, MSCI World and MSCI All Countries World which includes stock traded in other currency, they are exposed to currency risks as the changing currency rates will have an effect on the total return of the index, depending on which final currency returns are stated in. The three indices here are all measured in US dollars as the basis currency, and are then recalculated to Danish Kroner afterwards, by using the proper exchange rate. The calculation is made daily and was already done when retrieving the data from Bloomberg.

$$Index(DKK)_t = 100 * \frac{Index(USD)_t}{Index(USD)_{t-1}} * \frac{(DK - USD\ rate)_t}{(DK - USD\ rate)_{t-1}}$$

*(Equation 5.4)*

To reduce the risk of changing currency rate, the funds can hedge against the currency risk by using currency swaps or future contracts. Several of the fund’s states in their prospectus that they have the option to use financial instruments to reduce currency risk, but whether or not they do is seldom noted. As the benchmarks her are fully exposed to the currency changes, the funds which hedge against the currency risk, could have an advantage over the funds that do not hedge, as they can more easily control for their overall risk.

## 5.4 Benchmark

As mentioned earlier, results can be very sensitive to the choice of benchmark selected. To overcome this issue and avoid choosing a wrong index, only funds with a self-defined benchmark was included in the sample. Going over the prospectus of the funds, four different benchmarks was registered. This is not seen as a problem but rather a strengthening of the data. Instead of choosing one general benchmark which would suit the group as a whole but might not suit as a benchmark for the individual funds perfectly, all four benchmarks are included so the fund is compared to the exact benchmark they are trying to outperform. The benchmarks are all presented below, along with the number of funds using it. Similar to the data for the mutual funds, the total return index was collected for all the benchmarks from the Bloomberg terminal database.

### 5.4.1 Benchmark for the group investing in Danish equity

The benchmark used by the funds investing in Denmark is the OMX Copenhagen Cap Gross Index, where the gross in this case means that dividends are reinvested, and Cap means that the weight of one individually stock is capped at 10% if the market value makes up more than 10% of the index. The index is currently including 42 different stocks representing the largest and most traded stocks at Nasdaq Copenhagen. Though according to Nasdaq, it should include between 50-80 different shares depending on their selection criteria and changes in stock price. [6] The small number of stocks included in the index, compared to the European or Global indices, makes it less diversified and more exposed to be affected by changes of individual stocks. 20 funds in the sample are using this index as a benchmark.

***Table 5.3 - Funds using the benchmark OMX CPH CAP GI***

| | 2018 | 2017 | 2016 | 2015 | 2014 | 2013 | 2012 | 2011 | 2010 | 2009 | 2008 | 2007 | 2006 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OMX CPH | 20 | 20 | 20 | 20 | 20 | 20 | 19 | 18 | 17 | 17 | 17 | 12 | 12 | 232 |

### 5.4.2 Benchmark for the group investing in European equity

The MSCI Europe is an index representing the western European equity market, also described as the European developed market. The index includes stocks from 15 different markets, with UK (26.6%), France (18.0%), Switzerland (14.9%), Germany (13.8%) and the Netherlands (5.9%) forming the largest part of the index. It covers approximately 85% of all the free-float market capitalization of the European developed market. The index is made up of 442 different stocks, with the largest, Nestlé, representing around 3.8% of the index.[7] 16 of the funds in this sample use this benchmark.

***Table 5.4 - Funds using the benchmark MSCI Europe Total Net Return Index***

| | 2018 | 2017 | 2016 | 2015 | 2014 | 2013 | 2012 | 2011 | 2010 | 2009 | 2008 | 2007 | 2006 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EU | 16 | 16 | 16 | 16 | 15 | 15 | 14 | 13 | 12 | 12 | 12 | 9 | 8 | 174 |

[6] https://indexes.nasdaqomx.com/Index/Overview/OMXCBCAPGI
[7] https://www.msci.com/documents/10199/f6179af3-b1d1-4df0-8ac9-215451f3ac0a

### 5.4.3 Benchmark for the group investing in Global equity

The group with a global investment focus uses two different indices as benchmark, the MSCI World and the MSCI All Countries World. MSCI World includes all the markets defined as developed. This is besides the countries also included in MSCI Europe, also the US, Canada, Japan, New Zealand, Australia, Hong Kong and Singapore. The MSCI AC World index includes the same countries as MSCI World but expands the investment focus to include also emerging markets in eastern Europe, south America, Africa and Asia. MSCI AC World includes 2,844 different stocks, whereas MSCI World is made up by 1,651 stocks as of August 2019.[8][9] The market of the US is by far the largest and make up 62% of MSCI World, and 56% of the MSCI AC index.

***Table 5.5 - Funds using the benchmark MSCI World or MSCI World All Countries Total Net Return Index***

| MSCI | 2018 | 2017 | 2016 | 2015 | 2014 | 2013 | 2012 | 2011 | 2010 | 2009 | 2008 | 2007 | 2006 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AC World | 17 | 17 | 17 | 17 | 16 | 15 | 12 | 11 | 11 | 11 | 11 | 9 | 8 | 172 |
| World | 13 | 13 | 13 | 13 | 13 | 13 | 11 | 11 | 10 | 9 | 8 | 8 | 8 | 143 |

## 5.5 Fund Characteristics

Mutual funds have various characteristics which might explain the risk adjusted return generated by the fund. The list of selected characteristics to be tested in this study is not exhaustive but have been chosen based on empirical evidence on other markets, or due to general expectations that the characteristics should have significant effect on the return of the fund.

### 5.5.1 COSTS

The COST variable used in this study, represent the administration cost, and the trading cost of the fund. The costs are represented as a percentage of the average asset under management each year. Many researchers have studied the relation between cost and the risk adjusted return active mutual funds, and the general conclusion is that cost have a negative effect on return, and is found in many studies (Carhart, 1997; Dahlquist et al. 2000; Otten and Bams, 2002).

### 5.5.2 FEES

The variable FEES, is the expenses in excess of the general administration costs, and other cost associated with running the mutual funds. It is in example, front end and back end loading fees charged by the fund when an investor buys or sell shares of the mutual fund. Performance fee is not included herein. The fees are

[8] https://www.msci.com/documents/10199/890dd84d-3750-4656-87f2-1229ed5a5d6e
[9] https://www.msci.com/documents/10199/1ee87397-6313-4f46-87ae-6761f666558e

calculated as a percentage of the average asset under management during a year. The fees have unlike the cost, no direct connection to the trading activities, and should therefore at first, have no direct effect on the return of the fund. But as the fee is recirculated back to the fund and used to cover trading expenses, then it increases the value of the fund, and fees could therefore have a positive effect on returns. Though the expectations are that fee would have a positive effect on the return, no findings in the literature support this.

### 5.5.3 Size

The variable AUM used in this study, represent the size of the mutual fund and is the total asset under management invested in the fund at the end of each year stated in billions of kroner. The size of an investment fund has been proven to have significant effect on return, due to efficiency from economies of scale. But as found by Indro et al., (1999) the size effect of a fund is only positive up to a certain level, as the largest funds tends to overinvest, and therefore becomes inefficient.

### 5.5.4 Turnover

The portfolio turnover rate of a fund is a measure of how fast the assets of the fund is bought and sold. The turnover rate is the fraction of the portfolio that is being ”replaced” each year, and carries information about the trading activities of the fund. A passive managed index fund will have a relatively small turnover rate as, it only needs to rebalance the portfolio to follow the index. An active managed fund, on the other hands, which have an aim of outperforming the market, will have a much higher turnover rate as the manger will change the composition of the portfolio, depending on expectation to the market and performance of individually stocks. Higher trading activity would lead to increase in trading cost, so the fund needs to generate higher return to compensate for that (Grinblatt and Titman, 1993). Turnover rate has been found to have significant positive effect on returns, by Wermers (2000) and Dahlquist et al.(2000), while the opposite result was found by Elton et al. (1993), and Carhart (1997). Portfolio turnover is registered as the percentage of the fund portfolio which is changed during a yea, and is calculated as

$$Portfolio\ turnover = \frac{Net\ sales + Net\ purchas}{2 * AUM}$$

*(Equation 5.5)*

### 5.5.5 Flow

Flow of money have in many studies, been proved to have a positive effect on return (Grinblatt and Titman 1989; Zheng, 1999; and Dahlquist et al., 2000) The rationale behind these findings, is that investors are able to detect superior performance of a fund manager, and as the fund is traded at net asset value, this information is not reflected in the price of the mutual fund. As investors act on the information more will buy the fund and the inflow of money to funds that will perform well, will be higher than those who will performan badly (Gruber, 1996).

The variable FLOW is the net flow of asset going in or out of the fund stated in billions DKK. Since some of the funds is dividend paying funds, the number has been recalculated to represent reinvestment of dividends so that flow is not influenced by the yearly drop in assets generated from dividend payouts. The calculation of flow of money is mad by using the method suggested by Dahlquist et al. (2000). the calculation used is

$$Flow_{i,t} = \left(AUM_{i,t} - AUM_{i,t-1}\right) * \left(\frac{TRNI_{i,t}}{TRNI_{i,t-1}}\right)$$

*(Equation 5.6)*

### 5.5.6 Financial instruments

Those funds which have an investment focus being either Europe or Global are exposed to the exchange rate between DKK and the currency of the traded shares. Some of the funds are therefore using financial instruments to limit their exposure to foreign exchange rate, and better control for their level of risk. Beyond that, funds can also use financial instruments to protect them against sudden fluctuations in the market caused by special events. This could in example be elections, meeting between china and US regarding the trade war, or monetary meetings of the European Central Bank or Federal Reserve. As the use of financial instruments will cause a rise in expenses, mutual funds only benefit from the use, if it leads to higher returns or a reduction in potential losses, higher than the cost of the instrument. As it is only some of the funds which uses financial instruments, it is possible to test for the effect that the use of financial instruments has on return. The variable DERIVE is a dummy variable created to control for those funds which uses financial instruments. The variable will have the value 1 if the fund is allowed to use financial instruments, and 0 otherwise.

### 5.5.7 Passive investment strategy

Investment funds with a passive investment strategy is only aiming at mirroring the return of the market portfolio, instead of outperforming it As many studies have concluded, mutual funds are seldom able to outperform their benchmark net of expenses, passive investment funds could therefore be an alternative choice to active management The administration cost of the fund, will almost always make the return of the passive fund to be lower than their benchmark, and as a result the alpha of a passive fund would be negative, but insignificant. The inclusion of a dummy variable which controls for those funds with passive investment strategy, is therefore expected to have a negative relation with returns.

### 5.5.8 Markets

The final fund characteristic to be examined is the choice of investment focus, which in this study is either Denmark, Europe or Global. Difference in the risk adjusted return across markets relates directly to the efficient market hypothesis. If the three markets are equally (in)efficient there will be no significant difference between the three markets, and they will generate equally risk adjusted return across the groups. But if this is not the case there will be significant difference in the returns across the groups. This can be caused by many things, but Bodie et al (2014) suggest that smaller markets like Denmark, that is not that heavily covered by analysts as the US market, could be less efficient as some information might not have been uncovered yet. Furthermore, is the creation of the index used as benchmark also affected by the number of stocks included. From the day a stock is announced to no longer be included in a benchmark, the price of the stock will begin to decline, and will continue so even after the date of exclusion. Similar will the price of a stock that is announced to be included in an index start to rise and will do so some time after the actual date of inclusion (Chakrabarti et al., 2005; Pei-Gi Shu, Yin-Hua Yeh and Yu-Chen Huang, 2004). This effect can be exploited by the mutual funds in order to outperform benchmark, as the changes in prices will happen before the actual date of exclusion (inclusion). The effect might have larger effect on the Danish index which includes only 42 stocks, compared to the European or global index which includes 10 and 30 times as many stocks.

### 5.5.9 Descriptive statistics

All information about the above described characteristics, are obtained by manually going through the annual reports of each mutual fund and note the corresponding figures. In the progress additional information such as, investment scope, being either Denmark, Europe or Global, and if the fund was active or passive managed, was also collected. All fund characteristics have been gathered at a yearly basis and combined into a panel dataset, meaning that each observation represents one year of a fund. Not all funds had information for the full year, so the time horizon and number of observations varies from the performance evaluation dataset as seen below. The full dataset consists of 66 funds and a total of 671 observations.

**Table 5.6 - Observation for the cross-sectional dataset divided by the three groups DK EU GLOBAL**

| | DK | EU | Global | Total |
|---|---|---|---|---|
| 2018 | 20 | 16 | 30 | 66 |
| 2017 | 20 | 16 | 30 | 66 |
| 2016 | 20 | 16 | 30 | 66 |
| 2015 | 20 | 16 | 30 | 66 |
| 2014 | 20 | 15 | 29 | 64 |

| | | | | |
|---|---|---|---|---|
| 2013 | 20 | 14 | 27 | 61 |
| 2012 | 19 | 14 | 22 | 55 |
| 2011 | 18 | 13 | 21 | 52 |
| 2010 | 17 | 12 | 20 | 49 |
| 2009 | 17 | 12 | 19 | 48 |
| 2008 | 16 | 12 | 18 | 46 |
| 2007 | 12 | 8 | 12 | 32 |
| Total | 219 | 164 | 288 | 671 |

An examination of the different fund attributes shows some generally differences between the groups. Funds investing in the global equity market, have assets under management which in average are twice as high as found in the groups investing in Denmark and Europe. This seems logical as they need to cover a much greater number of shares, compared to the other two groups. The average level of costs is almost similar across the three groups, with the group Denmark having a slightly lower average cost level. Likewise, is the average turnover of the three groups only varying a few percentage points. As the group investing in Denmark have both the lowest number of stocks to cover one would expect a higher turnover rate in this group, though this is found at the funds investing globally. The average fee of the group Denmark is slightly lower, deviates less then seen in the other two groups.

***Table 5.7 - Descriptive statistic of the cross sectional dataset***

| | | N | Alpha | COST | AUM | Turnover | FEE | FLOW | Derive | Passive |
|---|---|---|---|---|---|---|---|---|---|---|
| Total | Mean | 671 | -0.00058 | 1.3888 | 1.3208 | 0.4007 | 0.3835 | 0.0248 | 0.46 | 0.10 |
| | Std. Dev. | 671 | 0.00486 | 0.3643 | 1.8974 | 0.3563 | 0.2219 | 0.6970 | 0.50 | 0.30 |
| | Min | 671 | -0.01920 | 0.4000 | 0.0149 | 0.0000 | 0.0100 | -7.0894 | 0.00 | 0.00 |
| | Max | 671 | 0.02204 | 2.2100 | 23.1463 | 2.7200 | 1.6330 | 4.4899 | 1.00 | 1.00 |
| | N = (1) | 671 | | | | | | | 312 | 68 |
| Denmark | Mean | 219 | -0.00022 | 1.3221 | 0.9946 | 0.3994 | 0.3506 | 0.0290 | 0.45 | 0.05 |
| | Std. Dev. | 219 | 0.00444 | 0.3200 | 1.0076 | 0.2993 | 0.1700 | 0.5129 | 0.50 | 0.23 |
| | Min | 219 | -0.01920 | 0.4000 | 0.0149 | 0.0000 | 0.0100 | -3.0514 | 0.00 | 0.00 |
| | Max | 219 | 0.01509 | 2.1400 | 4.2799 | 1.6600 | 0.8500 | 2.1420 | 1.00 | 1.00 |
| | N = (1) | 219 | | | | | | | 98 | 12 |
| Europe | Mean | 164 | 0.00000 | 1.4439 | 0.7848 | 0.3702 | 0.4188 | -0.0145 | 0.35 | 0.12 |
| | Std. Dev. | 164 | 0.00432 | 0.3207 | 0.7781 | 0.3802 | 0.2578 | 0.3682 | 0.48 | 0.32 |
| | Min | 164 | -0.01349 | 0.4500 | 0.0661 | 0.0000 | 0.0500 | -1.1800 | 0.00 | 0.00 |
| | Max | 164 | 0.01422 | 2.2100 | 4.3073 | 2.7200 | 1.6330 | 2.0359 | 1.00 | 1.00 |
| | N = (1) | 164 | | | | | | | 57 | 19 |
| Global | Mean | 288 | -0.00118 | 1.4080 | 1.8740 | 0.4191 | 0.3885 | 0.0440 | 0.55 | 0.13 |
| | Std. Dev. | 288 | 0.00537 | 0.4100 | 2.5956 | 0.3813 | 0.2318 | 0.9252 | 0.50 | 0.34 |
| | Min | 288 | -0.01746 | 0.4500 | 0.0379 | 0.0000 | 0.0100 | -7.0894 | 0.00 | 0.00 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Max | 288 | 0.02204 | 2.1900 | 23.1463 | 2.3400 | 1.3300 | 4.4899 | 1.00 | 1.00 |
| N = (1) | 288 | | | | | | | 157 | 37 |

### 5.5.10 Model creation

Most of the selected fund characteristics have been proven empirically to have either a significant negative or positive effect on the return of the fund. Though this has, to the best of my knowledge, never been tested on Danish mutual funds. To test if any of the characteristics would have significant influence on the return, a proper model needs to be built. As the data used to examine the fund characteristics is arranged as a panel data set, which besides the cross-sectional dimension also have the timeseries dimension, the general methodology for investigating such a dataset is to use a fixed effect model. However, if no fixed effect can be detected in the data, a pooled-regression will be suitable instead. (Wooldrige, 2016; Lobão and Gomes, 2015; Dahlquist et al., 2000).

In order to determine if fixed effect exist in the data, the fixed effect model needs to be created and then tested. By subtracting the mean of each variable for each observation of the individual funds, we first get equation 5.7, which will lead to the final fixed effect model stated in equation 5.8. One needs to be aware of that the fixed effect model removes all time-invariant effect, which means that the dummy variables DERIVE and Passive cannot be included in the model.

$$y_{i,t} - \overline{y_i} = \beta_1(COST_{i,t} - \overline{COST_i}) + \beta_2(FEES_{i,t} - \overline{FEES_i}) + \beta_3(AUM_{i,t} - \overline{AUM_i}) + \beta_4(FLOW_{i,t} - (\overline{FLOW_i}) + \beta_5(Turnover_{i,t} - \overline{Turnover_i}) + u_{i,t} - \overline{u_i}$$

*(Equation 5.7)*

$$\ddot{y}_i = \ddot{\beta}_1 COST_i + \ddot{\beta}_2 FEES_i + \ddot{\beta}_3 AUM_i + \ddot{\beta}_4 FLOW_i + \ddot{\beta}_5 Turnover + \ddot{u}_\iota$$

*(Equation 5.8)*

### 5.5.11 Test of the model

After the creation of the fixed effect model, one needs to test for the existence of fixed effect, to justify the continued use of the model. Even though the fixed effect model is preferred over the pooled-regression model, then if no fixed effect exist the assumption of different intercepts is not satisfied, and a pooled regression model is the better choice. If no fixed effect exists in the data the combined value of $\ddot{u}_\iota$, would be equal to zero, as the intercept of the funds will be the same. The hypothesis $\ddot{u}_\iota = 0$ will therefore be tested. A failure to reject this hypothesis, will conclude that no fixed effect exists, and the use of a pooled cross-sectional regression would be the better choice.

Running the test of the above-mentioned fixed effect model gives a p-value of 0.2086. This fails to reject the null hypothesis that $\ddot{u}_i$ at for all funds is equal to zero. This means that the intercept does not change between the funds, and that the pooled regression can be applied instead as it will not be biased.

The pooled regression has the advantage that in contrary to the fixed effect model, this can include time constant variables. Information about the funds use of financial instruments, their investment focus and if they use a passive strategy, will be included in the model.  The below model is used, and calculated for the total sample, and for the three groups defined by their investment focus.

$$\alpha_{i,t} = \beta_0 + \beta_1 COST_{i,t} + \beta_2 FEES_{i,t} + \beta_3 AUM_{i,t} + \beta_4 FLOW_{i,t} + \beta_5 Turnover_{i,t} + D_1 Passive_i + D_2 Derive_i + D_3 EU_i + D_4 Global_i + \varepsilon_{i,t}$$

*(Equation 5.9)*

The $\alpha_{i,t}$ is the alpha for fund $i$ at time $t$. $\beta_0$ is the intercept, of the regression and capture the unobserved effects in the data. Cost is the administrations cost for fund $i$ at time $t$, FEES is the front-end and back-end loading fees for fund $i$ at time $t$. AUM is the total asset under management for fund $i$ at time $t$. The variable FLOW is the net flow of money for fund $i$ at time $t$. Turnover is the portfolio turnover for fund $i$ at time $t$. The final term $\varepsilon_{i,t}$, is the error term which is expected to be zero on average. The variable passive is a dummy variable and will be one if the fund has a passive investment strategy. The variable Derive is also a dummy variable and will be one if the fund has stated that they are allowed to use financial instruments.

## 5.6 Robustness check

The Jensen model and the Treynor and Mazuy market timing model is, as mentioned earlier, based on the minimum variance portfolio by Harry Markowitz. For the model to minimize variance, the data used must be normally distributed, as a normal distribution is fully explained by the mean and the variance. Though return data is as earlier stated not fully normal distributed, but it can be assumed that it is approximately normal distributed. This assumption is also used in this study and can almost be justified when looking at the distribution of the return of the 4 different benchmarks, found in the appendix.

The Jensen model, the Treynor-Mazuy market timing model, and the pooled regression model are all using Ordinary Least square Regression. According to the Gauss-Markow theorem, six assumption must be fulfilled in order for OLS models to provide the best linear unbiased estimator, also known as BLUE (Wooldridge, 2016). The assumptions hold for both timeseries data, and for cross-sectional data, which are both used in this study.

The first four assumptions of the Gauss-Markow theorem is that the model is linear in its parameters, data are drawn from a random sample, have no perfect collinearity between independent variables, and that error term has expected value of zero. The final two assumptions are that the error term have a constant variance, and no serial correlation exist between the error term. The assumption of no serial correlation is only valid for the timeseries data, as the cross-sectional data, due to the assumption of random sampling, does not experience autocorrelation (Wooldridge, 2016). The first 4 assumptions are assumed for the data and will not be tested, however the last two assumption of homogeneity and no serial correlation of the errors will be tested, as a violation of these assumption will have the largest effect on the final tests.

### 5.6.1 Test for Autocorrelation

Positive autocorrelations are common to observe in economic timeseries data, like the return data used for performance evaluation. Positive first order autocorrelation implies that positive return in one period are followed by positive return in the next period. This effect has been found in several studies and is referred to as the momentum effect (Jegadeesh and Titman, 1993). The formula for first order autocorrelation is stated as:

$$u_t = \rho u_{t-1} + e_t, \qquad t = 1, 2, \dots, n$$

*(Equation 5.10)*

Autocorrelation in the data, will have no effect on the coefficient estimates, but OLS will no longer provide the minimum variance estimator, which will make the estimated standard error smaller than the true standard error. Smaller standard error will increase the t-statistic which can lead to wrong conclusion of significant coefficients (Halcoussis, 2006). The Durbin-Watson test will be used to test for positive autocorrelation on the return data. The test is based on the residuals of the OLS equation, and the statistic is given by the formula

$$DW = \frac{\sum_{t=2}^{n}(\hat{u}_t - \hat{u}_{t-1})^2}{\sum_{t=1}^{n}\hat{u}_t^2}$$

*(Equation 5.11)*

Where $\hat{u}_t$ is the error term from the OLS regression. The hypothesis of the DW test is that the $p$ of equation 5.10 is zero, while the alternative hypothesis is that p is positive.

$$H_0: \rho = 0 \qquad H_1: \rho > 0$$

To determine the results of the DW-test, the test static of the DW-test must be held up against a critical value. The DW-test static can take up values between zero and four and is held up against two critical values called the lower bound $d_L$ and the upper bound $d_U$.

$$if\ DW > d_u\ we\ fail\ to\ reject\ H_0, and\ no\ positive\ autocorrelation\ is\ present$$

$$if\ DW < d_L\ we\ reject\ H_0\ in\ favor\ of\ H_1, positive\ autocorrelation\ is\ present$$

$$if\ d_L \leq DW \leq d_U\ the\ test\ is\ inconclusive$$

The test is calculated using a five-percent significance level and performed for both models used in performance evaluation. The results from the tests is reported in the table below. The data used to evaluate performance, does not experience positive serial correlation. 65 out of 66 funds have a DW test statistic higher than the critical value, while the test value for the remaining funds falls between the critical values and is therefore inconclusive.

***Table 5.8 - Durbin-Watson test for autocorrelation***

| | Jensens Alpha | Treynor and Mazuy |
|---|---|---|
| Positive autocorrelation | 0.00 | 0.00 |
| Inconclusive | 1.00 | 1.00 |
| No autocorrelation | 65.00 | 65.00 |
| Total | 66.00 | 66.00 |

*As the critical values is dependent on number of observations for each fund and will differ for each test will therefore not reported in this table.*

Based on the output from the DW-test there is no concern of autocorrelation in the data, and the assumption seems to hold. No further adjustment of the data is therefor made.

### 5.6.2 Test for Heteroskedasticity

The fifth assumption of the Gauss-Markow theorem, is homoskedasticity of the error term, meaning that the error term $u$ in the OLS model has the same variance, given any values of the explanatory variables. If this assumption is violated and the variance of the error term changes with the explanatory variables, then there is presence of heteroskedasticity in a dataset. Heteroskedasticity have no effect on the estimate of the $\beta$ coefficient of the model, but it causes inconsistency in the variance of the $\beta$ estimate. This causes the t-statistic to no longer be t-distributed and as an effect, makes the results from the OLS statistics inefficient and, wrong conclusion can be made hereof (Wooldrigde, 2016).

To test for heteroskedasticity in the dataset, the Breusch-Pagan test is applied for each fund. To test the cross-sectional dataset, the White test was applied, where the null-hypothesis of the test is that the dataset is homoscedastic, while the alternative is presence of heteroskedasticity. The Breusch-Pagan test make use of an auxiliary regression where the squared residuals from the original OLS estimation is used as dependent variable along with the original independent variables. The Lagrange Multiplier (LM) statistic is then found by calculating the $R^2$ from the auxiliary regression with number of observations. From the LM statistic, which follow a $x^2$ distribution, the p-value is then calculated. Under the null hypothesis the data is homoscedastic, while the alternative hypothesis is the presence of heteroskedasticity.

The test where conducted using a five-percent significance level, and corresponding degrees of freedom. The results from the Breusch-Pagan tests is presented in table 5.9. The Whites test for the cross-sectional data set, returned a p-value of 0.0001 and rejected the null hypothesis of homoskedasticity in the dataset. As seen from table 5.9, heteroskedasticity is also present in the data for both for the Jensen's alpha and the market timing model. The data for 23 out of 76 funds is heteroskedastic for the Jensen model and xx for the market timing model. The presence of heteroskedasticity in the model, is as mentioned earlier, a violation of the OLS assumption, and the consequence is that the OLS estimator is no longer BLUE and therefor inefficient.

***Table 5.9 - Breusch-Pagan test for heteroskedasticity***

| | Jensens Alpha | | Treynor and Mazouy | |
|---|---|---|---|---|
| | Homoskedasticity | Heteroskedasticity | Homoskedasticity | Heteroskedasticity |
| Denmark | 16.00 | 4.00 | 16.00 | 4.00 |
| Europe | 11.00 | 5.00 | 9.00 | 7.00 |
| World | 19.00 | 11.00 | 16.00 | 9.00 |
| Total | 46.00 | 20.00 | 42.00 | 24.00 |

To correct for the violation of the homoscedastic assumption, the use the heteroskedastic-robust procedure suggested by Newey and West (1987) can be performed. This procedure provides us with heteroskedastic robust standard errors for the coefficient and makes the OLS statistic useable again. The robust standard errors are slightly larger than the regular the regular standard errors, which will make the t-statistic smaller, and reduces the possibility of rejecting $H_0$, when its true, and making a type 1 error. This procedure is suitable for the timeseries data used for Jensen's alpha model and the market timing model. The heteroskedastic robust statistics will therefore be used when calculating these models. For the cross-sectional data, the heteroskedasticity is caused by the alpha used as dependent variable. As the alpha in the cross-sectional data is a generated variable calculated from the performance data, it will as a result contains varying degrees of measurement errors. When the cause to heteroskedasticity is known, a Weighted Least Square WLS regression is to be used instead of the OLS (Wooldrigde, 2016). Each observation in the cross-sectional dataset will therefore be weighted using the inverse of the variance for the residuals of the estimated alpha. Each weight will be calculated using the formula,

$$w_{i,t} = \frac{1}{\sqrt{\sigma_{i,t}^2}}$$

*(Equation 5.12)*

Where $\sigma_{i,t}^2$ is the variance of the for the residuals for the estimated alpha, for fund $i$, at time $t$. This process will put higher weight on observation generated with less variance, and less weight for observation from high variance, a procedure also suggested by Dahlquist et al. (2000).

## 5.7 Survivorship bias

The sample of funds used in this study is as described in section five created using several criteria, one of them being only to include funds that was active in 2018. The sample covers the period December 2005 to December 2018, and funds which have ceased to exist during this period are not included. The consequence of this is the potential presence of survivorship bias in the data. Presence of survivorship bias in the data, can make the average alpha of the sample, be too high as it is often the poor performing funds which closes. Grinblatt and Titman, (1989) found that the bias of the alpha was around 0.5 pct. per year for US mutual funds. Dahlquist et al. (2000) produce similar results. The find that the survivorship bias of the alpha is around 0.6 pct. per year for Swedish mutual funds. Furthermore, did they found that around 80% of the funds that ceased to operate, merged into other funds. A total of 41 funds with an investment focus of either Denmark Europe or Global, have stopped operating during the period from December 2005 to December 2018. Of these, 21 had a self-defined benchmark and could potentially have been included in the sample. Of the 21 funds 17 merged with another fund while 4 closed down entirely. As the data from this sample is very similar to the data from Dahlquist et al. (2000), it cannot be concluded that the sample is free from survivorship bias. Though the effort to correct this would be too large a task for a study of this scope. No actions to correct this have therefore been taken, so when going over the results, one needs to have this in mind.

# 6. Empirical findings and analysis

In this section, the empirical findings will be presented and analyzed. The findings of the Jensen's alpha and the Treynor and Mazuy market timing model is first presented using gross return, and then by using net returns. This will be followed by findings from persistency test using the winner loser methodology. Finally, will the results from the cross-sectional regression be presented and the effect that fund characteristics have on returns will be analyzed. Each analyzed model will be followed by a short paragraph containing an intermediate conclusion of the most relevant findings.

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## 6.1 Performance evaluation

To evaluate the performance of Danish mutual funds, two models was estimated for each fund. The Jensen model which test for stock-picking skills of the fund manager, and the Treynor and Mazuy model, which besides stock-picking skills also test for the fund managers ability to time the market.

### 6.1.1 Jensen's Alpha

The null hypothesis in the Jensen's alpha model states that the alpha $\alpha$ is equal to zero, while the alternative states that the $\alpha$ is significant different from zero.

$H_0: \alpha = 0 \qquad H_1: \alpha \neq 0$

A failure to reject the null hypothesis indicates that all the return of the fund can be explained by the return of the market. A rejection of the null hypothesis imply that the fund has generated return either lower or higher than what can be explained by the market portfolio. A statistically significant negative alpha imply that the fund has generated returns lower than the selected benchmark, and that the fund would have performed better if just using a naïve buy-the-market and hold strategy. A significant positive alpha imply that the fund managers attempt in selecting stocks that generate returns higher than one would expect by their given level of risk, has been successful.

### 6.1.2 Treynor and Mazuy market timing model

The Treynor and Mazuy market timing model, includes both and alpha and a gamma. The alpha of the model will, just like the Jensen model, capture the selection skills of the fund manager, while the gamma capture the fund managers ability to adjust the portfolio $\beta$ according to fluctuations in the market. A significant positive gamma implies that the fund manager has been successful in timing the market, while a significant negative gamma means that the manager has mistimed the adjustment of the beta according to the market. The hypothesis of the Treynor and Mazuy market timing model is:

$H_0: \alpha = 0 \qquad H_1: \alpha \neq 0$

$H_0: \gamma = 0 \qquad H_1: \gamma \neq 0$

### 6.1.3 Gross Returns

The estimates for the models using gross returns is presented in table 6.1 and 6.2. The results are presented for each category, and for the total sample. The coefficients for the models are shown as the average for each group, along with the Newey-West robust standard error in parentheses below.

#### 6.1.3.1 Jensen's Alpha - Gross return

***Table 6.1- Jensen's Alpha - monthly gross returns***

| | | | | Alpha | | | | |
|---|---|---|---|---|---|---|---|---|
| | N | $R^2_{adj}$ | Beta | Alpha | No. Signif | Low | High | (Neg)/Pos |
| Denmark | 20 | 0.88538 | 1.01100 | 0.000612 | (0)/0 | -0.001272 | 0.003267 | (5)/15 |
| | | | (0.0307) | (0.0014) | | | | |
| Europe | 16 | 0.82467 | 1.00494 | 0.000091 | (0)/0 | -0.002498 | 0.001936 | (9)/7 |
| | | | (0.0424) | (0.0016) | | | | |
| Global | 30 | 0.77152 | 1.01777 | 0.000222 | (0)/0 | -0.001678 | 0.002499 | (15)/15 |
| | | | (0.0511) | (0.0017) | | | | |
| Total | 66 | 0.81891 | 1.01261 | 0.000309 | (0)/0 | -0.002498 | 0.003267 | (29)/37 |
| | | | (0.0428) | (0.0016) | | | | |

*The table shows the average coefficients and the Newey-West robust standard errors in parentheses below. Column No. Signif show the number of funds with a significant (negative)/positive alpha on a 5 percent significance level. The last three columns show the lowest and highest alpha in each group, along with total number of funds with a (negative)/positive alpha.*

The adjusted $R^2$ of each group falls between 77% and 89% and indicates the percentage of the return which is explained by the model. This is a relatively high power of explanations, though not as high as found by Christensen (2005, 2013).

The average beta for each group and for the total sample is all above, but very close to one, indicating that the net returns of the funds are slightly more volatile than their respective benchmark. The average alpha for all groups and for the total sample is positive. The group investing in Denmark, has an average alpha of 0.06%, which corresponds to a yearly return of 0.73% above their benchmark, the highest among the three groups. Three out of every four of the funds in the group investing in Denmark, have a positive alpha, while less than half of the funds investing in Europe generated positive alphas. For the group with a global investment focus, half of the funds had positive alphas in the period. In total 37 (56%) out of the full sample of 66 funds have a positive alpha, which indicates that the mutual funds on average can generate returns higher than their benchmark, when expenses are not accounted for. Though this is only indications, as none of the mutual fund's actual generated an alpha significantly different from zero at the 5-percent significance level.

Looking at the fund individually there is some distance between highest and lowest average alpha. Lowest monthly alpha is -0.25% and found at the group investing in Europe. This indicates that the fund generates a risk adjusted yearly return which is 3% lower than the corresponding benchmark. The highest alpha is found at the group Denmark, is 0.33%, and corresponds to the fund outperforming their benchmark with almost 4% per year. Though these two values can be seen as rather extreme, the p-value of the alphas is 0.45 and 0.17 respectively and can therefore not be concluded as significant. This is due to large standard errors of the coefficient, caused by high variance of the return data.

The average alpha of the sample is 0.03% which corresponds to the funds before expenses, generate a yearly return 0.37% above their benchmark. With the average yearly expense ratio being 1.39% this is hardly enough to cover the expenses of the active funds. The number of funds with negative alphas is therefore expected to increase when examining performance net of return.

#### 6.1.3.2 Treynor and Mazuy - Gross return

***Table - 6.2 Treynor and Mazuy market timing model - monthly gross returns***

| | | | | Alpha | | | | | Gamma | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | $R^2_{adj}$ | Beta | Alpha | No. Signif | Low | High | (Neg)/ Pos | Gamma | No. Signif | (Neg)/ Pos |
| Denmark | 20 | 0.887 | 1.01509 | 0.00044 | (0)/1 | -0.0016 | 0.0070 | (11)/9 | 0.03273 | (2)/5 | (7)/13 |
| | | | (0.0320) | (0.0016) | | | | | (0.3511) | | |
| Europe | 16 | 0.827 | 0.99093 | 0.00124 | (0)/1 | -0.0042 | 0.0033 | (2)/14 | -0.69958 | (5)/0 | (12)/4 |
| | | | (0.0436) | (0.0019) | | | | | (0.6998) | | |
| Global | 30 | 0.774 | 1.01275 | 0.00056 | (0)/1 | -0.0044 | 0.0038 | (9)/21 | -0.19381 | (6)/1 | (19)/11 |
| | | | (0.0523) | (0.0020) | | | | | (0.8984) | | |
| Total | 66 | 0.821 | 1.00817 | 0.00068 | (0)/3 | -0.0044 | 0.0070 | (22)/44 | -0.24777 | (13)/6 | (38)/28 |
| | | | (0.0442) | (0.0018) | | | | | (0.6844) | | |

*The table shows the average coefficients and the Newey-West robust standard errors in parentheses below. Column No. Signif show the number of funds with a significant (negative)/positive alpha or gamma on a 5 percent significance level. The column (Neg)/Pos show the total number of funds with a (negative)/positive alpha and gamma. The columns Low and High, show the lowest and highest alpha in each group.*

The explanatory power $R^2_{adj}$, have no noteworthy changes compared to the Jensen model, so the quadratic term included in the Treynor and Mazuy market timing model, have not helped to improve the explanation of the mutual funds return. But it has helped in explaining the differences in the return generated from the fund managers ability to select stocks, and her ability to exploit the fluctuations in the market. The average alpha for the total sample, and for the groups individually is still positive. When comparing the results with the Jensen model, the average alpha has now decreased for the group Denmark while it has increased for the groups Europe and Global. Furthermore, there is now three of the funds which have a significant positive alpha, one in each group. This imply that these three funds have poor market timing, which reduces the alpha and make it non-significant under the Jensen model.

The reduction in the average alpha of the funds investing in Denmark, suggest that the abnormal returns is not only generated through stock-picking, but also through successive market timing, shown by the positive average gamma of the group. The opposite is the case for the other two groups, as the average alpha has increased. This imply that the selection of stocks actually has been more successful, than suggested by the Jensen model, but poor market timing, has reduced the overall return of the funds, which also can also be deducted from the average negative gamma by the two groups.

The group Denmark has an average positive gamma of 0.0327, and 13(65%) of the funds have a positive gamma, of which five is significant at the 5-percent level. Two of the funds in the group generated a significant negative gamma. Of the 16 funds, investing in European stocks 12(75%) have a negative gamma, of which five is significant. Only four funds have a positive gamma in this group, and none is significant, and with an average gamma of -0.70 this imply poor market timing for this group. For the funds with a global investment focus, 19 (64%) have negative gamma, of which 6 is significantly negative. For the whole sample 13(20%) have significantly negative gamma, and with an average gamma of -0.248, this tells that the funds on average is not capable of timing the market.

#### 6.1.3.3 Intermediate conclusion - Gross return

None of the funds generates significant alphas when using the Jensen model and only three have significant positive alphas when using the market timing model. As these models is calculated before accounting for expenses, one would expect more funds to outperform the market. Though these result is much in line with the findings of Christens (2005). The overall assessment of the funds is that they do not possess the ability to time the market. Though looking at the three groups it is noteworthy that it is primarily funds with a European or Global investment focus which have significant negative gamma, while 25% of the funds investing in Denmark has positive significant gammas. This can indicate that it is easier for fund managers to time the Danish market compared to the European or global stock market. One reason could be that the OMX CPH CAP INDEX includes fewer shares, and the C25 companies make up the main part of the index. Fewer stocks make single company events more likely to influence the return of the index, so that correct stock-picking, could also result in correct market timing.

### 6.1.4 Net Returns

#### 6.1.4.1 Jensen's Alpha - Net return

When calculating the Jensen model using net return instead, the impact of the costs is clearly shown on the performance. The average alpha has now turned negative for all groups, and only 16(24%) funds out of the total sample now has a positive alpha, with all of them being insignificant. The only significant alpha is negative and found at the group Denmark. This fund has from 2006 to 2018 generated an average monthly return being -0.23% lower than their corresponding benchmark. This corresponds to an underperformance of -2.8% per year over a 12-year period. The highest alpha is also found at the group Denmark and is 0.19%. Though the majority of the funds have a negative alpha, only one fund is tested to significant different from zero. Therefore, the overall assessment of the fund performance using net returns, is that they perform neutrally.

***Table 6.3 - Jensen's Alpha - monthly net returns***

| | | | | Alpha | | | | |
|---|---|---|---|---|---|---|---|---|
| | N | $R^2_{adj}$ | Beta | Alpha | No. Signif | Low | High | (Neg)/Pos |
| Denmark | 20 | 0.88538 | 1.01099 | -0.000483 | (1)/0 | -0.002323 | 0.001995 | (14)/6 |
| | | | (0.0307) | (0.0014) | | | | |
| Europe | 16 | 0.82457 | 1.00471 | -0.001066 | (0)/0 | -0.003345 | 0.000628 | (12)/4 |
| | | | (0.0424) | (0.0016) | | | | |
| Global | 30 | 0.77141 | 1.01759 | -0.000947 | (0)/0 | -0.002535 | 0.001539 | (24)/6 |
| | | | (0.0511) | (0.0017) | | | | |
| Total | 66 | 0.81883 | 1.01247 | -0.000835 | (1)/0 | -0.003345 | 0.001995 | (50)/16 |
| | | | (0.0428) | (0.0016) | | | | |

*The table shows the average coefficients and the Newey-West robust standard errors in parentheses below. Column No. Signif show the number of funds with a significant (negative)/positive alpha on a 5 percent significance level. The last three columns show the lowest and highest alpha in each group, along with total number of funds with a (negative)/positive alpha.*

### 6.1.4.2 Treynor and Mazuy - Net return

The comparison of the Jensen model with the Market timing model using net returns, is very similar to the comparison using gross return. There is still an increase in the average alpha for the total sample, and for the groups with a European and global investment focus. The Average alpha for the group Europe has actually turned positive now but is extremely close to zero. The increase in alpha suggests poor market timing among fund managers in these two groups, which is additional supported by the average negative gamma and the number of significant negative gammas in the two groups. In the group investing in Denmark, 13(65%) had positive gamma, of which five funds had a significant positive gamma.

***Table 6.4 - Treynor and Mazuy market timing model - monthly net returns***

| | | | | Alpha | | | | | Gamma | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | $R^2_{adj}$ | Beta | Alpha | No. Signif | Low | High | (Neg)/ Pos | Gamma | No. Signif | (Neg)/ Pos |
| Denmark | 20 | 0.8868 | 1.01514 | -0.00066 | (1)/1 | -0.00238 | 0.00572 | (16)/4 | 0.03421 | (2)/5 | (7)/13 |
| | | | (0.0320) | (0.0016) | | | | | (0.3511) | | |
| Europe | 16 | 0.8267 | 0.99076 | 0.00007 | (0)/0 | -0.00510 | 0.00201 | (6)/10 | -0.69634 | (5)/0 | (12)/4 |
| | | | (0.0436) | (0.0019) | | | | | (0.6999) | | |
| Global | 30 | 0.7741 | 1.01262 | -0.00062 | (0)/0 | -0.00555 | 0.00258 | (18)/12 | -0.18839 | (6)/1 | (19)/11 |
| | | | (0.0523) | (0.0020) | | | | | (0.8985) | | |
| Total | 66 | 0.8210 | 1.00808 | -0.00046 | (1)/1 | -0.00555 | 0.00572 | (40)/26 | -0.24407 | (13)/6 | (38)/28 |

(0.0442) (0.0018) (0.6845)

### 6.1.4.3 Intermediate conclusion - Net returns

Results from the two models using net returns, supports the conclusion that the Danish mutual fund managers do not possess stock picking skills. Net of expenses all but one fund performed neutral, and the last fund performed significantly worse than market. When it comes to market timing, the conclusion is the same as for gross returns. Both gross and net of returns mutual funds investing in the European and global market have poor market timing, while some of those funds investing in Denmark seems to be able to time the market. These results are much in line with the findings made by Christensen (2005,2013). He found that almost half of the fund had significant negative alpha, though his sample period went from 2001 to 2010 including both the tech bubble, and the financial crisis, which could have an effect on his results. Furthermore, did he found that 64% of the funds with Danish investment focus had market timing, while this was only 6% for the rest of the examined funds. This add to the assumption that Danish fund managers are better to time fluctuations at the Danish market, though Christensen does not comment on this in his paper.

## 6.1.5 Performance over a three-year period

To fully assess the performance of the Danish mutual funds, the Jensen model was also calculated using a three-year time period, and for a single year. This was done to see if the funds performed differently over shorter periods, which would lead to a better evaluation of their overall performance.

***Table 6.5 - Jensen alpha using prior 36 months of gross return***

| | 2018-2016 | 2017-2015 | 2016-2014 | 2015-2013 | 2014-2012 | 2013-2011 | 2012-2010 | 2011-2009 | 2010-2008 | 2009-2007 | 2008-2006 | Total | Unique Funds |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Denmark | (2)/0 | (0)/1 | (0)/4 | (0)/4 | (0)/2 | (0)/0 | (0)/0 | (0)/0 | (0)/1 | (0)/0 | (0)/0 | (2)/12 | (2)/6 |
| Europe | (1)/0 | (0)/0 | (0)/1 | (0)/1 | (0)/1 | (0)/0 | (0)/0 | (0)/0 | (0)/0 | (0)/0 | (0)/0 | (1)/3 | (1)/2 |
| Global | (3)/0 | (0)/0 | (0)/0 | (0)/1 | (0)/0 | (0)/0 | (0)/0 | (0)/0 | (0)/0 | (0)/0 | (0)/0 | (3)/1 | (3)/1 |
| Total | (6)/0 | (0)/1 | (0)/5 | (0)/6 | (0)/3 | (0)/0 | (0)/0 | (0)/0 | (0)/1 | (0)/0 | (0)/0 | (6)/16 | (6)/9 |
| N | 66 | 66 | 64 | 63 | 56 | 53 | 50 | 49 | 48 | 38 | 36 | 589 | |

*Number of funds with a significant alpha in each time period. Last column shoes number of unique funds with significant alphas over the time period.*

Using only three years of data instead of the full period, several more funds now generates significant alphas. A total of nine different funds has at least on time during these subperiods, generated a positive alpha. Some of the funds have generated a significant positive alpha in several periods, most of them is found in the group investing in Denmark. One fund in this group have even delivered significant positive alpha in the four consecutive periods and have significantly outperform the market in the years between 2012 to 2017. The other significant positive alpha is generated in this period as well. Six funds have generated a significant negative alpha, all of them in the period from 2016-2018.

***Table 6.6 - Jensen alpha using prior 36 months of net return***

| | 2018-2016 | 2017-2015 | 2016-2014 | 2015-2013 | 2014-2012 | 2013-2011 | 2012-2010 | 2011-2009 | 2010-2008 | 2009-2007 | 2008-2006 | Total | Unique Funds |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Denmark | (5)/0 | (0)/0 | (0)/1 | (0)/4 | (0)/1 | (0)/0 | (0)/0 | (0)/0 | (0)/0 | (0)/0 | (0)/0 | (5)/6 | (5)/4 |
| Europe | (2)/0 | (0)/0 | (0)/0 | (0)/0 | (0)/0 | (1)/0 | (0)/0 | (1)/0 | (0)/0 | (0)/0 | (0)/0 | (4)/0 | (3)/0 |
| Global | (6)/0 | (1)/0 | (1)/0 | (0)/1 | (0)/0 | (1)/0 | (0)/0 | (0)/0 | (0)/0 | (0)/0 | (0)/0 | (9)/1 | (8)/1 |
| Total | (13)/0 | (1)/0 | (1)/1 | (0)/5 | (0)/1 | (2)/0 | (0)/0 | (1)/0 | (0)/0 | (0)/0 | (0)/0 | (18)/7 | (16)/5 |
| N | 66 | 66 | 64 | 63 | 56 | 53 | 50 | 49 | 48 | 38 | 36 | 589 | |

*Number of funds with a significant alpha in each time period. Last column shoes number of unique funds with significant alphas over the time period.*

When accounting for expenses the number of funds which deliver a significant negative alpha is now increased to 16, with 13 of these found in the period 2016-2018. This is 20% of the funds that significantly underperform their benchmark at least on time in over a three-year period. Five funds were able to generate a positive alpha, even when accounting for expenses. Of these, four of them invested in the Danish market.

### 6.1.6 Performance over 12 months

Reducing the evaluation period to only 12 months, can help to point out years with have effect on the overall performance of the funds. The use of only 12 datapoints in the regression is in many cases also increasing the standard errors, which decreases the likelihood of a significant result.

Before expenses 16 funds have a significant positive alpha and 14 have a significant negative alpha. This suggest very little persistence among the funds, as the significant alphas are spread out across different funds. Only two funds have generated a significant alpha in more than one year, and only three funds have performed significant worse more than one year. The positive alphas are concentrated at the years, 2014, 2015 and 2017, with 15 of the significant alphas gross of expenses observed here. This is rather telling that in a 13-year period, even before expenses there is only three years where funds are able to significantly outperform their benchmark.

***Table 6.7 - Jensen alpha using prior 12 months of gross return***

| | 2018 | 2017 | 2016 | 2015 | 2014 | 2013 | 2012 | 2011 | 2010 | 2009 | 2008 | 2007 | 2006 | Total | Unique |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Denmark | (3)/0 | (0)/0 | (0)/0 | (0)/4 | (0)/3 | (0)/0 | (0)/0 | (0)/0 | (0)/0 | (0)/0 | (0)/0 | (1)/0 | (0)/0 | (4)/7 | (4)/5 |
| Europe | (1)/0 | (0)/1 | (0)/0 | (0)/3 | (0)/1 | (0)/0 | (0)/0 | (1)/0 | (0)/0 | (0)/0 | (0)/0 | (0)/0 | (0)/0 | (2)/5 | (2)/5 |
| Global | (2)/0 | (0)/3 | (6)/0 | (0)/2 | (0)/1 | (0)/0 | (0)/0 | (1)/0 | (0)/0 | (0)/0 | (0)/0 | (1)/1 | (0)/0 | (10)/7 | (8)/6 |
| Total | (6)/0 | (0)/4 | (6)/0 | (0)/9 | (0)/5 | (0)/0 | (0)/0 | (2)/0 | (0)/0 | (0)/0 | (0)/0 | (2)/1 | (0)/0 | (16)/19 | (14)/16 |

| N | 66 | 66 | 66 | 66 | 64 | 63 | 56 | 53 | 50 | 49 | 48 | 38 | 36 | 721 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

Net of expenses only seven funds were able to generate a significant positive alpha and outperform their benchmark, while 21 funds significantly underperformed compared to their benchmark. Out of the 24 observed negative alphas 15 are found in the two years 2016 and 2018. With so few funds that over- or underperform more than one year, it seems that this happens more by coincidence than an effect of stock-picking skills. The overall assessment of the funds' performance will therefore be addressed as neutral.

***Table 6.8 - Jensen alpha using prior 12 months of net return***

| | 2018 | 2017 | 2016 | 2015 | 2014 | 2013 | 2012 | 2011 | 2010 | 2009 | 2008 | 2007 | 2006 | Total | Unique |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Denmark | (5)/0 | (1)/0 | (0)/0 | (0)/1 | (0)/1 | (1)/0 | (0)/0 | (0)/0 | (0)/0 | (0)/0 | (0)/0 | (1)/0 | (1)/0 | (9)/2 | (8)/2 |
| Europe | (1)/0 | (1)/0 | (1)/0 | (0)/2 | (0)/0 | (0)/0 | (0)/0 | (1)/0 | (0)/0 | (0)/0 | (0)/0 | (0)/0 | (0)/0 | (4)/2 | (4)/2 |
| Global | (2)/0 | (0)/2 | (6)/0 | (0)/0 | (0)/0 | (0)/0 | (0)/0 | (2)/0 | (0)/0 | (0)/0 | (0)/0 | (1)/1 | (0)/0 | (11)/3 | (9)/3 |
| Total | (8)/0 | (2)/2 | (7)/0 | (0)/3 | (0)/1 | (1)/0 | (0)/0 | (3)/0 | (0)/0 | (0)/0 | (0)/0 | (2)/1 | (1)/0 | (24)/7 | (21)/7 |
| N | 66 | 66 | 66 | 66 | 64 | 63 | 56 | 53 | 50 | 49 | 48 | 38 | 36 | 721 | |

### 6.1.7 Intermediate conclusion - Performance evaluation

Using 12 and 36 months of return data to evaluate the performance, did not deliver much support for the existence of stock-picking skills among the fund managers. Before accounting for expenses there is not much difference between the number of funds which significantly outperform their benchmark, compared to the number of funds which significantly underperform, and after accounting for expenses three times as many funds had significant negative alphas as positive. Though several funds generated significant alphas in individual years, very few funds did so in several years. Those who did outperform their benchmarks, were often found among those funds investing in Denmark, and one fund in this group was able to outperform the market in four consecutive time periods of three years. When looking at the funds as a total group, very little persistence exists among the funds. Many of the funds over- or underperform the benchmark in the same years. This can happen if the funds have a portfolio with beta which always is more than one. Then the fund will overperform when market goes up and underperform when the general market goes down. When the funds over- or underperform according to their benchmark, it therefore seems more as isolated incidents caused by the fund's choice of beta being more than one, rather than the effect of stock-picking skills or lack of by the manager.

## 6.2 Persistence

While examining the performance of the funds using 12 and 36 months of data, there was little evidence for the existence of persistence of the mutual funds. But as it was only the significant alphas shown in the table for each year, it does not give the full picture of the persistence. To examine the persistence of the funds properly, the funds was divided into winners and losers as described in the methodology section, and then tested according to two hypotheses. The null of the first hypothesis states that no “hot-hands” effect exists among the funds, meaning that winning is not followed by winning. The null of the other hypothesis states that no “cold-hands” effect exists, meaning losing is not followed by losing. A rejection of the two hypotheses will prove persistence among the funds, which if the z-value is positive will speak in favor of hot or cold hands effect, or if negative will speak in favor of negative persistence. The funds are both tested over a 12-month and a 36-month time period. And result from the test are shown in the tables below.

***Table 6.9 - Persistence using Jensen alpha from 12 months of net return***

| N | Initial year | | Next Year | | Percentage winner | Percentage Loser | Z-value | P-value |
|---|---|---|---|---|---|---|---|---|
| | | | Winner | Loser | | | | |
| 36 | 2006 | Winner | 11 | 7 | 61,1% | | 0,9428 | 0,2558 |
| | | Loser | 7 | 11 | | 61,1% | 0,9428 | 0,2558 |
| 38 | 2007 | Winner | 7 | 12 | 36,8% | | -1,1471 | 0,2066 |
| | | Loser | 11 | 8 | | 42,1% | -0,6882 | 0,3148 |
| 48 | 2008 | Winner | 9 | 15 | 37,5% | | -1,2247 | 0,1884 |
| | | Loser | 14 | 10 | | 41,7% | -0,8165 | 0,2859 |
| 49 | 2009 | Winner | 15 | 9 | 62,5% | | 1,2247 | 0,1884 |
| | | Loser | 9 | 16 | | 64,0% | 1,4000 | 0,1497 |
| 50 | 2010 | Winner | 14 | 11 | 56,0% | | 0,6000 | 0,3332 |
| | | Loser | 10 | 15 | | 60,0% | 1,0000 | 0,2420 |
| 53 | 2011 | Winner | 17 | 9 | 65,4% | | 1,5689 | 0,1165 |
| | | Loser | 8 | 19 | | 70,4% | 2,1170 | 0,0424** |
| 56 | 2012 | Winner | 16 | 12 | 57,1% | | 0,7559 | 0,2998 |
| | | Loser | 12 | 16 | | 57,1% | 0,7559 | 0,2998 |
| 63 | 2013 | Winner | 14 | 17 | 45,2% | | -0,5388 | 0,3450 |
| | | Loser | 18 | 14 | | 43,8% | -0,7071 | 0,3107 |
| 64 | 2014 | Winner | 15 | 17 | 46,9% | | -0,3536 | 0,3748 |
| | | Loser | 17 | 15 | | 46,9% | -0,3536 | 0,3748 |
| 66 | 2015 | Winner | 15 | 18 | 45,5% | | -0,5222 | 0,3481 |
| | | Loser | 18 | 15 | | 45,5% | -0,5222 | 0,3481 |
| 66 | 2016 | Winner | 16 | 17 | 48,5% | | -0,1741 | 0,3929 |
| | | Loser | 17 | 16 | | 48,5% | -0,1741 | 0,3929 |
| 66 | 2017 | Winner | 19 | 14 | 57,6% | | 0,8704 | 0,2732 |
| | | Loser | 14 | 19 | | 57,6% | 0,8704 | 0,2732 |
| | 2006-2018 | Winner | 168 | 158 | 51,5% | | | |
| | | Loser | 155 | 174 | | 52,9% | | |

*The table shows the yearly sorting of funds being winners or losers depending on whether the funds alpha lie above(below) the median. The columns percentage winner (loser) shows the percentage of fund that was winner(loser) the initial year, and the next year. Last column shows the P-value and the level of significance *10% **5% ***1%*

It shows from table 6.9 that the percentage of repeated winners are above 50% in 6 out of the 12 years, and over the whole period winning is followed by winning in 51.5% of the cases. This is as close to an equal distribution as one could expect. Similar results are seen when looking at the percentage of repeated loser which are also above 50% in 6 of the 12 years. Losing followed by losing happens in 52.9% of the cases. The hypothesis of no hot-hands effect is failed to be rejected in all cases, while the hypothesis of no cold-hands effect is failed to be rejected in all cases but one. In 2011, 19 of the funds which had an alpha below the median in 2011 also had so in 2012.

When looking at the persistence over the three subperiods of three years, the findings are much the same as when using a 12-month period. Funds with an alpha above the median in one period, is equally likely to be above as below the median in the next period. Over all periods the percentage of a win followed by a win happens in 54.7% of cases and a loss followed by a loss happens in 50% of the cases. All z-values of the tests are insignificant which favor the null hypothesis of no existence of either hot-hands or cold-hands among the mutual funds.

***Table 6.10 - Persistence over 3 subperiods of 36 months using Jensen alpha***

| N | Initial Period | | next 2010-2012 | | Percentage winner | Percentage Loser | Z-value | P-value |
|---|---|---|---|---|---|---|---|---|
| | | | Winner | Loser | | | | |
| 38 | 2007-2009 | Winner | 10 | 9 | 52,6% | | 0,2294 | 0,3886 |
| | | Loser | 9 | 10 | | 52,6% | 0,2294 | 0,3886 |
| | | | nextr 2013-2015 | | Percentage winner | Percentage Loser | Z-value | P-value |
| | | | Winner | Loser | | | | |
| 50 | 2010-2012 | Winner | 16 | 9 | 64,0% | | 1,4000 | 0,1497 |
| | | Loser | 12 | 13 | | 52,0% | 0,2000 | 0,3910 |
| | | | Next 2016-2018 | | Percentage winner | Percentage Loser | Z-value | P-value |
| | | | Winner | Loser | | | | |
| 63 | 2013-2015 | Winner | 15 | 16 | 48,4% | | -0,1796 | 0,3926 |
| | | Loser | 17 | 15 | | 46,9% | -0,3536 | 0,3748 |
| | 2006-2018 | Winner | 41 | 34 | 54,7% | | | |
| | | Loser | 38 | 38 | | 50,0% | | |

*The table shows persistence between 3 subperiods. Funds are sorted as being winners or losers depending on whether the funds alpha lie above(below) the median. The columns percentage winner (loser) shows the percentage of fund that was winner(loser) the initial period, and the next period. Last column shows the P-value and the level of significance *10% **5% ***1%*

### 6.2.1 Intermediate conclusion - Persistence

Besides a single year of which the tests supported the cold-hands effect, there is no support for the existence of persistence among mutual funds. This support the findings of the evaluation of the performance, which showed that under- or overperformance of the funds should be viewed as isolated incidents. Though these findings contradict the evidence of hot-hands effect made by Grinblatt and Titman (1992) Goetzmann and Ibbotson (1994) and Malkiel (1995). Though they all used American mutual funds in their examination. Christensen (2005) on the other hand examined Danish mutual funds in the period 1996-2003, and got similar results concluding no persistence among the funds, with exception of equity funds investing in the pacific area.

## 6.3 Fund characteristic

The effect of fund characteristics is tested with the use of a pooled cross-sectional regression. The regression is made using the funds yearly alpha as dependent variable, and Cost of the funds, Asset Under Management, Fees, portfolio turnover and flow as independent variables. There is also included four dummy variables which are used to control for the effect of passive investment, change in investment focus and the funds use of derivatives to reduce risk.

When going over the results one must remember that the dependent variable alpha, in its original form was the monthly excess return compared to their benchmark, while the coefficients are yearly estimates. To ease the interpretation the alpha was recalculated to yearly figures before making the regression, which can be done by multiplying by 12 as lognormal returns are addable. The coefficient shall therefore be interpreted as a one unit increase of the variable will have the coefficient effect on the yearly alpha.

***Table 6.11 - The effect of fund characteristics on yearly alpha***

| | Total | | Denmark | | Europe | | Global | |
|---|---|---|---|---|---|---|---|---|
| N | 671 | | 219 | | 164 | | 288 | |
| R^2adj | 0.0707 | | 0.1742 | | 0.0474 | | 0.0707 | |
| | Coeff | p-value | Coeff | p-value | Coeff | p-value | Coeff | p-value |
| COST | -1.8455 | 0.013** | -0.9480 | 0.415 | -3.0607 | 0.056* | -3.3893 | 0.007*** |
| | (0.7380) | | (1.1617) | | (1.5893) | | (1.2370) | |
| AUM | -0.0269 | 0.819 | -0.0009 | 0.998 | -0.2736 | 0.583 | 0.0077 | 0.956 |
| | (0.1173) | | (0.3297) | | (0.4976) | | (0.1396) | |
| Turnover | 0.0990 | 0.887 | 4.0642 | 0.001*** | -2.8706 | 0.025** | -0.4292 | 0.708 |
| | (0.6980) | | (1.2367) | | (1.2679) | | (1.1451) | |
| FEE | 2.4035 | 0.022** | 8.0574 | 0.000*** | 4.4376 | 0.012** | -0.3110 | 0.862 |
| | (1.0434) | | (1.9438) | | (1.7374) | | (1.7903) | |
| FLOW | 1.7826 | 0.000*** | 2.4130 | 0.000*** | 1.5006 | 0.139 | 1.5695 | 0.000*** |
| | (0.3019) | | (0.6487) | | (1.0094) | | (0.3774) | |
| Derive | -0.4451 | 0.307 | -0.8480 | 0.243 | -2.1906 | 0.023** | 0.1764 | 0.824 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | (0.4358) | | (0.7236) | | (0.9508) | | (0.7942) | |
| Passive | -0.6650 | 0.427 | 1.3946 | 0.358 | -3.6822 | 0.019** | -2.8820 | 0.083* |
| | (0.8367) | | (1.5124) | | (1.5473) | | (1.6591) | |
| Europe | 0.5487 | 0.320 | | | | | | |
| | (0.5508) | | | | | | | |
| Global | -0.8078 | 0.109 | | | | | | |
| | (0.5030) | | | | | | | |
| _cons | 1.4490 | 0.205 | -3.2021 | 0.071* | 5.1809 | 0.057* | 3.9242 | 0.066* |
| | (1.1425) | | (1.7666) | | (2.7044) | | (2.1258) | |

*This table shows the result of a Weighted Least Square regression using the alpha calculated over 12 months of net returns as the dependent variable. The weights used is the inverse of the variance for the residuals of the estimated alpha.*

A quick glance at the coefficients for the full sample shows that the three variable *COST, FEE* and *Flow* are all significant*.* Cost have negative sign, meaning that higher cost reduces the excess return of the fund, while the level of *FEE* and portfolio *Turnover* have a positive relation with the return of the funds. Going over the rest of the table one notice that the $R^2_{adj}$ is quite low, with only 5% to 17% explained by the coefficient. This is rather low compared to what is usually seen using OLS regression but looking at similar studies this is rather normal, with this type of data and using a yearly alpha as dependent variable. Similar studies have an $R^2_{adj}$ which varies between 3% and 26% (Indro et al., 1999; Otten and Bams, 2002; Ferreri et al., 2012). Going over the coefficient of the variables, there is some differences in the signs when comparing across groups. In example is *Turnover* significant and positive for the group Denmark, while significant and negative for Europe, and negative but insignificant for the group *Global*. Similar is the variable *FEE* positive and significant for the whole sample and the groups investing in Denmark and Europe, while insignificant and negative for the group Global. These variations indicate some general difference related to the focus of investment, even though the variables controlling for investment focus, *EU* and *Global*, are insignificant for the whole sample. In the section below, each variable and the coefficients across groups will be reviewed.

### 6.3.1 Markets

For the regression using the whole sample, two dummy variables were included to see the difference in investment focus, with all other variables kept fixed. The coefficients *Europe* and *Global* shall be interpret as going from the Group Denmark to either of the two, will have the coefficient effect on return. The coefficient for *Europe* is positive meaning that a higher excess return can be gained by investing in the group *Europe* rather than *Denmark*, while it will be reduced if one chose the group *Global* instead. Both coefficients are insignificant so investment focus have no statistically significant effect on the return of the mutual funds.

### 6.3.2 Cost

As seen in the performance evaluation in section 6.1, costs have substantial negative effect on the alpha, as it is directly deducted the return. It is therefore no surprise that the coefficient is negative for the total sample and for the three groups. For the total sample *COSTs* have a significant effect of -1.85% on the annual alpha. This is much in line, though higher, than the -1.45% found by Dahlquist et al. (2000) using Swedish mutual funds.

For the groups of funds investing in European and Global stocks, *Costs* have a negative and significant relation with the return, though coefficients are considerably lower than for the full sample. The effect of the costs in these two groups are higher than one to three, meaning that the cost are three times higher than the excess return generated from them. These effects are considerable higher than found in many other studies, though similar high negative effect of costs was found by Otten and Bams (2002), when examining mutual funds in Germany and the Netherlands. Overall the *COSTS* have negative effect on the return of the Danish mutual funds, suggesting that when investors when selecting funds should look for the lowest cost with the desired investment focus as costs will, at least for these funds examined here, reduce the final return.

### 6.3.3 Asset Under Management

The coefficient of the *AUM* variable is negative for the whole sample and for the two groups investing in Denmark and Europe, while positive for the group with a global investment focus. As all the coefficients of the *AUM* variable is insignificant, the asset under management seems to have no effect on the return of the Danish mutual funds. Though the signs of the coefficient could suggest that the funds investing in Denmark and Europe are to small to generate sufficient return to cover expenses as suggested by Indro (1999). Several other studies have found size to have either a significant positive or negative effect on return. Though these studies are not fully comparable, as most of these were conducted using US mutual funds which in general is several times larger than the Danish fund (Indro et al., 1999; Otten and Bams 2002)

### 6.3.4 Portfolio Turnover

The trading activity of the mutual fund managers is measured by the portfolio turnover, as the fraction of the portfolio that are being replaced each year. Higher trading activity should lead to higher trading costs, and in order for those costs to be covered, the coefficient of the *Turnover* variable should be positive, and expected to be significant as found in Wermers (2000), Dahlquist et al. (2000) and Lobão and Gomes (2015).

The turnover is for the whole sample positive, but insignificant, and can be concluded to have no effect on returns on Danish mutual funds as a whole. This is also the case for the group with global investment focus, but for the group Denmark and Europe it is significant, though with opposite signs. The group of funds investing in Denmark have a significant positive *Turnover* coefficient of 4, while the group investing in Europe have significant negative *Turnover* coefficient of -2.8. The difference in the two may be connected to the benchmark they are comparing up against. The OMX CPH CAP is a rather small benchmark of between 50 to 80 different stocks, so rather few transactions need to be made to rebalance the portfolio or change beta of the portfolio to exploit fluctuations in the market. The MSCI Europe have more than 440 stocks, so it is much more costly to change the composition of the portfolio to benefit for market timing.

### 6.3.5 Entry and Exit Loading Fees

The coefficient of the variable *FEE* is positive and significant for the whole sample, and for the two groups *Denmark* and *Europe*. For the group *Global* the coefficient is negative and insignificant. The coefficient for the group *Denmark* and *Europe* is 8 and 4.4 respectively. This is a rather large effect compared to coefficients of the other variables. An increase in the fees of 0.1% would lead to an increase in the annual excess return of 0.8% for the funds investing in Denmark and 0.44% for the funds investing in Europe. The large effect could be related to the investment horizon of the investors, and the trading volume of the fund's shares.

The exit and loading fees are recirculated back to the fund and used to cover the expenses of the trading costs. So, though the fees are an expense for the individual investor it can actual help to increase the return of the fund. If those investing in the group *Denmark* and *Europe,* in general have a shorter investment horizon than the seven years used to calculate the fees, then this would lead to higher trading volume of the fund's shares and thereof higher revenue from the fees.

A positive relation between fees and the return of the funds, is as far as I know not found before in the literature. Ferreira et al. (2012) examine a group of mutual funds from various countries around the world and finds that fees have no relation to the return of the fund. Carhart (1997) and Pollet and Wilson (2008) on the other hand found a significant negative relationship between fees and the return of the fund. The fee structure between countries is not necessarily the same as it is in Denmark, and this can be the main reason that these other studies finds a different relation between fees and the return of the fund.

### 6.3.6 Flow of money

The coefficients of the variable *FLOW* are positive for all groups and for the total sample, and it is significant for the full sample and for the groups investing in Denmark and Global. This speaks for the hypothesis of "smart money" to be accepted and it seems that if money flows into the fund, the fund does perform better. For the whole sample, the average positive inflow is 340 million, which means that funds would have an average return being 0.6% higher than those funds with negative inflow. The significant positive relation between positive inflow of money to a fund and their risk adjusted return, has been proven in many studies before. The results in this study, is therefore much in line with the existing literature and the findings of Gruber (1996), Zheng (1999) and Dahlquist et al. (2000).

### 6.3.7 Financial instruments

The mutual funds can use financial instruments to either reduce risk or boost returns of the portfolio, but there is cost associated in doing so. The is no prove of the use of financial instruments helps the fund to generate higher return. The sign of the coefficient Derive is negative except for the group Global. For the group Europe the coefficient is significantly negative, and the yearly return is 2.2% lower for those funds that use financial instruments compared to those that do not. So, for the group Europe, the effort in reducing risk or boosting returns by using financial instruments, proves unsuccessful and cost more than the return generated from doing so. For the other groups the effect is negative but non-significant.

### 6.3.8 Passive Funds

The investment goal for a passive investment fund is to just mimic the benchmark. If done so perfectly the return will of course be similar to the market. But as the passive fund have administration costs, these expenses will reduce the return to always be lower than their benchmark. The alpha of a passive fund is therefore expected to be negative but insignificant. This is also reflected in the coefficients of the Passive variable, which for the full sample will produce a yearly alpha 0.66% lower than the active alternative. This corresponds almost to the average costs of the passive funds and is in line with what was expected. Even though the coefficients are negative, they are all insignificant, which means that the passive fund does not generate returns lower than the active funds.

### 6.3.9 Intermediate conclusion - Fund characteristics

The examination of the relation between risk-adjusted return and specific fund characteristics, shows that these in fact can be used to explain the excess return of Danish mutual funds. An important finding is that even though the Danish mutual funds can be assessed as a whole group, there is substantial differences in both the significance and the magnitude of the coefficient when dividing the funds with respect to their investment focus. Though some of the findings is ambiguous when comparing the results across, there is still some general conclusion to be drawn from these results. It is possible to conclude that the administration costs of the fund have a significant negative effect on the excess return of the funds, and investors should avoid funds with high costs as it would lower their return. Furthermore, is the inflow of money to the fund positive related to the return of the fund. In addition is the fees of the funds also found to have a significant positive relation with the excess return of the funds investing in Denmark and in Europe. This is contradicting the findings made in other studies, which concludes that fees have no or significant negative effect on the excess return. However, this could be a result of different fee structure across countries (Carhart, 1997; Pollet and Wilson, 2008; Ferreira et al., 2012).

# 7. Conclusion

In this study the performance and persistence of 66 Danish mutual funds was assessed in the period from 2006 to 2018, using both the Jensen alpha model and the Treynor and mazy market timing model. Furthermore, was the relationship between the excess return of the funds and their characteristics examined through a pooled cross-sectional regression.

The empirical findings of this study provide rather little support of significant performance among Danish fund managers. The overall results using bot the Jensen model and the Treynor and Mazuy model showed that the majority of all funds performed neutrally both net and gross of expenses.

Concerning market timing ability less than 10% of the overall sample of funds showed signs of significant positive market timing ability, while 20% of the funds actually mistimed the market significantly. However, for the group investing in Denmark 25% of the funds possessed market timing. Though the overall conclusion is that the Danish mutual funds do not possess market timing ability, some evidence indicates that the managers are better at timing the Danish market, rather than the European or the global market, which might come as a result of the Danish market being more homogenous compared to the other two.

Evaluating the performance using subperiods of one to three years, showed evidence of some funds that could outperform their benchmark, but only few funds could do so over consecutive years. When accounting for expenses there was an overweight of funds underperforming their benchmark compared to those that overperformed. Furthermore, did the evidence show that many of the funds over- or underperform the benchmark in the same years as the market goes up and goes down. This can happen if the funds have a portfolio with a beta which always is more than one. Then the fund will overperform when market goes up and underperform when the general market goes down. When the funds over- or underperform according to their benchmark, it therefore seems more as isolated incidents caused by the fund’s choice of beta being more than one, rather than the effect of stock-picking skills or lack of by the manager.

The overall performance of the funds is neutral, and of those funds that either over- or underperform relative to their benchmark, is only doing so in individual years. This is also supported by the persistency test made year by year and using three subperiods of three years. The examination showed no persistence of the performance of the Danish mutual funds, as funds that delivered excess return above the sample median in one year, was equally likely to deliver both above and below the sample median in the subsequent year.

Evidence from a cross-sectional regression shows that fund characteristics is a suitable measure to explain excess return of a fund. Though not all attributes can be used in a Danish context. Both the use of derivatives, passive management and size of the fund was found to have no significant effects, though the effect have been proven to be significantly in other studies.

Other variables however did have a significant effect on the risk-adjusted return of the fund. Costs is the only variable that have a significant negative effect on the performance of the Danish mutual fund as a group. The effect is rather striking as a 1% increase in costs tends to lower the performance by 1.8%. The results also showed evidence of significant positive relation between the return of a fund and the inflow of money into the fund, documenting the existence of the smart money effect on the Danish mutual fund market. Furthermore, is the level of front-end and back-end loading fees found to have significant effect on the return of funds investing in the Danish market. This finding is new to the performance literature and contradict other findings of the relationship between fees and returns, which could be explained by the structure of the Danish fund market.

The overall conclusion is that Danish mutual funds perform neutral or underperform their benchmark. A few funds outperform their benchmark sporadically, and most of them is found in the group investing in Danish equity. No persistence of performance exists among the Danish mutual funds, so for an investor to single-out the funds that perform well in the future will be difficult using only historic return. But results show that characteristics of funds does have influence on the return. So, If these characteristics also have the same effect in the future, an investor could increase return by selecting funds according to their characteristics.

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https://www.msci.com/documents/10199/f6179af3-b1d1-4df0-8ac9-215451f3ac0a
https://www.msci.com/documents/10199/890dd84d-3750-4656-87f2-1229ed5a5d6e
https://www.msci.com/documents/10199/1ee87397-6313-4f46-87ae-6761f666558e

Nasdaq OMX - Index construction:
https://indexes.nasdaqomx.com/Index/Overview/OMXCBCAPGI

*The Statbank of Danmarks Nationalbank Table DNIFSUM*

*The Statbank of Danmarks Nationalbank Table DNIFAM*

# Appendix

## Regression output of the fixed effect model

```
Fixed-effects (within) regression               Number of obs     =        671
Group variable: ID                              Number of groups  =         66

R-sq:                                           Obs per group:
     within  = 0.0938                                         min =          4
     between = 0.0085                                         avg =       10.2
     overall = 0.0591                                         max =         12

                                                F(5,600)          =      12.42
corr(u_i, Xb)  = -0.3959                        Prob > F          =     0.0000
```

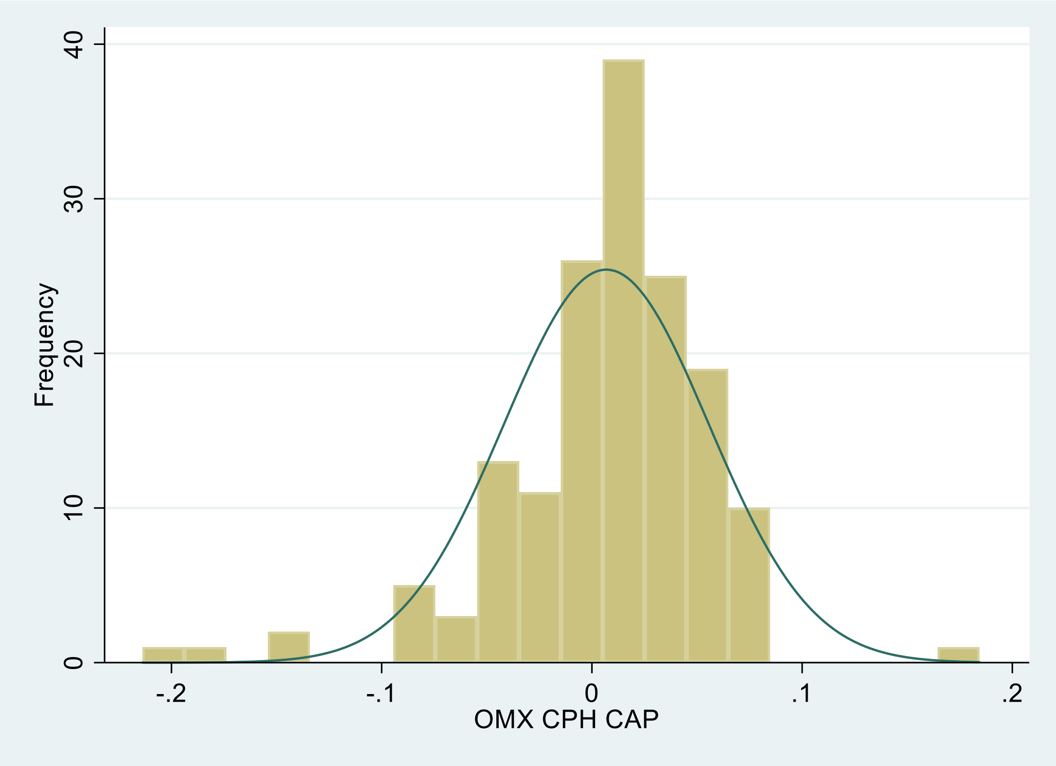
| Alpha | Coef. | Std. Err. | t | P>\|t\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| COST | -.0035981 | .0011198 | -3.21 | 0.001 | -.0057973 | -.0013989 |
| AUM | -.0002047 | .0002007 | -1.02 | 0.308 | -.0005989 | .0001895 |
| Turnover | -.0005157 | .0008175 | -0.63 | 0.528 | -.0021211 | .0010898 |
| FEE | .0029193 | .0010915 | 2.67 | 0.008 | .0007756 | .005063 |
| FLOW | .0017068 | .0002968 | 5.75 | 0.000 | .001124 | .0022896 |
| _cons | .0037338 | .0016808 | 2.22 | 0.027 | .0004328 | .0070348 |
| sigma_u | .00187112 | | | | | |
| sigma_e | .00465884 | | | | | |
| rho | .13889907 | (fraction of variance due to u_i) | | | | |

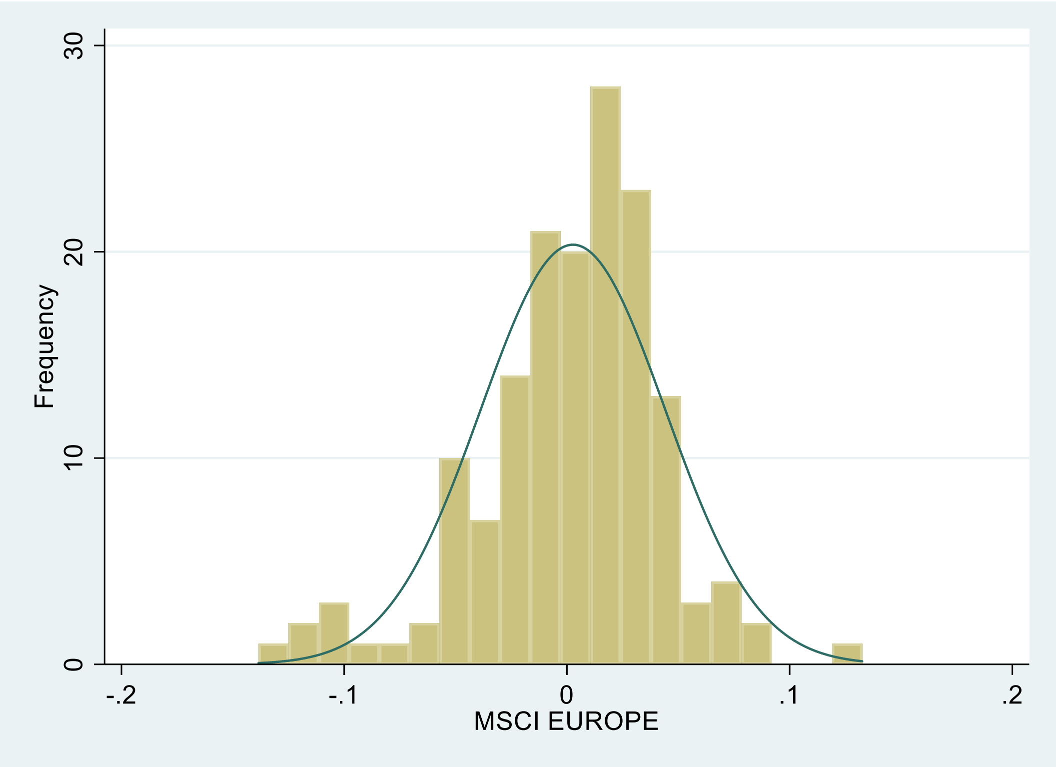
## Output for the test of existence of fixed effect

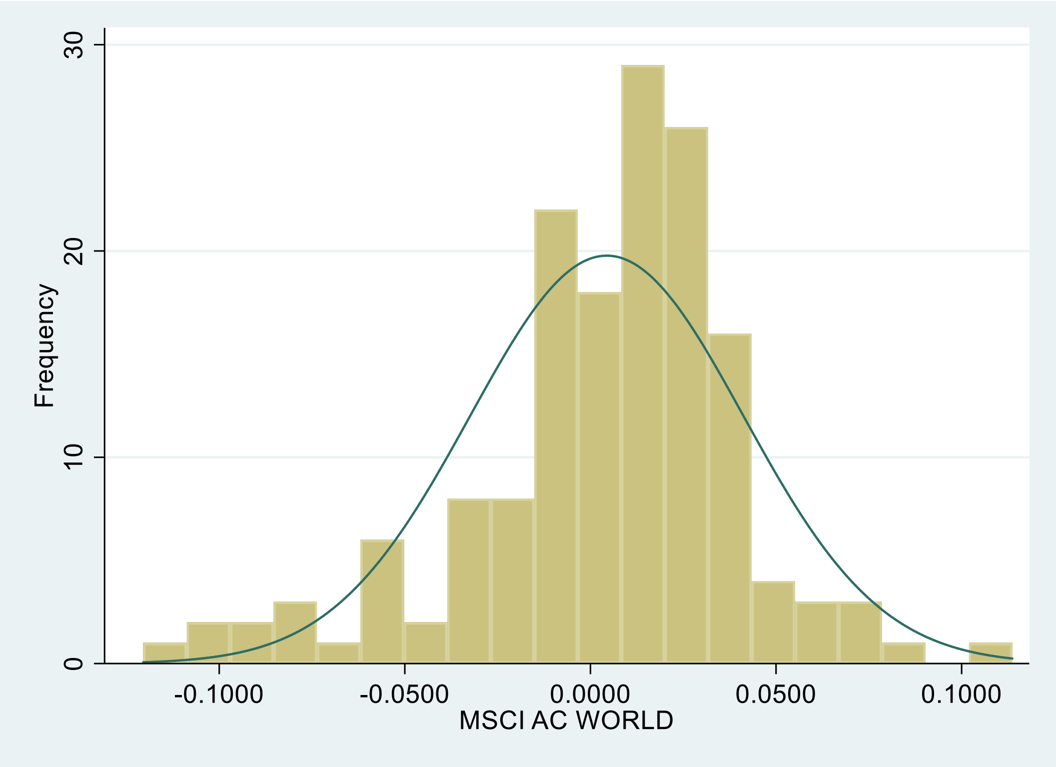
F test that all u_i = 0 : F (65, 600) = 1.15 Prob > F = 0.2086

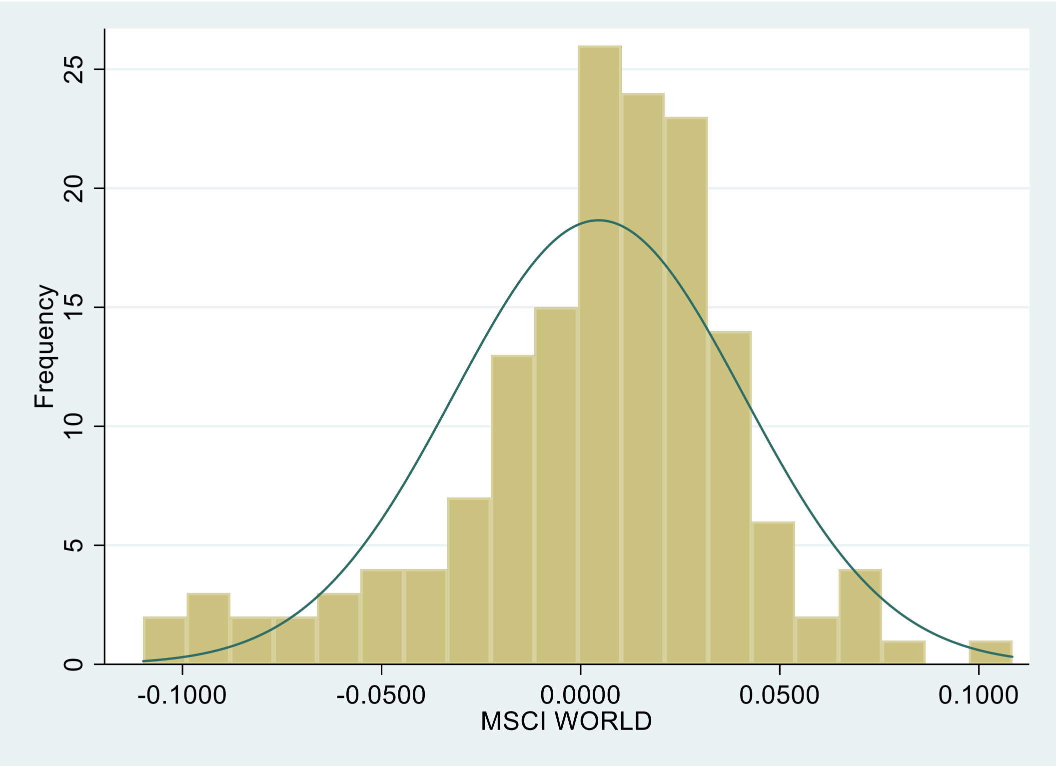
Failed to reject the null - No fixed effect exists.

## Distribution of return




30
20
10
0
Frequency
-0.1000
-0.0500
0.0000
0.0500
0.1000
MSCI AC WORLD


25
20
15
10
5
0
Frequency
-0.1000
-0.0500
0.0000
0.0500
0.1000
MSCI WORLD

### Test for heteroskedasticity in the cross-sectional dataset

```
White's test for Ho: homoskedasticity
         against Ha: unrestricted heteroskedasticity

         chi2(38)      =     80.36
         Prob > chi2   =    0.0001

Cameron & Trivedi's decomposition of IM-test
```

| Source | chi2 | df | p |
|---|---|---|---|
| Heteroskedasticity | 80.36 | 38 | 0.0001 |
| Skewness | 47.09 | 8 | 0.0000 |
| Kurtosis | 16.52 | 1 | 0.0000 |
| Total | 143.97 | 47 | 0.0000 |

## Regression output - Jensen's Alpha - Net returns

| DENMARK | Aktiv/passiv | Benchmark | Beta | Alpha | T-stat | P-value | R^2_adj | Alpha Error | Beta error |
|---|---|---|---|---|---|---|---|---|---|
| Formuepleje Danske Aktier | Aktiv | OMX CPH CAP | 0,9884 | -0,0012 | -0,7576 | 0,4508 | 0,8613 | 0,0015 | 0,0427 |
| BankInvest Danske Aktier A | Aktiv | OMX CPH CAP | 0,9840 | -0,0013 | -0,9575 | 0,3398 | 0,8935 | 0,0013 | 0,0273 |
| C WorldWide Danmark KL | Aktiv | OMX CPH CAP | 0,9879 | -0,0007 | -0,5241 | 0,6009 | 0,9008 | 0,0013 | 0,0263 |
| Danske Invest Danmark - Akkumulerende, klasse DKK | Aktiv | OMX CPH CAP | 1,0367 | -0,0001 | -0,1216 | 0,9034 | 0,9612 | 0,0009 | 0,0175 |
| Danske Invest Danmark Fokus, klasse DKK d | Aktiv | OMX CPH CAP | 1,1101 | -0,0014 | -0,8944 | 0,3733 | 0,8814 | 0,0016 | 0,0413 |
| Danske Invest Danmark, klasse DKK d | Aktiv | OMX CPH CAP | 1,0483 | -0,0011 | -1,1915 | 0,2353 | 0,9535 | 0,0009 | 0,0186 |
| Handelsinvest Danmark AK | Aktiv | OMX CPH CAP | 0,9984 | -0,0002 | -0,1304 | 0,8964 | 0,8834 | 0,0014 | 0,0291 |
| Jyske Invest Danske Aktier KL | Aktiv | OMX CPH CAP | 1,0757 | -0,0023 | -2,1241 | 0,0353 | 0,9381 | 0,0011 | 0,0222 |
| Lån & Spar Invest Danske Aktier | Aktiv | OMX CPH CAP | 0,9672 | 0,0007 | 0,1844 | 0,8540 | 0,5864 | 0,0036 | 0,0708 |
| Maj Invest Danske Aktier | Aktiv | OMX CPH CAP | 1,0171 | -0,0003 | -0,2736 | 0,7848 | 0,9312 | 0,0011 | 0,0222 |
| Nordea Invest Danmark | Aktiv | OMX CPH CAP | 0,9859 | 0,0002 | 0,2601 | 0,7952 | 0,9488 | 0,0009 | 0,0184 |
| Nordea Invest Danske aktier fokus | Aktiv | OMX CPH CAP | 1,0542 | 0,0020 | 0,8298 | 0,4081 | 0,7765 | 0,0024 | 0,0476 |
| Nykredit Invest Danske aktier | Aktiv | OMX CPH CAP | 1,0205 | -0,0007 | -0,6842 | 0,4949 | 0,9382 | 0,0010 | 0,0210 |
| Nykredit Invest Danske aktier Akk. | Aktiv | OMX CPH CAP | 0,9569 | 0,0001 | 0,0518 | 0,9588 | 0,9081 | 0,0013 | 0,0256 |
| PFA Invest Dansk aktier | Aktiv | OMX CPH CAP | 0,9943 | -0,0018 | -0,7938 | 0,4299 | 0,7635 | 0,0023 | 0,0646 |
| SEBinvest AKL Danske Aktier Akkumulerende P | Aktiv | OMX CPH CAP | 1,0183 | 0,0002 | 0,0920 | 0,9268 | 0,8699 | 0,0017 | 0,0330 |
| SEBinvest AKL Danske Aktier P | Aktiv | OMX CPH CAP | 0,9855 | 0,0007 | 0,5078 | 0,6123 | 0,8977 | 0,0013 | 0,0267 |
| Sparinvest Danske Aktier KL A | Aktiv | OMX CPH CAP | 0,9626 | -0,0011 | -1,0558 | 0,2927 | 0,9248 | 0,0011 | 0,0220 |
| Sydinvest Danmark A DKK | Aktiv | OMX CPH CAP | 1,0006 | -0,0008 | -0,6806 | 0,4971 | 0,9249 | 0,0011 | 0,0229 |
| Danske Invest Danmark Indeks, klasse DKK d | Passiv | OMX CPH CAP | 1,0273 | -0,0005 | -0,6205 | 0,5359 | 0,9643 | 0,0008 | 0,0159 |

| Europe | Aktiv/passiv | Benchmark | Beta | Alpha | T-stat | P-value | R^2_adj | Alpha Error | Beta error |
|---|---|---|---|---|---|---|---|---|---|
| Alm. Brand Invest, Europæiske Aktier ETIK | Aktiv | MSCI EUROPE | 0,9910 | -0,0016 | -1,1197 | 0,2646 | 0,8372 | 0,0015 | 0,0351 |
| SEBinvest AKL Europa Indeks I | Passiv | MSCI EUROPE | 0,9497 | -0,0006 | -0,3078 | 0,7590 | 0,7506 | 0,0020 | 0,0586 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Danske Invest Europa 2 - Akkumulerende KL | Aktiv | MSCI EUROPE | 1,0290 | -0,0020 | -0,8466 | 0,3992 | 0,7041 | 0,0023 | 0,0662 |
| Danske Invest Europa 2 KL | Aktiv | MSCI EUROPE | 1,0777 | -0,0019 | -1,1725 | 0,2428 | 0,8302 | 0,0016 | 0,0391 |
| Danske Invest Europa Højt Udbytte - Akkumulerende, klasse DKK | Aktiv | MSCI EUROPE | 0,9352 | 0,0004 | 0,3487 | 0,7278 | 0,8995 | 0,0011 | 0,0264 |
| Danske Invest Europa Højt Udbytte, klasse DKK d | Aktiv | MSCI EUROPE | 0,9617 | 0,0006 | 0,4874 | 0,6267 | 0,8794 | 0,0013 | 0,0300 |
| Danske Invest Europa, klasse DKK d | Aktiv | MSCI EUROPE | 1,0651 | 0,0000 | -0,0220 | 0,9825 | 0,8886 | 0,0013 | 0,0303 |
| Handelsinvest Europa AK | Aktiv | MSCI EUROPE | 1,0323 | -0,0009 | -0,4829 | 0,6299 | 0,7992 | 0,0019 | 0,0435 |
| Jyske Invest Europæiske Aktier KL | Aktiv | MSCI EUROPE | 1,0389 | -0,0015 | -1,2824 | 0,2016 | 0,8933 | 0,0012 | 0,0288 |
| Nordea Invest Europa | Aktiv | MSCI EUROPE | 1,0651 | -0,0019 | -1,7431 | 0,0833 | 0,9131 | 0,0011 | 0,0264 |
| PFA Invest Europa Value Aktier | Aktiv | MSCI EUROPE | 0,9862 | -0,0033 | -1,0127 | 0,3163 | 0,6981 | 0,0033 | 0,0923 |
| PFA Invest Højt Udbytte Aktier | Aktiv | MSCI EUROPE | 0,9206 | 0,0002 | 0,1149 | 0,9088 | 0,7487 | 0,0021 | 0,0632 |
| SEBinvest AKL Europa Højt Udbytte P | Aktiv | MSCI EUROPE | 0,8367 | 0,0001 | 0,0848 | 0,9326 | 0,7307 | 0,0017 | 0,0407 |
| Sparinvest Value Europa KL A | Aktiv | MSCI EUROPE | 1,1527 | -0,0027 | -1,2774 | 0,2034 | 0,7826 | 0,0021 | 0,0494 |
| Sydinvest Europa Ligevægt & Value A DKK | Aktiv | MSCI EUROPE | 1,0427 | -0,0013 | -1,2130 | 0,2270 | 0,9142 | 0,0011 | 0,0257 |
| Danske Invest Europa Indeks, klasse DKK d | Passiv | MSCI EUROPE | 0,9907 | -0,0007 | -0,7044 | 0,4823 | 0,9239 | 0,0010 | 0,0228 |

| GLOBAL | Aktiv/passiv | Benchmark | Beta | Alpha | T-stat | P-value | R^2_adj | Alpha Error | Beta error |
|---|---|---|---|---|---|---|---|---|---|
| Alm. Brand Invest, Globale Aktier ETIK | Aktiv | MSCI WORLD | 0,9933 | -0,0018 | -1,3113 | 0,1917 | 0,8186 | 0,0014 | 0,0375 |
| Formuepleje Globale Aktier | Aktiv | MSCI AC WORLD | 0,9914 | 0,0005 | 0,2484 | 0,8044 | 0,7453 | 0,0019 | 0,0624 |
| Formuepleje LimiTTellus | Aktiv | MSCI AC WORLD | 1,0081 | -0,0010 | -0,4815 | 0,6320 | 0,8088 | 0,0021 | 0,0642 |
| Nykredit Invest Engros Global Opportunities | Aktiv | MSCI AC WORLD | 1,0045 | 0,0005 | 0,4275 | 0,6697 | 0,8968 | 0,0011 | 0,0285 |
| Nykredit Invest Globale Aktier Basis | Passiv | MSCI WORLD | 1,0193 | -0,0005 | -0,9790 | 0,3300 | 0,9752 | 0,0005 | 0,0166 |
| BankInvest Basis Globale Aktier A | Aktiv | MSCI AC WORLD | 1,0005 | -0,0009 | -0,8133 | 0,4173 | 0,8853 | 0,0011 | 0,0289 |
| BankInvest Basis Globale Aktier Akk. A | Aktiv | MSCI AC WORLD | 1,0187 | -0,0010 | -1,0664 | 0,2879 | 0,9098 | 0,0010 | 0,0258 |
| C WorldWide Glob.Akt.Etik Klasse Udloddende | Aktiv | MSCI AC WORLD | 1,0210 | -0,0021 | -0,6947 | 0,4895 | 0,5855 | 0,0030 | 0,1001 |
| C WorldWide Globale Aktier KL Klasse A | Aktiv | MSCI AC WORLD | 0,9851 | 0,0004 | 0,2511 | 0,8021 | 0,7986 | 0,0015 | 0,0397 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Danske Invest Global StockPicking - Akkumulerende, klasse DKK | Aktiv | MSCI AC WORLD | 0,9694 | -0,0004 | -0,3285 | 0,7430 | 0,8624 | 0,0012 | 0,0326 |
| Danske Invest Global StockPicking 2 KL | Aktiv | MSCI AC WORLD | 0,9624 | -0,0007 | -0,6768 | 0,4995 | 0,8963 | 0,0010 | 0,0263 |
| Danske Invest Global StockPicking, klasse DKK d | Aktiv | MSCI AC WORLD | 0,9886 | -0,0003 | -0,2075 | 0,8359 | 0,8054 | 0,0014 | 0,0390 |
| Jyske Invest Favorit Aktier KL | Aktiv | MSCI AC WORLD | 1,0437 | -0,0014 | -0,8085 | 0,4201 | 0,7514 | 0,0018 | 0,0482 |
| Jyske Invest Globale Aktier KL | Aktiv | MSCI AC WORLD | 1,1220 | -0,0021 | -1,3577 | 0,1765 | 0,8255 | 0,0015 | 0,0414 |
| Jyske Invest Globale Aktier Special KL | Aktiv | MSCI AC WORLD | 0,9145 | -0,0016 | -0,4197 | 0,6762 | 0,5105 | 0,0037 | 0,1157 |
| Lån & Spar Invest Verden Selection | Aktiv | MSCI WORLD | 0,8790 | -0,0012 | -0,4670 | 0,6411 | 0,4973 | 0,0026 | 0,0708 |
| Maj Invest Global Sundhed | Aktiv | MSCI WORLD | 1,1702 | -0,0023 | -0,9213 | 0,3588 | 0,6779 | 0,0025 | 0,0735 |
| Maj Invest Value Aktier | Aktiv | MSCI WORLD | 0,9849 | 0,0015 | 0,9684 | 0,3344 | 0,7684 | 0,0016 | 0,0434 |
| Maj Invest Vækstaktier | Aktiv | MSCI WORLD | 0,8875 | 0,0001 | 0,0430 | 0,9658 | 0,7709 | 0,0014 | 0,0388 |
| Nordea Invest Global Stars | Aktiv | MSCI AC WORLD | 0,9047 | 0,0003 | 0,1734 | 0,8626 | 0,7654 | 0,0015 | 0,0402 |
| Nykredit Invest Bæredygtige Aktier | Aktiv | MSCI AC WORLD | 0,9805 | -0,0008 | -0,3284 | 0,7435 | 0,6263 | 0,0025 | 0,0838 |
| Nykredit Invest Globale Aktier SRI | Aktiv | MSCI WORLD | 1,0197 | -0,0014 | -0,7116 | 0,4782 | 0,7040 | 0,0020 | 0,0610 |
| Nykredit Invest Globale Fokusaktier | Aktiv | MSCI AC WORLD | 1,0763 | -0,0010 | -0,6050 | 0,5469 | 0,8135 | 0,0017 | 0,0568 |
| PFA Invest Globale Aktier | Aktiv | MSCI WORLD | 1,1985 | -0,0025 | -1,1829 | 0,2407 | 0,8067 | 0,0021 | 0,0686 |
| Sparinvest Cumulus Value KL A | Aktiv | MSCI WORLD | 1,0981 | -0,0016 | -0,8910 | 0,3743 | 0,7580 | 0,0018 | 0,0498 |
| Sparinvest Momentum Aktier Akk. KL A | Aktiv | MSCI WORLD | 1,1364 | -0,0021 | -1,0256 | 0,3067 | 0,7321 | 0,0020 | 0,0552 |
| Sparinvest Value Aktier KL A | Aktiv | MSCI WORLD | 1,0993 | -0,0021 | -1,4637 | 0,1453 | 0,8299 | 0,0015 | 0,0400 |
| Danske Invest Global Indeks - Akkumulerende, klasse DKK h | Passiv | MSCI AC WORLD | 0,9376 | -0,0014 | -0,5155 | 0,6070 | 0,5604 | 0,0027 | 0,0697 |
| Danske Invest Global Indeks, klasse DKK d | Passiv | MSCI WORLD | 1,0479 | -0,0002 | -0,1507 | 0,8804 | 0,8725 | 0,0012 | 0,0322 |
| Nordea Invest Globale Aktier Indeks | Passiv | MSCI WORLD | 1,0645 | -0,0011 | -0,7615 | 0,4489 | 0,8834 | 0,0014 | 0,0455 |

## Regression output - Treynor and Mazuy - Net returns

| DENMARK | Beta | Gamma | Alpha | P-value alpha | P-value Gamma | R^2_adj | Alpha Error | Beta Error | Gamma Error |
|---|---|---|---|---|---|---|---|---|---|
| Formuepleje Danske Aktier | 0,9984 | -0,5638 | -0,0006 | 0,7531 | 0,5380 | 0,8603 | 0,0018 | Beta Error | 0,9118 |
| BankInvest Danske Aktier A | 0,9853 | 0,0293 | -0,0014 | 0,3655 | 0,9062 | 0,8928 | 0,0015 | 0,0295 | 0,2483 |
| C WorldWide Danmark KL | 1,0087 | 0,4701 | -0,0019 | 0,1771 | 0,0487 | 0,9027 | 0,0014 | 0,0281 | 0,2366 |
| Danske Invest Danmark - Akkumulerende, klasse DKK | 1,0523 | 0,3444 | -0,0011 | 0,2780 | 0,0276 | 0,9623 | 0,0010 | 0,0187 | 0,1546 |
| Danske Invest Danmark Fokus, klasse DKK d | 1,0954 | -1,3093 | 0,0006 | 0,7257 | 0,0260 | 0,8863 | 0,0018 | 0,0410 | 0,5789 |
| Danske Invest Danmark, klasse DKK d | 1,0568 | 0,1934 | -0,0016 | 0,1165 | 0,2526 | 0,9536 | 0,0010 | 0,0200 | 0,1684 |
| Handelsinvest Danmark AK | 0,9875 | -0,2469 | 0,0005 | 0,7664 | 0,3518 | 0,8833 | 0,0016 | 0,0314 | 0,2643 |
| Jyske Invest Danske Aktier KL | 1,0642 | -0,2588 | -0,0016 | 0,1835 | 0,1996 | 0,9384 | 0,0012 | 0,0239 | 0,2009 |
| Lån & Spar Invest Danske Aktier | 0,9790 | 0,2564 | -0,0001 | 0,9873 | 0,6832 | 0,5837 | 0,0041 | 0,0767 | 0,6269 |
| Maj Invest Danske Aktier | 1,0514 | 0,7730 | -0,0024 | 0,0429 | 0,0001 | 0,9374 | 0,0012 | 0,0228 | 0,1921 |
| Nordea Invest Danmark | 1,0048 | 0,4254 | -0,0009 | 0,3620 | 0,0104 | 0,9506 | 0,0010 | 0,0195 | 0,1639 |
| Nordea Invest Danske aktier fokus | 0,9932 | -1,3466 | 0,0057 | 0,0288 | 0,0013 | 0,7910 | 0,0026 | 0,0496 | 0,4113 |
| Nykredit Invest Danske aktier | 1,0329 | 0,2809 | -0,0015 | 0,2056 | 0,1416 | 0,9387 | 0,0012 | 0,0226 | 0,1901 |
| Nykredit Invest Danske aktier Akk. | 0,9471 | -0,2166 | 0,0007 | 0,6450 | 0,3462 | 0,9080 | 0,0014 | 0,0277 | 0,2292 |
| PFA Invest Dansk aktier | 0,9877 | 0,4206 | -0,0022 | 0,4074 | 0,7584 | 0,7605 | 0,0027 | 0,0685 | 1,3621 |
| SEBinvest AKL Danske Aktier Akkumulerende P | 1,0409 | 0,5001 | -0,0012 | 0,5088 | 0,0903 | 0,8717 | 0,0018 | 0,0354 | 0,2932 |
| SEBinvest AKL Danske Aktier P | 1,0089 | 0,5279 | -0,0008 | 0,6052 | 0,0289 | 0,9002 | 0,0015 | 0,0284 | 0,2393 |
| Sparinvest Danske Aktier KL A | 0,9606 | -0,0444 | -0,0010 | 0,3994 | 0,8253 | 0,9243 | 0,0012 | 0,0238 | 0,2007 |
| Sydinvest Danmark A DKK | 1,0128 | 0,2763 | -0,0015 | 0,2307 | 0,1842 | 0,9253 | 0,0013 | 0,0246 | 0,2071 |
| Danske Invest Danmark Indeks, klasse DKK d | 1,0349 | 0,1729 | -0,0010 | 0,2774 | 0,2314 | 0,9644 | 0,0009 | 0,0171 | 0,1439 |
| | | | | | | | | | |
| Europe | Beta | Gamma | Alpha | P-value alpha | P-value Gamma | R^2_adj | Alpha Error | Beta Error | Gamma Error |
| Alm. Brand Invest, Europæiske Aktier ETIK | 0,9521 | -1,5662 | 0,0012 | 0,4818 | 0,0009 | 0,8475 | 0,0016 | 0,0359 | 0,4639 |
| SEBinvest AKL Europa Indeks I | 0,9497 | -1,6463 | 0,0013 | 0,6044 | 0,1938 | 0,7527 | 0,0024 | 0,0583 | 1,2569 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Danske Invest Europa 2 - Akkumulerende KL | 1,0175 | -1,2974 | -0,0003 | 0,9100 | 0,3157 | 0,7041 | 0,0028 | 0,0672 | 1,2865 |
| Danske Invest Europa 2 KL | 1,0533 | -0,9785 | -0,0002 | 0,9294 | 0,0669 | 0,8328 | 0,0019 | 0,0410 | 0,5303 |
| Danske Invest Europa Højt Udbytte - Akkumulerende, klasse DKK | 0,9395 | 0,1733 | 0,0001 | 0,9572 | 0,6295 | 0,8989 | 0,0013 | 0,0279 | 0,3585 |
| Danske Invest Europa Højt Udbytte, klasse DKK d | 0,9722 | 0,4231 | -0,0002 | 0,9126 | 0,2992 | 0,8794 | 0,0015 | 0,0316 | 0,4060 |
| Danske Invest Europa, klasse DKK d | 1,0403 | -0,9977 | 0,0018 | 0,2253 | 0,0154 | 0,8921 | 0,0014 | 0,0315 | 0,4072 |
| Handelsinvest Europa AK | 1,0077 | -0,9954 | 0,0010 | 0,6568 | 0,0916 | 0,8018 | 0,0022 | 0,0456 | 0,5859 |
| Jyske Invest Europæiske Aktier KL | 1,0167 | -0,8951 | 0,0001 | 0,9679 | 0,0226 | 0,8962 | 0,0014 | 0,0300 | 0,3886 |
| Nordea Invest Europa | 1,0675 | 0,0986 | -0,0021 | 0,1035 | 0,7854 | 0,9125 | 0,0013 | 0,0280 | 0,3616 |
| PFA Invest Europa Value Aktier | 0,9899 | 1,3624 | -0,0051 | 0,2248 | 0,4832 | 0,6949 | 0,0041 | 0,0929 | 1,9274 |
| PFA Invest Højt Udbytte Aktier | 0,9189 | -0,9523 | 0,0013 | 0,6179 | 0,4848 | 0,7468 | 0,0026 | 0,0634 | 1,3560 |
| SEBinvest AKL Europa Højt Udbytte P | 0,8107 | -1,0455 | 0,0020 | 0,3048 | 0,0601 | 0,7352 | 0,0020 | 0,0427 | 0,5521 |
| Sparinvest Value Europa KL A | 1,1066 | -1,8656 | 0,0007 | 0,7622 | 0,0053 | 0,7924 | 0,0024 | 0,0509 | 0,6585 |
| Sydinvest Europa Ligevægt & Value A DKK | 1,0346 | -0,3258 | -0,0007 | 0,5643 | 0,3543 | 0,9141 | 0,0012 | 0,0271 | 0,3507 |
| Danske Invest Europa Indeks, klasse DKK d | 0,9750 | -0,6327 | 0,0005 | 0,6752 | 0,0422 | 0,9254 | 0,0011 | 0,0239 | 0,3088 |
| | | | | | | | | | |
| Global | Beta | Gamma | Alpha | P-value alpha | P-value Gamma | R^2_adj | Alpha Error | Beta Error | Gamma Error |
| Alm. Brand Invest, Globale Aktier ETIK | 0,9772 | -0,9107 | -0,0005 | 0,7490 | 0,1485 | 0,8199 | 0,0016 | 0,0390 | 0,6271 |
| Formuepleje Globale Aktier | 0,9928 | 0,4026 | 0,0001 | 0,9692 | 0,7456 | 0,7426 | 0,0022 | 0,0629 | 1,2367 |
| Formuepleje LimiTTellus | 1,0028 | -0,5314 | -0,0004 | 0,8695 | 0,6685 | 0,8060 | 0,0025 | 0,0658 | 1,2343 |
| Nykredit Invest Engros Global Opportunities | 0,9898 | -0,7745 | 0,0016 | 0,1998 | 0,0840 | 0,8983 | 0,0013 | 0,0295 | 0,4451 |
| Nykredit Invest Globale Aktier Basis | 1,0188 | -0,0808 | -0,0004 | 0,4969 | 0,8096 | 0,9749 | 0,0006 | 0,0168 | 0,3344 |
| BankInvest Basis Globale Aktier A | 1,0103 | 0,5030 | -0,0016 | 0,2062 | 0,2734 | 0,8854 | 0,0013 | 0,0302 | 0,4576 |
| BankInvest Basis Globale Aktier Akk. A | 1,0201 | 0,0694 | -0,0011 | 0,3217 | 0,8654 | 0,9093 | 0,0011 | 0,0270 | 0,4090 |
| C WorldWide Glob.Akt.Etik Klasse Udloddende | 1,0394 | 2,1592 | -0,0043 | 0,2418 | 0,2726 | 0,5868 | 0,0036 | 0,1013 | 1,9528 |
| C WorldWide Globale Aktier KL Klasse A | 0,9820 | -0,1596 | 0,0006 | 0,7299 | 0,8006 | 0,7974 | 0,0017 | 0,0417 | 0,6305 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Danske Invest Global StockPicking - Akkumulerende, klasse DKK | 0,9580 | -0,5956 | 0,0005 | 0,7338 | 0,2463 | 0,8627 | 0,0015 | 0,0340 | 0,5115 |
| Danske Invest Global StockPicking 2 KL | 0,9463 | -0,8294 | 0,0005 | 0,6366 | 0,0459 | 0,8983 | 0,0011 | 0,0272 | 0,4122 |
| Danske Invest Global StockPicking, klasse DKK d | 0,9498 | -1,9973 | 0,0026 | 0,1188 | 0,0011 | 0,8174 | 0,0016 | 0,0395 | 0,5981 |
| Jyske Invest Favorit Aktier KL | 1,0005 | -2,2203 | 0,0018 | 0,3914 | 0,0033 | 0,7635 | 0,0020 | 0,0492 | 0,7438 |
| Jyske Invest Globale Aktier KL | 1,0776 | -2,2803 | 0,0012 | 0,4889 | 0,0004 | 0,8382 | 0,0017 | 0,0417 | 0,6313 |
| Jyske Invest Globale Aktier Special KL | 0,9458 | 3,3056 | -0,0051 | 0,2441 | 0,1365 | 0,5211 | 0,0044 | 0,1163 | 2,1887 |
| Lån & Spar Invest Verden Selection | 0,9336 | 3,0854 | -0,0055 | 0,0685 | 0,0089 | 0,5162 | 0,0030 | 0,0724 | 1,1641 |
| Maj Invest Global Sundhed | 1,1702 | 1,9666 | -0,0046 | 0,1119 | 0,1135 | 0,6820 | 0,0029 | 0,0730 | 1,2335 |
| Maj Invest Value Aktier | 1,0035 | 1,0483 | 0,0001 | 0,9724 | 0,1504 | 0,7700 | 0,0019 | 0,0451 | 0,7252 |
| Maj Invest Vækstaktier | 0,9008 | 0,7510 | -0,0010 | 0,5568 | 0,2500 | 0,7714 | 0,0017 | 0,0405 | 0,6504 |
| Nordea Invest Global Stars | 0,9020 | -0,1360 | 0,0005 | 0,7961 | 0,8316 | 0,7640 | 0,0018 | 0,0422 | 0,6383 |
| Nykredit Invest Bæredygtige Aktier | 0,9754 | -0,7231 | -0,0001 | 0,9613 | 0,6647 | 0,6225 | 0,0029 | 0,0851 | 1,6622 |
| Nykredit Invest Globale Aktier SRI | 1,0321 | -1,2834 | -0,0002 | 0,9444 | 0,2367 | 0,7050 | 0,0023 | 0,0618 | 1,0789 |
| Nykredit Invest Globale Fokusaktier | 1,0710 | -0,7591 | -0,0003 | 0,8760 | 0,5030 | 0,8122 | 0,0020 | 0,0576 | 1,1282 |
| PFA Invest Globale Aktier | 1,1978 | -0,1053 | -0,0024 | 0,3468 | 0,9373 | 0,8040 | 0,0026 | 0,0697 | 1,3337 |
| Sparinvest Cumulus Value KL A | 1,0836 | -0,8185 | -0,0005 | 0,8273 | 0,3286 | 0,7579 | 0,0022 | 0,0519 | 0,8351 |
| Sparinvest Momentum Aktier Akk. KL A | 1,0997 | -2,0746 | 0,0008 | 0,7221 | 0,0244 | 0,7391 | 0,0024 | 0,0568 | 0,9128 |
| Sparinvest Value Aktier KL A | 1,0939 | -0,3060 | -0,0017 | 0,3282 | 0,6494 | 0,8290 | 0,0017 | 0,0418 | 0,6718 |
| Danske Invest Global Indeks - Akkumulerende, klasse DKK h | 0,8908 | -2,4478 | 0,0024 | 0,4471 | 0,0250 | 0,5730 | 0,0031 | 0,0718 | 1,0802 |
| Danske Invest Global Indeks, klasse DKK d | 1,0481 | 0,0099 | -0,0002 | 0,8919 | 0,9855 | 0,8716 | 0,0014 | 0,0337 | 0,5412 |
| Nordea Invest Globale Aktier Indeks | 1,0651 | 0,0809 | -0,0012 | 0,4956 | 0,9276 | 0,8818 | 0,0017 | 0,0463 | 0,8878 |

## Regression output - Jensen's Alpha - Gross returns

| Denmark | Aktiv/passiv | Benchmark | Beta | Alpha | T-stat | P-value | R^2_adj | Alpha Error | Beta error |
|---|---|---|---|---|---|---|---|---|---|
| Formuepleje Danske Aktier | Aktiv | OMX CPH CAP | 0,9883 | 0,0002 | 0,1277 | 0,8987 | 0,8613 | 0,0015 | 0,0427 |
| BankInvest Danske Aktier A | Aktiv | OMX CPH CAP | 0,9843 | 0,0001 | 0,0752 | 0,9401 | 0,8938 | 0,0013 | 0,0272 |
| C WorldWide Danmark KL | Aktiv | OMX CPH CAP | 0,9879 | 0,0007 | 0,5028 | 0,6158 | 0,9008 | 0,0013 | 0,0263 |
| Danske Invest Danmark - Akkumulerende, klasse DKK | Aktiv | OMX CPH CAP | 1,0371 | 0,0009 | 1,0339 | 0,3030 | 0,9613 | 0,0009 | 0,0175 |
| Danske Invest Danmark Fokus, klasse DKK d | Aktiv | OMX CPH CAP | 1,1099 | -0,0001 | -0,0632 | 0,9497 | 0,8814 | 0,0016 | 0,0413 |
| Danske Invest Danmark, klasse DKK d | Aktiv | OMX CPH CAP | 1,0486 | -0,0001 | -0,1075 | 0,9145 | 0,9536 | 0,0009 | 0,0186 |
| Handelsinvest Danmark AK | Aktiv | OMX CPH CAP | 0,9976 | 0,0011 | 0,7619 | 0,4473 | 0,8830 | 0,0014 | 0,0292 |
| Jyske Invest Danske Aktier KL | Aktiv | OMX CPH CAP | 1,0756 | -0,0013 | -1,1626 | 0,2468 | 0,9381 | 0,0011 | 0,0222 |
| Lån & Spar Invest Danske Aktier | Aktiv | OMX CPH CAP | 0,9670 | 0,0018 | 0,4832 | 0,6298 | 0,5864 | 0,0036 | 0,0708 |
| Maj Invest Danske Aktier | Aktiv | OMX CPH CAP | 1,0177 | 0,0005 | 0,4650 | 0,6426 | 0,9315 | 0,0011 | 0,0222 |
| Nordea Invest Danmark | Aktiv | OMX CPH CAP | 0,9863 | 0,0011 | 1,2213 | 0,2238 | 0,9490 | 0,0009 | 0,0184 |
| Nordea Invest Danske aktier fokus | Aktiv | OMX CPH CAP | 1,0536 | 0,0033 | 1,3591 | 0,1763 | 0,7764 | 0,0024 | 0,0476 |
| Nykredit Invest Danske aktier | Aktiv | OMX CPH CAP | 1,0204 | 0,0004 | 0,3954 | 0,6931 | 0,9381 | 0,0010 | 0,0210 |
| Nykredit Invest Danske aktier Akk. | Aktiv | OMX CPH CAP | 0,9568 | 0,0012 | 0,8931 | 0,3733 | 0,9080 | 0,0013 | 0,0256 |
| PFA Invest Dansk aktier | Aktiv | OMX CPH CAP | 0,9937 | -0,0010 | -0,4385 | 0,6623 | 0,7632 | 0,0023 | 0,0647 |
| SEBinvest AKL Danske Aktier Akkumulerende P | Aktiv | OMX CPH CAP | 1,0182 | 0,0016 | 0,9409 | 0,3484 | 0,8698 | 0,0017 | 0,0330 |
| SEBinvest AKL Danske Aktier P | Aktiv | OMX CPH CAP | 0,9856 | 0,0020 | 1,4871 | 0,1390 | 0,8977 | 0,0013 | 0,0267 |
| Sparinvest Danske Aktier KL A | Aktiv | OMX CPH CAP | 0,9633 | -0,0002 | -0,1897 | 0,8498 | 0,9250 | 0,0011 | 0,0220 |
| Sydinvest Danmark A DKK | Aktiv | OMX CPH CAP | 1,0008 | 0,0001 | 0,1156 | 0,9081 | 0,9252 | 0,0011 | 0,0228 |
| Danske Invest Danmark Indeks, klasse DKK d | Passiv | OMX CPH CAP | 1,0272 | 0,0001 | 0,1016 | 0,9192 | 0,9642 | 0,0008 | 0,0159 |

| Europe | Aktiv/passiv | Benchmark | Beta | Alpha | T-stat | P-value | R^2_adj | Alpha Error | Beta error |
|---|---|---|---|---|---|---|---|---|---|
| Alm. Brand Invest, Europæiske Aktier ETIK | Aktiv | MSCI EUROPE | 0,9917 | -0,0004 | -0,2934 | 0,7696 | 0,8374 | 0,0015 | 0,0351 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SEBinvest AKL Europa Indeks I | Passiv | MSCI EUROPE | 0,9510 | 0,0004 | 0,1870 | 0,8521 | 0,7511 | 0,0020 | 0,0586 |
| Danske Invest Europa 2 - Akkumulerende KL | Aktiv | MSCI EUROPE | 1,0292 | -0,0006 | -0,2736 | 0,7850 | 0,7042 | 0,0023 | 0,0662 |
| Danske Invest Europa 2 KL | Aktiv | MSCI EUROPE | 1,0781 | -0,0007 | -0,4013 | 0,6887 | 0,8305 | 0,0016 | 0,0391 |
| Danske Invest Europa Højt Udbytte - Akkumulerende, klasse DKK | Aktiv | MSCI EUROPE | 0,9358 | 0,0017 | 1,4919 | 0,1380 | 0,8996 | 0,0011 | 0,0264 |
| Danske Invest Europa Højt Udbytte, klasse DKK d | Aktiv | MSCI EUROPE | 0,9623 | 0,0019 | 1,5027 | 0,1352 | 0,8796 | 0,0013 | 0,0300 |
| Danske Invest Europa, klasse DKK d | Aktiv | MSCI EUROPE | 1,0656 | 0,0011 | 0,8829 | 0,3787 | 0,8887 | 0,0013 | 0,0303 |
| Handelsinvest Europa AK | Aktiv | MSCI EUROPE | 1,0320 | 0,0006 | 0,3250 | 0,7457 | 0,7990 | 0,0019 | 0,0435 |
| Jyske Invest Europæiske Aktier KL | Aktiv | MSCI EUROPE | 1,0386 | -0,0004 | -0,3028 | 0,7624 | 0,8934 | 0,0012 | 0,0288 |
| Nordea Invest Europa | Aktiv | MSCI EUROPE | 1,0652 | -0,0008 | -0,7511 | 0,4537 | 0,9131 | 0,0011 | 0,0264 |
| PFA Invest Europa Value Aktier | Aktiv | MSCI EUROPE | 0,9860 | -0,0025 | -0,7563 | 0,4532 | 0,6981 | 0,0033 | 0,0922 |
| PFA Invest Højt Udbytte Aktier | Aktiv | MSCI EUROPE | 0,9207 | 0,0011 | 0,5182 | 0,6059 | 0,7488 | 0,0021 | 0,0631 |
| SEBinvest AKL Europa Højt Udbytte P | Aktiv | MSCI EUROPE | 0,8366 | 0,0014 | 0,8344 | 0,4053 | 0,7306 | 0,0017 | 0,0408 |
| Sparinvest Value Europa KL A | Aktiv | MSCI EUROPE | 1,1528 | -0,0011 | -0,5407 | 0,5895 | 0,7826 | 0,0021 | 0,0494 |
| Sydinvest Europa Ligevægt & Value A DKK | Aktiv | MSCI EUROPE | 1,0430 | -0,0002 | -0,1935 | 0,8468 | 0,9141 | 0,0011 | 0,0257 |
| Danske Invest Europa Indeks, klasse DKK d | Passiv | MSCI EUROPE | 0,9907 | 0,0000 | -0,0390 | 0,9690 | 0,9240 | 0,0010 | 0,0228 |

| Global | Aktiv/passiv | Benchmark | Beta | Alpha | T-stat | P-value | R^2_adj | Alpha Error | Beta error |
|---|---|---|---|---|---|---|---|---|---|
| Alm. Brand Invest, Globale Aktier ETIK | Aktiv | MSCI WORLD | 0,9932 | -0,0003 | -0,2196 | 0,8264 | 0,8187 | 0,0014 | 0,0375 |
| Formuepleje Globale Aktier | Aktiv | MSCI AC WORLD | 0,9915 | 0,0019 | 1,0079 | 0,3164 | 0,7441 | 0,0019 | 0,0626 |
| Formuepleje LimiTTellus | Aktiv | MSCI AC WORLD | 1,0090 | 0,0005 | 0,2646 | 0,7923 | 0,8094 | 0,0021 | 0,0642 |
| Nykredit Invest Engros Global Opportunities | Aktiv | MSCI AC WORLD | 1,0043 | 0,0012 | 1,0696 | 0,2866 | 0,8968 | 0,0011 | 0,0285 |
| Nykredit Invest Globale Aktier Basis | Passiv | MSCI WORLD | 1,0191 | 0,0000 | -0,0842 | 0,9331 | 0,9752 | 0,0005 | 0,0166 |
| BankInvest Basis Globale Aktier A | Aktiv | MSCI AC WORLD | 1,0006 | 0,0004 | 0,4142 | 0,6793 | 0,8851 | 0,0011 | 0,0290 |
| BankInvest Basis Globale Aktier Akk. A | Aktiv | MSCI AC WORLD | 1,0188 | 0,0004 | 0,3769 | 0,7068 | 0,9099 | 0,0010 | 0,0257 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| C WorldWide Glob.Akt.Etik Klasse Udloddende | Aktiv | MSCI AC WORLD | 1,0214 | -0,0006 | -0,1979 | 0,8437 | 0,5859 | 0,0030 | 0,1000 |
| C WorldWide Globale Aktier KL Klasse A | Aktiv | MSCI AC WORLD | 0,9850 | 0,0017 | 1,1660 | 0,2454 | 0,7986 | 0,0015 | 0,0397 |
| Danske Invest Global StockPicking - Akkumulerende, klasse DKK | Aktiv | MSCI AC WORLD | 0,9699 | 0,0008 | 0,6683 | 0,5050 | 0,8626 | 0,0012 | 0,0326 |
| Danske Invest Global StockPicking 2 KL | Aktiv | MSCI AC WORLD | 0,9630 | 0,0006 | 0,5694 | 0,5699 | 0,8963 | 0,0010 | 0,0263 |
| Danske Invest Global StockPicking, klasse DKK d | Aktiv | MSCI AC WORLD | 0,9891 | 0,0009 | 0,6570 | 0,5122 | 0,8056 | 0,0014 | 0,0390 |
| Jyske Invest Favorit Aktier KL | Aktiv | MSCI AC WORLD | 1,0433 | -0,0003 | -0,1490 | 0,8817 | 0,7517 | 0,0018 | 0,0481 |
| Jyske Invest Globale Aktier KL | Aktiv | MSCI AC WORLD | 1,1221 | -0,0009 | -0,6112 | 0,5420 | 0,8258 | 0,0015 | 0,0414 |
| Jyske Invest Globale Aktier Special KL | Aktiv | MSCI AC WORLD | 0,9137 | -0,0003 | -0,0839 | 0,9334 | 0,5103 | 0,0037 | 0,1156 |
| Lån & Spar Invest Verden Selection | Aktiv | MSCI WORLD | 0,8790 | 0,0000 | -0,0112 | 0,9911 | 0,4974 | 0,0026 | 0,0708 |
| Maj Invest Global Sundhed | Aktiv | MSCI WORLD | 1,1701 | -0,0012 | -0,4699 | 0,6393 | 0,6784 | 0,0025 | 0,0734 |
| Maj Invest Value Aktier | Aktiv | MSCI WORLD | 0,9862 | 0,0025 | 1,5736 | 0,1176 | 0,7691 | 0,0016 | 0,0434 |
| Maj Invest Vækstaktier | Aktiv | MSCI WORLD | 0,8888 | 0,0010 | 0,6861 | 0,4937 | 0,7720 | 0,0014 | 0,0388 |
| Nordea Invest Global Stars | Aktiv | MSCI AC WORLD | 0,9052 | 0,0015 | 0,9870 | 0,3252 | 0,7656 | 0,0015 | 0,0402 |
| Nykredit Invest Bæredygtige Aktier | Aktiv | MSCI AC WORLD | 0,9810 | 0,0007 | 0,2874 | 0,7746 | 0,6267 | 0,0025 | 0,0838 |
| Nykredit Invest Globale Aktier SRI | Aktiv | MSCI WORLD | 1,0196 | -0,0002 | -0,0999 | 0,9206 | 0,7040 | 0,0020 | 0,0610 |
| Nykredit Invest Globale Fokusaktier | Aktiv | MSCI AC WORLD | 1,0764 | 0,0003 | 0,1572 | 0,8755 | 0,8134 | 0,0017 | 0,0569 |
| PFA Invest Globale Aktier | Aktiv | MSCI WORLD | 1,1985 | -0,0017 | -0,7831 | 0,4361 | 0,8067 | 0,0021 | 0,0685 |
| Sparinvest Cumulus Value KL A | Aktiv | MSCI WORLD | 1,0984 | -0,0001 | -0,0496 | 0,9605 | 0,7582 | 0,0018 | 0,0498 |
| Sparinvest Momentum Aktier Akk. KL A | Aktiv | MSCI WORLD | 1,1366 | -0,0005 | -0,2675 | 0,7895 | 0,7322 | 0,0020 | 0,0551 |
| Sparinvest Value Aktier KL A | Aktiv | MSCI WORLD | 1,0996 | -0,0006 | -0,4108 | 0,6818 | 0,8300 | 0,0015 | 0,0399 |
| Danske Invest Global Indeks - Akkumulerende, klasse DKK h | Passiv | MSCI AC WORLD | 0,9375 | -0,0007 | -0,2782 | 0,7813 | 0,5603 | 0,0027 | 0,0697 |
| Danske Invest Global Indeks, klasse DKK d | Passiv | MSCI WORLD | 1,0475 | 0,0004 | 0,3744 | 0,7086 | 0,8722 | 0,0012 | 0,0322 |
| Nordea Invest Globale Aktier Indeks | Passiv | MSCI WORLD | 1,0645 | -0,0006 | -0,4456 | 0,6573 | 0,8834 | 0,0014 | 0,0455 |

## Regression output - Treynor and Mazuy - Gross returns

| Denmark | Beta | Gamma | Alpha | P-value alpha | P-value Gamma | R^2_adj | Alpha Error | Beta Error | Gamma Error |
|---|---|---|---|---|---|---|---|---|---|
| Formuepleje Danske Aktier | 0,9984 | -0,5681 | 0,0008 | 0,6636 | 0,5350 | 0,8602 | 0,0018 | Beta Error | 0,9118 |
| BankInvest Danske Aktier A | 0,9855 | 0,0257 | 0,0000 | 0,9832 | 0,9175 | 0,8931 | 0,0015 | 0,0295 | 0,2480 |
| C WorldWide Danmark KL | 1,0087 | 0,4701 | -0,0006 | 0,6701 | 0,0487 | 0,9027 | 0,0014 | 0,0281 | 0,2366 |
| Danske Invest Danmark - Akkumulerende, klasse DKK | 1,0525 | 0,3405 | 0,0000 | 0,9789 | 0,0292 | 0,9623 | 0,0010 | 0,0187 | 0,1546 |
| Danske Invest Danmark Fokus, klasse DKK d | 1,0952 | -1,3102 | 0,0019 | 0,2805 | 0,0259 | 0,8862 | 0,0018 | 0,0410 | 0,5791 |
| Danske Invest Danmark, klasse DKK d | 1,0570 | 0,1892 | -0,0006 | 0,5528 | 0,2631 | 0,9537 | 0,0010 | 0,0200 | 0,1685 |
| Handelsinvest Danmark AK | 0,9869 | -0,2423 | 0,0017 | 0,2780 | 0,3614 | 0,8829 | 0,0016 | 0,0314 | 0,2647 |
| Jyske Invest Danske Aktier KL | 1,0642 | -0,2583 | -0,0006 | 0,6364 | 0,2006 | 0,9384 | 0,0012 | 0,0239 | 0,2009 |
| Lån & Spar Invest Danske Aktier | 0,9788 | 0,2559 | 0,0010 | 0,8018 | 0,6837 | 0,5837 | 0,0041 | 0,0766 | 0,6268 |
| Maj Invest Danske Aktier | 1,0516 | 0,7656 | -0,0016 | 0,1848 | 0,0001 | 0,9375 | 0,0012 | 0,0228 | 0,1921 |
| Nordea Invest Danmark | 1,0049 | 0,4203 | 0,0000 | 0,9802 | 0,0112 | 0,9507 | 0,0010 | 0,0194 | 0,1637 |
| Nordea Invest Danske aktier fokus | 0,9928 | -1,3436 | 0,0070 | 0,0078 | 0,0014 | 0,7909 | 0,0026 | 0,0496 | 0,4112 |
| Nykredit Invest Danske aktier | 1,0329 | 0,2814 | -0,0003 | 0,7642 | 0,1412 | 0,9386 | 0,0012 | 0,0226 | 0,1903 |
| Nykredit Invest Danske aktier Akk. | 0,9470 | -0,2166 | 0,0018 | 0,2256 | 0,3462 | 0,9080 | 0,0014 | 0,0277 | 0,2292 |
| PFA Invest Dansk aktier | 0,9871 | 0,4221 | -0,0014 | 0,5953 | 0,7576 | 0,7602 | 0,0027 | 0,0685 | 1,3626 |
| SEBinvest AKL Danske Aktier Akkumulerende P | 1,0409 | 0,5049 | 0,0002 | 0,9208 | 0,0874 | 0,8715 | 0,0018 | 0,0354 | 0,2933 |
| SEBinvest AKL Danske Aktier P | 1,0090 | 0,5276 | 0,0005 | 0,7110 | 0,0290 | 0,9002 | 0,0015 | 0,0284 | 0,2394 |
| Sparinvest Danske Aktier KL A | 0,9607 | -0,0594 | 0,0000 | 0,9698 | 0,7672 | 0,9246 | 0,0012 | 0,0238 | 0,2004 |
| Sydinvest Danmark A DKK | 1,0128 | 0,2708 | -0,0006 | 0,6340 | 0,1925 | 0,9256 | 0,0013 | 0,0246 | 0,2068 |
| Danske Invest Danmark Indeks, klasse DKK d | 1,0351 | 0,1790 | -0,0004 | 0,6459 | 0,2157 | 0,9643 | 0,0009 | 0,0171 | 0,1440 |
| | | | | | | | | | |
| Europe | Beta | Gamma | Alpha | P-value alpha | P-value Gamm | R^2_adj | Alpha Error | Beta Error | Gamma Error |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Alm. Brand Invest, Europæiske Aktier ETIK | 0,9524 | -1,5822 | 0,0024 | 0,1461 | 0,0008 | 0,8479 | 0,0016 | 0,0358 | 0,4635 |
| SEBinvest AKL Europa Indeks I | 0,9510 | -1,6282 | 0,0022 | 0,3638 | 0,1989 | 0,7530 | 0,0024 | 0,0584 | 1,2575 |
| Danske Invest Europa 2 - Akkumulerende KL | 1,0176 | -1,2963 | 0,0010 | 0,7231 | 0,3160 | 0,7042 | 0,0028 | 0,0672 | 1,2864 |
| Danske Invest Europa 2 KL | 1,0537 | -0,9826 | 0,0011 | 0,5583 | 0,0656 | 0,8331 | 0,0019 | 0,0410 | 0,5300 |
| Danske Invest Europa Højt Udbytte - Akkumulerende, klasse DKK | 0,9399 | 0,1665 | 0,0014 | 0,2977 | 0,6430 | 0,8990 | 0,0013 | 0,0279 | 0,3585 |
| Danske Invest Europa Højt Udbytte, klasse DKK d | 0,9726 | 0,4157 | 0,0012 | 0,4406 | 0,3075 | 0,8796 | 0,0015 | 0,0316 | 0,4059 |
| Danske Invest Europa, klasse DKK d | 1,0406 | -1,0056 | 0,0029 | 0,0449 | 0,0146 | 0,8923 | 0,0014 | 0,0315 | 0,4069 |
| Handelsinvest Europa AK | 1,0075 | -0,9899 | 0,0025 | 0,2560 | 0,0934 | 0,8016 | 0,0022 | 0,0456 | 0,5860 |
| Jyske Invest Europæiske Aktier KL | 1,0164 | -0,8946 | 0,0012 | 0,3704 | 0,0225 | 0,8963 | 0,0014 | 0,0300 | 0,3881 |
| Nordea Invest Europa | 1,0676 | 0,0964 | -0,0010 | 0,4360 | 0,7902 | 0,9126 | 0,0013 | 0,0280 | 0,3616 |
| PFA Invest Europa Value Aktier | 0,9897 | 1,3422 | -0,0042 | 0,3132 | 0,4896 | 0,6948 | 0,0041 | 0,0929 | 1,9272 |
| PFA Invest Højt Udbytte Aktier | 0,9189 | -0,9686 | 0,0022 | 0,4063 | 0,4772 | 0,7470 | 0,0026 | 0,0634 | 1,3553 |
| SEBinvest AKL Europa Højt Udbytte P | 0,8107 | -1,0405 | 0,0033 | 0,0955 | 0,0614 | 0,7350 | 0,0020 | 0,0427 | 0,5522 |
| Sparinvest Value Europa KL A | 1,1066 | -1,8699 | 0,0023 | 0,3402 | 0,0052 | 0,7924 | 0,0024 | 0,0509 | 0,6585 |
| Sydinvest Europa Ligevægt & Value A DKK | 1,0347 | -0,3335 | 0,0004 | 0,7548 | 0,3432 | 0,9141 | 0,0012 | 0,0271 | 0,3508 |
| Danske Invest Europa Indeks, klasse DKK d | 0,9752 | -0,6221 | 0,0011 | 0,3272 | 0,0457 | 0,9254 | 0,0011 | 0,0239 | 0,3087 |
| | | | | | | | | | |
| Global | Beta | Gamma | Alpha | P-value alpha | P-value Gamm | R^2_adj | Alpha Error | Beta Error | Gamma Error |
| Alm. Brand Invest, Globale Aktier ETIK | 0,9773 | -0,8982 | 0,0010 | 0,5561 | 0,1541 | 0,8199 | 0,0016 | 0,0390 | 0,6272 |
| Formuepleje Globale Aktier | 0,9928 | 0,3833 | 0,0016 | 0,4923 | 0,7581 | 0,7414 | 0,0023 | 0,0630 | 1,2405 |
| Formuepleje LimiTTellus | 1,0039 | -0,5216 | 0,0011 | 0,6536 | 0,6739 | 0,8066 | 0,0025 | 0,0658 | 1,2330 |
| Nykredit Invest Engros Global Opportunities | 0,9897 | -0,7671 | 0,0023 | 0,0698 | 0,0870 | 0,8983 | 0,0013 | 0,0295 | 0,4450 |
| Nykredit Invest Globale Aktier Basis | 1,0186 | -0,0793 | 0,0000 | 0,9522 | 0,8129 | 0,9749 | 0,0006 | 0,0168 | 0,3342 |
| BankInvest Basis Globale Aktier A | 1,0105 | 0,5096 | -0,0003 | 0,8180 | 0,2677 | 0,8852 | 0,0013 | 0,0303 | 0,4581 |
| BankInvest Basis Globale Aktier Akk. A | 1,0201 | 0,0673 | 0,0003 | 0,8156 | 0,8695 | 0,9094 | 0,0011 | 0,0270 | 0,4088 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| C WorldWide Glob.Akt.Etik Klasse Udloddende | 1,0397 | 2,1520 | -0,0027 | 0,4507 | 0,2741 | 0,5871 | 0,0036 | 0,1013 | 1,9524 |
| C WorldWide Globale Aktier KL Klasse A | 0,9819 | -0,1611 | 0,0019 | 0,2629 | 0,7987 | 0,7974 | 0,0017 | 0,0417 | 0,6305 |
| Danske Invest Global StockPicking - Akkumulerende, klasse DKK | 0,9582 | -0,6118 | 0,0018 | 0,2309 | 0,2334 | 0,8630 | 0,0015 | 0,0340 | 0,5112 |
| Danske Invest Global StockPicking 2 KL | 0,9466 | -0,8431 | 0,0018 | 0,1203 | 0,0426 | 0,8984 | 0,0011 | 0,0272 | 0,4123 |
| Danske Invest Global StockPicking, klasse DKK d | 0,9501 | -2,0062 | 0,0038 | 0,0207 | 0,0010 | 0,8177 | 0,0016 | 0,0395 | 0,5979 |
| Jyske Invest Favorit Aktier KL | 1,0002 | -2,2188 | 0,0029 | 0,1531 | 0,0033 | 0,7638 | 0,0020 | 0,0491 | 0,7431 |
| Jyske Invest Globale Aktier KL | 1,0777 | -2,2826 | 0,0024 | 0,1765 | 0,0004 | 0,8385 | 0,0017 | 0,0417 | 0,6306 |
| Jyske Invest Globale Aktier Special KL | 0,9449 | 3,2920 | -0,0039 | 0,3779 | 0,1380 | 0,5207 | 0,0044 | 0,1162 | 2,1881 |
| Lån & Spar Invest Verden Selection | 0,9336 | 3,0849 | -0,0044 | 0,1508 | 0,0089 | 0,5163 | 0,0030 | 0,0724 | 1,1641 |
| Maj Invest Global Sundhed | 1,1701 | 1,9309 | -0,0035 | 0,2346 | 0,1199 | 0,6823 | 0,0029 | 0,0730 | 1,2325 |
| Maj Invest Value Aktier | 1,0043 | 1,0212 | 0,0011 | 0,5730 | 0,1610 | 0,7706 | 0,0019 | 0,0451 | 0,7249 |
| Maj Invest Vækstaktier | 0,9017 | 0,7294 | -0,0001 | 0,9757 | 0,2632 | 0,7724 | 0,0017 | 0,0404 | 0,6495 |
| Nordea Invest Global Stars | 0,9024 | -0,1436 | 0,0017 | 0,3407 | 0,8223 | 0,7641 | 0,0018 | 0,0422 | 0,6384 |
| Nykredit Invest Bæredygtige Aktier | 0,9758 | -0,7343 | 0,0014 | 0,6356 | 0,6598 | 0,6229 | 0,0029 | 0,0851 | 1,6618 |
| Nykredit Invest Globale Aktier SRI | 1,0321 | -1,2860 | 0,0011 | 0,6377 | 0,2356 | 0,7051 | 0,0023 | 0,0618 | 1,0787 |
| Nykredit Invest Globale Fokusaktier | 1,0708 | -0,7862 | 0,0010 | 0,6177 | 0,4880 | 0,8122 | 0,0020 | 0,0576 | 1,1283 |
| PFA Invest Globale Aktier | 1,1977 | -0,1071 | -0,0016 | 0,5426 | 0,9362 | 0,8040 | 0,0026 | 0,0697 | 1,3336 |
| Sparinvest Cumulus Value KL A | 1,0839 | -0,8206 | 0,0011 | 0,6246 | 0,3272 | 0,7581 | 0,0022 | 0,0519 | 0,8349 |
| Sparinvest Momentum Aktier Akk. KL A | 1,0997 | -2,0802 | 0,0024 | 0,3161 | 0,0240 | 0,7393 | 0,0024 | 0,0568 | 0,9126 |
| Sparinvest Value Aktier KL A | 1,0941 | -0,3093 | -0,0002 | 0,9242 | 0,6458 | 0,8291 | 0,0017 | 0,0418 | 0,6717 |
| Danske Invest Global Indeks - Akkumulerende, klasse DKK h | 0,8910 | -2,4334 | 0,0030 | 0,3392 | 0,0259 | 0,5727 | 0,0031 | 0,0718 | 1,0805 |
| Danske Invest Global Indeks, klasse DKK d | 1,0480 | 0,0247 | 0,0004 | 0,7729 | 0,9637 | 0,8714 | 0,0014 | 0,0337 | 0,5416 |
| Nordea Invest Globale Aktier Indeks | 1,0651 | 0,0809 | -0,0007 | 0,6748 | 0,9276 | 0,8818 | 0,0017 | 0,0463 | 0,8878 |