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Value Investing in the Scandinavian Context

Inspired by "Dogs of the Dow"

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NORWEGIAN SCHOOL OF ECONOMICS

Abstract

The objective of this thesis is to investigate the relevance of the high dividend-yield strategy, "Dogs of the Dow" (DoD), combined with two additional value investing strategies. All strategies are examined in a Scandinavian context for a Norwegian based investor in the period 2005 to 2019.

We find that the price-to-earnings strategy beats the reference index over the investment period in terms of raw returns, while the DoD strategy obtains the same returns as the reference index. The price-to-book strategy underperforms both the two other strategies and the reference index in terms of raw returns. We do a thorough investigation of transaction costs and taxes which we later use to adjust the raw returns. We find low tax costs associated with the value strategies for the Scandinavian market, especially when dividends are low, since capital gains are not taxed immediately. When adjusting for transaction costs and taxes, only the price-to-earnings strategy outperforms the reference index slightly based on raw returns. When risk-adjusting the raw returns with the Sharpe ratio and Treynor index, we find that our value strategies underperform when the stock market decline rapidly. Further, we analyse the raw returns using single-factor and multi-factor regression models. When including momentum in Carhart's four-factor model, we find annual abnormal returns of 5.60 and 9.40 percent for the DoD and the price-to-earnings strategies before transaction costs and tax adjustments. When we run the regressions on the returns adjusted for transaction costs and taxes, alpha is no longer statistically significant for the DoD strategy. As for the price-to-earnings strategy, the alpha decreases to 8.60 percent and remains statistically significant on a five percent level.

Altogether the results obtained in this thesis indicate that the DoD and price-to-book strategies do not create abnormal returns for the Norwegian based investor with the applied regression models, after adjusting for transaction costs and taxes. However, we find indications that the price-to-earnings strategy creates abnormal returns for the investor in this thesis.

Keywords: Value Investing, Dogs of the Dow, Dividends, Price-to-Earnings, Price-to-Book, Tax.

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The authors' common interest in the stock market was the foundation for this partnership. We have had countless discussions throughout our studies regarding this topic. Thus, we wanted to combine our theoretical and practical knowledge into this thesis. It has been a challenging process, and our knowledge of finance, econometrics, Excel and programming has been put to the test.

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1. Introduction

1.1 Background

The rationale behind value investing strategies is based on investors' overreaction to adverse financial news, creating value stocks, and positive overreaction to superior company financial news, creating growth stocks (Visscher & Filbeck, 2003). Based on this, Visscher and Filbeck (2003) studied the characteristics of value stocks and developed several criteria for picking them[1]. Numerous studies show evidence of superiority for value strategies in the U.S. financial market (Basu 1977; Ambachtsheer 1977; Ambachtsheer & Farrell 1979; Estep, Hanson, & Johnson 1983; Sorensen & Williamson 1985; Harris & Marston 1994; Chan, Jegadeesh, & Lakonishok 1995). Clifford, Moskowitz and Pedersen (2013) find evidence for value strategies on several other financial markets as well. Further, a comprehensive number of studies show evidence that value stocks are persistently undervalued compared to growth stocks, due to overreactions to company announcement (Hagen, 1997). The evidence of value strategies superiority in the U.S. combined with Hagens (1997) statement of persistent undervaluation of value stocks due to investors overreactions encouraged us to dig into this highly discussed and interesting part of finance.

Several prominent economic studies argue that the dividend-yield can be used as a measure for expected stock returns (Williams, 1938; Walter, 1956; Rozeff, 1984; Fama & French, 1988; Goetzmann & Jorion, 1993, among others). Using dividend as an investment criterion is supported by several prominent studies in investment and trading theory (Dorfman, 1988; Knowles & Petty, 1992; O'Higgins & Downes,1992; Grant, 1995; Visscher & Filbeck, 1997, 2003; Da Silva, 2001; Gwilym, Seaton & Thomas, 2005; Lin, 2017). Dividend is a process where wealth is distributed from the company to its shareholders, often as cash payments. While this seems fairly uncomplicated, economic literature is divided when it comes to the value of dividends and whether high dividends are favourable for investors. Fisher Black, an American economist presented dividends as a puzzle with pieces that do not fit together

[1] These criteria will be presented in section 3.2.

(Black, 1976) whereas other theories argue that investors prefer to receive dividends over stock returns, known as the "bird in hand theory[2]" (Bunge & Wendelken, 2009).

One of the most popular dividend-based strategies is the "Dogs of the Dow[3]", presented in the Wall Street Journal by John Slatter, an analyst for Prescott, Ball & Turben Inc., in the 1980s (Dorfman, 1988). The strategy is simple:

> Buy the 10 with the highest yield; keep them one year, and make any switches needed to put you in the top 10 again. In most years, you will have to sell no more than three stocks, which means your commissions and taxes will be minimal (Dorfman, 1988).

The strategy capitalises on the general contrarian conviction that the out-of-favour stocks one year tend to reverse direction. Slatter gained support from Knowles and Petty (1992) and O'Higgins and Downes (1992) who wrote books about this high dividend-yield strategy. There has been done similar research on the DoD strategy on several stock exchanges in multiple financial markets. Despite the popularity of dividend strategies there is limited empirical research concerning the relevance of the DoD strategy in a Scandinavian context. Thus, we aim to extend existing literature by testing this investment strategy on the Scandinavian stock market.

While the main prospect of this thesis is to test the DoD strategy on the Scandinavian market, two additional value strategies will also be tested to see if a value exposure creates abnormal returns for the investor. The value factors chosen are inspired by Fama and French (1993, 2015) and Visscher and Filbeck (2003)[4]. Rosenberg, Reid and Lanstein (1985) and Fama and French (1993, 2008) provide evidence supporting the price-to-book strategy, where stocks with a low price relative to book value tend to provide investors with higher average returns[5]. Research done by Williamson (1970), Basu (1977) and Fama and French (2002) emphasise the potential excess returns achieved from investing in stocks with a low price-to-earnings ratio[6].

[2] See section 3.2.1.1.

[3] Referred to as DoD.

[4] See section 3.2.

[5] See section 3.2.2.

[6] See section 3.2.3.

Our master thesis is inspired by, amongst others, the work done by Visscher and Filbeck (1997, 2003), Rinne and Vähämaa (2010), Lin (2017) as well as research conducted by Fama and French (1993, 2015) and Carhart (1997). The first four studies provide insights into the DoD strategy applied on different stock markets, laying the foundation for the portfolio selection process applied in this thesis. The three latter studies provide us with other value factors used when creating our value strategies and the methodology for analysing the performance of these strategies.

1.2 Hypotheses

The main objective of this master thesis is to investigate the DoD, price-to-book and price-to-earnings value investment strategies and their validity on the Scandinavian stock market. We want to analyse both raw returns and raw returns adjusted for transaction costs and taxes through regression analysis of the value strategies. Thus, this study comprises three research questions, hypothesis 1, 2 and 3 as proposed by Lin (2017). We do a thorough investigation of taxes to obtain a correct view on the returns for an investor in the Scandinavian market. If a strategy significantly underperforms the reference index in terms of raw returns, we will not adjust these returns for transaction costs and taxes and the strategy is dropped from the regression analysis in section 6.4.4.

1.2.1 Hypothesis 1: Performance of Raw Returns

H_0: There is no difference in the raw returns of the three value strategies when compared with the buy-and-hold return of the reference index.

1.2.2 Hypothesis 2: Performance of Returns Adjusted for Transaction Costs and Taxes

H_0: There is no difference in the returns adjusted for transaction costs and taxes when compared with the buy-and-hold strategy of the reference index.

1.2.3 Hypothesis 3: Performance of Risk-Adjusted Returns

H_0: There is no difference in the risk-adjusted returns of the three value strategies when compared with the buy-and-hold strategy of the reference index.

1.3 Structure

This thesis consists of seven chapters that are structured as follows; in chapter 2 we begin with a review of academic research on the DoD, the price-to-book and price-to-earnings ratios as investment strategies. In chapter 3 we present the most prominent theories on the efficient market hypothesis and Fama and French's investment criteria, followed by a review of the Sharpe ratio, Treynor index and the single and multi-factor models included in our regression analysis inspired by Fama & French (1993, 2015) and Carhart (1997). Chapter 4 provides an examination of the Norwegian tax system and discusses different tax rule implications for the Norwegian based investor investing in the Scandinavian market. Further, in chapter 5 we describe how the data in this study is collected, cleansed and structured. Further, a description of how the different portfolios, the reference index, the risk-free rate and the risk factors included in the factor models are constructed. Chapter 5 also includes a description of the applied methodology as well as the adjustments made for the regression analysis. Chapter 6 presents the empirical results from this thesis, and finally, some concluding remarks are provided in chapter 7.

2. Prior Research

In this chapter, evidence from prior studies on the DoD strategy and value investing will be presented. We will mainly focus on the results from using high dividend-yield as an investment criterion, as this is the main motivation for the thesis. We will examine results from studies regarding behavioural finance as well as results from the U.S. and other international findings regarding the portfolio returns.

2.1 Evidence of the "Dogs of the Dow" Strategy

DoD, as previously mentioned, was founded by John Slatter in the late 1980s. Slatter introduced a strategy that he meant was able to beat the Dow Jones Industrial Average[7] stock index over a longer period of time (Dorfman, 1988). This index consists of 30 companies and he suggested to construct a portfolio including ten of these companies. These companies should be picked on the basis of the highest dividend-yields the previous year. Slatter was using a 15-year horizon in his analysis, from 1972 to the end of 1987 (Dorfman, 1988). His strategy achieved an annual return of 18.4 percent which was more than seven percentage points better than the total index in the same time period (Dorfman, 1988). It is worth mentioning that this index may not be representative for every index. Typically, utilities and bank stocks are companies with high dividend-yields and thus included in the portfolios (Visscher & Filbeck, 1997, 2003). However, the DJIA stock index includes very few of these (Dorfman, 1988).

After Slatter published his investment strategy this has been given comprehensive attention, and several papers and books have been written about this subject in hindsight. In the period 1973-1991 O'Higgins and Downes (1991) showed an average annual return of 16.61 percent[8] and an average annual abnormal return of 6.18 percent. Knowles and Petty (1992) used a longer period from 1957-1990 and also obtained strong results. Over the 34-year period the strategy obtained 14.20 percent annual average return and 3.80 percent average annual

[7] From now on called DJIA.

[8] The return is measured with a three percent deduction annually for commissions and ignore taxes. The returns are prospects of high standard deviation making it difficult to determine whether the differences in means is statistically significant on a risk-adjusted basis (O'Higgins and Downes, 1992).

abnormal return. These two books contributed to the popularity of the DoD strategy which still attracts attention today.

The DoD strategy obtains support from other well-known studies in the behavioural finance literature. Some of these studies explore the under and overreaction of the market, mean reversion in regard of stock prices and contrarian investing (De Bondt & Thaler, 1985; Jegadeesh & Titman, 1993; Barberis, Schleifer & Visnhy, 1998; Daniel, Hirshleifer & Subrahmanyam, 1998). These studies provided support to the DoD strategy and can possibly give a description of how it obtains abnormal results against the market. Hence, is contrary to the efficient market hypothesis[9].

Domian, Louton and Mossman (1998) demonstrated in their paper that stocks included in the strategy behaved consistent with the overreaction hypothesis. During the period 1964-1997 their replication of the portfolio achieved 4.76 percent average annual abnormal return. They emphasised that prior to the stock market crash of 1987, the DoD strategy contained companies which went from "losers" to "winners". The abnormal returns in these years are consistent with what Bondt and Thaler (1985) found in their research suggesting that a portfolio of "losers" seems to outperform a portfolio of "winners" in the subsequent years. Jegadeesh and Titman (1993) argue that momentum will have an effect on future stock returns. This is in line with the results of Carhart (1997). He argues that momentum will have an effect on next year's stock returns and added momentum as an additional explanatory factor to Fama and French's (1993) three-factor model. Based on the work of Domian, Louton and Mossman (1998) the DoD strategy can be negatively loaded against Carhart's (1997) momentum factor, which states that last year's "winners" tend to outperform last year's "losers".

Hirschey (2000) also found that the DoD strategy experienced periods of overperformance, but these results were balanced with periods of underperformance. Even though the strategy achieved a 1.77 percent average annual abnormal return, he emphasised that the strategy did not achieve abnormal returns when adjusting for taxes and transaction costs. McQueen, Shields and Thorley (1997) obtained the same results. They found that the DoD strategy beats the reference index statistically with obtaining higher average annual returns. However, when

[9] Described in section 3.1.

adjusting for the extra risk, transaction costs and taxes, the strategy did not achieve significant abnormal returns.

All the research mentioned above has conducted their studies in the U.S. However, similar studies have also been conducted in several financial markets. Visscher and Filbeck (1997, 2003) have studied the DoD strategy in the British and in the Canadian context. In the period 1984-1994 the strategy was not effective in Britain. They pointed out that the FTSE 100 Index is much larger and contains more industries than the DJIA as a possible explanation for the results (Visscher & Filbeck, 1997). However, in the period 1988-1997 they found that the DoD strategy outperformed the Toronto 35 Index and the Toronto Stock Exchange 300 Index with respect to risk-adjusted returns. In addition, they also concluded that the compounded returns for the strategy were sufficient when taking transaction costs and taxes into account for the Canadian stock market (Visscher & Filbeck, 2003).

Gwilym et al. (2005) found in their research, in the British context, that most of the excess returns the strategy obtained were removed when adjusting for risk. Over the period 1994-1999 Da Silva (2001) studied the DoD strategy in Latin America. Da Silva argues that the strategy obtains abnormal returns but lack statistical significance. Rinne and Vähämaa (2010) have conducted a study of this investment strategy in Finland in the period 1988-2008. In this study, the strategy initially outperforms the Finnish stock market without considering transaction costs and taxes. Taking these market imperfections into account, they conclude that these results no longer apply.

In summary, the better part of the support for the DoD strategy comes from behavioural finance which argue that the overaction of the market and contrarian investing are potential explanations for the abnormal results achieved in the DoD strategy (Domian et al., 1998, amongst others)[10].

One issue that needs to be addressed when studying high dividend-yield as an investment strategy is the firm's trade-off between distributing retained earnings as dividends or through share repurchase or other cash distribution methods (Bagwell & Shoven, 1989). Grullon and Michely (2002) argue that U.S. based firms prefer dividends rather than repurchase, despite

[10] See Appendix A for summarised international findings.

the tax advantages associated with capital gains over ordinary income. However, share repurchase programs relative to total earnings have increased and Grullon and Michley (2002) find an increase from 4.8 percent in 1980 to 41.2 percent in 2000, while the growth rate of dividends stagnated. This is in line with evidence provided by Fama and French (2001) stating that the number of firms paying dividends has declined. We note that when firms pay out more of retained earnings this can create a bias for a dividend strategy. Thus, looking at total payout could be a better measure instead of dividend-yield, in line with the results of the research of Grullon and Michley (2002). However, Denis and Osobov (2008) argue that the distribution of dividends experiences growth in six of the largest capital markets. This is later supported by research done by Michaley and Moin (2020) which finds evidence of an increasing proportion of dividend-paying firms since 2000. This underlines that dividends are still relevant for the investor in this thesis. As mentioned, we note that repurchase has become a more popular way of distributing retained earnings to shareholders, and the dividend effect could have been stronger in the previous research papers mentioned above.

2.2 Evidence of Value Investing

The semi-strong form of the efficient market hypothesis[11] rejects the possibility of creating excess returns based on fundamental analysis and stock picking, because the news are already known and reflected in the market pricing. However, economic literature provides, as shown, evidence for using different factors and criteria that defines different companies as the foundation for investment decisions[12]. Fama and French (1996) and Lankonishok, Shleifer and Vishny (1994) show that there exists a value premium in average returns for U.S. stocks, when sorting the stocks after factors such as low price-to-book and price-to-earnings ratios. In a study by Fama and French (1998), value stocks outperform growth stocks in 12 of 13 global stock markets due to a value premium. This paper further emphasises that the value premium is a compensation for risk missed by the Capital Asset Pricing Model (CAPM) of Sharpe (1964), Lintner (1965), Mossin (1966) and Treynor[13]. Davis (1994) also provides evidence

[11] See section 3.1.

[12] See section 3.2.1 to 3.2.3.

[13] The article by Treynor was never published.

that value premium existed in returns for the U.S. before the 1960s as well, a period prior to the growth in empirical research explaining the market anomalies.

The increasing use of data mining in finance to exploit patterns in stock returns and anomalies as a foundation for trading strategies will affect returns (Bodie, Kane & Marcus, 2018). By redoing analysis of past returns and stock returns across sufficient dimensions several times, a set of criteria will appear by simple chance predicting returns in the future. After being announced in academic literature, some of these problems have not occurred in the same way. However, the problems with data mining need to be recognised and thus there is a puzzle that needs to be emphasised (Bodie et al., 2018). We note that some of the returns from previous studies may be affected by data mining. When discussing the problem with data mining, Bodie et al. (2018) still argue that value stocks compared to growth stocks tend to have higher average returns. Black (1993) argues that if past returns are examined over and over, patterns will occur purely by chance. However, the value factors proposed by Fama and French (1993) predict future returns across several time periods and financial markets, and hence mitigate potential problems regarding data-snooping (Bodie et al., 2018).

The two value factors chosen in addition to the main strategy in this study, DoD, have shown the persistent ability to beat the market in several different economic studies and are the factors with the most supporting empirical research.

2.2.1 Price-to-Book

A few early studies notwithstanding, not until the 1990s when a set of articles published by Fama and French (1993, 1998) spur increased interest in the relationship between returns and a company's price-to-book ratio. In violation of the efficient market hypothesis, a price-to-book strategy where investors buy companies with low market value compared to their reported book values can create excess returns (Rosenberg et al., 1985). Fama and French (1998) argue that stocks with a low price-to-book ratio have higher returns than stocks with a high price-to-book ratio across the world. For the period 1975-1990 their study argues that a global portfolio of stocks with low price-to-book ratios beats a global portfolio of stocks with high price-to-book ratios with 7.60 percent (t=3.39)[14] higher average returns per year. The

[14] T-value shows that the returns are statistically significant on a one percent significant level.

Fama and French (1998) is a global study focusing on 12 major EAFE (Europe, Australia and the far east) countries, and thus show that the price-to-book factor also can create excess returns in a Scandinavian context.

2.2.2 Price-to-Earnings

The price-to-earnings measure is a useful measure of whether a stock is overpriced, fairly priced or underpriced with regards to the company's earnings potential. Basu (1977) shows in his study that the performance of the common stocks is related to their price-to-earnings ratio. Nicholson (1968), amongst others, argues that about 4000 calculations of a quarter century of price changes show a five-year appreciation averaging 32 percent for stocks with a price-to-earnings ratio above 20, and 90 percent for the stocks with a ratio below ten. This emphasises that a high level of earnings is desirable contrary to low earnings. This inference is strengthened further by comparison of returns over longer periods, six to seven years, and shorter time periods of one to four years (Nicholson, 1968). The value premium from investing in stocks with a low price-to-earnings ratio on a global basis is around seven percent (Fama and French 1998). Graham's value criteria emphasise a price-to-earnings ratio below nine as favourable (Rea, 1977).

3. Theoretical Framework

3.1 Efficient Market Hypothesis

The theoretical assumption that changes in stock prices could be sufficiently forecasted through a detailed analysis of previous price fluctuations was proven to have little empirical support when examined statistically[15] (Bachelier, 1900; Kendall, 1953; Cootner, 1964). Bachelier argues that share prices are independent of all prior fluctuations and has been pivotal in the efficient market hypothesis (EMH) discussion. Even though EMH is one of the most thoroughly researched hypotheses in economic literature since the early 1970s, there is still no consensus to its validity (Sewell, 2012). When the EMH holds, the share price reflects all information available to the investors and follows a random walk structure (Kendall, 1953)[16]. Economic theory defines three forms of market efficiency: weak, semi-strong and strong (Fama, 1970). These different forms are distinguished by the degree of information reflected in the stock prices. In the weak form, stock prices only reflect the information contained in historical price data. This means that it is impossible to make consistently superior profits studying historical data. For the semi-strong form, the stock prices reflect not just historical price data but also all other public information available to investors (Brealey, Myers & Allen, 2017; Bodie et al., 2018). Strong market efficiency implies that all market information, both public and insider information, is accounted for in stock prices. With the latter form in place, there would not be any superior investment manager who can consistently beat the market (Berk & DeMarzo 2014; Bodie et al., 2018). The different forms of market efficiency are created from a theoretical standpoint and the market tends to not always be fully efficient. Jensen (1967) argues that the market is not efficient in the strong form. Fama (1970) regards especially the strong form of market efficiency as an unrealistic view of reality.

The relevance of EMH to our study is related to abnormal returns and to what extent the market is really efficient. Since Kendall's (1953) discovery the economic society has undertaken a myriad of tests on the weak form of market efficiency, confirming something close to a random walk structure. But, Lo and MacKinlay (1999) contest this theory arguing that there

[15] Bachelier (1900) suggested that changes in stock prices where independent and followed a classical Brownian motion.

[16] Random walk implies that price changes are independent of one another (Kendall, 1953).

is serial correlation between stock prices, especially in the short run. Lo, Mamaysky and Wang (2000) also argue that some forms of technical analysis may have some predictive power, which is in contrast to a weak-form EMH. Further, economists have discovered that for bigger intervals[17], stock prices tend to reverse (De Bondt & Thaler, 1985; Poterba & Summer, 1988); Fama & French, 1988b; Fluck, Malkiel & Quandt, 1997). This evidence was later contested by Jegadeesh and Titman (1993) who argue that the stocks which outperformed the market the last three to 12 months in the U.S. financial markets often achieve higher future returns. However, Lo and MacKinaly (1990) argue that the abnormal returns Jegadeesh and Titman (1993) find comes from delayed stock market reactions to common factors. Sagi and Seasholes (2007) support the momentum factor, but argue that momentum returns are driven by risks that affect firm-specific attributes.

There has also been conducted several studies on the stronger forms of market efficiency, looking to professional investors and mutual funds to see if they can consistently beat their reference index. Pettit's (1972) theory that the market systematically overestimates or underestimates relevant information provides professionals with a chance to create abnormal returns. However, research on the performance of professionals and mutual funds states that they achieve lower return than the benchmark after adjusting the returns for expenses and roughly match the benchmark before expenses (Jensen, 1967; Malkiel, 1995; Carhart, 1997). Jensen's (1967) research shows that on average the wealth of the consumers investing in mutual funds over the ten-year period 1955-1964 is 15 percent less than if they held the corresponding portfolios along the market line. Jensen (1967) also shows that the risk-adjusted returns for 58 of the 115 mutual funds included in the study were below the market line. Newer research on the field states that there are some outperforming investors in the market that are able to beat the reference index and show persistent performance over time (Berk & Green, 2004; Kosowski et al., 2006; Fama & French, 2010). This study will further test this and see if different investment strategies can benefit from a not fully efficient financial market and create abnormal returns to beat the reference index persistently over a chosen period of time[18].

[17] Time interval in which the returns are measured.

[18] This study is conducted for the time period 2005-2019.

3.2 Fama & French

There has been conducted several empirical studies regarding different investing strategies that can create excess returns. In the wake of Graham's hypothesis (Rea, 1977), among others, Visscher and Filbeck (2003) list four common value investment strategies: High dividend-yield, low price-to-book ratio, low price-to-earnings ratio and low expected growth rates. Use of different factors as investment criteria are one of the most researched investment strategies and are derived from Fama and French's three- and five-factor models (Fama & French, 1993, 2015). These factors models, like the arbitrage pricing theory (APT)[19], accounts for risk exposure. Whereas the Capital Asset Pricing Model[20] focuses on how investors can create efficient portfolios, APT and the factor models assumes that each stock's return is influenced by a set of factors that investors can position themselves against to create returns. In opposition to APT, the Fama and French factor models determines variables that have no special standing in asset pricing theory, but which show reliable power to explain the cross-section of average returns (Fama and French, 1993[21], 2015).

Carhart (1997) finds evidence supporting that momentum has an effect on returns from the stock market. Carhart finds that the "hot hand" theory stated by Hendricks, Patel and Zeckhauser (1993) is explained by Jegadeesh and Titman's (1993) one-year momentum factor. Grinblatt, Titman and Wermers (1995) argue that fund following a momentum strategy performed better before management fees and transaction costs. Carhart (1997), on the other hand, argues that the returns do not come from following momentum strategies, but rather from the part of a portfolio which is last year's winners. He concludes in his paper that the returns from directly following a momentum strategy will be consumed by transaction costs, but being exposed to this factor can create returns for the investor (Carhart, 1997). From this finding he derived the Carhart (1997) four-factor model which adds a momentum factor to the Fama and French three-factor model.

[19] APT is a multi-factor Capital Asset Pricing Model built on the assumption that an asset's return can be predicted more precisely when including a set of macroeconomic factors that capture systematic risk (Ross, 1976).

[20] See section 3.3.3 for further discussion of the Capital Asset Pricing Model.

[21] This article is an extension of the Fama and French 1992a study.

Research done on the three-factor model argues that this model is incomplete for estimating expected returns, because it misses much of the variation in average returns related to profitability and investments (Novy-Marx, 2013; Titman, Wei & Xie, 2004, and others). In the aftermath of this research, Fama and French (2015) expanded the three-factor model by including profitability and investment factors. This indirectly states that they include the factors price-to-earnings ratio[22] and dividend-yield[23].

The dividend discount model can be used to explain why investments, profitability and price-to-book are related to average returns and why these factors can work as criteria for investment strategies.

Equation 1 - Dividend Discount Model

$$P_t = \sum_{\tau=1}^{\infty} \frac{E(d_{t+\tau})}{(1+r)^{\tau}}$$

In ***Equation 1***, P_t represents the share price at time t. $E(d_{t+\tau})$ is the expected dividends per share for the period $t+\tau$ and r is the internal rate of return on expected dividends. ***Equation 1*** states that if at time t the stocks of two companies with the same expected dividends while having different prices, the stock with the lower price has a higher long-term average expected return, but must be subject to higher risk[24] (Fama & French, 2015).

The implications for the relations between expected return and expected profitability, expected investment and the book-to-market ratio can be extracted from ***Equation 1*** with a bit of manipulation. Implied by ***Equation 1***, Miller and Modigliani (1961) show that at time t the value of the firm's stock is:

Equation 2 - Adjusted Dividend Discount Model 1

$$P_t = \sum_{\tau=1}^{\infty} \frac{E(Y_{t+\tau} - dB_{t+\tau})}{(1+r)^{\tau}}$$

[22] Fama and French use earnings-to-price as an estimate for profitability, while this thesis uses the inverse of this, the price-to-earnings ratio.

[23] The level of investments affects the payout-ratio and thus dividends.

[24] If pricing is rational (Fama and French, 2015).

In ***Equation 2***, $Y_{t+\tau}$ is total equity earnings for period t+τ and $dB_{t+\tau} = B_{t+\tau} - B_{t+\tau-1}$ is the change in total book equity (Fama & French, 2015). Dividing by book equity at time t gives:

Equation 3 - Adjusted Dividend Discount Model 2

$$\frac{P_t}{B_t} = \frac{\sum_{\tau=1}^{\infty} E(Y_{t+\tau} - dB_{t+\tau})/(1+r)^{\tau}}{B_t}$$

Equation 3 can be used to explain relations between factors and expected returns. If B_t, P_t and expected returns are held constant, higher growth in book equity (investments) implies a lower expected return seen from ***Equation 3***. This is in favour for a dividend strategy where a company's payout ratio is higher and investments are lower. Furthermore, if all variables in ***Equation 3*** are held constant, except of P_t and expected return, r, then a lower value for P_t implies a higher expected return. This is the same as a low price-to-book ratio. If we hold every variable in ***Equation 3*** constant, except expected future earnings and expected future stock returns, higher expected earnings imply higher expected return. When the stock price, P_t, is held constant this statement argues that a lower price-to-earnings ratio gives a higher expected return (Fama & French, 2015).

In this thesis three different value portfolios are created and compared to the market portfolio. The underlying strategy is to invest in value stocks and the factors are chosen thereafter. The factors chosen are from the DoD strategy and the Fama and French's (1993, 2015) three and five-factor models and each factor will be presented in more depth in the sections below.

3.2.1 High Dividend-Yield

3.2.1.1 Dividend Irrelevance and "Bird in Hand" Theory

The dividend irrelevance theory presented by Miller and Modigliani (1961) argues that in a perfect world without transactions costs and taxes the dividend policy has no effect on the price of a company's shares. The irrelevance proposition suggests that dividends will be equally offset with a corresponding drop in share price. The rationale behind the theory is that firm value will remain unchanged regardless of dividends, as a rational investor will be indifferent whether the return comes directly from dividends or from capital gain. As a counterbalance to this, Gordon (1960) and Lintner (1962) developed the "Birds in Hand" theory. The basic principle of this theory is simple: Investors prefer dividends to capital gains since the latter is associated with higher risk and uncertainty. Since the investors presumably are risk averse, it is assumed better to have a bird in the hand than two in the bush (Bunge &

Wendelken, 2009). However, Miller and Modigliani (1961) criticised Gordon's (1960) view regarding the "bird in the hand" theory and called it a "bird in the hand" fallacy because, as mentioned above, investors are indifferent between receiving dividend or capital gain. They further argue that an increase in dividend will increase the expected dividend payment, but may not in the general case affect the expected total return during the given period or the uncertainty with this return. They indicate that many investors will reinvest the dividends in the same or other similar companies, and thus the cash flows from operating assets are what affect the risk associated with the company (Miller & Modigliani, 1961).

3.2.1.2 The Relationship Between Dividend-Yield and Stock Prices

Walter (1956) explored the use of dividend-yields to forecast stock prices. He argues that retained earnings influence stock prices through their effect on future dividend payments, creating a relationship between dividends and stock returns. Over longer periods, stock prices reflect the present value of expected dividends (Williams, 1938; Walter, 1956; Fama & French, 1988a; Goetzmann & Jorion, 1993, among others).

Economic theory is divided when it comes to the relationship between dividend-yield and stock returns. Numerous studies conducted on the topic document a positive relationship between dividend-yield and stock returns (Fama & French, 1988a; Hodrick, 1992; Grant, 1995). However, economic research is also critical to if there exists a positive relationship between dividends and stock returns (Black & Scholes, 1974; Goetzmann & Jorion, 1993, 1995). Black and Scholes (1974) argue in their paper that it is not possible to demonstrate, using the best available empirical methods[25], that the expected return on common stocks with high dividend-yield differ from the expected return on low yield common stocks either before or after tax.

There has also been conducted several studies regarding other aspects of the relationship between dividend-yield and stock prices such as the "U-shape" relationship. The premise of the "U-shape" relationship is that both high dividend paying common stocks and non-dividend paying common stocks tend to have higher returns than common stocks with a dividend-yield in-between these levels. Litzenberger and Ramaswamy (1979) argue that there is a strong positive relationship between expected returns and dividend-yields of common stocks prior to

[25] At the time of their research (1974).

taxation. This paper, in accordance with Miller and Modigliani (1961), concludes that stockholders in higher tax brackets choose stocks with lower dividend-yield, and vice versa[26]. Prior research argues that except for stocks which previously paid zero dividend, the higher the dividend-yield the higher the excess return (Elton, Gruber & Rentzler, 1983). They further argue that stocks that do not pay dividend have higher excess returns than expected. This, combined with other research-papers done on this topic supports the "U-shape" relationship between dividend-yield and stock returns (Blume, 1980; Keim, 1986; Christie, 1990; Morgan & Thomas, 1998).

3.2.1.3 Dividend-Yield as Investment Criterion

In the wake of Fama and French's three factor model (1993) they added two more risk factors to further explain risk the three-factor model overlooked, related to profitability and investment (Fama & French, 2015). The paper argues that the econometric model[27] used, explains between 71 and 94 percent of the cross variance of expected returns for the portfolios examined, where dividend is one of them. Fama and French (2015) document strong patterns in average returns for the cross-section results for size and dividends in this study. It is favourable to control for size since univariate sorts on variables, like dividends, are typically dominated by big stocks. This is one of the main messages from Fama and French (1993, 2012, 2015), stating that the most serious issues when it comes to asset pricing are related to small stocks. The use of cross-sectional data does not undermine the strong results coming from the dividend criterion in Fama and French's (2015) research. The advantage with this practice is the increasing chance for excluding companies that have high dividend-yield due to an aberrant low share price, which normally lead to a reduction in dividends due to financial distress. Fama and French (2015) reveal negative effects for small companies with high dividend-yield compared to big companies with a high dividend-yield. This due to negative evolvement in profitability factors for smaller companies which lower the estimates for expected return in the five-factor model.

[26] See chapter 4 for an elaboration of the Norwegian tax system.

[27] The five-factor econometric regression model used by Fama and French (2015):

$$R(t) - R_F(t) = a + b[R_M(t) - R_F(t)] + sSMB(t) + hHMLO(t) + rRMW(t) + cCMA(t) + e(t)$$

O'Higgins and Downes (1992) argue that dividend-yield can be used to create excess returns, building on the prior research done by Slatter (Dorfman, 1988). In their book, "Beating the Dow"[28], the authors show that the dividend strategy is superior to the DJIA[29]. Several studies have revealed strong results for this strategy and dividend as an investment criterion (Knowles & Petty, 1992; Grant, 1995; Visscher & Filbeck, 1997, 2003; Da Silva, 2001; Gwilym et al., 2005; Lin, 2017).

Benjamin Graham, known as the father of value investing, researched dividend-yield as an investment criterion as well. Graham compared the DJIA to stocks with dividend-yield greater than two-thirds of the average AAA bond yield for the period 1925-1975. The latter group of the stocks outperformed the DJIA with higher returns (Rea, 1977). The success of this study led to Graham including this as one of his ten famous investment rules. This further emphasises high dividend-yield as an investment criterion.

3.2.2 Price-to-Book

Firms with higher ratios of book value of common stocks to its market value, i.e., low price-to-book ratio, have higher average stock returns (Rosenberg et al., 1985; Fama & French, 1993, 2008; Lankonishok, Shleifer & Vishny, 1994). It is documented that the price-to-book ratio is related to economic fundamentals (Fama & French, 1993)[30] and measure expected stock return because it varies with the companies' cash flows (Fama & French, 2008). Fama and French (1993) argue that there is reason to expect that the price-to-book factor is a proxy for common risk factors in returns.

Using price-to-book ratio when selecting stocks has historically resulted in positive risk-adjusted returns and higher alpha, explained by the capture of risk not represented in the market portfolio (Fama & French, 1993, 2015). One of the first systematic studies of the price-to-book ratio conducted by Rosenberg et al. (1985) evaluates the price-to-book performance and found significant empirical results, emphasising that the strategy beats the market

[28] Beating the Dow: A High-Return, Low-Risk Method for Investing in the Dow-Jones Industrial Stocks with as Little as 5000$.

[29] See section 2.1.

[30] Fama and French (1993) use book to market (BE/ME) while this paper use price-to-book. These factors are just the inverse of each other and will produce the same empirical results.

portfolio. This accentuates that there is large potential for excess profits to be made if investors find valuation errors that correlate with the price-to-book ratio. Fama and French's three-factor APT model provides a lower estimate for expected return of growth stocks with higher price-to-book ratio. However, the model produces higher estimates for expected returns for value stocks, such as banks and other asset-heavy industries, with a low price-to-book ratio (Fama & French, 1993).

The strategy created by Fama and French (1993) is a self-financing strategy, which means that you finance your long position in the low price-to-book strategy with a short position in the high price-to-book strategy[31]. This can be seen as going long in value stocks and short in growth stocks (Fama and French, 1993).

3.2.3 Price-to-Earnings

There is substantial empirical evidence supporting the implication that higher expected earnings lead to higher expected returns, most famously derived by the five-factor model (Fama & French, 2015). Further research has focused on estimating the equity premium using dividend and earnings growth rate (Claus & Thomas, 2002; Fama & French, 2002). Fama and French (2002) argue that average stock returns are higher than expected for the period 1951-2000 due to a decline in discount rates that leads to large unexpected capital gains. This emphasises that the earnings-to-price ratio may work as a proxy for implied cost of equity and as an explanatory factor for realised returns (Basu, 1977). While the EMH is supported by strong empirical evidence[32], research also shows that the price-to-earnings ratio is an indicator for future expected returns. Proponents of this hypothesis argue that securities with a low price-to-earnings ratio will outperform securities with a high price-to-earnings ratio (Williamson, 1970). The price-to-earnings hypothesis asserts that this ratio may be an indicator of future investment performance of a security due to exaggerated investor expectations[33] (Basu, 1977). Basu further argues that information regarding the price-to-

[31] In this thesis, the long position will not be financed with a short position when testing the price-to-book strategy against the other strategies and the market portfolio.

[32] See section 3.1.

[33] Smidt (1968) argues that a part of market inefficiency is created by inappropriate response to information by market participants. An elaboration on how this effects the price-to-earnings hypothesis can be found in research done by: (Miller & Widmann, 1966; Nicholson, 1960, 1968; Williamson, 1970; Ofer, 1975).

earnings ratio was not "fully reflected" in the security prices as rapid as postulated by the semi-strong form of the EMH. Over the period of the study, securities are mispriced against each other when valuing them using this ratio, creating an opportunity for investors to exploit this and create excess returns. Over the 14-year period of the study[34], low price-to-earnings securities earned superior risk-adjusted returns supporting the hypothesis (Basu, 1977). Numerous studies have been published emphasising the price-to-earnings ratio hypothesis (McWilliams, 1966; Miller & Widmann, 1966; Breen, 1968; Breen & Savage, 1968; Nicholson, 1968).

3.3 Risk Adjustments

When holding a portfolio of only ten stocks each year, idiosyncratic risk has impact on the total return of the portfolio, as well as correlation between stocks inside the portfolio. Thus, for a risk averse investor, the portfolio returns need to be adjusted for the additional risk taken. The issue is not the idiosyncratic risk which should be uncompensated, but to analyse the returns exposure with respect to systematic risk and other priced factors. Without doing so, it is more or less meaningless to compare the different strategies against each other or the reference index. This thesis will adjust for additional risk by using Sharpe ratio, Treynor index and factor models. Sharpe ratio and Treynor index are acknowledged measures for diversified portfolios. However, we will apply them on the portfolios consisting of few stocks in this thesis and interpret them with caution. Factor models will be used to risk-adjust the returns by measuring the exposure to priced factors in the market.

3.3.1 Sharpe Ratio

In 1994, 25 years after introducing this measure for the first time, William F. Sharpe wrote an article in the *Journal of Portfolio Management* providing a more general and a wider relevance for the measure he first introduced in 1966 (Sharpe, 1994). In his article he examines both ex ante and ex post versions of the measure. This thesis will focus on the latter, the ex post Sharpe ratio. The Sharpe ratio was created by Sharpe (1994) and enables to measure if an investor makes greater excess return on the investment in exchange for taking on additional risk.

[34] Study period: 1957-1971.

Equation 4 - Sharpe Ratio

$$S_{p,t} = \frac{r_{p,t} - r_{f,t}}{\sigma_{p,t}}$$

Above, the Sharpe ratio for a given portfolio at a given period of time is defined. Let $r_{p,t}$ be return on the fund in period t, $r_{f,t}$ the risk-free rate in period t and $\sigma_{p,t}$ the standard deviation for the fund in period t. The Sharpe ratio measures the excess return of a portfolio per unit of risk (Sharpe, 1994). In opposition to the Capital Asset Pricing Model, which uses beta as the risk measure, the Sharpe ratio uses standard deviation[35]. Standard deviation measures total risk, and not just market risk or systematic risk. When it comes to the interpretation of the calculated Sharpe ratio, the greater the value the better is the risk-adjusted excess returns[36] (Sharpe, 1994).

3.3.2 Treynor Index

While the Sharpe ratio uses standard deviation to appraise total risk, the Treynor index uses beta, same as the Capital Asset Pricing Model. In 1965 Jack L. Treynor wrote an article in the *Harvard Business Review* where he introduced a measure which uses systematic risk, measured by beta, when calculating the risk-adjusted returns (Treynor, 1965). Thus, this measure suits well for well-diversified investors[37]. Whereas the Sharpe ratio measures a portfolios excess return compared to standard deviation of returns, the Treynor index measure excess return against the stock-market as a whole using beta.

Equation 5 - Treynor Index

$$T_{p,t} = \frac{r_{p,t} - r_{f,t}}{\beta_{p,t}}$$

In the formula above, the Treynor index for a given portfolio in period t is defined. The numerator is exactly the same as in the Sharpe ratio and is explained in the previous part[38].

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[35] Includes idiosyncratic and systematic risk (Sharpe, 1994).

[36] Excess returns here refer to the return earned above what investors could get investing in risk-free treasury bonds. Same for Sharpe ratio and Treynor index.

[37] Firm-specific risk can be diversified away, and investors do not get any risk-premium for taking on systematic risk.

[38] Let $r_{p,t}$ be return on the fund in period t, $r_{f,t}$ the risk-free rate in period t.

However, the denominator differs. The Treynor index uses systematic risk, and hence the denominator consists of $\beta_{p,t}$, the beta for the portfolio in period t. The higher the Treynor index, the greater is the excess return generated per unit of additional market risk.

3.3.3 Capital Asset Pricing Model

The Capital Asset Pricing Model (CAPM) was first introduced by Sharpe (1964), Lintner (1965), Mossin (1966) and Treynor[39], and explains the relationship between expected return and systematic risk for a stock or a portfolio. CAPM was inspired by Markowitz's (1952) article "Portfolio Selection" where he argues that the best portfolio for an investor is the one which obtains the best trade-off between return and risk.

Equation 6 - CAPM

$$E(r_i) = r_f + \beta_i \times [E(r_m) - r_f]$$

The CAPM is illustrated in ***Equation 6*** and displays the expected return ($E(r_i)$) of a stock or a portfolio. According to CAPM this is given by the risk-free rate (r_f) plus the systematic risk (β_i) multiplied with the market risk premium ($[E(r_m) - r_f]$). The beta in CAPM illustrates the systematic risk of a stock or a portfolio and cannot be diversified because it is connected to market fluctuations.

Equation 7 - Systematic Risk

$$\beta_i = \frac{COV(r_i, r_m)}{\sigma_m^2}$$

The beta coefficient in CAPM is the covariance of the return to the asset (r_i) and the return to the market portfolio (r_m) divided by the variance of the market return (σ_m^2) and is illustrated in ***Equation 7***. Reinganum (1982) argues that small stocks have higher beta and thus higher expected return premium than large stocks. Fama and French (1993) later contrasted this by stating that the beta effect goes away when including the omitted variable, size, in the regression. The value of beta indicates how sensitive the asset is to cyclical fluctuations compared to the market (Bodie et al., 2018).

[39] The article by Treynor was never published.

Equation 8 - Expected Excess Return

$$E(r_i) - r_f = \beta_i \times [E(r_m) - r_f]$$

By moving r_f to the left-hand side, ***Equation 7*** can be derived into ***Equation 8***, which shows the expected excess return for a stock or a portfolio. Jensen (1967) pointed out an issue in finance regarding of evaluating performance of portfolios existing of risky securities. With foundation in the CAPM, Jensen (1967) established the single-factor model defined in ***Equation 9***. He finds that the expected return on an asset and the market could be regressed as a time series, and this model is the basis of multi-factor models measuring performance.

Equation 9 - Single-Factor Model

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_i \times MKT_t + e_{i,t}$$

In this context, Jensen (1967) came up with what is called the Jensen's alpha (α_i) and is the intercept in the model above. Jensen's alpha is measuring the performance against the market in a given period. In addition, the model consists of the return of a portfolio in a given period ($r_{i,t}$), the risk-free rate in a given period ($r_{f,t}$), the systematic risk measured by the beta coefficient (β_i), a market factor (MKT_t) and an error term ($e_{i,t}$) which represents the idiosyncratic volatility of the portfolio. Jensen (1967) argues that the error term should have an expectation value of zero and be serially independent. With the assumption that CAPM holds, a positive alpha indicates that the given portfolio achieves returns that are higher than expected by the market based on the level of risk in the portfolio. A negative alpha indicates the opposite.

3.3.4 Fama-French Three-Factor Model

The market factor is the only factor which describes average stock returns in the single-factor model. If the portfolio is subject to other risk factors, the Jensen's alpha will not capture accurate risk-adjusted returns. Fama and French (1993) came up with a new model, namely the Fama and French three-factor model. This model includes two additional risk factors in size and book-to-market equity. These factors are called SMB and HML, respectively. Fama and French (1993) argue that the SMB and HML risk factors capture strong variation in stock returns, regardless of which other factors are included in the time-series regression. Thus, these factors work as proxies for stock returns sensitivity to common risk factors (Fama & French, 1993).

Equation 10 - Fama-French Three-Factor Model

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{1,i} \times MKT_t + \beta_{2,i} \times SMB_t + \beta_{3,i} \times HML_t + e_{i,t}$$

For the SMB, market values are sorted into portfolios using the median to split the sample into big and small companies with regards to market capitalisation. For the HML, book-to-market values are sorted into portfolios using breakpoints for the bottom 30 percent (low), middle 40 percent (neutral) and top 30 percent (high) of book-to-market values for the companies in the sample (Fama & French, 1993). These portfolios are used to create the SMB and HML factors. The portfolios are value-weighted (Fama & French, 1993). Here SMB is calculated by creating three portfolios for small stocks and three portfolios for big stocks with different book-to-market values as seen from ***Equation 11***. The SMB factor is then the difference between the return for small firms and big firms with an average book-to-market equity value (Fama & French, 1993). The HML is calculated by creating two portfolios, one with small firms and big firms with high book-to-market ratio and one with small firms and big firms with low book-to-market ratio, see ***Equation 12***. The HML factor is then the difference between high book-to-market and low book-to-market firms with close to the same weighted average size (Fama & French, 1993). High book-to-market indicates value stocks while low book-to-market ratio indicates growth stocks (Fama & French, 1993).

The size factor, SMB, is calculated as follows:

Equation 11 - SMB

$$SMB = \frac{1}{3}(Small\ Value + Small\ neutral + Small\ Growth) - \frac{1}{3}(Big\ value + Big\ Neutral + Big\ Growth)$$

The value factor, HML, is calculated as follows:

Equation 12 - HML

$$HML = \frac{1}{2}(Small\ Value + Big\ Value) - \frac{1}{2}(Small\ Growth - Big\ Growth)$$

The intercept in this model (α_i) is now measuring abnormal returns, like in the single-factor model, but are now controlling for two additional risk factors.

3.3.5 Carhart Four-Factor Model

In the three-factor model by Fama and French (1993) the returns are adjusted for several risk factors investors can position themselves against to create returns. Carhart (1997) argues that portfolios often are exposed to a momentum factor, also when a momentum strategy is not intentionally implemented. Thus, it is appropriate to take this factor into account when analysing portfolio returns.

Equation 13 - Carhart Four-Factor Model

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{1,i} \times MKT_t + \beta_{2,i} \times SMB_t + \beta_{3,i} \times HML_t + \beta_{4,i} \times UMD_t + e_{i,t}$$

Carhart (1997) calculates a momentum factor, $PR1YR_t$, as the difference in the equal-weighted average of firms with the 30 percent highest 11-month returns lagged one month minus the equal-weighted average of the firms with the lowest 30 percent 11-month return lagged one month. Thus, this factor takes into account if investors are exposed to last year's winners or losers.

Fama and French (2012) constructed an alternative factor for momentum which we will use in this thesis. Here the same approach as for constructing SMB and HML is used. When creating the momentum portfolios, Fama and French (2012) sort on size and prior returns using the same breakpoints as size and book-to-market above, creating six portfolios. The UMD factor is then the difference between high prior returns and low prior returns with close to the same weighted average size, as seen from ***Equation 14.***

Equation 14 - UMD

$$UMD = \frac{1}{2}(Small\ High + Big\ High) - \frac{1}{2}(Small\ Low + Big\ Low)$$

The intercept in this model (α_i) is now measuring abnormal returns when we control for these four risk factors.

4. Taxes

Taxes play an important role in this master thesis because the government requires a fraction of the return obtained by the investor. Thus, taxes decrease the total return over time and is considered as one of the most obvious market imperfections (Miller & Modigliani, 1961). Since this thesis emphasises the perspective of a Norwegian investor, the Norwegian tax system needs to be reviewed. Our investor starts investing in 2005, and for that reason we only briefly explain the Norwegian tax system before 2005. We do this to obtain a rapid view of how the system was orientated prior to our investment period. Moreover, the Norwegian tax system after 2005 will be examined thoroughly as it is essential to highlight the tax effects for the strategies over the investment period.

4.1 The Norwegian Tax System Before 2005

Prior to 2005 the last tax reforms implemented were in 1987 and 1992, which were comprehensive reforms. Earlier, the Norwegian tax system was characterised by high taxes and extensive tax deductions. However, the reforms of 1987 and 1992 led to decreased taxes and fewer possibilities for tax deductions (Christensen, 2018). Further, the intention of these reforms were to increase the justice in the tax system and contribute to more effective use of resources in the Norwegian economy. These reforms distinguished a more market orientated tax system from an old and more social democratic one (Christensen, 2018).

4.2 The Norwegian Tax System After 2005

The tax reform of 1992 contributed to the foundation of the economic growth in the Norwegian economy in the 1990s. However, the reform brought at least one major drawback. The difference in marginal taxes on capital income and labour income was substantial. Over the years, after the implementation of this reform, it became easier to avoid taxes by converting labour income to capital income (Christensen, 2018). This was the main reason for the new tax reform implemented in Norway in 2006 (Thoresen, 2009).

4.2.1 The Shareholder Model

Before the reform was implemented, withdrawal from a company was in reality only taxed once through taxation on the profit. After 2006, shareholders also became subject to tax

(Klette, 2010). Among other important changes, the split-income model[40] was replaced with the dividend exemption method[41] that allowed for the deduction of the risk-free rate (Alstadsæter, Fjærli & Thoresen, 2006). Three different models were implemented so the method with deduction for the risk-free rate (dividend tax exemption)[42] could be used on all forms of businesses (Klette, 2010). These three models are the shareholder model, the partnership model and the enterprise model. This study will only examine one of these, namely the shareholder model[43]. The deduction for the risk-free rate in the shareholder model is the yearly return on the stock that correspond to alternative risk-free return (Klette, 2010). This ensures that only the return that exceeds the risk-free rate is subject to taxation, and the formula can be seen below.

Equation 15 - Dividend Tax Exemption

$$Dividend\ tax\ exemption = Dividend\ tax\ exemption\ basis \times Tax\ exempt\ dividend$$

The dividend tax exemption basis[44] is calculated for every single stock and consists of cost price in addition to incidental expenses associated with the acquisition of the stock. The tax exempt dividend[45] is calculated by the average three month treasury bill. Unused dividend tax exemption can be used at a later date, and will hence increase the deduction (Klette, 2010). After the introduction of the shareholder model, capital income is no longer only taxed once, but subject to double taxation. This implies taxation at the personal level as well as corporate level.

In 2015, the Ministry of Finance proposed a new tax reform which was implemented in 2016. After this reform, the nominal tax rate was gradually reduced from 28 percent to 22 percent (Meld. St. 4, (2015-2016)). However, the declining tax rate on general income[46] was combined

[40] In Norwegian: «Delingsmodellen».

[41] In Norwegian: «Skjermingsmetoden».

[42] In Norwegian: «Skjermingsfradrag».

[43] In Norwegian: «Aksjonærmodellen».

[44] In Norwegian: «Skjermingsgrunnlag».

[45] In Norwegian: «Skjermingsrente».

[46] In Norwegian: «Alminnelig inntekt».

with higher tax rates associated with personal income[47]. Hence, without further changes it was now more profitable to channelise funds to capital income instead of labour income. For that reason, an adjustment factor was also introduced (Meld. St. 4, (2015-2016)). This factor increased yearly, simultaneous to a decrease in the general income tax rate. In 2019, the tax rate on general income was finally at the level proposed in the tax reform. In the same year, the adjustment factor was 1.44 which led to an effective tax rate on capital income of 31.68 percent. The evolution of the effective tax rate during the period can be seen in ***Table 1***. These tax rates apply for both dividend and capital gains, in reference to the Norwegian Taxes Act §§10-11 and 10-31.

Table 1 - Effective Tax Rates

Year	Tax rate	Adj. factor	Effective tax rate
2005	28 %	1	28.00 %
2006	28 %	1	28.00 %
2007	28 %	1	28.00 %
2008	28 %	1	28.00 %
2009	28 %	1	28.00 %
2010	28 %	1	28.00 %
2011	28 %	1	28.00 %
2012	28 %	1	28.00 %
2013	28 %	1	28.00 %
2014	27 %	1	27.00 %
2015	27 %	1	27.00 %
2016	25 %	1.15	28.75 %
2017	24 %	1.24	29.76 %
2018	23 %	1.33	30.59 %
2019	22 %	1.44	31.68 %

Source: Regjeringen (2013, 2014, 2015, 2016, 2017, 2018)

In this thesis, a Norwegian investor invests in the Scandinavian stock markets. Thus, we also need to examine tax effects for holding foreign stocks. A Norwegian investor holding stocks abroad is subject to tax on dividend received from a company, called withholding tax[48]. Denmark and Sweden are included in the Nordic tax agreement and hence this withholding tax is limited to 15 percent (Nordisk eTax, n.d.). Immediately, holding stocks abroad appear

[47] In Norwegian: «Personinntekt».

[48] In Norwegian: «Kildeskatt».

as an obvious disadvantage compared to holding domestic stocks. However, the withholding tax can be deducted from the Norwegian tax[49], in reference to the Norwegian Taxes Act §16-20. This means that the total tax is the same after all, which means 31.68 percent in 2019. Hence, with respect to taxes, the investor is indifferent between holding stocks in Norway or in other countries.

In 2017, the share savings account[50] was introduced in Norway. With the introduction of this account, tax on capital gain could be deferred while dividend was subject to taxes on an ongoing basis. However, after 2019, dividend is processed on the same basis as capital gain (Skatteetaten, n.d.). I.e., both capital gain and dividend can be deferred and taxed first when they are withdrawn from the account, in reference to the Norwegian Taxes Act §10-21(3). The handling of the withholding tax for the share savings account has so far been uncertain, and to the best of our knowledge, these problems still exist.

4.2.2 The Exemption Method

The exemption method[51] was introduced with the tax reform implemented in 2006 as well. This model does not include personal shareholders but includes revenues associated with owning shares by other stock corporations (Klette, 2010). Stock corporations are not subject to tax on dividend and capital gain according to the exemption method, avoiding multi-stage tax and delay it until it is withdrawn at the personal level (Klette, 2010). However, companies that fall in under the exemption method is still subject to tax on three percent on received dividend, in reference to the Norwegian Taxes Act §2-38(6). This also include companies domiciled abroad that are considered as equivalent to Norwegian companies included in this paragraph, in reference to the Norwegian Taxes Act §2-38(1). Hence, Norwegian stock corporations are subject to tax in Norway on three percent of received dividend in all countries mentioned in this paper.

[49] In 2019: 15 percent can be deducted from 31.68 percent which means 16.68 percent tax on the dividend (received abroad) in Norway this year.

[50] In Norwegian: «Aksjesparekonto».

[51] In Norwegian: «Fritaksmetoden».

Stock corporations are mainly, as personal shareholders, subject to withholding tax on dividend received from a company domiciled abroad. In our case[52], because of the Nordic tax agreement, this is limited to 15 percent (Nordisk eTax, n.d.). Companies domiciled abroad are typically included in the Norwegian exemption method and exempt from withholding tax from Norwegian companies (Mæhlum & Nymoen, 2017). However, to the best of our knowledge, we do not find any similar rules in Sweden or Denmark. Thus, Norwegian stock corporations are subject to withholding tax on dividend from companies in Sweden or Denmark. In addition, because dividend in Norway is exempted from taxation through the exemption method, withholding tax paid abroad cannot be deducted in Norway. ***Table 2*** summarises the taxation received from Norway and abroad, respectively. It illustrates that Norwegian stock corporations in total pay three percent on dividend received from Norway and 18 percent on dividend received from abroad. Hence, it is a clear tax advantage of holding domestic stocks.

Table 2 - Tax on Dividend with Regard to Geographical Location

Tax	Dividend received from Norway	Dividend received from abroad
Tax in Norway	3 %	3 %
Withholding tax	0 %	15 %
Sum	**3 %**	**18 %**

4.3 Discussion of Preferred Method

This chapter has so far examined the tax effects of the shareholder model and the exemption method. This section will discuss the advantages and disadvantages with both methods and will conclude which method is best for the Norwegian based investor in this thesis. The investor is rational and will hence select the option which minimises taxes. The chosen method will be used later in this thesis when taking taxes into consideration.

On the basis of 2019, there is no real discussion about the best option in this case. The share savings account offers to defer both dividend and capital gain until the funds are withdrawn from the account. Hence, in practise the investor does not pay any yearly taxes in our case

[52] Companies domiciled in Sweden or Denmark.

with this option[53]. However, the share savings account was offered for the first time in 2017. Our investor starts investing in 2005, and thus we believe it is unfair to take these tax effects into consideration in this thesis. I.e., we ignore the share savings account as an option.

When deciding between the shareholder model and the exemption method, we are really discussing whether to invest as a private person or through an investment company. The discussion needs to examine the effects dividend and capital gain have on taxation. We start by looking at dividend. The taxation rules explained earlier in this thesis are summarised in ***Table 3*** with an example of dividend received from a company.

Table 3 - An Example of 100 in Received Dividend in 2019

Tax	Norway		Abroad	
	Exemption method	Shareholder model	Exemption method	Shareholder model
Received dividend	100.00	100.00	100.00	100.00
Dividend tax exemption[54]	0.00	(26.00)	0.00	(26.00)
Tax base	**100.00**	**74.00**	**100.00**	**74.00**
Withholding tax[55]	0.00	0.00	15.00	15.00
Taxes in Norway	3.00	23.44	3.00	8.44[56]
Total taxes	**3.00**	**23.44**	**18.00**	**23.44**

As seen from the table, total taxes in the shareholder model are exactly the same for both cases. In the exemption method, total taxes are 3.00 on dividend received from Norway and 18.00 on dividend received from abroad. This is due to the withholding tax on dividend to companies domiciled in Sweden or Denmark. Even though the total taxes differ in the exemption method, it is less than in the shareholder model in both cases. Hence, from a dividend point of view, investing through a company seems like the best decision.

[53] Note that there exist some uncertainties regarding the handling of the withholding tax in the share savings account.

[54] We assume a dividend-yield of five percent of the stock price at end of the year. We also assume no unused dividend tax exemption. Hence: 100/0.05 = 2000 in dividend tax exemption basis. With tax exempt dividend of 1.3 percent in 2019 (Skatteetaten, n.d.) this gives dividend tax exemption: 2000 * 0.013 = 26.

[55] According to the Nordic tax agreement this is limited to 15 percent. No dividend tax exemption for withholding tax in the shareholder model.

[56] 74.00 * 0.3168 – 15.00 = 8.44.

When considering taxation on capital gain there is also a clear difference. In the shareholder model, profit is taxed in the year which it is realised. The profit is, in 2019, taxed with an effective tax rate of 31.68 percent[57] unless there is unused dividend tax exemption (Regjeringen, 2018). Since our investment strategies require yearly rebalancing, this means that the shareholder model will lead to yearly taxation on potential profits. Of course, potential losses can also be deducted. On the other side, in the exemption method, all profits on capital gain are free from tax even when it is realised. I.e., yearly rebalancing in the exemption method do not trigger any taxation. Because of this, it seems favourable to use the exemption method also in this case[58]. However, this only applies as long as the funds are not withdrawn at the personal level but stay in the company. If the investor wants to withdraw all the funds from the investment company, hopefully, the investor has some profit which needs to be taxed. We find it rational to believe that the investor wants to reinvest the funds at the end of the period and can defer the taxation even further. In other words, we ignore the tax effects of withdrawing funds from the investment company in this thesis[59]. In addition, if the investor wants to withdraw all the funds at the end of the period, deferring the taxation will be better than continuously taxation.

Based on the discussion above, we have come to the conclusion that a rational investor who wants to minimise taxes will invest through an investment company. Thus, the tax rules stated in the exemption method will apply in this thesis.

[57] See ***Table 1***.

[58] Because we expect the trend to be increasing stock prices.

[59] Even though we ignore these effects in this thesis, we have to state that these effects can have a significant effect on the return after tax on the personal level.

5. Data & Methodology

This part of the thesis will be divided into four parts. Initially, the data collection process will be examined. This part includes further explanations of the dataset used and how we manage the currency adjustments. Secondly, the samples used in this thesis will be thoroughly explained and the construction of the reference index, the risk-free rate and the different portfolios will be given comprehensive attention. Further, the method for calculating returns will be presented. Lastly, we will examine which considerations we take and how these are implemented for the regressions in our analysis.

5.1 Data Collection

This study is based on data procured on companies listed on the three Scandinavian stock exchanges in the period 2005-2019[60]. We find it applicable to set 2005 as the starting year for several reasons: Firstly, the original DoD strategy was tested over a 15-year period. Part of this study is to test this strategy on the Scandinavian market and see the results up against previous findings[61], and thus we use the same investment period as previous research. In addition, we use a 15-year period to limit the scope for this master thesis. Lastly, we want to include turbulent events such as the financial crisis in 2008 and the oil crisis in 2014 to see how our strategies behave under these types of shocks to the economy.

5.1.1 Dataset

The company sample from the three stock exchanges is the most comprehensive dataset used in this thesis. Since value strategies are the basis for this study, we use indices rather than each major stock exchange. For Norway, we use the OBX Total Return Index. The index consists of the 25 most liquid stocks on the Oslo Stock Exchange and is structured as a free float adjusted total return index (Oslo Børs, n.d.). A characteristic worth mentioning is that the OBX is an oil dominated index, consisting of nine oil and gas, transportation and oil service companies. The largest company in the index, Equinor ASA, represent approximately 24

[60] Oslo Børs, Nasdaq Stockholm AB, Nasdaq Copenhagen.

[61] See section 2.1.

percent[62] of the index (Oslo Børs, n.d.). Thus, this index varies more with the oil price than the other two indices used. For the Nasdaq Stockholm AB exchange in Sweden, we use the OMX Stockholm 30 Index. It consists of the 30 most traded stocks on the Nasdaq Stockholm AB exchange structured as a market weighted price index. For Nasdaq Copenhagen exchange we use the OMX Copenhagen 20 Index. This index is structured as a market weighted price index consisting of the 20 largest and most traded stocks on the Nasdaq Copenhagen Exchange.

The data used in this study is derived from Thomson Reuters *Datastream* and the Oslo Stock Exchange[63]. We extracted all companies ever included on each of the three indices as well as a "leavers and joiners" list for each index created in *Datastream*. This is a list of companies going in and out of these indices each year. We use the data from *Datastream* and combined it with the "leavers and joiners" list to create the constituents lists for each index.

Dividend-yields, dividend-per-share, price-to-book, price-to-earnings, earnings-per-share, buybacks, number of shares and total returns are extracted from *Datastream*. We merged all the companies and the financial information into one dataset. After a cleansing process, we structured the data and created our portfolios and the reference index. In this process the data for all the individual companies included in the constituents lists were double-checked to quality control all events. In addition, we used *Newsweb* and annual reports to cross-check dividend payments, buybacks, earnings-per-share and book values[64].

5.1.2 Currency Adjustments

When analysing the dataset, it is important that all dividends, earnings, book values and returns are in the currency of the investor's home country to obtain appropriate results. This study aims to analyse if the investment strategies create excess returns for a Norwegian based investor, therefore the whole dataset had to be converted to NOK[65]. We currency-adjusted the dataset in *Datastream* using the "$" code when extracting the data. There are several ways to

[62] Calculated the 19th of November 2020.

[63] Information on the OBX was provided by the Oslo Stock Exchange.

[64] Newsweb is the web service provider of stock exchange announcements from the Oslo Stock Exchange.

[65] See Appendix B for fluctuations in the exchange rates over the investment period.

currency adjust in *Datastream*, but for this amount of data we find this way the most applicable. All returns, indices and factors in this thesis are converted to NOK. The factors are currency-adjusted manually with daily exchange rates extracted from *Datastream*.

5.2 Sample Selection

This thesis examines different value strategies in the Scandinavian context, and hence certain aspects need to be taken into consideration. Firstly, Scandinavia does not have a common stock index that represents the stock market of these countries[66]. Thus, we need to construct such an index. For simplicity, this will throughout the thesis be referred to as *the reference index*. This also applies to the risk-free rate. All three different countries have their own risk-free rate set by their respective Central Bank. Thus, we also need to construct a risk-free rate that represents these countries in a proper way. This part of the thesis will look into these discussions and describe how these constructions are conducted. Lastly, this part will describe how we carry out the process of selecting companies for the different value strategies, and which criteria are required to be on the selection list[67].

5.2.1 Construction of the Reference Index

Creating a reference index is appropriate for several reasons. Most importantly, we need a sample where ten companies can be selected each year. In addition, a reference index can be used to compare both raw returns and risk-adjusted returns. The reference index needs to reflect the different countries included in a proper way, emphasising that a convenient index will include all the three indices and weight them against each other. The reference index consists of all the companies on the three different indices, a total of 75 companies each year.

5.2.1.1 Weighting the Reference Index

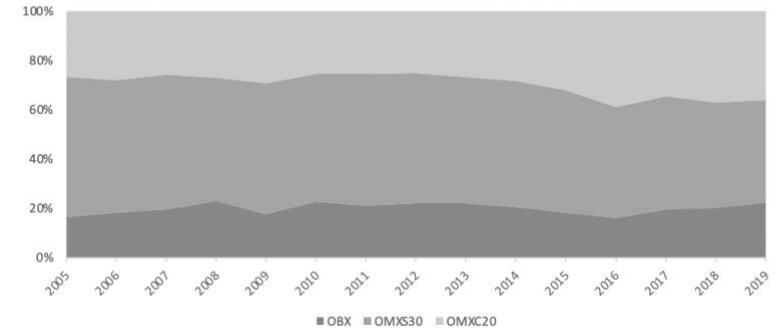
The different indices have to be value-weighted to reflect their own contribution. Weighting based on the number of companies in the index is unreasonable. This does not take the combined market capitalisation into consideration and would bias the reference index. Thus, we create a reference index which is weighted by their market capitalisation on the last trading

[66] Such as the OBX, OMXS30 and OMXC20 for Norway, Sweden and Denmark, respectively.

[67] There are added a constraint for the price-to-book portfolios. See section 5.3.2.2.

day each year. More precisely, we extract the market capitalisation for each index for the last trading day each year in NOK[68] and compare them with each other. After adjusting the reference index based on these aspects, we get what we believe is a correct distributed value-weighted reference index.

Figure 1 - Weighting of the Reference Index



Year	OBX	OMXS30	OMXC20
2005	17%	57%	27%
2006	18%	54%	28%
2007	20%	55%	26%
2008	23%	50%	27%
2009	18%	53%	29%
2010	23%	52%	25%
2011	21%	53%	25%
2012	22%	53%	25%
2013	22%	51%	27%
2014	21%	51%	28%
2015	18%	50%	32%
2016	16%	45%	39%
2017	20%	46%	34%
2018	20%	43%	37%
2019	22%	42%	36%

Table 4 - Weighting of the Reference Index[69]

The calculated weights are shown in ***Table 4***. The Swedish index is the biggest contributor to the index, even though it is descending in size throughout the investment period. Denmark is the second largest contributor, while Norway has the smallest weighted impact. The development of the weights for the investment period is illustrated in ***Figure 1***.

5.2.2 Construction of the Risk-Free Rate

To be able to calculate excess returns and analyse risk-adjusted returns we need a risk-free rate. Since the reference index created in this thesis consists of several countries, we create a weighted risk-free rate using the same rationale. The weights of the different countries in accordance to the risk-free rate is calculated in the same manner as for the reference index. We use the 10-year government bond as a representation of our risk-free rate. We find this interest rate appropriate because of the low maintenance of the portfolios and the long time horizon of the strategies. Using this rate is consistent with previous research compiled by

[68] Market capitalisation for each index in NOK is extracted from *Datastream*.

[69] Due that the weights in percentage are rounded to integers the sum of weights are not always 100 percent.

Rinne and Vähämaa (2010). The 10-year government bond for each country is extracted on a monthly basis from *Datastream*[70].

Table 5 - Weighted Risk-Free Rate[71]

Year	Norway	Sweden	Denmark	Weighted
2005	3.73 %	3.38 %	3.38 %	3.44 %
2006	4.10 %	3.71 %	3.83 %	3.81 %
2007	4.79 %	4.17 %	4.31 %	4.32 %
2008	4.43 %	3.89 %	4.27 %	4.12 %
2009	4.00 %	3.25 %	3.61 %	3.49 %
2010	3.48 %	2.89 %	2.89 %	3.03 %
2011	3.13 %	2.60 %	2.72 %	2.74 %
2012	2.08 %	1.59 %	1.45 %	1.67 %
2013	2.58 %	2.12 %	1.75 %	2.12 %
2014	2.44 %	1.72 %	1.34 %	1.76 %
2015	1.54 %	0.72 %	0.71 %	0.87 %
2016	1.33 %	0.54 %	0.32 %	0.58 %
2017	1.65 %	0.66 %	0.52 %	0.81 %
2018	1.87 %	0.65 %	0.44 %	0.82 %
2019	1.50 %	0.10 %	-0.17 %	0.31 %

The risk-free and the adjusted risk-free rates for each country applied in this thesis are presented in ***Table 5***. As shown in the table, the interest rates have decreased over the time period and are approximately zero in 2019. The weighted risk-free rate in 2019 is as low as 0.31 percent. In comparison, this interest rate was 3.44 percent in 2005. This rapid decline can be addressed to the cut in interest rates done by the Central Banks to stimulate economic activity following the market downturn in 2008.

5.2.3 Construction of the Portfolios

The purpose of this master thesis is to test value strategies in the Scandinavian market, where we want to replicate the portfolio construction of the DoD strategy. Thus, we choose to construct the portfolios using equal-weights instead of value-weights. In addition, we choose

[70] We have calculated the yearly rates presented in ***Table 5*** by taking the average of the rates published on a monthly basis extracted from *Datastream*.

[71] See Appendix C for a graphic illustration of the risk-free rates over the investment period.

to only go long in the top ten companies for each strategy, and thus do not create long-short portfolios. The argument supporting this choice is the same as for why we use equal-weighting. The dataset consists of a diversified sample of companies listed on the three different stock exchanges. In the cleansing process of the dataset, we omitted all holding companies, which Banerjee, Leleux and Vermaelen (1997) describe as companies managed by professional actors, which owns stocks in private and public companies. These companies are omitted as they might have ownership in other companies in our portfolios, creating unwanted additional exposure to these companies. We choose to include banks in line with previous research on the DoD strategy (see for example, Visscher & Filbeck, 1997, 2003).

The construction of the portfolios requires three steps which are inspired by the methodology used in previous research on the DoD strategy (see for example, Visscher & Filbeck, 1997, 2003). Since we want to analyse and compare the returns of the three different portfolios against each other, we find it applicable to use the same methodology for the price-to-book and price-to-earnings portfolios as for the DoD strategy. However, there are some differences that require mentioning. An explanation of how the different portfolios are composed is provided in the subsections below.

5.2.3.1 High Dividend-Yield Portfolios

The process of constructing the high-dividend yield portfolios is rather straightforward. Firstly, on the last trading day of the year, all of the companies in the reference index are ranked based on their dividend-yields, from highest to lowest. An equal amount is invested in each of the top ten companies with the highest dividend-yields. Further, this portfolio is held for one year. After one year, the portfolio is rebalanced based on the same criterion and this step is repeated each year.

5.3.2.2 Price-to-Book Portfolios

When constructing the price-to-book portfolios the strategy selects the ten companies with the lowest price-to-book ratios the previous year, and an equal amount is invested in each of the top ten companies. The portfolio is held for one year. After one year, the portfolio is rebalanced based on the same criterion and this is repeated each year. In addition, we have included a constraint regarding the selection of the portfolios. All companies which have a price-to-book ratio below 0.5 cannot be selected into the portfolio. This is reasoned with regards to that a company with a price-to-book ratio below 0.5 has experienced a collapse in its stock price and is often earning a very low or negative return on its assets (Kaldestad & Møller, 2016). When

trading this low we find it more rational to break up the company's asset values and distribute it to shareholders. Step two and three is precisely the same for this selection process as for the high dividend-yield portfolios.

Beginning with 2005, the price-to-book ratio for the sample securities was computed. The numerator of the ratio is defined as the price of the common stock multiplied with the number of shares outstanding as of December 31st and the denominator as reported book values (before extraordinary items) from the annual report available to common stockholders. Although the price-to-book ratios are computed on 31st December each year, it is unlikely that the investors will possess this information at the investment point. Over 90 percent of firms release their financial report within three months of the fiscal year-end (Basu, 1977). Thus, it would be more precise to invest from the 1st of April or later. Since we want to compare several strategies in this study, we want all the portfolios to start at the same time, the last trading day each year despite this bias. This rationale also insinuates for the price-to-earnings portfolio.

5.3.2.3 Price-to-Earnings Portfolios

When constructing the price-to-earnings portfolio the strategy selects the ten companies with the lowest price-to-earnings ratios the previous year, and an equal amount is invested in each of the top ten companies. The portfolio is held for one year. After one year, the portfolio will be rebalanced based on the same criterion and this is repeated each year. The price-to-earnings ratio has received critics in economic literature since it mixes capital structure and nonoperating items with expectations of operating performance, which is a less reliable guide to companies' relative value (Koller, Goedhart & Wessels, 2015).

Beginning with 2005, the price-to-earnings ratio for the sample securities was computed. The numerator of the ratio is defined as the price of the common stock as of December 31st and the denominator as reported earnings per share (before extraordinary items) from the annual report available to common stockholders. The price-to-earnings ratios were ranked in ascending order and the ten companies were selected each year, within the criterion emphasised above.

5.3 Portfolio Returns

To calculate portfolio returns, the performance of each individual stock is identified. We collected daily closing prices adjusted for dividends, merger and acquisitions (M&A), stock splits and reversed splits for the relevant stocks that go into the portfolios. Total return for

each stock was derived from *Datastream* using the RI code[72]. Over a specified period, the RI code provides theoretical growth in the value of a stock position, assuming that dividends are reinvested to purchase additional stocks on the ex-dividend date. *Datastream* and the Oslo Stock Exchange served as our primary data sources, and we assess them as reliable and accurate.

When calculating returns for the portfolios, the buy-and-hold abnormal return method is used[73]. Research testing performance over a longer time will normally use either this method or the cumulative abnormal return method[74]. Barber and Lyon (1997) argue that CAR produces positively biased results because this method does not take compounding into account. In contrast, Barber and Lyon said that BAHR obtained negatively biased results. Three years later, Hirschey (2000) brought up the same issue. He argues that some of the previous research, which achieved abnormal returns by using DoD, obtained these returns by using arithmetic averages which positively biased the results. Because the downward performance is limited and the upward performance is unlimited when using this method, Hirschey (2000) claimed that the research is upward biased.

We use the BAHR because this method includes the compounded returns over the investment period, and is consistent with previous research compiled by Visscher and Filbeck (1997, 2003) and Rinne and Vähämaa (2010). In this thesis, we calculate monthly returns on the different portfolios and the reference index based on the collected daily prices for each stock.

5.4 Single and Multi-Factor Models

We analyse how the value investing strategies perform by using the single-factor model, Fama and French three-factor model (FF3) and Carhart four-factor model (FFC4). The theory behind these models is examined in section 3.3.3 to 3.3.5. In section 5.4.1, we scrutinise how the different factors applied in the regression analysis are constructed. Additionally, we will address the considerations taken for the regressions in section 5.4.2.

[72] RI is cumulative and adds any changes to the previous day's value.

[73] From now on called BAHR.

[74] From now on called CAR.

5.4.1 Construction of Factors

As previously explained, monthly returns are calculated for the different portfolios after collecting daily closing prices from *Datastream* using the RI code. The risk-free rate used to calculate excess returns in these models deviates from the risk-free rate constructed in section 5.2.2. These models are regressed on monthly returns, and thus we find it appropriate to use interest rates with shorter maturities. We have extracted the three-month Norwegian Interbank Offered Rate (NIBOR), the three-month Stockholm Interbank Offered Rate (STIBOR) and the three-month Copenhagen Interbank Offered Rate (CIBOR) from *Datastream.* The risk-free rates for the different countries are weighted in the same manner as in section 5.2.2, with the yearly weights applicable for every month in each year. These returns are annualised, and therefore divided by 12 to get monthly rates. The market factor applied in the regression models is the monthly returns calculated for the reference index constructed in section 5.2.1 subtracted by the monthly risk-free rates.

The SMB, HML and UMD factors are extracted from AQR Capital Management's (n.d.) webpage[75] for Norway, Sweden and Denmark. These factors are value-weighted in the same manner as the risk-free rate and market factor to obtain synthetic factors for the Scandinavian market in this study. The factors extracted from AQR are currency adjusted to NOK to ensure that the factors are in the same currency as the rest of the dataset used in this study. We tried our regressions by replacing the Norwegian factors from AQR with the Norwegian factors constructed by Bernt Arne Ødegaard (n.d.). These factors have frequently been used by academic researchers in the Norwegian market and, to the best of our knowledge, appear to be well accepted. The changes in the regressions were minimal, which we believe increase the credibility of the factors extracted from AQR. Thus, we choose to use the factors from AQR for Norway to ensure consistency for all the Scandinavian countries in this thesis. The use of value-weighted factors between the three Scandinavian countries is in line with Fama and French's construction of the global factors for SMB, HML and UMD, where they use the value-weights for each country (Griffin, 2002). Hence, we find it applicable to do the same in our thesis. The factors extracted from AQR are constructed in line with Fama and French (1992, 1993 & 1996), Asness and Frazzini (2013) and Asness, Frazzini and Pedersen (2018)

[75] The data is available from https://www.aqr.com/library/data-sets.

which are examined in section 3.3.4 and 3.3.5. We note that these factors may be slightly biased because we construct synthetic factors for the Scandinavian market as a whole by value-weighting the three country-specific factors, and hence we interpret the regression results with caution.

5.4.2 Multivariate Regression

To evaluate returns from the three value strategies, we run multivariate regressions with monthly stock returns for each strategy as the dependent variable. We use the single-factor model, FF3 model and the FFC4 model in our performance analysis.

In the single-factor model our independent variable is the weighted market factor. In the FF3 regression we add two more independent variables to explain returns, the SMB and HML factors. When taking these risk factors into account, it provides more insight into how the returns are generated. When including more independent variables the risk of having omitted variable bias in our regressions is reduced (Woolridge, 2016). In the FFC4 model, we add one additional independent variable in terms of momentum, UMD.

When running regressions with the variables mentioned above, we account for some of the risk factors the investor will be positioned against. When seeing the FF3 and FFC4 models up against the single-factor model, the correct asset pricing model is uncertain and hence we include alternative models. The results obtained from the regression models can thus generate alpha since it is not certain that either of the models applied are the correct one. An alpha can also be caused by mispriced assets, meaning that there is no correct model to price the assets included in the portfolios. The investor can increase expected alpha by positioning the portfolio against a set of risk factors. This is what the investor in this thesis tries to exploit with the three value strategies. Using additional control variables in the regressions will increase R-squared and explain more of the variance in the returns. This might lead to a more precise alpha estimate (Woolridge, 2016). However, we note that maximum one model included in the study is the correct one and that the others will be misspecified. Thus, adding more factors to the misspecified models will not increase the precision of the alpha estimates. We note that there will be more factors explaining our returns than those from the single-factor, FF3 and FFC4 regression models. However, these models make it possible to observe the potential bias when excluding alternative factors from our analysis.

Novy-Marx (2013) argues that a profitability factor is relevant for explaining returns, and Titman, Wei and Xie (2004) argue that an investment factor should be included when analysing returns as well. Fama and French (2015) include these factors in their five-factor model[76], but argue that the factor HML is a mix of premiums related to book-to-market, profitability and investments. This means that this factor explains some of the average returns related to a high dividend-yield portfolio. The investor in this thesis also uses price-to-earnings as an investment strategy. Fama and French (1995) argue that the HML factor accounts for earnings and explain returns in line with Chen (1991). They show that the FF3 model captures the average returns from price-to-earnings portfolios (Fama & French, 1996). Fama and French (2015) also argue that adding extra factors can cause problems. They mention that adding a momentum factor in their five-factor model can lead to poor diversification in some of the portfolios which are used to construct the factors, because of correlations between the factors. Based on these considerations, we find MKT, SMB, HML and UMD to be the best fit for our performance analysis for the three factor models mentioned above. In addition, to the best of our knowledge AQR does not provide the two additional factors included in the Fama and French (2015) five-factor model. Thus, we would have to construct them, and to limit the scope of this master thesis we choose to not use the Fama and French (2015) five-factor model.

The DoD portfolio selection method which this thesis follows (Dorfman, 1988), creates yearly portfolios consisting of ten stocks for each strategy as previously mentioned. These portfolios create small sample bias where outliers have a larger impact. Consequently, the coefficient estimates will often not pick up the true population mean, leading to inaccurate regressions (Goldberg, 1991). In the monthly returns for the portfolios, we discover that some of the returns are outliers by analysing scatter plots for the returns[77]. Outliers are unusual observations, clearly different from other observations in the population. These outliers can, especially for small samples, have a great effect on the results in the regressions (Woolridge, 2016). Hence, we choose to remove these outliers using a winsorization method to improve robustness. We exclude the top and bottom 2.5 percent values and replace these values with the 97.5 and 2.5 percentiles, respectively. We note that removing outliers provides more accurate regressions and is much used in statistics. However, it may lead to an inaccurate view

[76] See section 3.2.

[77] See Appendix D.

of the risk incorporated into our returns. Woolridge (2016) argues that regressions that substantially change by removing outliers should be reported both with and without outliers. Removing the outliers have some effect on the regression results in this thesis, and thus the results without removing outliers are included in the appendix[78].

Autocorrelation is the covariance between lags in time-series and might affect the efficiency of the regression estimates, but should not lead to biased coefficients. It is a sign of dynamic misspecification in the regression model. Thus, we need to test for autocorrelation in our regressions (Woolridge, 2016).

Equation 16 - Autocorrelation Assumption

$$cov(u_i|u_j) = 0$$

To test for autocorrelation we use the Durbin Watson test. The result from the Durbin Watson tests states that we have trouble with first-order autocorrelation in our regressions. A description of how we correct for this to avoid inefficiency is provided later in this section (Woolridge, 2016).

Heteroskedasticity is also a known problem when running regressions. When heteroskedasticity is present, it can lead to biased standard errors (Woolridge, 2016). Financial markets tend to be volatile and subject to economic shocks, resulting in nonconstant variance of the error term. Thus, we test for heteroskedasticity to check if the standard errors are constant in the regressions.

Equation 17 - Heteroskedasticity Assumption

$$Var(u|x) = x_1, x_2, \dots, x_k = \sigma^2$$

We run a test using *Stata* where we generate the squared residuals for each regression and run an OLS regression against the independent variables for each regression. We use these squared residuals as the dependent variable. Further, we test if the independent variables are equal to zero using an F-test. In most cases we can reject H_0, that all independent variables in the regression equal zero, meaning homoskedasticity. Thus, we have a problem with heteroskedasticity leading to biased standard errors (Woolridge, 2016). When doing this

[78] See Appendix F.

process manually, we are able to create scatter plots where we can visually analyse heteroskedasticity. We also run a formal Breusch-Pagan test which obtains the same results[79].

To mitigate the problems with autocorrelation and heteroskedasticity in our regressions we use Newey and West adjusted standard errors with five lags for measuring the t-statistics (Newey & West, 1987, 1994). This regression method has also been used in acknowledged economic papers previously published (see for example, Nelson & Kim, 1993). As a weakness of our regressions, we note that the dependent variables can be subject to omitted variable bias as well as misspecified variables, which means that they do not have a causal interpretation when this is the case (Stock & Watson, 2011).

[79] See Appendix E.

6. Results

In this chapter, we present the empirical results from the investment strategies tested in this study. Firstly, we present the constituents lists with the companies included each year for the different portfolios in section 6.1. Secondly, in section 6.2 we present the findings regarding the obtained raw returns. Further, in section 6.3 we adjust the returns for transaction costs and taxes to obtain a more realistic view on the performance of the raw returns when these market imperfections are taken into account. In section 6.4, we risk-adjust the returns with the Sharpe ratio, Treynor index, single-factor and multi-factor regression models.

6.1 Constituents Lists

An abiding issue when analysing investment strategies is the turnover of stocks in the different portfolios. A high turnover is associated with transaction costs that can eliminate or lead to negative excess returns for the strategies. In the following sections we will present the constituents lists for each of the three investment strategies. The underlying reason behind these lists is to show which companies we invest in, the characteristics describing these companies and the turnover rate for the different strategies. Moreover, it increases the transparency of the study.

6.1.1 High Dividend-Yield Portfolios

Table 6 - High Dividend-Yield Portfolios

Company	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Frontline LTD	x	x	x	x	x		x						x			7
Norske Skogsindustrier ASA	x	x	x	x												4
Holmen	x	x														2
Fabega	x															1
Electrolux AB	x	x						x								3
Stora Enso	x	x														2
Sandvik AB	x															1
Danske Bank A/S	x	x	x		x											4
Skanska AB	x		x			x	x		x						x	6
Alfa Laval AB	x															1
Storebrand ASA		x	x													2
Torm (A)		x	x													2
DNB ASA		x	x	x	x			x								5
Svenska Cellulosa SCA AB		x				x										2
Tryg A/S			x	x												2
Volvo AB			x	x	x											3
Svenske Handelsbanken AB			x												x	2
Aker Yards ASA				x												1
Eniro				x	x											2
Boliden AB				x												1
Swedbank AB				x	x					x	x	x		x	x	7
Nordea Bank (Denmark)				x								x		x	x	4
DS Norden A/S					x	x	x									3
Aker ASA					x											1
Skandinaviska Enskilda Banken AB					x							x	x	x	x	5
Seadrill					x		x	x	x	x						5
Mowi ASA						x	x	x			x		x	x		6
AstraZeneca PLC						x	x		x							3
Nokia						x	x	x	x							4
Fred Olsen Energy						x		x	x	x	x					5
Securitas AB						x			x							2
Orkla ASA						x	x	x		x	x					5
H&M AB						x								x	x	3
Equinor ASA							x				x	x				3
Telia Company AB							x		x	x	x	x	x	x		7
Tele2 AB								x	x	x		x	x	x		6
Gjensidige Forsikring ASA								x	x	x	x		x			5
Prosafe								x	x	x						3
TDC A/S										x	x	x				3
Yara International ASA										x						1
Petroleum Geo-Services											x					1
TGS NOPEC Geophysical Company ASA											x	x				2
BW LPG ltd												x	x			2
Nordea Bank Abp (Sweden)												x	x	x	x	4
Telefonaktiebolaget LM Ericsson													x			1
Telenor ASA													x			1
Grieg Seafood ASA														x		1
Swedish Match AB														x		1
Golden Ocean Group															x	1
Pandora A/S															x	1
Subsea 7 ASA															x	1
Total	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**150**
Number of companies that staying on the list		5	5	4	4	1	6	4	6	6	6	5	5	5	5	
Turnover		5	5	6	6	9	4	6	4	4	4	5	5	5	5	
Average turnover																5.21

During the 15-year investment period, 51 companies were included in the annual portfolio at least one time. 15 companies were included once, while six companies were included at least six times. The turnover for the annual portfolios averaged 5.21 companies, amounting to approximately 50 percent of each annual portfolio. This is in line with the results presented by Visscher and Filbeck (1997) who find the same average annual turnover for the high dividend-yield strategy. This is a high turnover and not optimal in light of transaction costs.

The three companies that appeared most frequently, with seven times each, are Frontline Ltd, Swedbank AB and Telia Company AB. Frontline Ltd is listed on the Oslo Stock Exchange and is one of the world leaders within international seaborne transportation of crude oil and refined products (Frontline Ltd, n.d.). Frontline Ltd appeared in our annual portfolios in the beginning of the 15-year period when the company was at its peak. The stock was rallying and the dividends increased. Although it fell back in 2008, it was included in 2008 and 2009 as the dividend-yield was kept artificially high when the stock price dropped. It was included in both 2011 and 2017 for the same reason, declining stock price while the dividend remained fixed. Swedbank AB, listed on Nasdaq Stockholm AB, is a solid Swedish bank known for a sustainable and high payout policy. The company was included in 2008 and 2009 due to the same phenomenon as Frontline Ltd. It took some years for the stock to rebound from the financial crisis in 2008, but Swedbank AB came back and continued with the high dividend policy. Telia AB is an incumbent telecom operator listed on Nasdaq Stockholm AB. The company is known for a steady dividend policy and is included in our annual portfolios in the latter part of our investment period. Based on the last annual results we see that Swedbank AB and Telia AB satisfy several of the value stocks criteria posed by Warren Buffet in every annual report for Berkshire Hathaway since 1982 (Berkshire Hathaway Inc., n.d.), and the value criteria posed by Benjamin Graham (Rea, 1977).

6.1.2 Price-to-Book Portfolios

Table 7 - Price-to-Book Portfolios

Company	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Norske Skogsindustrier ASA	x	x	x	x												4
Fabega	x															1
Tele2 AB	x	x	x													3
Vestas Wind Systems A/S	x															1
Svenska Cellulosa SCA AB	x	x	x	x	x	x	x									7
Stolt Nielsen	x															1
Norsk Hydro	x				x			x	x	x		x	x		x	8
Holmen	x	x														2
Ementor ASA	x															1
Carlsberg A/S (B)	x	x														2
EAC Invest		x														1
Vostok Gas		x	x	x												3
Telia Company		x														1
Orkla ASA		x	x													2
Storebrand ASA		x		x		x	x	x	x	x	x	x	x	x	x	12
Mowi ASA			x	x												2
AP Moeller - Maersk A/S (B)			x					x	x		x	x		x	x	7
Torm (A)			x													1
Danske Bank A/S			x	x		x	x	x	x	x					x	8
DNB ASA			x			x	x	x	x			x	x	x		8
Seadrill				x						x						2
Aker Yards ASA				x												1
Swedbank AB				x		x	x									3
Skandinaviska Enskilda Banken AB				x	x	x		x								4
Sydbank					x		x	x								3
Petroleum Geo-Services					x						x	x	x	x	x	6
SSAB AB					x			x	x	x	x		x	x	x	8
Aker ASA					x											1
NKT A/S					x											1
Nordea Bank (Denmark)					x				x							2
Nordea Bank Abp (Sweden)					x									x	x	3
DS Norden A/S						x	x									2
Seven Marine ASA						x	x									2
Songa Offshore ASA						x										1
AP Moeller - Maersk A/S (A)						x	x	x	x	x	x	x	x	x		9
REC Silicon							x			x	x	x				4
Vestas Wind Systems A/S								x	x							2
Jyske Bank									x	x		x	x	x	x	6
Subsea 7 ASA										x	x		x	x	x	5
Boliden AB										x						1
Akastor											x					1
Equinor ASA											x					1
BW LPG Ltd											x	x	x	x		4
Avance Gas Holding												x				1
Frontline Ltd													x			1
BW Offshore Ltd															x	1
Total	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**150**
Number of companies that staying on the list		4	4	4	2	2	8	5	8	6	5	6	7	8	7	
Turnover		6	6	6	8	8	2	5	2	4	5	4	3	2	3	
Average turnover																4.57

Over the course of the chosen time period, 46 companies were included in the annual portfolios for the price-to-book ratio at least once. 17 of these companies only appear once. Even though there is a higher number of companies included only once, the average turnover is 4.57 companies, lowest for the three strategies. For this strategy, the Norway based insurance and savings company Storebrand ASA appears most frequently. It is included 12 of 15 years. Storebrand ASA trades historically on a low market price per share compared to the book value per share, one of Graham's criteria for value stocks (Rea, 1977).

Banks and insurance related companies are highly represented in the price-to-book portfolio, together with other asset-heavy sectors such as shipping and construction. Many of the companies only appearing once are subject to a rapid decline in share price without any momentary changes in book value. This can be caused by negative forecasts related to financial performance, restructuring, replacement of management or just a negative sentiment in the sector. From our data, we note that this often leads to impairments that lags the stock price, resulting in an artificially low price-to-book ratio.

6.1.3 Price-to-Earnings Portfolios

Table 8 - Price-to-Earnings Portfolios

Company	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Orkla ASA	x													x		2
Frontline Ltd	x	x	x	x	x							x	x			7
AP Moeller-Maersk A/S (A)	x	x				x		x	x		x	x				7
Torm (A)	x	x	x													3
Storebrand ASA	x	x								x	x		x			5
Electrolux AB	x			x												2
Equinor ASA	x	x	x						x							4
Norsk Hydro	x							x							x	3
ABB Ltd	x															1
AP Moeller-Maersk A/S (B)	x					x		x			x	x			x	6
Stora Enso		x														1
Vostok Gas		x	x	x												3
Nordea Bank Abp (Sweden)		x	x						x				x		x	5
Yara International ASA		x			x		x	x	x	x		x				7
DNB ASA		x	x	x	x		x	x	x	x	x	x	x			11
Seadrill			x	x			x			x	x					5
Mowi ASA			x	x			x	x						x		5
Swedbank AB			x	x	x								x			4
Nordea Bank (Denmark)			x						x							2
Aker Yards ASA				x												1
Tryg A/S				x			x									2
Boliden AB				x	x										x	3
NKT A/S					x											1
Skandinaviska Enskilda Bank AB					x	x						x			x	4
Petroleum Geo-Services					x					x						2
Danske Bank A/S					x										x	2
Sydbank					x											1
Songa Offshore ASA						x										1
Fred. Olsen Energy ASA						x	x		x	x						4
SSAB AB						x										1
AstraZeneca PLC						x	x	x	x							4
Prosafe						x	x			x						3
Modern Times Group AB						x										1
Scania						x										1
DS Norden A/S							x									1
Telenor ASA							x									1
GN Store Nord A/S								x								1
Cermaq ASA								x								1
Schibsted ASA (A)								x								1
Topdanmark A/S									x							1
Gjensidige Forsikring ASA									x							1
Tele2 AB										x						1
Telia Company AB										x				x		2
TGS NOPEC Geophysical Company ASA										x						1
Jyske Bank											x		x	x	x	4
REC Silicon											x	x				2
Akastor											x					1
Subsea 7 ASA											x					1
BW LPG Ltd											x	x				2
TDC A/S												x				1
Avance Gas Holding												x				1
Fingerprint Cards AB													x			1
Grieg Seafood													x	x		2
Swedish Match AB													x			1
P/F Bakkafrost													x			1
DNO ASA														x		1
Golden Ocean Group														x	x	2
Norwegian Air Shuttle														x		1
Salmar ASA														x		1
Leroy Seafood Group ASA														x		1
Volvo AB															x	1
Pandora A/S															x	1
Total	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**150**
Number of companies that staying on the list		5	6	6	4	1	3	4	4	3	3	5	2	2	2	
Turnover		5	4	4	6	9	7	6	6	7	7	5	8	8	8	
Average turnover																6.43

For the price-to-earnings strategy, 62 companies are included in the annual portfolios whereas 29 companies were only included once. The average turnover is higher than for the two other

strategies, with an average replacement rate of 6.43 companies. We note that this is high and will lead to increased transaction costs for this strategy. There are few companies with a long track record for the price-to-earnings strategy. DNB ASA is the exemption and is included in 11 of 15 years. This company tends to historically trade on a price-to-earnings ratio below nine which is what Graham argues is a sustainable level to pay for future earnings for value companies (Rea, 1977). A price-to-earnings ratio of nine implies an earnings-yield of 11.11 percent which is considerably higher than the ten-year treasury bond yield. Companies priced low compared to their earnings per share often tend to have a lower growth rate since investors are not as willing to pay a higher premium for future earnings, which is typical for value companies (Kaldestad & Møller, 2016; Koller et al., 2015). Like the case was for the price-to-book annual portfolios, many companies appear only once due to a rapid decline in share price without momentarily changes in earnings.

We note that in terms of the EMH, there should be no easy way to beat the market, in this case based on companies' high dividend-yield, price-to-book and price-to-earnings ratios which are public information (Fama, 1970).

6.2 Raw Returns

In this part of the thesis, the compound annual returns of the strategies and the reference index will be presented. In addition, the performance over the whole period will be demonstrated in a figure. All the returns in this section are raw returns, and hence transaction costs and taxes are not taken into consideration[80].

6.2.1 Compound Returns

Table 9 summarises the findings regarding the compound annual returns for the investment strategies as well as the reference index. To check whether the strategies are statistically different from the reference index we use a paired differenced t-test[81].

[80] Transaction costs and taxes will be taken into account in section 6.3.

[81] The output from the t-tests is shown in ***Table 9***.

Table 9 - Summary of Raw Returns[82]

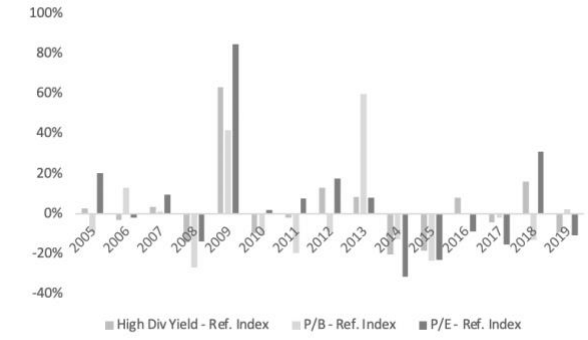
Year	High Div Yield	t-Test	P/B	t-Test	P/E	t-Test	Ref.Index
2005	28.59	0.37	16.79	-0.81	46.35	1.43	26.00
2006	22.58	-0.39	38.54	1.33	23.58	-0.17	25.51
2007	-1.07	0.43	-3.28	0.16	4.90	1.83*	-4.46
2008	-52.08	-1.51	-64.52	-1.98*	-51.84	-1.16	-37.86
2009	92.85	2.16*	71.21	1.78	114.40	2.62**	29.68
2010	16.74	-0.68	15.41	-0.59	28.24	0.27	26.24
2011	-16.75	-0.29	-34.46	-1.67	-7.32	0.69	-14.87
2012	26.55	1.31	4.00	-0.77	30.86	1.25	13.38
2013	39.86	0.82	91.07	2.85**	39.46	0.83	31.40
2014	-4.79	-1.76	3.00	-0.79	-15.61	-2.44**	15.69
2015	0.31	-1.43	-4.93	-0.89	-4.47	-1.06	18.55
2016	3.25	0.81	-4.37	0.14	-13.75	-0.44	-4.88
2017	12.51	-0.60	14.94	-0.07	1.47	-1.31	16.93
2018	6.00	1.54	-23.00	-0.71	20.82	1.46	-10.11
2019	12.86	-0.77	24.47	0.21	11.48	-0.67	22.07

**p-value < 0.10, **p-value < 0.05, ***p-value < 0.01*

The reference index achieves higher returns than the other investment strategies in four years, which means that in 11 years at least one of the strategies is better than the reference index with respect to raw returns. The high dividend-yield strategy obtains the highest raw returns in one year, the price-to-book strategy in three years and the price-to-earnings strategy in seven years. Hence, the price-to-earnings strategy is the investment choice achieving highest raw returns in most years. We note that the majority of yearly returns are not statistically different from the reference index in terms of t-values.

[82] Returns in the table are written in percent.

Figure 2 - Excess Returns



Year	Diff. High Div Yield	Diff. P/B	Diff. P/E
2005	2.59 %	-9.21 %	20.35 %
2006	-2.93 %	13.03%	-1.92 %
2007	3.40 %	1.18 %	9.36 %
2008	-14.22 %	-26.65 %	-13.98 %
2009	63.17 %	41.53 %	84.72 %
2010	-9.50 %	-10.83 %	2.00 %
2011	-1.88 %	-19.59 %	7.55 %
2012	13.16 %	-9.38 %	17.48 %
2013	8.46 %	59.66 %	8.06 %
2014	-20.47 %	-12.68 %	-31.30 %
2015	-18.24 %	-23.48 %	-23.02 %
2016	8.13 %	0.51 %	-8.87 %
2017	-4.42 %	-1.99 %	-15.46 %
2018	16.11 %	-12.89 %	30.93 %
2019	-9.21 %	2.39 %	-10.59 %

Table 10 - Excess Returns[83]

As a comparison, ***Figure 2*** and ***Table 10*** illustrate how the strategies perform against the reference index. 2009 stands out as a year where all the strategies have higher raw returns than the reference index with a solid margin. The three strategies beat the reference index with 63.17, 41.53 and 84.72 percent, respectively. The reference index falls far less than the strategies the prior year, the year when the housing bubble burst in the U.S. which led to the Great Recession. The great recoveries subsequent to recessions are often mentioned as the phenomenon "bounce-back" effect, and can possibly explain the extreme returns obtained in 2009. Maheu and McCurdy (2000) studied over 160 years of monthly data and found that the best market returns came at the beginning of a bull market. In recent times, Zeng and Bec (2015) used a model to examine returns in five developed countries for the period after 1970. Their conclusion was in accordance with the findings by Maheu and McCurdy (2000) and concluded that the "bounce-back" effect was strong and that a bull market starts with significant returns. Further in our study, 2014 and 2015 are two subsequent years where the reference index outperforms all the strategies with respect to raw returns.

In 2014 there was a significant decline in the oil price, and hence is a year that needs comprehensive attention in this thesis because of OBX's exposure to this sector[84]. Interestingly, the reference index achieves a far better return than the strategies this year. All the different strategies consist of several Norwegian companies in the oil sector, while Norway

[83] Returns are calculated in the following way: ($R_{Portfolio} - R_{Ref.Index}$)

[84] See section 5.1.1.

only counts for 21 percent of the reference index this year[85]. Hence, this may explain the differences in returns, as the Norwegian stock market is more responsive to changes in the oil price than the stock market in Sweden and Denmark.

Table 11 - Summary Statistics

Strategy	Arithmetic Mean	Geometric Mean	Standard Deviation
High Dividend-Yield Strategy	12.49 %	8.26 %	18.57 %
Price-to-Book Strategy	9.66 %	2.62 %	24.83 %
Price-to-Earnings Strategy	15.24 %	9.75 %	22.05 %
Reference Index	10.22 %	8.20 %	15.22 %

Table 11 summarises the annualised arithmetic mean, geometric mean and standard deviation for the strategies and the reference index over the investment period. Based on raw returns, the price-to-earnings strategy has the highest arithmetic mean followed by the high dividend-yield strategy, the reference index and the price-to-book strategy. The price-to-earnings strategy also has the highest geometric mean, while the high dividend-yield strategy and the reference index have more or less the same results based on this measure. However, the price-to-earnings strategy has the highest standard deviation of these three investment choices implying higher volatility in the returns and thus higher risk. Hence, these numbers do not provide much information on performance and will be more thoroughly examined on a risk-adjusted basis later in this thesis.

6.2.2 Portfolio Performance

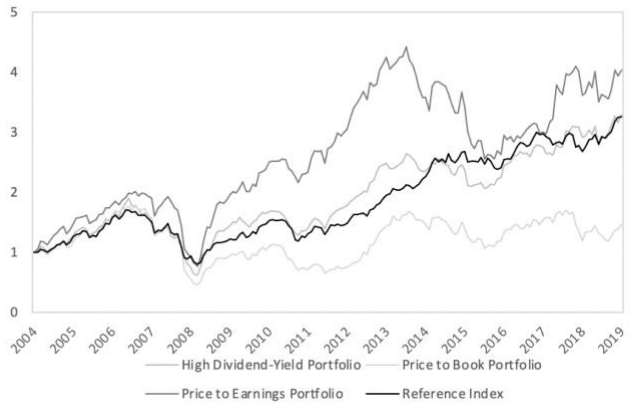
Figure 3 and ***Table 12*** illustrate the compounded returns from 2005 through 2019, with the assumption of a 1 NOK investment on the last trading day of 2004[86]. The price-to-earnings strategy has the best compounded return with a 304 percent return. Further, the reference index and the high dividend-yield strategy perform about identical, with 226 and 229 percent returns over the investment period. The price-to-book strategy achieves a 47 percent return in the same period. The reference index outperformed the other strategies in 2008 and when the oil price dropped in 2014. This supports the theory that the optimal portfolio in an efficient market is

[85] See ***Table 4***.

[86] The returns in ***Figure 3*** and ***Table 12*** are not adjusted for risk, transaction costs or taxes.

the market portfolio (Sharpe, 1964; Lintner, 1965; Mossin, 1966; Treynor[87]). While ***Figure 3*** illustrates that the strategies have a more negative reaction to crises, it seems like the price-to-earnings and high dividend-yield strategies outperform the reference index in normal times.

Figure 3 - Portfolio Performance



Year	High Div Yield	P/B	P/E	Ref. Index
2004	1.00	1.00	1.00	1.00
2005	1.29	1.17	1.46	1.26
2006	1.58	1.62	1.81	1.58
2007	1.56	1.56	1.90	1.51
2008	0.75	0.56	0.91	0.94
2009	1.44	0.95	1.96	1.22
2010	1.68	1.10	2.51	1.54
2011	1.40	0.72	2.33	1.31
2012	1.77	0.75	3.05	1.48
2013	2.48	1.43	4.25	1.95
2014	2.36	1.47	3.59	2.25
2015	2.37	1.40	3.43	2.67
2016	2.44	1.34	2.95	2.54
2017	2.75	1.54	3.00	2.97
2018	2.92	1.18	3.62	2.67
2019	3.29	1.47	4.04	3.26

Table 12 - Cumulative Returns

One of the main hypotheses for this study is that the value strategies would outperform the reference index in terms of raw returns. The results show that only the price-to-earnings strategy creates 78 percentage points higher compounded raw returns than the reference index over the investment period, while the DoD strategy creates the same return as the reference index. The price-to-earnings strategy has a strong increase in the first half of the investment period and the return for this strategy peaks in 2013. However, in the three subsequent years this strategy experience losses each year, which leads to a rapid decline in value. In 2017, the price-to-earnings strategy and the reference index are on the same level. The price-to-earnings portfolios are in these years composed of several oil service and shipping companies, which are experiencing years with negative returns because of the low oil price. In 2018, the portfolio is composed of, among others, four companies in the fishing industry which all obtain 40 percent or higher returns this year. The difference in returns between the price-to-earnings strategy and the reference index this year leads to higher compounded raw returns for the price-to-earnings strategy over the investment period. As stated in the previous section, this needs to be emphasised by risk-adjusting the returns to provide more information.

[87] The article by Treynor was never published.

Table 12 shows that the high dividend-yield strategy beats the market in the majority of years based on raw compounded returns, but takes on some heavy losses in 2008 and underperforms the market from 2015 to 2017. In the abnormal event in 2008 the high dividend-yield strategy declined by 52.08 percent while the reference index declined by 37.86 percent. The high dividend-yield portfolio of 2008 is characterised by industry, oil service and shipping companies. These are asset heavy sectors with high leverage. The demand for these types of products and services often falls rapidly in economic downturns because the demand shift downwards creating oversupply and lower prices. Loss of earnings gives these companies troubles with managing their debt obligation and increase the bankruptcy risk. There are also several banks in this portfolio that took a major hit during the financial crisis. Dividend is often a lagging variable the company uses some time to revaluate, creating an artificially high dividend-yield due to the rapid decline in stock prices. As mentioned in section 6.2.1, the high dividend-yield strategy has a strong "bounce-back" effect, which leads to a higher compounded return already the year after the financial downturn in 2008. In 2015 through 2017 the high dividend-yield portfolios consist of mainly oil service companies and banks. These were two underperforming sectors in this time period leading to the underperformance of the high dividend-yield strategy.

In terms of raw compounded returns, the price-to-book strategy is severely outperformed by the reference index. This strategy obtains low raw returns in 2011 and 2012. The banking and insurance sector underperformed the market in this period based on raw returns, and a high portion of the price-to-book portfolios consist of these types of companies, leading to low raw returns in the period. In 2008, after the oil price dropped in 2014 and in 2018, the price-to-book strategy also underperforms the reference index in terms of raw returns.

6.3 Transaction Costs and Taxes

To the best of our knowledge, prior research has ignored comprehensive calculations regarding taxes, but some research has examined the effects of transaction costs[88]. This thesis will take these market imperfections into account and see how they affect the raw returns. Because of the underperformance of the price-to-book strategy based on raw returns we find it appropriate

[88] See chapter 2.

to only advance with the high dividend-yield and price-to-earnings strategies in this part of the thesis.

6.3.1 Transaction Costs

To identify transaction costs associated with rebalancing the portfolios we will make several assumptions. We will calculate transaction costs each year and illustrate the process for the first year for the high dividend-yield strategy. Firstly, we extract the first turnover for the portfolio. As we can read from ***Table 6***, the turnover this year is five. This means a turnover rate of 50 percent. We assume one percent in transaction costs, which is consistent with previous research compiled by Hirschey (2000) and Rinne and Vähämaa (2010). In our case, this means 0.50 percent[89] in transaction costs due to turnover.

Secondly, we account for costs associated with rebalancing the stocks that continue as a part of the portfolio. With a turnover rate of 50 percent, the portion of companies remaining in the portfolio is 50 percent as well. As we can read from ***Table 9***, the return in 2005 is 28.59 percent and the average dividend-yield extracted from our dataset is 5.88 percent. This indicates a capital appreciation of 22.71 percent[90]. If all the remaining companies in the high dividend-yield portfolio appreciated 22.71 percent, no restructuring would be necessary. On the other hand, the worst-case scenario demands 22.71 percent of the market value in restructuring (Hirschey, 2000). By the assumption of randomly distributed capital appreciation around the mean, annual restructuring adds a minimum turnover rate of 5.67 percent[91], further implying extra transaction costs of 0.06 percent[92]. In total, this indicates transaction costs of rebalancing of 0.56 percent[93]. The methodology behind these calculations is inspired by Hirschey (2000). The investment period for the value strategies ends on the last trading day in 2019. For simplicity, we assume that the investor does not sell any proportion of the portfolios to rebalance or liquidate on this day, and hence transaction costs in 2019 will be zero.

[89] 0.01 * 0.50 = 0.0050.

[90] 0.2859 – 0.0588 = 0.2271.

[91] 0.5 * (0.2271/2) = 0.0567.

[92] 0.0567 * 0.01 = 0.0006.

[93] 0.0050 + 0.0006 = 0.0056.

As previously mentioned, we use an equal-weighting scheme in this master thesis to replicate the DoD strategy (Dorfman, 1988). Using this approach when selecting portfolios instead of value-weighting leads to higher transaction costs related to rebalancing. We note that a rational investor would try to minimise the transaction costs and prefer a value-weighting scheme.

There is a wide selection of index tracking funds, either through mutual funds or ETFs[94]. We therefore assume that the reference index can be replicated by a buy-and-hold strategy. However, we note that such ETF is non-existent for the reference index used in this study. Hence, to replicate the reference index a synthetic portfolio of three different ETFs must be created to mirror the returns. This will lead to yearly rebalancing to emulate the respective weights of each of the three stock indices[95]. Since we find it relevant to test the value investment strategies against a buy-and-hold strategy in the reference index, we choose not to create a synthetic portfolio. We emphasise that due to holding only three financial instruments, the transaction costs related to the synthetic portfolio would be negligible. Thus, we find it appropriate to ignore transaction costs for the reference index in this study.

6.3.2 Taxes

With respect to taxes, the tax rules examined in section 4.2.2 will be applied in this part of the thesis. By investing through an investment company, the exemption method allows for tax-free rebalancing of stocks and thus only dividends are subject to tax. In the previous part, we argued that transaction costs can be ignored with respect to the reference index. The availability of for example ETFs allows the investor to choose between funds that either accumulate or pay out dividends. A rational investor wants to minimise the tax burden and will hence choose a fund that accumulate dividends. For that reason, the return for the reference index will not be affected by taxes.

[94] Exchange Traded Funds.

[95] See ***Table 4***.

Table 13 - Overview of Origins

Year	Norway[96]		Abroad[97]		Total	Tax	
	High Div Yield	P/E	High Div Yield	P/E		High Div Yield	P/E
2005	2	5	8	5	10	0.58 %	0.31 %
2006	4	5	6	5	10	0.54 %	0.36 %
2007	4	5	6	5	10	0.60 %	0.36 %
2008	4	5	6	5	10	2.28 %	1.16 %
2009	4	4	6	6	10	0.21 %	0.03 %
2010	3	3	7	7	10	0.59 %	0.28 %
2011	5	7	5	3	10	0.82 %	0.44 %
2012	7	6	3	4	10	0.51 %	0.25 %
2013	4	5	6	5	10	0.57 %	0.33 %
2014	6	8	4	2	10	0.64 %	0.37 %
2015	7	7	3	3	10	0.42 %	0.20 %
2016	3	6	7	4	10	0.80 %	0.77 %
2017	5	5	5	5	10	0.56 %	0.46 %
2018	2	8	8	2	10	0.95 %	0.24 %
2019	2	2	8	8	10	0.95 %	0.74 %

Because of the difference in the effective tax rate on dividend received from a Norwegian company and companies domiciled in Sweden or Denmark, ***Table 13*** provides a rapid view of the number of companies which are taxed at what effective tax rate. In addition, it includes the costs of tax for the high dividend-yield and price-to-earnings strategies in percentage points each year. For simplicity, taxes are being deducted on the last trading day of the year and decrease the return by the stated percentage points.

6.3.3 Adjusting for Transaction Costs and Taxes

6.3.3.1 High Dividend-Yield Strategy

The adjusted returns are calculated in ***Table 14***, by subtracting transaction costs and taxes from the original returns. Transaction costs are calculated yearly as explained in section 6.3.1, whereas taxes are calculated based on the dividend payments from the companies. Adding

[96] Companies taxed with three percent on dividends.

[97] Companies taxed with 18 percent on dividends.

these costs together give yearly costs between one and two percentage points, with the exception of 2008, 2015 and 2019 with 3.02, 0.93 and 0.95 percentage points, respectively.

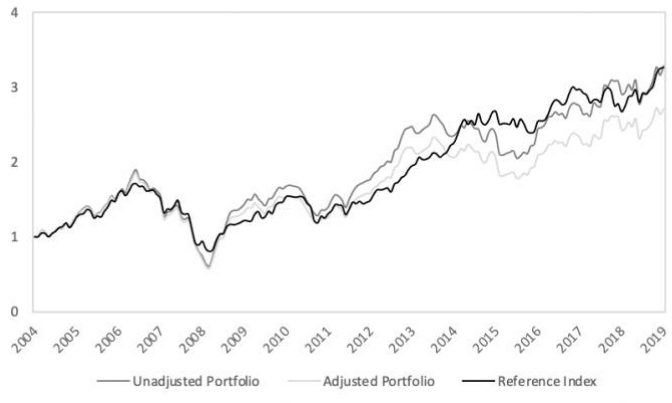
Table 14 - Adjusted Raw Returns for High Dividend-Yield Strategy[98]

Year	Returns	Transaction costs	Taxes	Adjusted returns
2005	28.59	0.56	0.58	27.45
2006	22.58	0.54	0.54	21.50
2007	-1.07	0.61	0.60	-2.28
2008	-52.08	0.74	2.28	-55.10
2009	92.85	0.95	0.21	91.69
2010	16.74	0.44	0.59	15.71
2011	-16.75	0.65	0.82	-18.23
2012	26.55	0.46	0.51	25.58
2013	39.86	0.50	0.57	38.79
2014	-4.79	0.44	0.64	-5.86
2015	0.31	0.51	0.42	-0.62
2016	3.25	0.51	0.80	1.94
2017	12.51	0.52	0.56	11.43
2018	6.00	0.50	0.95	4.56
2019	12.86	0.00	0.95	11.91

These adjusted returns require to be analysed in light of the compounded returns over the period, which are illustrated in ***Figure 4*** and ***Table 15***. These illustrations include the adjusted and unadjusted high dividend-yield portfolios as well as the reference index. The figure expresses the effect these market imperfections have on the compounded returns. We note from the table that the return over the period is reduced from 229 to 167 percent. This means a decrease of 62 percentage points over the 15-year investment period. With transaction costs and taxes normally summed to between one and two percentage points, this illustrates the power of compounding causing these market imperfections to destroy value over time for the investor.

[98] Numbers in the table are written in percent.

Figure 4 - Adjusted Portfolio Performance for High Div. Yield Strategy



Year	Unadj. Port.	Adj. Port.	Ref. Index
2004	1.00	1.00	1.00
2005	1.29	1.27	1.26
2006	1.58	1.55	1.58
2007	1.56	1.51	1.51
2008	0.75	0.68	0.94
2009	1.44	1.30	1.22
2010	1.68	1.51	1.54
2011	1.40	1.23	1.31
2012	1.77	1.55	1.48
2013	2.48	2.15	1.95
2014	2.36	2.02	2.25
2015	2.37	2.01	2.67
2016	2.44	2.05	2.54
2017	2.75	2.28	2.97
2018	2.92	2.39	2.67
2019	3.29	2.67	3.26

Table 15 - Adjusted Cumulative Returns for High Div. Yield Strategy[99]

By subtracting transaction costs and taxes from the unadjusted returns the portfolios do not outperform the reference index based on adjusted raw returns. Until 2013 the adjusted portfolios and the reference index follow each other quite closely with the former leading at this point. However, after this point, the reference index has a more rapid increase in value, and the high dividend-yield strategy never recovers to the same values.

6.3.3.2 Price-to-Earnings Strategy

Table 16 is presented in the same way as ***Table 14*** for the high dividend-yield portfolios. We note that the tax costs for the price-to-earnings strategy are lower every year compared to the high dividend-yield strategy, which are reasonable since only dividends are subject to tax. In addition, we also note that transaction costs for the price-to-earnings strategy are higher than for the high dividend-yield strategy in the majority of years, caused by the higher turnover for the price-to-earnings strategy.

[99] When investing 1 NOK on the last trading day of 2004.

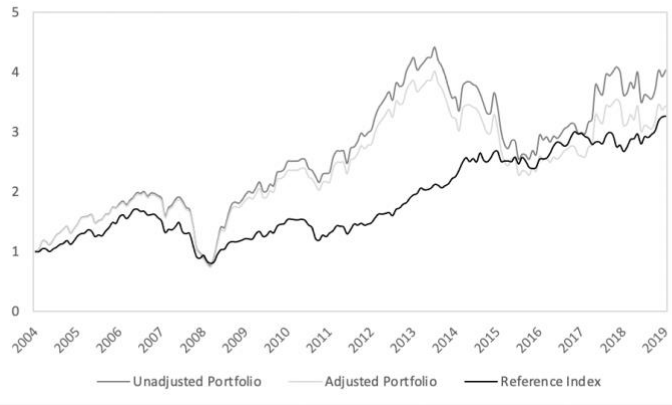
Table 16 - Adjusted Raw Returns for Price-to-Earnings Strategy[100]

Year	Return	Transaction costs	Taxes	Adjusted returns
2005	46.35	0.60	0.31	45.44
2006	23.58	0.46	0.36	22.77
2007	4.90	0.40	0.36	4.14
2008	-51.84	0.73	1.16	-53.73
2009	114.40	0.96	0.03	113.41
2010	28.24	0.74	0.28	27.22
2011	-7.32	0.63	0.44	-8.39
2012	30.86	0.66	0.25	29.96
2013	39.46	0.75	0.33	38.38
2014	-15.61	0.73	0.37	-16.71
2015	-4.47	0.52	0.20	-5.18
2016	-13.75	0.83	0.77	-15.36
2017	1.47	0.80	0.46	0.21
2018	20.82	0.82	0.24	19.76
2019	11.48	0.00	0.74	10.74

Figure 5 and ***Table 17*** below illustrate the compounded returns over the investment period and include the adjusted and unadjusted price-to-earnings portfolios as well as the reference index. When taking transaction costs and taxes into account, the return for the price-to-earnings strategy decreases with 62 percentage points from 304 to 242 percent. As in the case for the high dividend-yield strategy, this illustrates how costs associated with these market imperfections destroy value over the 15-year investment period due to compounding. After adjusting the raw returns for these market imperfections, we note that the price-to-earnings strategy still has slightly higher returns than the reference index. However, as the difference is small and the returns are not risk-adjusted, this provides little information on performance.

[100] Numbers in the table are written in percent.

Figure 5 - Adjusted Portfolio Performance for P/E Strategy



Year	Unadj. Port.	Adj. Port.	Ref. Index
2004	1.00	1.00	1.00
2005	1.46	1.45	1.26
2006	1.81	1.79	1.58
2007	1.90	1.86	1.51
2008	0.91	0.86	0.94
2009	1.96	1.84	1.22
2010	2.51	2.34	1.54
2011	2.33	2.14	1.31
2012	3.05	2.78	1.48
2013	4.25	3.85	1.95
2014	3.59	3.21	2.25
2015	3.43	3.04	2.67
2016	2.95	2.57	2.54
2017	3.00	2.58	2.97
2018	3.62	3.09	2.67
2019	4.04	3.42	3.26

Table 17 - Adjusted Cumulative Returns for P/E Strategy[101]

6.4 Risk-Adjusted Returns

While the comparison of raw returns in section 6.2 and the raw returns adjusted for transaction costs and taxes in section 6.3 gives some information regarding the performance of the investment strategies, little information concerning the level of risk contained in the portfolios is provided. As previously mentioned, the single-factor model (Jensen, 1967), Fama and French (1993) three-factor-model and Carhart (1997) four-factor model are based on that stock returns are subject to a set of risk factors. The investment strategies presented in this thesis may be subject to priced risk driven by these factors. Therefore we examine factor-adjusted returns to evaluate strategy performance. In addition to using the single and multi-factor regression models, we will use two commonly used risk-adjustment measures. These are created for comparison purposes to assess the risk incorporated in the raw returns presented above. In section 6.4.1, the raw returns excluding transaction costs and tax adjustments, are risk-adjusted using the Sharpe ratio, whereas the same raw returns are risk-adjusted using the Treynor index in section 6.4.2. In section 6.4.3 and 6.4.4, the single-factor, FF3 and FFC4 regression models are applied to analyse the returns both before and after adjusting for transaction costs and taxes.

[101] When investing 1 NOK on the last trading day of 2004.

6.4.1 Sharpe Ratio

Section 3.3.1 presented the theory behind the Sharpe ratio. ***Table 18*** shows the Sharpe ratios of the three investment strategies and the reference index. When comparing the results of the investment strategies to the reference index in the period 2005-2019, the reference index is superior for five of the 15 years using the Sharpe ratio.

Table 18 - Sharpe Ratio

	High Div Yield	P/B	P/E	Ref.Index
2005	1.64	0.72	2.18	1.70
2006	1.39	2.37	1.39	1.51
2007	-0.33	-0.65	0.06	-0.82
2008	-2.01	-1.76	-1.63	-1.47
2009	2.39	1.77	2.73	1.15
2010	1.06	0.54	1.61	1.60
2011	-1.60	-1.69	-0.92	-1.01
2012	1.66	0.11	1.68	0.81
2013	4.54	5.04	3.19	3.19
2014	-0.73	0.08	-1.54	2.00
2015	-0.05	-0.24	-0.26	1.48
2016	0.16	-0.20	-0.59	-0.44
2017	1.52	0.98	0.07	2.17
2018	0.35	-1.00	0.83	-1.05
2019	0.80	1.10	0.57	2.14

The price-to-earnings strategy obtains the highest Sharpe ratio for seven years during the 15-year investment period, beating the reference index for eight years. The Sharpe ratio for the price-to-earnings strategy delivers the best result in a majority of the years prior to 2014, and a lower Sharpe ratio than the reference index for the rest of the 15-years investment period, with the exemption of 2018. This can be explained by high exposure to companies within the oil and oil service sector which had a turbulent period after the oil price started to decline in 2014 as previously mentioned. We note from ***Table 11*** that the price-to-earnings strategy has a higher standard deviation than the reference index, which leads to a lower risk-adjusted return in some years, when using the Sharpe ratio.

The DoD strategy obtains the highest Sharpe ratio in one of the 15 years, beating the reference index for six years. From ***Table 18*** we see that there are signs of a “bounce-back” effect in the

returns, where the Sharpe ratio for the strategy rebound after a sharp decline in the prior year, especially in the years 2009 and 2012.

The price-to-book strategy beats the reference index for five years. As seen in ***Table 11***, the price-to-book has the highest standard deviation. This leads to a lower value for the Sharpe ratio compared to the price-to-earnings strategy and the reference index when adjusting for the volatility in the returns.

6.4.2 Treynor Index

Table 19 - Treynor Index

	High Div Yield	P/B	P/E	Ref.Index
2005	0.24	0.11	0.35	0.23
2006	0.22	0.40	0.25	0.22
2007	-0.04	-0.10	0.01	-0.09
2008	-0.70	-0.65	-0.57	-0.42
2009	0.62	0.42	0.68	0.26
2010	0.25	0.09	0.26	0.23
2011	-0.34	-0.40	-0.20	-0.18
2012	0.29	0.02	0.33	0.12
2013	0.68	0.75	0.38	0.29
2014	-0.79	0.01	-1.34	0.14
2015	-0.01	-0.07	-0.08	0.18
2016	0.03	-0.04	-0.10	-0.05
2017	0.18	0.35	0.04	0.16
2018	0.05	-0.15	0.20	-0.11
2019	0.10	0.19	0.07	0.22

In the same manner as the CAPM, the Treynor index adjusts for systematic risk through the beta. When using beta, we only adjust for market risk in opposition to using standard deviation which adjusts for both systematic and idiosyncratic risk.

From ***Table 19*** we see that the price-to-earnings strategy delivers the best risk-adjusted returns in terms of the Treynor index for six years, and is superior to the reference index in eight of 15 years. This means that it delivers higher returns per unit of additional risk compared to the reference index for these years. As for the Sharpe ratio, we see that the price-to-earnings strategy performs best compared to the reference index in the majority of years prior to 2014. In the last years of the investment period it achieves lower values in terms of the Treynor index

than the reference index, with the exception of 2018. Thus, this strategy does not create higher excess returns compared to the reference index for each additional unit of risk undertaken by the investor in the last years of the investment period.

The DoD strategy beats the reference index for ten years, four more years than when we adjusted with the Sharpe ratio. We see that it often beats the reference index the same years as the price-to-earnings strategy dominates in terms of the value for the Treynor index. This means that the investor is rewarded for undertaking additional risk when investing in this strategy these years.

The price-to-book strategy performs worse when risk-adjusting the returns using the Treynor index, which is contrary to the DoD strategy. It only beats the reference index for four years. Why the price-to-book strategy performs worse while the DoD strategy performs better is unclear. However, a possible explanation is that the price-to-book strategy is subject to less idiosyncratic risk compared to the high dividend-yield strategy. Hence, the DoD strategy performs better when a measure that only considers systematic risk is applied.

The reference index performs best in the years of a declining market, such as 2008 and 2014. When investing in the reference index the investor is fully diversified and not subject to idiosyncratic risk, which seems to be an advantage in a turbulent market. From our dataset, we see that the price-to-book and price-to-earnings strategies have on average higher betas than the high dividend-yield strategy. We note that these strategies are subject to higher systematic risk than the high dividend-yield strategy. For the price-to-earnings strategy this is logical, as it creates high raw returns compared to the other strategies and the reference index, especially prior to 2014 as previously mentioned. Consequently, it performs better than the other strategies in terms of the Treynor index since the returns are high compared to the level of risk. For the price-to-book strategy the result is the opposite. It delivers low raw returns compared to risk, and thus this strategy underperforms when we risk-adjust the returns with the Treynor index.

6.4.3 Single and Multi-Factor Models

Table 20 displays the regression results from the single-factor, FF3 and FFC4 regression models. In the single-factor model, we find that the average performance of the three strategies measured by the annualised alpha, is 1.00 percent, -3.30 percent and 3.60 percent, respectively. These alphas are not statistically significant and thus we cannot state that these strategies have

returns that differ from what is expected by the market. Hence, the returns for the strategies when analysed with the single-factor model is in line with market expectations (Sharpe, 1964; Lintner, 1965; Mossin, 1966; Treynor[102]). We note that all three strategies are loaded positively against the market factor and statistically significant on a one percent level. This means that a large percent of the returns come from direct exposure to the systematic risk of the market. The R-squared varies from 49 percent to 60 percent for the three regressions, meaning that our strategies vary with the market fluctuations to some extent.

For the FF3 regressions, we note that the strategies do not create higher returns than expected by the market when controlling for the exposure against the factors in this model. All strategies are exposed to the market factor on a one percent significance level. We note that all strategies also are loaded against small companies, but only the price-to-book factor has a significant coefficient. Based on the previous discussion about the price-to-book strategy, this is in line with expectations. The price-to-book portfolios often include asset-heavy companies that experience a sharp decline in stock prices, leading to a low market capitalisation and thus a significant exposure against small companies. Further, the regressions show that all three strategies are loaded against companies with low price-to-book ratios, HML. Moreover, this indicates that the companies included in the portfolios for each strategy will have the same characteristics, thus a low price-to-book ratio. The price-to-book strategy obtains the largest loading against the HML factor, which is natural since this is the foundation for this investment strategy. The price-to-earnings strategy has a lower, but still statistically significant loading against this factor. Thus, this implies that the price-to-earnings strategy has some similarity to the price-to-book strategy, which we find logical since both strategies seek a low price compared to a financial characteristic. Additionally, since both strategies have a positive exposure against HML, holding all other factors in the regression constant, this implies that the returns will fluctuate with each other. However, the price-to-earnings strategy's returns will fluctuate less due to a lower loading against HML compared to the price-to-book strategy. The DoD strategy has the lowest loading against HML, meaning that it fluctuates less with this risk-factor compared to the other two strategies. We note from Rea (1977) that a low price-to-book ratio is one of Graham's value criteria. Since the other two strategies are value strategies as well, we find it logical that they will be loaded against HML to some extent.

[102] The article by Treynor was never published.

We note that the R-squared increases compared to the single-factor model when adding the SMB and HML factors in our regressions. This means that these two variables contribute positively to explaining the returns from these three value strategies.

When we run the FFC4 regressions we obtain a significant positive alpha on a five percent level for two of our strategies, the DoD and the price-to-earnings strategies. The DoD strategy achieves an annual alpha of 5.60 percent whereas the price-to-earnings strategy achieves an alpha of 9.40 percent. We note that the alphas in the regressions without removing outliers are 8.30 and 11.10 percent[103], respectively. However, alphas are still significant on a five percent level when outliers are included. This means that these strategies achieve higher returns than expected from the market when adding an extra explanatory risk factor in the FFC4 regression. We see that all three strategies are negatively loaded against the momentum factor, meaning that we invest in last year's losers (Carhart, 1997). The three strategies in this thesis try to buy value stocks that have underperformed the market and thus trading at a low price compared to the financial factors of interest. When the price of a value stock is low, the dividend-yield will increase assumed that dividends are held fixed. In addition, the price-to-earnings ratio will decrease and the same goes for the price-to-book ratio. The investor buys the companies which trade at the highest dividend-yield, lowest price-to-earnings and price-to-book ratios each year. Thus, the strategies will naturally be negatively loaded against the momentum factor UMD. It is the exposure to this factor that leads to the positive and significant alphas for these strategies. When controlling for the momentum factor, which our strategies are negatively loaded against, the intercept is positively affected for all the strategies. Moreover, it becomes significant on a five percent level for the high dividend-yield and the price-to-earnings strategies.

The R-squared increases for all three strategies when the momentum factor is added to our regressions, meaning that this factor explains some of the variance in the returns obtained by the value strategies. The loadings against the other factors are in line with the findings of the FF3 regression. The DoD strategy has the highest R-squared of 66.70 percent. While the price-to-earnings strategy obtains a higher alpha than the DoD strategy, we note that this strategy has the lowest R-squared. Omitted factors explain a higher part of the variance in returns not explained in this model compared to the other strategies. For this reason, we point out that

[103] See Appendix F.

there may be other factors not included in this model that explains the statistically significant difference in returns, and thus the positive alphas found in these regressions.

Based on the findings in this section, we will run new regressions on the DoD and price-to-earnings strategies in the following section to see which effect transaction costs and taxes have on the alphas and the exposure against the different risk factors from ***Table 20***.

Table 20 - Factor Models

Regressions for the single-factor, FF3 and FFC4 models for the whole period are summarised in this table. Newey and West adjusted standard errors are used with five lags for the t-statistics in parentheses. DW is the Durbin Watson d-statistic. Alphas are annualised. Outliers are removed to ensure more precise estimates.

	High Dividend-Yield Strategy			Price-to-Book Strategy			Price-to-Earnings Strategy		
	CAPM	FF3	FFC4	CAPM	FF3	FFC4	CAPM	FF3	FFC4
α	0.010	0.021	0.056**	-0.033	-0.010	0.014	0.036	0.047	0.094**
	(0.35)	(0.80)	(2.00)	(-0.83)	(-0.29)	(0.40)	(0.94)	(1.25)	(2.38)
β_{MKT}	0.834***	0.844***	0.781***	1.053***	1.089***	1.047***	0.891***	0.892***	0.806***
	(17.19)	(16.48)	(14.92)	(14.90)	(15.16)	(13.53)	(11.37)	(10.64)	(11.26)
β_{SMB}	-	0.201	0.124	-	0.528***	0.477***	-	0.136	0.032
		(1.65)	(1.00)		(4.84)	(4.15)		(0.92)	(0.23)
β_{HML}	-	0.451**	0.384**	-	0.830***	0.785***	-	0.595***	0.505***
		(3.53)	(3.07)		(5.94)	(5.72)		(4.23)	(3.67)
β_{UMD}	-	-	-0.228***	-	-	-0.154**	-	-	-0.308***
			(-3.87)			(-1.92)			(-3.12)
Observations	180	180	180	180	180	180	180	180	180
Adjusted R^2	0.601	0.646	0.667	0.528	0.637	0.640	0.488	0.535	0.561
DW	1.60	1.64	1.87	1.84	1.86	1.89	1.77	1.78	1.97

**p-value < 0.10, **p-value < 0.05, ***p-value < 0.01*

6.4.4 Single and Multi-Factor Models – Adjusted

The regression results from the three different factor models for the DoD and price-to-earnings strategies, with returns adjusted for transaction costs and taxes, are summarised in ***Table 21***. Moreover, the regression coefficients MKT and HML are subject to very small changes and are still significant at the one percent level both before and after adjusting for transaction costs and taxes. This applies for the single-factor model and the FF3 model. We note that the SMB factor is still positive but insignificant in these regressions, meaning these two strategies are not significantly loaded against small companies. The most interesting difference in the regressions in ***Table 20*** and ***Table 21*** is the decrease in alpha for the two strategies when

controlling for momentum in the FFC4 regression. We note that alpha for the high dividend-yield strategy decreases from 5.60 percent to 4.10 percent and is no longer statistically significant. Thus, we cannot state that the DoD strategy creates abnormal returns compared to the reference index when adjusting for MKT, SMB, HML and UMD. The transaction costs and taxes calculated in section 6.3 eliminate the alpha for this strategy. For the price-to-earnings strategy the alpha decreases as well, but is still statistically significant on a five percent level. This strategy, adjusted for transaction costs and taxes, achieves an abnormal return of 8.60 percent annually. Thus, when controlling for the four risk factors included in the FFC4 regression, this strategy obtains 8.60 percent higher return than what is expected by the market. Additionally, the results deviate more for the regressions adjusted for transaction costs and taxes with and without outliers compared to the regressions in ***Table 20***. Without removing outliers, the DoD strategy's alpha is not eliminated by transaction costs and taxes and is still statistically significant. In this case, the alphas for the DoD and price-to-earnings strategies are 7.40 and 10.30 percent, respectively[104]. However, there are higher uncertainties regarding the interpretations of the regression models with outliers due to the possibility of inaccurate and less robust regressions. Thus, we believe this is in favour of using the regression models without outliers, indicating that the alpha is not statistically significant for the DoD strategy and 8.60 percent for the price-to-earnings strategy. Moreover, the abnormal return of 8.60 percent obtained annually for the price-to-earnings strategy may be due to the use of a misspecified regression model. Another possibility for why the strategy obtains an alpha, is that mispriced assets are included in the portfolios, meaning that there is no correct model.

Although R-squared decreases, the change in the FFC4 regression is minimal for the DoD strategy. The model explains 64.60 percent of the variation of portfolio returns, the dependent variable. For the price-to-earnings strategy, the R-squared decreases slightly as well, and the FFC4 regression model now explains 55 percent of the change in the portfolio returns.

[104] See Appendix F.

Table 21 - Factor Models Adjusted for Transaction Costs and Taxes

Regressions for the single-factor model, FF3 and FFC4 for the whole period are summarised in this table. Newey and West adjusted standard errors are used with five lags for the t-statistics in parentheses. Alphas are annualised. Outliers are removed to ensure more precise estimates.

	High Dividend-Yield Strategy			Price-to-Earnings Strategy		
	CAPM	FF3	FFC4	CAPM	FF3	FFC4
α	-0.007	0.005	0.041	0.026	0.038	0.086**
	(-0.22)	(0.18)	(1.41)	(0.66)	(0.99)	(2.17)
β_{MKT}	0.840***	0.855***	0.790***	0.880***	0.883***	0.796***
	(16.76)	(15.62)	(14.23)	(11.02)	(10.43)	(11.07)
β_{SMB}	-	0.246	0.167	-	0.170	0.064
		(1.45)	(0.98)		(0.97)	(0.39)
β_{HML}	-	0.477**	0.408**	-	0.609**	0.517**
		(3.43)	(2.96)		(4.18)	(3.62)
β_{UMD}	-	-	-0.237***	-	-	-0.315***
			(-3.94)			(-3.21)
Observations	180	180	180	180	180	180
Adjusted R^2	0.574	0.625	0.646	0.472	0.522	0.550

**p-value < 0.10, **p-value < 0.05, ***p-value < 0.01*

7. Conclusion

In this thesis, we have examined the DoD, price-to-book and price-to-earnings value investment strategies in the Scandinavian stock market.

Initially, we analysed the strategies' performance against the reference index with respect to raw returns. Based on compounded raw returns, the price-to-earnings strategy dominates the reference index with 78 percentage points over the 15-year investment period. The DoD strategy obtains more or less identical compounded raw returns as the reference index over the same period, achieving 229 and 226 percent raw returns, respectively. The price-to-book strategy underperforms the reference index based on compounded raw returns and show no signs of being able to create excess returns when applied to the Scandinavian stock market in this study.

After adjusting raw returns for transaction costs and taxes, the DoD strategy obtains 62 percentage points lower compounded returns over the investment period and is now achieving lower returns than the reference index. When making the same cost adjustments for the price-to-earnings strategy, it still obtains slightly higher compounded returns than the reference index, with 16 percentage points.

Further, we risk-adjusted the returns using the Sharpe ratio and Treynor index. The market seems to outperform our strategies when the stock market declines rapidly based on the Sharpe ratio and Treynor index. We note that the price-to-earnings strategy has a higher Sharpe ratio than the reference index in eight of the years, while the DoD strategy has a higher ratio for six years. The price-to-book strategy has a higher Sharpe ratio than the reference index for five years. We note from our analysis that the DoD strategy obtains better results when risk-adjusting with Treynor index compared to the Sharpe ratio. The price-to-book strategy performs worse in terms of the Treynor index, beating the reference index four times.

When risk-adjusting using the single-factor and FF3 regression models, we find that the strategies obtain returns as expected by the market based on the exposure to risk factors included in these models. When adding the momentum factor in the FFC4 model we find annual positive alphas of 9.40 and 5.60 percent for the price-to-earnings and DoD strategies, respectively. However, by regressing the returns adjusted for transaction costs and taxes the alpha of the DoD strategy disappears and have no longer statistically significant abnormal

risk-adjusted returns. This is in line with Hirschey (2000) who argues that the DoD strategy has volatile returns, which over time pose no threat to the efficient market hypothesis. This is also in line with previous research done by McQuenn et al. (1997). For the price-to-earnings strategy, the alpha decreases to 8.60 percent annually but is still significant on a five percent level. We note that the alphas obtained in this thesis are caused by either the use of a misspecified model or due to mispriced assets in the constructed portfolios. If the assets included in the portfolios are mispriced, this indicates that the price-to-earnings strategy obtains abnormal returns when controlling for the risk factors in the FFC4 model, even when accounting for transaction costs and taxes. Nevertheless, we note that there may be other factors explaining the difference in returns not captured in this thesis. In addition, for the reasons mentioned in section 5.4.2, we are careful in claiming that the price-to-earnings strategy is superior to the market.

7.1 Further Research

The results obtained in this thesis raise several questions opening for further research concerning this topic. Our findings indicate that a Norwegian based investor is able to create a positive alpha when following a price-to-earnings investment strategy. Since this thesis follows the portfolio selection process proposed by Slatter we only include ten stocks each year (Dorfman, 1988). Also, we only create long portfolios. This raises the question of whether the alpha would still be statistically significant for the price-to-earnings strategy if another portfolio selection process was used, e.g., more in line with Fama and French (1993, 2015) creating larger portfolios with both long and short positions.

By following the portfolio selection process of Slatter, we also apply equal-weights instead of value-weights for our portfolios (Dorfman, 1988). When using an equal-weighting scheme the investor needs to trade more in the market to rebalance the portfolio and thus obtain higher transaction costs, in turn diminishing the returns. We do not assess value-weighting in this thesis and thus leave this open to further research.

Lastly, Fama and French (2001) state that the number of companies paying dividends is decreasing and many companies choose to distribute retained earnings through repurchase or other cash distribution methods (Bagwell & Shoven, 1989; Grullon & Michely, 2002). Implementing a criterion that measures total payout could be more efficient than solely looking at dividend-yield, even though recent economic research still finds increasing dividends

(Denis & Osobov, 2008; Michaely & Moin, 2020). As this thesis tests the DoD strategy (amongst others), we do not assess this problem, opening it for further research.

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Appendices

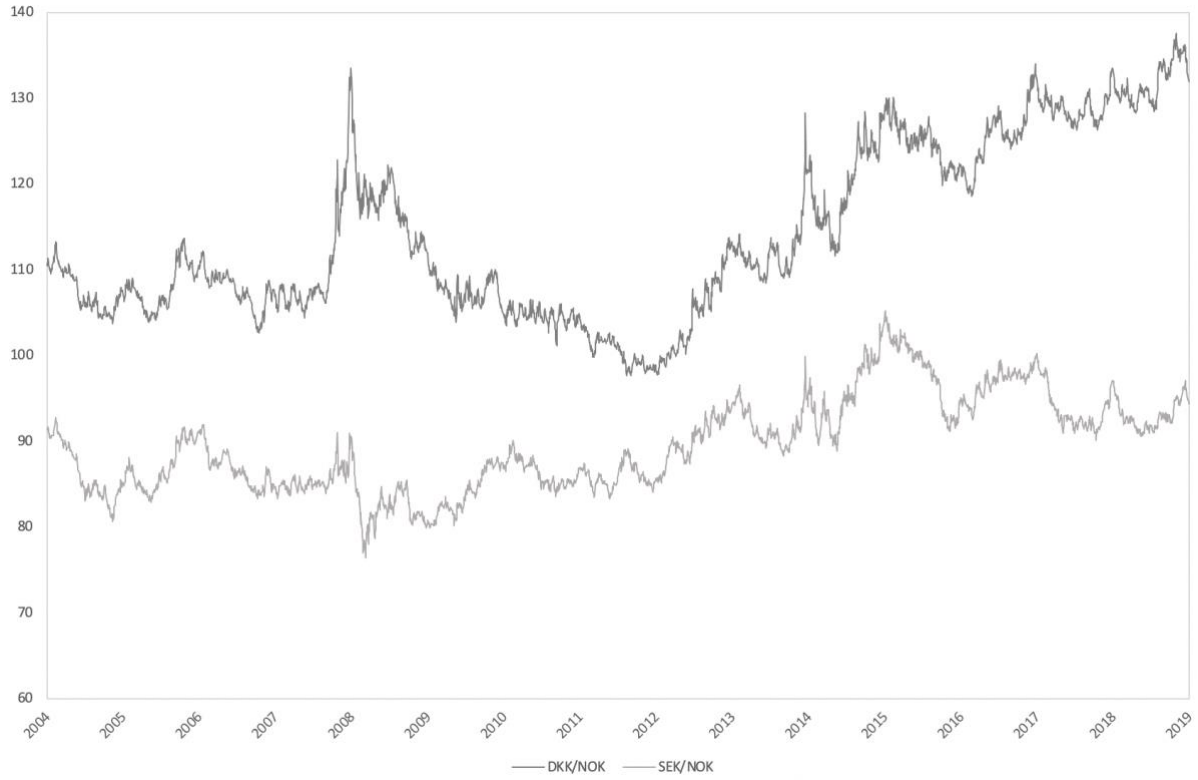
Appendix A: International Findings of the DoD Strategy

Appendix A presents a summarised table of the returns obtained from different international studies done on the DoD strategy discussed in section 2.1.

Author(s)	Market	Sample Period	DoD Return	Market Return	Excess Return	Risk Adjusted
Slatter (1988)	US	1972-1988	18.39	10.80	7.59	No
O'Higgins and Downes (1991)	US	1973-1991	16.61	10.43	6.18	No
Knowles and Petty (1992)	US	1957-1990	14.20	10.40	3.80	No
McQueen, Shields and Thorley (1997)	US	1946-1995	16.77	13.71	3.06	S.D., Sharpe
Visscher and Filbeck (1997)	UK	1985-1994	9.48	11.58	-2.10	S.D., Sharpe, Treynor
Domian, Louton and Mossman (1998)	US	1964-1997	16.06	10.91	4.76	No
Hirschey (2000)	US	1961-1998	14.16	12.39	1.77	S.D.
Da Silva (2001)	Argentina	1994-1999	2.32	1.66	0.66	S.D., Sharpe
	Brasil	1994-1999	4.64	8.90	-4.26	S.D., Sharpe
	Chile	1994-1999	4.30	1.21	3.09	S.D., Sharpe
	Colombia	1994-1999	-0.83	-1.39	0.56	S.D., Sharpe
	Mexico	1994-1999	2.91	2.22	0.69	S.D., Sharpe
	Peru	1994-1999	2.70	2.49	0.21	S.D., Sharpe
	Venezuela	1994-1999	4.30	3.05	1.25	S.D., Sharpe
Visscher and Filbeck (2003)	Canada	1988-1997	16.57	9.95	6.62	Sharpe, Treynor
Gwilym, Seaton and Thomas (2005)	UK	1980-2001	20.64	5.53	2.11	S.D.
Rinne and Vähämaa (2011)	Finland	1988-2008	15.5	11.00	4.50	Sharpe, Treynor, Fama-French

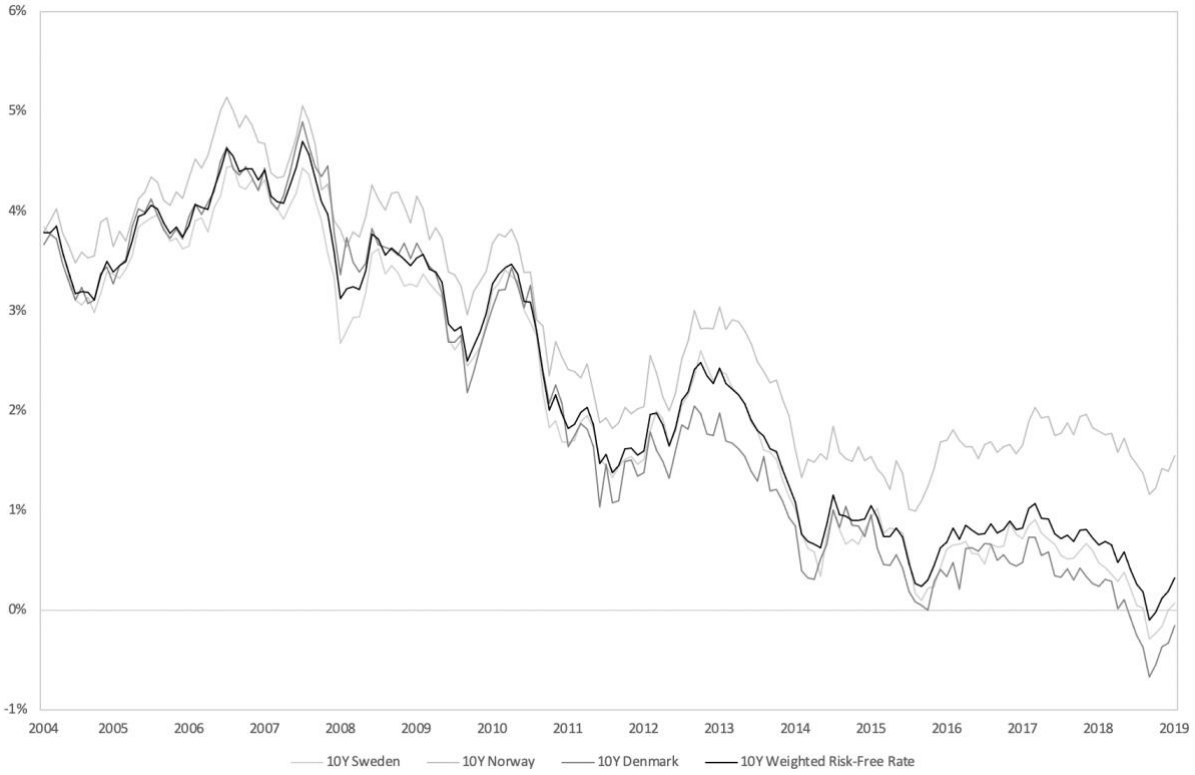
Appendix B: Exchange Rates

Appendix B illustrates the NOK against the SEK and DKK. The exchange rates will have an effect on the returns for the Norwegian based investor in this thesis.



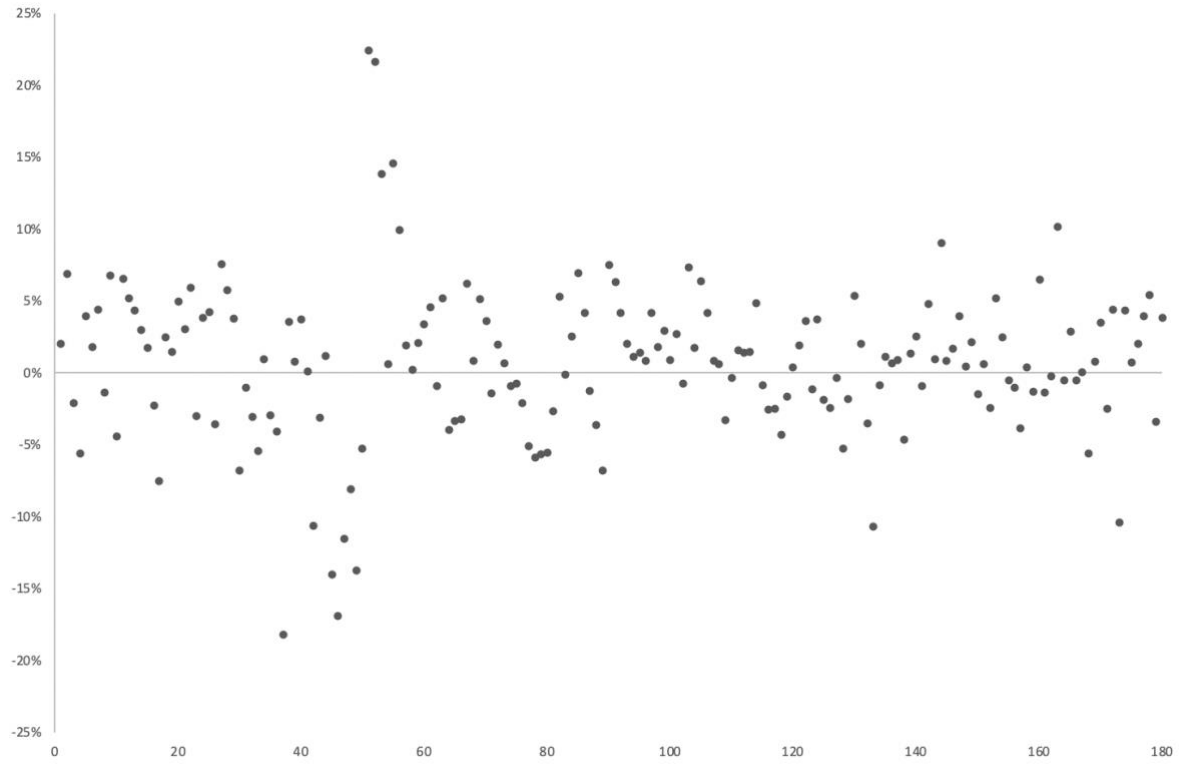
Appendix C: 10-Year Risk-Free Rates

Appendix C illustrates the 10-year government bond rates for Norway, Sweden, Denmark and the weighted risk-free rate constructed in this thesis.

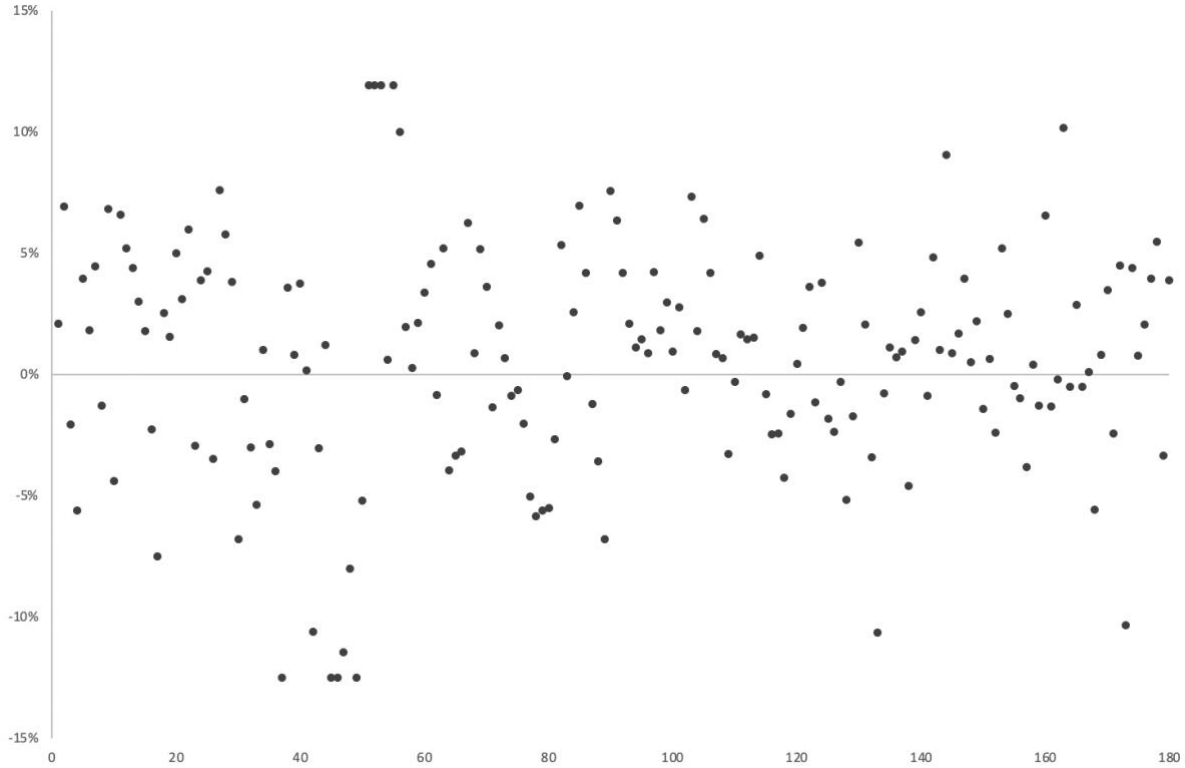


Appendix D: Plots of Monthly Returns

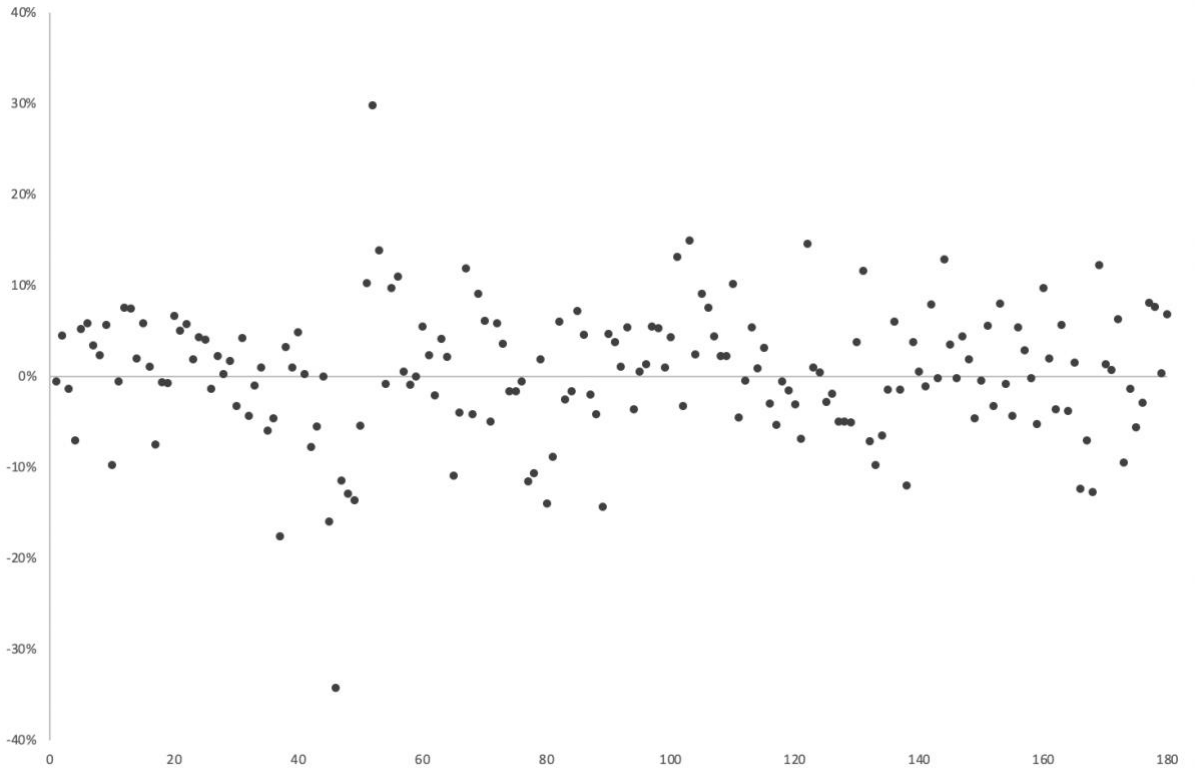
Appendix D1 - High Dividend-Yield Strategy Before Removing Outliers



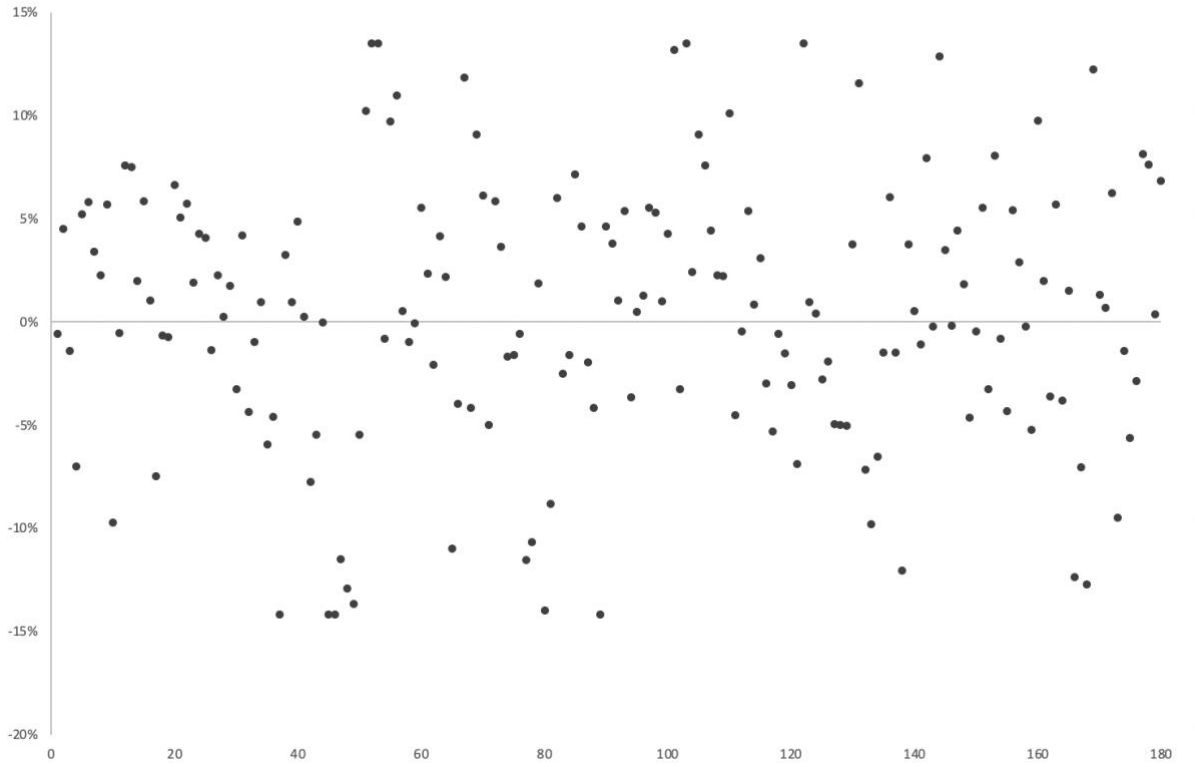
Appendix D2 - High Dividend-Yield Strategy After Removing Outliers



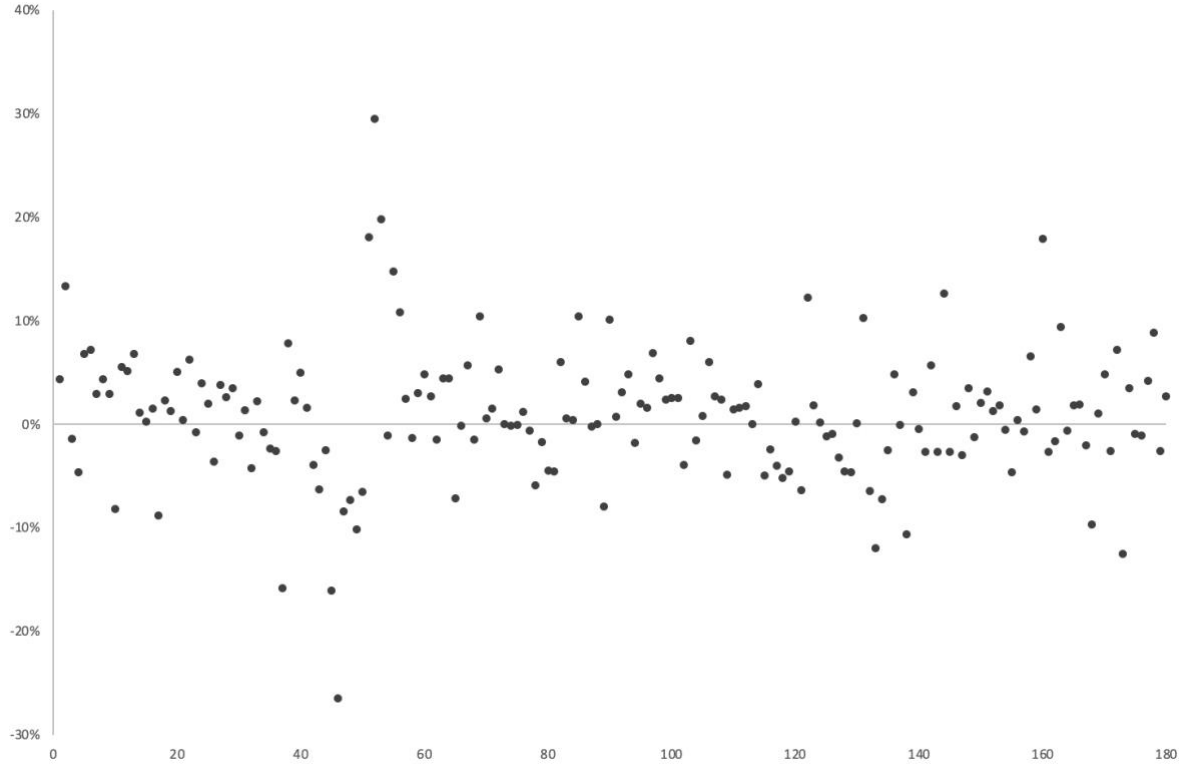
Appendix D3 - Price-to-Book Strategy Before Removing Outliers



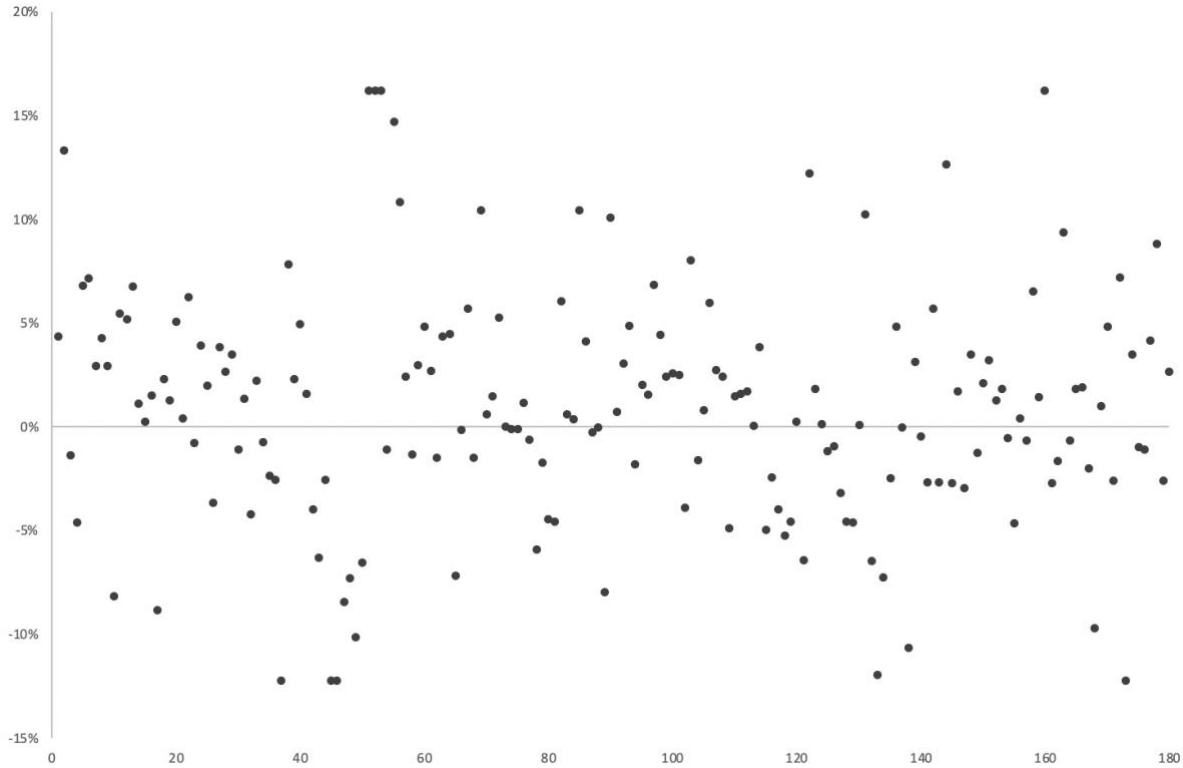
Appendix D4 - Price-to-Book Strategy After Removing Outliers



Appendix D5 - Price-to-Earnings Strategy Before Removing Outliers



Appendix D6 - Price-to-Earnings Strategy After Removing Outliers



Appendix E: Breusch-Pagan / Cook-Weisberg Test

Below are the results from the Breusch-Pagan / Cook-Weisberg test. The test checks our sample for heteroskedasticity and thus if the standard errors are biased (Stock & Watson, 2011). If the H_0 can be rejected this states that we have a problem with heteroskedasticity.

H_0: Constant variance, meaning homoskedasticity.

Appendix E1 - Breusch-Pagan / Cook-Weisberg Test for the DoD Strategy

	High Dividend-Yield Strategy		
	CAPM	FF3	FFC4
chi2	3.26*	0.28	0.31
p-value	0.0710	0.5991	0.5806

**p-value < 0.10, **p-value < 0.05, ***p-value < 0.01*

Appendix E2 - Breusch-Pagan / Cook-Weisberg Test for the P/B Strategy

	Price-to-Book Strategy		
	CAPM	FF3	FFC4
chi2	3.09*	0.14	2.94*
p-value	0.0786	0.7058	0.0865

**p-value < 0.10, **p-value < 0.05, ***p-value < 0.01*

Appendix E3 - Breusch-Pagan / Cook-Weisberg Test for the P/E Strategy

	Price-to-Earnings Strategy		
	CAPM	FF3	FFC4
chi2	5.80**	3.04*	0.66
p-value	0.0160	0.0813	0.4168

**p-value < 0.10, **p-value < 0.05, ***p-value < 0.01*

Appendix F: Factor Models Without Adjusting for Outliers

Appendix F1 - Factor Models with Outliers

Regressions for the single-factor, FF3 and FFC4 models for the whole period are summarised in this table. Newey and West adjusted standard errors are used with five lags for the t-statistics in parentheses. Alphas are annualised.

	High Dividend-Yield Strategy			Price-to-Book Strategy			Price-to-Earnings Strategy		
	CAPM	FF3	FFC4	CAPM	FF3	FFC4	CAPM	FF3	FFC4
α	0.010	0.020	0.083**	-0.053	-0.027	0.029	0.022	0.034	0.111**
	(0.30)	(0.66)	(2.31)	(-1.22)	(-0.78)	(0.83)	(0.49)	(0.79)	(2.31)
β_{MKT}	0.947***	0.959***	0.847***	1.255***	1.303***	1.200***	1.063***	1.075***	0.936***
	(11.40)	(10.53)	(12.66)	(15.44)	(13.43)	(15.25)	(9.38)	(8.18)	(10.81)
β_{SMB}	-	0.212	0.076	-	0.634***	0.509***	-	0.231	0.064
		(1.51)	(0.56)		(4.09)	(3.54)		(1.17)	(0.40)
β_{HML}	-	0.430**	0.312**	-	0.782***	0.674***	-	0.545***	0.400***
		(3.05)	(2.51)		(4.96)	(4.66)		(3.76)	(2.79)
β_{UMD}	-	-	-0.405***	-	-	-0.371***	-	-	-0.500***
			(-4.03)			(-4.34)			(-3.49)
Observations	180	180	180	180	180	180	180	180	180
Adjusted R^2	0.602	0.634	0.687	0.593	0.685	0.710	0.540	0.575	0.632

**p-value < 0.10, **p-value < 0.05, ***p-value < 0.01*

Appendix F2 - Adjusted Factor Models with Outliers

Regressions for the single-factor model, FF3 and FFC4 for the whole period are summarised in this table. Newey and West adjusted standard errors are used with five lags for the t-statistics in parentheses. Alphas are annualised.

	High Dividend-Yield Strategy			Price-to-Earnings Strategy		
	CAPM	FF3	FFC4	CAPM	FF3	FFC4
α	-0.003	0.010	0.074**	0.012	0.025	0.103**
	(-0.07)	(0.31)	(2.05)	(0.26)	(0.58)	(2.14)
β_{MKT}	0.933***	0.950***	0.835***	1.052***	1.066***	0.926***
	(11.12)	(10.24)	(12.29)	(9.27)	(8.05)	(10.64)
β_{SMB}	-	0.267	0.127	-	0.266	0.096
		(1.41)	(0.71)		(1.19)	(0.51)
β_{HML}	-	0.464**	0.343**	-	0.600**	0.412**
		(3.05)	(2.53)		(3.72)	(2.79)
β_{UMD}	-	-	-0.415***	-	-	-0.507***
			(-4.16)			(-3.54)
Observations	180	180	180	180	180	180
Adjusted R^2	0.569	0.610	0.664	0.525	0.564	0.622

**p-value < 0.10, **p-value < 0.05, ***p-value < 0.01*