Master's thesis

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Short-Term Trading around the Ex-Dividend Day: Evidence from the Oslo Stock Exchange

Master's thesis in Economics and Business administration
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Preface

This thesis is conducted as a final assignment in our journey as students pursuing our Master of Science in Economics and Business Administration with a major in finance at the Norwegian University of Science and Technology. The research project has been a big achievement in our academic journey and has provided us with a challenging and educational experience.

We are grateful to our supervisor Professor Florentina Paraschiv, for precious feedback and guidance throughout writing this thesis. We also want to thank our family and friends, which have contributed with emotional support during this semester.

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Trondheim, May 2023

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Abstract

This thesis explores the potential for generating significant cumulative average abnormal return (CAAR) through short-term trading strategies around the ex-dividend day on dividend stocks listed on the Oslo Stock Exchange (OSE) between 1992-2022. To conduct the analysis, we employ an event study methodology that compares the actual return of the stocks with the expected return calculated using the Capital Asset Pricing Model (CAPM). Additionally, we incorporate transaction costs based on the average bid-ask spread. Our results are examined across different time periods, industry sectors, and market capitalization categories. To test if our findings are statistically significant, we employ a two-sided t-test.

The findings reveal that Strategy 1, implemented from 15 days before to 1 day before the ex-dividend day, generated a significant CAAR of 0.17%. Strategy 2, spanning from 15 days before to 15 days after the ex-dividend day, yielded a CAAR of 1,05% without being statistically significant. Strategy 3, which examined the period from the ex-dividend day to 15 days afterward, produced a significant CAAR of -1.07%. The main reason behind the CAAR generated from strategy 2 was explained by the ex-dividend anomaly, which demonstrated that the price drop was typically lower than the distributed dividend amount. On average, the return from the ex-dividend anomaly was 2.03%.

Our thesis found significant differences in the performance between 1992-2005 and 2006-2022. The first period yielded a higher CAAR for all the short-term trading strategies and a more prominent ex-dividend anomaly for the stocks. These disparities could possibly be explained by the tax reforms implemented in 1992 and 2006. When breaking down our results into business sectors and cap-size, it was found that the sectors *Software & IT Services*, *Food & Beverages*, and *Banking & Investment Services* displayed the highest overall CAAR. The biggest sector in our study, *Energy - Fossil Fuel*, contradicted our expectations with an overall poor performance. Additionally, our analysis reveals that *Small-Cap* companies consistently outperformed their larger counterparts in almost all strategies and time periods, illustrating the presence of small-firm effects.

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1 Introduction

1.1 Background

Companies that pay dividends reward shareholders who have invested in their equity by distributing a portion of their profits back to the investors. The distribution of profits causes the company's market value to decrease because the money that was distributed as dividends is no longer retained by the company, but is instead held by individual shareholders. Therefore, after the stock goes ex-dividend, there is a drop in the stock price (Mueller, 2021).

Dividend stocks can be an appealing option for several types of investors. Long-term investors may find dividend stocks attractive because they could provide consistent income over time and are typically viewed as financially stable (Boythe-White, 2023). On the other hand, short-term traders might be interested in exploiting market movements on and around the ex-dividend day, in an attempt to achieve short-term gains by exploiting an ex-dividend anomaly[1].

For long-term investors and short-term traders interested in dividend stocks, it is essential to be familiar with the ex-dividend day. This is the first trading day where dividend-paying companies are traded without the right to receive a dividend payout. In other words, the day before the ex-dividend day, also known as the inc-day, is the last day when stocks can be purchased with the right to receive dividends (Schmidt, 2023).

According to the ”dividend irrelevance theory” introduced by Miller and Modigliani (1961), a company's dividend policy does not impact the firm's valuation. They argued that investors should be indifferent between capital gains and dividend income and that the stock price should decrease by the same amount as the dividend payout on the ex-dividend day. This theory assumes perfect capital markets[2], which do not account for the complexities in real financial markets, such as transaction costs, taxes, and behavioral biases. Boyd and Jagannathan's (1994) study provided support to Miller and Modigliani's

[1] In this thesis, the ex-dividend anomaly refers to the phenomenon where the stock price drops by less than the distributed dividend amount on the ex-dividend day.

[2] In a perfect capital market, the transactions of each buyer and seller of securities are too small to have a noticeable impact on price movements, and all investors have access to the same information without incurring any costs. Additionally, there are no costs associated with buying and selling and no tax differences on capital gains and dividend income (Miller & Modigliani, 1961).

(1961) work, as they found the price drop on the ex-dividend day to be almost equal to the dividend yield. This finding also aligned with the traditional perceptions of brokers and stockholders, who believed that the stock price should drop by approximately the amount of the dividend payout on the ex-dividend day (Campbell and Beranek, 1955). Despite receiving support from some sources, the ”dividend irrelevance” theory has been contradicted by several researchers that have investigated the behavior of stocks on the ex-dividend day.

Campbell and Beranek (1955) studied the stock price behavior on the New York Stock Exchange and discovered that stock prices typically decreased by approximately 90% of the dividend amount on the ex-dividend day. This evidence was supported by Durand and May (1960), who found that the price drop on the ex-dividend day tended to be smaller than the dividend amount for the American Telephone and Telegraph stock. Building on earlier research, Elton and Gruber (1970) demonstrated that the average price drop on the ex-dividend day was approximately 78% of the dividend amount and that the results were significant.

Subsequent studies by various researchers have supported the findings of Campbell and Beranek (1955), Durand and May (1960), and Elton and Gruber (1970), where they showed that the ex-dividend price drop was generally less than the distributed dividend amount (see, e.g., Barclay, 1987; Dupuis, 2019; Liljeblom et al., 2001; Rantapuska, 2008). This phenomenon has also been observed in the Norwegian stock market, as shown by Dai and Rydqvist (2009).

Previous research that has investigated the behavior of stocks around the ex-dividend day, based on U.S. data, has shown that investors were taxed more heavily on dividend income than capital gains in general (Barclay, 1987; Elton & Gruber, 1970). Furthermore, they argued that investors traded around the ex-dividend day based on their tax brackets. In more detail, Elton and Gruber (1970) argued that the ex-dividend anomaly could be explained by tax clientele effects. Investors in high tax brackets tended to prefer capital gains over dividend income because they were taxed less heavily on capital gains compared to dividend income. Hence, market participants in high tax brackets found it more profitable to invest in stocks with lower dividend yields, while those in low tax brackets found it more profitable to invest in stocks with higher dividend yields. To clarify, Elton and Gruber (1970), along with later academic support for their hypothesis (Barclay, 1987; Rantapuska, 2008), proposed a contrary view to the work of Miller and Modigliani (1961), where they argued that the company's dividend policy and taxes had a significant impact on stock prices and the investor behavior around the ex-dividend day.

Although the tax clientele hypothesis has been widely supported as the reason behind the ex-dividend anomaly, it has also received criticism. For instance, Kalay (1982) argued that transaction costs could have been the underlying cause behind the ex-dividend anomaly. Furthermore, evidence of a price drop lower than the dividend payout on the ex-dividend day has also been found in markets exempted from taxes on both capital gains and dividend income, indicating that other factors beyond tax clientele effects may have been at play. Frank and Jagannathan (1998) suggested that the ex-dividend anomaly in Hong Kong was due to a bid-ask bounce, while Dupuis (2019) identified a lack of liquidity as the most important factor in the United Arab Emirates. Despite extensive research into the reason behind the ex-dividend anomaly, a widespread agreement on the underlying cause has not been reached. Nevertheless, if the ex-dividend anomaly does indeed occur consistently, there might be opportunities to achieve abnormal returns on and around the ex-dividend day.

When investigating the potential for generating abnormal returns, outlining the implications of the Efficient Market Hypothesis (EMH) is central. The EMH mainly concerns whether available information truly reflects the prices of securities at any given time and can be divided into three categories (Fama, 1970). Specifically, weak form, semi-strong form, and strong form. The strong form of the EMH states that all information is reflected in the stock price at any given time, meaning that it should be impossible to achieve abnormal returns. Even though the EMH has been highly supported and recognized by many academics and professionals like Fama (1970) and Malkiel (1973), it is important to acknowledge that there are also critics who have argued that markets are not always efficient (De Bondt & Thaler, 1985; Jegadeesh & Titman, 1993; Rendleman Jr et al., 1982). Warren Buffett (2023), often regarded as one of the most successful investors of all time, has even stated that efficient markets only exist in textbooks.

In addition to the criticism of the EMH, both abnormal volume and abnormal return, as well as arbitrage return are discovered in previous studies that have examined the behavior of stocks around the ex-dividend day. In particular, Lakonishok and Vermaelen (1986) found positive abnormal returns before the ex-dividend day due to buying pressure, and negative abnormal returns afterward. Furthermore, Kadapakkam (2000) detected increased trading volume before the ex-dividend day, but could not find any evidence of this afterward. Liljeblom et al. (2001) discovered that there was abnormal trading volume around the ex-dividend day in the Finnish stock market, while Rantapuska (2008) identified the existence of ex-dividend arbitrage in the same market. In the Norwegian stock market, Dai and Rydqvist (2009) argued that uncertainty around cash flows hindered arbitrage. Moreover, Henry and Koski (2017) reported abnormal returns around the ex-dividend day but argued that only skilled institutions could achieve such returns. Several other researchers have also discussed abnormal return, abnormal volume, and arbitrage return around the ex-dividend day (Dupuis, 2019; Heath & Jarrow, 1988; Kalay, 1984; Koski & Scruggs, 1998).

1.2 Research Question

The behavior of stocks around the ex-dividend day has been extensively studied in previous literature, revealing interesting findings and discussions. Nevertheless, there has been limited investigation on this topic in relation to the Norwegian stock market, particularly in terms of short-term trading and the possibility of achieving abnormal returns. In this thesis, we aim to fill this gap in the literature by investigating the potential of achieving cumulative average abnormal returns (CAAR) throughout short-term trading strategies around the ex-dividend day on the Oslo Stock Exchange (OSE).

To achieve this, we have developed and tested three short-term trading strategies by using data on dividend stocks from the OSE between 1992 and 2022. The time period was chosen because Norway underwent significant tax changes during this period, which could have influenced the investor's preferences for dividend income and capital gains, potentially affecting the behavior of stocks and the ability to receive CAAR around the ex-dividend day. Additionally, we categorized our findings into industry sectors and company sizes to gain a more comprehensive understanding of the behavior in specific segments of the OSE. Based on these factors, we formulated our research question and derived three sub-questions, that formed the foundation of this thesis.

Research question

Was it possible to generate a significant cumulative average abnormal return (CAAR) by employing short-term trading strategies on dividend stocks on the Oslo Stock Exchange (OSE) around the ex-dividend day during the period 1992-2022?

Sub-question 1

Was the average return generated from the relationship between the ex-dividend price drop and the distributed dividend amount significantly different from zero?

Sub-question 2

Was there a significant difference in the cumulative average abnormal return (CAAR) generated by the short-term trading strategies between 1992-2005 and 2006-2022?

Sub-question 3

How do the short-term trading strategies perform when categorizing the data into industry sectors and cap-size?

1.3 Short-Term Trading Strategies

To accurately measure the financial impact of the behavior of stocks around the ex-dividend day and eliminate any confounding effects on stock prices, we have employed an event study methodology in this thesis.

Prior research has typically used an event period of 5 days before to 5 days after the ex-dividend day (day 0), as proposed by Lakonishok and Vermaelen (1986). However, we use a longer event period for all three short-term trading strategies in this thesis, as we believe it can provide a more comprehensive understanding of the behavior of stocks around this event. In the following three sections, we have outlined the short-term trading strategies that we have developed to address our research questions.

1.3.1 Strategy 1

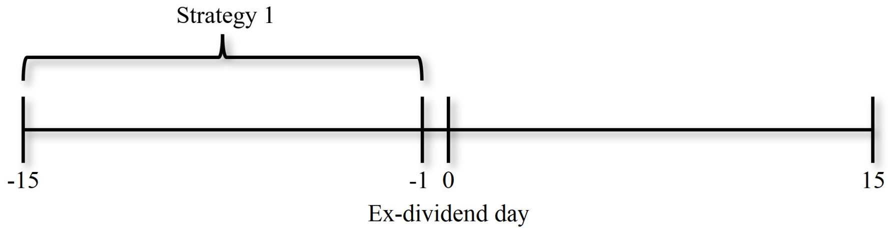


Figure 1: Illustration of Strategy 1

In this strategy, a trader receives a daily return between 15 days to 1 day before the ex-dividend day, which is referred to as day 0. Hence, the event period is 15 days. As this strategy involves selling the stocks before the ex-dividend day, the trader is not entitled to any dividend payouts.

1.3.2 Strategy 2

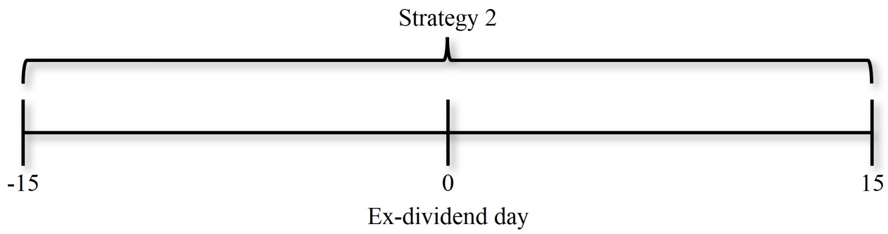


Figure 2: Illustration of Strategy 2

This strategy is an extension of strategy 1. Specifically, the trader has the same buying point as in strategy 1 but sells the stocks at the closing price 15 days after the ex-dividend day. In this strategy, the trader receives dividend payouts, and the event period is 31 days.

The relationship between the distributed dividend amount and the stock price drop on the ex-dividend day is important to this strategy, as strategy 2 is the only strategy that includes the dividend payment. To provide further research on the ex-dividend anomaly, we isolated a measure of the return from this relationship, referred to as *Div/Drop*[3].

[3] The *Div/Drop* measure is explained in detail in Section 5.4.

1.3.3 Strategy 3

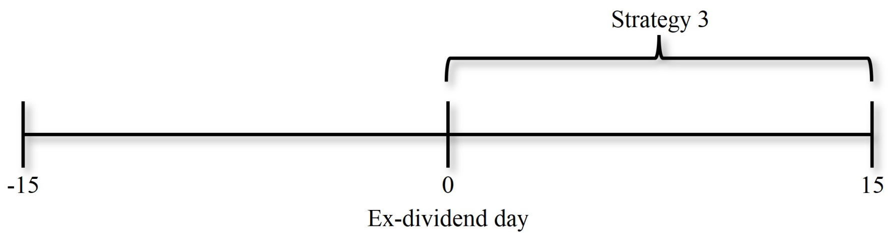


Figure 3: Illustration of Strategy 3

In the last strategy, a trader buys dividend stocks at the opening price on day 0 (the ex-dividend day) and sells the stocks at the same point as in strategy 2. This strategy does not receive any dividend payouts, and the event period is 16 days.

2 Literature Review and Theory

This chapter of the thesis comprehensively reviews relevant theories and evidence from previous literature. The literature review is divided into two sections. In the first section, we explore research on the ex-dividend behavior of stocks, examining the relationship between dividend payout and stock price movements. We also show evidence of abnormal volume, abnormal return, and arbitrage return on and around the ex-dividend day. Additionally, insights are provided into the types of investors participating in and dominating trades on and around the ex-dividend day. In the second section, we highlight previous literature on the historical performance of sectors on the OSE and stock performance based on market capitalization size.

Moving forward to the theoretical part, we delve into three distinct sections. First, we outline the implications of the EMH and examine previous support and criticisms of the theory. Subsequently, we introduce the Capital Asset Pricing Model (CAPM), discussing its underlying assumptions and addressing previous criticisms. Finally, we introduce the event study methodology and present previous theories and literature on the selection of the event and estimation window.

2.1 Litterature Rewiev

2.1.1 Ex-Dividend Behavior of Stocks

Miller and Modigliani (1961) introduced the ”dividend irrelevance theory,” which suggested that a firm’s dividend policy does not impact shareholder overall return or the stock price. The authors argued that investors can offset the effect of dividends by selling an equivalent amount of shares, making the distributed dividend amount irrelevant. Additionally, they proposed that a firm’s value is not determined by how dividends are distributed but rather entirely by real factors such as earning power and investment policy. It is important to note that this theory assumes perfect capital markets and rational behavior[4].

Based on these conditions, the ”dividend irrelevance” theory maintained that the dividend policy was irrelevant to a firm’s valuation. Additionally, Miller and Modigliani (1961) stated that whether or not a company paid dividends should not impact the overall return to shareholders. In a perfect capital market, this implied that stock price should generally decrease by the same amount as the dividend payout on the ex-dividend day. Nevertheless, it is important to acknowledge that in real financial markets, factors such as varying access to information, costs associated with buying and selling, different tax treatments, and behavioral biases can impact market dynamics. Hence, the assumption of perfect capital markets does not fully capture the complexities of real financial markets. Despite employing the assumption of perfect capital markets in their study, Miller and Modigliani (1961) were aware of the limitations it had and suggested that further analysis of dividend policy should move beyond the assumption of perfect capital markets. The authors also noted that it could be variations in the preferences for dividend income and capital gains among the investors in imperfect markets, possibly influenced by clientele effects.

Campbell and Beranek (1955) investigated stock price behavior on the New York Stock Exchange and found evidence that stock prices typically fell by approximately 90% of the dividend amount on the ex-dividend day. This evidence suggested that stock prices may have declined by an amount less than the dividend amount, which challenged the ”dividend irrelevance” theory proposed by Miller and Modigliani (1961), as well as the

[4] Investors were indifferent to whether they received additional wealth through an increase in stock value or through dividend income, as they always wanted more wealth rather than less (Miller & Modigliani, 1961).

common perception among brokers and stockholders that stock prices decrease by approximately the dividend amount on the ex-dividend day (Campbell & Beranek, 1955). The researchers challenged this belief because they were convinced that a perfect relationship between the distributed dividend amount and the decline in stock prices would give tax-conscious investors a high incentive to sell the stocks before the ex-dividend day and buy them back afterward. They believed this incentive would lead to marked pressure, which would decrease the price drop on the ex-dividend day. Their results showed that the price drop on the ex-dividend day varied greatly among the observations, making it difficult to establish a clear relationship between the distributed dividend amount and the stock price development on the ex-dividend day.

In an examination of the ex-dividend behavior of the American Telephone and Telegraph stock, Durand and May (1960) provided support to the work put forward by Campbell and Beranek (1955). Although the deviations were small and not statistically significant, their research revealed that stock prices tended to decline by an amount less than the distributed dividend amount on the ex-dividend day.

Building on earlier research, Elton and Gruber (1970) investigated the behavior of all stocks that paid dividends from April 1, 1966, to March 31, 1967, on the New York Stock Exchange. In line with the findings of Durand and May (1960) and Campbell and Beranek (1955), Elton and Gruber (1970) found evidence that stock prices declined by an amount less than the dividend payout on the ex-dividend day. Specifically, they showed that the average price drop over the period was approximately 78% and that the results were significant. Furthermore, they also discovered a positive relationship between dividend yield and the price drop on the ex-dividend day, which they argued was evidence of clientele effects[5].

In more detail, the clientele effect hypothesis suggested that investors preferred stocks with certain dividend yields based on their tax bracket. Specifically, they found that individual investors were typically taxed more heavily on dividends than on capital gains. Therefore, companies that paid high dividends but had slower growth prospects could appeal to investors seeking dividend income, while companies that reinvested more earnings

[5]Miller and Modigliani (1961) was first to suggest the impact of clientele effects (Kalay, 1982). However, as they also put forward the ”dividend irrelevance” theory, we refer to Elton and Gruber (1970) as the authors behind the clientele effect in this thesis. This is done to avoid any potential misunderstandings between the two theories.

for growth could attract investors seeking capital gains. In other words, investors in higher tax brackets tended to find low dividend-yield stocks more profitable, while investors in lower tax brackets preferred high dividend-yield stocks. The authors contended that the price drop on the ex-dividend day was expected to reflect the relative value of dividends compared to capital gains for the marginal stockholders in a rational market. Since investors aimed to maximize after-tax wealth, and dividends were generally taxed more heavily than capital gains for individual investors, the authors argued that this resulted in a price drop on the ex-dividend day that was less than the dividend amount. Finally, Elton and Gruber (1970) showed that the ex-dividend behavior of common stocks could be used to identify the marginal stockholder tax brackets.

In contrast to previous research aimed at explaining the ex-dividend anomaly, Kalay (1982) offered a different perspective. The author re-examined earlier research on the ex-dividend behavior of stocks and proposed that factors beyond tax clientele effects could contribute to the ex-dividend anomaly. The study found evidence that the price drop on the ex-dividend day was smaller than the dividend amount, but the difference was not statistically significant. The author argued that transaction costs could be the reason behind these findings but also suggested that short-term traders indifferent between receiving capital gains and dividend income should arbitrage away any potential ex-dividend anomaly.

In a reply to his own study from 1982, Kalay (1984) suggested that opportunities for abnormal returns might still exist around the ex-dividend day due to transaction costs not always being large enough to eliminate short-term profits. By studying trading volume around the ex-dividend day, Lakonishok and Vermaelen (1986) provided evidence for the potential of achieving abnormal returns around the ex-dividend day. The researchers found evidence of a significant rise in volume during this period and showed that trading volume was negatively associated with transaction costs and positively related to the dividend yield. Additionally, the authors observed an abnormal increase in stock prices before the ex-dividend day due to buying pressure. On the other hand, they detected an abnormal price decrease following the ex-dividend day. Incorporated investors competed to own high-yield stocks because of the tax advantages they could receive through cum-ex trading[6]. As a result, a positive abnormal stock increase of 1% on high-yield stocks

[6] Incorporated investors had a tax incentive to sell cum-dividend and buy ex-dividend (Lakonishok & Vermaelen, 1986).

was detected in the three days leading up to the ex-dividend day. Finally, the researchers contended that short-term traders significantly impacted the price behavior around the ex-dividend day.

Heath and Jarrow (1988) analyzed arbitrage opportunities in relation to the size of the stock price drop on the ex-dividend day, in a scenario with continuous trading and a frictionless economy[7]. They contended that short-term traders could not make an arbitrage profit[8], even if the stock price did not decline by the same amount as the dividend payout on the ex-dividend day. In more detail, they argued that while stock prices typically decreased by an amount less than the dividend payout on the ex-dividend day, there was still a possibility that the stock price could drop by an amount greater than the dividend payout. Since it was impossible to predict with absolute certainty how the stock price would behave and whether it would decrease by more or less than the dividend amount on the ex-dividend day, the authors concluded that it was not feasible to exploit the ex-dividend anomaly for arbitrage profit.

Contrary to several studies published after Miller and Modigliani (1961), which have argued that stock prices tended to decline by less than the distributed dividend amount on the ex-dividend day, Boyd and Jagannathan (1994) challenged this view. They argued that previous literature had overlooked important factors in their analysis, such as different tax treatments and transaction costs that investors were subject to. Their results showed that the price drop on the ex-dividend day was almost exactly equal to the dividend yield. This evidence supported Miller and Modigliani's (1961) "dividend irrelevance" theory but contradicted several other researchers that have investigated the ex-dividend behavior of stocks.

In markets where taxes do not exist on either capital gains or dividend income, factors beyond the tax clientele effects have to be responsible for a possible ex-dividend anomaly. Frank and Jagannathan (1998) investigated such a market, where they used data from the Hong Kong stock market between January 1980 to December 1993. Although there were no taxes involved, the results showed that the stock price still declined by less than the dividend payout on the ex-dividend day. The authors argued that the ex-dividend anomaly could be explained by a common practice among traders, where they executed trades at

[7]No transaction costs (Heath & Jarrow, 1988).

[8]Generating profit without any risk exposure (Heath & Jarrow, 1988).

the bid price on the inc-day and at the asking price on the ex-dividend day. This led to an average increase in stock prices on the ex-dividend day regardless of the size of the dividend payout.

In a later investigation in the same market, Kadapakkam (2000) pointed out that arbitrage traders were hammered by settlement procedures[9] during the majority of the period studied by Frank and Jagannathan (1998). However, after the implementation of electronic settlement in 1992, the author's results showed that the previously observed positive ex-dividend return detected by Frank and Jagannathan (1998) was nearly eliminated. Furthermore, he found evidence of increased trading volume right before the ex-dividend day, but this was not found afterward.

The United Arab Emirates (UAE) was another country that did not have any taxes on either capital gains or dividends. Dupius (2019) investigated the ex-dividend day price premiums and abnormal returns between April 2007 to May 2016 in this equity market. Specifically, he found evidence that stock prices dropped by an amount less than the distributed dividend amount, where the results were significantly different from 1. Additionally, the author presented results of a significant average abnormal return of 1.69%, which indicated that investors could be able to profit from the ex-dividend anomaly and that inefficiencies could exist in tax-free markets. The evidence showed further that lack of liquidity appeared to be the most important factor in explaining the ex-dividend anomaly and the ex-dividend behavior of stocks in this market.

Koski and Scruggs (1998) used transaction data to investigate who trades around the ex-dividend day. The paper found strong evidence of dividend-capture trading[10], but little evidence of trades based on tax clientele effects. Furthermore, they concluded that security dealers caused significant abnormal volume around the ex-dividend day, where they sold high-yield stocks cum-dividend, and bought them back ex-dividend. The authors also detected abnormal volume for private investors and taxable corporations in high-yield stocks.

Later studies have also examined who trades around ex-dividend day. Henry and Koski

[9]Settlement procedures included regulatory features that constrained short-term trading. Specifically, these features required physical delivery of share certificates within one day, and during the registration process, it was not possible to sell the stocks until 21 days had passed (Kadapakkam, 2000).

[10]Dividend-capture trading was a strategy where investors bought stocks cum-dividend and sold them ex-dividend to ”capture” dividends (Koski & Scruggs, 1998).

(2017) argued that institutions concentrated their trades on certain ex-dividend days, rather than being a consistent market participant, leading to higher profits. Additionally, they observed an institutional abnormal volume around the ex-dividend day. Institutional dividend capture trades represented only 6% of the sample but gave more than 15% abnormal returns. Furthermore, the authors showed that abnormal returns from dividend capture trading were highly correlated with trade execution skills. They asserted that only certain institutions with a high level of this skill set[11] could achieve abnormal returns around the ex-dividend day.

Liljeblom et al. (2001) investigated the consequences of a high degree of foreign ownership on the OMXH (Nasdaq Helsinki), where domestic and foreign investors were exposed to different tax treatments. The paper presented evidence of an average ex-dividend day price drop significantly lower than one and suggested that the degree of foreign ownership was to some extent related to variations in the price drops. Additionally, the authors found evidence that was consistent with the tax clientele effect, where dividend yield was significantly related to a higher ex-dividend day ratio. Furthermore, significant abnormal volumes were detected around the ex-dividend day.

Rantapuska (2008) investigated similar to Liljeblom et al. (2001) the Finish Stock Market. More precisely, the paper examined the trading behavior of all investors on OMXH around the ex-dividend day. The author stated that foreign investors accounted for more than 40% of the gross trading volume in the period from January 1, 1995, to November 28, 2002, and dominated the market. The evidence showed further that many investors took advantage, and implemented trades around the ex-dividend day based on their tax status. Specifically, foreign investors who had a preference for capital gains accelerated sales cum-dividend and accumulated buys ex-dividend. On the other hand, domestic investors who preferred dividend income tended to accelerate their purchases before a stock went ex-dividend and increased their sales after the stock went ex-dividend. Rantapuska (2008) contended that this behavior was in line with tax clientele effects. Furthermore, Rantapuska (2008) provided evidence of a price decline on the ex-dividend day that was smaller than the dividend payout, which was consistent with the findings presented by Liljeblom et al. (2001). Additionally, he showed that nontaxable institutions sold stocks before the ex-dividend day, and bought them back on the ex-dividend day. Domestic

[11] Skilled investors are also referred to as market players in this thesis.

taxable investors were on the other side active in overnight buy-and-sell tax arbitrage. Both short-term strategies gave an average overnight return of 2% after accounting for transaction costs. While tax status was indeed highly relevant for the behavior around the ex-dividend day, the author noted that investors did not always behave in a tax-optimal way.

Another Scandinavian country that experienced a high degree of foreign ownership was Norway, where approximately 40% of the shares on the OSE were owned by foreign investors in 2019 (Rydne, 2019). In this market, Dai and Rydqvist (2009) estimated the costly-arbitrage model of Boyd and Jagannathan (1994), where they looked at the price formation around the ex-dividend day. The authors showed that investors made trades around the ex-dividend day based on their tax status, where foreign investors sold stocks cum-dividend and bought them back on the ex-dividend day. The results indicated further that domestic banks and corporations operated as cum-dividend buyers, taking the opposite side of the trade. Although this evidence was in line with the work put forward by Rantapuska (2008), Dai and Rydqvist (2009) rejected the tax-clientele effect. Moreover, the authors presented evidence of a relative price drop on the ex-dividend day that was less than one. Lastly, Dai and Rydqvist (2009) contended that uncertainty around cash flows hindered arbitrage on the OSE.

2.1.2 Industry Sector and Cap-Size

Ødegaard (2017) published a study where he examined the historical returns for the different sectors on the OSE. This empirical study concluded that Energy, Consumer Staples, IT, and Material were the sectors yielding the highest return during the period of 1980-2016, where the market was dominated by the Energy sector. On the other hand, the worst performance was conducted by the Financial Sector, Utilities, and Telecommunication. These findings aligned with an earlier study by Næs et al. (2007), that analyzed sector returns on the OSE in ten-year intervals between 1980 and 2006.

The small-firm effect was introduced by Banz (1981), positing that small firms tended to surpass large firms in generating higher returns without necessarily increasing the risk. Banz (1981) demonstrated further that smaller companies had a persistent outperformance over bigger companies over several decades and even after controlling for other relevant factors. This anomaly has been consistently replicated in subsequent studies having nearly 100 peer-reviewed journal articles on the topic in the *Journal of Banking and Finance* (van Dijk, 2011), highlighting its robust and enduring nature. The small-firm effect can be explained by the fact that small firms are less closely monitored by investors and analysts, which increases the chance of mispricing. Other research has indicated that the small-firm effect can be attributed to the higher systematic risk in smaller companies (Fama & French, 1992). Nevertheless, this finding still aligned with the notion that smaller companies tended to provide higher returns.

2.2 Theory

2.2.1 The Efficient Market Hypothesis

Fama (1970) reviewed the theoretical and empirical literature on the EMH. Primarily, the EMH concerns whether available information is fully reflected in security prices at any given time. The theorem is generally divided into three different categories. Specifically, weak form, semi-strong form, and strong form. According to the weak form, security prices are fully reflected by historical prices, implying that predicting future prices based on previous stock movements is not possible. However, it could be possible for investors to generate abnormal returns even with this limitation if they have access to relevant information beyond historical stock prices. The semi-strong form states that security prices are reflected by all information that is publicly available at any given time. This restriction implies that investors need private information to achieve abnormal returns. In the strongest form of the EMH, achieving abnormal returns is theoretically impossible, as all existing information should be immediately reflected in the security price at any given time.

The EMH has remained a cornerstone of financial theory and has stimulated extensive research in the area of market efficiency and asset pricing (Downey, 2022). This hypothesis has also been highly recognized and supported by many academics like Fama (1970) and Malkiel (1973). Jensen (1978) presented that the EMH has been tested in a wide variety of markets and has been consistent with the data, with a few exceptions. Additionally, the study argued that empirical evidence supporting the EMH was more robust than any other proposition in economics. However, it is important to acknowledge that there have also been critics of the EMH who has argued that markets were not always efficient.

Bondt and Thaler (1985) found that poorly performing portfolios in the previous years tended to outperform high-performing portfolios in the same period, with an average of 25% higher cumulative return in the following period. The poorly performing portfolios also appeared to have a significantly lower risk than the previous high-performing portfolios in the following period. In this study, the ”previous period” referred to the last five years, and the ”following period” referred to the next three years. This ”reversal effect” was explained by the fact that unexpected and dramatic news caused most people to overreact. Portfolios that had performed very well could therefore be exposed to a ”reversal effect” when the market detected an overreaction (Bodie et al., 2020, p. 348). Since the evidence presented by the authors implied that it was possible to use historical prices to detect portfolios that would achieve higher returns and have a lower risk compared to other portfolios, Bondt and Thaler (1985) questioned the validity of the EMH.

Similar to Bondt and Thaler (1985), Jegadeesh and Titman (1993) suggested that markets might not be perfectly efficient and that there could be opportunities for investors to earn excess returns by exploiting patterns in stock returns. The authors found evidence that contradicted Bondt and Thaler’s (1985) findings, where buying past winners and selling past losers resulted in a significant abnormal return from 1965 to 1989. This phenomenon was related to momentum effects, where the holding period in this analysis ranged from 3 to 12 months, in contrast to Bondt and Thaler’s (1985) study, which considered several years. The authors explained the interpretation of the results by price overreaction or underreaction to information about short-term prospects compared to long-term prospects.

The research put forward by Rendleman et al. (1982) is also relevant to the EMH discussion. They investigated how unexpected earnings announcements affected the stock price 20 days before to 90 days after the announcement. Since earnings announcements were publicly available information, stock prices should have reflected this information immediately at the announcement point, in both the semi-strong and the strong-form of the EMH (Fama, 1970). However, Rendleman et al. (1982) showed that stocks that announced unexpected positive earnings started to rise in the 20-day window before the announcement and continued to rise in the 90-day window after the announcement. The result was quite the opposite for stocks that reported negative unexpected earnings, with stock prices declining. This suggested that abnormal returns could be obtained if investors bought stocks that report positive unexpected earnings on the announcement point and shorted stocks of companies that reported negative unexpected earnings. As a result, this raised questions about the validity of the EMH, similar to Bondt and Thaler (1985) and Jegadeesh and Titman (1993), as prices were found to potentially not accurately reflect all available information at any given time.

Another critical viewpoint against the EMH was put forward by Grossman and Stiglitz (1980). They stated that investors would have no incentives to use time and money on research activities if they were unlikely to contribute to higher investment returns. Hence, all such activities would be pointless in perfectly efficient markets (Bodie et al., 2020, pp. 333-334). Furthermore, if the market were in fact of such a nature, it remains paradoxical that approximately 325 000 subscribers paid an estimated annual subscription fee of $27 660 as of 2020 for Bloomberg Terminal[12] (Bloomberg, 2023; Kenton, 2022).

While the EMH has faced criticism, it has also received substantial support, as presented earlier. Malkiel (1973), the author of ”A Random Walk Down Wall Street,” supported the EMH. In his book, he introduced the ”random walk theory” as an explanation for stock price behavior (Malkiel, 1973). This theory was consistent with the EMH, stating that stock prices follow a random and unpredictable pattern, making it impossible to consistently predict their movements or achieve abnormal returns. In a later published article titled ”The Efficient Market Hypothesis and Its Critics”, Malkiel (2003) maintained a consistent stance on the EMH. However, he argued that patterns and irregularities in prices could sometimes be predictable and persist in the short run due to irrational market participants. In line with previous criticisms of the EMH, Malkiel (2003) concluded that financial markets cannot be perfectly efficient, as professional investors would lack the incentive to detect information that was already reflected in stock prices. Nevertheless, the article also argued that arbitrage opportunities did not persist for long, and that historical irrationality and patterns did not contribute to a strategy that generated consistent abnormal returns.

Last but not least, we find Warren Buffett’s perspective on the EMH worth mentioning. For those who may not be familiar, he is widely recognized as one of the most successful investors of all time and serves as Chairman of the Board for Berkshire Hathaway Inc.

[12] Bloomberg Terminal gives fast access to news, data, unique insight, and trading tools, making it the cutting edge of innovation and information delivery for more than four decades (Bloomberg, 2023).

In a letter to the shareholders dated February 25, 2023, he wrote the following: ”It's crucial to understand that stocks often trade at truly foolish prices, both high and low. 'Efficient' markets exist only in textbooks. In truth, marketable stocks and bonds are baffling, their behavior usually understandable only in retrospect” (Buffett, 2023). In other words, Buffet appeared to be lacking faith in the efficiency of real financial markets.

Based on the presented literature on the EMH and Warren Buffet's statement, it seems reasonable to assume that certain investors have the potential to generate abnormal returns. Therefore, it may be possible to exploit eventual anomalies on and around the ex-dividend day and achieve significant CAAR throughout short-term trading on the OSE.

2.2.2 Capital Asset Pricing Model

The CAPM was first introduced by Sharpe (1964) and Lintner (1965) and is an asset pricing model that provides accurate predictions of the relationship that we should observe between the risk of an asset and the expected return (Elbannan, 2014). This model is based on numerous assumptions that are split into two parts, where the first category concerns individual behavior and the second category concerns market structure (Bodie et al., 2020, pp. 275-276). The first category assumes that investors are rational mean-variance optimizers. Additionally, their typical planning horizon is a single period, and all investors use an identical input list, where they most often assume that all relevant information is publicly available to them. Furthermore, the market structure category assumes that all assets are traded on public exchanges and are publicly held, investors can short-trade securities, and investors can lend or borrow at the same risk-free rate. Finally, there are no transaction costs or taxes, meaning that investors are unaffected by these factors differences.

It is essential to understand that all investors in the CAPM use that market as their risky portfolio. This is explained by the fact that all investors use the same input list in this model and have the same estimates of variance, covariance, and expected return (Bodie et al., 2020, pp. 278-284). With these assumptions taken into account, investors do not need to analyze securities because the market portfolio is the efficient portfolio[13]. Hence, the company's risk is exclusively reflected by beta in the CAPM, where higher returns can

[13]Portfolios that for any given risk offers the highest expected return (Brealey et al., 2019, p. 202).

only be achieved by carrying more risk.

Although the CAPM is considered a cornerstone of the modern financial economy (Bodie et al., 2020, p. 275), the model has received criticism for explaining differences in expected return exclusively by variations in the beta coefficient (Brealey et al., 2019, pp. 212-213). Fama and French (1992) presented evidence that average stock returns appeared to be described by the book-to-market equity and the firm size of the company. Over the period 1926-2017, the CAPM failed to account for some of these factors, where value stocks, which had a high book-to-market value, outperformed growth stocks, which had a low book-to-market value (Brealey et al., 2019, pp. 212-213). Even though this effect has been well documented, it is relatively easy to find strategies that have given excess return by looking at charts from the past. Hence, the results shown above could be attributed to data mining. Because of this uncertainty, it is hard to determine to which degree this evidence damaged the level of trust in the CAPM.

In a later study, Black (1993) investigated the relationship between beta and return in the period spanning from 1926-1991, and found higher returns for high-beta stocks compared to low-beta stocks. However, high-beta stocks did worse than what the CAPM predicted, and low-beta stocks did better. Since the return did not increase as rapidly as predicted with higher beta coefficients, this led to criticism against the CAPM.

In addition to the evidence presented above, the CAPM has also faced criticisms for its number of strong assumptions. One of these assumptions was that all assets are marketable, which is not applicable in the real world, where some assets such as human capital cannot be bought or sold (Brealey et al., 2019, p. 213). Additionally, the CAPM assumes that there exists a risk-free asset, but even government bonds are not guaranteed to provide returns. Moreover, borrowing rates are usually higher than lending rates in real financial markets, which contradicts the CAPM assumption of equal borrowing and lending rates. The model further assumes rational behavior and that all information is publicly available, a premise that can be subjected to questioning. Lastly, the CAPM assumes no taxes or transaction costs, which also is not the case in real financial markets.

Although certain assumptions within the CAPM may not be realistically achievable, it is difficult to empirically test the model's validity. This is because not all assets that trade can be observed, and the proxy used in practice is not the theoretical market portfolio. If empirical tests support or reject the model, it is hard to determine whether a correct or flawed model caused the results or because the proxy for the market portfolio does not accurately represent the theoretical market portfolio (Bodie et al., 2020, p. 296). It is crucial to note that any economic model serves as a simplified representation of reality. Lastly, while the CAPM has its limitations, it is still considered a plausible and widely employed model (Brealey et al., 2019, pp. 208, 217).

2.2.3 Event Study

Event studies are a method of empirical financial research that enables observers to estimate how a certain event affects a company's stock price (Bodie et al., 2020, p. 342). This method relies on the assumption that the stock market is efficient and that the event is unanticipated, meaning that there are no other confounding factors affecting the stock price during the event window. In order to accurately measure the financial impact of the event, these assumptions must be valid and the research design must be appropriately executed (McWilliams & Siegel, 1997). It is essential to mention that it may not always be feasible to satisfy all the assumptions in event studies, and thus, the results may be vulnerable to certain biases. However, despite the criticism and weaknesses, the method remains a widely accepted technique to measure the economic impact of a wide range of events (Bodie et al., 2020, p. 344).

The estimation window, the event window, and the post-event window are the three-time frames that make up an event study (Benninga, 2014, p. 332). These time frames are illustrated in Figure 4. It is important to note that the post-event window is not considered in this thesis.

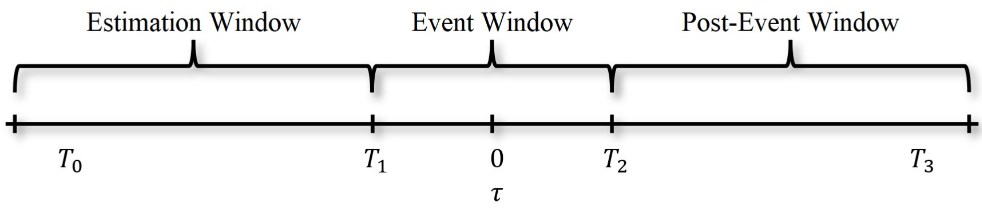


Figure 4: Time line for an event study (MacKinlay, 1997)

There are no rules on how long or short the event and estimation window should be, but there are several factors that should be taken into account (Krivin et al., 2003). McWilliams and Siegel (1997) suggested that longer event windows could make it harder to control for confounding effects and potentially lead to incorrect conclusions about the importance of an event. On the other hand, they found that shorter event windows tended to capture the significant effect of an event more accurately. The authors recommended that the duration of the event window should be long enough to capture the significant effects of an event while being short enough to eliminate any confounding effects. This trade-off between risk and accuracy does also apply to the estimation window. Specifically, longer windows could lead to biases due to the risk of confounding effects, but it also entails larger samples of returns that could give more precise estimations (Krivin et al., 2003).

Previous research that has investigated the ex-dividend behavior of stocks has used different estimation windows in their studies. However, a number of them have used an estimation window of approximately 50 days, which ended on various dates prior to the ex-dividend day (Frank & Jagannathan, 1998; Kadapakkam, 2000; Lakonishok & Vermaelen, 1986). There are also some studies that have used an estimation window both before and after the event (Henry & Koski, 2017; Liljeblom et al., 2001). The research conducted by Koski and Scruggs (1998) deviated from the studies presented above, where they used an estimation period consisting of their full sample period, excluding the trading days in their event period.

While the ex-dividend literature has demonstrated some variability in the utilized estimation window, the length of the event window has been relatively consistent. Several researchers have used the methodology put forward by Lakonishok and Vermaelen (1986), where the event window was set to 11 days, spanning from 5 days before the ex-dividend day to 5 days after it (see Dai and Rydqvist, 2009; Frank and Jagannathan, 1998; Henry and Koski, 2017; Kadapakkam, 2000; Koski and Scruggs, 1998; Liljeblom et al., 2001). Nevertheless, it is worth noting that other studies have employed different event windows, both shorter and longer in duration. For instance, Rantapuska (2008) employed a 21-day event window, covering a period of 10 days before and after the ex-dividend day.

3 Regulatory Framework

From 1992 to 2022, Norway underwent significant tax changes. In this chapter of the thesis, we focus on the most important changes that occurred during this period. To provide a clear explanation, we have organized this chapter into three sections. The first and second section provides an overview of the tax reform implemented in 1992 and 2006, respectively. Finally, the third section outlines the impact of these reforms on various investor groups, including both domestic and foreign investors.

3.1 The Tax Reform of 1992

In 1992, Norway implemented a tax reform called ”tosatsmodellen,” which was internationally referred to as the Nordic dual tax system (Zimmer, 2006). The reform was implemented to make capital taxation more neutral and prevent investors from taking their capital out of the country. Additionally, the reform aimed to reduce the value of the deduction for debt interest and establish it as unrelated to the income level and the tax subject. The ”tosatsmodell” created a clear distinction between capital and labor income for taxpayers, and used ”delingsmodellen” to divide business income into these categories (Aarbu & Lian, 1996; Zimmer, 2006). Capital income was taxed at relatively low proportional rates, while labor income was subject to progressive taxation rates in this model. The 1992 tax reform faced certain issues and areas that needed improvement, leading to the introduction of the 2006 tax reform, which brought in new tax laws (Zimmer, 2006).

3.2 The Tax Reform of 2006

The Norwegian Parliament replaced ”delingsmodellen” with ”skjermingsmetoden” in a new tax reform that took effect in 2006, leading to the taxation of any return exceeding the risk-free return as ordinary income in most cases (Thoresen et al., 2006). To apply ”skjermingsmetoden” to all types of businesses and companies, ”tosatsmodell” was replaced by three new models. Specifically, ”foretaksmodellen”, ”deltakermodellen”, and ”aksjonærmodellen”. In brief terms, ”foretaksmodellen” applied to self-employed, ”deltakermodellen” applied to personal participants in general partnerships, and ”aksjonærmodell” applied to personal shareholders (Skattedirektoratet, 2006). Furthermore, limited liability companies (LLCs) were generally subject to ”fritaksmetoden,” but this method was introduced already in 2004, before the tax reform of 2006 (Høyland, 2007; Skattedirektoratet, 2006).

After 2006, we assume that traders were generally subject to either ”aksjonærmodellen” or ”fritaksmetoden”. In the subsequent section, we delve into these models in more detail, referring to them as the shareholder model and the exemption method, respectively. The other models from the tax reform of 2006 are not particularly relevant to this thesis and are not highlighted to any further degree.

3.3 The Impact of the Tax Reforms

Previous research has indicated that taxes influence the behavior of stocks around the ex-dividend day. Therefore, it is plausible that the tax reforms implemented during our analysis period could have influenced the potential to achieve significant CAAR on the OSE. To gain a thorough understanding of this topic, it is crucial to introduce the impact of these tax reforms for both domestic and foreign investors. The hypothesis concerning the performance of the short-term trading strategies during the periods of 1992-2005 and 2006-2022 is presented in Chapter 6.

The shareholder model introduced in 2006, applied to personal shareholders that were resident in Norway for tax purposes (Skatteetaten, 2023a). The goal of the model was to reduce the difference in taxation of capital and labor by taxing dividends, beyond a certain level, as ordinary income (Skattedirektoratet, 2006). It should be noted that personal domestic investors were subject to the same tax rates on capital gains and dividend income from 2006 to 2022. These investors could also claim a tax deduction on eventual capital losses during this time period (KPMG, 2022). Before the tax reform in 2006, domestic shareholders had not been charged tax on legally distributed dividends from LLCs and equivalent companies. Technically, the dividend tax was eliminated through an ”allowance” (Skattedirektoratet, 2006).

LLCs or other equal companies that owned stocks or had ownership in LLCs or other equal companies were subject to the exemption method after 2004. We assume that domestic institutions and investment companies that traded around the ex-dividend day were typically subject to this model. The exemption method exempted investors in general from taxes on capital gains and dividend income (Høyland, 2007; Skattedirektoratet, 2006). However, it was common for these investors to apply a 3% income recognition on the dividend amount. In contrast to the shareholder model, it was generally not possible to obtain a tax deduction for potential capital losses for investors subject to the exemption method (Skatteetaten, 2021a).

Throughout our analysis period, personal investors and companies with a foreign background were exclusively taxed on capital gains by their home state, according to the rules and tax rates that applied there (Zimmer, 2006). In other words, Norway did not have the authority under domestic law to tax foreign shareholders on capital gains (Fritzsønn & Nytrøen, 2023). On the other hand, they had the right to impose withholding tax on dividends paid out of the country (Fritzsønn & Nytrøen, 2023; Zimmer, 2006). If the company that distributed dividends did not know the tax status and the identity of foreign investors, the withholding tax rate was set to 25% of the dividend amount (Skatteetaten, 2023b). These investors could be entitled to a reduced withholding tax rate if Norway had a tax agreement with the investors country of origin, in which case the withholding tax was most often set to 15% (Fritzsønn & Nytrøen, 2023). Foreign companies that corresponded to Norwegian companies that were subject to the exemption method typically fell under the same tax regulation. Nevertheless, if specified criteria were not met, these companies were subject to withholding taxes likewise to personal foreign investors (Skatteetaten, 2021b).

It is important to be clear on the fact that tax agreements between countries took place, and was proportional before the tax reform in 1992 (Zimmer, 2006). As a result, the tax changes implemented in Norway between 1992 and 2022 had a limited impact on foreign investors. However, previous research has indicated that foreign investors and domestic investors with different tax statuses engage in trading activities with each other around the ex-dividend day. This relationship may have played a role on the OSE during our analysis period, where foreign investors could have influenced the behavior of stocks around the event.

4 Data

In this chapter, we provide an overview of the data used in this thesis. First, we demonstrate how we extracted and prepared the data. Additionally, we explain the rationale behind our choices. Lastly, we display some descriptive statistics on our data when categorizing into *Total*, *Sector*, and *Cap-Size*

4.1 Data Selection

The data used in this thesis are stocks that are or have been noted on the OSE between 1992-2022. OSE is one of the primary stock exchanges in Scandinavia, providing a platform for companies to raise capital and investors to purchase securities (Euronext, 2023). This study focuses on stocks that paid dividends back to the investors, and all the extracted data have been adjusted to NOK.

We specifically selected stocks that had more than five dividend payouts listed on the OSE between 1992-2022. We used all the available ex-dividend days for the selected stocks, which means that our analysis included both active and inactive companies. All the financial data that was retrieved for this thesis were collected from *Refinitiv Eikon Datastream*. Daily stock prices for both the stocks and the OSEBX[14] index were retrieved using an ek.get_data() code in Python. The ex-dividend days were categorized into three time periods: 1992-2005, 2006-2022, and 1992-2022, with a total of 243 stocks and a combined amount of 2772 ex-dividend days.

Our data set was sorted into three categories, including *Total*, *Sector* and *Cap-Size*. The *Total* category included all observations, while the *Sector* category used *Refinitiv Eikon Datastream* to divide the companies into different business sectors, using the *Thomson Reuters Business Classification(TRBC)*. The *Cap-Size* category sorted the different stocks based on their market-cap on the ex-dividend day. Our goal was to investigate the CAAR for the different time periods and to analyze the results across sectors and market cap-sizes.

To ensure the reliability of our data, we performed data cleaning using Python. We

[14]OSEBX: Oslo Stock Exchange Benchmark Index.

scanned every stock for missing values and removed a total of 10 416 observations in our data set. In our analysis, we wanted the data set to be as representative as possible, so we removed stocks with five or fewer ex-dividend days. Additionally, we used winsorizing to trim our results, where we trimmed the 2,5% edge on both side of our distribution as done in previous research by Henry & Kuski (2017). By placing restrictions on numbers of observations and winsorizing our data, we could have reduced the influence of outliers on our analysis, and obtained a more accurate picture of the stock returns.

4.2 Total

Table 1: Ex-Dividend Days *Total*

This table shows the number of ex-dividend days for all the companies combined and separated into time periods.

	Strategy 1	Strategy 2	Strategy 3	Div/Drop
Time period	Number of Ex-Dividend Days			
1992-2022	2772	2708	2763	2772
1992-2005	708	678	700	708
2006-2022	2064	2030	2063	2064

There was a total of 2772 observations included in the total data set from 1992-2022 in table 1. The table shows that the period between 1992-2005 had 1356 fewer observations than between 2006-2022. This could be explained by the fact that the last period consists of 17 years while the first period only consists of 14 years. It is important to note that the reason why some of the strategies have more observations than others is because of the absence of trading days in the event window.

4.3 Sectors

The companies were automatically sorted in *Refinitiv Eikon Datastream* using the *Thomson Reuters Business Classification* system, which is a well-structured and market-based system for identifying, analyzing, and monitoring industries across global markets (Refinitiv, 2020). In our analysis, we included all sectors that had 10 or more companies.

Table 2: TRBC Business Sectors

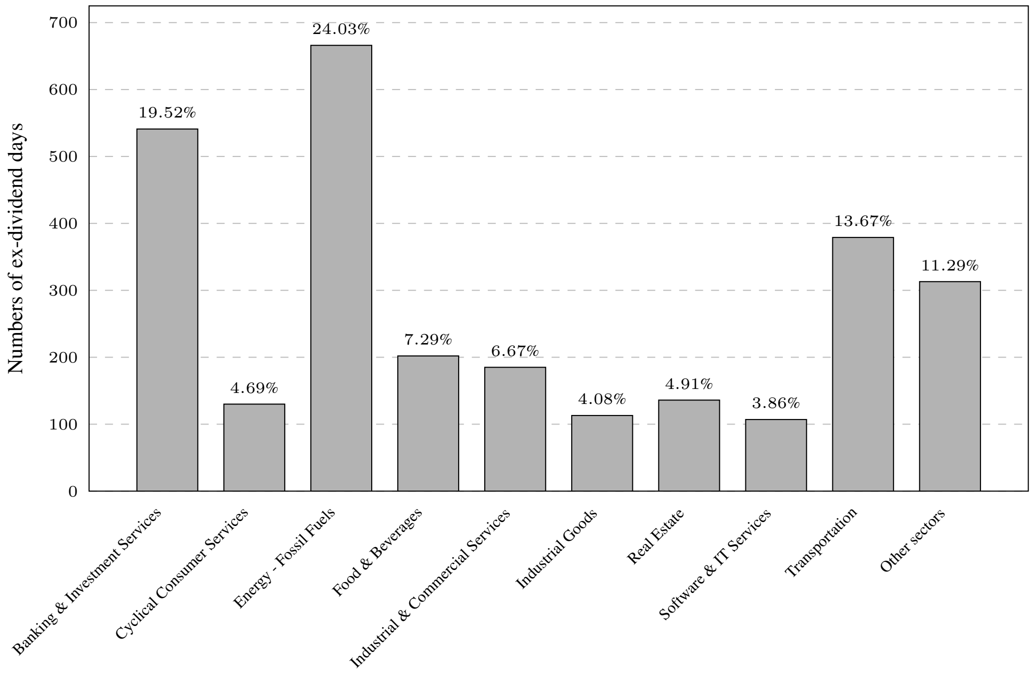
Table 2 provides a brief overview of the primary activities of each sector. The sectors are broad categories that group together companies based on their primary business activities, sorted in Refinitiv Eikon Datastream *with the* TRBC *System*

Sector	Description
Banking & Investment Services	Provides financial services including banking, investment management, and insurance.
Industrial Goods	Companies manufacturing and distributing goods such as machinery, equipment, construction materials, aerospace, and defense products.
Cyclical Consumer Services	Provides services to consumers, such as hotels, restaurants, and leisure facilities.
Fossil Fuel Energy	Explores, extracts, and refines fossil fuels, including oil, gas, and coal.
Food & Beverages	Produces and distributes food and beverages, including packaged goods, soft drinks, and alcoholic beverages.
Industrial & Commercial Services	Provides services to businesses, such as logistics, transportation, and advertising.
Real Estate	Owns, manages and develops real estate properties, including commercial and residential buildings, hotels, and shopping malls.
Software & IT Services	Provides software and information technology services, including software development, consulting, and data analytics.
Transportation	Provides transportation services, including airlines, shipping, and logistics.
Other Sectors	Companies in other sectors were excluded from this study because they had fewer than 10 companies.

Energy- Fossil Fuels, *Banking & Investment Services* and *Transportation* combines for a total 57,22% of the data. The OSE is an oil-dominant exchange, as presented in Figure 5. *Food & Beverages* and *Industial & Commercial Services* were respectively 7.29% and 6.67% of the observations, while the rest of the sectors were all under 5.00%. The graphs tell us that 11.29% of the total observations in our data set were excluded from the study, due to being a part of a sector consisting of less than 10 companies.

Figure 5: Histogram of numbers of ex-dividend days for sector

Figrue 5 is a histogram presenting the numbers of ex-dividend days in each sector. The number on top of the bars is the sector's percentage of the total population.



The total number of observations for each sector is presented in the following page in Table 3. We observed that the sector *Energy - Fossil Fuel* had the most observation in all the time periods. On the other, the smallest sector *Software & IT services* presented only 107 observations. The table shows that the majority of the observation happened in the period 2006-2022. *Other Sectors* observed 313 ex-dividend days that was excluded from this study.

Table 3: Ex-Dividend Days *Sector*

Table 3 gives a overview of the total numbers of ex-dividend days. Each sector is decomposed into time period [1] *and* [2] *, where* [1] *= 1992-2005 and* [2] *= 2006-2022.*

Sector	Strategy 1	Strategy 2	Strategy 3	Div/Drop
	Number of Ex-Dividend Days			
Banking & Investment Services	540	531	541	541
Banking & Investment Services[1]	168	161	168	168
Banking & Investment Services[2]	372	370	373	373
Cyclical Consumer Services	128	124	127	130
Cyclical Consumer Services[1]	57	56	57	59
Cyclical Consumer Services[2]	71	68	70	71
Energy - Fossil Fuels	666	656	663	666
Energy - Fossil Fuels[1]	207	201	202	207
Energy - Fossil Fuels[2]	459	455	458	459
Food & Beverages	202	198	200	202
Food & Beverages[1]	32	30	30	32
Food & Beverages[2]	170	168	170	170
Industrial & Commercial Services	185	177	184	185
Industrial & Commercial Services[1]	49	43	49	49
Industrial & Commercial Services[2]	136	134	135	136
Industrial Goods	113	109	112	113
Industrial Goods[1]	46	44	45	46
Industrial Goods[2]	67	65	67	67
Real Estate	136	133	134	136
Real Estate[1]	31	28	29	31
Real Estate[2]	105	105	105	105
Software & IT Services	107	103	106	107
Software & IT Services[1]	32	30	31	32
Software & IT Services[2]	75	73	75	75
Transportation	377	370	378	379
Transportation[1]	95	94	96	97
Transportation[2]	282	276	282	282
Other Sectors	312	309	311	313

4.4 Cap-Size

In our analysis, we aimed to investigate how the CAAR aligned based on the companies market capitalization size on the ex-dividend day. We sorted the companies into three different cap-sizes as presented in Table 4. The cap-size for each company is the total market capitalization we received from *Refinitiv Eikon Datastream* on the ex-dividend day. This means that there could be situations where some companies were in multiple cap-sizes depending on what the cap-size was on the ex-dividend day.

The requirements we used for the cap-size on the ex-dividend day are built on previous research put forward by Moiseev et al. (2023). Their study focused on the Chinese and American markets, which are significantly larger than the Norwegian market. In order to adjust for this difference we reduced the requirements for a better fit to the OSE and our data. The requirements are presented in Table 4.

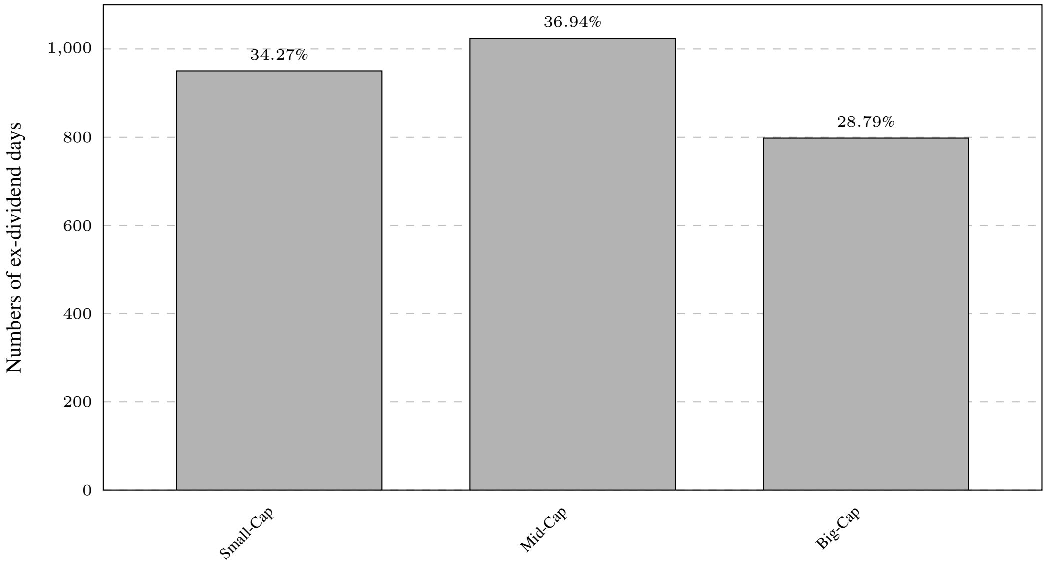
Table 4: Market Capitalization on the ex-dividend day

The following table outlines the requirements for the different market capitalization sizes on the ex-dividend day

Category	Requirements
Small-cap	$<$ Market Capitalization size less than 2 billion NOK.
Mid-cap	Between 2 billion and 10 billion NOK.
Big-cap	$>$ Market capitalization size bigger than 10 billion NOK.

Figure 6: Numbers of ex-dividend days for cap-size

Figure 6 is a histogram presenting the numbers of ex-dividend days in each cap-size. The number on top of the bars is the sectors percentage of the total population.



In Figure 6, the *Mid-cap* consists of the largest portion of the recorded ex-dividend days with 36,94% of all the observations. Next, we had *Small-cap* with 34.27% while *Big-Cap* had the smallest sample size of 28.79%.

Table 5: Ex-Dividend Days *Cap-Size*

Table 5 gives an overview of the total numbers of when categorizing into cap-size on ex-dividend days. Each cap-size is decomposed into time period [1] and [2] , where [1] = 1992-2005 and [2] = 2006-2022.

	Strategy 1	Strategy 2	Strategy 3	Div/Drop
Market Capitalization Size	Number of Ex-Dividend Days			
Small-cap	950	923	948	950
Small-cap[1]	319	304	316	319
Small-cap[2]	631	619	632	631
Mid-cap	1024	999	1021	1024
Mid-cap[1]	244	237	241	244
Mid-cap[2]	780	762	780	780
Big-cap	798	788	796	798
Big-cap[1]	145	138	144	145
Big-cap[2]	653	650	652	653

Table 5 gives a presentation of how the observations are distributed between the cap-size in the different time periods. *Mid-Cap* had the most observations in 1992-2022 and 2006-2022, while *Small-Cap* had the most observation between 1992-2005 with 319 ex-dividend days.

5 Methodology

In this chapter, we provide an overview of the methodology used in this thesis and explain the rationale behind the chosen estimation window and event window. We derive the capital asset pricing model (CAPM), the cumulative average abnormal return (CAAR), and the *Div/Drop*. Lastly, we introduce the bid-ask spread as a proxy for transaction costs, and the procedure for testing statistical significance.

5.1 Event and Estimation Window

Given the nature of our research question, we found it appropriate to employ an event study methodology in this thesis. The selection of the event and estimation window builds on the theory presented in Section 2.2.3. The estimation window is employed to estimate the expected return for a stock in relation to an industry or market index (Benninga, 2014, pp. 332-333). Building upon the methodology employed by a number of previous researchers (Frank & Jagannathan, 1998; Kadapakkam, 2000; Lakonishok & Vermaelen, 1986), our thesis adopted a 50-day estimation window, spanning from 65 days before to 16 days before the ex-dividend day.

The event window is the period where we measured the effect of the event (McWilliams & Siegel, 1997), which in this circumstance is the ex-dividend day. In this thesis, there are three different event windows, one for each of the short-term trading strategies that are presented in Section 1.3. In summary, Strategy 1, Strategy 2, and Strategy 3 have an event window of 15, 31, and 16 days, respectively. These three event windows exceeded the commonly used 11-day event window, which is based on the methodology proposed by Lakonishok and Vermaelen (1986), and are more aligned with Rantapuska's (2008) event window of 21 days.

Given that our data set covers a long period from 1992 to 2022 with a large number of observations, it was not feasible to manually check the estimation windows and the event windows for confounding effects. Although we acknowledge that there most likely have been some confounding effects over the analysis period, we believe that they were relatively small compared to the overall data set. Therefore, we do not expect these effects to have a substantial impact on either the estimation window or the even window.

It is still important to note that employing a longer event window could potentially introduce problems with confounding effects, and data biases, as presented in Section 2.2.3. On the other hand, it has also the potential to capture a wider range of market movements, both before and after the ex-dividend day, and provide a more comprehensive understanding of stock behavior during this period. Given our assumption that the data set is robust against confounding effects, we believe that the potential benefits of using a longer event window than several previous studies outweigh the risks. This choice could potentially contribute new insights to previous research in this area.

5.2 Expected Return

In this thesis, we found the CAPM a good fit for its intended purpose, despite the criticisms and limitations of the model outlined in Section 2.2.2. Specifically, we utilized the CAPM to estimate the expected return for dividend stocks on the OSE over the analysis period. The CAPM is derived in equation (1), where we used the same model as Elbannan (2014).

$$\hat{R}_{i,t} = R_{f,t} + \beta_{i,t}(R_{m,t} - R_{f,t}) \tag{1}$$

Where $\hat{R}_{i,t}$ are the expected return on asset i on time t, $R_{f,t}$ are the risk-free rate of return, $\beta_{i,t}$ are the asset's beta coefficient and $R_{m,t}$ represent the expected return on the market. To calculate the beta coefficient in this model, the following formula was used:

$$\beta_{i,t} = \frac{\text{Cov}(R_{i,t}, R_{m,t)}}{\sigma^2(R_{m,t})} \tag{2}$$

Where $\beta_{i,t}$ are the beta coefficient for asset i on time t, $\text{Cov}(R_{i,t}, R_{m,t})$ are the covariance between the return on asset i and the market return R_m, and $\sigma^2(R_{m,t})$ are the variance of the market return. The proxy for the market return was in this study set to the OSEBX index return.

The measure for the risk-free rate was set to the 10-year Norwegian government bond, as this was the most widely used risk-free rate in the Norwegian markets according to PWC (2021). In detail, the synthetic yield series published by Norges Bank was employed as a proxy for the 10-year Norwegian government bonds for each year between 1992-2020. However, as of June 30, 2021, Norges Bank stopped updating the synthetic yield series (Norges Bank, 2022). Hence, we had to utilize the zero coupon yield published by Norges Bank with a maturity of 10 years as a proxy for the risk-free rate for the two last years of the study (Norges Bank, 2023). The risk-free return proxy for each year between 1992-2022 is presented in Appendix 1.

5.3 Cumulative Average Abnormal Return

To determine if the short-term trading strategies generated returns exceeding the expected return, we formulated a model that calculated the Cumulative Average Abnormal Return (CAAR). Our model was based on the previous research by Michelson et al. (2000) and Brown and Warner (1980). The formula for the abnormal return (AR), which was the first step in the model, is provided below.

$$AR_{i,t} = R_{i,t} - E(\hat{R}_{i,t}) \tag{3}$$

In this formula, the $R_{i,t}$ is the daily actual return for stock *i* on time *t*, while the $E(\hat{R}_{i,t}$ is the expected daily return on time *t* for the same asset calculated using CAPM.

To evaluate the overall performance of the short-term trading strategies, we calculated the daily average abnormal return (AAR) across all stocks in our sample for each strategy. AAR is the average of the AR for all companies *N* for a given time *t*, and it provides an indication of the profitability of the strategy as a whole. The formula is listed in equation (4).

$$AAR_{i,t} = \frac{1}{N}\sum_{i=1}^{N} AR_{i,t} \tag{4}$$

In this thesis, we aimed to investigate the daily behavior of stock prices around the ex-dividend day. Therefore, we utilized the cumulative average abnormal (CAAR) return measure. Unlike the AAR, which reflects average AR over a specific period, CAAR aggregates the AARs over the entire period of interest, making it a more appropriate measure for our research purposes. Specifically, we calculated the CAAR for each short-term trading strategy to examine the performance of the strategies in the event windows and to compare the actual daily behavior of stock prices to their expected behavior. The formula for CAAR is presented below .

$$CAAR_{i,(t_1,t_2)} = \sum_{t=t_1}^{t_2} AAR_{i,t} \quad (5)$$

5.4 Div/Drop

To isolate the average return generated from the difference between the dividend payout and the stock price decline between the closing price on the inc-day, and the opening price on the ex-dividend day, we constructed the *Div/Drop*. This measurement does not include transaction cost or expected return and could be seen as an attempt to isolate the ex-dividend anomaly. Below, the *Div/Drop* formula is presented.

$$\text{Div/Drop}_i = \frac{1}{N}\sum_{t=1}^{N} \frac{(\text{Open Price}_{i,t} - \text{Close price}_{i,t_{-1}}) + \text{Dividend}_{i,t}}{\text{Close price}_{i,t_{-1}}} \quad (6)$$

Where *N* is the total number of observed ex-dividend days for an asset *i* on time *t*, and the $(\text{Open Price}_{i,t} - \text{Close price}_{i,t_{-1}}) + \text{Dividend}_{i,t}$ is the difference between the decline in the stock price and the dividend. We divided each observation with the Close $\text{price}_{i,t_{-1}}$ in order to find the average actual return from this relationship.

5.5 Transaction Cost

The transaction cost was estimated using the average bid-ask spread for each individual company. The bid-ask spread is conceptually the effective measure of the cost of immediate execution and can be seen as the ”midpoint” average between the highest bid and the lowest ask (Hagströmer, 2021). To better reflect the real-world impact of our strategies, we included these costs in our analysis. Given that our strategies involve both buying and selling stocks within a short time period, we included transaction costs for both processes. The formula for the relative bid-ask spread is derived in equation (7).

$$\text{Bid-Ask Spread } (\%)_{i,t} = \frac{(\text{Ask Price}_{i,t} - \text{Bid Price}_{i,t})}{\frac{1}{2}(\text{Ask Price}_{i,t} + \text{Bid Price}_{i,t})} \tag{7}$$

Where the bid ask-spread in % was calculated by taking the difference between the ask-price and bid-price, and dividing it by the average spread. This measurement has been used in several publications (Eleswarapu & Reinganum, 1993; Amihud, 2002).

$$\text{Transaction Cost}_{(t_1,t_2)} = \frac{1}{N}\sum_{t=1}^{N} \text{Bid-Ask Spread } (\%)_{i,t} \tag{8}$$

The bid-ask spread is manually calculated for each day for the strategies, while the transaction cost is calculated as the averages of all bid-ask spreads for all companies combined in our study. This means that there is a different transaction cost for each strategy.

5.6 Significance Test

To allow for the possibility that the CAAR was positive or negative, we aimed to maintain the flexibility to assess the significance level using a two-sided t-test. We follow the method used by Patell (1976), Linn and McConnel (1980), and Schipper and Smith (1983). The formulation of the two-sided t-test is presented below.

$$t = \frac{\bar{x}}{s/\sqrt{n}} \tag{9}$$

Where $\bar{x}$ is the sample mean, s is the sample standard deviation, and n is the sample size. The test statistic t follows a t-distribution with $n - 1$ degrees of freedom. In this study, the $\bar{x}$ represents the CAAR from the strategies or the *Div/Drop*. The two-sided t-test aims to challenge the null hypothesis where the mean is not significantly different from zero.

$$t = \frac{\bar{x} - \bar{y}}{s_p\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} \tag{10}$$

When comparing the different time periods against each other, we needed to expand the test to check two means against each other. In this case, the formula is presented above, where $\bar{x}$ is the sample mean of period 1, while $\bar{y}$ is the mean of period 2. The null hypothesis in this test claims that there is not a significant difference between the time periods. The "pooled variance" s_p is formulated in equation (11).

$$s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2} \tag{11}$$

Where n_i is the sample size, and the test statistic t follows a t-distribution with $n - 1$ degrees of freedom. In this test, we aimed to see if there was any significant difference between the means of the populations. In line with the recommendation of Studenmund (2017), the null hypothesis is rejected if the p-value is below the recommended significance level of 5% (pp. 144-154).

6 Hypotheses

This chapter is dedicated to presenting our hypotheses for the short-term trading strategies, along with the research questions and the three sub-questions. These hypotheses have been developed through an examination of previous research and serve as a framework for presenting and discussing our results in Chapter 7.

Kaddapakkam (2000) found abnormal volume in the days before the ex-dividend day, while Lakonishok and Vermaelen (1986) argued that buying pressure caused significant abnormal returns before the ex-dividend day. Based on these findings, we anticipate a rise in the price of dividend-paying stocks in the days preceding the ex-dividend day, resulting in a positive CAAR for strategy 1. After the ex-dividend day, Kaddapakkam (2000) did not discover abnormal volume, while Lakonishok and Vermaelen (1986) identified an abnormal price decline. These findings may suggest a potential decreasing interest after the stock goes ex-dividend, and we anticipate a negative CAAR for Strategy 3.

Strategy 2 is the only strategy that receives dividend payouts. Prior research has documented evidence of an ex-dividend anomaly in the Norwegian stock market (Dai & Rydqvist, 2009), in markets exempted from taxes on both dividend income and capital gains (Dupuis, 2019; Frank & Jagannathan, 1998), and in other financial markets (Elton and Gruber, 1970; Liljeblom et al., 2001). Building on this existing research, we expect that the ex-dividend price drop on the OSE during our analysis period, is less than the distributed dividend amount and that this relationship generates a positive average return significantly different from zero. We expect that the combined impact of Strategy 1 and the return from the ex-dividend price drop exceeds the decline predicted in Strategy 3, resulting in an overall positive CAAR for Strategy 2.

Previous research has indicated that foreign and domestic investors, who are subject to varying tax regulations and preferences, can impact stock behavior around the ex-dividend day (Dai & Rydqvist, 2009; Liljeblom et al., 2001; Rantapuska, 2008). We anticipate that the 2006 tax reform made investments in dividend stocks less profitable for the average investor as the ex-dividend anomaly became less prominent. As a result, we expect to observe a significant difference in CAAR between 1992-2005 and 2006-2022.

By reviewing historical returns from company size and industry sector, we anticipate *Energy - Fossil Fuel*, *Food & Beverages*, and *Software & IT Services* to exhibit the highest performance, where the *Banking & Investment Services* sector is likely to deliver the weakest cumulative average abnormal returns (CAAR). We recognize the influence of the small-firm effect (SFE), which is expected to produce excess returns in sectors comprised of smaller companies. *Industrial Goods* consists of the fewest observations along with *Software & IT Services*. We have a hypothesis that the smallest sectors have a high degree of small companies, and anticipate the *Industrial Goods* sector to perform favorably in our analysis. We expect smaller companies to generate higher returns and assume *small-cap* companies to outperform the other sizes. Given that our research focuses exclusively on CAAR rather than risk-adjusted measures such as The Sharpe ratio, these expectations are strongly supported by previous literature presented in section 2.1.2.

7 Results and Discussion

This chapter presents and discusses the findings obtained from our short-term trading strategies and the *Div/Drop*. The chapter is divided into three sections, where the first section discusses the results from the complete data set. Subsequently, the second and third sections analyze the findings when decomposing the data based on industry sector and market capitalization, respectively. The findings are examined across the total period of 1992-2022 and in the divided periods that span between 1992-2005 and 2006-2022. Throughout the chapter, we discuss the results in relation to our hypotheses and previous literature, with the primary aim of answering our research question and the three sub-problems.

7.1 Results from the Category Total

Table 6: Cumulative average abnormal return(%) *Total*

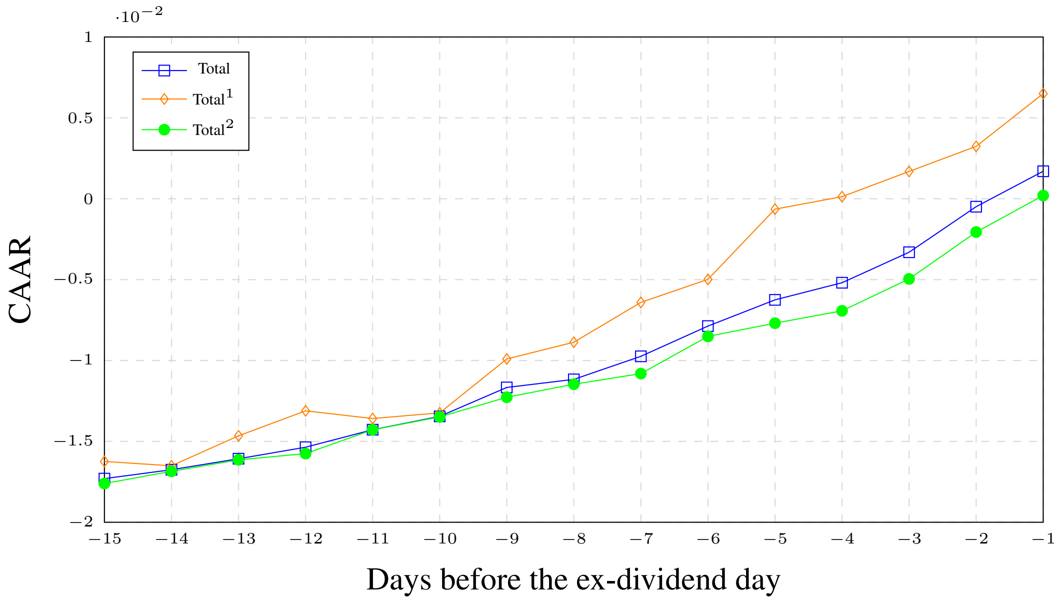
The values for the CAAR and the Div/Drop are derived from all the stocks in the data set, taking various time periods into account. It is important to note that CAAR has incorporated transaction costs, while the Dividend/Drop values measure does not consider transaction costs.

	Strategy 1	Strategy 2	Strategy 3	
Time period		CAAR		Div/Drop
1992-2022	0.0017***	0,0105	-0,0107***	0,0203***
1992-2005	0.0065***	0,0563***	0,0033***	0,0541***
2006-2022	0.0002***	0,0060	-0,0135***	0,0181***

$^{*}p < 0.1,^{**}p < 0.05,^{***}p < 0,01$

In Strategy 1, Table 6 shows that the period between 1992-2005 had the highest CAAR of 0.65%, followed by a decline in the CAAR from 2006-2022 with a CAAR of 0.02%. Despite this decrease, the CAAR remained positive for the entire period of 1992-2022, with an overall positive CAAR of 0.17%. All the examined time periods for Strategy 1 were statistically significant at a 1% significance level. The positive CAAR observed across all time periods is consistent with our hypothesis and gives support to the findings presented by Lakonishok and Vermaelen (1986), who identified significant abnormal returns in the days before the ex-dividend day.

Figure 7: Strategy 1 *Total*



This thesis has not investigated the underlying cause of the observed positive CAAR for Strategy 1. However, Figure 7 could provide some clues to the story. Specifically, it reveals a consistent trend for Strategy 1 across all time periods, where we observe a relatively steady positive increase from 15 days before to 1 day before the ex-dividend day. We also observe that the CAAR is higher and has a steeper positive trend in the days leading up to the ex-dividend day between 1992-2005 compared to 2006-2022. According to Lakonishok and Vermaelen (1986), the significant abnormal returns observed before the ex-dividend day were attributed to buying pressure. This was also consistent with Kaddapakkam's (2000) findings of abnormal volume in the days leading up to the ex-dividend day. While the consistent trend over the time periods might indicate that the positive CAAR in Strategy 1 could be due to buying pressure, this hypothesis is not empirically tested in this study.

As presented in Section 3.3, domestic investors were practically exempted from taxes on dividend income between 1992 to 2005. This favorable tax treatment may have caused these investors to prefer dividend income over capital gains during this period. On the other hand, domestic personal investors were taxed at the same rate on both dividend income and capital gains from 2006, which we assume should have made them indifferent between where they received gains in general. Therefore, it is possible that more investors were interested in receiving dividend income before 2006 compared to the period after. Additionally, the *Div/Drop* measure indicates that it was more profitable to capture dividends before 2006 compared to the period after. These factors may have increased buying pressure before 2006, leading to a higher CAAR for Strategy 1 between 1992-2005 compared to 2006-2022. However, it should be noted that the impact of the tax reforms could be more complex due to the involvement of foreign investors and various investor groups subject to different tax rules. Although the tax reform could potentially explain the differences observed across different periods, and buying pressure might be the underlying cause behind the consistent pattern observed in Strategy 1, it is necessary to conduct further research to assess the validity of these hypotheses on the OSE.

Even though Strategy 1 produced positive CAAR in all periods, the strategy only gave positive CAAR in 49%, 56%, and 47% of the observations between 1992-2022, 1992-2005, and 2006-2022, respectively, as shown in Table 7. This indicates that the positive CAAR observations between 1992-2022 and 2006-2022 had larger values than the negative observations. Furthermore, it seems logical that the period between 1992-2005, which generated the highest CAAR, also had the highest relative positive observations.

Table 7: Numbers of positive CAAR (% of total) for *Total*

This table presents the total number of positive observations in the different strategies including the Div/Drop. The numbers in parentheses represent the percentage of the observations that were positive.

	Strategy 1	Strategy 2	Strategy 3	Div/Drop
Time period	Numbers of positive CAAR (% of total)			
1992-2022	1366 (49)	1436 (53)	886 (32)	2244 (81)
1992-2005	393 (56)	430 (63)	286 (41)	592 (84)
2005-2022	973 (47)	1006 (50)	600 (29)	1652 (80)

To strengthen the understanding of how the relationship between the ex-dividend price drop and the distributed dividend amount contributed to the generated CAAR in Strategy 2, we constructed the *Div/Drop* measure, which is presented in Table 6. This measure provides the average actual return from this relationship and is explained thoroughly in Section 5.4. The *Div/Drop* was 2.03% during the total period, 5.41% during 1992-2005, and 1.81% during 2006-2022. In all periods, the *Div/Drop* were significantly different from zero at a 1% significance level. By subtracting the *Div/Drop* measure from 1, we can observe the average percentage decrease in share prices relative to the distributed dividend amounts on the ex-dividend day. Our findings show that, in the total period from 1992-2022, the stock prices decreased by 97.97% (1-0.0203) of the distributed dividend amount on the ex-dividend day. During the periods spanning from 1992-2005, the drop was 94.59%, and in 2006-2022 the drop was 98.19%.

Table 7 displays the percentage of positive *Div/Drop* returns over the entire period. Our analysis reveals that in 81%, 84%, and 80% of the ex-dividend days between 1992-2022, 1992-2005, and 2006-2022 respectively, the ex-dividend price drop was lower than the distributed dividend amount, resulting in a positive actual average return. In the remaining cases, the ex-dividend price drop exceeded the dividend payout and gave a negative *Div/Drop*.

Heath and Jarrow (1988) argued that while the ex-dividend price drop is generally lower than the dividend payout, it could also be higher. While our findings show that a positive *Div/drop* is observed in most cases, negative returns are detected in 19% of the total observations. If we assume that the ex-dividend price drop cannot be accurately predicted before the event, our findings align with the authors, and we cannot claim that arbitrage profits can be achieved by exploiting an ex-dividend anomaly on the OSE.

Table 8: Transaction Cost

This table presents the average bid-ask spread and the total transaction cost used in this study. It is important to note that the total transaction cost includes the cost of both buying and selling the stock.

	Average Bid-Ask Spread	Total Transaction Cost (%)
Strategy 1	0.90%	1.80%
Strategy 2	0.91%	1.82%
Strategy 3	0.92%	1.84%

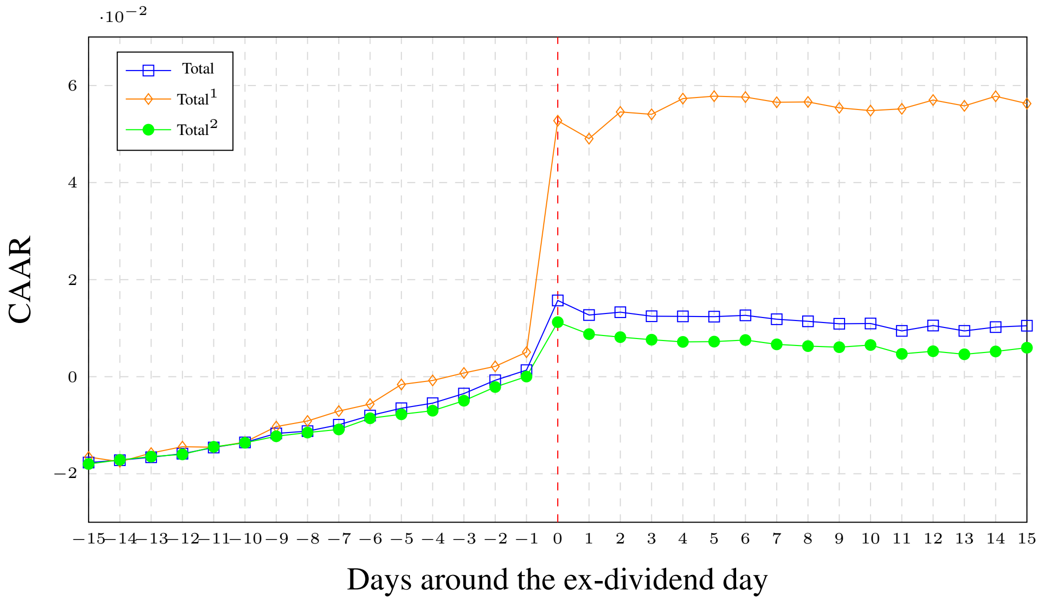
Furthermore, it is important to note that the *Div/Drop* measure does not factor in transaction costs. The average combined transaction cost of buying and selling is presented in Table 8 and was 1,82% for Strategy 2, which includes the ex-dividend day. This indicates that if a short-term trader bought at the closing price on the inc-day and sold at the opening price on the ex-dividend day, transaction costs could greatly reduce the profits from capturing dividends.

In Strategy 2, transaction costs are equal to the average bid-ask spread for each day, from 15 days before to 15 days after the ex-dividend day, times two. Thus, these costs may not fully reflect those incurred by traders seeking to capture dividends. Nevertheless, based on this transaction cost, our analysis shows that it was not substantial enough to eliminate short-term profits between 1992-2005 and 1992-2022. This finding supports the suggestion put forward by Kalay (1984), which proposed that transaction costs may not always be significant enough to completely offset short-term gains around the ex-dividend day.

While the evidence presented above indicates that exploiting the ex-dividend anomaly for short-term gains during our analysis period may have been possible, this could only be achieved by a small number of investors, according to Henry and Koski (2017). Specifically, they found evidence that institutional investors concentrated their trades on specific ex-dividend days and that only institutions with a high level of trade execution skills could achieve abnormal returns on the ex-dividend day. This thesis has not tested this hypothesis, and further research is necessary to confirm the validity of Henry and Koski's (2017) suggestion on the OSE.

In summary, our *Div/Drop* results contradict the theory proposed by Miller and Modigliani (1961), as well as the empirical evidence presented by Boyd and Jagannathan (1994). Both studies argued that the ex-dividend price drop should decrease by the same amount as the dividend payout. Instead, our findings show that the *Div/Drop* was significantly different from zero in all periods and provides evidence of an ex-dividend anomaly on the OSE. These findings align with previous research conducted by Dai and Ryqvist (2009) within the same market, as well as several studies from different markets, which have also found evidence of an ex-dividend price drop that was less than the distributed dividend amount (Dupuis, 2019; Durand & May, 1960; Elton & Gruber, 1970; Frank & Jagannathan, 1998; Kalay, 1982; Liljeblom et al., 2001; Miller & Modigliani, 1961; Rantapuska, 2008). However, because the transaction costs used in Strategy 2 may not accurately reflect the costs incurred in dividend capture trading, we cannot claim with certainty that transaction costs are low enough to exploit the ex-dividend anomaly for short-term gains on the OSE. Conducting additional research in this area could offer valuable insights into the feasibility of exploiting inefficiencies on the OSE and could potentially challenge the EMH.

Figure 8: Strategy 2 *Total*



Moving on to Strategy 2, Table 6 shows that the highest CAAR of 5.63% is observed between 1992 and 2005 and is statistically significant at a 1% level. This period had also the highest *Div/Drop*, which greatly contributed to the generated CAAR. Figure 8 illustrates this by showing a steep increase in CAAR from the closing price on the inc-day (day -1) to the closing price on the ex-dividend day (day 0). The other periods also show a positive development in CAAR between these points but with weaker values than the 1992-2005 period. However, it is important to remember that Figure 8 does not illustrate the isolated effect from the *Div/Drop*, as the generated CAAR from the opening price to the closing price on the ex-dividend day also is factored in.

The period from 2006-2022 shows a CAAR of 0.6%, while the overall CAAR for the entire period was 1.05%. interestingly, none of these values were significant. After the ex-dividend day, we found a negative CAAR between 1992-2022 and 2006-2022, while 1992-2005 provided a small positive CAAR. The return generated by the *Div/Drop* was the most important factor contributing to the generated CAAR values in Strategy 2. The findings from this strategy support our hypothesis over the total period, as we observe a positive CAAR before the ex-dividend day, a positive *Div/Drop* effect that contributes to a higher CAAR, and a negative CAAR after the ex-dividend day that reduces the overall CAAR.

Similar to Strategy 1, Strategy 2 had the highest number of positive CAAR observations from 1992-2005. However, across the other periods, there was almost an equal amount of positive and negative observations. Furthermore, Figure 8 indicates that transaction costs strongly reduced the CAARs in Strategy 2, especially between 1992-2022 and 2006-2022.

It is essential to note that comparing the CAAR generated from Strategy 2 directly to the combined return of Strategy 1, Strategy 3, and the *Div/Drop* is inappropriate and results in an inaccurate CAAR. This is because each strategy considers transaction costs related to buying and selling. This means that merging the CAAR from two strategies results in four transaction costs being considered instead of two. Additionally, the results from the strategies and the *Div/Drop* have undergone winsorizing, which involves trimming the top and bottom 2.5% of the results. Consequently, there is slight variations between the *Div/Drop* included in the strategies and the isolated *Div/Drop* measure. Nevertheless, the isolated *Div/Drop* measure provides a valuable indication of the contribution of this return to the generated CAAR in Strategy 2.

Figure 9: Strategy 3 *Total*

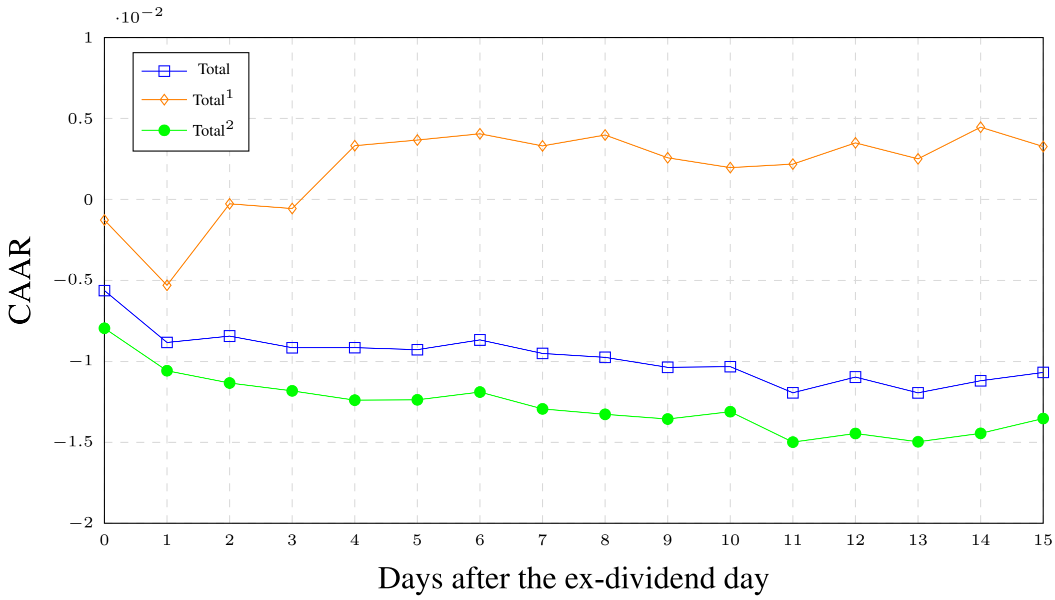


Figure 9 illustrates that the differences in CAAR between 1992-2005 and 2006-2022 continue to be evident in Strategy 3. Specifically, Table 6 shows that Strategy 3 generated a CAAR of - 1.07% in the total period. This result was mainly due to the CAAR of -1.35% observed between 2006-2022. In contrast, the period spanning from 1992-2005 had a positive CAAR of 0.33%, which is notably different from the other two periods. The observed CAARs in Strategy 3 are statistically significant at a 1% level across all periods.

In comparison to Strategies 1 and 2, where the number of positive and negative CAAR observations were almost equal, Strategy 3 appears to be dominated by negative observations. Table 7 shows that for this strategy, only 32%, 41%, and 29% of the observations were positive during 1992-2022, 1992-2005, and 2006-2022, respectively, with the remainder being negative. Our evidence suggests that there could be a consistent downward trend in stock prices after the ex-dividend day, instead of a random walk. However, it is important to bear in mind that CAAR represents the difference between the actual return in the event window and the expected return estimated using CAPM in the estimation window. Thus, the negative CAAR observed in two of the periods might reflect that the expected return was more positive than the actual return rather than an actual decrease in stock prices after the ex-dividend day. Despite a high number of negative observations, the period from 1992-2005 generated a positive CAAR after the ex-dividend day, as presented earlier. This suggests that the positive observations had higher values than the negative ones.

The hypothesis for Strategy 3 is presented in Chapter 6 and is based on the evidence presented by Lakonishok and Vermaelen (1986), who found an abnormal decrease in stock prices following the ex-dividend day. As a result, we expected to observe a negative CAAR for this strategy. Hence, our results align with our hypothesis for the periods between 1992-2022 and 2006-2022, but the period from 1992-2005 had a different trend that contradicted our hypothesis.

Previous literature does not provide a clear explanation for the observed relationship after the ex-dividend day. As mentioned earlier, an abnormal trading volume may have contributed to the positive CAAR observed before the ex-dividend day in Strategy 1. However, after the ex-dividend day, the right to receive dividend payout is gone, which may have led to a decreased interest. This suggestion is in line with Kadapakkam's (2000) findings that abnormal trading volume occurred before the ex-dividend day but not after it. Consequently, the negative CAAR observed after the ex-dividend day during the total period could have been influenced by low interest and volume.

On the other hand, the relationship around the ex-dividend day is complex, and several other factors could have influenced the observed CAAR in this strategy. For instance, foreign ownership has been shown to influence the ex-dividend behavior of stocks in prior literature (Dai & Rydqvist, 2009; Liljeblom et al., 2001; Rantapuska, 2008). Additionally, several researchers have argued that clientele effects exist, where investors trade around the ex-dividend day based on their tax status (Barclay, 1987; Elton & Gruber, 1970). Based on these prior evidence those who preferred dividend income may have contributed to a period of excess selling shortly after the ex-dividend day, while those favoring capital gains would likely moderate this effect through buying. The interplay of these factors could potentially account for the negative CAAR observed after the ex-dividend day between 1992-2022 and 2006-2022.

As presented earlier, the results between 1992-2005 are different than the other periods, where we observe a positive CAAR for Strategy 3. Similar to the discussion above, this findings could have been influenced by various factors, but it is likely that the advantageous taxation on dividend income for domestic investors before 2006 played a role, as presented in Section 3.3. Nevertheless, in this thesis, we have not conducted empirical research on the reason behind the observed CAAR after the ex-dividend day. Therefore, similar to Strategies 1 and 2, further research is necessary to gain a deeper understanding of the factors driving the results in Strategy 3.

Table 9: Comparing CAAR from *Total* between 1992-2005 and 2006-2022

This table shows the p-values achieved when doing a two-sided t-test where we compared the time period 1992-2005 against 2006-2022.

	Strategy 1	Strategy 2	Strategy 3
Category		*p-value*	
Total	0.2763	0.0001***	0.0000***

$^{*}p < 0.1,^{**} p < 0.05,^{***} p < 0,01$

Table 9 shows a significant difference at a 1% level in the CAAR between Strategy 2 and 3 for the time periods 1992-2005 and 2006-2022. In Strategy 1, we find no significant difference in the CAAR between these two time periods. Figure 7 shows a similar pattern across all time periods for Strategy 1. In contrast, Figures 8 and 9 display distinct differences in the generated CAAR between the two time periods for Strategy 2 and Strategy 3. This explains why we observe significant variations across the different periods for these strategies. Our findings are partly consistent with our hypothesis, where we expected to observe a significant difference in the generated CAAR from the short-term trading strategies in these periods. However, the results from Strategy 1 contradicted our hypothesis.

In summary, based on the results presented in this section, it seems like it was indeed possible to generate a significant CAAR from short-term trading strategies around the ex-dividend day between 1992-2022 on the OSE. This is in line with previous researchers that have found abnormal returns around the ex-dividend day (Dupuis, 2019; Henry & Koski, 2017; Lakonishok & Vermaelen, 1986), but contradicts the semi-strong and strong-form of the EMH, where such return should not have been achievable. Consequently, these results question the validity of the EMH and give support to previous research that has implied that markets are not always efficient and that anomalies could be exploited (De Bondt & Thaler, 1985; Jegadeesh & Titman, 1993; Rendleman Jr et al., 1982).

7.2 Results from the Category Sector

The following results were obtained by dividing the stocks based on the *TRBC Business Sector* in *Refinitive Eikon*. As expected, the results displayed variations across different sectors during the different periods.

Table 10 shows that the sector *Industrial & Commercial Services* returned the highest CAAR during 1992-2005 with 5.50% and during the whole period with a CAAR of 1.89% for Strategy 1. However, it is noteworthy that none of these outcomes achieved statistical significance. Conversely, the sector *Software & IT Services* generated the weakest performance between 1992-2005, with a significant CAAR of -1.90% at a 1% level. This finding contradicted our initial hypothesis, as we anticipated that this sector would exhibit one of the strongest performances. Furthermore, our expectations were not met when assuming that the *Industrial Goods* sector, being one of the smallest sectors, would be among the top performers. Surprisingly, the CAAR for Strategy 1 revealed one of the weakest performances for this sector in our analysis. One possible explanation for this result could be that the *Industrial Goods* sector comprises a few but large companies, challenging our assumption that sectors with fewer observations consist of smaller companies.

Regarding Strategy 2, where 15 days before to 15 days after the ex-dividend day was considered, the sector *Food & Beverages* yielded the highest return with a statistically significant CAAR of 19.27% during 1992-2005. The sector *Software & IT Services* demonstrated an improved performance from Strategy 1, as it had the highest significant CAAR

Table 10: CAAR Sectors

Table 10 shows the CAAR gained when performing the different strategies within the sectors. Each sector is divided into time period ^{1} and ^{2} , where ^{1} = 1992-2005 and ^{2} = 2006-2022.

	Strategy 1	Strategy 2	Strategy 3	
Sector		CAAR		Div/Drop
Banking & Investment Services	-0,0005***	0,0555***	-0,0231***	0,0877***
Banking & Investment Services^1	-0,0018***	0,1246***	-0,0135***	0,1588***
Banking & Investment Services^2	0,0000***	0,0248**	-0,0273***	0,0526***
Cyclical Consumer Services	-0,0092***	0,0016***	-0,0058***	0,0165***
Cyclical Consumer Services^1	-0,0101***	0,0064**	0,0006***	0,0170***
Cyclical Consumer Services^2	-0,0084***	-0,0019***	-0,0103***	0,0158***
Energy - Fossil Fuels	0,0029***	0,0126	-0,0104***	0,0206***
Energy - Fossil Fuels^1	0,0136	0,0591***	0,0036	0,0450***
Energy - Fossil Fuels^2	-0,0019***	-0,0089***	-0,0170***	0,0105***
Food & Beverages	0,0044***	0,0547***	-0,0188***	0,0686***
Food & Beverages^1	-0,0004	0,1927***	-0,0380***	0,2215***
Food & Beverages^2	0,0054***	0,0288***	-0,0153***	0,0408***
Industrial & Commercial Services	0,0189	0,0540***	0,0052	0,0430***
Industrial & Commercial Services^1	0,0550	0,1779***	0,0259***	0,1282***
Industrial & Commercial Services^2	0,0058***	0,0142***	-0,0023***	0,0144***
Industrial Goods	-0,0038***	0,0385**	0,0023***	0,0461***
Industrial Goods^1	-0,0034***	0,0624***	0,0084***	0,0635***
Industrial Goods^2	-0,0041***	0,0223	-0,0019***	0,0324***
Real Estate	-0,0023***	0,0190	-0,0040***	0,0344***
Real Estate^1	0,0106**	0,0142	-0,0232***	0,0809**
Real Estate^2	-0,0060***	0,0202	0,0013***	0,0231***
Software & IT Services	0,0116***	0,0746***	-0,0125***	0,0803***
Software & IT Services^1	-0,0190***	-0,0078***	-0,0168***	0,0203***
Software & IT Services^2	0,0247	0,1084***	-0,0108***	0,1070***
Transportation	0,0133**	0,0325***	-0,0019***	0,0226***
Transportation^1	0,0226	0,0772***	0,0245***	0,0405***
Transportation^2	0,0100***	0,0179**	-0,0109***	0,0155***

$^*p < 0.1, ^{**} p < 0.05, ^{***} p < 0,01$

from 1992-2022 with a result of 7.46% for Strategy 2. This finding aligned with our hypothesis, and we could see that this sector had one of the biggest effects of the *Div/Drop*. The sector with the weakest performance during Strategy 2 was *Energy – Fossil Fuels* with a CAAR of -0.89% during 2006-2022, which was statistically significant at the 1% level. We initially expected this sector to be one of the strongest performers, but an explanation for this result could be that some of the big oil companies could entail a lower return.

For Strategy 3, most sectors displayed a negative CAAR during the period after the ex-dividend day, with *Food & Beverages* showing the most substantial decline at -3.80% at a 1% significant level. However, *Industrial & Commercial Services* demonstrated a positive CAAR of 2.59% during 1992-2005, which was statistically significant at the 1% level, and resulted in the highest return for all observations for Strategy 3.

When analyzing the *Div/Drop*, Table 10 shows that all observations except *Real Estate* during 1992-2005 achieved statistical significance at the 1% level. Each observation displayed a positive differential between the dividend payment and the decline in the stock price on the ex-dividend day. *Food & Beverages* had the highest return with 22.15% during 1992-2005, whereas *Energy – Fossil Fuel* produced the lowest return of 1.05% from 2006-2022. These results gave clear proof that the ex-dividend anomaly was apparent for each sector, whereas the effect was positive in all sectors but with varying degrees of influence.

Figure 10: Strategy 2 *Sector* 1992-2022

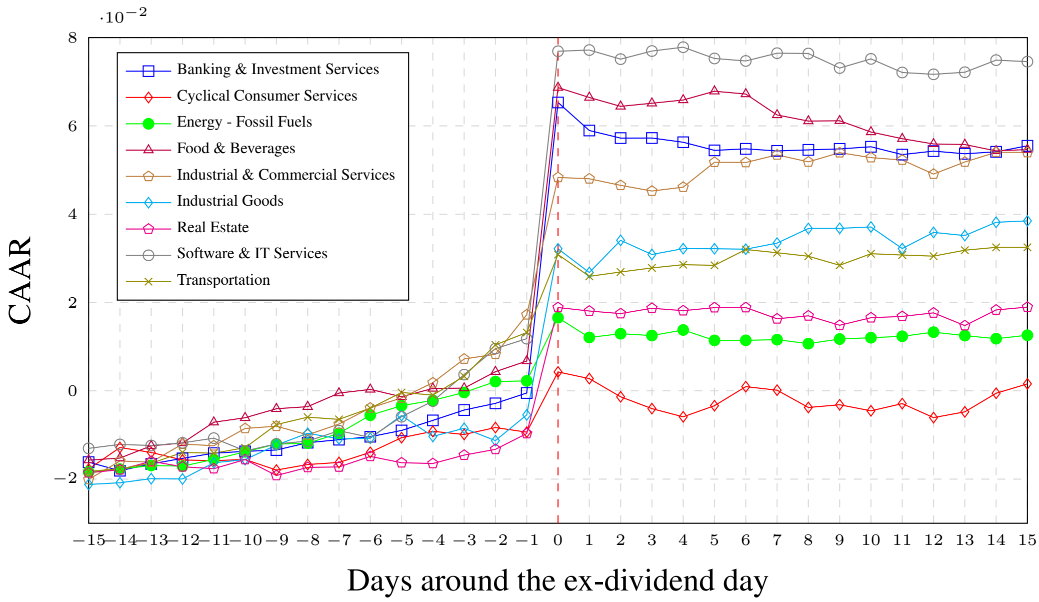
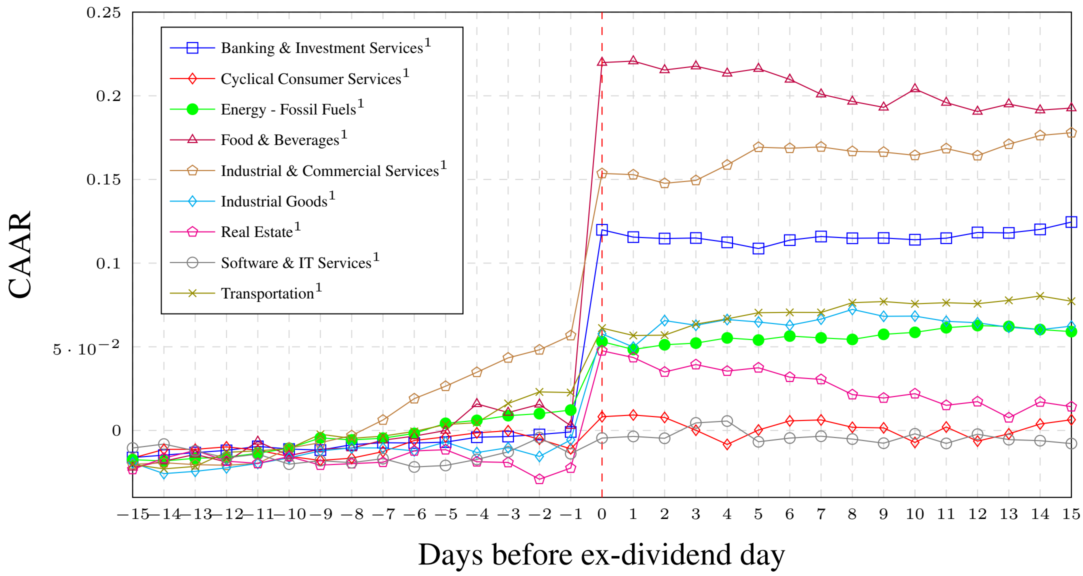


Figure 10 illustrates the development of CAARs across different sectors from 1992 to 2022. The results align with the significant positive returns observed on the ex-dividend day, as shown in Table 10. These returns are the primary contributors to the high CAAR during this period. Furthermore, the Figure shows a clear increase in CAAR during the days leading up to the ex-dividend day. This outcome was anticipated, as prior research has suggested that increased buying pressure and abnormal trading volume in the days leading up to the ex-dividend day can contribute to a positive price increase (Kadapakkam, 2000; Lakonishok & Vermaelen, 1986). The period after the ex-dividend day exhibited a pattern that aligned more closely with the random walk theory proposed by Malkiel (1973). During this period, some sectors experienced declines, and the overall pattern was unclear.

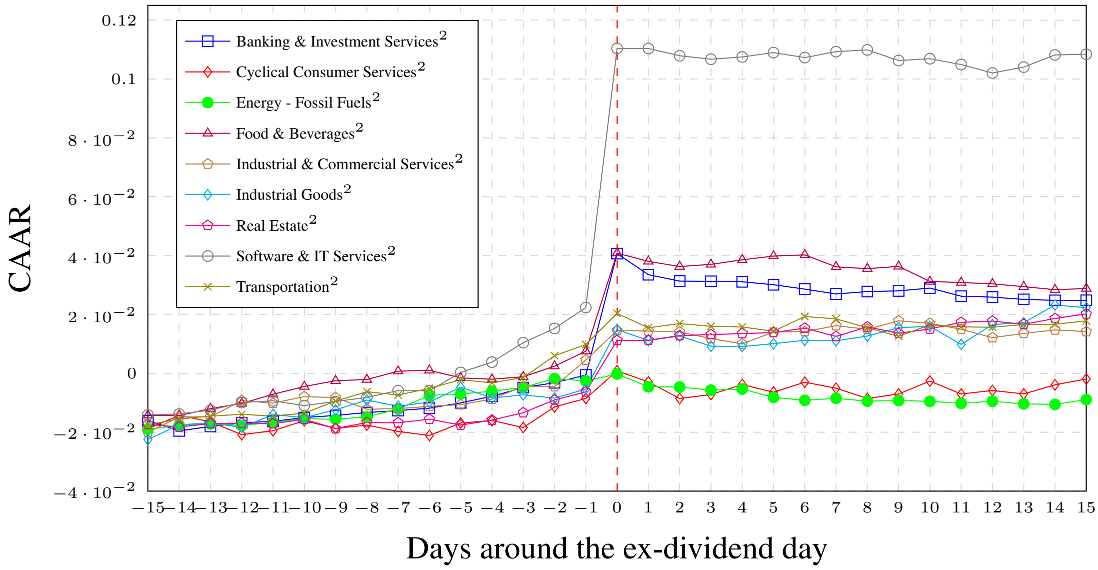
The sectors *Software & IT Services*, *Cyclical Consumer Services*, *Industrial & Commercial Services*, and *Food & Beverages* exhibited the highest performance, while *Cyclical Consumer Services* displayed the weakest performance. The *Div/Drop* are apparent in every sector as seen in the *Total* data set. As expected, *Software & IT Services* and *Food & Beverages* performed well, while the most dominant sector in our analysis *Energy - Fossil Fuel* had a poor performance, contradicting our expectations as earlier mentioned. Our findings suggest that the *Banking & Investment Services* sector exhibited one of the strongest performances during our analysis, indicating a possible presence of big market players in this sector. This result is noteworthy, considering that previous literature has presented lower overall returns for this sector between 1980 to 2016.

Figure 11: Strategy 2 *Sector* 1992-2005



From 1992 to 2005, we observe a bigger variation in the results across the sectors. As expected, the tax reform seemed to have a substantial effect on the CAAR attained in the different sectors. The sectors *Food & Beverages* and *Industrial & Commercial Services* had the best performances, with a CAAR over 17%. This was directly linked to a high positive difference between the dividend payment and the corresponding decrease in stock prices on the ex-dividend day. As a result, we see that the exploitation of the ex-dividend anomaly was most evident in these sectors. It is worth noting that the *Software & IT Services* sector had almost no effect on the ex-dividend day, resulting in a total negative CAAR of -0.78%. This could be due to a lack of market players, lower overall interests, or other macro conditions. Additionally, we observed that the spread between the returns was greater during this time frame compared to the overall period.

Figure 12: Strategy 2 *Sector* 2006-2022



During the period of 2006-2022, there was an overall lower performance observed across almost every sector, with two negative observations from *Cyclical Consumer Services* and *Energy – Fossil Fuels*, having a CAAR of -0.19% and -0.89%. This could possibly be attributed to the 2006 tax reform, which introduced harsher taxation on dividend income. The remaining sectors showed relatively similar returns during this period, ranging from a CAAR of 1.40% to 2.90%. The sector of *Software & IT Services* was a clear outlier, with a substantial increase in performance from -0.78% between 1992-2005 to 10.84% from 2006-2022, making it the best performing sector during this time period. This was one of the main reasons why this sector became one of the best performing sectors overall. It is possible that this sector had the biggest market players in this period, as we could see that it had the most prominent CAAR increase in the days leading up to the ex-dividend day, as well as the biggest *Div/Drop*. We speculate that the rapid technological revolution experienced worldwide could be one of the factors that contributed to this result.

7.3 Results from the Category Cap-Size

In this section, we present the results from our analysis after dividing the companies based on their market capitalization size on the ex-dividend day.

Table 11: CAAR cap-size

Table 11 shows the CAAR gained when performing the different strategies within the market capitalization size on the ex-dividend day. Each cap-size is decomposed into time period [1] *and* [2] *, where* [1] *= 1992-2005 and* [2] *= 2006-2022.*

	Strategy 1	Strategy 2	Strategy 3	
Cap-Size		CAAR		Div/Drop
Small-cap	0,0115**	0,0744***	-0,0142***	0,0872***
Small-cap[1]	0,0095***	0,1319***	-0,0007***	0,1383***
Small-cap[2]	0,0119**	0,0436***	-0,0213***	0,0569***
Mid-cap	0,0022***	0,0182	-0,0134***	0,0303***
Mid-cap[1]	0,0076***	0,0406***	-0,0046***	0,0404***
Mid-cap[2]	0,0005***	0,0109	-0,0163***	0,0274***
Big-cap	-0,0012***	0,0127	-0,0050***	0,0171***
Big-cap[1]	0,0012***	0,0779***	0,0108***	0,0683***
Big-cap[2]	-0,0018***	-0,0011***	-0,0084***	0,0070***

$^{*}p < 0.1,^{**} p < 0.05,^{***} p < 0,01$

For Strategy 1, Table 11 shows a positive CAAR for every *Small-Cap* and *Mid-Cap* during each time period, while the *Big-Cap* only generated a positive CAAR from 1992-2005, on 0.12%. The *Mid-Cap* and *Big-Cap* revealed a greatly larger return during 1992-2005, while the *Small-Cap* demonstrated an increase in the CAAR from 0.95% between 1992-2005 to 1.19% between 2006-2022. Nearly all of the outcomes were significant at the 1% level, except for the *Small-Cap* during the periods of 1992-2022 and 2006-2022, where it was significant at a 5% level.

When analyzing Strategy 2, the *Small-Cap* yielded the highest CAAR for each time period. Specifically, the CAAR was 7.44% between 1992-2022, 13.19% for 1992-2005, and 4.36% for 2006-2022. These findings show that smaller companies generated a better CAAR, despite a decline in the last period. Positive CAAR was observed for every *Mid-Cap* during all periods, with the highest CAAR of 4.06% found between 1992-2005. However, significant results were only obtained during 1992-2005. Although the *Big-Cap* had a significant CAAR of 7.79% from 1992-2005, it declined to the overall lowest

CAAR of -0.11% during 2006-2022, still significant at a 1% level.

During the period for Strategy 3, almost every cap-size generated a negative CAAR, except for the *Big-Cap*, which yielded a positive CAAR of 1.08%. Additionally, *Small-Cap* had the lowest result of -2.13% from 2006-2022. When examining the relationship between the *Div/Drop* in cap-size, the *Small-Cap* generated the highest return of 13.83% during 1992-2005 and 5.69% from 2006-2022. Moreover, all results were positive and significant at a 1% level.

Figure 13: Strategy 2 *Cap-size* 1992-2022

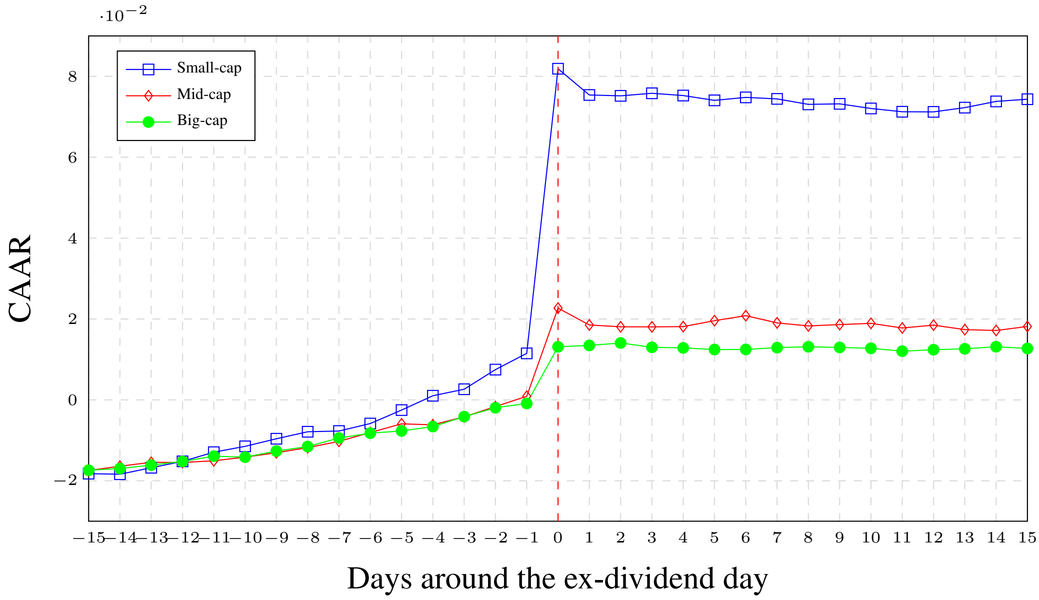
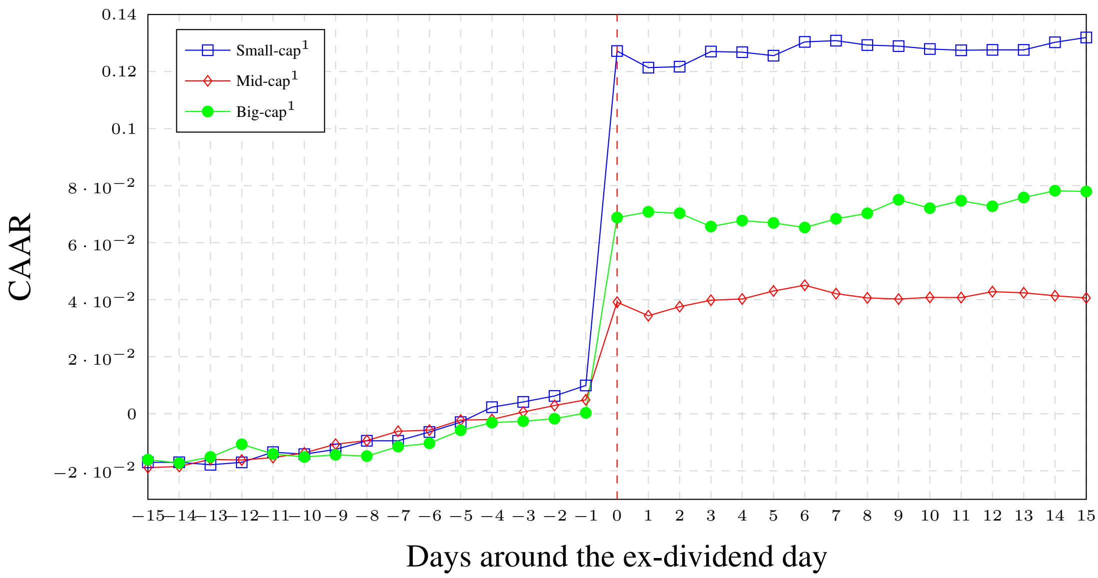


Figure 13 provides a clear visualization that smaller companies had a better performance on the ex-dividend day between 1992 and 2022 compared to the other two categorizations, aligning with our hypothesis that the small-firm effect was apparent. Additionally, the figure reflects the higher returns in the days leading up to the ex-dividend day, as demonstrated in Table 11 with a CAAR for Strategy 1 of 1.15%. As reported in previous literature presented in Section 2.1.2, the smaller stocks could be a victim of mispricing. Additionally, we observe that the *Div/Drop* metric had a more significant impact on the *Small-Cap* category than other categories. Therefore, it is plausible that market players targeted the ex-dividend anomaly in the *Small-Cap* more than in other categories, aiming to take advantage of potential mispricing and the apparent effect of the *Div/Drop*.

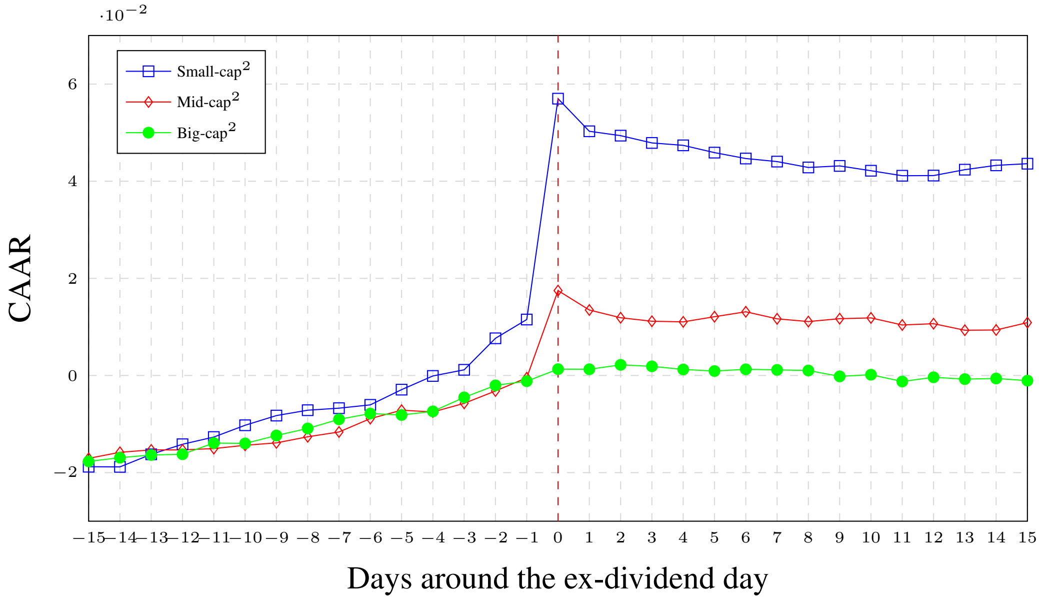
The differences between the *Mid-Cap* and *Big-Cap* categories were relatively small, although *Mid-Cap* displayed a slightly stronger performance when comparing the dividend and the stock decline on the ex-dividend day. Taking our expectations to consideration, we thought there would be a bigger difference between these two sizes especially in the days during Strategy 1.

Figure 14: Strategy 2 *Cap-size* 1992-2005



When decomposing the cap sizes into time periods, we observed that the ex-dividend anomaly had a more prominent effect during 1992-2005 than in 2006-2022. *Small-Cap* exhibited the best results before and on the ex-dividend day, resulting in the highest overall return, almost producing twice the return as the biggest companies. One possible explanation for the outperformance of *Big-Cap* over *Mid-Cap* during this period could be that larger companies may have attracted a higher degree of foreign investors, who influenced the dynamics around the ex-dividend day, as suggested by Rantapuska (2008) and Liljeblom et al. (2001). However, this is not empirically tested in this thesis, and further research is needed to validate this hypothesis.

Figure 15: Strategy 2 *Cap-size* 2006-2022



Upon analyzing the last period, it became apparent that *Small-Cap* also produced the highest return in this period. We also recognized that this cap-size experienced the greatest decline in the days following the ex-dividend day, providing proof of a bigger variation in the results for these companies. This is supported by Fama (1992), which stated that a higher return for smaller companies was a premium for higher risk. Nonetheless, smaller companies also yielded the highest *Div/Drop* during 2006-2022. Interestingly, we observed a shift in the performance between *Mid-Cap* and *Big-Cap*, where *Mid-Cap* in this period outperformed *Big-Cap* and generated the best results among the two. Our initial reaction to this transition is the change in tax regulations which in this period gave results that corresponded more with our expectations. The SFE was still apparent in this time period, and we observe that *Big-Cap* had a minimal effect on the ex-dividend day compared to the other periods.

8 Conclusion

This thesis examined three different short-term trading strategies around the ex-dividend day to answer our research question: *Was it possible to generate a significant cumulative average abnormal return (CAAR) by employing short-term trading strategies on dividend stocks on the Oslo Stock Exchange (OSE) around the ex-dividend day during the period 1992-2022?*. We employed an event study methodology, where CAAR was calculated by comparing the actual return from the strategies with the expected return estimated through CAPM. The results take into account the total transaction costs associated with buying and selling stocks, which were calculated based on the average bid-ask spread. To gain a comprehensive understanding of the behavior of stocks around the ex-dividend day, we divided the results into different time periods, industry sectors, and market-cap. Finally, we conducted a two-sided t-test to determine the significance of our findings.

Between 1992-2022, our results show a positive CAAR of 0.17% in the 15 days prior to the ex-dividend day in Strategy 1. Strategy 2, covering the period from 15 days before to 15 days after the ex-dividend day, generated a positive CAAR of 1.05%. For strategy 3, which concerns the 16 days after the ex-dividend day, we observed a negative CAAR of 1.07%. Both Strategy 1 and Strategy 3 were statistically significant, while Strategy 2 was non-significant. Additionally, our findings demonstrated an ex-dividend anomaly where the ex-dividend price drop was on average lower than the distributed dividend amount, producing a significant return of 2.03% when excluding transaction cost.

When isolating the results in two time periods from 1992-2005 and 2006-2022, we found significant differences between the periods in the generated CAAR for Strategy 2 and Strategy 3. These periods were influenced by significant tax changes, particularly in 1992 and 2006. Our findings reveal that the first period, where domestic investors were practically exempted from taxes on dividend income, resulted in the highest CAAR for all the strategies, and the highest return from the ex-dividend anomaly.

Furthermore, the performance of the sectors aligns mostly with previous research where *Software & IT Services* and *Food & Beverages* produced some of the highest overall CAAR. *Enegry - Fossil Fuel* contradicted our hypotheses, resulting in an overall poor performance despite being the biggest sector on the OSE, while *Banking & Investment Services* which was expected to underperform, resulted in one of the best performances.

The small-firm effect was apparent when analyzing the CAAR based on the companies market-cap around the ex-dividend day, as *Small-Cap* clearly outperformed their larger counterparts in almost all of the strategies and periods.

The findings in this thesis indicate that there indeed was possible to generate significant CAAR on the OSE, by employing short-term trading strategies around the ex-dividend day during 1992-2022. The evidence is also consistent with a substantial body of research conducted across different markets, providing further support for the existence of the ex-dividend anomaly and the potential for achieving excess returns around the ex-dividend day. Finally, these findings raise questions about the validity of the strongest form of the EMH, as the obtained results should not have been achievable based on the assumptions of the theory.

8.1 Limitations

While this thesis offers insights into the behavior of dividend stocks around the ex-dividend day and the potential to generate significant short-term CAAR on the OSE, it is crucial to acknowledge that several limitations could be considered in future research. The CAAR generated in our strategies is based on all ex-dividend days for nearly all dividend-paying companies (active and inactive) throughout the analysis period. Achieving such CAAR would have required substantial capital and investment of time. Therefore, this limitation must be acknowledged in interpreting the results. Additionally, we have not measured the risks associated with trading around the ex-dividend day, which leaves a gap in understanding how the strategies balance risk and reward.

The fact that taxes are not taken into account in the calculations of CAAR is another limitation. This is because different investor groups are subject to various tax rules, meaning that the after-tax profitability of different strategies may not be equivalent for all traders. Furthermore, it is important to acknowledge that the measure of transaction costs used in this thesis, the average bid-ask spread, may not fully reflect the actual transaction costs for traders. Thus, the absence of a sensitivity analysis on transaction costs is a limitation, as different cost scenarios could have led to other results. Lastly, it is worth noting that there are various ways to categorize the size of stocks. Although our results align with previous literature, alternative categorization methods could have produced different outcomes.

8.2 Further Research

In our analysis, we did not delve into the factors contributing to our observed results. Consequently, it would be valuable for future research to explore the underlying causes of the significant CAAR in our trading strategies, as well as the presence of the ex-dividend anomaly. Additionally, testing alternative short-term trading strategies around the ex-dividend day could provide valuable insights into the effectiveness of different approaches.

It is likely that the tax reforms implemented during our analysis period played a role in the observed difference in the CAAR between 1992-2005 and 2006-2022. However, further research is needed to validate this hypothesis. Furthermore, it could be valuable to examine the period following the introduction of the ”aksjesparekonto” (ASK) on September 1, 2017, in future studies. Since the introduction aimed to make it easier and more flexible for small savers to invest in stocks and mutual funds (Framstad, 2017), analyzing the effect of the ASK could provide additional insight into the relationship between taxes and the ex-dividend behavior of stocks.

Another area for further research could be to explore the trading behavior of different investor groups and investigate whether specific traders achieve extraordinary short-term gains around the ex-dividend day. Moreover, examining the risk factors associated with trading in the same period could provide a comprehensive understanding of the trade-off between risk and reward. The investigations proposed above might also help explain the observed variations in CAAR across industry sectors and market-cap on the OSE.

Based on the limitations presented in Section 8.1, future studies should consider directly incorporating taxes into the calculation of CAAR and differentiate tax rates for various investors, taking into account their specific tax regulations. This approach could improve the accuracy of measuring the actual gains achieved from trading activities, and provide valuable insights into how different investors position themselves based on their tax status. Lastly, conducting a sensitivity analysis of transaction costs would strengthen the robustness of future studies, enabling a better understanding of the impact of transaction costs.

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Appendix

Appendix 1: Risk Free Rate

Table 12: Risk Free Rate

This table show the rf-rate used in this thesis. The years 1992-2020 contains the synthethic yield for the 10 year Government Bond (Norges Bank, 2022). In 2021 and 2022 the yield from the zero coupon yield published by Norges Bank was used (Norges Bank, 2023).

Year	Rate	Year	Rate
1985	12.910%	2004	4.360%
1986	13.300%	2005	3.740%
1987	13.310%	2006	4.070%
1988	12.880%	2007	4.780%
1989	10.860%	2008	4.470%
1990	10.680%	2009	4.000%
1991	9.990%	2010	3.520%
1992	9.620%	2011	3.120%
1993	6.860%	2012	2.100%
1994	7.460%	2013	2.580%
1995	7.430%	2014	2.520%
1996	6.780%	2015	1.570%
1997	5.890%	2016	1.330%
1998	5.400%	2017	1.640%
1999	5.520%	2018	1.880%
2000	6.220%	2019	1.490%
2001	6.240%	2020	0.820%
2002	6.380%	2021	0.990%
2003	5.040%	2022	1.707%

Appendix 2: Bid-Ask Spread

Table 13: Bid-Ask Spread

This table show the average bid-ask spreads for all companies from 1992-2022 for each strategy.

	t	Strategy 1	t	Strategy 2	t	Strategy 3
	-15	0.009219	-15	0.009219	0	0.009207
	-14	0.009359	-14	0.009359	1	0.009429
	-13	0.008944	-13	0.008944	2	0.008962
	-12	0.008741	-12	0.008741	3	0.009201
	-11	0.009372	-11	0.009372	4	0.009188
	-10	0.009013	-10	0.009013	5	0.009473
	-9	0.009061	-9	0.009061	6	0.009575
	-8	0.009085	-8	0.009085	7	0.009444
	-7	0.009353	-7	0.009353	8	0.009344
	-6	0.009611	-6	0.009611	9	0.008897
	-5	0.008946	-5	0.008946	10	0.009627
	-4	0.008698	-4	0.008698	11	0.008965
	-3	0.008433	-3	0.008433	12	0.008804
	-2	0.008482	-2	0.008482	13	0.008879
	-1	0.00866	-1	0.00866	14	0.00963
			0	0.009207	15	0.008939
			1	0.009429		
			2	0.008962		
			3	0.009201		
			4	0.009188		
			5	0.009473		
			6	0.009575		
			7	0.009444		
			8	0.009344		
			9	0.008897		
			10	0.009627		
			11	0.008965		
			12	0.008804		
			13	0.008879		
			14	0.00963		
			15	0.008939		
Average		0.008999		0.009114		0.009223

Appendix 3: Historical Returns from Sectors on the OSE between 1980-2016

Panel A: Equally weighted industry indices

	First year	Last year	Average return	Standard deviation	average n	T
10 Energy(ew)	1980	2016	1.94	9.18	20.5	444
15 Material(ew)	1980	2016	1.89	11.70	6.1	444
20 Industry(ew)	1980	2016	1.70	5.97	31.7	444
25 ConsDisc(ew)	1980	2016	1.64	6.97	10.3	444
30 ConsStapl(ew)	1980	2016	2.08	6.49	7.0	444
35 Health(ew)	1980	2016	1.70	8.82	4.6	444
40 Finan(ew)	1980	2016	1.25	4.84	28.3	444
45 IT(ew)	1980	2016	2.43	10.54	11.3	444
50 Telecom(ew)	1987	2016	1.19	9.61	1.6	260
55 Util(ew)	1996	2016	0.98	6.11	2.7	252

Figure 16: Historical Returns from Sectors on the OSE between 1980-2016

Data from (Ødegaard, 2017).

Appendix 4: Average Historical Returns from Sectors on the OSE between 1980-2006

Panel A: Avkastning på industriporteføljer

		Første år	Siste år	Gjennomsnittlig avkastning	Standard-avvik	Gjennnomsnittlig ant.selsk.	T
10	Energi	1980	2006	2.59	9.89	18.6	324
15	Materialer	1980	2006	2.07	8.64	7.8	324
20	Industri	1980	2006	1.98	6.38	32.4	324
25	Forbruksvarer	1980	2006	1.71	6.72	12.1	324
30	Konsumentvarer	1980	2006	2.10	6.58	6.8	324
35	Helsevern	1980	2006	1.92	9.78	3.6	324
40	Finans	1980	2006	1.46	5.18	28.6	324
45	Informasjonsteknologi (IT)	1980	2006	2.74	11.80	11.9	324
50	Telekommunikasjon og tjenester	1987	2006	1.36	11.75	1.2	140
55	Forsyningsselskaper	1996	2006	1.27	6.99	2.4	132

Figure 17: Average Historical Returns from Sectors on the OSE between 1980-2006

Data from (Næs et al., 2007)

Appendix 5: Numbers of positive CAAR (% of total) for *Sector*

Table 14: Numbers of positive CAAR (% of total) for *Sector*

This table presents the number of positive observation in the different strategies including the Div/Drop for the category Sector. *The numbers in the parentheses represent the percentage of the observations that were positive.*

	Strategy 1	Strategy 2	Strategy 3	Div/Drop
Sector	Numbers of positive CAAR (% of total)			
Banking & Investment Services	247 (46)	280 (53)	129 (24)	482 (89)
Banking & Investment Services[1]	81 (48)	104 (65)	56 (33)	155 (92)
Banking & Investment Services[2]	166 (45)	176 (48)	73 (20)	327 (88)
Cyclical Consumer Services	60 (47)	62 (50)	51 (40)	91 (70)
Cyclical Consumer Services[1]	27 (47)	30 (54)	27 (47)	40 (68)
Cyclical Consumer Services[2]	33 (46)	32 (47)	24 (34)	51 (72)
Energy - Fossil Fuels	318 (48)	339 (52)	235 (35)	478 (72)
Energy - Fossil Fuels[1]	107 (52)	126 (63)	84 (42)	154 (74)
Energy - Fossil Fuels[2]	211 (46)	213 (47)	151 (33)	324 (71)
Food & Beverages	95 (47)	105 (53)	61 (31)	176 (92)
Food & Beverages[1]	16 (50)	22 (73)	7 (23)	30 (94)
Food & Beverages[2]	79 (46)	83 (49)	54 (32)	146 (86)
Industrial & Commercial Services	102 (55)	105 (59)	74 (40)	116 (63)
Industrial & Commercial Services[1]	34 (69)	31 (72)	27 (55)	25 (51)
Industrial & Commercial Services[2]	68 (50)	74 (55)	47 (35)	91 (67)
Industrial Goods	57 (50)	57 (53)	47 (42)	90 (80)
Industrial Goods[1]	27 (59)	29 (66)	24 (53)	37 (80)
Industrial Goods[2]	30 (45)	28 (43)	23 (34)	53 (79)
Real Estate	59 (43)	77 (58)	37 (28)	110 (81)
Real Estate[1]	17 (55)	18 (64)	10 (34)	22 (71)
Real Estate[2]	42 (40)	59 (56)	27 (26)	88 (85)
Software & IT Services	56 (52)	58 (56)	28 (26)	91 (85)
Software & IT Services[1]	14 (44)	13 (43)	8 (26)	24 (75)
Software & IT Services[2]	42 (56)	45 (62)	20 (27)	67 (89)
Transportation	210 (56)	203 (55)	138 (37)	313 (83)
Transportation[1]	67 (71)	70 (74)	43 (45)	80 (82)
Transportation[2]	143 (51)	133 (48)	95 (34)	232 (82)

Appendix 6: Numbers of positive CAAR (% of total) for *Cap-Size*

Table 15: Numbers of positive CAAR (% of total) for *Cap-Size*

This table presents the number of positive observation in the different strategies including the Div/Drop for the category Cap-Size. *The numbers in the parentheses represent the percentage of the observations that were positive.*

	Strategy 1	Strategy 2	Strategy 3	Div/Drop
Total	Numbers of positive CAAR (% of total)			
Small-cap	480 (51)	547 (59)	270 (28)	825 (87)
Small-cap[1]	177 (55)	208 (68)	124 (45)	299 (93)
Small-cap[2]	303 (48)	339 (55)	146 (23)	526 (83)
Mid-cap	496 (48)	503 (50)	340 (33)	830 (81)
Mid-cap[1]	137 (56)	141 (59)	89 (37)	179 (73)
Mid-cap[2]	359 (46)	362 (48)	251 (32)	651 (83)
Big-cap	398 (50)	402 (51)	283 (36)	586 (73)
Big-cap[1]	78 (54)	84 (61)	71 (49)	112 (77)
Big-cap[2]	320 (49)	318 (49)	212 (33)	474 (73)

Appendix 7: t-values from the significance test

Table 16: Two-sided t-test for *Total*

This table present the t-statistics achieved when performing the two-sided t-test of comparing the mean from the CAAR against 0.

	Strategy 1	Strategy 2	Strategy 3	Strategy 4
Year	t-Statistics			
1992-2022	-6,278***	0,539	-24,984***	15,402***
1992-2005	-3,587***	4,230***	3,031***	9,846***
2006-2022	-7,500***	-0,953	-28,171***	16,838***

$^{*}p < 0.1,^{**} p < 0.05,^{***} p < 0,01$

Table 17: Two-sided t-test for *Sector*

This table present the t-statistics achieved when performing the two-sided t-test of comparing the mean from the CAAR against 0.

	Strategy 1	Strategy 2	Strategy 3	Strategy 4
Sector	t-Statistics			
Banking & Investment Services	-7,726***	3,835***	-28,490***	12,561***
Banking & Investment Services[1]	-7,664***	4,886***	-23,839***	8,824***
Banking & Investment Services[2]	-7,689***	2,390**	-19,544***	11,021***
Cyclical Consumer Services	-15,455***	-6,266***	-10,905***	5,148***
Cyclical Consumer Services[1]	-6,480***	-2,671**	-3,494***	2,816***
Cyclical Consumer Services[2]	-18,520***	-8,846***	-16,130***	3,768***
Energy - Fossil Fuels	-4,481***	0,868	-34,006***	11,799***
Energy - Fossil Fuels[1]	-1,292	4,693***	0,320	9,160***
Energy - Fossil Fuels[2]	-6,935***	-10,667***	-22,783***	7,831***
Food & Beverages	-3,816***	4,858***	-8,564***	7,428***
Food & Beverages[1]	-2,047	5,343***	-8,375***	8,434***
Food & Beverages[2]	-4,057***	4,376***	-8,014***	5,047***
Industrial & Commercial Services	-1,643	4,447***	0,911	4,377***
Industrial & Commercial Services[1]	1,217	5,995***	3,432***	3,371***
Industrial & Commercial Services[2]	-6,136***	1,185***	-4,579***	3,099***
Industrial Goods	-8,390***	2,548**	-2,822***	6,211***
Industrial Goods[1]	-7,823***	3,536***	8,385***	4,352***
Industrial Goods[2]	-8,287***	0,541	-10,145***	4,299***
Real Estate	-11,644***	0,402	-16,508***	6,896***
Real Estate[1]	-2,194**	1,131	-3,766***	2,630**
Real Estate[2]	-17,066***	0,079	-6,079***	7,369***
Software & IT Services	-3,149***	4,715***	-25,547***	4,987***
Software & IT Services[1]	-12,974***	-7,192***	-9,357***	3,543***
Software & IT Services[2]	-0,569	5,289***	-25,417***	4,699***
Transportation	-2,275**	3,557***	-10,707***	11,301***
Transportation[1]	-0,680	5,010***	10,947***	5,299***
Transportation[2]	-3,272***	2,096**	-22,911***	12,434***

$^{*}p < 0.1,^{**} p < 0.05,^{***} p < 0,01$

Table 18: Two-sided t-test for *Cap-Size*

This table present the t-statistics achieved when perfoming the two-sided t-test of comparing the mean from the CAAR against 0.

	Strategy 1	Strategy 2	Strategy 3	Strategy 4
Cap-Sizze	t-Statistics			
Small-cap	-2,9576**	4,6623***	-23,0541***	16,995***
Small-cap[1]	-3,5760***	5,0136***	-6,5876***	12,425***
Small-cap[2]	-2,7330**	4,0969***	-17,6805***	12,914***
Mid-cap	-6,0121***	1,7100	-37,1251***	17,333***
Mid-cap[1]	-3,2761***	3,6822***	-6,9460***	9,643***
Mid-cap[2]	-7,3066***	0,3452	-30,9204***	14,355***
Big-cap	-8,0134***	0,7130	-47,0006***	8,715***
Big-cap[1]	-5,7609***	4,2589***	2,3085***	5,984***
Big-cap[2]	-8,4289***	-3,9878***	-25,0031***	8,057***

$^{*}p < 0.1,^{**} p < 0.05,^{***} p < 0,01$

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