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Price Movements and Trading Volume Around Ex-Dividend Day in a Market with a High Degree of Foreign Ownership: Evidence from Norway

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Abstract

This paper investigates the presence of an ex-dividend price anomaly in a market heavily influenced by foreign investors, the Oslo Stock Exchange, post the implementation of the 2006 tax reform that equalized taxes on dividends and capital gains in Norway.

We study the price-drop-to-dividend-ratio derived by comparing the ex-dividend price movements to the corresponding dividend per share. Our results identify a mean ratio equal to 0.753. This is inconsistent with our expectation of a ratio equal to 1, which is what the Norwegian tax regulations would imply. Hence, we confirm the presence of an ex-dividend price anomaly on the Oslo Stock Exchange.

Due to domestic tax regulations and from the Norwegian investor´s point of view, the tax-induced clientele hypothesis should be an irrelevant explanation to the observed anomaly. However, in this thesis we provide an extension to the latter hypothesis by including foreign owners, naturally facing different tax regulations, as an important investor group. Using two different data sources, we find mixed results on the relationship between foreign owners and ex-dividend price movements. However, based on the data source of main interest, we find significant results not all consistent with foreign ownership driving the ex-dividend price anomaly. The observed anomaly combined with domestic tax regulations and weak results on foreign influence, makes us question the tax-induced clientele hypothesis.

In addition, this paper provides results confirming abnormal trading volume around ex-dividend day. Consistent with previous research, we have reason to believe that the observed abnormal volume is partly driven by domestic and foreign owners with different dividend preferences trading with each other around ex-dividend day.

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1. Introduction

This thesis investigates the ex-dividend[1] price movements on the Oslo Stock Exchange (referred to as OSE from here onwards) post the implementation of the major tax reform in 2006 referred to as "Aksjonærmodellen" (Finansdepartementet, 2004).

The vast majority of previous empirical research reports of a price drop on ex-dividend day that is less than the corresponding dividend per share. In addition, the deviation between price drop on ex-dividend day and the corresponding dividend per share is different from what the equilibrium condition[2] would imply.

Ever since Campbell and Beranek (1955) first opened Pandora's box by reporting of a price-drop-to-dividend-ratio[3] (referred to as PDR from here onwards) less than one, there has been numerous research all trying to explain the reason for the observed ex-dividend price movement anomaly. First was Elton and Gruber (1970), who argued that the marginal stockholder tax brackets play an importing role in the observed anomaly. Later, other theories have developed. These theories are mainly basing their arguments on market microstructure and short-term trading. However, there are still an ongoing debate on the ex-dividend price movement anomaly. And today, almost 50 years after Elton and Gruber (1970) started the debate, the question remains open – what is causing the ex-dividend price drop to move different from what financial theory suggests?

An important feature of the major Norwegian tax reform in 2006, was that the tax rate on dividends and capital gains was equated (Finansdepartementet, 2004; Skatteetaten, 2006). Also, the Norwegian tax regulations do not have multiple tax brackets on investment income. Countries with equal tax rate on capital gains and dividends and no multiple tax brackets on investment income are not common

[1] Ex-dividend day is the day the shares are no longer traded with the right to receive the most recently declared dividend.
[2] $(P_C - P_E)(1 - t_{cg}) = D(1 - t_d)$, where P_C denotes the share market price on cum-dividend day, P_E is the share price on ex-dividend day. The tax on capital gains is denoted t_{cg} and t_d is the tax on dividend D. For more info, see section 4.
[3] $(P_C - P_E)/D$, where P_C denotes the share market price on cum-dividend day, P_E is the share price on ex-dividend day and D is dividend.

(Carroll, Pizzola, Hultman, & Segerström, 2012), which makes the investigation of ex-dividend movements on the Norwegian market highly interesting. This because in Norway, according to the equilibrium condition, the price drop on ex-dividend day should be equal to the corresponding dividend per share. In addition, the Norwegian tax regulations should make the tax-anchored arguments for the ex-dividend price anomaly irrelevant[4].

Hence, any results that confirms the presence of an ex-dividend anomaly on the Oslo Stock Exchange, will question previous research suggesting that tax regulations are the reason for the observed anomaly.

In addition to a contribution to the ongoing debate on ex-dividend movements, our analysis on the Norwegian stock market will shed a light on investor's preferences towards capital gains and dividends, arbitrage opportunities on the Oslo Stock Exchange and the long-term profitability of dividend paying stocks vs. non-dividend paying stocks.

There are no previous studies (that we are aware of) done on the subject in Norway after the implementation of the major tax reform in 2006.

A new trading account was introduced in Norway 1st of September 2017. This account was labeled "Aksjesparekonto" (referred to as ASK from here onwards) and increased the importance of a thorough investigation of the ex-dividend price movements on the OSE. Most noticeable was that the new account type provided the possibility of deferring tax on capital gains. However, deferring of tax on dividend was not included in this account type.

It is reasonable to assume that the different taxation of capital gains and dividends makes the users of ASK prefer capital gains over dividends. By the equilibrium condition on the Norwegian market, the investor should be able to sell his shares on cum-dividend day[5] and buy them back at ex-dividend day to capture the dividends as capital gains[6]. In that way, the investor can utilize ASK to enable tax deferral on dividends as well. However, this requires that the equilibrium condition

[4] From the Norwegian investor's point of view.

[5] Cum-dividend day is the last day the shares are traded with the right to receive the most recently declared dividend.

[6] With Norway's equal tax on dividends and capital gains, the equilibrium condition states that the price drop on ex-dividend day should be equal to the corresponding dividend per share. Hence, by selling you shares around closing on cum-dividend day and buying them back at opening, the investor should be able to capture the dividend as capital gains. Factors like risk premium, transaction costs and overnight news are not considered.

holds and thus that the price drop on ex-dividend day drops equal to the corresponding dividend per share.

In this thesis, we have investigated ex-dividend price movements from 2006 to 2015. Our results states that the ex-dividend price drop is, on average, significantly less than the corresponding amount of dividend per share. Even though this is in line with previous research, we find these results surprising as this is far from what we would predict based on the Norwegian tax regulations in our investigated period. The results on ex-dividend price movements on OSE are highly interesting as they should be an important contribution to the ongoing debate on the causes of the ex-dividend price anomaly, especially by questioning the tax-related arguments.
In addition, these results indicate that on average, 1. the investors trading on the OSE are preferring capital gains over dividends, 2. that there are arbitrage opportunities related to ex-dividend price movements, 3. that investors will not be able to perform trading strategies to capture the dividend as capital gains and 4. that long-term investors holding dividend paying stocks have received a premium as they have received more in dividends than what the corresponding shares has lost in value.

With increased globalization and more integrated markets, the importance of the foreign investor's presence rises. As foreign investors owned approximately 36.4 percent of the OSE during the period 2006 to 2015[7], the foreign presence on the Norwegian stock market is significant. Naturally, we suspect foreigners to be one of the reasons for the observed ex-dividend price anomaly on the OSE.
Therefore, an important aspect in this thesis is that we choose not to discard tax as a contributor to the observed ex-dividend price drop, we rather provide an extension to previous research on tax-related causes for the ex-dividend anomaly by including foreign owners (with different tax preferences) as an important investor group.

In general, foreigners are known to be dividend averse due to higher tax rates on dividends relative to capital gains (Carroll et al., 2012; Liljeblom, Löflund, & Hedvall, 2001; Rantapuska, 2008). In addition, many foreigners are exposed to multiple tax brackets on investment income. Lastly, foreigners can become even

[7] 36.4 percent is the average of the annual fraction of foreign ownership on the OSE in the period 2006 to 2015 (OsloBørs, 2017).

more dividend averse when they trade on exchanges outside their national borders as they will be exposed to withholding tax on their dividends which can be perceived as a nuisance (Deloitte, 2018; Skatteetaten, 2018b).

Assuming higher tax rate on dividends relative to capital gains for foreign owners, the equilibrium condition states that the price-drop-to-dividend-ratio should be less than one (as observed on the Oslo Stock Exchange). Therefore, we suspect that the traditional tax-related literature that accounts solely for domestic tax regulations, might be somewhat outdated. We have reason to believe that the ex-dividend price movements in Norway is not caused by domestic investors facing domestic tax regulations, but they can be influenced by foreign investors facing different tax regulations.

Very few articles emphasize the foreign investor's impact on the ex-dividend price drop. That is probably because the majority of previous research is dated prior to the rise of the globalization and the opening of markets we see today. However, Liljeblom et al. (2001) investigated the relationship between foreign presence and ex-dividend price movements on the Finnish market. Similar to the Norwegian market, foreigner investors are also heavily present on the Finnish stock market (Liljeblom et al., 2001). In line with their expectations, they found that there is some relationship between the foreigners and the ex-dividend price movements and that the price-drop-to-dividend-ratio seems to decrease with an increased presence of foreign owners. Rantapuska (2008) later follows up on the research by Liljeblom et al. (2001) and finds that the foreign owners are the group of investors that trades the most around ex-dividend day.

In this thesis, we use a similar approach as Liljeblom et al. (2001) to investigate if and how the foreign presence influence the ex-dividend price movements. Using foreign ownership data that is restricted with a threshold of 5% foreign owners[8], we obtain similar results as Liljeblom et al. (2001) and in line with our expectations[9]. This implies that the foreign owner's tax regulations and thus their dividend

[8] Meaning that all foreign investors owning less than 5% was excluded from the database.
[9] The drop in price on ex-dividend day seems to decrease relatively to the corresponding dividend per share with an increase of foreign owners presence.

aversion can contribute to the unexpected ex-dividend price drop observed on the Oslo Stock Exchange.

However, using use another database containing foreign ownership data without the 5% threshold, we obtain highly unexpected results. In fact, contrary to Liljeblom et al. (2001) and our expectations, we obtain results stating that the price-drop-to-dividend-ratio is positively related to the degree of foreign presence. In isolation, this may indicate that the foreigners are not dividend averse, but rather dividend liking. We suspect that this relationship may be somewhat biased as other factors like firm size, liquidity and bid-ask spread could explain parts of the observed relationship. Therefore, we run a regression where we account for this possible endogeneity problem. When including factors like firm size and bid-ask spread, the sign on the explanatory variable related to the foreign presence changes to suggest that an increased foreign presence is, in fact, lowering the price-drop-to-dividend-ratio.

Nevertheless, we find that firms with no foreign owners have close to equal results on the ex-dividend price movements as firms with foreign owners. Therefore, foreign owner's tax regulations cannot be the only reason for the reported ex-divided anomaly observed on the Oslo Stock Exchange.

We have also identified abnormal trading volume around ex-dividend day and analyzed whether there is any link between foreign presence and trading volume. Given the different dividend preferences of the domestic owners and the foreign owners, we expected to see an increased trading between these two groups around ex-dividend day as argued by the dynamic dividend clientele.

Our results confirm our expectations as they show most abnormal trading in the investor group most characterized by an equal mixture of domestic and foreign investors, thus the group with the most interplay of trading decisions by investors with different tax status. These results are also in line with Liljeblom et al. (2001) as well as Michaely and Vila (1995) who reports of results indicating that trading volume on the ex-dividend day is found to increase with tax heterogeneity. Therefore, we have reason to believe that a large part of the observed abnormal trading volume around ex-dividend day is indeed due to domestic and foreign investors with different dividend preferences trading with each other.

This paper is organized in two main parts. Part 1 investigates the general ex-dividend price movements on the Oslo Stock Exchange post the major tax reform in 2006.

Whereas Part 2 investigates the relationship between the observed ex-dividend price movements and the presence of foreign owners, as well as the trading volume around ex-dividend day and its relationship to foreign owners.

Prior to the main parts we discuss previous research on ex-dividend price movements and present a thorough description of the Norwegian tax environment followed by a description of the theoretical framework.

We complete the thesis with an overall conclusion independent of given parts.

2. Literature Review

This section of the thesis will consist of previous literature related to ex-dividend price movements and dividend preferences. Previous findings are important to study in order to educate the reader on the most renowned theories in the field. By looking at previous literature we know what to expect and are able to analyze our findings on the basis of previous literature.

In perfect capital markets[10], the share price should decrease by the same amount as the dividend per share, thus making investors indifferent between dividends and capital gains (Miller & Modigliani, 1961). However, it has been proven empirically that the equilibrium condition (1) does not hold. In 1955, Campbell and Beranek (1955) posted the first known study on stock price behavior on ex-dividend dates. By using data on stocks listed on New York Stock Exchange they observed that on average, the share price drop on the ex-dividend day amounted to about 90 percent of the dividend amount. Shortly after, Durand and May (1960) studied the share price on ex-dividend day for the American Telephone and Telegraph stock (AT&T). They observed that the share price decreased by less than the dividend amount, which confirmed the findings of Campbell and Beranek (1955). The findings of Campbell and Beranek (1955); Durand and May (1960) has later been confirmed by several consecutive studies on stock price behavior around ex-dividend dates. (Al Yahyaee, Pham, & Walter, 2008; Bali & Hite, 1998; Bauer, Beveridge, & Jha, 2006; Borges, 2008; Boyd & Jagannathan, 1994; Dasilas, 2009; Elton & Gruber, 1970; Frank & Jagannathan, 1998; Kalay, 1982; Lakonishok & Vermaelen, 1986; Liljeblom et al., 2001; Rantapuska, 2008).

In 1970, Elton and Gruber (1970) published one of the first papers trying to explain the ex-dividend share price anomaly. They observed the same anomaly as Campbell and Beranek (1955); Durand and May (1960) had previously reported and stated that the anomaly was due to different relative taxation of dividend and capital gains.

[10] A market with no tax or transaction costs, where all agents are perfectly rational and receive costless information that is either certain or risky simultaneously. For a detailed description of perfect capital markets, see section I in Miller and Modigliani (1961).

They developed the tax-induced clientele model to explain the anomaly. In the tax-induced clientele model, Elton and Gruber (1970) studied the ex-dividend behavior of common stocks to derive the marginal investor's tax bracket[11]. They observed that the share price drop was less than the corresponding dividend amount due to different taxation on dividend and capital gains. Further, they calculated the implied tax rate for the marginal investors and linked that to the dividend yield. The study showed that a higher dividend yield leads to lower implied tax on dividend. Elton and Gruber (1970) concluded that the marginal investor's preference for dividend or capital gains was dependent on the taxation of dividend and capital gains. Such that investors in a low tax brackets would prefer high dividend yield stocks and investors in a high tax brackets would prefer for low dividend yield stocks.

Other theories basing their arguing on market microstructure and short-term trading around ex-dividend day has developed after the tax induced clientele model was first introduced by Elton and Gruber (1970).

One of the market microstructure theories was proposed by Frank and Jagannathan (1998). They analyzed the Hong-Kong stock market, where there were no taxes on dividends or capital gains and short-term trading where excluded. Surprisingly, they observed that the share price drop on the ex-dividend day was less than the dividend amount and used market microstructure arguments to explain this theoretically. They observed that handling dividends was a nuisance to individual buyers and sellers in Hong-Kong, but not for market makers. Kadapakkam (2000) examined the Hong-Kong market after the electronic settlement and observed an ex-day stock price drop closer to one. This supported the argument that pricing efficiency around the ex-dividend day was inefficient due to regulatory or institutional features that inhibited short-term trading around ex-dividend day in the Hong-Kong stock market. Another market microstructure argument was proposed by Bali and Hite (1998). They argue that the ex-dividend day price drop anomaly that exist is caused by price discreteness enforced by the exchange. This theory has later been outdated in several countries as decimalization of stock prices was introduced (Al Yahyaee et al., 2008).

[11] In the context of rational arbitrage, the share price drop should reflect the after-tax value of dividends and capital gains. This implies that one should be able to determine the marginal investor's income tax rate by simply observing the price drop on the ex-dividend day.

Another theory was proposed by Kalay (1982). He stated that short-term traders were trying to exploit the difference in share price drop-off and the dividend amount caused by tax differentials. When arbitragers tried to profit of this deviation, the deviation decreased. Therefore, he indicated that the deviation that still existed was caused by transaction costs, and not the tax differential. The findings of Kalay (1982) is consistent with a similar argument proposed by Miller and Scholes (1982). They both agree that share price drop to dividend ratio is influenced by arbitrage trading. As an extension to the short-term trading hypothesis, Koski and Scruggs (1998) examined two different types of investors that chose to trade around ex-dividend day. First, they found that security traders with the same tax rate on dividend and capital gains, but low transaction cost has an incentive to trade. If the share price drops with less than dividend, and the difference is greater than the transaction cost, then the security trader may be able to exploit this. Second, some taxable corporations have strong incentives to capture the dividend income if they pay less taxes on dividend compared to capital gains. Koski and Scruggs (1998) found indications of abnormal trading volume by security traders around the ex-dividend day, which is positively related to dividend yield and negatively related to transaction costs. Furthermore, they found evidence of corporations trying to dividend-capture trade. The study concludes that short-term traders influence the share price drop to dividend ratio. This is also consistent with the findings of Lakonishok and Vermaelen (1986).

More recent studies such as Chen, Chow, and Shiu (2013); Rantapuska (2008) found that high-tax bracket individuals are prone to selling their shares on the cum-dividend day and buy ex-dividend day while low-tax bracket individuals are prone to buying shares before the ex-dividend day and sell on ex-dividend day.

As market microstructure effects have declined over time and short-term trading restrictions often are non-binding, the evidence is often in favor of the tax-induced clientele hypothesis (Al Yahyaee et al., 2008; Kadapakkam, 2000; Liljeblom et al., 2001). However, as markets become more integrated, domestic tax rates may not be the defining factor in price changes around ex-dividend dates. In Norway, approximately 36.4 percent of the stocks on the OSE are owned by foreign investors (OsloBørs, 2017). Thus, a possible explanation as to why the share price drop is less than the dividend amount is because foreign investors are subject to a higher tax rate on dividend income than capital gains income, making them dividend

averse (Carroll et al., 2012; Liljeblom et al., 2001). Liljeblom et al. (2001) published a paper that investigated the effects of different taxation for foreign and domestic investors on the Finnish stock market, which is a market heavily influenced by foreign ownership. The results indicated that the price-drop-to-dividend-ratio is far less than one for stocks with high degree of foreign ownership and closer to one for stocks with low degree of foreign ownership. In addition, they detected significantly abnormal ex-dividend day trading volumes. Rantapuska (2008) published an extension to the paper of Liljeblom et al. (2001) where he looked at how foreigners trades around ex-dividend dates in the Finnish market. He observed that foreign investors dominated the market around ex-dividend day and that they accounted for approximately 40 percent of the gross trading volume.

As previously argued, foreigners are in general dividend averse (Carroll et al., 2012; Deloitte, 2018; Skatteetaten, 2018b). However, assuming that the majority of foreign investors are considered to be big institutional investors, some researchers argue otherwise. Grinstein and Michaely (2005) found that institutions avoid firms that does not pay dividend. Generally, institutions has a preference for dividend due to the tax advantages that some institutions have for dividends and prudent-man rule restrictions (Grinstein & Michaely, 2005).

It's crucial to understand the investigated country's tax regulations when studying the ex-dividend price anomaly. As mentioned above, tax is an important part of previous literature as evidence is often in favor of the tax-induced clientele theory (Barclay, 1987; Bell & Jenkinson, 2002; Elton & Gruber, 1970; Graham, Michaely, & Roberts, 2003; Liljeblom et al., 2001; Litzenberger & Ramaswamy, 1979; McDonald, 2001; Zenonos & Lasfer, 2003).
In the following section we will explain the Norwegian tax environment post the implementation of the major tax reform in 2006.

3. Tax environment

This section explains the taxation rules and regulations of dividends and capital gains in Norway from the period 2006 to 2015. A Glossary to this section is provided in Appendix 1.

3.1 The major tax reform in 2006 - Aksjonærmodellen

In 2004, a major tax reform referred to as "Aksjonærmodellen" was first introduced (Finansdepartementet, 2004). The tax reform was implemented in 2006 and has since remained broadly unchanged (Skatteetaten, 2006). The tax reform introduced several new rules regarding tax on dividend and capital gains for individual and institutional shareholders. The main goal of the tax reform was to equalize the tax rates on labor income and investment income as well as ensure free flow of capital within the EEA area (Finansdepartementet, 2004; Skatteetaten, 2006).

3.1.1 Tax rules on dividend and capital gains for domestic shareholders

Before 2006, domestic shareholders payed no tax on dividends (Skatteetaten, 2006). When the tax reform was implemented in 2006, domestic shareholders no longer earned tax-free dividend. The tax reform states that dividend and capital gains greater than the tax-free amount is taxed at the 28 percent rate for individual shareholders. The latter tax rate has been kept steady throughout the period 2006 to 2015. In addition, investment losses are tax deductible (Finansdepartementet, 2004).

From 2006 to 2015 the tax rate on dividend and capital gains were equal the tax rate of ordinary income (Skatteetaten, 2018a). The tax rates on dividend income and capital gains is shown in Appendix 2.

Domestic shareholders are also entitled to a tax-free allowance. The purpose of the tax-free allowance is to remove taxation of the investment's risk-free return (Finansdepartementet, 2004). The tax-free allowance will be equal to a risk-free interest rate times the shareholder’s tax base cost of the shares (Skatteetaten, 2006).

3.1.2 Tax rules on dividend and capital gains for foreign shareholders

Dividend received by foreign shareholders are taxed with a withholding tax rate. Furthermore, foreign shareholders within the EEA area has a right to get tax-free allowance (Skatteetaten, 2006).

Norway has a tax treaty with several countries[12], in these particular countries the withholding tax rate is 15 percent. Other countries without a tax treaty has a withholding tax rate of 25 percent[13] (Skatteetaten, 2012).

In regard to capital gains, foreign shareholders do not pay taxes to the Norwegian government.

3.1.3 Tax rules on dividend and capital gains for institutional shareholders

In Norway, the tax-exemption method states that domestic and foreign companies that are established and has economic activity inside the EEA area does not pay tax on dividends or capital gains from trading shares (Regjeringen, 2009). However, as for domestic companies, an additional 3 percent of the dividend is taxed as ordinary income (Finanskomiteen, 2011).

The tax-exemption method is applicable for domestic and foreign companies that are established and has economic activity inside the EEA countries (Regjeringen, 2009). If the conditions of the tax-exemption method are not fulfilled, the company are subject to withholding tax for the dividend received[14]. The tax-exemption method is not applicable for foreign companies outside the EEA area. They are obligated to pay withholding tax for the dividend received.

[12] For the complete list of countries, see Regjeringen (2014, 2018).
[13] Dividends paid to foreign shareholders are subject to a withholding tax. The withholding tax rate is 15 percent for OECD countries and 25 percent for most other countries.
[14] There are exceptions to the tax-exemption method, but in our analysis, we base our results on the assumption that domestic and foreign institutional shareholders established inside the EEA area do not pay withholding tax to Norway.

4. Theoretical Framing

For there to be an anomaly, there must be a theory. This section explains how the ex-dividend price should move according to theory.

The ex-dividend price movement is theoretically defined by the equilibrium condition (1):

$$(P_C - P_E)(1 - t_{cg}) = D\,(1 - t_d) \qquad (1)$$

Where P_C denotes the share market price cum-dividend day, P_E is the share price on ex-dividend day. The tax on capital gains is denoted t_{cg}, while t_d is the tax on dividend D.

In Norway, the tax rate on dividend and capital gains are equal. Following formula (1) the difference in price on cum-day and ex-day should by theory be equal to the dividend amount.

Part 1

In Part 1, we investigate the general ex-dividend price movements on the Oslo Stock Exchange in the period 2006-2015. The price movements are investigated by comparing price changes around ex-dividend day to the corresponding dividend per share.

We seek to identify whether the commonly observed ex-dividend price movement anomaly is also present on the marketplace in Norway – a country with an equal tax rate on dividends and capital gains.

5. Arbitrage boundaries

A violation of the equilibrium condition (1) is not necessarily synonymous with an arbitrage opportunity. The transaction costs in particular make the non-arbitrage price interval expand.

In this section we derive the arbitrage boundaries based on the Norwegian tax regulations faced by domestic taxed and non-taxed investors (private and institutional investors, respectively) by following the theoretical framework of Kalay (1982), Lakonishok and Vermaelen (1986) and Liljeblom et al. (2001).

Any price-drop-to-dividend-ratio exceeding these boundaries are associated with possible arbitrage opportunities.

The following equations are equal to equation (3-6) in Liljeblom et al. (2001). We assume different tax rates on dividend and capital gains as well as zero discount rate[15].

An investor would not participate in any dividend capture trading as long as

$$(1 - t_{cg})[(P_E(1 - C_u) - P_C(1 + C_u)] + (1 + t_d)D \leq 0 \qquad (2)$$

Where t_{cg} is tax on capital gains and t_d is tax on dividend. P_C is the share price cum-day while P_E is the share price on ex-day. Transaction costs is denoted C_u.

After rearranging, we get the following no-arbitrage condition

$$\frac{P_C - P_E}{D} \geq \frac{1-t_d}{1-t_{cg}} - 2C_u\frac{\bar{P}}{D} \qquad (3)$$

Where $\bar{P}$ is the average share price of the share price cum-day and ex-day.

Similarly, an investor trying to exploit an arbitrage opportunity is not interest in short-selling as long as

[15] Liljeblom et al. (2001) assume zero discount rate for simplicity. See Boyd and Jagannathan (1994) equations (1-8) for the theoretical framework when including discount rate. Equation (4) in Liljeblom et al. (2001) corresponds to equation (6) in Boyd and Jagannathan (1994) while equation (5) in Liljeblom et al. (2001) corresponds to equation (8) in Boyd and Jagannathan (1994) after setting risk and time adjusted discount factors equal to one.

$$\frac{P_C - P_E}{D} \leq \frac{1-t_d}{1-t_{cg}} + 2C_u \frac{\bar{P}}{D} \quad (4)$$

Combining (3) and (4) gives us the following formula for the no-arbitrage condition

$$\frac{1-t_d}{1-t_{cg}} - 2C_u \frac{\bar{P}}{D} \leq \frac{P_C - P_E}{D} \leq \frac{1-t_d}{1-t_{cg}} + 2C_u \frac{\bar{P}}{D} \quad (5)$$

If the price-drop-to-dividend-ratio lies outside of this interval it is considered an arbitrage opportunity.

The arbitrage boundaries for the two different investor categories are illustrated in Table 1 below.

Table 1 Arbitrage boundaries for different investor categories

Investor categories	Dividend tax (t_d)	Capital gains tax (t_{cg})	Price-drop-to-dividend-ratio with C_u = 0%.	Quasi-arbitrage boundary with C_u = 0.05% (domestic) and average dividend yield = 4.6%
A. Domestic Taxed	t_d	t_{cg}	1	$0.978 < \frac{(P_C - P_E)}{D} < 1.022$
B. Domestic non-taxed	0	0	1	$0.978 < \frac{(P_C - P_E)}{D} < 1.022$

Our calculations are based upon equal tax rate on dividend and capital gains for domestic taxed investors[16]. Transaction cost C_u are estimated to be 0.05%[17]. The dividend yield used are calculated from our *main sample* (see Table 2 in section 7.2).

Group A in Table 1 are domestic private investors paying taxes t_d on dividend and capital gains tax t_{cg} on investment income. Since t_d = t_{cg} in Norway, domestic private investors are indifferent between dividend and capital gains if the share price dropped by the same amount as the dividend amount.

Group B in Table 1 are domestic non-taxed investors such as institutional investors. They are not required to pay tax on neither dividend nor capital gains[18]. Like Group A, they are indifferent between dividend and capital gains as long as the share price drops by the same amount as the dividend. These two investor categories have the same no-arbitrage interval, which range from 0.978 to 1.022. Hence any price-drop-to-dividend-ratio exceeding these upper and lower boundaries on the OSE, are considered to be an arbitrage opportunity.

[16] See Appendix 2.

[17] Domestic transaction cost is based upon the average brokerage fee of the 4 most popular stock brokers in Norway, DNB, Nordnet, Nordea and Pareto. The domestic brokerage fee per trade has stayed broadly unchanged in our investigated time interval according to various transaction costs presented by Pedersen (2006).

[18] See section 3.1.3.

6. Hypothesis

The main objective of Part 1 is to investigate the ex-dividend price movements in Norway. The Norwegian stock market is interesting to take a closer look at because of the equal tax rate on dividend income and capital gains, as well as the non-multiple tax brackets on investment income.

A large and important part of previous research on ex-dividend price movements is related to tax and evidence of an ex-dividend price movement anomaly is often in favor of the tax-induced clientele hypothesis. Based on the theoretical framework presented and tax-induced clientele hypothesis first introduced by Elton and Gruber (1970), the Norwegian tax regulations should make the ex-dividend price drop with the same amount as the corresponding dividend per share.

Naturally, our first hypothesis looks specifically at the ex-dividend price drop relative to the corresponding dividend per share in the Norwegian stock market. We would expect the price-drop-to-dividend-ratio to equal one because of equal tax rates on dividend income and capital gains in Norway[19].
Any deviation from our expectations will come as a surprise. Not because that would violate the equilibrium condition, but rather because that would question the school of thought most recognized in previous research – the tax induced clientele.

Hypothesis 1:

H0: The price-drop-to-dividend-ratio on the Oslo Stock Exchange is equal to one.

HA: The price-drop-to-dividend-ratio on the Oslo Stock Exchange is different from one.

[19] See section 4.

7. Data

7.1 Data Collection

This study is based on ex-dividend events for dividend paying firms listed on the Oslo Stock Exchange during 2006 through 2015. Data on dividend events as well share price performance, trading volume and other daily security data by listed firms on the Oslo Stock Exchange was retrieved from the Compustat Global database.

Additional security and fundamental data not available in Compustat Global data like bid-ask prices and total asset value was extracted from Bloomberg Terminal and Thomson Reuters, respectively.

Daily expected returns were calculated using the Fama-French 3-Factor model with asset pricing factors for the OSE retrieved from Bernt A. Ødegaard's resource page (Ødegaard, 2018). The latter database was also used for the extraction of historical Norwegian risk-free rates as well as OSE allshare index values.

The dividend observations listed in USD were multiplied with historical currency rates retrieved from Infront Finance.

7.2 Sample Selection

The data's sample stretches from the beginning of 2006 as this marks the start of the large tax reform known as "Aksjonærmodellen" (Skatteetaten, 2006) and ends in 2015 due to data restrictions in ownership data and asset pricing factors. This time interval is unaffected by major tax reforms that might affect the consistency of the ex-dividend price movements.

The dividend payments are cash dividends solely, both regular and special dividends are included. In addition, all share prices in the dataset are listed as closing prices.
Further, each stock's ex-dividend day together with its corresponding dividend is referred to as an observation.

All firms with no dividend track record and observations with no trading on ex-divided day were all excluded.

In addition, firms with a foreign "ISO Country Code" is excluded from our sample and thus the remaining firms are all tax resident in Norway.

The exclusion of firms with a foreign tax residence, is primarily because of restrictions in ownership data as well as the risk of inconsistency in the institutional domestic investor's dividend preferences due to the "The exemption method"[20] (Regjeringen, 2009).

All firms listed on Merkur[21] are also excluded from our sample. However, as this is OSEs market place for small medium sized enterprises and characterized by firms in a rather early stage of their life-cycle, dividend payments from firms on Merkur were almost absent, resulting in the exclusion of only two observations.

Dividend yields[22], turnovers[23] and price-drop-to-dividend-ratios were calculated for all dividend payments. By the interquartile range rule (See Appendix 3), we identified statistical outliers in all three measures. All observations with dividend yields (PDRs) larger than 25.22% (247.38%) or lower than 0.54% (-101.19%), was excluded. However, for the turnover measures only the observations exceeding the lower bound (0.00032%) was excluded and not the observations exceeding the upper bound since we would like to capture the effect from potential arbitrage traders and other trading around ex-dividend day.

Throughout this thesis, we primarily focus on and base our analysis on the sample described above (*main*), but for comparison reasons and greater insight, we choose to include three additional samples. This results in a total of four samples, one main sample and three complimentary:

[20] As a part of the 2006 tax reform, *limited companies* were exempted from tax (and the right to deduct losses) on dividends and capital gains in companies that are tax resident within in the EEA. This does not apply for dividends and capital gains in companies that are tax resident in low-tax countries outside the EEA, but might apply for dividends and capital gains in companies that are tax resident in normal-tax countries outside the EEA if the company owning the shares satisfies certain conditions (RegnskapNorge, 2015).

[21] Oslo Stock Exchange's market place for small medium sized enterprises.

[22] Dividend per share divided by the share's price on cum-date.

[23] Number of shares traded on ex-date divided by the firm's total number of shares on ex-date.

Sample	Description
Main	Excluding identified outliers and including special dividends.
Including All	Including identified outliers and including special dividends.
Excluding Special Dividends	Including identified outliers and excluding special dividends.
Excluding All	Excluding identified outliers and excluding special dividends.

In the end, we are left with a *main* sample (*including all*) of 148 (159) unique firms and 741 (838) observations. Given that Rantapuska (2008), Borges (2008), Liljeblom et al. (2001) and Koski and Scruggs (1998) had 855, 446, 122 and 70 observations respectively in their samples, we find the size of our samples sufficient.

Table 2 Descriptive statistics for dividends and dividends yields on the OSE (2006 – 2015)

Sample		Dividend Per Share (NOK)	Dividend Yield
Main (Observations: 741)			
	Mean	5.26	0.046
	SE	0.59	0.001
	Median	2.50	0.040
	Std. Dev	16.09	0.028
	Kurtosis	134.54	2.804
	Skewness	10.78	1.394
	Min	0.05	0.005
	Max	250	0.192
Including All (Observations: 838)			
	Mean	5.17	0.055
	SE	0.54	0.003
	Median	2.25	0.038
	Std. Dev	15.52	0.084
	Kurtosis	137.97	54.661
	Skewness	10.75	6.817
	Min	0.05	0.003
	Max	250	0.905

Table 2 illustrates the descriptive statistics for dividend per share and dividend yield for the *main* and *including all* samples. The descriptive statistics for the *excluding special dividends* and *excluding all* samples are illustrated in Appendix 4.

Figure 1 Yearly Average dividend yields on the OSE by various investigated samples (2006 - 2015)

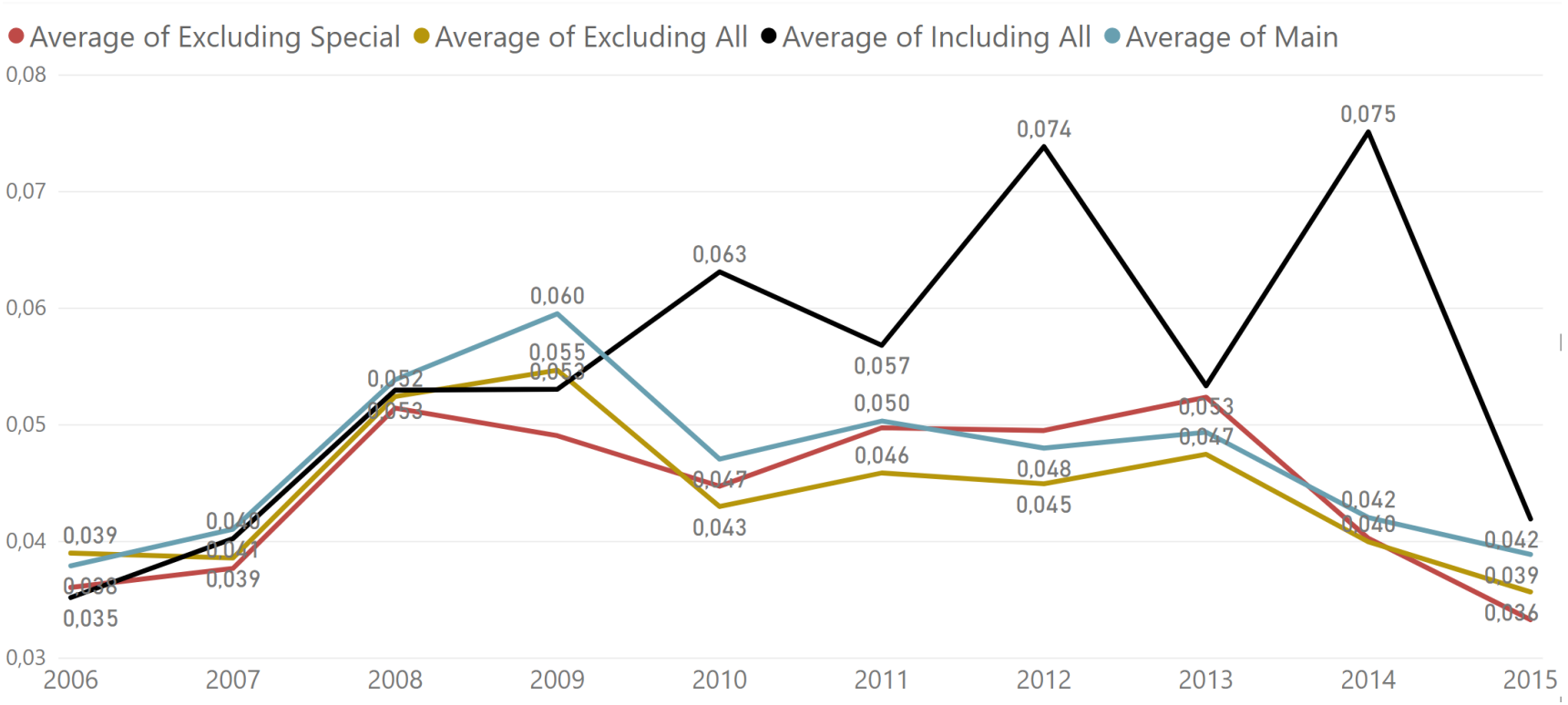
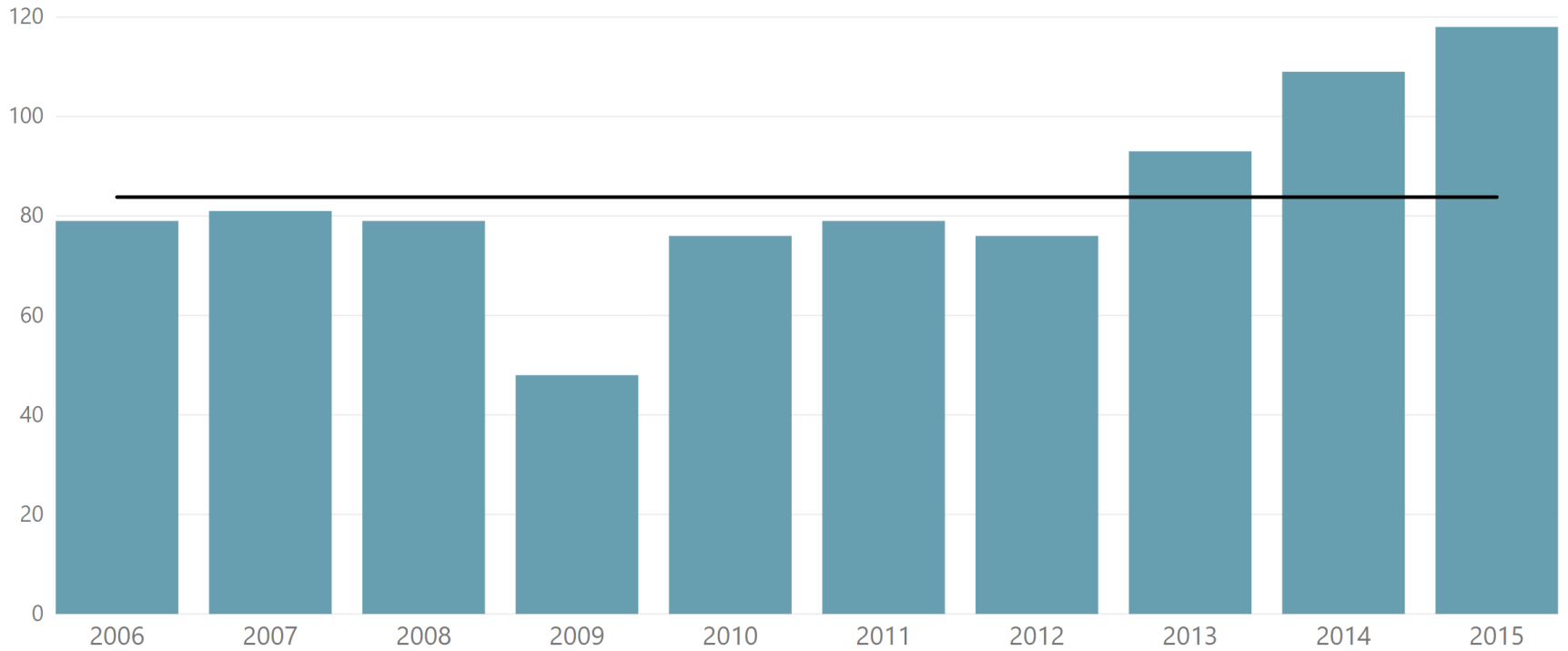


Figure displays the development of average dividend yields on the OSE divided in the investigated samples from 2005-2015. Dividend yield is on the y-axis and the year in which the dividends was paid out is on the x-axis. The sample including both special dividends and identified outliers stands out as being the sample with most year to year fluctuation in average dividend yield.

Figure 2 Distribution of the yearly amount of dividend payments on the OSE (2006 – 2015)



The figure displays the number of yearly observations (dividend payments) in the sample including all observations. The y-axis is the number of dividend payments and the x-axis represent the year in which the dividends was paid out. The horizontal line illustrates the average amount of yearly dividend payments from 2006-2015. The figure highlights a sudden decline in dividend payments in the wake of the financial crisis, followed by a steady growth in dividend payments.

8. Methodology

In order to examine the actual change in price from cum-day to ex-day relative to the corresponding dividend, we compute four different PDR statistics referred to as $PDR_{unadj.}$, $PDR_{FF\ adj.}$, $PDR_{Allshare\ adj.}$ and $Ret_{FF\ adj.}$.

As previously discussed, in a perfect world and given Norway's equal tax on dividend and capital gains – the mean PDR statistics should be close to one (close to zero if $Ret_{FF\ adj.}$).

The first statistic is the most studied measure and is denoted as

$$PDR_{unadj.} = \frac{P_{C,i,t} - P_{E,i,t}}{D_{i,t}} \quad (6)$$

Where $P_{C,i,t}$ and $P_{E,i,t}$ is the closing price on cum-dividend day and ex-dividend day for the i'th stock related to a given dividend payment and $D_{i,t}$ is the stock's respective cash dividend per share related to the same dividend payment.

The use of closing prices might introduce statistical bias due to price fluctuations between the cum-dividend day and the end of ex-dividend day. To adjust for this, we also include two additional adjusted statistics similar to Liljeblom et al. (2001), Borges (2008) and Dasilas (2009) in our analysis.
In the second statistic we adjust the ex-day price with the ex-day allshare market return.

$$PDR_{Allshare\ adj.} = \frac{P_{C,i,t} - \frac{P_{E,i,t}}{(1+R_{A,t})}}{D_{i,t}} \quad (7)$$

Where $R_{A,t}$ is the OSE allshare return at ex-dividend day.

Unlike any previous research that we are aware of, we also include a PDR statistic adjusted with the expected return of the i'th stock on the ex-day using the framework of Fama and French's (1993) three factor model. In this way we hope

to obtain a more accurate adjustment measure as we adjust for the stock specific expected ex-dividend day return, rather than the general market return.
Fama & French is denoted as FF from here onwards.

$$PDR_{FF\ adj.} = \frac{P_{C,i,t} - \frac{P_{E,i,t}}{(1+R_{FF,i,t})}}{D_{i,t}} \quad (8)$$

Where $R_{FF,i,t} = \hat{\alpha}_i + R_{Ft} + \hat{\beta}_i(R_{Mt} - R_{Ft}) + \hat{s}_i SMB_t + \hat{h}_i HML_t$[24].

Eades, Hess, and Kim (1984) referred to in Liljeblom et al. (2001) points out that the price ratios are heteroscedastic. As suggested by Liljeblom et al. (2001), we compute the ex-day excess return to avoid heteroscedasticity. We adjust the ratio with expected daily return according to Fama & French's three factor model.
This provides us with our final statistic, denoted as

$$Ret_{FF\ adj.} = \frac{\frac{P_{E,i,t}}{(1+R_{FF,i,t})} + D_{i,t} - P_{C,i,t}}{P_{C,i,t}} \quad (9)$$

[24] Coefficients are based on a 250 days estimation period prior to the i'th firms investigated ex-dividend day. The coefficients was estimated with the following regression: $R_{it-} R_{Ft} = \alpha_i + \beta_i(R_{Mt} - R_{Ft}) + s_i SMB_t + h_i HML_t + \varepsilon_{it}$. SMB and HML are measures of the historical excess returns of small capitalization stocks over big capitalization stocks and high book-to-market stocks over low book-to-market stocks (Fama & French, 1993). The allshare return on the OSE is used as market return (R_M) and the risk-free rate is denoted R_F.

9. Results

The results on average PDR statistics on the OSE from 2006 through 2015 according to samples of particular interest (see Appendix 5 for results on additional samples) are reported in Table 3.

The equilibrium condition states that the PDR should be one. Also, based on the Norwegian investor, the tax-induced clientele arguments should not explain an ex-dividend price anomaly. Therefore, we expect the PDR statistics to be close to one.

Table 3 Average PDR statistics on the OSE (2006 – 2015)

Sample		Mean Price Drop Ratios			
Main		$\mathrm{PDR}_{\mathrm{unadj.}}$	$\mathrm{PDR}_{\mathrm{FF\ adj.}}$	$\mathrm{PDR}_{\mathrm{Allshare\ adj.}}$	$\mathrm{Ret}_{\mathrm{FF\ adj.}}$
	Obs	741	741	741	741
	Mean ($\hat{x}$)	0.753***	0.753***	0.787***	0.008***
	S.E. of mean ($s\sqrt{n}$)	0.024	0.025	0.027	0.001
	Min	-1.000	-2.940	-3.417	-0.469
	Max	2.444	2.940	3.460	0.133
Including all					
	Obs	838	838	838	838
	Mean ($\hat{x}$)	0.692***	0.683***	0.719***	0.010***
	S.E. of mean ($s\sqrt{n}$)	0.047	0.046	0.047	0.001
	Min	-15.607	-15.356	-16.222	-0.469
	Max	15.000	14.958	15.000	0.368

Table 3 reports the mean computed PDR statistics based on all observations in the reported samples, where the mean $PDR_{unadj.} = \frac{1}{N}\sum_{j=1}^{N}\frac{P_{C,i,t}-P_{E,i,t}}{D_{i,t}}$, the mean $PDR_{FF\ adj.} = \frac{1}{N}\sum_{j=1}^{N}\frac{P_{C,i}-\frac{P_{E,i,t}}{(1+R_{FF,i,t})}}{D_{i,t}}$, the mean $PDR_{Allshare\ adj.} = \frac{1}{N}\sum_{j=1}^{N}\frac{P_{C,i,t}-\frac{P_{E,i,t}}{(1+R_{A,t})}}{D_{i,t}}$ and the mean $RET_{FF\ Adj.} = \frac{1}{N}\sum_{j=1}^{N}\frac{\frac{P_{E,i,t}}{(1+R_{FF,i,t})}+D_{i,t}-P_{C,i,t}}{P_{C,i,t}}$. An observation is denoted as j and consists of a given firm *i* at a given ex-dividend date *t*. $R_{FF,i,t}$ is the i'th firm's Fama & French expected return at a given ex-dividend date t and $R_{A,t}$ is the daily allshare return at t. *** denotes statistically different from 1 (from 0 when $RET_{FF\ Adj.}$) at the 1% level. The *main* sample is excluded for identified outliers in turnovers, dividend yields and PDRs whereas the sample *including all* includes all identified observations.

The results in Table 3 report of a PDR significantly different from one (different from zero when $RET_{FF\ Adj.}$) at the 1% level (two-sided tests) in all samples and by all statistics. Hence, the results are contradicting the null hypothesis of hypothesis 1. In addition, all the PDR statistics is greatly exceeding the lower bound of the no-arbitrage midpoint.

The $PDR_{Allshare\ adj.}$ is closer to one than the two remaining PDR statistics[25] in both samples. However, the mean of the $PDR_{Allshare\ adj.}$ is not statistically significantly different from the other statistics by any sample[26]. Therefore, we will favor the $PDR_{FF\ adj.}$ for theoretical reasons.

Contradicting the equilibrium condition (and our first null hypothesis), but in line with previous research on ex-dividend price movements (Al Yahyaee et al., 2008; Bali & Hite, 1998; Bauer et al., 2006; Borges, 2008; Boyd & Jagannathan, 1994; Dasilas, 2009; Elton & Gruber, 1970; Frank & Jagannathan, 1998; Kalay, 1982; Lakonishok & Vermaelen, 1986; Liljeblom et al., 2001; Rantapuska, 2008), our results imply that the price drop on ex-dividend day is, on average, significantly less than the corresponding dividend per share. Even though this is in line with previous research, we find these results surprising as this is far from what we would predict based on the Norwegian tax regulations in our investigated period.

Below are figures that illustrates the yearly variation of the average PDR statistics (except the ex-day excess return).

[25] PDR statistics excluding the $Ret_{FF\ adj.}$.

[26] The $PDR_{Allshare\ adj.}$ was tested against both $PDR_{FF\ adj.}$and $PDR_{unadj.}$ with a two-sample z-test based on both the *main* sample and the *including all* sample. The null hypothesis of the difference in mean being 0 could not be rejected in any of the tests and it thus seems to be little difference between the $PDR_{Allshare\ adj.}$ and the two remaining statistics.

Figure 3a Yearly average PDR statistics on the OSE including all observations (2006 – 2015)

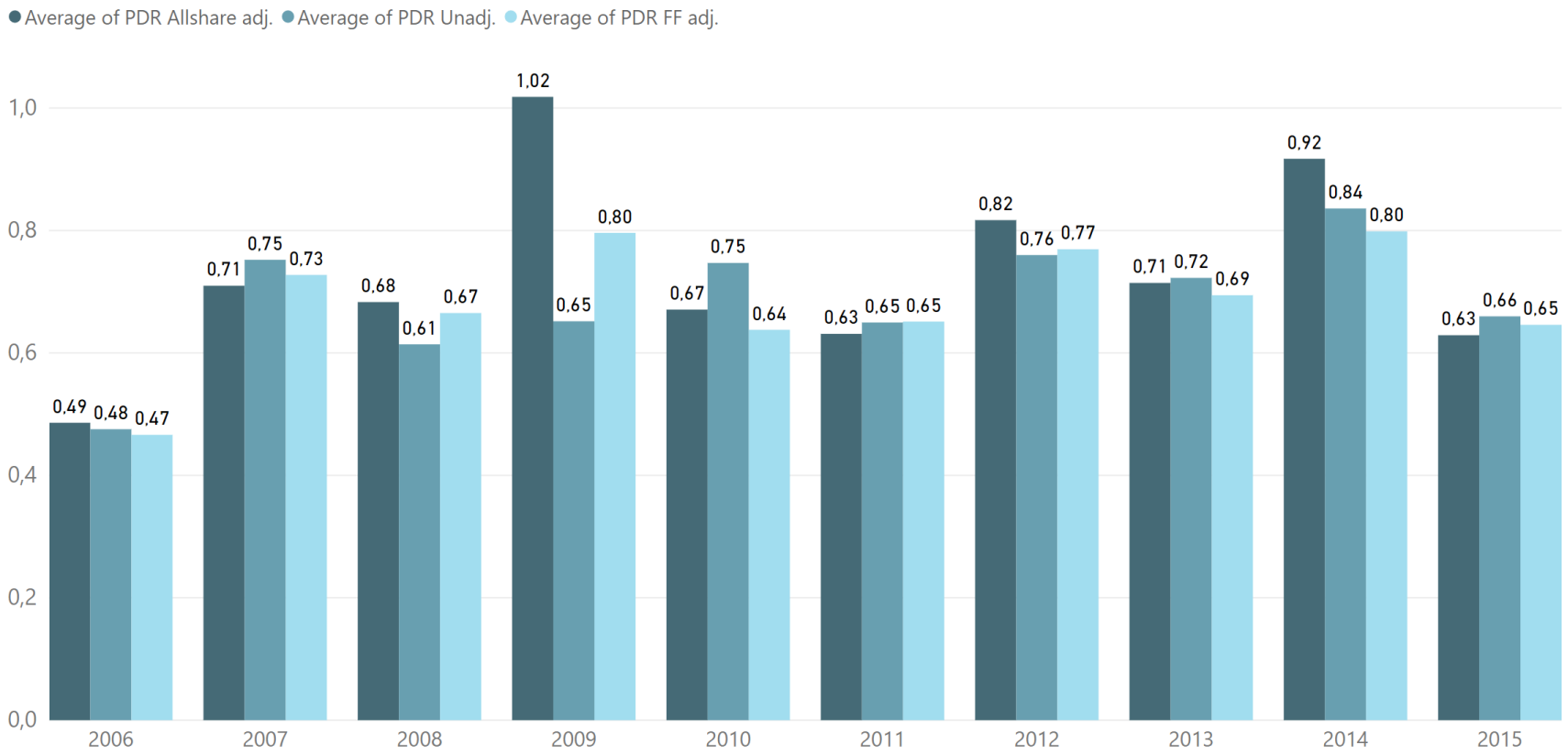


Figure 3a illustrates the yearly average PDR statistics on the OSE including all observations in each year of our sample period. No specific statistic stands out as significantly different than others. However, 2006 stands out relatively to other years in our defined sample period with a low ratio. No trend is spotted.

Figure 3b Yearly average PDR statistics on the OSE excluding outliers (2006-2015)

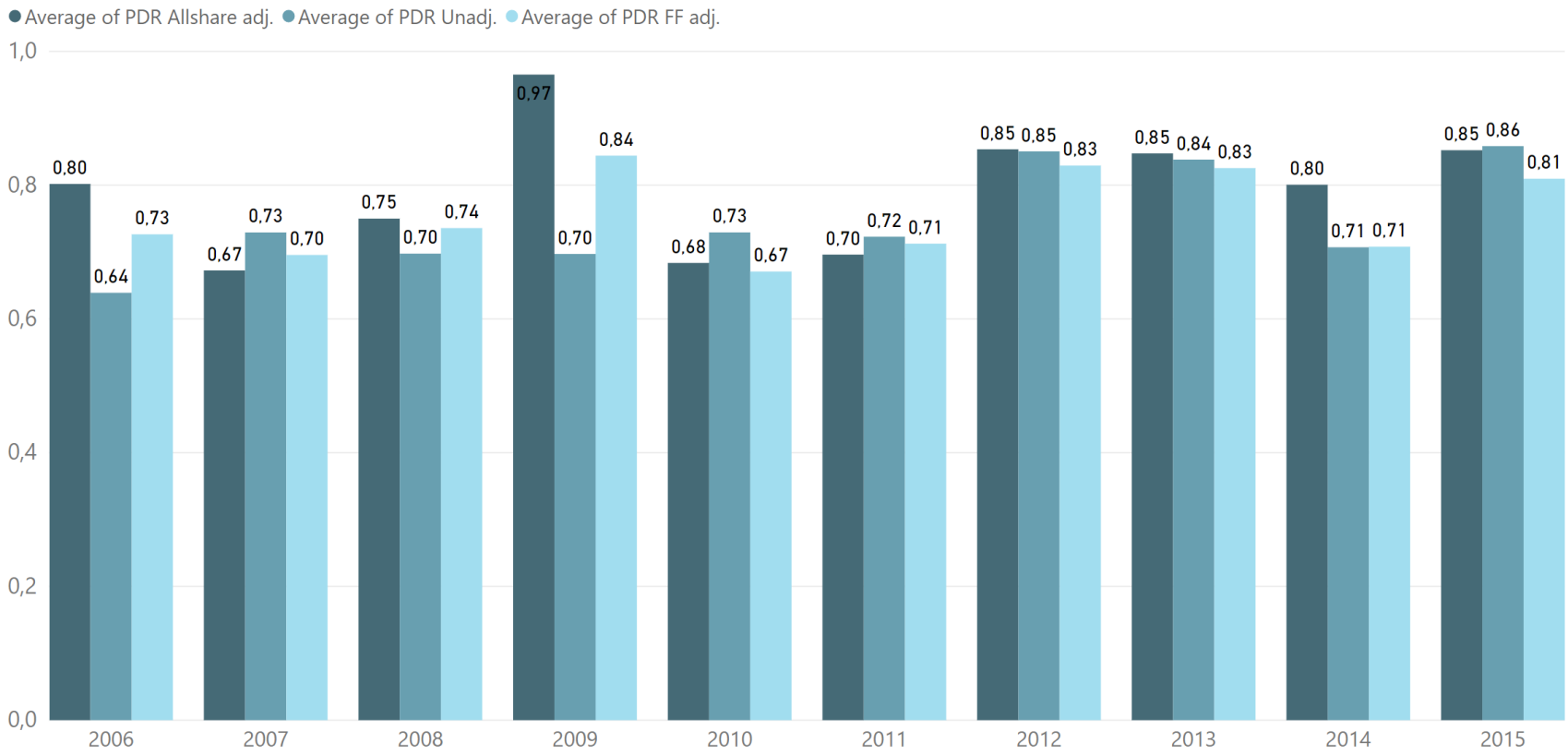


Figure 3b illustrates the yearly average PDR statistics on the OSE excluding outliers in each year of our sample period. Overall the ratio becomes closer to one. In addition, the year-to-ear fluctuations become smaller and the year of 2006 does no longer stand out as a year with a significantly low ratio. No trend is spotted.

See Appendix 6 for figures of yearly average price drop ratios of solely outliers and special dividends.

Summary

In Part 1 we have confirmed the presence of an ex-dividend price anomaly on the Oslo Stock Exchange by proving that the ex-dividend price drop has, on average, dropped less that the corresponding dividend from 2006 throughout 2015. This is consistent with previous literature in the field, which often reports of an ex-dividend price anomaly.

However, the presence of an ex-dividend price anomaly on the OSE was far from expected based on Norwegian tax regulations and the results should therefore function as an important contribution to the ongoing debate on the causes of the ex-dividend price anomaly, especially by questioning the tax-related arguments.

The results may indicate that there is a general preference for capital gains over dividends among the investors on the OSE since the investors receiving the dividends is compensated with a premium[27].

Since the observed PDR statistics are greatly exceeding the no-arbitrage boundaries of the domestic owners, the results in Part 1 may also indicate that there are arbitrage opportunities present on the Oslo Stock Exchange.

Lastly, investors trying to capture dividends as capital gains by trading around ex-dividend day, will receive approximately 25% less in capital gains than what they could have obtained by receiving the dividend (without including transaction costs). The latter suggests that on average, it will not be profitable to utilize the newly introduced account type "ASK" to defer tax on dividends, by trying to capture the dividends as capital gains.

[27] The investor receives a premium since she is receiving more in dividends than the corresponding stocks decrease in value.

Part 2

Part 2 seek to identify possible reasons for the ex-dividend price anomaly observed in Part 1.

With increased globalization and more integrated markets, the importance of the foreign investor's presence rises. Acknowledging the significant presence of foreign owners on the Oslo Stock Exchange (OsloBørs, 2017), we choose to not discard the tax-induced clientele hypothesis even though the domestic tax regulations would imply so for the Norwegian investor. Therefore, we rather provide an extension by including foreign investors (who are facing different tax regulations) in our analysis.

Obviously, foreign owners is a broad term as it is represented by the entire world except, in our case, Norway. This makes it difficult to identify specific foreign tax regulations as a whole. However, we do know that foreigners are generally more dividend averse due to tax regulations and are often facing multiple tax brackets on investment income (OECD, 2018). In addition, foreigners can become even more dividend averse when they trade on exchanges outside their national borders as they will be exposed to withholding tax on their dividends which can be perceived as a nuisance (Deloitte, 2018; Skatteetaten, 2018b).

Tax clientele literature states that the investor's preference for dividend or capital gains is dependent on the relative taxation of dividend and capital gains. Elton and Gruber (1970) argue that investors in a high tax bracket is the most dividend averse and therefore would prefer low dividend yield stocks. Further, they find that the dividend yield is positively correlated with the price-drop-to-dividend-ratio, meaning that the group of investors that are in the low dividend yield stocks (in high tax brackets) have the smallest price-drop-to-dividend-ratio and vice versa. In other words, they argue that the price-drop-to-dividend-ratio is negatively correlated with the owner's dividend aversion.

The combination of foreign owner's dividend aversion and their significant presence on the Oslo Stock Exchange, gives us reason to believe that the degree of

foreign owners negatively influences the price-drop-to-dividend-ratio on the OSE. This will be investigated thoroughly in Part 2.

In the following sections, we begin with performing the same test as Elton and Gruber (1970) to investigate if their findings also apply on the Oslo Stock Exchange. The Elton and Gruber (1970) test should in principle not apply on the OSE since Norwegian investors are not faced with multiple tax-brackets on their investment income. Hence, any significant results in line with Elton and Gruber (1970) will be the first confirmation of a possible foreign influence.

Further, we divide the calculated PDR statistics into different brackets defined by degree of foreign ownership to investigate the relationship between the ex-dividend price movements and degree of foreign ownership.

We also perform an investigation of the trading volume around ex-dividend day and link that to the foreign investor's trading.

Lastly, we run a regression that is intended to summarize as well as confirm the discussion in Part 2. The regression seeks to identify factors affecting the observed deviation from the no-arbitrage midpoint. Included as explanatory variables are mainly factors linked to foreign presence and trading volume literature. Firm size is also included as an explanatory variable since we expect this to explain some of the foreign presence.

10. Arbitrage boundaries

Since a new investor group is included in Part 2, the arbitrage boundaries will be re-written in this section.

As an extension to the arbitrage boundaries derived in section 5, we include foreign investors as a third investor category (Group C) and derive the arbitrage boundary based on the Norwegian tax regulations faced by foreign investors.

The extended version of the arbitrage boundaries including three different investor categories are illustrated in Table 4.

Table 4 Arbitrage boundaries for different investor categories

Investor categories	Dividend tax (t_d)	Capital gains tax (t_{cg})	Price drop to dividend ratio with C_u = 0%.	Quasi-arbitrage boundary with C_u = 0.05% (domestic), C_u = 0.5% (foreign) and average dividend yield = 4.6%
A. Domestic Taxed	t_d	t_{cg}	1	$0.978 < \frac{(P_C - P_E)}{D} < 1.022$
B. Domestic non-taxed	0	0	1	$0.978 < \frac{(P_C - P_E)}{D} < 1.022$
C. Foreign	t_d	0	(1-t_d) < 1	$0.632 < \frac{(P_C - P_E)}{D} < 1.068$

Our calculations are based upon equal tax rates on dividend and capital gains for domestic taxed investors[28]. Foreign investors are subject to 15% tax rate on dividend and 0% tax in capital gains [29]. Transaction cost C_u are estimated to be 0.05% for domestic investors while foreign investors are subject to a hypothetical transaction cost of 0.5%.[30]. The dividend yield used are calculated based on our *main* sample (see Table 2 in section 7.2) to compute the arbitrage boundaries.

Group C illustrated in Table 4 consists of foreign investors which are subject to tax on dividends, but not capital gains[31]. The foreign investor's no-arbitrage interval ranges from a PDR of 0.632 to 1.068.

[28] See Appendix 2.

[29] Norway has a tax treaty with several countries (Regjeringen, 2014, 2018). Investors in these particular countries are subject to 15% withholding tax on dividend.

[30] Domestic transaction cost is based upon the average brokerage fee of the four most popular stock brokers in Norway, DNB, Nordnet, Nordea and Pareto. The domestic brokerage fee per trade has stayed broadly unchanged in our investigated time interval according to various transaction costs presented by Pedersen (2006).
A transaction cost of 0,5% are used for foreign investors. This is consistent with the transaction cost used by Boyd and Jagannathan (1994); Liljeblom et al. (2001). Since their study is based on an earlier time interval than us, we suspect that the used brokerage fee might be somewhat outdated. However, by DNB's (one of the largest banks in Norway) homepages, we are informed that foreign trading is charged with a commission of 0,5% when using a broker. Hence, we conclude that the rate suggested by Boyd and Jagannathan (1994); Liljeblom et al. (2001) is still relevant.

[31] See section 3.1.2.

Notice that the latter arbitrage boundaries imply that foreign investors have, on average, no arbitrage opportunity since all the PDR statistics reported in Part 1[32] lies inside the foreign investor's upper and lower arbitrage boundary. In addition, Table 4 shows that all the PDR statistics reported in Part 1 lies outside the no-arbitrage midpoint[33], meaning that on average, only the domestic investors are facing arbitrage opportunities.

[32] See section 9.

[33] No-arbitrage midpoint is referred to as the price interval where no investor groups have arbitrage opportunities. Based on our calculations, the no-arbitrage midpoint stretches from a price-to-dividend-ratio of 0,978 to 1,022. Hence, any price-drop-to-dividend-ration inside this interval will not provide an arbitrage opportunity for any investor group.

11. Hypotheses

As discussed in the introduction of Part 2, this part is dedicated to analyzing whether the heavy presence of foreign investors is influencing the Norwegian ex-dividend price movements. More specifically, we assess whether the foreign presence is making the tax-clientele arguments applicable on the OSE – a stock exchange where Norwegian tax regulations should make the domestic investor indifferent between dividends and capital gains.

In addition, we seek to answer whether there is any abnormal trading volume on the OSE around ex-dividend day and assess whether any identified abnormal volume is related to domestic and foreign investors trading with each other.

11.1 Foreign influence on ex-dividend price movements

11.1.1 Hypothesis 2

In our second hypothesis, we want to test if foreign owners influence the price-drop-to-dividend-ratio. As argued by Elton and Gruber (1970), dividend aversion should be negatively correlated with this ratio. Assuming foreign investors to be dividend averse, we argue that the ratio should decrease with the degree of foreign owners since a strong dominating presence of a large group of foreign owners with different dividend preferences should be reflected in the ex-dividend price drop.

Hence, our second hypothesis,

H0: The ex-dividend price drop decreases relative to the corresponding dividend per share with the degree of foreign owners.

HA: The ex-dividend price drop does not decrease relative to the corresponding dividend per share with the degree of foreign owners.

11.2 Abnormal trading volume around ex-dividend day

11.2.1 Hypothesis 3

In our third hypothesis, we test for abnormal volume around ex-dividend day.

Given that all our previously reported PDR statistics are significantly exceeding the no-arbitrage midpoint, we should not expect any abnormal trading volume.
This because abnormal trading volume should have pushed these statistics closer to the no-arbitrage midpoint and thus removed the observed ex-dividend price anomaly. However, Rantapuska (2008) argue that the majority of investors fail to understand the potential tax savings achievable by ex-day trading as he see evidence indicating that individual investors do not necessarily behave in a tax-optimal way. Therefore, we argue that a price-drop-to-dividend-ratio exceeding the no-arbitrage midpoint and abnormal volume around ex-dividend day may co-exist. The reason being that the abnormal volume is not necessarily large enough to move the price-to-dividend-ratio inside the no-arbitrage midpoint.

By the dynamic dividend clientele model[34], we expect to see some abnormal trading around the ex-dividend day since, especially the domestic dividend indifferent investors, have a strong incentive to exploit the reported ex-dividend price anomaly[35].

Our third hypothesis becomes the following,

H0: There is abnormal trading volume around ex-dividend day.

HA: There is no abnormal trading volume around ex-dividend day.

[34] Dynamic dividend clientele models (Michaely & Vila, 1995; Michaely, Vila, & Wang, 1996) states that tax heterogeneity leads to differential valuation of dividends and thus that the PDR is not driven by a single group of investors, but rather the interplay of trading decisions by investors with different tax status (Rantapuska, 2008). Previous research, like Rantapuska (2008) investigation of the Finnish market, has shown that different investor groups take advantage of differences in tax rates by trading around the ex-dividend day (Rantapuska, 2008).
[35] The reported PDRs are exceeding the no-arbitrage boundaries of the domestic owners.

11.2.2 Hypothesis 4

Our fourth and final hypothesis question whether (possible) abnormal trading volume around ex-dividend day is related to foreign owners. More specifically, we seek to identify a relationship between the fraction of foreign owners and the abnormal trading volume around ex-dividend day.

We expect the abnormal trading volume to rise in the stocks with an equal mixture of foreign and domestic owners. This because a strong dominating presence of a large homogenous group of owners will reflect the dividend preferences of the largest group of owners (Liljeblom et al., 2001). Hence, the stocks with a more heterogeneous group of investors with different preferences should increase the trading activity in these stocks.
Michaely and Vila (1995) also reports of results indicating that trading volume on the ex-day is found to increase with tax heterogeneity.

Naturally, our hypothesis becomes the following,

H0: Abnormal volume around ex-dividend day is related to the degree of foreign owners.

HA: Abnormal volume around ex-dividend day is unrelated to the degree of foreign owners.

12. Data

In addition to the security and fundamental data explained in Part 1, ownership data on Norwegian firms listed on the OSE had to be collected.

An extensive and thorough examination of ownership data was performed on various data sources. We have been provided with ownership data from CCGR (Centre for Corporate Governance Research) (annual data), Thomson Reuters (monthly data) and Bloomberg Terminal (annual data) [36].

After investigating the registered fraction of foreign ownership related to the companies in our sample, we were surprised to find that all three databases provided significantly different fractions of foreign ownership related to the same observations. In addition, there were, especially in the CCGR and the Thomson Reuters bases, a significant lack of foreign ownership data[37].

The fraction of foreign owners in Thomson Reuters' database was restricted with a threshold of 5% foreign owners, meaning that all foreign owners owning less than 5% was excluded from the database. This and the different frequency of the data, explains some of the discrepancies between the latter database and the rest[38].

The credibility of the different data sources had to be investigated thoroughly due to the inconsistent data across various data sources. Numerous data on foreign owners from every source was compared to the company's respective annual report. In the end, the data from Bloomberg Terminal was by far the most credible, showing close to exact equal numbers on foreign ownership as the investigated annual reports. This, combined with Bloomberg's relatively large amount of foreign data, made the ownership data from Bloomberg Terminal the data we base our analysis on in this thesis[39].

Notice that the ownership data from Bloomberg Terminal is annual data, which should be considered as a limitation in our dataset.

[36] In addition to mentioned data sources, we have been in dialogue with both VPS (Norwegian Central Securities Depositary) and OSE. However, the data in the time period of our interest had to be produced by their employees and was thus too expensive to generate.

[37] 17%, 22% and 45% of our sample's observations had registered foreign owners when using the Thomson Reuters, CCGR and Bloomberg Terminal respectively.

[38] A similar threshold was not present in Bloomberg Terminal nor CCGR.

[39] Results based on the data from Thomson Reuters are presented on some occasions as this data provides a unique opportunity to isolate the large foreign owners.

13. Methodology

13.1 Tax-induced clientele effect - Elton and Gruber (1970)

This section consist of a description of the original test Elton and Gruber (1970) applied in their study.

We run the same test to investigate if their findings also apply on the Oslo Stock Exchange. In principal, the Elton and Gruber (1970) test should not apply on the OSE since domestic investors are not faced with multiple tax-brackets on their investment income. However, 36.4 percent of the OSE consist of foreign investors which most likely are exposed to multiple tax brackets (OECD, 2018; OsloBørs, 2017). Hence, any significant results in line with Elton and Gruber (1970) will function as a first verification of a potential tax-induced clientele effect present in the Norwegian market, possibly caused by a high presence of foreign investors.

By using the theoretical framework of Elton and Gruber (1970) we can examine the relationship between the dividend yield and the price-drop-to-dividend-ratio to test if there is a tax-induced clientele effect present on the OSE.
Elton and Gruber (1970) used dividend yield as an explanatory variable to explain the tax effect in the price drop. They argued that the dividend yield affects the investor's preference for which company to invest in, since the dividend yield is a measurement for how much a company pays in dividend. Meaning that investors that hold stocks with a high dividend yield should be in low tax bracket while investors that hold stocks with a low dividend yield should be in a high tax bracket.

Following the model of Elton and Gruber (1970) we group the dividend yield for each sample into 10 deciles. We compute the mean $PDR_{unadj.}$, $PDR_{FF\ adj.}$ and $PDR_{Allshare\ adj.}$ for each decile and rank them based on their value. Further, the Spearman Rank correlation coefficient is estimated to assess whether there exists a relationship between the dividend yield and price drop.

The following formula is used to calculate the Spearman Rank correlation coefficient r_S.

$$r_S = 1 - \frac{6\sum D^2}{n(n^2-1)} \quad (10)$$

Where *D* is the difference between ranks while *n* denotes the number of pairs of measurements.

The significance of the test[40] is determined by comparing the calculated Spearman Rank correlation coefficient to a table of critical values (Zar, 1972, 1984).

13.2 Abnormal volume

Abnormal volumes are identified using an event study methodology. In an event study, abnormal volumes are often measured in one or two ways; using a fixed mean from an estimation period or using a market factor model (Chae, 2005). In this thesis, we use the latter methodology as this is commonly used in empirical studies of event-related trading activity (Tkac, 1999).

In line with Tkac (1999), we use turnover (TO)[41] as a measure of trading volume and estimate the benchmark turnover using a trading volume market model running a time-series regression for each firm on each observation in our investigated sample. As oppose to Tkac (1999), we decided to use a logarithmic measure of the turnover as recommended by Ajinkya and Jain (1989), referred to in Chae (2005), to correct for extreme skewness and kurtosis often observed when using raw turnover measures.

We estimate the market model version for turnover as defined in equation (11),

$$\ln(TO_{i,t}) = \alpha_i + \beta_i(\ln(TO_{m,t})) + \varepsilon_t^i, \quad (11)$$

$$TO_{i,t} = \left(\frac{Trading\ Volume_{i,t}}{Outstanding_{i,t}}\right) \quad (12)$$

[40] For instance, a 5 percent statistically significant Spearman Rank correlation coefficient means that we can be sure that there is less than a 5 percent chance that the strength of the relationship found between the dividend yield and the PDR statistics happened by chance.
[41] The percentage of traded shares relative to shares outstanding. When using turnover as a measure, we adjust for shares outstanding, as oppose to absolute trading volume measures.

$$TO_{m,t} = \left(\frac{Trading\ Volume_{m,t}}{Outstanding_{m,t}}\right)^{42} \quad (13)$$

$$AV_{i,t} = \ln(TO_{i,t}) - E(\ln(TO_{i,t}))^{43} \quad (14)$$

Where $AV_{i,t}$ is the abnormal volume (turnover) for the i'th stock on day t and $E(\ln(TO_{i,t}))$ represent the i'th stock's expected turnover at t which is estimated with equation (11), denoted as $\widehat{\alpha_i} + \widehat{\beta_i}(\ln(TO_{m,t}))$.

Coefficients are estimated outside the event window of t=-5 to t=5 (-5,5), ex-dividend day being the event. Our estimation period stretches from t=-65 to t=-6 in order to avoid an estimation period overlapping with the i'th firm's previous dividend payments and still obtain an adequate period of time.
Shorter and longer estimation periods (t=-125 to t=-6 and t=-35 to t=-6) are also analyzed as a robustness check (see Appendix 7).

Lakonishok and Vermaelen (1986) and Koski and Scruggs (1998) use, in addition to the abnormal volume as an absolute measure, a percentage measure of abnormal volume since abnormal volume is hard to interpret.
Our measure is especially hard to interpret (for the common reader) since we investigate the abnormal volume as the difference in logarithmic measures. However, since the difference in logarithmic measures is the same as the logarithmic ratio (15), we compute the exponential of the logarithmic difference to get the ratio of actual volume over expected volume ($\%AV_{i,t}$), as shown below

$$AV_{i,t} = \ln(TO_{i,t}) - E(\ln(TO_{i,t})) = \ln\left(\frac{TO_{i,t}}{E(TO_{i,t})}\right) \quad (15)$$

$$\%AV_{i,t} = e^{AV_{i,t}} - 1 = \frac{(TO_{i,t})}{E(TO_{i,t})} - 1 \quad (16)$$

Hence, $\%AV_{i,t}$ can be interpreted as the percentage amount of actual turnover exceeding the expected turnover in the i'th stock on an observed ex-dividend day[44].

[42] Market is referred to as all shares noted on the OSE.
[43] Abnormal Volume is denoted AV and is calculated in each day of the event window. E is short for Expected.
[44] We assume the shares outstanding related to the denominator in turnover measures to be equal for both the actual and the expected turnover. Hence, the shares outstanding will cancel each other out in the %AV measure and we are in principle left with the actual trading volume over the expected trading volume.

14. Results

14.1 Tax clientele effect - (Elton & Gruber, 1970)

As argued in the methodology, we run a classical Elton and Gruber (1970) test performed on the Norwegian market that will function as a first verification of a tax-induced clientele effect present in the Norwegian market.

By default, we do not expect to see any results consistent with Elton and Gruber's (1970) findings due to Norwegian tax regulations. We argue that any result opposite from our expectations can be related to a high presence of (dividend averse) foreign owners that are facing multiple tax-brackets on their investment income.

Table 5 and 6, displays the results of a classical Elton and Gruber (1970) test performed on the Norwegian market based on the *main* and the *including all* sample, respectively.

Table 5 Relationship between dividend yield and price drop – Spearman rank correlation
Sample: *Main* (Observations: 741)

Decile	Mean	$PDR_{unadj.}$		$PDR_{FF\ adj.}$		$PDR_{Allshare\ adj.}$	
	Dividend yield	Mean	Rank	Mean	Rank	Mean	Rank
1	0.0169	0.6341	1	0.7190	2	0.6549	3
2	0.0222	0.7238	5	0.7543	4	0.8479	1
3	0.0271	0.6858	3	0.9460	10	0.6787	2
4	0.0331	0.6659	2	0.7063	1	0.7638	8
5	0.0402	0.8542	10	0.7967	8	0.8432	4
6	0.0463	0.7478	6	0.7570	5	0.7696	10
7	0.0548	0.7100	4	0.7230	3	0.7430	5
8	0.0659	0.8389	9	0.8527	9	0.8686	6
9	0.0825	0.7921	8	0.7844	7	0.7997	7
10	0.1923	0.7667	7	0.7574	6	0.8170	9
Spearman rank corr. coefficient		0.6485		0.3333		0.5939	
Significance level		5%		Not significant		Not significant	

The mean of $PDR_{unadj.}$, $PDR_{FF\ adj.}$ and $PDR_{Allshare\ adj.}$ are computed for each decile. The spearman rank correlation coefficient is compared to a critical value (Zar, 1972, 1984) to test for significance.

Table 6 Relationship between dividend yield and price drop – Spearman rank correlation

Sample: *Including all* (Observations: 838)

Decile	Mean	$PDR_{unadj.}$		$PDR_{FF\ adj.}$		$PDR_{Allshare\ adj.}$	
	Dividend yield	Mean	Rank	Mean	Rank	Mean	Rank
1	0.0145	0.6177	3	0.5625	2	0.5570	3
2	0.0206	0.4604	2	0.4813	1	0.5267	2
3	0.0250	0.2737	1	0.5667	3	0.3207	1
4	0.0313	0.7896	6	0.8091	8	0.8546	9
5	0.0382	0.7201	5	0.7252	5	0.7699	5
6	0.0452	0.8301	9	0.8024	6	0.8338	7
7	0.0539	0.6952	4	0.7172	4	0.7268	4
8	0.0658	0.8192	8	0.8191	9	0.8453	8
9	0.0871	0.8121	7	0.8025	7	0.8194	6
10	0.9046	0.9870	10	0.9840	10	0.9885	10
Spearman rank corr. coefficient		0.7939		0.8060		0.6848	
Significance level		5%		1%		5%	

The mean of $PDR_{unadj.}$, $PDR_{FF\ adj.}$ and $PDR_{Allshare\ adj.}$ are computed for each decile. The spearman rank correlation coefficient is compared to a critical value to test for significance.

We find that for the *main* sample only $PDR_{unadj.}$ is significant at the 5 percent level. In the *including all* sample we find that $PDR_{unadj.}$, $PDR_{FF\ adj.}$ and $PDR_{Allshare\ adj.}$ are significant at the 5%, 1% and 5% level, respectively. Further, we find that $PDR_{unadj.}$, $PDR_{FF\ adj.}$ and $PDR_{Allshare\ adj.}$ are significant at the 5%, 10% and 5% level for the *excluding special dividends* sample, respectively. In the *excluding all* sample we find that only $PDR_{unadj.}$ is significant at the 5 percent level. The results from the *excluding special dividends* and *excluding all* samples are attached in Appendix 8.

From these results, we can infer that there is some positive correlation between dividend yield and price drop which is consistent with Elton and Grubers' (1970) findings. Typically, these results would lead us to believe that there is a tax clientele effect present in the market. However, considering the absence of multiple tax brackets in Norway, there should be no correlation between the dividend yield and

price drop, at least as a result of tax brackets. But interestingly enough, we get quite similar results from that of Elton and Gruber (1970), thus making their model questionable.
However, as argued, a possible explanation as to why we get these results is because of the heavy foreign presence on the OSE. Therefore, we must be careful before we can discard the theory proposed by Elton and Gruber (1970).

The results displayed in Table 5 and Table 6 (and Appendix 8) may indicate that the fraction of foreign owners in the Norwegian market is significant enough to influence the price-drop-to-dividend-ratio.

14.2 Ex-dividend price movements in different ownership groups

In section 14.1, we observed a potential tax induced clientele effect present at the Oslo Stock Exchange. We suspect that this observed clientele effect is caused by foreign investors that are exposed to different tax regulations.
The following section continues the investigation of the foreign investor's influence on ex-dividend price movements by dividing the mean PDR statistics from Part 1 into different foreign ownership brackets.

As argued in hypothesis 2, we expect the price-drop-to-dividend ratio to decrease with the degree of foreign owners. The reason being that a strong dominating presence of a large group of foreign owners with different dividend preferences (stronger dividend aversion) should be reflected in the ex-dividend price drop.

First, we investigate the price-drop-to-dividend-ratios for firms with a low, medium and high degree of foreign ownership by using ownership data extracted from the Thomson Reuters database. As argued in the data section, this is valuable since the source of data are restricted with an ownership cap of 5%, meaning that only large owners are included. The results are displayed in Table 7 below.

Table 7 Average PDR statistics per foreign ownership bracket – Data from Thomson Reuters

Sample					
Main	Category	$\text{PDR}_{\text{unadj.}}$	$\text{PDR}_{\text{FF adj.}}$	$\text{PDR}_{\text{Allshare adj.}}$	$\text{Ret}_{\text{FF Adj.}}$
	Low foreign ownership *38 obs.*	1.0050 (0.7778)	0.9526 (0.7826)	0.9576 (0.8412)	0.0019 (0.0264)
	Medium foreign ownership *35 obs.*	0.7765** (0.6278)	0.7378** (0.6636)	0.7584* (0.7278)	0.0096** (0.0277)
	High foreign ownership, *40 obs.*	0.8285 (0.7004)	0.7855* (0.7027)	0.8651 (0.6836)	0.0073 (0.0278)
Including all	Category	$\text{PDR}_{\text{unadj.}}$	$\text{PDR}_{\text{FF adj.}}$	$\text{PDR}_{\text{Allshare adj.}}$	$\text{Ret}_{\text{FF Adj.}}$
	Low foreign ownership *42 obs.*	0.9391 (1.2022)	0.9447 (1.1051)	0.9134 (1.1150)	0.0030 (0.0287)
	Medium foreign ownership *49 obs.*	0.7043 (1.3517)	0.7180 (1.2529)	0.7668 (1.1812)	0.0089** (0.0292)
	High foreign ownership *48 obs.*	0.4787** (1.4002)	0.3440*** (1.6119)	0.4697** (1.4015)	0.0247*** (0.0453)

Table 7 illustrates the average $PDR_{unadj.}$, $PDR_{FF\ adj.}$, $PDR_{Allshare\ adj.}$ and $RET_{FF\ Adj.}$ for firms with low, medium and high degree of foreign ownership. The *main* sample consist of 114 observations, while the *including all* sample consist of 139 observations. The standard deviations of the mean ratios are reported within parentheses. *** denotes statistically significantly different from one (from 0 when $RET_{FF\ Adj.}$) at the 1% level, ** denotes statistically significantly different from one (from 0 when $RET_{FF\ Adj.}$) at the 5% level while * denotes statistically significantly different from one (from 0 when $RET_{FF\ Adj.}$) at the 10% level.

For the *main* sample, Table 7 report that the $PDR_{unadj.}$ and $PDR_{FF\ adj.}$($Ret_{FF\ Adj.}$) are significantly different from one (zero) at the 5 percent level while the $PDR_{Allshare\ adj.}$ are significantly different from one at the 10 percent level for firms with medium degree of foreign ownership. For firms with high degree of foreign ownership, only $PDR_{FF\ adj.}$ are significantly different from one at the 10 percent level.

For the sample *including all* observations, we see that the $PDR_{unadj.}$, $PDR_{FF\ adj.}$ and $PDR_{Allshare\ adj.}$ ($Ret_{FF\ Adj.}$) are significantly different from one (zero) at the 5%, 1% and 5% (1%) for firms with high degree of foreign ownership, respectively. For firms with medium degree of foreign ownership, only $Ret_{FF\ Adj.}$ are significantly different from zero at the 5 percent level.

As expected, we observe that the PDR statistics ($Ret_{FF\ Adj.}$) is closer to one (zero) for firms with a low degree of foreign ownership and significantly different from one (zero) for firms with high degree of foreign ownership.
Based on these results we have reason to believe that an increase in fraction of foreign owners impacts the price-drop-to-dividend-ratio negatively.
These results are also in line with the results of Liljeblom et al. (2001) which found a clear trend indicating that the price-drop-to-dividend-ratio decreased with foreign ownership.

Initially, we argue that these results are groundbreaking, as they suggest that foreign tax regulations affect the ex-dividend price movements on the OSE. Hence, the tax-clientele arguments might still be applicable on a stock exchange where domestic tax should make the domestic investor indifferent between dividends and capital gains.

Using ownership data extracted from the Bloomberg Terminal we do the exact same analysis as above - investigate the average PDR statistics for firms with a low, medium and high degree of foreign ownership. Naturally, we expect to see the same pattern between the degree of foreign ownership and PDR statistics as the ones reported in Table 7. The results are displayed in Table 8 below.

Table 8 Average PDR statistics per foreign ownership bracket – Data from Bloomberg Terminal

Sample					
Main	Category	$PDR_{unadj.}$	$PDR_{FF\ adj.}$	$PDR_{Allshare\ adj.}$	$Ret_{FF\ adj.}$
	Low foreign ownership *111 obs.*	0.6586*** (0.6595)	0.6980*** (0.6059)	0.7274** (0.6635)	0.0105*** (0.0286)
	Medium foreign ownership *111 obs.*	0.7547*** (0.6821)	0.7496*** (0.7684)	0.7406*** (0.8642)	0.0065*** (0.0215)
	High foreign ownership *111 obs*.	0.8068*** (0.7288)	0.8041** (0.8531)	0.8797 (0.8246)	0.0062*** (0.0233)
	Domestic owners *322 obs.*	0.7608*** (0.6165)	0.7520*** (0.5871)	0.7898*** (0.6395)	0.0092*** (0.0374)
	Foreign owners *333 obs.*	0.7450*** (0.6919)	0.7548*** (0.7488)	0.7863*** (0.7900)	0.0076*** (0.0247)
Including all	Category	$PDR_{unadj.}$	$PDR_{FF\ adj.}$	$PDR_{Allshare\ adj.}$	$Ret_{FF\ adj.}$
	Low foreign ownership *133 obs*.	0.6188*** (0.8233)	0.6508*** (0.7339)	0.7186*** (0.7027)	0.0112*** (0.0284)
	Medium foreign ownership *124 obs*.	0.6882 (1.3414)	0.6984*** (1.1372)	0.6835*** (1.1897)	0.0062*** (0.0225)
	High foreign ownership *124 obs*.	0.8512 (1.4651)	0.8515 (1.6258)	0.9210 (1.5622)	0.0064** (0.0312)
	Domestic owners *357 obs.*	0.6767*** (1.5406)	0.6597*** (1.4920)	0.7036*** (1.5129)	0.0118*** (0.0484)
	Foreign owners *381 obs.*	0.7170*** (1.1523)	0.7316*** (1.1405)	0.7730*** (1.1149)	0.0080*** (0.0261)

Table 8 illustrates the average $PDR_{unadj.}$, $PDR_{FF\ adj.}$, $PDR_{Allshare\ adj.}$ and $RET_{FF\ Adj.}$ for firms with low, medium and high degree of foreign ownership. The standard deviations of the mean ratios are reported within parentheses. *** denotes statistically significantly different from one (from 0 when $RET_{FF\ Adj.}$) at the 1% level, ** denotes statistically significantly different from one (from 0 when $RET_{FF\ Adj.}$) at the 5% level while * denotes statistically significantly different from one (from 0 when $RET_{FF\ Adj.}$) at the 10% level.

Based on the *main* sample, Table 8 reports that all the PDR statistics are statistically significantly different from one (zero if $Ret_{FF\ Adj.}$) at either the 1% or 5% level, except the $PDR_{Allshare\ adj.}$ for the high foreign ownership bracket.
Based on the *including all* sample, Table 8 reports that all the PDR statistics, except for $PDR_{unadj.}$ in the medium foreign ownership bracket, are statistically significantly different from one (zero if $Ret_{FF\ Adj.}$) at the 1 percent level for the low and medium foreign ownership brackets. However, for the high foreign ownership bracket, only $Ret_{FF\ Adj.}$ are significantly different from zero at the 5 percent level.

When observing the price-drop-to-dividend-ratios for stocks with solely registered domestic owners as well as registered foreign owners, we observe that all the PDR statistics are significantly different from one (zero if $Ret_{FF\ Adj.}$) at the 1 percent level based on both the *main* and the *including all* samples.

From Table 8, there is a clear pattern indicating that the price-drop-to-dividend-ratio ($Ret_{FF\ Adj.}$) are most negatively deviating from one (positively deviating zero) in stocks with a low degree of foreign ownership and moves closer to one (zero) in stocks with a high degree of foreign ownership.
Shockingly, these results are the opposite of what is reported in Table 7, and thus not in line with what we would expect. This may indicate that foreign investors are, surprisingly enough, not dividend averse – but rather dividend liking.

However, we must be cautious before we imply any relationship at all. When running a two-sample z-test on the price-drop-to-dividend-ratio on the high foreign ownership sample against the low foreign ownership sample, we cannot reject that the mean of the ratio is significantly different from each other in the two samples[45]. Nevertheless, in section 14.4 this pattern will be investigated further.

Also, notice that the group of stocks with no registered foreign owners report of PDR statistics significantly different from one (zero when $Ret_{FF\ Adj.}$). In addition, the mean of the price-drop-do-dividend-ratio[46] based on the sample of stocks with

[45/46] The $PDR_{FF\ adj.}$ is the PDR statistic used in the two-sample z-test. As argued in the methodology in Part 1, this measure is the measure of most interest due to theoretical reasons.

solely registered domestic owners and the sample of stocks with registered foreign owners are not significantly different from each other. This suggests that the observed ex-dividend price anomaly is not solely caused by foreign investors.

Overall in this section, we obtain results indicating that the price-drop-to-dividend-ratio on the OSE is influenced negatively by the degree of foreign presence when using data from the Thomson Reuters database. However, when using data extracted from the Bloomberg Terminal, we obtain opposite results indicating that the price-drop-to-dividend ratio is positively related to the degree of foreign owners.

Nevertheless, as argued in the data section (section 12), we will favor the results based on the data obtained from Bloomberg Terminal. Hence, these results might point in a direction of rejecting the null hypothesis of hypothesis 2[47] as the results obtained from Table 8 might suggest that the fraction of foreign owners is positively (negatively) related to the PDR statistics ($Ret_{FF\ Adj.}$).
However, we wait with the final rejection since this relationship will be investigated more thoroughly in section 14.4.

In addition, we obtain results indicating that the previously observed ex-dividend price anomaly on the Oslo Stock Exchange is caused by other factors than solely foreign owners.

For results on average PDR statistics per ownership bracket based on the *excluding special dividends* and *excluding all* samples, see Appendix 9.

14.3 Cumulative abnormal volume

In this section, we start by presenting the results of average abnormal turnover around the ex-dividend day before we report our event window's ((-5,5) and (-1,0)) cumulative abnormal turnover in different foreign ownership brackets. Even though we do not have sufficient data on who that is trading, we believe that the latter can function as an estimate of foreign investor trading.

[47] The null hypothesis of hypothesis 2: The ex-dividend price drop decreases relative to the corresponding dividend per share with the degree of foreign owners.

14.3.1 Average abnormal turnover around ex-dividend day.

Table 9 displays the abnormal volume on the OSE around ex-dividend day (t=0) based observations in the *main* sample from 2006 to 2015. Benchmark turnover is estimated outside the event window of t=-5 to t=5 (-5,5), ex-dividend day being the event. The estimation period stretches from t=-65 to t=-6.

As a robustness check, results based on different estimation periods for both the *main* and the *including all* sample are also analyzed (Appendix 7). The results based on different estimation periods are consistent with the ones reported in this section.

As argued in hypothesis 3, based on the dynamic dividend clientele model[48], we expect to see abnormal trading volume around ex-dividend day. Also, the domestic dividend indifferent investors have a strong incentive to exploit the reported mean PDRs[49], which we expect to see reflected in some abnormal trading volume.

[48] Dynamic dividend clientele models (Michaely & Vila, 1995; Michaely et al., 1996) states that tax heterogeneity leads to differential valuation of dividends and thus that the price-drop-to-dividend-ratio is not driven by a single group of investors, but rather the interplay of trading decisions by investors with different tax status (Rantapuska, 2008). Previous research, like Rantapuska (2008) investigation of the Finnish market, has shown that different investor groups take advantage of differences in tax rates by trading around the ex-dividend day (Rantapuska, 2008).

[49] The reported mean PDR statistics in Part 1 are exceeding the no-arbitrage boundaries of the domestic owners.

Table 9 Daily average abnormal turnover around the ex-dividend day (sample: *Main*)

Day	-5	-4	-3	-2	-1	0	1	2	3	4	5
AV	0.0261	-0.0103	0.0361	**0.0716**	**0.1337**	**0.1722**	0.0054	-0.0143	-0.0307	-0.0252	-0.0207
	(0.7815)	(-0.3432)	(1.0614)	(1.9825)	(3.8832)	(3.6752)	(0.1974)	(-0.3856)	(-0.9842)	(-0.6339)	(-0.5928)
AV%	2.65 %	-1.02 %	3.67 %	**7.43 %**	**14.30 %**	**18.80 %**	0.54 %	-1.42 %	-3.02 %	-2.49 %	-2.05 %

The table reports the results of investigated average abnormal turnover around the ex-dividend day in the period 2006-2015. AV is the average difference between the logarithmic measures of actual and expected turnover whereas AV(%) is the percentage of the average actual turnover's deviation from the average expected turnover. T- values are denoted in parentheses. Abnormal turnover significantly different from zero at the 5% are denoted in bold. The expected turnover's estimation period stretches from t=-65 to t=-6.

Table 9 reports of an average abnormal turnover of 14.30% and 18.80% more than the expected turnover on cum-dividend day and ex-dividend day respectively. For the entire examination period, only the -2, -1 (cum-day) and 0 (ex-day) is statistically significantly different from zero (at the 5%, 1% and 1% level, respectively).

Results are in line with our expectations and thus confirms the null hypothesis of hypothesis 3. These results are also consistent with previous research on volume around the ex-dividend day (Koski & Scruggs, 1998; Lakonishok & Vermaelen, 1986; Rantapuska, 2008).

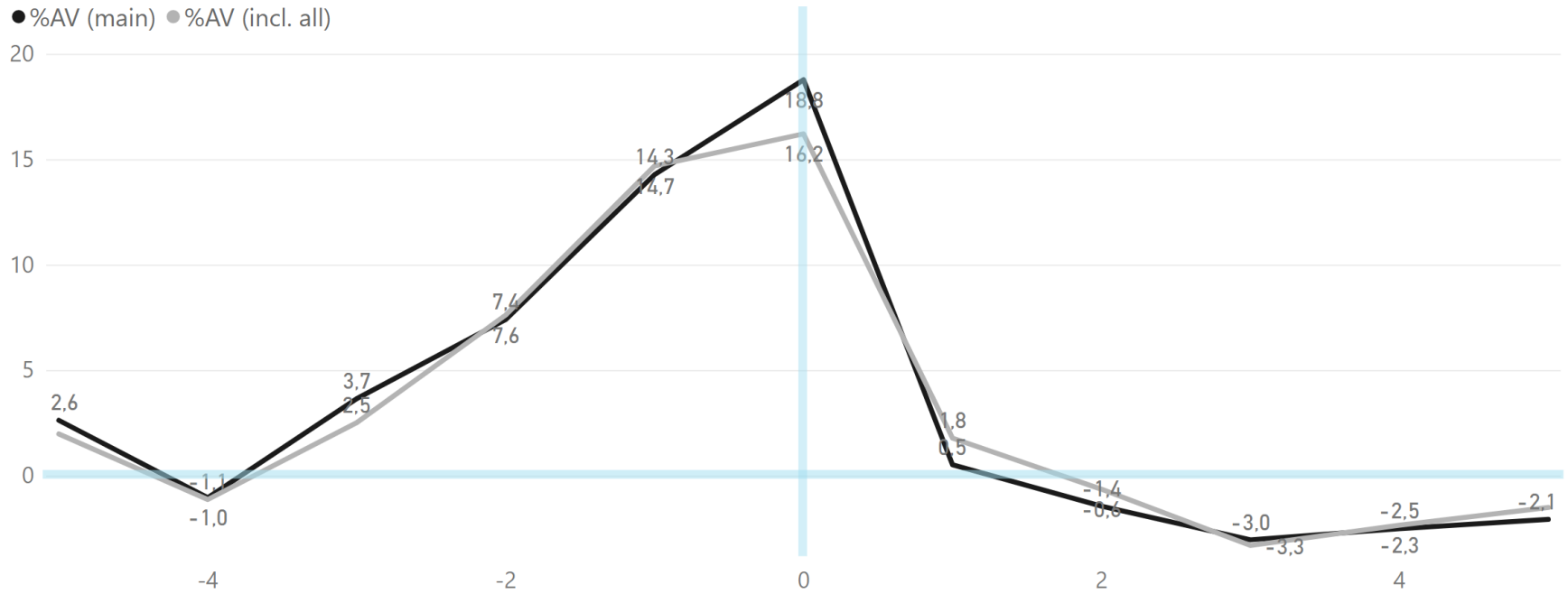
Whether the reported abnormal trading volume is due to the reasons suggested by the dynamic dividend clientele theory is challenging to answer at this stage. However, we do have reasons to believe that a large part of the abnormal trading volume observed is a result of foreigners trading with domestic investors (which is the two large previously identified groups with different preferences towards dividends due to differences in relative taxation of dividends).

As all the reported mean PDR statistics reported in section 9 exceeds the domestic investor's arbitrage boundaries derived in section 5 and 10, it is easy to defend why this group of investors should trade around the ex-dividend day. It is more challenging to defend why the foreign investors should take the opposite side of the trade, as the reported mean PDR statistics in section 9 are all inside the foreigners' no-arbitrage price interval derived in section 10.
However, as argued by Kyle (1985), foreigners might want match the domestic investor's trading orders due to reasons other than arbitrage opportunities. Kyle (1985) refer to "information traders" that trade on mispriced shares. If the foreigners on some occasions are considered "informed investors", we believe that they can use the increased liquidity around ex-dividend day to execute large orders on mispriced stocks and thus be willing to match the orders of the domestic investors.

Overall, the results in Table 9 confirms an abnormal trading volume concentrated around ex-dividend day which is consistent with the null hypothesis of hypothesis 3.

The figure below (Figure 4) displays the average abnormal daily turnover around the ex-dividend day based on both the *main* and *including all* sample.

Figure 4 Daily average abnormal turnover around the ex-dividend day



The figure displays average AV% measure (times 100) based on the *main* and the *including all* sample. Hence the percentage volume that exceeds the expected volume in the event window t=-5 to t=5. Where t = 0 is the ex-dividend day. Estimation window stretches from t=-65 to t=-6.

14.3.2 Average cumulative turnover by different degrees on foreign ownership

In this section, we test our fourth hypothesis and thus if abnormal volume around ex-dividend day is related to the degree of foreign owners.

As argued, we expect the abnormal trading volume to rise in the stocks with an equal mixture of foreign and domestic owners since this is a more heterogeneous group of investors with different preferences which in turn will increase the trading activity in these stocks.

Results in line with our expectations, will indicate that the abnormal trading volume around ex-dividend on the OSE is partly driven by domestic and foreign investors trading with each other.

Table 10 Average cumulative abnormal volume with different degrees of foreign ownership

Sample	Event Window		Degree of Foreign Ownership					
Main			Low	Medium	High	All Obs.	No foreign owners	With foreign owners
	CAV (-5,5)							
		Average CAV	0.250 (0.818)	0.436 (1.758)	0.074 (0.289)	**0.314** (2.929)	0.319 (1.944)	0.254 (1.615)
		Average CAV(%)	28.41%	54.70%	7.70%	**36.91%**	37.61%	28.85%
	CAV (-1,0)							
		Average CAV	**0.350** (4.461)	**0.366** (6.103)	0.099 (1.529)	**0.278** (9.526)	**0.304** (6.636)	**0.272** (6.793)
		Average CAV(%)	**41.89%**	**44.26%**	10.47%	**32.10%**	**35.48%**	**31.26%**
	Obs.		111	111	111	741	322	333

Where the bold numbers are statistically significantly different from zero at the 5% level. T-values are reported in parentheses. The "No Foreign Owners" category are stocks with zero registered foreign ownership, while the "With Foreign Owners" category are stocks with any registered foreign ownership. The stocks in which we were not able to extract any ownership data on, is included in the "all obs" column. We divide the degree of foreign ownership into brackets, low, medium and high degree of foreign owners. Estimation periods stretches from t=-65 to t=-6 and t=-60 to t=-1 in the event window (-5,5) and (-1,1) respectively.

Table 10 displays significant cumulative abnormal volume (CAV) in both the broader event window of (-5,5) and the narrower window of (-1,0) based on the *main* sample (see Appendix 10 for the sample *including all* observations). The broader window results in the greatest cumulative abnormal volume with a reported

actual volume of 36.91% more than the expected volume (versus 32.10% in the narrower window).

Further, the table reports of positive cumulative abnormal trading volume around ex-dividend day in every degree of foreign ownership. However, only CAV in the low and medium degree of foreign owners in the event window t=-1 to t=0 are statistically different from zero at the 5 percent level (CAV in the medium degree of foreign owners in the event window t=-5 to t=5 is statistically significantly different from zero at the 10% level). Most of the measures in the broader event-window are not significant at a 5% level because the broader window is subject to greater standard deviation.

There are significantly greater abnormal volumes around the event for stocks with medium foreign ownership. It is the opposite for the stocks with high foreign ownership which is the group of stocks reporting of the lowest abnormal volume around the ex-dividend day. The latter could be due to foreigners investing in more liquid stocks which regularly have a lot of trading, making the *abnormal* volume relatively low. The abnormal volume in the group of stocks with medium and high foreign ownership are significantly different from each other[50].

Since the results in Table 10 report of most abnormal trading in the investor group most characterized an equal mixture of domestic and foreign investors (most likely the group with the most interplay of trading decisions by investors with different tax status as argued by dynamic dividend clientele), we have reason to believe that the abnormal trading volume around ex-dividend day on the OSE is partly driven by domestic and foreign investors trading with each other.

These results are consistent with the ones reported by Liljeblom et al. (2001) and confirms our fourth null hypothesis.

[50] The cumulative abnormal volume (-1,0) in the group of "medium foreign owners" was tested against the cumulative abnormal volume (-1,0) in the group of "high foreign owners" with a two-sample z-test based on both the *main* sample and the *including all* sample. The null hypothesis of the difference in mean being 0 was be rejected and it thus seems to be a difference between the cumulative abnormal volume around ex-dividend day in the group of stocks with medium and high foreign ownership. However, when running the same test on the broader event window (-5,5), we could not reject the null hypothesis because of a great variance in the cumulative abnormal trading volume.

However, notice that stocks with no registered foreign owners also report of significant abnormal volume around ex-dividend day. In addition, the cumulative abnormal trading volume in the group of stocks with and without foreign owners are not statistically different from each other[51]. Hence, foreign investors trading with domestic investors is not the isolated cause of the abnormal volume reported.

Nevertheless, these results indicate that there is most abnormal trading in the investor group most characterized an equal mixture of domestic and foreign investors, suggesting that these two large groups of investors are trading frequently with each other around ex-dividend day. Since this is the group with most tax heterogeneity, the results are in line with the dynamic dividend clientele model.

14.4 Determinants of deviations from no-arbitrage midpoint

Liljeblom et al. (2001) tests whether risk and transaction costs attributes can explain the observed deviation from the no-arbitrage midpoint[52]. They argue that dividend arbitrage, which is likely to occur in low-risk, low-transaction cost stocks, forces the price-drop-to-dividend ratio of these stocks more towards the no-arbitrage midpoint than the high-risk, high transaction cost stocks. They refer to studies like Karpoff and Walkling (1988, 1990) and Boyd and Jagannathan (1994) that report of significant relationships between transaction cost proxies and risk variables, and price-drop-to-dividend ratios.

In this section we will test for the same and use the regression developed by Liljeblom et al. (2001) as a base. The regression seeks to summarize as well as confirm the discussion in Part 2 as it seeks to identify how both the foreign presence as well as short term trading attributes affects the ex-dividend price movements in Norway. In addition, we include firm size as an explanatory variable since we expect this to explain some of the foreign presence.

[51] The cumulative abnormal volume (-1,0 and -5,5) in the group of stocks with registered foreign owners was tested against the cumulative abnormal volume (-1,0 and -5,5) in the group of stocks with no registered foreign owners with a two-sample z-test based on the *main* sample. The null hypothesis of the difference in mean being 0 could not be rejected and it thus seems to be little difference in CAV between the two groups of stocks.

[52] The no-arbitrage midpoint is the price-drop-to-dividend-rate interval where no investor group have possible arbitrage opportunities. For Norway in 2006-2015 this interval is 0.978 to 1.022 as derived in section 10. The mean investigated PDR statistics in Norway (2006-2015) all exceeded this interval, as reported in section 9.

14.4.1 The Variables

The table below provides a brief explanation of the regression's variables and the reason for why they are included as well as our expectations towards the sign on the estimated coefficients.

We assume that all deviations from the no-arbitrage midpoint (PDR from 0.987 to 1.022) caused by the explanatory variables are more likely to be left of the no-arbitrage midpoint[53] and thus that all variables causing deviation from the no-arbitrage midpoint should be positively related to the ex-day excess return (negatively related to the PDR).

A more thorough explanation is to be found in the next section (14.4.2).

Name	**Dependent/ explanatory**	**What**	**Why**	**Formula**	**Expec-tation**
Ret	Dependent variable	Ex-day excess return.	The ex-day excess return is favored over the PDR because it is, as argued by Liljeblom et al. (2001), free of problems due to the heteroscedasticity of the price-drop-to-dividend-ratio.	$\frac{P_E + D - P_C}{P_C}$ Where P_E is the ex-day closing price and P_C is the cum-day closing price. Dividend per share is denoted *D*.	N/A
$Ret_{FF\ adj.}$	Dependent variable	Fama & French adjusted ex-day excess return.	Run a second regression were the dependent variable is adjusted for daily expected return to avoid ex-day price fluctuations.	$\frac{\frac{P_E}{(1 + R_{FF})} + D - P_C}{P_C}$ Where R_{FF} is the expected daily return by the Fama & French three factor model.	N/A
Div_Yield	Explanatory variable	The dividend yield. Measured as the dividend per share divided by the closing price on cum-day.	Transaction costs proportional to prices makes it more expensive to trade on low dividend yield (high price) stocks which in turn reduces the likelihood of arbitrage trading and thus increases the likelihood of a PDR outside the no-arbitrage midpoint.	$\frac{D}{P_C}$	-

[53] Since the earlier derived no-arbitrage boundaries suggests that the PDR is more likely to range below 1 (and should not be much greater than 1). This is confirmed by the reported mean PDR statistics.

Bid_Ask	Explanatory variable	The average bid-ask closing spread during an estimation period of t=-6 to t=-65.	As the bid-ask spread decreases it becomes cheaper to trade which should facilitate more short-term arbitrage trading around the ex-dividend day. This should in turn force the PDR towards the no-arbitrage midpoint.	$\frac{P_A - P_B}{P_A}$ Where the closing ask price is denoted as P_A and the closing bid price is denoted as P_B.	+
Var_Returns	Explanatory variable	The variance in returns during an estimation period of t=-6 to t=-65.	In line with Liljeblom et al. (2001) we include the stock specific variance as a proxy for risk.		+
%_Foreign	Explanatory variable	The fraction of foreign ownership relative to total ownership. The measure is denoted % × 100 and is the fraction registered on a given stock in the year of a given ex-day. Bloomberg data is used.	To investigate whether a strong dominating presence of a large group of foreign owners makes the preferences of foreign owners affect the ex-dividend price movements.		+ (-)
AV(-1,0)	Explanatory variable	The abnormal volume around ex-dividend with the event time of t=-1 to t=0 and estimation period of t=-2 to t=-61. Turnover is referred to as the volume.	To investigate whether abnormal trading volume and arbitrage trading activity indeed do push the PDR closer to one and thus reduces the likelihood of an ex-day excess return.	AV = ln(TO) – E(ln(TO))	-
Size	Explanatory variable		To avoid possible endogeneity problems as we suspect the firm size to explain some of the effects reported in the other variables.	Ln(Total Assets)	-
OSE_Allshare	Explanatory variable	Average OSE all share return *(OSE_Allshare)* in the estimation period of t =-60 to t=-1.	To investigate if the market sentiment is related to the ex-dividend price movements.		-

14.4.2 The reasoning behind the variables

Contrary to Liljeblom et al. (2001) that report of arbitrage boundaries with a price-drop-to-dividend-ratio that vary from 0.517 (lower boundary for foreign investors) to 1.667 (upper boundary for domestic taxed investors), we report of an arbitrage boundary that vary from 0.632 (lower boundary for foreign investors) to 1.068

(upper boundary for foreign investors). Naturally, Liljeblom et al. (2001) argue that they should use the *absolute value* of the ex-day excess return as a dependent variable because they are likely to observe deviations in both directions from the no-arbitrage midpoint. However, we find it more sufficient to use the *actual value* of the ex-day excess return as a dependent variable because we are likely to observe deviations exceeding only the lower boundary of the no-arbitrage midpoint. Consequently, our dependent variable will be the excess return from cum-day to ex-day.

We use two separate measures for the dependent variable, one that is unadjusted *(Ret)* and one where the ex-day price is adjusted with the daily expected return[54] *($Ret_{FF\ adj.}$)* to avoid ex-dividend day price fluctuations.

Notice that dependent variable is negatively correlated with the PDR statistics – If the price-drop-to-dividend-ratio is less than one, the ex-day excess return will be greater than zero since the investor holding the stock will receive a premium, and vice versa. Nevertheless, the ex-day excess return is favored over the PDR statistics because it is, as argued by Liljeblom et al. (2001), free of problems due to the heteroscedasticity of the price-drop-to-dividend ratio.
Also notice that an ex-day excess return closer to zero (closer to one if PDR statistics) is equivalent with a PDR closer to the no-arbitrage midpoint.

We include dividend yield *(Div_Yield)* as the first explanatory variable. This because transaction costs proportional to prices makes it more expensive to trade on low dividend yield (high price) stocks which in turn reduces the likelihood of arbitrage trading and thus increases the likelihood of a PDR outside the no-arbitrage midpoint. We also believe that the massive presence of foreign owners on the OSE and their (assumed) dividend aversion might contribute to a positive relationship between the PDR and the dividend yield.
Therefore, we expect the dividend yield to be negatively related to the ex-day excess return.

[54] Daily expected return is estimated with the Fama & French three factor model. The similar estimation as explained in section 8.

As a proxy for transaction costs we use the bid-ask spread as suggested by Karpoff and Walkling (1990) referred to in Liljeblom et al. (2001).
As the bid-ask spread decreases it becomes cheaper to trade which should facilitate more short-term arbitrage trading around the ex-dividend day. This should in turn force the PDR towards the no-arbitrage midpoint. In line with Liljeblom et al. (2001), we include the bid-ask spread *(Bid_Ask)* as an explanatory variable and expect it to be positively related to the ex-day excess return.

Michaely and Vila (1995) found relationships between abnormal volumes and both dividend yield and risk. In line with Liljeblom et al. (2001) we include the stock specific variance *(Var_Returns)* as a proxy for risk. We measure the stock specific variance as the i'th stocks variance in returns in our estimation period prior to the event window. We expect this explanatory variable to be positively related to the ex-day excess return since the risk weakens the presence of the short-term arbitrage traders.

Liljeblom et al. (2001) also include an explanatory variable to test whether the current ownership heterogeneity of the company is associated with more ex-dividend day trading.
They look at two groups of owners with two different dividend preferences – the domestic owners and the foreign owners. Further, they argue that the deviation from the no-arbitrage midpoint will increase in stocks where there is a strong dominating presence of either foreign or domestic owners. This because the owners will not have an incentive to trade with each other due to equal preferences (assuming short selling limitations).

In order to capture this relationship, Liljeblom et al. (2001) use the *absolute* value of the deviation between the amount of actual foreign ownership in the ex-dividend month versus the value of 50%.
However, since the Norwegian tax regulations and thus the derived arbitrage boundaries differ from the Finnish-derived[55], we do not find this variable applicable for the Norwegian market. By the boundaries based on the Finnish market, a dominating presence of domestic owners should increase the likelihood of a price-

[55] Liljeblom et al. (2001) investigates the Finnish stock market.

drop-to-dividend-ratio of more than one (ex-dividend excess return of less than zero), while a dominating presence of foreign owners should increase the likelihood of a PDR of less than one (ex-dividend excess return of more than zero). By the Norwegian boundaries however, only a dominating presence of foreign investors can cause more deviation from the no-arbitrage midpoint since the domestic no-arbitrage boundaries is equal to the no-arbitrage midpoint's boundaries. Hence, a large dominating group of Norwegian domestic owners should, contrary to Liljeblom et al. (2001), decrease the deviation from the no-arbitrage midpoint.

Therefore, we rather use the fraction of foreign ownership in the year of the ex-dividend day *(%_Foreign)* as an explanatory variable.

Based on the no-arbitrage boundaries and our initial assumption of dividend averse foreigners, we would expect the latter variable to be positively related to the ex-day excess return (negatively related to the price-drop-to-dividend-ratio). However, as we have already reported of a PDR pattern that is positively related with the fraction of foreign ownership, we will not be surprised to find a negative relation between the fraction of foreign ownership and the dependent variable.

In line with Liljeblom et al. (2001) we also include the abnormal volume around ex-dividend as an explanatory variable with the event time of t = -1 to t = 0 (*AV(-1,0))*, where turnover is referred to as volume. This is to investigate whether abnormal trading volume and arbitrage trading activity indeed do push the PDR closer to one and thus reduces the likelihood of an ex-day excess return.

Finally, we also perform the regression with two additional variables not included by Liljeblom et al. (2001). The first variable is the firm size *(Size)*[56], while the second variable is the average OSE allshare return *(OSE_Allshare)* in the estimation period of t = - 60 to t = -1.

The first variable is added in order to avoid possible endogeneity problems as we suspect the firm size to explain some of the effects reported in the other variables (especially the bid-ask spread, variance in returns and the fraction of foreign ownership).

The latter variable is included to simply investigate if the market sentiment is related to the ex-dividend price movements. The market sentiment is driven by

[56] Measured as the ln of total assets.

investor psychology. Hence, if we identify a significant relationship between the OSE all share return in the period prior to ex-dividend day and the ex-day excess return it could be a contribution to the behavioral finance literature.

As liquidity and "market attention" increases with firm size, we expect the firm size variable to be negatively related to our dependent variable.

We have a slight expectation that the OSE allshare return variable is negatively related to the ex-day excess return. If that is the case, it might be due to investors "sitting on the fence" (reluctant to trade) in bad times which in turn weakens the trading volume needed to push the price-drop-to-dividend-ratio towards the no-arbitrage midpoint. The negative relationship could also be explained by reference points, where the reference point is the price in which the share was bought. In bad times, investors might be reluctant to trade since the current share price deviates negatively from their reference point. Also, dividends might be associated with "safe income" which will be even more valued in bad times and thus affecting the dividend preferences.

14.4.3 Regression outputs

The results based on the *main* sample are reported in Table 11 below.

As we were not able to obtain data on foreign ownership related to all our dividend observations, we have excluded the observations lacking ownership data when running the regression. As a result, 86 out of 741 (100 out of 838) observations were excluded from the *main* (*including all*) sample. This can cause some sample selection bias which should be considered.

In this section, we analyze the regression outputs using robust standard errors. See appendices for regression outputs using non-robust standard errors.

Table 11 Regression output**:** The determinants for deviations from no-arbitrage interval midpoint (*Main* sample)

Dependent variable	Intercept	Div_Yield	Var_Returns	Bid_Ask	AV(-1,0)	%_Foreign	Size	OSE_Allshare	$R^2_{adj.}$ *(F-val)*
Ret	**0.0087**					-5.02E-05			0.0016
	(8.0793)					*(-1.1233)*			*(40,6064)*
Ret	**0.0052**	0.0515	**2.8758**		-0.0006	-4.08E-05			0.0007
	(2.5121)	*(1.5491)*	*(1.8084)*		*(-0.6338)*	*(-0.8918)*			*(19.3636)*
Ret	0.0009	**0.0535**	-0.9986	**0.3439**	-0.0010	1.99E-05			0.0318
	(0.4312)	*(1.6626)*	*(-0.5903)*	*(6.6759)*	*(-0.9766)*	*(0.4337)*			*(28.7591)*
Ret	**0.0319**	0.0396	**0.7584**		-0.0006	-3.61E-05	**-0.0016**	0.2937	0.0103
	(3.6808)	*(1.1841)*	(0.4572)		*(-0.5901)*	*(-0.7960)*	*(-3.1762)*	*(0.4449)*	*(15.5871)*
Ret	0.0092	0.0519	-1.2338	**0.3136**	-0.0009	1.56E-05	-0.0005	0.4566	0.0304
	(0.9617)	*(1.5911)*	*(-0.7217)*	*(5.5657)*	*(-0.9591)*	*(0.3392)*	*(-0.9270)*	*(0.7081)*	*(21.2133)*
$Ret_{FF\ adj.}$	**0.0085**					-5.32E-05			0.0003
	(8.1968)					*(-1.2414)*			*(41.3085)*
$Ret_{FF\ adj.}$	**0.0045**	0.0545	**3.0865**		0.0002	-3.97E-05			0.0019
	(2.2630)	*(1.7102)*	*(2.0269)*		*(0.1866)*	*(-0.9072)*			*(20.3966)*
$Ret_{FF\ adj.}$	4.97E-05	**0.0569**	-0.0579	**0.3522**	-0.0002	1.58E-05			0.0284
	(0.0243)	*(1.8552)*	*(-0.0359)*	*(7.1644)*	*(-0.1944)*	*(0.3594)*			*(33.6816)*
$Rte_{FF\ adj.}$	**0.0359**	0.0355	0.3747		0.0002	-3.52E-05	**-0.0018**	-0.3459	0.0145
	(4.3449)	*(1.1159)*	*(0.2372)*		*(0.2434)*	*(-0.8129)*	*(-3.8076)*	*(-0.5503)*	*(16.7221)*
$Ret_{FF\ adj.}$	**0.0154**	0.0472	-0.8359	**0.2923**	-4.58E-05	8.87E-06	-0.000824	-0.3213	0.0281
	(1.6886)	*(1.5126)*	*(-0.5112)*	*(5.4228)*	*(-0.0485)*	*(0.2011)*	*(-1.6312)*	*(-0.5209)*	*(23.5667)*

T-values are reported in parentheses. Variables significant at the 10% level are denoted in boldface. Sample used contains 655 observations and the F-value is estimated using the Wald test.

Throughout this section, the regression analysis will primarily be based on two regressions: the regression where all variables are included and the regression where all variables except *Size* and *OSE_Allshare* are included.

Table 11 shows that with the exception of *Div_Yield (*and *OSE_Allshare* when using the unadjusted dependent variable), we obtained expected signs on all explanatory variables. However, we experienced some problems with the *Var_Returns* variable due to the correlation with the *Bid_Ask* variable[57]. When we include the latter variable in the regression, the *Var_Return*s variable obtains an unexpected (and highly unlikely) sign. Therefore, we have also estimated the regression excluding the *Bid_Ask* variable which results in an expected sign on the *Var_Return* and very similar results for the remaining explanatory variables. Liljeblom et al. (2001) reports of the same problem and similar outcome when dealing with the *Bid_Ask* variable.

Notice that even the *%_Foreign* suggests that the price-drop-to-dividend-ratio decreases when the foreign fraction increases. This is contradicting what we previously found when separating the PDR statistics into ownership brackets. However, this relationship is only the case when including the bid-ask spread, suggesting that some of the previously reported relationships[58] between the PDR statistics and the fraction of foreign owners could also be explained by a relationship between the foreign fraction and other factors like bid-ask spread.
We argue that the latter statement can be explained by the fact that foreigners are more likely to invest in larger more liquid firms and avoid smaller firms (associated with high bid-ask spread). This arguing is strengthened when looking at the correlation matrix (see Appendix 12) which identifies a positive (negative) correlation between the degree of foreign ownership and firm size (bid-ask spread) as well as a negative correlation between the firm size and the bid-ask spread.

The results are consistent across the two separate dependent variables, but the level of significance changes slightly.

[57] However, the Variable Inflation Factors (VIF) indicate no multicollinearity in our regression.
[58] Reported in section 14.2.

We find no significant relationship between the foreign ownership fraction and the ex-dividend price drop. This is disappointing, but given our previous results, not surprising. We are pleased to see that our additional variable (*Size*) shows some significance and that its relationship with the dependent variable is as expected. As reported in the table, this additional variable seems to take some of the explanatory power away from the variables used by Liljeblom et al. (2001).

For robustness reasons, we also run the regressions with data from the sample *including all* observations (see Appendix 13). The results are essentially consistent[59] with the ones reported based on the *main sample*. Based on all observations, the ownership fraction now becomes significant when it is the only explanatory variable included. However, the sign on its coefficient suggests that an increase in the degree of foreign ownership increases the ex-dividend price drop relative to the corresponding dividend per share.

As stated, the regressions used by Liljeblom et al. (2001) differ from ours since they use an absolute measure of the ex-day excess return as their dependent variable. In that way they examine the explanatory variables relationship with the *absolute deviation* from an ex-day excess return of 0 and thus avoid that the relationship must be either negative or positive.
Since we use the actual ex-day excess return as a dependent variable, we depend on the explanatory variables to move the dependent variable in a certain direction in order to obtain significant results.

To investigate whether the PDR is deviating from the no-arbitrage midpoint differently than our previously argued expectations[60], we run the same regression as Liljeblom et al. (2001)[61] and thus use an *absolute* measure of the ex-day excess return as our dependent variable (Results are reported in Appendix 14).

[59] The coefficient sign on the variable that represents the fraction of foreign owners changes in some of the estimated regressions when using the sample including all observations.
[60] Initially, we assume that all deviations from the no-arbitrage midpoint (PDR from 0.987 to 1.022) caused by the explanatory variables are more likely to be left of the no-arbitrage midpoint and thus that all variables causing deviation from the no-arbitrage midpoint should be positively related to the ex-day excess return (negatively related to the PDR).
[61] Liljeblom et al. (2001) use the absolute value of the deviation between the amount of actual foreign ownership versus the value of 50% as one of their explanatory variables. However, as argued in section 14.4.2, this variable is not applicable on the OSE, therefore we rather use the degree of foreign ownership.

Using the absolute ex-day excess return as a dependent variable provides more significant results and a considerably higher R-squared.
Also, when the dependent variable is the absolute Fama & French adjusted excess return, we now see 4 out of 5 (4 out of 7) significant explanatory variables in the regression where all variables are included except *Size* and *OSE_Allshare* (in the regression where all variables are included). In addition, all the coefficients show signs that are in line with our initial expectations except from the dividend yield.
Lastly (and important), the fraction of foreign ownership is significant and states that an increase in the degree of foreign ownership is increasing the absolute deviation from the no-arbitrage midpoint. This suggests that that the foreign presence is not necessarily influencing the ex-dividend price movements in a certain direction – but that it is influencing the ex-dividend price movements.

The fact that we obtain substantially more satisfying results when looking at how the explanatory variables affects the *absolute deviation* of the ex-day excess return, makes us question our assumption that, in general, the deviations from the price-drop-to-dividend-ratio should be *less* than one. These results indicate that the explanatory variables can cause both positive and negative deviations from the expected PDR. This leads us to believe that there are players on the Norwegian market with unexpected dividend preferences that affects the price-drop-to-dividend ratio differently than initially assumed. It is also suggesting that we should be careful in interpreting foreign owners as one (dividend averse) homogenous group.

This section reports of a significant relationship between the absolute deviation from the no-arbitrage midpoint and the degree of foreign ownership. However, it provides no significant results indicating that the ex-day price drop decreases relative to the corresponding dividend per share with the degree of foreign owners. The latter, combined with our results in section 14.2, leads to a rejection of the second null hypothesis.

15. Conclusion

This paper attempted to identify the presence of an ex-dividend price anomaly and analyse the foreign owner's influence on ex-dividend price movements as well as abnormal volume around ex-dividend day on the Oslo Stock Exchange.

We obtain results showing that the ex-dividend price drop is, on average, significantly less than the corresponding dividend per share. This contradict what the theory suggests but is in line with previous research that primarily reports of a price-drop-to-dividend-ratio that is less than one.
We find these results highly interesting and relevant in the ongoing discussion about reasons for the ex-dividend price anomaly. This because the results combined with the Norwegian tax regulations are questioning the school of thought most recognized in previous research – the tax induced clientele. In addition, our results on ex-dividend price movements suggests that there are arbitrage opportunities around ex-dividend day for the domestic investor.

Initially, we assume dividend averse foreigners who are facing different tax regulations to cause some of the observed ex-dividend price movements. However, we find few significant results indicating that the foreign presence on the OSE is causing the ex-dividend price to drop less than the corresponding dividend per share[62]. In fact, stocks with a high degree of foreign owners have a mean price-drop-to-dividend-ratio closer to one than stocks with a low degree of foreign owners. The latter contradicts our initial assumptions of dividend averse foreigners. Also, foreign investors do not seem to be the only cause to the observed ex-dividend anomaly since similar ex-dividend price movements are observed in stocks with no registered foreign owners.
However, firm size and bid-ask spread are correlated with the degree of foreign owners. When running a regression including these two factors as explanatory variables next to the degree of foreign ownership, we get results consistent with our initial expectations indicating that increased foreign presence is decreasing the

[62] The results are dependent on what database we base our analysis on. When we use data extracted from Thomson Reuters, we find results indicating that the foreign presence is in fact causing the ex-dividend price to drop less than the corresponding dividend per share. However, as argued in the data section, we find the Bloomberg data most credible and choose to favor that database.

price-drop-to-dividend-ratio, but these results are not significant. Nevertheless, this might indicate that factors like firm size and bid-ask spread has been influencing some of the unexpected patterns between ex-dividend price movements and foreign presence.

We obtain more significant results when we investigate the relationship between the *absolute* ex-day excess return and various independent variables of certain interest than when we investigate the same relationships with the *actual* ex-day excess return. For instance, we obtain significant results indicating that the fraction of foreign owners is slightly increasing the absolute deviation from the no-arbitrage midpoint. The latter suggests that foreign presence is not necessarily influencing the ex-dividend price movements in a certain direction – but that it is influencing the ex-dividend price movements. Maybe this is because there is a large variation of foreign owners facing different tax regulations and thus we should be careful with interpreting foreigners as one homogenous group of investors. Also, we see deviations from the no-arbitrage midpoint in both directions which gives us reason to believe that there are players on the Norwegian market with unexpected dividend preferences.

This thesis also confirms significant abnormal trading volume around ex-dividend day, especially in the day before cum-day, cum-day and ex-day.
The investor group most characterized by an equal mixture of domestic and foreign investors are experiencing the highest cumulative abnormal trading volume around ex-dividend day. These results are consistent with the dynamic dividend clientele model as this is the group with most tax heterogeneity. The latter results suggest that domestic and foreign owners trading with each other, are driving some the observed abnormal volume around ex-dividend day. However, we also observe significant cumulative abnormal trading volume in stocks without registered foreign owners. Hence, foreign owners trading with domestic owners is not the solely cause for the observed abnormal trading volume around ex-dividend day.
Our results also state that risk and transaction costs attributes that previously have proven to affect arbitrage trading and thus abnormal volume are significantly related to the price-drop-to-dividend-ratio on the Oslo Stock Exchange. Especially the cost (represented by bid-ask spread) is a significant explanatory variable in all cases and by all used methods.

Overall, we conclude that the ex-dividend anomaly is present in Norway, that foreigners are somewhat affecting the ex-dividend price movements and that foreign owners trading with domestic owners around ex-dividend day is increasing the confirmed abnormal trading volume. However, we have no significant results that suggests a given pattern between the ex-dividend price movements and the degree of foreign ownership. Also, we have significant results confirming that foreign owners are not the only reason for the observed ex-dividend price anomaly nor the abnormal trading volume around ex-day.

Based upon our results, this thesis questions the tax-clientele arguments in the ongoing debate of causes to the ex-dividend price anomaly.

16. Further research

In this paper we base our analysis on a time-interval unaffected by major tax reforms that might affect the consistency of the ex-dividend price movements. For further research it would be valuable to expand this time-interval to compare results based on time-intervals both after and prior to tax reforms. E.g., comparing the ex-dividend price movements before and after the implementation of "Aksjonærmodellen" in 2006 or the implementation of "Aksjesparekonto" in 2017. This because significant differences between these sample periods might strengthen the tax induced clientele arguments.

Also, it may be interesting to examine the effect of foreign investor's influence on the ex-dividend price movements over longer periods of time and in more countries, as this could provide useful information on home bias and the behaviour of foreign investors.

Lastly, if new and more detailed data on OSE trading becomes available, further research should also focus on how foreigners are trading around ex-dividend day. It may be interesting to follow the footsteps of Rantapuska (2008), to identify who that is trading around ex-dividend day in Norway.

Appendices

Appendix 1: Glossary – Tax environment

The major tax reform in 2006: *"Aksjonærmodellen"* implemented in 2006.

EEA area: European Economic Area. Countries that belong to the EEA include Austria, Belgium, Bulgaria, Czech Republic, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and United Kingdom.

The tax-free amount: Shareholder's tax base cost of the shares. Norwegian term: "skjermingsgrunnlag".

Tax-free allowance: The Norwegian term for tax-free allowance is *"skjermingsfradrag"*

Risk-free interest rate: Yearly average of government bonds with 5 years' time to maturity after tax.

Withholding tax rate: The Norwegian term for withholding tax rate is *"kildeskatt".*

OECD countries: The Organization for Economic Co-operation and Development. The 34 OECD member countries are: Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States.

The tax-exemption method: The Norwegian term for the tax-exemption method is *"fritaksmetoden".*

Appendix 2: Tax rates on dividend and capital gains in Norway (2006 to 2015)

Year	Tax rate on dividend	Tax rate on capital gains
2015	27%	27%
2014	27%	27%
2013	28%	28%
2012	28%	28%
2011	28%	28%
2010	28%	28%
2009	28%	28%
2008	28%	28%
2007	28%	28%
2006	28%	28%

Appendix 3: Interquartile Range: Dividend Yield, Turnover and PDR

Dividend Yield

	LN Values	%Yield
Quartile 1	-3.784189634	
Quartile 3	-2.82153971	
IQR	0.962649924	
Upper Fence	-1.377564824	25.22%
Lower Fence	-5.22816452	0.54%
Number of observations inside fences	814	
Number of observations outside fences	24	

Turnover

	LN Values	%Turnover
Quartile 1	-8.633071	
Quartile 3	-5.9440272	
IQR	2.68904378	
Upper Fence	-1.9104615	14.80%
Lower Fence	-12.666637	0.00032%
Number of observations inside fences	822	
Number of observations outside fences	16	

Price-drop-to-dividend-ratio

	LN Values	%Diff/Div
Quartile 1		0.295249116
Quartile 3		1.166666667
IQR		0.87141755
Upper Fence		2.473792992
Lower Fence		-1.011877209
Number of observations inside fences		773
Number of observations outside fences		65

Appendix 4: Descriptive statistics for dividends and dividends yields 2006 – 2015 in samples *excluding special dividends* & *excluding all*

Sample		Dividend Per Share (NOK)	Dividend Yield
Excluding special dividends (Observations: 704)			
	Mean	4.570763	0.04376585
	SE	0.505093	0.001555585
	Median	2.078553	0.036363636
	Std. Dev	13.40162	0.041274333
	Kurtosis	139.7685	83.91822578
	Skewness	10.93648	7.227599464
	Min	0.05	0.00316414
	Max	199.2481	0.64516129
Excluding all (Observations: 630)			
	Mean	4.855261	0.043459953
	SE	0.558566	0.00100574
	Median	2.49	0.038884569
	Std. Dev	14.0199	0.025243862
	Kurtosis	129.378	2.607873811
	Skewness	10.58195	1.264748061
	Min	0.05	0.005447471
	Max	199.2481	0.192307692

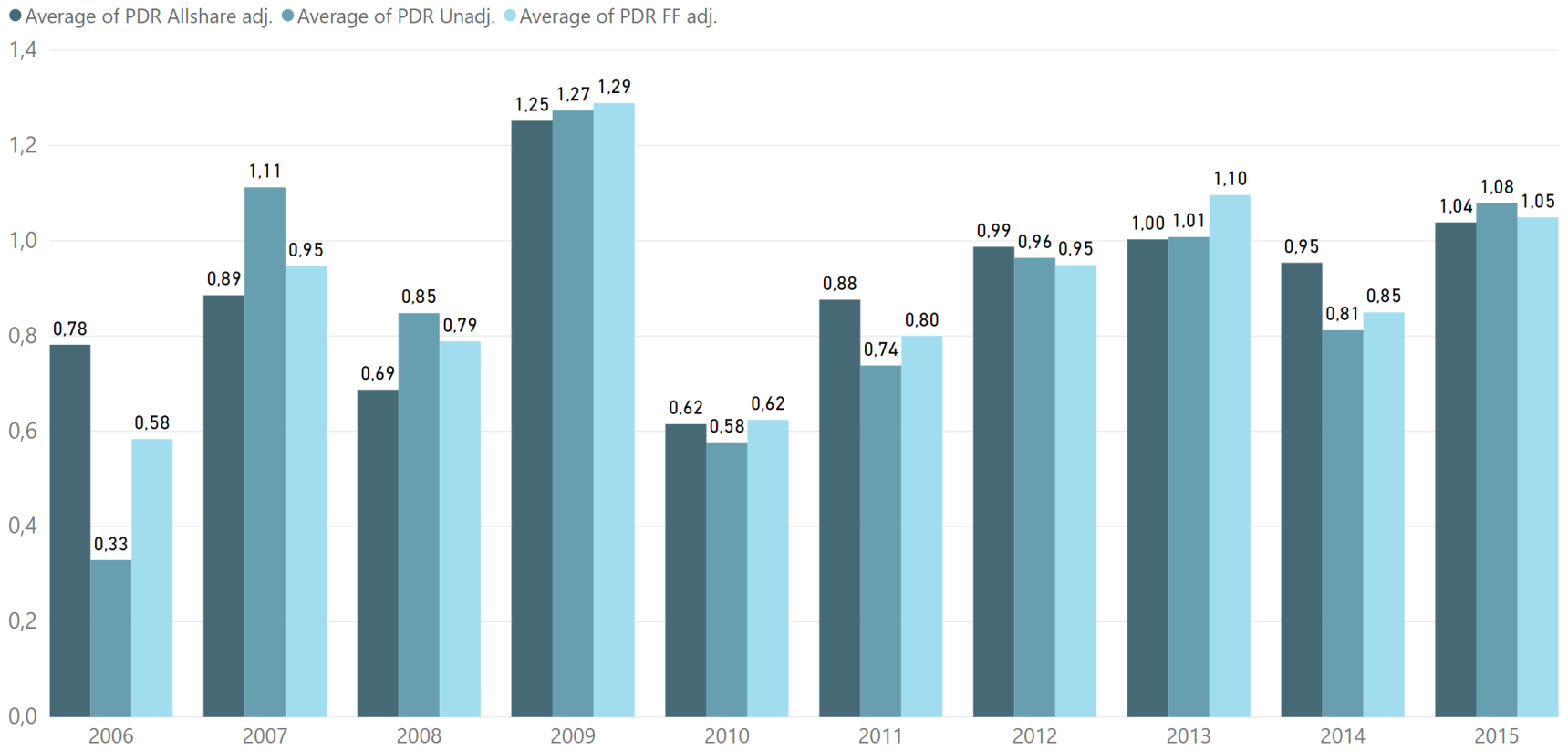
Appendix 5: Average price drop ratios on the OSE 2006 – 2015 for the "Excluding special dividends", "Excluding all", "Only Domestic Owners (Bloomberg), Main" and "Only Foreign Owners (Bloomberg), Main" samples

Sample		Mean Price Drop Ratios			
Excluding special dividends		$PDR_{unadj.}$	$PDR_{FF\ adj.}$	$PDR_{Allshare\ adj.}$	$Ret_{FF\ adj.}$
	Obs	704	704	704	704
	Mean ($\hat{x}$)	0.657***	0.643***	0.683***	0.0103
	S.E. of mean ($s\sqrt{n}$)	1.445	1.415	1.445	0.0267
	Min	0.054	0.053	0.054	0.001
	Max	-15.607	-15.356	-16.222	-0.4686
Excluding all					
	Obs	679	679	679	679
	Mean ($\hat{x}$)	0.726***	0.726***	0.762***	0.0092
	S.E. of mean ($s\sqrt{n}$)	0.664	0.684	0.742	0.0308
	Min	0.025	0.026	0.028	0.001
	Max	-1.000	-2.592	-3.417	-0.4686
Only Domestic Owners (Bloomberg), Main Sample					
	Obs	322	322	322	322
	Mean ($\hat{x}$)	0,761***	0.752***	0.790***	0.009***
	S.E. of mean ($s\sqrt{n}$)	0.617	0.587	0.639	0.037
	Min	0.034	0.033	0.036	0.002
	Max	-1.000	-1.179	-1.619	-0.469
Only Foreign Owners (Bloomberg), Main Sample					
	Obs	333	333	333	333
	Mean ($\hat{x}$)	0.745***	0.755***	0.786***	0.008***
	S.E. of mean ($s\sqrt{n}$)	0.692	0.749	0.790	0.025
	Min	0.038	0.041	0.043	0.001
	Max	-1.000	-2.592	-3.417	-0.146

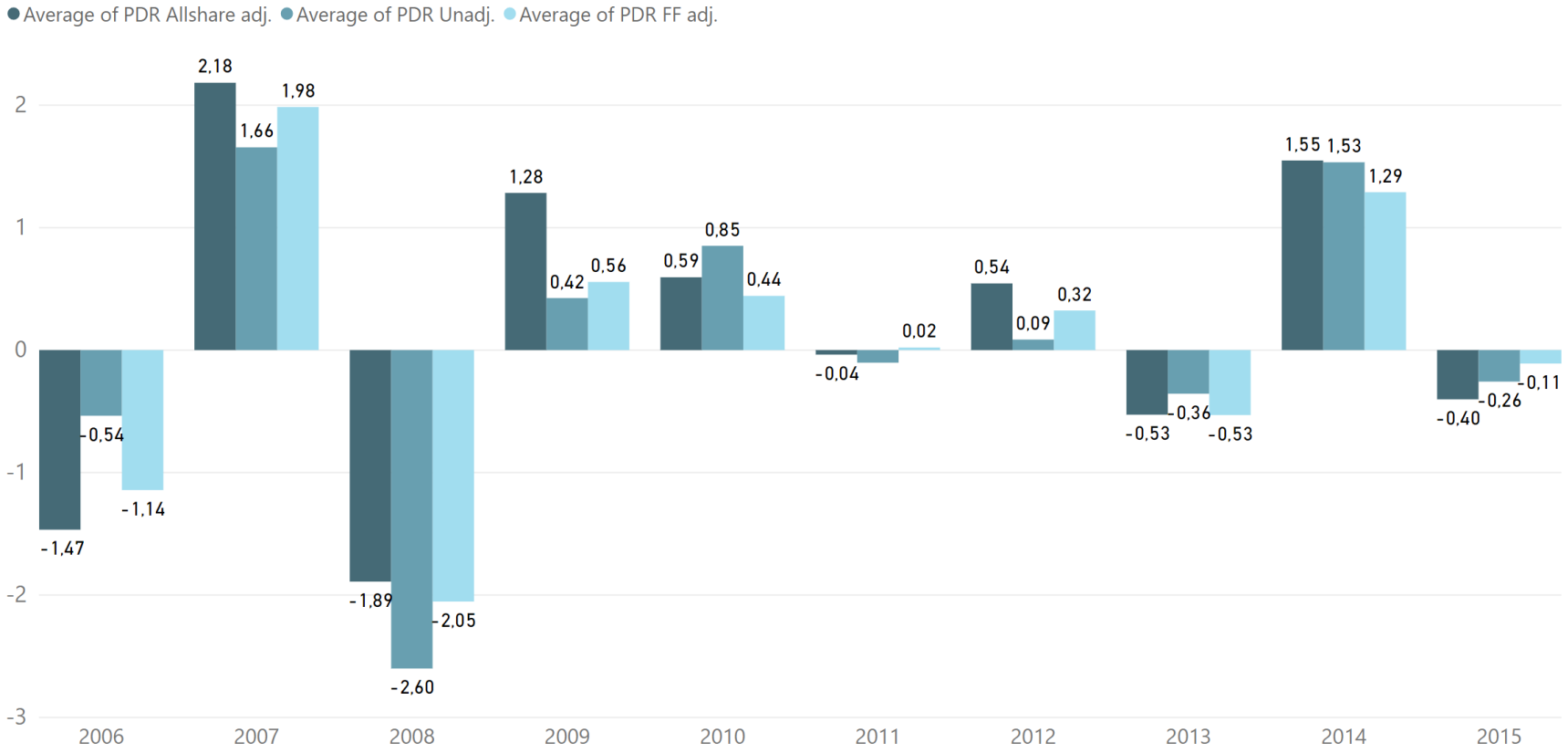
The tables reports the mean computed PDR statistics based on all observations in the reported samples, where the mean $PDR_{unadj.} = \frac{1}{N}\sum_{j=1}^{N}\frac{P_{C,i,t}-P_{E,i,t}}{D_{i,t}}$, the mean $PDR_{FF\ adj.} = \frac{1}{N}\sum_{j=1}^{N}\frac{P_{C,i}-\frac{P_{E,i,t}}{(1+R_{FF,i,t})}}{D_{i,t}}$, the mean $PDR_{Allshare\ adj.} = \frac{1}{N}\sum_{j=1}^{N}\frac{P_{C,i,t}-\frac{P_{E,i,t}}{(1+R_{A,t})}}{D_{i,t}}$ and the mean $RET_{FF\ Adj.} = \frac{1}{N}\sum_{j=1}^{N}\frac{\frac{P_{E,i,t}}{(1+R_{FF,i,t})}+D_{i,t}-P_{C,i,t}}{P_{C,i,t}}$. An observation is denoted as j and consists of a given firm *i* at a given ex-dividend date *t*. $R_{FF,i,t}$ is the i'th firm's Fama & French expected return at a given ex-dividend date t and $R_{A,t}$ is the daily allshare return at t. *** denotes statistically different from 1 (from 0 when $RET_{FF\ Adj.}$) at the 1% level.

Appendix 6: Yearly average PDR statistics in samples only including special dividend payments and only including identified outliers

6a. Only including observations labeled as "special"



6b. Only including observations identified as outliers



Appendix 7: Daily average abnormal turnover around ex-dividend day

*7a. Estimation period t=-35 to t=-6 (*sample: *Main)*

Day	-5	-4	-3	-2	-1	0	1	2	3	4	5
AV	0.0078	-0.0287	0.0175	0.0533	**0.1154**	**0.1537**	-0.0129	-0.0328	-0.0489	-0.0436	-0.0391
	(0.2352)	(-0.9300)	(0.4923)	(1.4182)	(3.2010)	(3.9783)	(-0.4834)	(-0.9675)	(-1.5554)	(-1.1589)	(-1.1506)
AV%	0.78 %	-2.83 %	1.76 %	5.48 %	**12.24 %**	**16.61 %**	-1.28 %	-3.23 %	-4.77 %	-4.26 %	-3.83 %

The table reports the results of investigated average abnormal turnover around the ex-dividend day in the period 2006-2015. AV is the average difference between the logarithmic measures of actual and expected turnover whereas AV(%) is the percentage of the average actual turnover's deviation from the average expected turnover. T- values are denoted in parentheses. Abnormal turnover significantly different from zero at the 5% are denoted in bold. The expected turnover's estimation period stretches from t=-35 to t=-6.

*7b. Estimation period t=-125 to t=-6 (*sample: *Main)*

Day	-5	-4	-3	-2	-1	0	1	2	3	4	5
AV	0.048	0.010	0.057	**0.092**	**0.154**	**0.194**	0.027	0.007	-0.010	-0.005	0.000
	(1.302)	(0.311)	(1.673)	(2.429)	(4.265)	(3.637)	(0.936)	(0.190)	(-0.290)	(-0.109)	(-0.001)
AV%	4.90 %	1.04 %	5.83 %	**9.67 %**	**16.65 %**	**21.36 %**	2.69 %	0.71 %	-0.96 %	-0.46 %	0.00 %

The table reports the results of investigated average abnormal turnover around the ex-dividend day in the period 2006-2015. AV is the average difference between the logarithmic measures of actual and expected turnover whereas AV(%) is the percentage of the average actual turnover's deviation from the average expected turnover. T- values are denoted in parentheses. Abnormal turnover significantly different from zero at the 5% are denoted in bold. The expected turnover's estimation period stretches from t=-125 to t=-6.

*7c. Estimation period t=-35 to t=-6 (*sample: *Including all)*

Day	-5	-4	-3	-2	-1	0	1	2	3	4	5
AV	0.0007	-0.0303	0.0057	0.0545	**0.1181**	**0.1309**	-0.0013	-0.0256	-0.0526	-0.0429	-0.0343
	(0.0207)	(-0.9883)	(0.1618)	(1.4328)	(3.2277)	(3.0257)	(-0.0413)	(-0.7594)	(-1.6741)	(-1.1638)	(-1.0047)
AV(%)	0.07 %	-2.99 %	0.57 %	5.60 %	**12.54 %**	**13.98 %**	-0.13 %	-2.53 %	-5.13 %	-4.20 %	-3.37 %

The table reports the results of investigated average abnormal turnover around the ex-dividend day in the period 2006-2015. AV is the average difference between the logarithmic measures of actual and expected turnover whereas AV(%) is the percentage of the average actual turnover's deviation from the average expected turnover. T- values are denoted in parentheses. Abnormal turnover significantly different from zero at the 5% are denoted in bold. The expected turnover's estimation period stretches from t=-35 to t=-6.

*7d. Estimation period t=-65 to t=-6 (*sample: *Including all)*

Day	-5	-4	-3	-2	-1	0	1	2	3	4	5
AV	0.0198	-0.0112	0.0251	**0.0736**	**0.1373**	**0.1504**	0.0179	-0.0062	-0.0334	-0.0235	-0.0150
	(0.5932)	(-0.3762)	(0.7490)	(2.0270)	(3.9253)	(2.9392)	(0.4261)	(-0.1655)	(-0.9965)	(-0.5920)	(-0.4120)
AV(%)	2%	-1.1%	2.54%	**7.64%**	**14.71%**	**16.23%**	1.80%	-0.62%	-3.29	-2.33%	-1.48%

The table reports the results of investigated average abnormal turnover around the ex-dividend day in the period 2006-2015. AV is the average difference between the logarithmic measures of actual and expected turnover whereas AV(%) is the percentage of the average actual turnover's deviation from the average expected turnover. T- values are denoted in parentheses. Abnormal turnover significantly different from zero at the 5% are denoted in bold. The expected turnover's estimation period stretches from t=-65 to t=-6.

*7e. Estimation period t=-125 to t=-6 (*sample: *Including all)*

Day	-5	-4	-3	-2	-1	0	1	2	3	4	5
AV	0.0404	0.0083	0.0444	**0.0931**	**0.1565**	**0.1706**	0.0379	0.0141	-0.0135	-0.0039	0.0047
	(1.1048)	(0.2496)	(1.3210)	(2.4538)	(4.2447)	(2.9659)	(0.8377)	(0.3672)	(-0.3734)	(-0.0928)	(0.1235)
AV(%)	4.12 %	0.83 %	4.54 %	**9.76 %**	**16.94 %**	**18.60 %**	3.86 %	1.42 %	-1.34 %	-0.39 %	0.47 %

The table reports the results of investigated average abnormal turnover around the ex-dividend day in the period 2006-2015. AV is the average difference between the logarithmic measures of actual and expected turnover whereas AV(%) is the percentage of the average actual turnover's deviation from the average expected turnover. T- values are denoted in parentheses. Abnormal turnover significantly different from zero at the 5% are denoted in bold. The expected turnover's estimation period stretches from t=-125 to t=-6.

Appendix 8 – Relationship between dividend yield and price drop for the *excluding special dividends* and *excluding all* samples (Elton & Gruber, 1970)

8a. Sample: Excluding special dividends

(Observations: 704)

Decile	Mean	$PDR_{unadj.}$		$PDR_{FF\ adj.}$		$PDR_{Allshare\ adj.}$	
	Dividend yield	Mean	Rank	Mean	Rank	Mean	Rank
1	0.0141	0.4910	3	0.3224	1	0.4695	3
2	0.0202	0.4194	2	0.3796	2	0.3894	1
3	0.0242	0.3502	1	0.3880	3	0.4244	2
4	0.0302	0.7685	7	1.0661	10	0.7862	8
5	0.0364	0.6070	4	0.6104	4	0.6583	4
6	0.0433	0.9083	10	0.9066	9	0.9537	10
7	0.0503	0.6704	5	0.6850	5	0.7176	5
8	0.0600	0.7120	6	0.7229	6	0.7452	6
9	0.0750	0.7875	8	0.7807	7	0.7785	7
10	0.6452	0.8667	9	0.8641	8	0.8661	9
Spearman rank corr. coefficient		0.7333		0.6242		0.6848	
Significance level		5%		10%		5%	

The mean of $PDR_{unadj.}$, $PDR_{FF\ adj.}$ and $PDR_{Allshare\ adj.}$ are computed for each decile. The spearman rank correlation coefficient is compared to a critical value to test for significance.

8b. Sample: Excluding all

(Observations: 630)

Decile	Mean	$PDR_{unadj.}$		$PDR_{FF\ adj.}$		$PDR_{Allshare\ adj.}$	
	Dividend yield	Mean	Rank	Mean	Rank	Mean	Rank
1	0.0169	0.5777	1	0.5082	1	0.5717	1
2	0.0221	0.6984	4	0.7390	5	0.8331	9
3	0.0261	0.6527	3	0.9439	10	0.6107	2
4	0.0322	0.6487	2	0.6726	2	0.7186	3
5	0.0389	0.8740	10	0.8531	9	0.9058	10
6	0.0451	0.7060	5	0.7237	3	0.7442	4
7	0.0525	0.7100	6	0.7377	4	0.7638	5
8	0.0629	0.7481	7	0.7470	6	0.7772	6
9	0.0757	0.7921	9	0.7937	8	0.7892	7
10	0.1923	0.7667	8	0.7574	7	0.8170	8
Spearman rank corr. coefficient		0.7576		0.3333		0.4182	
Significance level		5%		Not significant		Not significant	

The mean of $PDR_{unadj.}$, $PDR_{FF\ adj.}$ and $PDR_{Allshare\ adj.}$ are computed for each decile. The spearman rank correlation coefficient is compared to a critical value to test for significance.

Appendix 9: Drop per ownership bracket for the *excluding special dividends* and *excluding all* samples

9a. PDR per foreign ownership bracket - Thompson Reuters data

Sample Excluding Special dividends	Category	$PDR_{unadj.}$	$PDR_{FF\ adj.}$	$PDR_{Allshare\ adj.}$	$Ret_{FF\ Adj.}$
	Low foreign ownership, *35 obs.*	0.8877 (1.2745)	0.8770 (1.1537)	0.8175 (1.1409)	0.0048 (0.0260)
	Medium foreign ownership, *37 obs.*	0.6989 (1.4999)	0.6512 (1.4175)	0.7445 (1.3244)	0.0111** (0.0315)
	High foreign ownership, *36 obs.*	0.2152*** (1.4348)	0.0825*** (1.7227)	0.2345*** (1.4874)	0.0203*** (0.0331)
Excluding all	**Category**	$PDR_{unadj.}$	$PDR_{FF\ adj.}$	$PDR_{Allshare\ adj.}$	$Ret_{FF\ Adj.}$
	Low foreign ownership, *31 obs.*	0.9619 (0.7873)	0.8780 (0.7719)	0.8594 (0.8118)	0.0037 (0.0225)
	Medium foreign ownership, *30 obs.*	0.7451** (0.6410)	0.6858** (0.6767)	0.7001** (0.7680)	0.0096* (0.0270)
	High foreign ownership, *32 obs.*	0.7415** (0.5975)	0.6830*** (0.6054)	0.7792** (0.5838)	0.0114*** (0.0202)

The table illustrates $PDR_{unadj.}$, $PDR_{FF\ adj.}$, $PDR_{Allshare\ adj.}$ and $RET_{FF\ Adj.}$ for firms with low, medium and high degree of foreign ownership. The *main* sample consist of 114 observations, while the *including all* sample consist of 139 observations. The standard deviations of the mean ratios are reported within parentheses. *** denotes statistically significantly different from one (from 0 when $RET_{FF\ Adj.}$) at the 1% level, ** denotes statistically significantly different from one (from 0 when $RET_{FF\ Adj.}$) at the 5% level while * denotes statistically significantly different from one (from 0 when $RET_{FF\ Adj.}$) at the 10% level.

9b. PDR per foreign ownership bracket - Bloomberg data

Sample					
Excluding special dividends	Category	$PDR_{unadj.}$	$PDR_{FF\ adj.}$	$PDR_{Allshare\ adj.}$	$Ret_{FF\ adj.}$
	Low foreign ownership, *103 obs.*	0.6129*** (0.8693)	0.6359*** (0.7705)	0.7335*** (0.7495)	0.0117*** (0.0255)
	Medium foreign ownership, *109 obs.*	0.7363** (1.2828)	0.7413*** (1.0541)	0.7203*** (1.0984)	0.0064*** (0.0203)
	High foreign ownership, *107 obs.*	0.7406* (1.5849)	0.7253 (1.7758)	0.8018 (1.7234)	0.0081*** (0.0322)
	Domestic owners, *298 obs.*	0.6264*** (1.6457)	0.6119*** (1.5957)	0.6590*** (1.6187)	0.0121*** (0.0503)
	Foreign owners, *319 obs.*	0.6879*** (1.2814)	0.7019*** (1.2732)	0.7519*** (1.2575)	0.0087*** (0.0265)
Excluding all	Category	$PDR_{unadj.}$	$PDR_{FF\ adj.}$	$PDR_{Allshare\ adj.}$	$Ret_{FF\ adj.}$
	Low foreign ownership, *96 obs.*	0.6497*** (0.6859)	0.6871*** (0.6125)	0.7424*** (0.6799)	0.0110*** (0.0236)
	Medium foreign ownership, *93 obs.*	0.7556*** (0.6398)	0.7695*** (0.6420)	0.7695*** (0.6756)	0.0073*** (0.0204)
	High foreign ownership, *95 obs.*	0.7994 (0.7393)	0.7485** (0.9735)	0.7485** (1.0160)	0.0069** (0.0229)
	Domestic owners, *270 obs.*	0.7200*** (0.6285)	0.7161*** (0.6019)	0.7555*** (0.6598)	0.0010*** (0.0390)
	Foreign owners, *284 obs.*	0.7328*** (0.6902)	0.7346*** (0.7589)	0.7693*** (0.8043)	0.0084*** (0.0224)

The table illustrates $PDR_{unadj.}$, $PDR_{FF\ adj.}$, $PDR_{Allshare\ adj.}$ and $RET_{FF\ Adj.}$ for firms with low, medium and high degree of foreign ownership. The *main* sample consist of 330 observations, whereas the *including all* sample consist of 381 observations. The standard deviations of the mean ratios are reported within parentheses. *** denotes statistically significantly different from one (from 0 when $RET_{FF\ Adj.}$) at the 1% level, ** denotes statistically significantly different from one (from 0 when $RET_{FF\ Adj.}$) at the 5% level while * denotes statistically significantly different from one (from 0 when $RET_{FF\ Adj.}$) at the 10% level.

Appendix 10: Average cumulative abnormal volume for stocks with different degrees of foreign ownership (sample: *including all*)

Sample	Event Window		Degree of Foreign Ownership					
Incl. All			Low	Medium	High	All Obs.	No foreign owners	With foreign owners
	CAV (-5,5)							
		Average CAV	0.227 (0,758)	**0.524** (2,273)	0.200 (0,846)	**0.335** (3,045)	0.301 (1,742)	**0.315** (2,115)
		Average CAV(%)	25.48%	**68.94%**	22.18%	**39,75%**	35,18%	**37.04%**
	CAV (-1,0)							
		Average CAV	**0,323** (3,892)	**0,294** (4,069)	**0,192** (3,109)	**0,277** (8,756)	**0,291** (5,683)	**0,271** (6,349)
		Average CAV(%)	**38,07%**	**34,15%**	**21,20%**	**31,95%**	**33,79%**	**31,10%**
	Obs.		133	124	124	838	357	381

Where the bold numbers are statistically significantly different from zero at the 5% level. T-values are reported in parentheses. The "No Foreign Owners" category are stocks with zero registered foreign ownership, while the "With Foreign Owners" category are stocks with any registered foreign ownership. The stocks in which we were not able to extract any ownership data on, is included in the "all obs" column. We divide the degree of foreign ownership into brackets, low, medium and high degree of foreign owners. Estimation periods stretches from t=-65 to t=-6 and t=-60 to t=-1 in the event window (-5,5) and (-1,1) respectively.

Appendix 11: Regression output: The determinants for deviations from no-arbitrage interval midpoint – Non-robust standard errors (sample: *Main*)

Dependent variable	Intercept	Div_Yield	Var_Returns	Bid_Ask	AV(-1,0)	%_Foreign	Size	OSE_Allshare	$R^2_{adj.}$ *(F-val.)*
Ret	**0.0106**					-6.96E-05			0.0016
	(9.0083)					*(-1.4286)*			*(2.0410)*
Ret	**0.0048**	0.0569	**5.1729**		-0.0002	-4.2E-05			0.0174
	(2.1259)	*(1.5900)*	*(3.0211)*		*(-0.1679)*	*(-0.8544)*			*(3.9084)*
Ret	0.0015	0.0559	1.9857	**0.2327**	-0.0004	1.52E-05			0.0409
	(0.6364)	*(1.5810)*	*(1.0669)*	*(4.1070)*	*(-0.3708)*	*(0.3006)*			*(6.5765)*
Ret	**0.0301**	0.0433	**3.6372**		-0.0002	-3.3E-05	**-0.0015**	-0.4617	0.0261
	(3.2055)	*(1.1975)*	*(2.0266)*		*(-0.1447)*	*(-0.6615)*	*(-2.7466)*	*(-0.6465)*	*(3.9265)*
Ret	0.0142	0.0486	1.6734	**0.2021**	-0.0004	1.25E-05	-0.0007	-0.3800	0.0404
	(1.3508)	*(1.3526)*	*(0.8898)*	*(3.2603)*	*(-0.3251)*	*(0.2470)*	*(-1.2099)*	*(-0.5356)*	*(4.9341)*
$Ret_{FF\ adj.}$	**0.0092**					-6.07E-05			-0.000016
	(6.2055)					*(-0.9949)*			*(0.9898)*
$Ret_{FF\ adj.}$	0.0040	0.0580	**3.8114**		-2.3E-05	-3.6E-05			0.0040
	(1.4220)	*(1.2837)*	*(1.7649)*		*(-0.0165)*	*(-0.5830)*			*(1.6630)*
$Ret_{FF\ adj.}$	**0.0061**	0.0586	**5.8436**	**-0.1484**	0.0001	-7.3E-05			0.0090
	(2.0368)	*(1.3010)*	*(2.4655)*	*(5.0564)*	*(0.0842)*	*(1.1285)*			*(2.1828)*
$Ret_{FF\ adj.}$	**0.0240**	0.0444	2.6375		2.29E-05	-2.8E-05	**-0.0011**	-0.8601	0.0064
	(2.0248)	*(0.9716)*	*(1.1613)*		*(0.0166)*	*(-0.4498)*	*(-1.6719)*	*(-0.9516)*	*(1.7000)*
$Ret_{FF\ adj.}$	**0.0426**	0.0382	**4.9374**	**-0.2367**	0.0003	-1.8E-05	**-0.0020**	-0.9559	0.0186
	(3.2021)	*(0.8402)*	*(2.0724)*	*(-3.0141)*	*(0.1826)*	*(-1.2566)*	*(-2.7586)*	*(-1.0635)*	*(2.7731)*

T-values are reported in parentheses. Variables significant at the 10% level are denoted in boldface. Sample used contains 655 observations.

Appendix 12: Correlation matrices

12a. Sample: Main

Correlation	%_Foreign	*OSE_Allshare*	Bid_Ask	AV (-1,0)	Div_Yield	Size	Var_ Returns
%_Foreign	1						
OSE_Allshare	0.0445	1					
Bid_Ask	-0.2944	-0.0261	1				
AV(-1,0)	-0.0609	0.0153	0.0580	1			
Div_Yield	-0.1768	-0.1222	0.1263	0.1326	1		
Size	0.1099	-0.0313	-0.4914	-0.0163	-0.1720	1	
Var_Returns	-0.0937	-0.0162	0.4287	-0.0026	0.1725	-0.3368	1

12b. Sample: *Including all*

Correlation	%_Foreign	*OSE_Allshare*	Bid_Ask	AV (-1,0)	Div_Yield	Size	Var_ Returns
%_Foreign	1						
OSE_Allshare	0.0371	1					
Bid_Ask	-0.2781	-0.0158	1				
AV(-1,0)	-0.0366	0.0211	0.0679	1			
Div_Yield	-0.0964	-0.0485	0.1784	0.2717	1		
Size	0.1102	-0.0457	-0.4893	-0.0409	-0.2749	1	
Var_Returns	-0.0729	0.0220	0.4814	0.1942	0.7084	-0.3884	1

Appendix 13: Regression output: The determinants for deviations from no-arbitrage interval midpoint (Sample: *including all*)

13a. Robust standard errors

Dependent Variable	Intercept	Div_Yield	Var_Returns	Bid_Ask	AV(-1,0)	%_Foreign	Size	OSE_Allshare	$R^2_{adj.}$ *(F-val.)*
Ret	**0.0099**					**-7.87E-05**			0.0016
	(8.6084)					*(-1.7184)*			*(44.9260)*
Ret	**0.0079**	**0.0589**	-1.3462		-0.0012	-7.24E-05			0.0137
	(5.0949)	*(4.5681)*	*(-1.0969)*		*(-1.2539)*	*(-1.5744)*			*(22.7136)*
Ret	0.0014	**0.0444**	-1.1400	**0.3807**	-0.0011	4.25E-07			0.0446
	(0.8603)	*(3.5157)*	*(-0.9108)*	*(8.5621)*	*(-1.2099)*	*(0.0092)*			*(39.6740)*
Ret	**0.0344**	**0.0464**	-0.9070		-0.0009	-6.27E-05	**-0.0016**	0.3222	0.0219
	(4.2078)	*(3.4933)*	*(-0.7448)*		*(-0.9991)*	*(-1.3696)*	*(-3.3531)*	*(0.4611)*	*(19.0482)*
Ret	0.0052	**0.0438**	-1.0896	**0.3640**	-0.0011	-2.90E-06	-0.0002	0.6229	0.0430
	(0.5511)	*(3.3718)*	*(-0.8641)*	*(7.2184)*	*(-1.2277)*	*(-0.0625)*	*(-0.4516)*	*(0.9094)*	*(29.4501)*
$Ret_{FF\ adj.}$	**0.0095**					**-8.13E-05**			0.0020
	(8.7362)					*(-1.8764)*			*(44.9260)*
$Ret_{FF\ adj.}$	**0.0073**	**0.0572**	-0.6335		-0.0006	**-7.98E-05**			0.0131
	(4.9530)	*(4.6706)*	*(-0.5435)*		*(-0.6136)*	*(-1.8274)*			*(24.1572)*
$Ret_{FF\ adj.}$	0.0010	**0.0428**	-0.3506	**0.3835**	-0.0004	-1.12E-05			0.0432
	(0.6489)	*(3.5974)*	*(-0.2975)*	*(9.1596)*	*(-0.5065)*	*(-0.2563)*			*(46.0865)*
$Ret_{FF\ adj.}$	**0.0381**	**0.0428**	-0.1161		-0.0002	-6.74E-05	**-0.0019**	-0.2578	0.0250
	(4.9402)	*(3.4228)*	*(-0.1012)*		*(-0.2585)*	*(-1.5621)*	*(-4.0623)*	*(-0.3915)*	*(21.6242)*
$Ret_{FF\ adj.}$	0.0130	**0.0395**	-0.2665	**0.3338**	-0.0003	-1.59E-05	-0.0007	-0.0625	0.0419
	(1.4529)	*(3.2206)*	*(-0.2243)*	*(7.0247)*	*(-0.3472)*	*(-0.3643)*	*(-1.3196)*	*(-0.0968)*	*(33.1051)*

Statistically significant at the 10% level is denoted with boldface. T-values are denoted in parentheses. Sample used contains 738 observations and the F-value is estimated using the Wald test.

13b. Non-robust standard errors

Dependent Variable	Intercept	Div_Yield	Var_Returns	Bid_Ask	AV(-1,0)	%_Foreign	Size	OSE_Allshare	$R^2_{adj.}$ *(F-val.)*
Ret	**0.0124**					**-0.0001**			0.0031
	(7.9505)					*(-1.8019)*			*(3.2468)*
Ret	**0.0090**	**0.0791**	-0.9603		**-0.0022**	-8.79E-05			0.0208
	(4.8594)	*(3.2928)*	*(-0.6393)*		*(-1.7037)*	*(-1.4215)*			*(4.8886)*
Ret	0.0005	**0.1240**	**-6.7048**	**0.4276**	**-0.0024**	3.41E-05			0.0702
	(0.2238)	*(5.0669)*	*(-3.8880)*	*(6.3016)*	*(-1.8741)*	*(0.5386)*			*(12.0609)*
Ret	**0.0374**	**0.0780**	-1.9967		-0.0020	-7.29E-05	**-0.0017**	-0.5649	0.0266
	(3.2548)	*(3.2278)*	*(-1.2747)*		*(-1.5859)*	*(-1.1768)*	*(-2.4744)*	*(-0.5944)*	*(4.3379)*
Ret	0.0022	**0.1231**	**-6.6854**	**0.4234**	**-0.0023**	3.40E-05	-9.17E-05	-0.1797	0.0677
	(0.1740)	*(4.9564)*	*(-3.8497)*	*(5.7460)*	*(-1.8540)*	*(0.5366)*	*(-0.1247)*	*(-0.1927)*	*(8.5989)*
$Ret_{FF\ adj.}$	**0.0113**					-0.0001			0.00167
	(6.4831)					*(-1.4955)*			*(2.2365)*
$Ret_{FF\ adj.}$	**0.0089**	**0.0770**	-1.1602		-0.0015	**-0.0001**			0.0194
	(4.8389)	*(3.2243)*	*(-0.7773)*		*(-1.1575)*	*(-1.6608)*			*(4.6195)*
$Ret_{FF\ adj.}$	0.0014	**0.1169**	**-6.2665**	**0.3801**	-0.0016	6.39E-06			0.0587
	(0.6011)	*(4.7803)*	*(-3.6374)*	*(5.6069)*	*(-1.2934)*	*(0.1010)*			*(10.1377)*
$Ret_{FF\ adj.}$	**0.0345**	**0.0747**	-2.0274		-0.0013	-8.78E-05	**-0.0015**	-0.9255	0.0243
	(3.0198)	*(3.1222)*	*(-1.3020)*		*(-1.0350)*	*(-1.4255)*	(-2.2121)	*(-0.9794)*	*(4.0399)*
$Ret_{FF\ adj.}$	0.0034	**0.1149**	**-6.1757**	**0.3746**	-0.0016	6.81E-06	-8.80E-05	-0.5847	0.0567
	(0.2641)	*(4.6309)*	*(-3.5605)*	*(5.0897)*	*(-1.2598)*	*(0.1075)*	*(-0.1198)*	*(-0.6276)*	*(7.2824)*

Statistically significant at the 10% level is denoted with boldface. T-values are denoted in parentheses. Sample used contains 738 observations.

Appendix 14: Regression output: The determinants for deviations from no-arbitrage interval midpoint (Dependent variables in absolute values, *main* sample)

14a. Robust standard errors

Dependent variable	Intercept	Div_Yield	Var_Returns	Bid_Ask	AV(-1,0)	%Foreign	Size	OSE_Allshare	$R^2_{adj.}$ (F-val.)
Abs(Ret)	**0.0171**					-3.28E-05			0.0001
	(26.872)					*(-1.2481)*			*(493.2514)*
Abs(Ret)	**0.0111**	**0.0586**	**6.1188**		-0.0004	-1.21E-05			0.0385
	(9.3235)	*(3.0772)*	*(6.7161)*		*(-0.6520)*	*(-0.4620)*			*(227.2614)*
Abs(Ret)	**0.0081**	**0.0615**	**2.9812**	**0.2432**	-0.0009	3.46E-05			0.0879
	(6.5520)	*(3.3157)*	*(3.0551)*	*(8.1875)*	*(-1.5170)*	*(1.3044)*			*(221.7685)*
Abs(Ret)	**0.0278**	**0.0512**	**4.8430**		-0.0004	-7.30E-06	**-0.0010**	-0.1268	0.0462
	(5.6130)	*(2.6811)*	*(5.1080)*		*(-0.6094)*	*(-0.2811)*	*(-3.4447)*	*(-0.3360)*	*(167.2003)*
Abs(Ret)	**0.0103**	**0.0605**	**2.8842**	**0.2363**	-0.0009	3.38E-05	-0.0001	0.0280	0.0844
	(1.8680)	*(3.2108)*	*(2.9229)*	*(7.2663)*	*(-1.4969)*	*(1.2708)*	*(-0.4163)*	*(0.0752)*	*(165.2621)*
$Abs(Ret_{FF\ adj.})$	**0.0158**					-2.34E-05			-0.0007
	(25.33615)					*(-0.9116)*			*(443.3946)*
$Abs(Ret_{FF\ adj.})$	**0.0093**	**0.0707**	**6.3253**		-0.0002	-3.61E-06			0.0450
	(7.9316)	*(3.7573)*	*(7.0332)*		*(-0.2641)*	*(-0.1395)*			*(211.7822)*
$Abs(Ret_{FF\ adj.})$	**0.0055**	**0.0760**	**2.5914**	**0.2987**	-0.0009	**5.08E-05**			0.1038
	(4.6426)	*(4.2427)*	*(2.7501)*	*(10.4108)*	*(-1.5621)*	*(1.9818)*			*(226.9248)*
$Abs(Ret_{FF\ adj.})$	**0.0309**	**0.0608**	**4.2298**		-0.0003	4.39E-06	**-0.0013**	-0.1645	0.0557
	(6.4797)	*(3.3073)*	*(4.6335)*		*(-0.4866)*	*(0.1755)*	*(-4.6298)*	*(-0.4528)*	*(157.9358)*
$Abs(Ret_{FF\ adj.})$	**0.0104**	**0.0736**	**2.3697**	**0.2829**	-0.0008	**4.93E-05**	-0.0003	-0.0625	0.1014
	(1.9635)	*(4.0468)*	*(2.4890)*	*(9.0136)*	*(-1.4884)*	*(1.9225)*	*(-0.9241)*	*(-0.1741)*	*(168.8710)*

Statistically significant at the 10% level is denoted with boldface. T-values are denoted in parentheses. Dependent variables are in absolute values. Sample used contains 655 observations and the F-value is estimated using the Wald test.

14b. Non-robust standard errors

Dependent variable	Intercept	Div_Yield	Var_Returns	Bid_Ask	AV(-1,0)	%Foreign	Size	OSE_Allshare	$R^2_{adj.}$ *(F-val.)*
Abs(Ret)	**0.0211**					**-7.6E-05**			0.0058
	(24.9514)					*(2.1885)*			*(4.7895)*
Abs(Ret)	**0.0104**	**0.1086**	**9.1151**		-0.0006	-2.6E-05			0.1302
	(6.8746)	*(4.4947)*	*(7.8874)*		*(-0.7436)*	*(0.7935)*			*(25.4769)*
Abs(Ret)	**0.0059**	**0.1072**	**4.7266**	**0.3204**	-0.0009	-5.25E-05			0.2207
	(3.8780)	*(4.6882)*	*(3.9275)*	*(8.7458)*	*(-1.2128)*	*(-1.6044)*			*(38.0423)*
Abs(Ret)	**0.0302**	**0.0968**	**7.9278**		-0.0005	-1.9E-05	**-0.0011**	-0.5635	0.1421
	(4.7867)	*(3.9777)*	*(6.5606)*		*(-0.7066)*	*(-0.5622)*	*(-3.1636)*	*(-1.1718)*	*(19.0527)*
Abs(Ret)	0.0048	**0.1053**	**4.7799**	**0.3239**	-0.0008	-5.36E-05	-8.95E-05	-0.4324	0.2195
	(0.7036)	*(4.5313)*	*(3.9286)*	*(8.0782)*	*(-1.1844)*	*(-1.6336)*	*(-0.2381)*	*(-0.9421)*	*(27.2728)*
$Abs(Ret_{FF\ adj.})$	**0.0212**					-7.5E-05			0.0019
	(17.6155)					*(-1.5070)*			*(2.2708)*
$Abs(Ret_{FF\ adj.})$	**0.0107**	**0.0978**	**9.4305**		-6.7E-05	-2.5E-05			0.0612
	(4.7932)	*(2.7409)*	*(5.5294)*		*(-0.0611)*	*(-0.5173)*			*(11.6504)*
$Abs(Ret_{FF\ adj.})$	0.0016	**0.0950**	0.5473	**0.6486**	-0.0007	**-0.0001**			0.2462
	(0.7499)	*(2.9716)*	*(0.3255)*	*(12.6715)*	*(-0.6884)*	*(-2.9371)*			*(43.7214)*
$Abs(Ret_{FF\ adj.})$	**0.0395**	**0.0800**	**7.7170**		-1.7E-05	-1.4E-05	**-0.0017**	-0.9132	0.0737
	(4.2329)	*(2.2297)*	*(4.3266)*		*(-0.0160)*	*(-0.2862)*	*(-3.0966)*	*(-1.2866)*	*(9.6772)*
$Abs(Ret_{FF\ adj.})$	-0.0148	**0.0982**	1.0108	**0.6901**	-0.0007	**0.0001**	**0.0010**	-0.6340	0.2993
	(-1.5571)	*(3.0328)*	*(0.5970)*	*(12.3515)*	*(-0.6978)*	*(3.0591)*	*(1.8560)*	*(-0.9915)*	*(32.0292)*

Statistically significant at the 10% level is denoted with boldface. T-values are denoted in parentheses. Dependent variables are in absolute values. Sample used contains 655 observations.

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