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Combating Withholding Tax Reclaim Schemes in Europe

An event study examining the effect of policies aimed at combating fraudulent withholding tax reclaim schemes

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Abstract

In the last decade, numerous tax scandals have been exposed to the public. Among the largest of these is the so-called CumEx scandal, which revealed how billions of euros have been fraudulently acquired from European treasuries through trading schemes taking advantage of loopholes in the dividend tax legislation. These schemes are the center of this thesis. The first scheme, referred to as cum-ex, allows investors to obtain numerous tax reimbursements for a single dividend withholding tax payment. The second scheme, known as cum-cum, is a tax arbitrage strategy that exploits differences in dividend taxation rates between domestic and foreign investors, thereby lowering the effective tax liabilities of the participants.

This thesis contains an explanation of the inner workings of the schemes, an examination of their prevalence in various European countries, and an analysis of the effects of policy changes implemented to prevent the schemes from being executed. To assess the extent and development of the schemes we utilize daily transaction volume data of shares to detect abnormal trading activity around the ex-dividend date. Such abnormal activity is potentially indicative of the presence of cum-cum and cum-ex schemes. We assess the impact of policy changes taken to combat the schemes by comparing trading patterns around the ex-dividend date before and after the implementation of said changes.

We analyze nine separate reforms in seven countries aimed at combating cum-cum and cum-ex schemes. We find evidence of significant abnormal share trading around the ex-date in five out of seven countries, indicative of dividend tax schemes being present. We find that policy changes implemented in four out of nine reforms, in Germany (two separate reforms), France, and Finland, have led to a significant decline in abnormal trading correlating with that of known tax schemes. In the latter four countries, Austria, Belgium, Denmark, and Norway, the implemented policy changes had no significant impact on trading patterns, indicative of policy changes being ineffective in combating the cum-cum and cum-ex schemes.

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1. Introduction

Tax evasion poses a significant global challenge, estimated to cost governments around 3 trillion US dollars annually (UN, 2016). The burden of lost tax revenues due to evasion falls on ordinary citizens, which ultimately leads to increased inequality. Gone are the days of stashing away money in briefcases or under the mattress; modern financial innovation has given rise to highly sophisticated methods of tax evasion. The arsenal of evasion techniques is highly adaptable, and constant innovation outpaces the ability of authorities to take counteractive measures (Zingales, 2015).

Over the past decade, leaked documents such as the Panama Papers and the Paradise Papers (Oxfam, n.d.) have exposed tax evasion, tax avoidance, and aggressive tax planning as common business practices worldwide. Through complex and inadequately managed tax systems, wealthy individuals and multinational corporations are able to reduce their effective tax burdens by exploiting loopholes in both tax legislation and administration. In this thesis, we examine the so-called CumEx scandal, a scandal in which billions of euros have been taken or withheld from European treasuries through the exploitation of tax loopholes.

1.1 The cum-ex scandal

The term "cum-ex" gained widespread attention in October 2018 with the publication of the CumEx-files by Correctiv. This non-profit independent newsroom exposed a network of traders, lawyers, and banks that exploited flaws in the dividend tax system to fraudulently obtain billions of euros from European treasuries through two schemes. The first scheme, known as cum-ex, allowed investors to claim multiple dividend-withholding tax (DWT) reimbursements for a single DWT payment. In other words, the scheme made governments repay several tax refunds for a single tax payment, making participants in cum-ex schemes receive more tax reimbursements than what they initially paid. The second scheme, known as cum-cum, took advantage of differences in tax rates between foreign and domestic investors, resulting in reduced tax burdens for foreign investors. The terms "cum" and "ex" are derived from Latin, meaning "with" and "without", and refer to stocks being with and without dividend rights. Cum-ex and cum-cum are commonly referred to as "withholding tax reclaim schemes". We use the collective term "WHT-schemes" when discussing both schemes together in this thesis.

Several multinational corporations, like the Deutsche Bank, KPMG, HypoVereinsbank, and EY, have been involved in the CumEx scandal. The estimated tax loss from the scandal is staggering, amounting to around 150 billion euros (Correctiv, 2021). While some of the losses stem from the cum-ex scheme, the majority can be attributed to the cum-cum variant (Casi et al., 2022). Among the countries hardest hit by WHT-schemes are Germany, France, the Netherlands, Spain, and Denmark.

Several tax authorities were aware of schemes such as cum-ex and cum-cum before the release of the CumEx-files, and Germany made legislative changes to combat these schemes in 2012 (cum-ex) and 2016 (cum-cum). Similarly, other nations have followed Germany in combating the schemes in the last decade. Despite this, it seems like the authorities have not realized the scope or seriousness of these schemes. Christoph Spengel, an economics professor who has researched tax-driven transactions for years, states: *'In light of the fact that numerous states have been hit by cum-ex and cum-cum transactions, which are often backed by global players, the lack of awareness is incomprehensible'* (Correctiv, 2021).

According to Correctiv, too little has been done to stop the fraud since the 2018 scandal. They claim that *'authorities in Europe are still failing to act in the fight against systematic tax fraud'*. The European Union has also been criticized for failing to act. The EU's financial markets regulator and supervisors, ESMA, concluded in September 2020 that WHT-schemes are not to be considered market abuse and are thus outside their jurisdiction and should be left to the national authorities to deal with (ESMA, 2020). This can be problematic because of spillover effects, as Laturnus, Reichel & Wahrenburg (2022) investigate in their study of WHT-schemes in European nations after German reforms in 2012 and 2016. They find evidence of increased WHT-scheme activity in various countries after the reforms in Germany, which suggests that traders simply move their schemes to other, less regulated markets when new reforms are implemented.

There have been and are still several ongoing court cases against WHT-scheme participants. Two stock traders were put on probation in March 2020 for their involvement in cum-ex trading, whereas one of them had to pay back 14 million euros in tax debt (Correctiv, 2021). The bank M.M. Warburg had to pay back 176 million euros from cum-ex transactions, and one of their former employees was sentenced to five years and six months in prison for participating in WHT-schemes. A renowned tax lawyer and a central player in the cum-ex

scandal, Hanno Berger, was sentenced to eight years in prison by a German court in December 2022. The scandal in Germany is of such magnitude and has reached such prominent levels in society that even Olaf Scholz, the German Chancellor, is currently being investigated for his alleged role in the scandal. These are just some high-profile examples of recent convictions related to WHT-schemes, and more participants have been and are expected to get convicted.

Despite the increased awareness of WHT-schemes, it is still believed to be an ongoing problem. Olaya Argueso Perez, an editor at Correctiv, expresses concerns that tax law changes have not succeeded in eradicating the schemes across the EU, with Finland, France, Italy, Norway, and Spain among those still vulnerable. Perez claims that '*the trades may be theoretically banned, but the fraudsters have found new tricks to go in with their business'* (Nicol, 2021).

1.2 Literature on WHT-schemes

After the CumEx-files, there have been several studies researching WHT-schemes in Europe. A common denominator for most of them is that they find evidence that indicates widespread use of WHT-schemes in European nations. For the most part, the studies take advantage of the trading-patterns WHT-schemes leave around the ex-dividend day to identify the presence of extensive cum-cum or cum-ex trading.

Buettner, Holzmann, Kreidl, & Scholz (2020) study the effect of the German 2012 reform aimed at preventing cum-ex. Their conclusion is that the reform was effective at reducing the spike in trading volume on the German stock exchange around the dividend payment period, which indicates that the reforms were effective at combating cum-ex.

Casi, Gavrilova, Murphy, & Zoutman (2022) study the effects of Denmark's 2016 reform to close loopholes in the enforcement of the dividend withholding tax. The paper concludes that the reform successfully eliminated known patterns of WHT-scheme trading. Further, they estimate that Denmark has seen an increase in tax income of around 1.3 billion USD annually from the reform. The study also provides evidence that the 2016 reform in Germany was effective in combating cum-cum trading. In addition, they present evidence that WHT-schemes are a problem in several European countries.

Laturnus et al. (2022) use different data than Buettner et al. (2020) and Casi et al. (2022). They also conclude, however, that the reforms in Germany have been successful. Finally, Wagner & Wei (2022) study several financial markets in western Europe and find abnormal trading around ex-dividend day in every country included in their analysis.

1.3 The purpose and research question of this thesis

In their "final report on cum-ex, cum-cum, and withholding tax reclaim schemes" (2020), ESMA writes that *"only a few EU states have passed legislative changes in order to prevent WHT-schemes"*. ESMA provides an overview of the countries where such preventative measures have been implemented, we focus on these countries in this thesis.

The existence of WHT-schemes in Europe have been thoroughly documented by others, as seen in Chapter 1.2. We have, however, found little literature on what has been done to reduce the extent of WHT-schemes and how effective these preventative measures have been. Exceptions to this are Germany and Denmark, where reforms have proved to be effective – but we have not yet seen a systemic analysis evaluating the effect of policy implementations in Europe. That is the purpose of this thesis. By doing so, we aim to assist present and future policymakers in their efforts to combat WHT-schemes by providing them with information on what legislative tools have proven to be effective and what have proved to be less effective in preventing the schemes.

Austria, Germany, and Denmark took preventative measures against WHT-schemes in the early to mid-2010s, while Belgium, France, and Finland have done the same in the last few years. To our knowledge, the effect of the legislative changes in the latter mentioned countries has not yet been studied. We will thus contribute to the literature by assessing the effect of legislative changes against WHT-schemes in these countries. We will also study the former set of countries, as we intend to compare the effects of all legislative changes. By doing this, we hope to provide clarity as to what measures can be undertaken to combat WHT-schemes effectively. This will be done by analyzing changes in trading volumes, where we compare differences in abnormal trading volumes before and after policy implementations in each country.

Our research question is the following:

Is there evidence of abnormal trading volumes around the ex-dividend day, and is this affected by the implementation of tax policy changes to prevent WHT-schemes?

We have formulated a set of two hypotheses, which we will test empirically to answer the research question. These hypotheses are:

(1) H_0A*: The trading volume of shares around the ex-dividend date does not deviate from normal trading volumes.*
(2) H_0B: *The trading volume of shares around the ex-dividend date is unaffected by the implementation of reforms targeting WHT-schemes.*

Our main focus lies in the latter of the two, as our primary objective is to examine how policy changes affect WHT-schemes. Consequently, this is the area that will receive the most attention throughout the thesis. However, we find that answering H_0A is a necessary step towards achieving this primary objective.

To evaluate both hypotheses, we perform a two-way comparison event study, focusing on two distinct events: I) a company's stock going ex-dividend, and II) the implementation of policy changes to combat WHT-schemes. We define a regression model, equation 6 in Chapter 3.3, to which we apply weighted least squares (WLS) and analyze differences in the relative trading volume of company stocks to see how it is affected by the occurrence of said events. We analyze changes in daily share trading volume data for the 100 (if available) most traded dividend paying companies in each country of interest.

Based on previous research, we anticipate discovering abnormal trading in most countries prior to policy changes. Consequently, we will be able to reject hypothesis H_0A. Further, we anticipate finding similar results to Buettner et al. (2020) and Casi et al. (2022) - a drop in abnormal trading after the legislative changes in Germany and Denmark. In such case, we would also reject hypothesis H_0B. However, our study will make use of trading volume data, as opposed to share lending data or single stock futures which have been used by Casi et al. (2022) and other previous studies. Furthermore, we will analyze the abnormal trading in the period 2020-2022, which to our knowledge has not been done. Our result may thus yield

different conclusions. Our analysis will include data from Austria, Belgium, France, and Finland, for which the literature is less extensive than that of Denmark and Germany.

In addition, we intend to analyze WHT-schemes in our home country, Norway. It is not documented many cases of WHT-schemes being deployed in Norway; however, research has shown worrisome trading patterns (see e.g., ESMA (2020), and Wagner & Wei (2022)). We will examine the situation in Norway further.

The thesis onward is structured as follows: Chapter 2 presents a theoretical framework where the inner workings of cum-ex and cum-cum deals are described in detail, as well as other subjects relevant to the thesis. Here, we also present the relevant legislative changes designed to combat WHT-schemes in Europe. Next, in Chapter 3, we describe the data samples and the methodology used to detect and measure changes in WHT-schemes. We present and interpret our findings in Chapter 4. Finally, in Chapter 5, we provide a short discussion before we give our concluding answers to the research question of the thesis. We present a final section where we discuss the limitations of the thesis and highlight areas that warrant further investigation in future research.

2. Theoretical framework

This chapter explains the theory necessary to understand the basic structure of dividend taxation and how WHT-schemes exploit this system for personal gain at the expense of the general public. Further, we explain how WHT-schemes may leave traces in trading data through a distinct trading pattern, as well as other alternative explanations for these patterns. Finally, we present the policy changes implemented at the national level in Europe to counteract WHT-schemes.

2.1 Withholding tax and dividend taxation

In general, dividends can be subject to either an income tax or a withholding tax. The ways dividends are taxed throughout Europe differ as a function of different tax systems, national rules, and international agreements. Dividend taxation also depends on whether the shareholder is a natural or legal person, and if the shareholder is domestic or foreign.

When companies distribute dividends to domestic natural persons, it is usually subject to an income tax. Income taxes are limited to domestic shareholders, and dividends distributed to foreign shareholders cannot be subject to an income tax outside of the shareholder's resident country. Foreign shareholders are therefore usually subject to a withholding tax, where the dividend distributing company withholds a portion of the gross dividend from the shareholder. Taxation of domestic shareholders can be administered through the withholding tax as well, which will be credited against the shareholders income tax. In the event of a withholding tax, the dividend distributing company will have a legal remittance responsibility on behalf of its shareholders (Schreiber, 2013, p. 30-33).

The legal remittance responsibility is the requirement to send (pay) an amount of tax liability on behalf of others, and it is a key feature of modern tax administration. The natural or legal person that holds the legal liability for a tax can be different from the one that holds the legal remittance responsibility. This is the case with tax practices where businesses are required to pay taxes such as the value added tax, withheld tax on labor income, or withholding tax on dividends on behalf of customers, employees, and investors (Milanez, 2017, p. 8). In 2022, 34 out of 38 OECD countries levied withholding tax on dividends for both foreign and domestic shareholders, ranging between 10 and 35 percent of the dividend (OECD, 2023).

When a dividend is subject to withholding tax, a portion of the dividend equal to the withholding tax rate will be deducted from the gross dividend before the net dividend is paid. This portion of the dividend is withheld by the corporation to be forwarded to the tax authorities on behalf of the shareholders. When the withheld tax does not equal the amount of tax liability of the shareholder, the amount withheld can be credited against the shareholder's income tax, and an excess of the withheld tax may be refundable. As foreign shareholders do not have income tax in the resident country, and as dividend distributions between legal persons in many cases will be tax exempt, the withholding tax is often partially or fully refunded (Schreiber, 2013, p. 98-101).

There are several reasons why nations choose to move the tax remittance responsibility away from the holder of the legal tax liabilities, who is the statutory bearer of the tax. There are costs related to the documentation and collection of taxes, and it is cheaper for authorities to monitor employers than employees. In addition, the risk of tax avoidance and evasion is reduced, as the remitter of the tax has fewer incentives not to pay tax when the gains of such activity would not befall themselves. Companies also possess information, such as sales and salaries, which is needed to determine the tax liabilities of individuals (Slemrod, 2008, p. 252). Withholding tax is applied to make tax collection cheap, safe, and efficient.

There are also drawbacks to withholding taxes, which is at the core of our thesis. It can happen that taxes are not withheld or that they are not emitted to the tax authorities. Another problem is that withholding taxes often come with a refundable tax credit (Buettner et al., 2020). As we will explain, this is a problem that has been and may still be possible to trigger and exploit, and it is the foundation of what we call cum-ex schemes.

2.2 The dividend payment procedure

When a company´s shareholders vote through a dividend proposal at the general assembly, the company is legally obligated to make the dividend payment (Ciuara et al., 2022). The date of this vote is called the *declaration date*, and from then on, shares are sold *cum-dividend*, with dividend rights. The last day a share is sold cum-dividend is called the *cum-dividend date,* or *the cum-date*. Whoever owns shares on the cum-date and up until the ex-dividend day (called the *ex-date*) will receive dividend payouts. This means that investors will not receive dividends if they acquire a share at the ex-dividend date, or if they sell the

share at the cum-date. The ex-date is thus the critical date for investors to be aware of, and the ex-date is determined by the *record date*.

The record date is when a company looks at its shareholder records to see who is eligible for a dividend payment. The ex-date is typically two days (in the usual T+2 settlement cycle) before the record date because of the settlement period, i.e., it usually takes two days for a trade to be finalized. The purpose of the record date is to ensure that all investors who buy shares with dividend rights are registered as the owners of said shares before the distribution of dividends and are therefore the ones who receive dividends from the company. Finally, the dividends are distributed to the company's shareholders on the *payment date.*

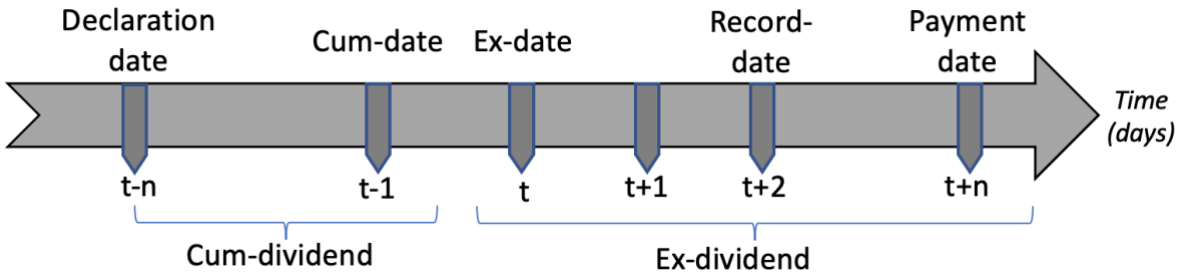


Figure 1: Important events and terms relating to the dividend payment procedure. The figure is centered at the ex-date, denoted day t.

2.3 Cum-ex schemes

Cum-ex schemes are highly sophisticated and complex transactions where shares with (cum) and without (ex) dividend rights are traded back and forth between three parties in a way that hides the identity of the real stockowner. This allows traders and banks to claim more than one tax refund for the same dividend payout. In other words, the state repays multiple tax refunds that only should have been refunded once.

To explain how a typical cum-ex works, we consider a situation where the owner of a stock sells shares two days before the ex-dividend date. The explanation we provide here is highly influenced by an explanation given by Buettner et al. (2020). When a share is sold two days before the ex-date, the stock may be delivered on the ex-dividend day because the stock-market guidelines require the settlement of a trade to be within two days after the day of the

transaction.[1] Due to the shares being delivered on the ex-dividend date, the seller of the stock will receive the net dividend. To ensure the right dividend distribution, a dividend settlement is necessary. This involves a compensation from the seller amounting to the net dividend, which is delivered to the buyer's account. The settlement also ensures that the buyer receives a WHT certificate. As a result of this, the buyer receives a three-part delivery. First, the stock without dividend rights. Secondly, the net dividend. Thirdly, a WHT-certificate issued by the buyer's depositary bank. All these operations are standard procedure, and do not raise any concerns.

In the situation above, the seller owned the shares before the sale. However, in the case of cum-ex trades, the seller does not own the shares. Instead, he conducts a short sale. Nevertheless, when the buyer receives the shares on ex-dividend day, the trade triggers the same dividend settlement process as described above, even though the short seller has not received any dividends. This means that the buyer can claim a WHT-certificate. This flaw in the system happens because the buyer's bank does not consider the short sale nature of the trade and therefore overlooks the fact that the seller does not have dividend rights. The dividend and another WHT-certificate are distributed to the original owner of the stock, of whom the seller lends the stock. Consequently, there have been two WHT-certificates issued for a single tax payment.

To further illustrate how cum-ex works, we provide a simplified example of the typical transactions involved:

1. Investor A short sells cum-dividend shares in company X to investor B two days before the ex-dividend date.
2. Investor C, who owns shares in Company X on the ex-dividend day, will receive a net dividend payment of 750 000 in addition to a DWT certificate worth 250 000.
3. On the same day, Investor C lends his shares to Investor A.
4. Investor A delivers these stocks to Investor B as part of their short deal.
5. Investor A also compensates investor B 750 000 as part of the settlement even though Investor A does not have dividend rights.

[1] This is called the settlement period, which for most security transfers are two business days. On the settlement day, payment must be received, and the shares must be delivered to the buyer.

6. Investor B can now claim a WHT-certificate from his custodian bank. The bank has no way of knowing that Investor A haven't received dividends.
7. Investor B transfers the stocks back to investor C, returning the participants to their original positions before the scheme.
8. The scheme is now finished. The three participants have made a profit of 250 000 (ignoring transaction-costs) which they share.

The example above and most of the theory on cum-ex are built on the German method before 2012. It is worth noting that cum-ex methods applied in other countries are not necessarily identical to the German method. Differences in the administration of dividends and DWT will lead to different adaptations of the method (Jensen and Lassen, 2019). However, nearly all cum-ex transactions share a basic structure that involves the transfer of shares around ex-dividend day, resulting in distinct trading patterns. For cum-ex, we expect to capture the short sale and thus find an increase in trading one or two days before the ex-dividend date. The crucial element of the short sale is that it occurs prior to the ex-dividend day, while the delivery of the shares takes place either on or after the ex-dividend day. The anticipated trading pattern we expect to appear from extensive cum-ex activities resembles the graphical representation presented in figure 2.

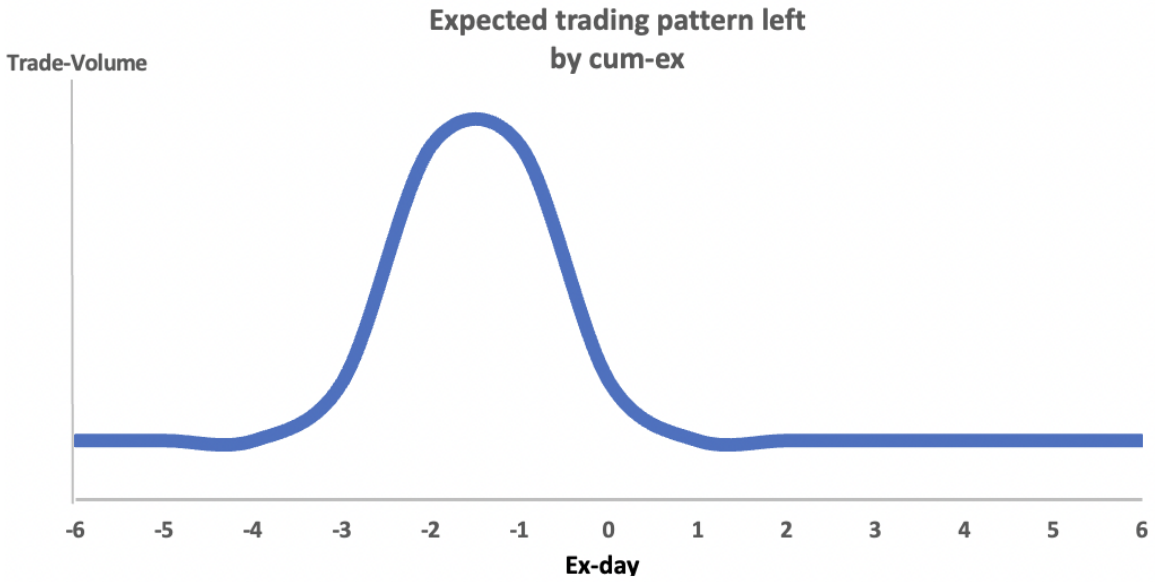


Figure 2: Accumulated expected trading pattern from cum-ex trading.

An exception to 'traditional' cum-ex trading is a method used in Denmark called cum-fake transactions. In this variation, investors falsely assert ownership of shares that have

distributed dividends (Wigan, 2019). The investors create fake documentation as evidence of their ownership and dividend payouts and then submit it to the Danish tax authorities to claim a dividend tax refund. Since no actual transfers of shares are involved, it's impossible to detect the scheme by analyzing market data.

2.4 Cum-cum schemes

Media coverage has primarily been concentrated on cum-ex trading, often blurring the distinction with cum-cum trading. However, they are vastly different operations, both legally and practically. While most countries have deemed cum-ex schemes criminal acts, cum-cum trading is considered more of a grey area. As the motive of cum-cum transactions is to avoid tax on dividends, they could be considered illegitimate, while they per definition are legal (Spengel, 2016).

ESMA classifies cum-cum trades as a form of dividend arbitrage, a practice commonly undertaken by several multinational corporations and wealthy individuals. German banks previously offered cum-cum as a financial product to their customers. However, this practice came to a halt in 2016 when Germany amended its tax legislation to prevent it. Germany's finance ministry labeled cum-cum trades as 'illegitimate, since their only purpose is to get around the legal taxation of dividends' (Shotter, 2016). It is believed that cum-cum trading was far more widespread than cum-ex, and from a tax revenue perspective cum-cum is likely vastly more important than cum-ex (Casi et al., 2022). It is estimated that Germany lost around 7 billion euros to cum-ex schemes and around 28.5 billion euros to cum-cum trades (Correctiv, 2021).

Cum-cum schemes are aimed at exploiting differences in tax rates between jurisdictions. In Europe, domestic investors are entitled to reimbursement from the DWT while foreign investors are not (Casi et al., 2022). In most cases, a foreign investor transfers their shares to a domestic investor, typically a bank, over a dividend period. The transfer of shares can happen either through the combined buying and selling of shares or through a lending agreement. After the ex-dividend date, the shares are transferred back to the original owner. The two participants share the profits made from the differential in tax liability between the foreign and domestic investors.

Cum-cum transactions are vastly similar in most countries (Wigan, 2019). All forms of cum-cum trading involve a transfer of ownership of a share before and after a stock goes ex-dividend. As mentioned, this can be done either through lending or buying shares. We use transaction volume data in this thesis and will thus not capture cum-cum deals that happen through share-lending. It is a bit more unambiguous when cum-cum transactions take place than with cum-ex, as the scheme does not require a specific timing. However, cum-cum requires both a sale before and after ex-dividend day. A cum-cum arrangement will therefore typically appear two times in the data, with the first sale and the buy-back of shares. We expect the trading pattern left by cum-cum to look somewhat like the figure below:

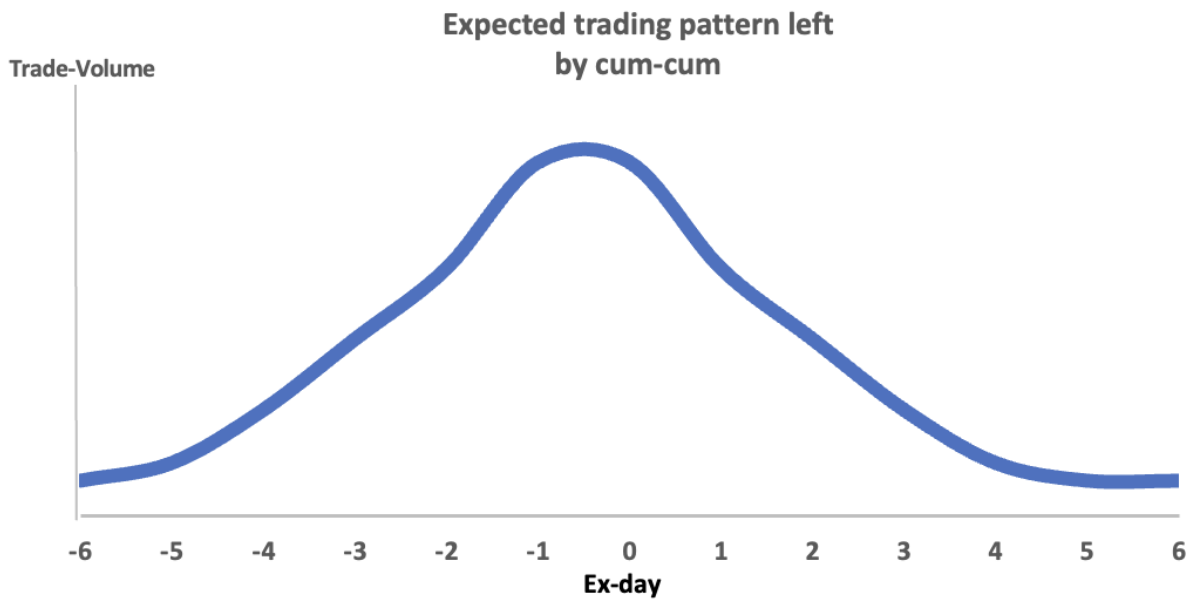


Figure 3: Accumulated expected trading pattern from cum-cum trading.

2.5 Increased trading around ex-dividend date

We analyze the trading around the ex-dividend date to seek patterns that can indicate cum-ex or cum-cum trading. We expect to find increased trading around the ex-dividend, especially before legislation preventing WHT-schemes has been implemented. However, past research has shown that some increased trading around the ex-dividend could be expected even when WHT-schemes are not prevalent. We thus find it appropriate to present the other reasons for this increased trading activity.

In a Walrasian perfect capital market where there are no transaction costs or taxes, stock prices would fall exactly by the value of the dividend that is paid on each share (Miller and Modigliani, 1961). However, it is well known that stock prices on average fall by less than the dividend amount (Frank and Jagannathan, 1998). This is predominantly attributed to taxes. Thus, when investors have a different effective tax rate on dividend payments, arbitrage opportunities appear. Prior research argues that the increased trading activity around the ex-dividend day is mainly a result of tax heterogeneity between investors (Wagner and Wei, 2022).

Lakonishok & Vermaelen (1986) studies trading volume around the ex-dividend date for 2300 AMEX and NYSE companies from 1970 to 1980. They find increased trading before and after the ex-dividend date. The increased trading volume is found to be positively correlated with the size of the dividend and negatively correlated with transaction costs, meaning that a high dividend yield and low transaction costs lead to more trading around ex-dividend day. This is in line with the findings of Michaely & Vila (1995) and Henry & Koski (2016). The latter also provide evidence that skilled institutions employ a dividend capturing strategy[2] to benefit from their low transaction costs.

Tax heterogeneity may not be the only factor that leads to increased trading around ex-dividend day. Milanos & Travlos (2001) investigate the trading volume around dividend day at the Athens Stock Exchange, they find a significant increase in trading volume around ex-dividend day. This is despite Greece not having any taxation on dividends or capital gains in 2001. They attribute this to a decrease in price on the ex-dividend day, which arises from transactions on the cum-dividend date taking place at the bid price, while transactions on the ex-dividend day occur at the ask price. This is due to the preference of investors who choose to buy shares on the ex-dividend day rather than on the cum-dividend day. On the other hand, those who have decided to sell, would prefer to advance their sale to the last cum-dividend day. Market makers also take advantage of this and buy the stock on cum-dividend day (Dasilas, 2007). These effects mean a higher trading level around ex-dividend day. This is in line with the findings of Al-Yahyaee, Pham & Walter (2011) who studies a similar market in Oman.

[2] A dividend capturing strategy is when an investor buys a stock for the sole purpose of capturing the dividend and then sellis it immediately after the dividend is paid (Punkasovitch, 2021). See https://www.investopedia.com/articles/stocks/11/dividend-capture-strategy.asp

We must take the above factors into consideration in this analysis of WHT-schemes. However, since we compare trading patterns before and after legislative changes, these factors will for the most part remain consistent after the change in legislation, enabling us to isolate the effect of WHT-schemes.[3]

2.6 Legislative changes to combat WHT-schemes

In this section, we provide an overview of the legislative measures implemented in European countries to address WHT-schemes. The inclusion of specific dates is crucial for our analysis, as it enables us to compare trade volumes before and after the implementation of the reforms. Only a few European states have passed legislative changes in the past decade to prevent WHT-schemes. These countries are Austria, Belgium, Finland, France, and Germany. Additionally, while not targeting WHT-schemes directly, Denmark has substantially strengthened its administration of dividend refunds (ESMA, 2020). The legislative changes can, according to Casi et al. (2022), broadly be categorized into two groups. The first set of changes implements additional documentation requirements, which mainly target the loopholes exploited by cum-ex schemes. The second set implements a minimum holding period for receiving a tax reimbursement certificate. This stops short-term transactions with the aim of tax-relief around the ex-dividend date, including cum-ex and cum-cum schemes.

2.6.1 Germany

Germany was the first to implement legislative changes of the first group, in 2012[4], when they replaced the so-called debtor principle with the paying agent principle. After the change, custodian banks withhold tax on dividends instead of the dividend-paying company. As a result, the same institution is responsible for both withholding the tax and the issuance of tax certificates. In addition, the traders must prove that they have paid taxes when applying for a tax refund on a dividend payment, securing that DWT reimbursements are not

[3] An exception could be when countries introduce a 'holding-period', e.g. when the investor must hold a share for at least x-amount of days to obtain a DWT-refund. A holding period could hinder a typical dividend-capture strategy.
[4] Germany implemented legislation designed to combat cum-ex already in 2007. The change in 2007 allowed depositary banks to withhold and remit dividend taxes instead of dividend-paying businesses. However, this only applied to domestic depositary banks. The traders started using foreign depositary banks as a result,, and cum-ex went worldwide (Schulz, 2021).

claimed without right. Regarding the second set of changes, in 2016, Germany introduced a minimum holding period of 45 days for receiving a full DWT reimbursement. A downside to this type of legislation is that it could hinder legal, non-tax arbitrage around dividend day. This is something to consider when measuring the effect of the legislative changes (Casi et al., 2022). Further, this reform is difficult and time-demanding to implement, as countries that carry out such changes need to modify all their double tax agreements to get the desired effect (Johannes Bangum, personal communication, February 10, 2023).

2.6.2 Austria

In 2015, Austria passed legislation such that all DWT-reclaims from the taxpayer had to be submitted in a single application after the calendar year. This makes it easier for the tax authorities to detect fraud. They also intensified the obligation to provide evidence of entitlement from the individual filing the DWT-reclaim request. Later, in 2019, dividend tax could no longer be refunded in the same year as it was deducted for foreign investors (Casi et al., 2022). In this way, foreign investors would incur a liquidity cost that was absent before. Interestingly, following a decision of the Austrian Supreme Administrative Court concerning short-term cum-ex trades, Austria recently passed new requirements for a shareholder to be entitled to a DWT refund (Mitterlehner, 2022). Under the new rules, the owner must have acquired the stock prior to the Annual General Meeting, i.e., before a dividend distribution is decided, to qualify for a dividend tax refund. [5]

2.6.3 Denmark

Denmark has implemented reforms that do not target WHT-schemes directly but are believed to have heavily reduced cum-ex and cum-cum trading in Denmark (Dalsbø & Solli, 2019). The reforms fall somewhere between the two groups. Denmark has since 2015 strengthened its administration of dividend refunds, including improved procedures and staff

[5] This change was, however, implemented too late (November 2022) to have any meaningful effect on our dataset. We will not include this reform in our analysis. It is, however, interesting that Austria have found it necessary to apply such changes to their legislation.

increases. As a result of cum-ex activity valued at approximately 12.7 billion, the Danish Tax Authorities suspended the processing of dividend tax refund claims in August 2015 (Riis, 2020). The suspension lasted until 2016, when the new regime was implemented.

After the 2016 reform, a tax refund must subsequently be requested with the submission of relevant documentation. This includes evidence of beneficial ownership of shares (Casi et al., 2022). Only the beneficial owner can receive a tax refund. If the shares are involved in a lending agreement, only the beneficial owner, i.e., the lender, will be entitled to a tax refund. The borrower will only be recognized as the beneficial owner of the shares if they have lent them for a duration exceeding six months. This model has a high administrative burden and has resulted in significant tax fraud involving fraudulent dividend tax refund claims (Kromann-Reumert, 2021). It's expected that a new relief-at-source model will be implemented in 2023. This model includes the requirement that foreign investors must be registered with the Danish tax authorities and have a unique identification number.

2.6.4 Belgium

Belgium implemented new regulations in January 2019 requiring the disclosure of full ownership of shares in order to qualify for a dividend tax refund (Casi et al., 2022). This is reminiscent of the reform in Denmark, i.e., a borrower of shares will not be eligible for a refund. Additionally, a minimum holding period of 60 days was established as a requirement for the refund. Unlike Germany, Belgium only applies this latter rule to pension funds, and not to other types of owners.

2.6.5 France

As of July 2019, France introduced a law that hindered dividend tax refunds for foreign shareholders who held shares in ways "that give the right or impose an obligation to return or sell the stocks"[6]. This law only applies if they held the shares for less than 45 days. Still, the shareholder can get a tax refund if they have proof of evidence that the transaction's effects and main purpose are neither to avoid DWT nor to obtain a tax benefit.

[6] See https://www.legifrance.gouv.fr/codes/id/LEGIARTI000037526673/2023-03-21/#LEGIARTI000037526673

2.6.6 Finland

In 2021, Finland became the first country to introduce the TRACE-model, which is an OECD initiative. TRACE aims to eliminate administrative hurdles, minimize administrative costs for all parties, and safeguard data privacy by limiting the number of parties involved in the DWT-reclaim process. TRACE also serves to prevent abuse of WHT-schemes (Raquest, n.d.). With TRACE, the Finnish Tax Administration has more access to information regarding corporate stockholding, so the information available to the dividend receiver is greater (ESMA, 2020). This enhancement of transparency is assumed to make it more problematic to evade taxes for the dividend beneficiary.

2.6.7 Norway

Norway has no WHT-system for residents. However, foreign investors get charged a 25 percent DWT when receiving dividends from Norwegian companies.[7] Investors from inside the EEA are entitled to a full DWT-reimbursement. According to the Norwegian Tax Agency (Skatteetaten), Norway was defrauded of just under 600.000 NOK in 2013. In 2015, the Danish government issued a warning regarding cum-ex activities. As a result, Norway was able to successfully prevent ten fraud attempts with a combined value of 350 million (Bergløff et al., 2018). After this, Norway imposed stricter control over the tax rebate system (Wigan, 2019). One can argue that this tightening has similarities to some of the reforms in the above-mentioned countries, and we therefore find it natural to analyze Norway in this thesis in a manner as if Norway had implemented legislative changes in 2015. [8]

According to the former tax director in Skatteetaten, Hans Christian Holte, cum-ex schemes were not possible in Norway in 2018. He pointed to control mechanisms where Skatteetaten could cross-check the demands for dividend refunds against central registers (Bergløff et al. 2018). However, it is worth noting that the ESMA-report (2020) and Wagner et al. (2022) show similar trading patterns in Norway to other countries that we know have been heavily

[7] Different rates may apply if the country has a double-tax agreement with Norway.
[8] We set the exact date to the 1st of September 2015, as Denmark became aware of the cum-ex scam in their country during the summer of 2015 and the news broke in the media at the end of August (Bergløff et al., 2018). We assume that Denmark warned Norway about cum-ex in August. For the sake of simplicity, we consider the 1st of September as the date when Norway officially became aware of the issue and changed some of their routines around the repayment of dividend WHT.

affected by WHT-schemes. Most likely, this comes from the cum-cum variant, as the cum-ex variant seems difficult to perform in Norway.

To further prevent tax evasion, authorities in Norway introduced a reform designed to develop a stricter system for DWT relief. From 2019, companies must hand in documentation that proves that they are conducting real economic activity in an EEA country before they receive the dividend tax benefit (Vold, 2017). This change is not targeting WHT-schemes directly but is aimed at restricting companies outside of the EEA from using so-called shell companies to gain tax benefits. So, in relation to cum-cum, this reform only prohibits the use of a shell company to perform cum-cum, while 'normal' cum-cum trades remain feasible. Hence, we will omit this reform from our analysis.

2.6.8 Summary of policy changes

Table 1: Summary of policy changes in Europe.

State	Start Date	Policy changes
Austria	1 January 2015	• Single application date • Provide evidence of entitlement
	1 January 2019	• Increased liquidity cost
Belgium	22 January 2019	• Minimum holding period for pension funds (60 days) • Beneficial ownership
Denmark	17 March 2016	• Enhanced procedures • Beneficial ownership
Finland	1 January 2021	• Trace-model: More transparency.
France	1 July 2019	• Minimum holding period for shares (45 days)
Germany	1 January 2012	• Paying-agent principle
	1 January 2016	• Minimum holding period (45 days)
Norway	1 September 2015 (estimated)	• Stricter control over the tax rebate system

3. Research approach

In this chapter, we introduce the data of interest and explain the process of manipulating and creating data samples prior to the statistical analysis. Next, we explain how we address the spatial and temporal nature of the data samples. Subsequently, we define and express a regression model designed to detect WHT-schemes in the data samples and explain how we expect the model to behave under given conditions.

3.1 The data

We intend to measure the extent of WHT-schemes and examine the effect of policies implemented to prevent them. To do so, we utilize the anticipated increase in transactions that such schemes are expected to produce around the ex-dividend date, as described in Chapter 2. We have therefore collected daily security transaction data of publicly traded companies between 01.01.2010 and 31.12.2022 for all countries of interest, for which we will analyze the 100 [9] most traded dividend-paying companies from the largest stock exchange of each country to examine (1) the presence of abnormal trading volumes around the ex-date, and (2) abnormal trading volume development after policy implementation.

Our data is gathered from the Compustat – Capital IQ global database of Wharton Research Data Services (WRDS), a data subscription service provided by The Wharton School, University of Pennsylvania[10]. The database contains global market information of publicly held companies, including our data of interest which is daily security (stock) data, including price-data, stock-exchange codes, trading volume, and dividend specific data such as ex-date and record-date information.

3.1.1 The data samples

We have been selective in what data to include in our samples for two purposes: (1) validating its suitability for statistical analysis and (2) ensuring that the sample accurately represents securities that would likely be impacted by potential WHT-schemes. In general,

[9] Exceptions apply when there are fewer than 100 companies that fulfill prior criteria, as is the case in Denmark, Belgium, and Austria, where respectively 89, 92, 69 (2015), and 61 (2019) companies are examined.
[10] See https://wrds-www.wharton.upenn.edu/pages/grid-items/compustat-global-wrds-basics/ for further details.

we restrict our samples in three ways, meant to make them both representative of the general (dividend-paying company) population and comparable across countries.

Our first restriction is to limit the transaction-data to trades made on what one can consider to be the main stock exchange in each country. For example, we have only kept transactions from the Oslo Stock Exchange (OSE:OSLO) for Norway and removed transactions from other exchanges. This is done due to a lack of information regarding the characteristics of smaller and more specialized exchanges, which often consist of companies that do not fulfill the requirements to be listed on the main stock exchange.

These omitted exchanges are often subject to the frequent circulation of new and volatile companies and may have less or different regulation than the main stock exchange. Such companies are less likely to pay regular dividends, and we believe those companies to be less attractive candidates for WHT-schemes given their unpredictable nature. Data from these alternative exchanges has also proven to be partially lacking in our dataset, which makes the data less suitable for statistical analysis. By limiting the data to a single stock exchange in each country, we also minimize the problem of dual listings, where we could risk analyzing the same security twice across different trading platforms.

For the second restriction, we limit the data to companies that pay out cash-dividends at least once in the pre-policy period and once in the post-policy period, totaling at least two cash-dividend payments. We use companies that pay dividends in both the pre- and post-policy periods as we will analyze differences in trading volumes within firms before and after a reform. A single dividend payout will therefore be insufficient, while non-dividend paying companies will provide little useable information. Our research is limited to the distribution of cash-dividends; to our knowledge, alternative dividend distributions do not facilitate WHT-schemes.

To determine the extent of WHT-schemes in the pre-policy period, we would possibly be better off analyzing all dividends in the pre-policy period – some of which we exclude by requiring companies to also have paid out dividends post-policy. Our main focus for this thesis lies with the effect of policy changes, however, for which we need both pre- and post-policy dividends from the same company to assess.

Our third restriction is to exclude all but the 100 most traded dividend-paying companies in each country. The main purpose of this step is to reduce the amount of data, which has proved to entail computational problems. The total trade volume is estimated in monetary terms by multiplying daily security closing prices with the daily number of traded shares of each stock, summarized for the whole period. This is expressed mathematically in equation 1, where subscript i indicates a company and subscript t denotes a given date.

$$Total\ trade\ value_i = \sum\left(Stock\ price_{i,t} * Trade\ volume_{i,t}\right)\ \mathrm{i} = 1, \ldots, \mathrm{N};\ \mathrm{t} = 1,\ \ldots, \mathrm{T} \quad (1)$$

This method allows companies that have been listed or unlisted from the exchange after 2010 to be included in a sample if they have accumulated the necessary monetary trading value. It does, however, favor companies with consistent trading throughout the whole period, as they have had more active trading days. The period in question will depend on the timing of the individual reform.

Investors partaking in WHT-schemes will want the trades to go unnoticed. We argue that bigger firms with regular dividend-payments are the most probable candidates for such schemes, as regular dividends allow for repeated transactions with limited planning, while large trades can be hidden in plain sight as they are common events in the bigger companies as opposed to being an uncommon event that may draw attention in a smaller company. We therefore argue that the reduction in data caused by this restriction does not come at a great cost to the validity of the analysis. We build further on this idea of separating companies by their relative size even within the samples in the main model of the thesis, expressed in equation 6 Chapter 3.3. We also explore this assumption in dept in the appendix “Does size really matter?” attached at the end of the thesis.

We want to emphasize that these restrictions may induce some survivorship bias in our samples and that they make our samples purposive and non-random. As we have already argued for these restrictions, however, we believe this bias is justified. We examine the effects of policy change, and these effects will only manifest themselves where WHT-schemes have been present. We therefore aim to create samples where it is probable that these schemes will be found, if present.

Several companies have multiple share classes. We have decided to treat each class separately, effectively the same way we treat separate companies. This is done because different share classes are traded with different sets of rights and are therefore not traded on equal terms or at the same price. We argue against pooling these different share classes together, despite them representing ownership in the same company. This means that a data sample can consist of less than N unique companies, as a single company may be represented several times if they have had several classes of shares that have been among the most traded stocks on the exchange. This is not common, however, as represented by the Norwegian and French data samples, where three and zero companies are represented by two different share classes, respectively, leaving 97 and 100 unique companies for further analysis.

After the abovementioned restrictions, we have nine data sample (one for each reform), with daily transaction data from the 100 [11] most traded companies in each country between 01.01.2010 and 31.12.2022. The time period in question is different for some samples, however, when multiple reforms have been implemented in the same country. Germany implemented two separate reforms in 2012 and 2016, and the data samples are designed to isolate their effects. For the reform implemented 01.01.2012, the data sample is limited to the period between 01.01.2010 and 31.12.2015. The sample for the 2016 reform, implemented 01.01.2016, consists of data from 01.01.2012 to 31.12.2023. The pre-2012 reform data is therefore removed from the sample of the 2016 reform, and the post-2016 data is similarly removed from the sample of the 2012 reform. We have some overlapping data in these samples - but the effects of the two reforms are separated. Austria has had multiple reforms as well (in 2015 and 2019), and the data is divided accordingly. We provide descriptive statistics of each sample in Chapter 3.4.

3.2 Panel data

Our data samples consist of repeated observations that cover both temporal and spatial dimensions and are combined time-series and cross-section datasets, for which the econometric term is a longitudinal dataset, or panel data (Biørn, 2017, p. 1-2).

[11] There are samples with fewer than 100 companies, as some countries do not have 100 companies that satisfy our criteria.

Such data encompasses information on both individual differences between firms and differences between periods. For our purposes, this allows us to separate companies by their time-invariant variables, such as a firm's sector, location, culture, or other characteristics of companies assumed to be permanent and not included as regressors in our model. The panel data also let us model the combined time-specific information from the data, such as macro-economic trends caused by exchange rates, the COVID-19 pandemic, the Evergrande liquidity crisis, and other unknown omitted regressors that affect the trading activity of all firms in the sample.

We want to address these time- and individual-specific variations as they contradict the assumptions of independent observations and uncorrelated errors in linear regression. From a general multiple regression model

$$Y = \beta_0 + \beta_1 X_1 + .. + \beta_n X_n + \varepsilon \qquad n = 1, \dots, N \ (2)$$

the covariance of the error terms ε_i and ε_j (subscripts i and j indicating different observation numbers) is assumed to be zero. When a covariate between variables increases, the reliability of the regression decreases (Osborne & Waters, 2002). In the case of time series, time-specific variables outside of the model may create patterns in the residuals and serial correlation. When a company is observed multiple times, as is the case with panel data, the observations are no longer independent as time-invariant individual differences may lead the residuals of a given company either to be, e.g., systematically positive or negative, indicating firm-dependent errors where $\mathrm{cov}(\varepsilon_{x,i}, \varepsilon_{x,j}) \neq 0$ (subscript x indicating company and subscripts i and j indicating different observation numbers).

To counteract this, we apply a two-way error component regression model as explained in chapter 3 of *Econometric Analysis of Panel Data* (Baltagi, 2005, p. 33-52). Starting with a general panel data multiple regression model (Arellano, 1987, p. 431)

$$Y_{i,t} = \beta_0 + \beta_1 X_{1_{i,t}} + .. + \beta_n X_{n_{i,t}} + \varepsilon_{i,t} \qquad i = 1, \dots, N;\ t = 1, \dots, T \ (3)$$

we assume the presence of correlated errors in the error term. We want to extract this correlation into its time-specific and individual-specific components with a two-way error component disturbance by dividing the error term expression into three separate parts:

$$\varepsilon_{i,t} = \mu_i + \lambda_t + v_{i,t} \quad i = 1, \dots, N;\ t = 1, \dots, T \ (4)$$

where μ_i captures unobservable individual effects and λ_t captures the unobserved time-specific effects, while $v_{i,t}$ is the remaining (assumed uncorrelated) stochastic error and operates under the same assumptions as ε from equation 2 (Baltagi, 2005, p. 32-39).

A potential problem with the time-specific estimator λ_t is that it would capture the ex-date effect instead of the normal trading volume variation if all companies in a data sample were to go ex-dividend during a span of seven days. There would then be a date where all companies had overlapping event-windows (see Chapter 3.3), and the ex-date effect would be indistinguishable from the time-specific variation in the market. We have investigated this, and we have found that even though ex-dates are somewhat clustered at quarterly intervals in all countries, total overlapping as described does not occur in any of the data samples.

The panel data sets are unbalanced, partly because of the endogenous selection of the samples. An unbalanced panel data set can be recognized as not all N subjects are measured over the same period T (see Biørn, 2017, p.287-289), which happens when a company of interest is either listed or unlisted from the stock exchange between 2010 and 2022. In such cases, the subject will be measured over a shortened period where $\sum t < T$.

3.3 Econometric model

For the model we have chosen to estimate a dependent variable $Y_{i,t}$ that we call *share turnover*. This variable represents the relative trading volume of a stock, and it increases with higher market activity. $Y_{i,t}$ is defined in equation 5.

$$Y_{i,t} = \frac{shares\ traded_{i,t}}{shares\ outstanding_{i,t}} * 100 \quad i = 1, \dots, N;\ t = 1, \dots, T \ (5)$$

Subscript i denotes company, and subscript t denotes date. This variable is meant to measure market activity while being consistent across stock splits or reverse stock splits, as well as the issuance of new company stock. We multiply by 100 and interpret the variable as the percentage of all outstanding shares of company i being traded on date t.

We make use of a double comparison in our model of $Y_{i,t}$, defined by the events *I)* a stock going ex-dividend and *II)* a country making policy changes to prevent further WHT-schemes.

For the first event, we compare the pre-policy level of share turnover in an event-window ranging [-3,3] days around the ex-date, denoted as date 0, to the level of trading in the non-event days outside of this window. The non-event days constitute what we call the "normal" trading volume, from which any significant deviation of trading volume in the event-window will be considered abnormal. This is done to detect the extent of WHT-schemes in the event-window before a policy implementation has been made.

This event-window is decided based on some assumptions regarding the structure of WHT-schemes. Traditional cum-ex transactions are bound by a specific trading pattern dictated by the exchange's cycle time, providing us with a reasonable assurance that such transactions will take place within the timeframe set by this event-window. As for cum-cum transactions, we believe most transactions will take place within the event-window as well. This is due to the investor's incentives, where they will want to center their trades at the ex-date to profit from minimizing equity risks and not lock up equity over a prolonged period, as illustrated in Figure 3.

For the second event, we compare the (abnormal) level of trading in the event-window *before* a legislative change has been implemented (pre-policy) to the level of trading in the event-window *after* a legislative change (post-policy). In this event, we investigate the impact of the implemented policy by examining whether the abnormal trading volume around the ex-date has remained consistent, decreased, or increased.

The regression model we use to evaluate the extent and development of WHT-schemes is expressed in equation 6,

$$Y_{i,t} = a_i + \beta_1 D_{1_{i,t}} + \beta_2 D_{1_{i,t}} D_{2_t} + \lambda_t + v_{i,t} \quad \text{i} = 1, \dots, \text{N};\ \text{t} = 1, \dots, \text{T} \ (6)$$

where subscripts i denote company and t indicate different dates between 01.01.2010 and 31.12.2022. $Y_{i,t}$ is the share turnover of company i on date t, calculated as shares traded divided by shares outstanding each day.

a_i is an individual specific intercept, which is the sum of β_0 from equation 3 and μ_i from equation 4. This intercept is company adjusted and represents unobserved individual specific differences between companies. a_i will be used to estimate the "normal" trading volume of company i, together with λ_t that adjusts for daily market movements.

$D_{1_{i,t}}$ is a dummy variable that takes the value of 1 (0 otherwise) if date t is in the ex-dividend period of company i. β_1 estimates the abnormal trading in the pre-policy event-window and is a coefficient of great interest as it can be interpreted as evidence for WHT-schemes in the pre-policy period. $\beta_1$will therefore be used to evaluate hypothesis H_0A. We expect β_1 to be significant and positive, as we see few incentives to implement legislative changes in the absence of pre-policy WHT-schemes.

D_{2_t} is another dummy variable, that takes the value of 1 (0 otherwise) when date t is in the post policy period. β_2 will estimate abnormal trading in the event-window post policy, anchored on the abnormal trading in the event-window pre-policy. β_2 is designed to evaluate hypothesis H_0B. We expect β_2 to be negative if a policy has been effective in reducing the extent of WHT-schemes. If β_2 is non-significant, the trading volume pattern in the event-window will be assumed consistent between the pre- and post-policy periods, and the policy will be deemed unsuccessful.

λ_t *and* $v_{i,t}$ are the date-specific variation and the idiosyncratic error term respectively, which is the remainder of $\varepsilon_{i,t}$ from equation (4) as the firm-specific characteristics are captured in a_i. Their interpretation remains as earlier stated and they are of little interest besides being controlled for in the regression.

We apply a weighted least squares (WLS) method to regression model equation 6. This is done in line with our arguments from Chapter 3.1.1, where we express why we believe

bigger companies are more probable candidates to be used in WHT-schemes. We believe this to be true within our samples as well, and we therefore apply more weight to observations made of bigger companies.

We use the annual average market value of a company to calculate a yearly company specific weight, ω, which we apply to all observations made of the company the given year. This average market value is calculated as the mean product of a company's outstanding shares multiplied with the stock closing price, on a daily level throughout the year. For any given year the company with the (on average) highest market value is given the weight $\omega = \frac{Max\ avg.market\ value}{Max\ avg.market\ value} = 1$ to all observations, while observations of a company with e.g. half the market value of the biggest company in the same market is given the weight $\omega = \frac{\mathbf{0.5} * Max\ avg\ market\ value}{Max\ avg\ market\ value} = 0.5$.

This annual weighting scheme is chosen to ensure that ex-dividend shares are not systematically underweighted, as would happen if we used the daily company market value as the observation weight due to how stock prices drop relative to the dividend size on the ex-date (see Kalay, 1982, p. 1059 - 1068). The annual observation weights are also chosen as they adapt to market developments, as a company's relative size changes over time.

We cluster standard errors at the company level with a cluster-robust variance matrix estimator, as recommended by Cameron and Miller (2015), to allow for heteroscedasticity in the error term. This also addresses the possibility that there may still be some serial correlation in the data that is not captured by the two-way fixed effects components in equation 4. The cluster-robust variance matrix is compatible with the fixed effects model, as demonstrated by Arellano (1987, p. 431–434).

3.4 Descriptive statistics

In this section, we provide descriptive statistics of the data samples. There is one sample for each reform, and the samples differ in size based on the reform-period, the number of companies examined, and the number of dividends distributed. Measures provided as a "mean" are weighted by company representation, where companies with more observations have more influence (this is controlled for with individual intercepts in the regression

model). We must therefore be careful not to read too much into these statistics. We do believe, however, that these statistics can be a good tool to paint a picture of share turnover development over time and across the different samples, as well as an approximation of average values, which we will use to put the forthcoming β1 and β2 coefficients in Chapter 4 into perspective.

Table 2: Descriptive statistics of the data samples

Data sample	**Companies**	**Observations**	**Dividend payouts**		**Mean share turnover outside the event-window *(%)***		**Mean share turnover in the event-window *(%)***	
			Pre-policy	**Post-policy**	**Pre-policy**	**Post-policy**	**Pre-policy**	**Post-policy**
Austria 2015	69	146 258	301	248	0.06430	0.07148	0.06143	0.06575
Austria 2019	61	118 404	216	201	0.07317	0.07213	0.07181	0.07423
Belgium 2019	92	292 980	796	379	0.07831	0.07529	0.12512	0.13139
Denmark 2016	89	275 250	422	511	0.15883	0.14898	0.17262	0.21289
Finland 2021	100	280 633	894	261	0.14845	0.12388	0.19088	0.15902
France 2019	100	319 782	1 070	335	0.23400	0.22589	0.26263	0.20055
Germany 2012	100	152 640	190	382	0.42498	0.32910	0.59766	0.37528
Germany 2016	100	273 740	397	672	0.33781	0.31458	0.33753	0.30329
Norway 2015	100	293 660	494	779	0.13032	0.14497	0.14614	0.19694
Total	*811*	*2 153 347*	*4 780*	*3 768*	-	-	-	-

Note: All numbers rounded to 5 decimal points.

4. Results

In this chapter, we provide the results obtained for each reform after applying the regression model equation 6, presented in Chapter 3, to the data samples. We start by providing a big-picture overview of all regression outputs and give a thorough explanation of how to interpret the results. After this, we analyze each reform individually in a country-specific analysis, accompanied by visual representations that illustrates the share turnover pattern around the ex-date.

4.1 Model output and overall results

Table 3 : Model output from regression model equation 6.

Reform	β_1: **Pre-policy abnormal trading**	β_2: **Reform effect**
Austria 2015	0.00038 *(0.0032)*	0.00381 *(0.0070)*
Austria 2019	0.00536 *(0.0063)*	0.00681 *(0.0071)*
Belgium 2019	0.01938 *** *(0.0027)*	-0.00097 *(0.0048)*
Denmark 2016	0.00700 *(0.0083)*	0.01019 *(0.0093)*
Finland 2021	0.04883 *** *(0.0070)*	-0.03829 *** *(0.0106)*
France 2019	0.02994 *** *(0.0028)*	-0.01851 *** *(0.0039)*
Germany 2012	0.39700 *** *(0.0487)*	-0.32574 *** *(0.0491)*
Germany 2016	0.06569 *** *(0.0058)*	-0.02327 *** *(0.0068)*
Norway 2015	0.01985 ** *(0.0069)*	-0.00600 *(0.0077)*
Method	*Fixed effects (WLS)*	*Fixed effects (WLS)*
Stock specific intercept α_i	*Company-level*	*Company-level*

Time adjusted dummy λ_t	*Date-level*	*Date-level*
Cluster-robust standard errors	*Company-level*	*Company-level*
		(Standard errors in parenthesis)

*Note: Regression model output (equation 6). Significance level illustrations indicating p-value intervals: 0 '***' 0.001, 0.001 '**' 0.01, 0.01 '*' 0.05, 0.05 '.' 0.1, and 0.1 ' ' 1, where e.g. '*' is to be understood as "p-value between 0.01 and 0.05", satisfying a significance level threshold of 5 percent.*

We explain how to interpret the coefficients presented in Table 3 in the upcoming subchapters.

4.1.1 The β1 coefficient – Abnormal trading around the ex-date

β1 is designed to test hypothesis H_0A, and serves as an estimate of the difference in share turnover between the event-window and the non-event observations in the pre-policy period. The model estimates increased trading within the event-window when β1 is positive. For instance, β1 is 0.397 for Germany 2012. This implies that the model estimates a 0.397 percent surge in share turnover (in absolute terms) for days within the event-window compared to the days outside of the window.

When β1 is statistically significant given a 5 percent significance level threshold, we classify the share turnover within the event-window as "abnormal". In such instances, we reject H_0A and have confidence that there is in fact a disparity in trading volume between event-window and non-event observations. Conversely, for a non-significant β1 coefficient as observed for Austria, the trading activity within the event-window is consistent with the share turnover outside the event, and the share turnover is considered normal. In such cases, we fail to reject hypothesis H_0A.

We find that there is a significant increase in share turnover in the pre-policy event-window in six out of nine data samples – Belgium, Finland, France, Germany 2012, Germany 2016, and Norway. We do not find evidence of increased trading around the ex-date in Austria or Denmark.

The interpretation of the β1 coefficient, representing the absolute percentage increase in share turnover, can be challenging without the proper context. To address this, we have

calculated how the share turnover in the event-window compares to the non-event trading period in relative terms. These calculations are provided in the second column of Table 4, and they are based on the descriptive statistics presented in Table 2 and the coefficient estimates from Table 3. For instance, referring to Table 4, the share turnover within the event-window was approximately 93 percent higher compared to the non-event share turnover before the 2012 reform in Germany. It is important to note that the calculations in Table 4 are influenced by the weighting scheme applied in the regression, and that this influence is not accounted for.

4.1.2 The β2 coefficient – The reform effects

The β2 coefficient evaluates the extent of which share turnover in the event-window changes relative to changes in the non-event normal trading volume, following the implementation of a new policy. Taking the case of Germany's event-window after the 2012 reform, the β2 coefficient indicates a decrease of 0.32574% in abnormal trading within the event-window compared to the pre-policy period. Consequently, the model estimates a remaining increase in trading during the event-window following the policy change of approximately 0.071% (calculated as 0.397% minus 0.326% = 0.071%). Whether this remaining increase in share turnover should be considered abnormal or not is not further analyzed in this thesis. When β2 is negative, the reform has led to a decrease in abnormal trading. We reject hypothesis H_0B when the β2 coefficient is significant given a p-value that satisfies a 5% threshold level. We are then confident that there has been a change in trading patterns, which we can attribute to the policy changes. We find evidence of reduced abnormal trading in the post-policy event-window for four out of the nine reforms: in Finland, France, Germany 2012, and Germany 2016.

The third column of Table 4 displays the relative percentage amount by which the reform impacted the abnormal share turnover during the event-window. For instance, an estimated 82% decrease in Germany after 2012 indicates that the reform successfully reduced abnormal share turnover in the event-window by 82% compared to pre-policy event-window trading. One should take this figure with a grain of salt, however, as we have not considered the standard errors, or the effect of the weighting scheme applied to the regression in these calculations. When the β1 coefficient is small, as observed in the case of Austria, the relative

size of the policy change effect can become misleadingly high. Results in Table 4 based on non-significant coefficients can be ignored. Results from significant coefficients are presented in bold text.

Table 4: Abnormal trading and policy change effects in relative terms.

Reform	Estimated abnormal trading pre-policy $\frac{\beta 1}{Mean\ share\ turnover\ outside\ event-window} * 100$	Estimated reform effect on abnormal trading $1 - \frac{\beta 1 + \beta 2}{\beta 1} * 100$
Austria 2015	0.59%	1002.63%
Austria 2019	7.33%	127.05%
Belgium 2019	**24.75%**	-5.00%
Denmark 2016	4.41%	145.57%
Finland 2021	**32.89%**	**-78.41%**
France 2019	**12.79%**	**-61.82%**
Germany 2012	**93.42%**	**-82.05%**
Germany 2016	**19.45%**	**-35.42%**
Norway 2015	**15.23%**	-3.22%

Note: Calculations from significant coefficients are written in bold text. This does not mean, however, that the estimates presented in this table can be considered significant.

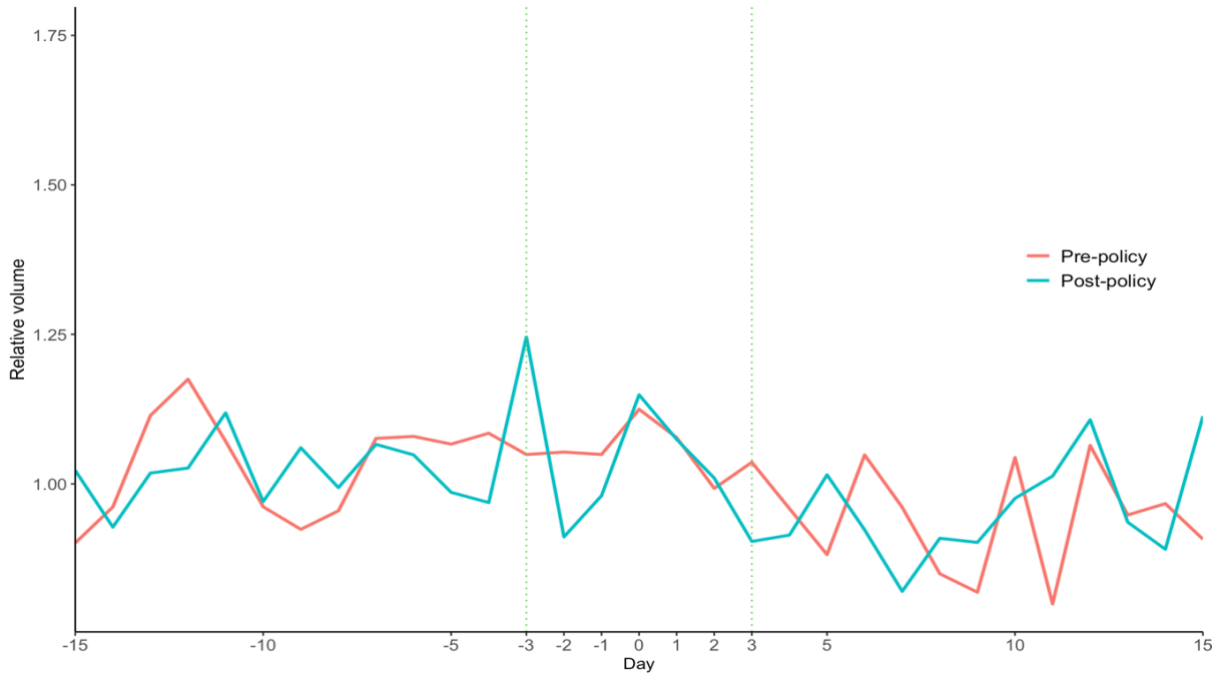
4.2 Country-specific analysis

We will now present a country-specific analysis of each individual reform, where we report and comment on key findings. Furthermore, we provide reform-specific graphs displaying the pre- and post-policy mean adjusted share turnover of each reform, which will aid in illustrating differences or consistencies in trading activity.

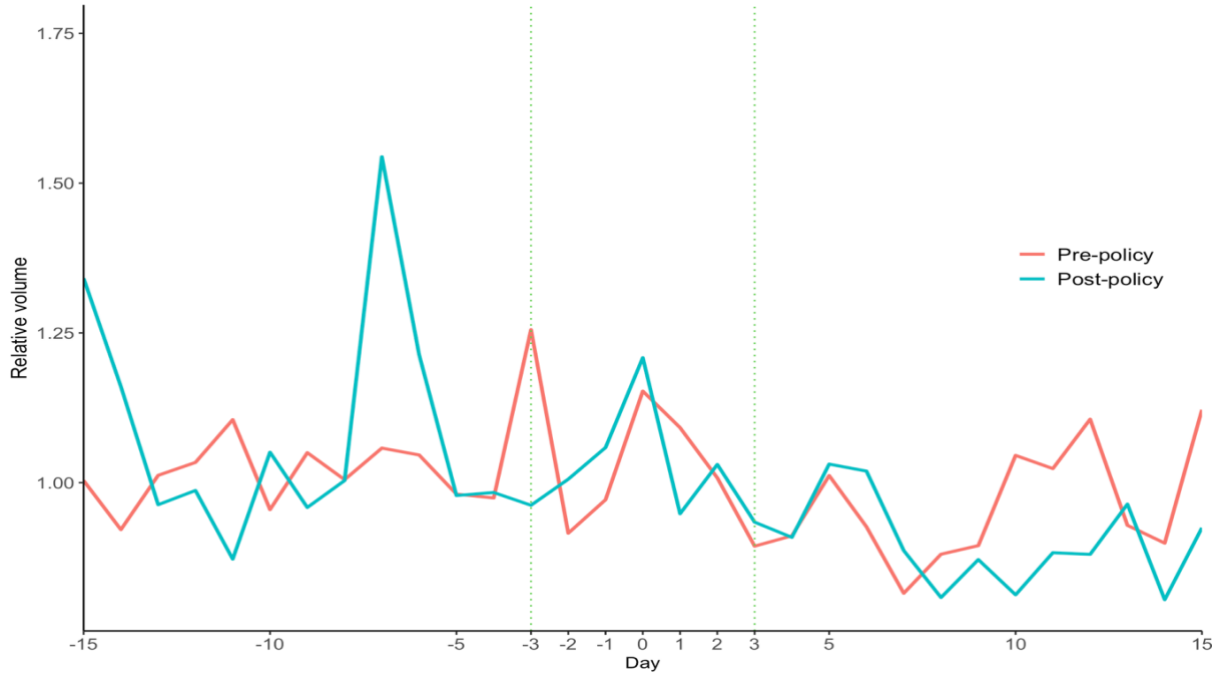
4.2.1 Austria

Austria introduced two reforms over the past decade to tackle WHT-schemes, which involved implementing additional documental requirements and modifying the repayment timing for withholding taxes. Our analysis results in non-significant β1 and β2 coefficients for both reforms, and we thus fail to reject H_0A and H_0B. Based on these findings, it appears that there have not been WHT-schemes in Austria. This is somewhat surprising, considering that the authorities have deemed it necessary to introduce two separate reforms to address such practices. According to Correctiv's report from 2021, the use of WHT-schemes resulted in a loss of approximately 1.2 billion euros for Austria. Although this is a significant sum, it pales in comparison to the estimated 36 billion euros lost in Germany. The trading may therefore be on such a small scale that it is not captured by our model. Another possibility for the lack of abnormal trading is that the WHT-schemes employed in Austria do not possess characteristics that can be detected in trading volume data.

In Graph 1 and Graph 2, we see how trading in the event-window does not, on average, stand out from the normal trading activity around the ex-dividend date. It does seem, however, like there is a noticeable spike on the ex-dividend date for all periods defined by both reforms in Austria. This may be consistent with some WHT-scheme trading, but it can also stem from other market mechanisms as accounted for in Chapter 2.5.



Graph 1: Mean-adjusted share turnover ratio, comparing data from Austria pre-policy (01.01.2010 – 31.12.2014) and post-policy (01.01.2015 - 31.12.2019). The graph is centered at the ex-date denoted day 0.

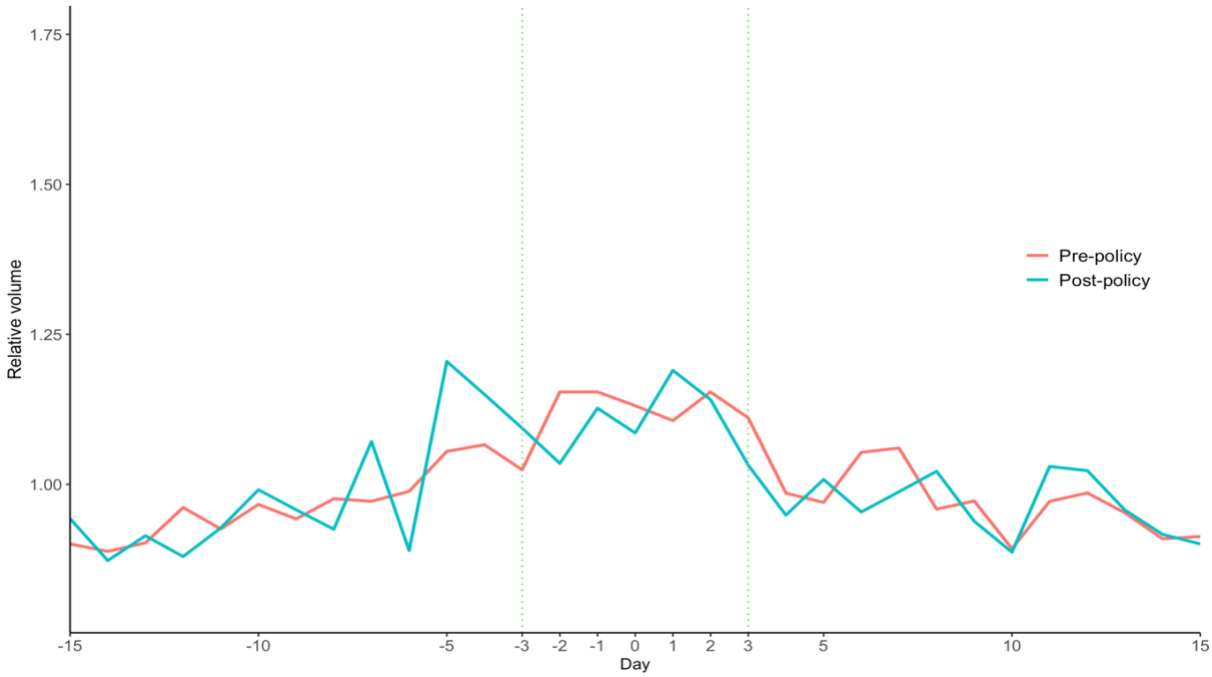


Graph 2: Mean-adjusted share turnover ratio, comparing data from Austria pre-policy (01.01.2015 – 31.12.2018) and post-policy (01.01.2019 - 31.12.2022). The graph is centered at the ex-date denoted day 0.

4.2.2 Belgium

We find evidence of abnormal trading in Belgium. In Table 4, we estimate a 24.75% increase in trading during the event-window pre-policy. From the non-significant β2 coefficient, it appears that the reform did not effectively mitigate this abnormal trading. A reason for this can be that one of the changes implemented in Belgium focused on beneficial ownership, which does not affect stock ownership. The other change in the reform solely targeted pension funds, and WHT-schemes could therefore still be possible for other actors. This could explain the sustained levels of trading activity in the event-window following the reform.

In Graph 3, illustrating share turnover around the ex-date in Belgium, we can see a "wave" of increased trading in the event-window, as confirmed by β1. This looks similar to the pattern we have expected to stem from cum-cum trading. The consistent surge in trading during the event-window is observed in both the pre- and post-policy periods, aligning with the non-significant β2 coefficient.



Graph 3: Mean-adjusted share turnover ratio, comparing data from Belgium pre-policy (01.01.2010 – 21.01.2019) and post-policy (22.01.2019 - 31.12.2022). The graph is centered at the ex-date denoted day 0.

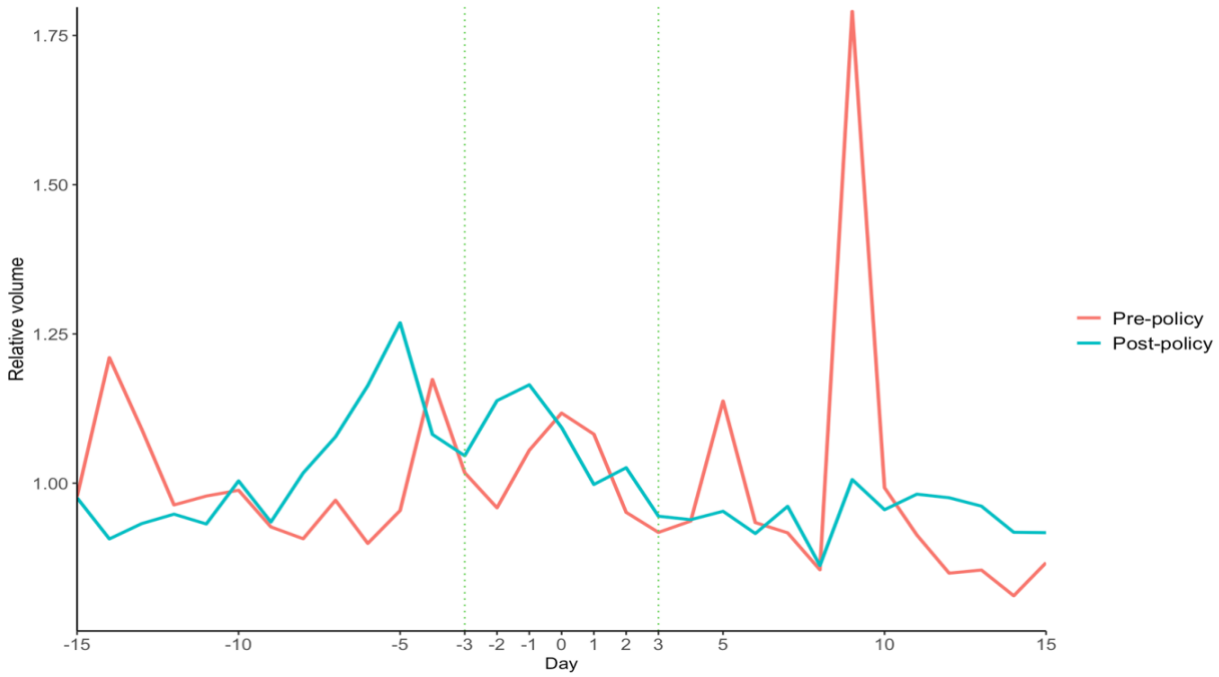
4.2.3 Denmark

Our analysis gives no indications of WHT-schemes being performed in Denmark. The fact that there is no noticeable increase in trading activity during the event-window is surprising, particularly considering the significant media attention and the academic literature devoted to the CumEx scandal in Denmark.

There are, however, two plausible explanations for the absence of the expected uptick in trading activity around the ex-dividend day: 1) There was a popular cum-ex variant in Denmark, known as cum-fake, that involved the creation of fraudulent documentation to falsely establish ownership and dividend pay-outs. These fabricated documents were submitted to the Danish tax authorities in order to claim repayment of divided taxes (Wigan, 2019). As no real shares were involved in the scheme, it would not be reflected in trading volume data such as ours. 2) Cum-cum schemes in Denmark have traditionally utilized share-lending, as shown by Casi et al. (2022), and have therefore not involved the selling and buying of shares. WHT-schemes conducted through share lending will not appear in trading volume data.

After implementing the reform, that focused on strengthening the administration of dividend refunds and introducing beneficial ownership, there was no notable alteration in share turnover in Denmark. The β2 coefficient is non-significant, and we fail to reject H_0B. This conflicts with the conclusions reached by Casi et al. (2022), who argue that cum-cum trading was eliminated by the Danish reform. Danish tax expert Rasmus Corlin Christensen argues that although the reform in Denmark addressed and stopped cum-cum through share-lending, it did not fully resolve the issue of cum-cum through selling and buying operations on the open market (Johannes Bangum, personal communication, February 10, 2023). Investors who used to perform cum-cum through lending pre-policy may therefore have advanced to do cum-cum through selling and buying. Considering this, it is noteworthy that the β2 coefficient, while not statistically significant, is positive.[12]

[12] We comment further on this issue in the appendix attached to the thesis.

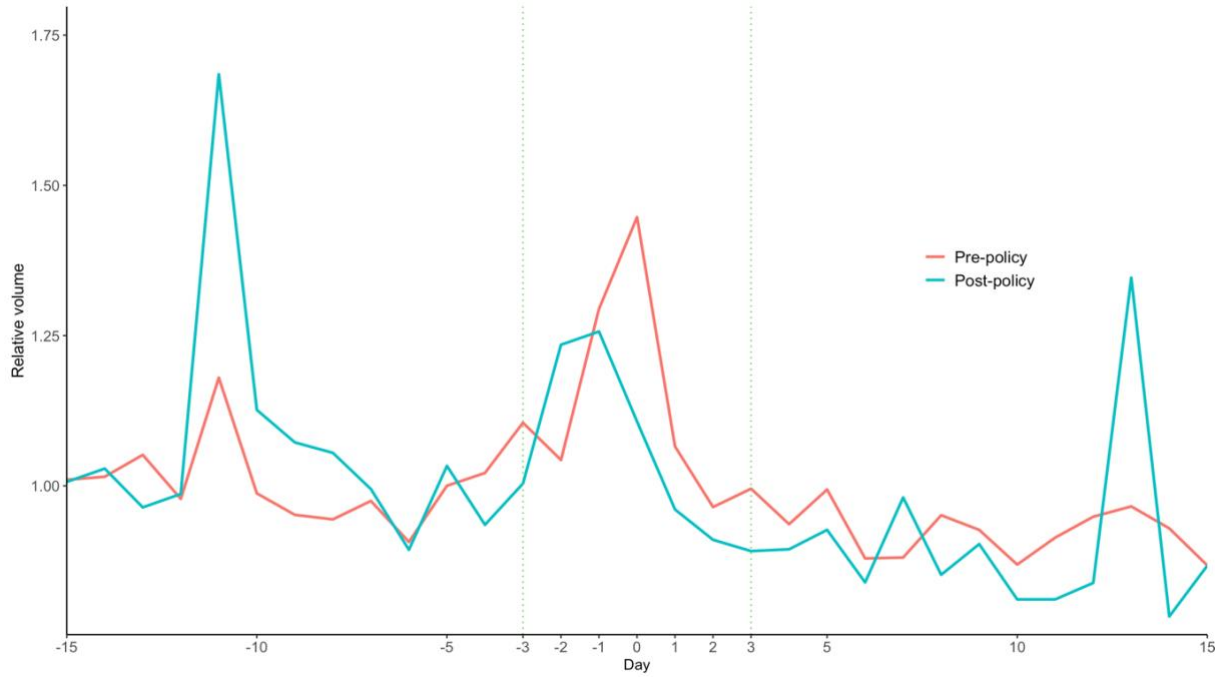


Graph 4: Mean-adjusted share turnover ratio, comparing data from Denmark pre-policy (01.01.2010 – 16.03.2016) and post-policy (17.03.2016 - 31.12.2022). The graph is centered at the ex-date denoted day 0.

4.2.4 Finland

The β1 coefficient indicates a statistically significant increase in share turnover during the event-window prior to reform in Finland. Table 4 estimates that the increase in share turnover is approximately 33%. The β2 coefficient for the post-policy share turnover is negative and statistically significant. There was an estimated drop in event-window abnormal trading of 78% following the policy change. This is quite a substantial decrease, and it suggests that the TRACE-reform had its desired effects.

We note that there are several spikes in trading volume outside of the event-window after the reform, which appear in Graph 5. The post-policy period in this case only contains two years of data, which makes the graph sensitive to events and outliers that could cause these random spikes. We can see an increase in trading volume in the event-window along with a relative decrease after the reform, as confirmed by the regression coefficients.

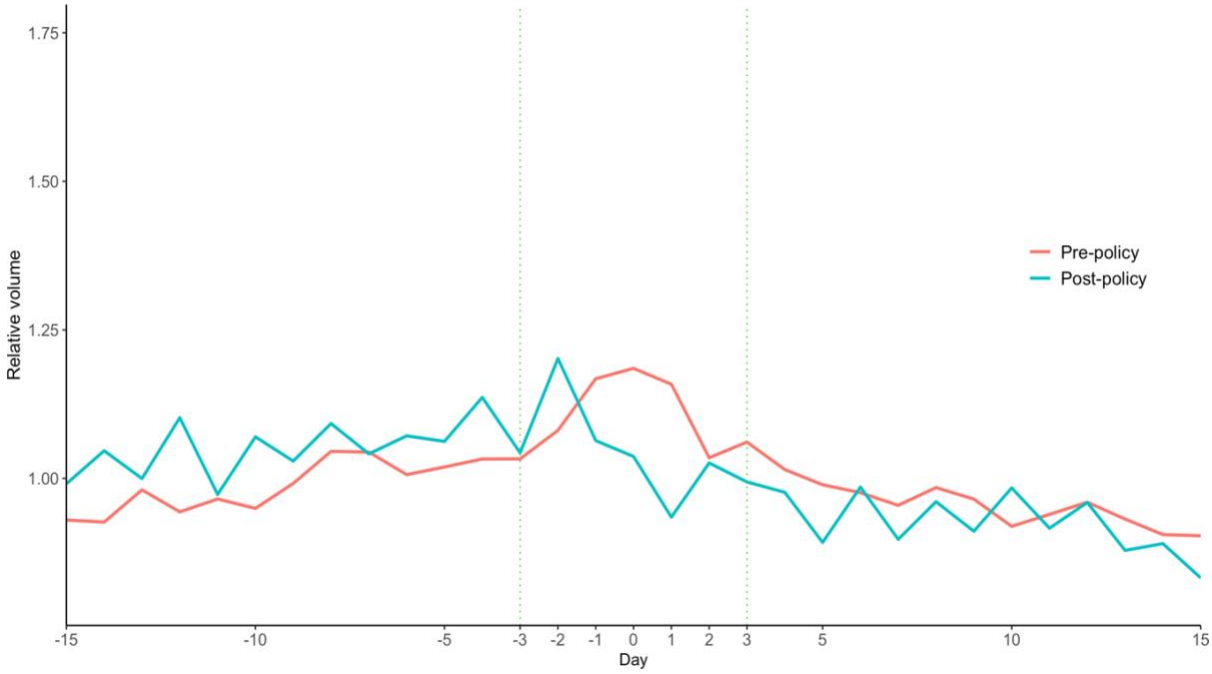


Graph 5: Mean-adjusted share turnover ratio, comparing data from Finland pre-policy (01.01.2010 – 31.12.2020) and post-policy (01.01.2021 - 31.12.2022). The graph is centered at the ex-date denoted day 0.

4.2.5 France

The β1 coefficient indicates a statistically significant uptick in share turnover in the event-window. Further, the significant β2 coefficient estimates a decrease in abnormal trading volume in event-window following the 2019 reform. Based on these results, we reject both H_0A and H_0B, and conclude that the reform, which introduced a minimum holding period of 45 days for shares as a requirement to qualify for a DWT refund, has been successful in reducing the extent of WHT-schemes in France. Table 4 shows an estimated 13% increase in trading in the pre-policy event-windows. After the policy change, there is an estimated drop in event-window abnormal trading of around 62%.

Graph 6 reveals a slight increase in trading in the pre-policy period and how this increase seems to disappear in the post-policy period, in accordance with the regression model outputs for France.



Graph 6: Mean-adjusted share turnover ratio, comparing data from France pre-policy (01.01.2010 – 30.06.2019) and post-policy (01.07.2019 - 31.12.2022). The graph is centered at the ex-date denoted day 0.

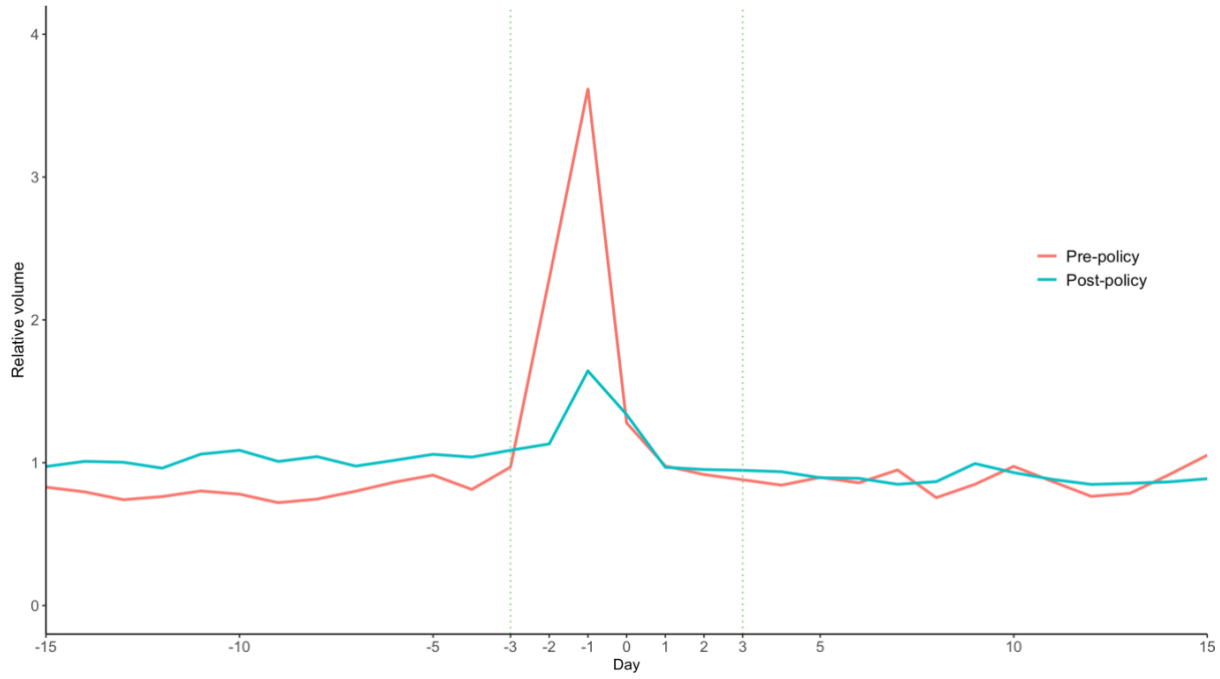
4.2.6 Germany

The 2012 reform:

We examine data from 2010 to 31.12.2015 for the German 2012 reform. The regression model β1 coefficient output gives clear evidence that Germany was heavily affected by WHT-schemes before the reform in 2012. There was an estimated 93.4% increase in share turnover during the pre-policy event-window. The β2 coefficient indicates a significant drop in abnormal trading of 82% following the 2012 reform. We reject both H_0A and H_0B for this reform. The replacement of the debtor principle with the paying agent principle proved highly effective in reducing cum-ex activities in Germany. However, we note that there was still a significant amount of abnormal trading in the event-window in the period 2012-2016, as can be seen from the significant β1 coefficient from the 2016 reform as well as visually in Graph 7. The graph also illustrates how extensive the pre-policy abnormal trading was in the event-window in Germany before 2012, as we have had to expand the y-axis compared to the similar graphs of other reforms to capture the whole spike in average share turnover.

Given the purported impossibility of traditional cum-ex schemes after the 2012 reform (Correctiv, 2021), the remaining heightened activity in the event-window post-policy is

likely attributable to cum-cum trading or unconventional variations of cum-ex schemes. If the spike between 2012 and 2016 is cum-cum trading, we register that the scheme leaves a somewhat different pattern than what we have originally assumed. It would then appear that cum-cum transactions are primarily executed on the ex-dividend day and the cum-date, rather than on the other days within the event-window. We address this observation in Chapter 5.

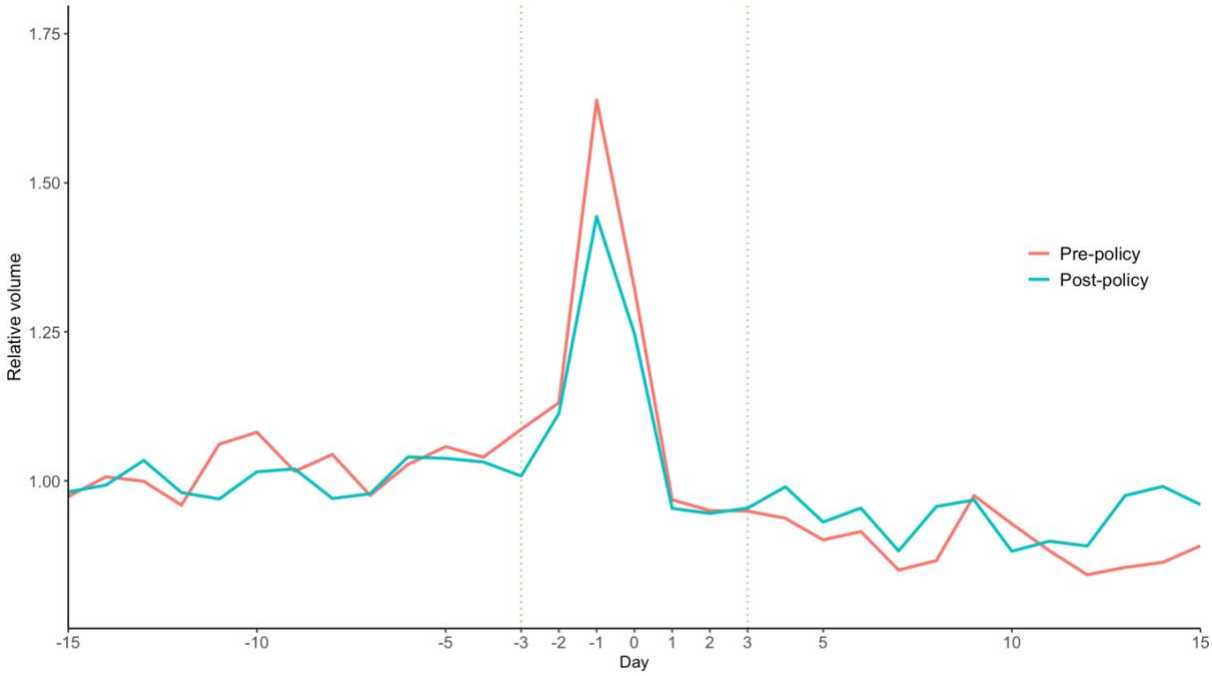


Graph 7: Mean-adjusted share turnover ratio, comparing data from Germany pre-policy (01.01.2010 – 31.12.2011) and post-policy (01.01.2012 - 31.12.2015). The graph is centered at the ex-date denoted day 0. Note: This plot uses a different scale on the y-axis than other, similar plots.

The 2016 reform:

For the German 2016 reform, we examine data from 2012 to 2022. We find that there is an increase in trading activity in the event-window, given the significant and positive β1 coefficient. We therefore reject hypothesis H_0A. The model estimates a 19.4% increase in trading during the event-window, compared to non-event days. The β2 coefficient is also significant, and we reject H_0B with the model estimating a 18% decrease in abnormal trading in the event-window after the 2016 reform. Graph 8 shows a decrease in share turnover on the cum-date following the 2016 reform. The reform, in which they introduced a minimum holding period, clearly had some effect. However, Germany still experienced a

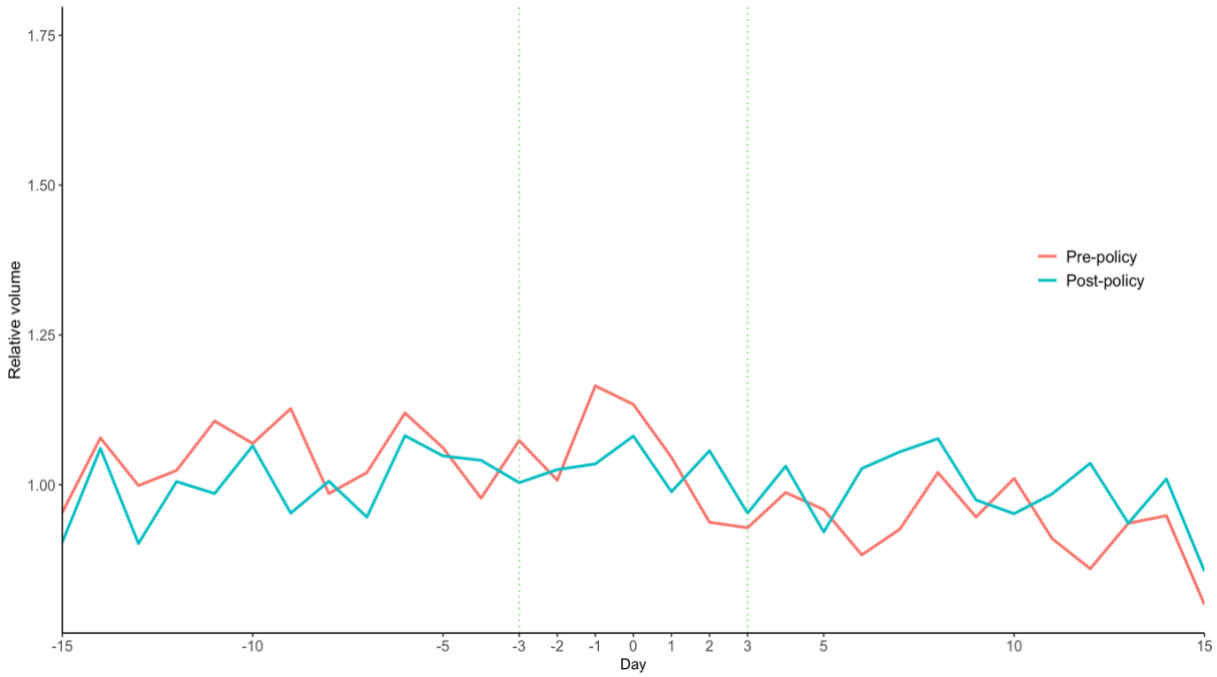
clear spike in the event-window trading even after the policy change in 2016. This suggests that the reform may not have effectively eliminated all WHT-schemes.



Graph 8: Mean-adjusted share turnover ratio, comparing data from Germany pre-policy (01.01.2012 – 31.12.2015) and post-policy (01.01.2016 - 31.12.2022). The graph is centered at the ex-date denoted day 0.

4.2.7 Norway

The β1 coefficient for Norway reveals a significant increase in pre-policy event-window trading. We therefore reject H_0A. The model estimates that there was an increase in average share turnover of 15% in the event window compared to the non-event days. Prior to the policy change in 2015, which involved implementing stricter control over the tax rebate system, Norway witnessed a slight increase in trading activity on both the ex-dividend day and the cum-date, as depicted in Graph 9. This pattern resembles the trading behavior typically associated with cum-ex trading. This spike seems to disappear in the post-policy period. Despite this, the change in share turnover during the event-window after the policy change is not statistically significant, and we fail to reject H_0B.



Graph 9: Mean-adjusted share turnover ratio, comparing data from Norway pre-policy (01.01.2010 – 31.08.2015) and post-policy (01.09.2015 - 31.12.2022). The graph is centered at the ex-date denoted day 0.

5. Final discussion and conclusions

Having presented the results in Chapter 4, we want to direct our attention to an important question of interest before we provide our conclusive answers to the research question. We start by discussing the assumed connection between abnormal trading activity and WHT-schemes. To address this, we present an alternative model that incorporates a modified event-window, influenced by the trading patterns observed in Chapter 4.2. We also include the United Kingdom as a control group to compare its trading pattern around the ex-dividend day with that of our countries of interest. Subsequently, we address the research question of this thesis to give our final answers. In closing, we direct our attention towards future researchers and tax authorities, where we present what we consider to be the limitations of this thesis and give our recommendations for future research aimed at advancing the WHT-literature.

5.1 To what extent can abnormal trading be attributed to WHT-schemes?

We have found evidence of abnormal trading around the ex-date in several markets. However, we feel the need to explore the relationship between this abnormal trading and WHT-schemes further to establish whether the trading can be attributed to WHT-schemes.

The country most affected by WHT-schemes in the CumEx scandal was Germany. Upon examining the graphs presented in Chapter 4.2, it becomes evident that the abnormal trading observed in the other countries pales in comparison to the magnitude of abnormal trading witnessed in Germany between 2010 and 2012. For instance, France witnessed around a 13% rise in trading activity before the reform, in contrast to Germany's 93% increase. It is thus possible that France's upturn could be attributed to other market mechanisms, as explored in chapter 2.5. Hence, drawing a definitive conclusion regarding whether the abnormal trading witnessed in other countries can be attributed to WHT-schemes is challenging. To shed light on the relationship between the observed abnormal trading and WHT-schemes, we discuss two key points of interest in the following subsections.

5.1.1 An alternative event-window

Upon visual analysis of the graphs provided for each reform in Chapter 4.2, it seems like abnormal trading activity is primarily concentrated on the ex-dividend day and the cum-date immediately preceding it (days [-1,0]). This observation is especially prevalent in Germany, where the presence of WHT-schemes is undisputed.

This trading pattern can reasonably be attributed to both cum-ex and cum-cum schemes. As seen in the graph from the German 2012 reform, we can infer that the short-sale that occurs in a cum-ex scheme seems to mostly occur on the cum-date, and not on day [-2] as in the example provided in Chapter 2.3. After the reform in Germany 2012, cum-ex was supposedly not feasible in Germany. Yet, the post-policy trading pattern of abnormal spikes on the ex-date and the cum-date is consistent, although reduced. Hence, if we assume the post-2012 abnormal trading to be cum-cum trading, we may have overestimated the duration of the cum-cum 'window'. This assertion seems reasonable since the two days mentioned represent the final and initial days when shares are traded with and without dividend rights, respectively. Minimizing the time gap between trading operations in a cum-cum transaction will mitigate equity risks, and it seems reasonable for investors to take this approach. This suggests that the event-window we have defined in our model may be too wide to fully capture the effect of WHT-schemes.

Considering these arguments, we explore an alternative model with only the ex-dividend day and the cum-date in the event-window. We have conducted an analysis that incorporates this narrow event-window, which ranges the days [-1,0] with the ex-date denoted day 0. Apart from this, the model, the data, and its interpretation remain identical to those of regression model equation 6 in Chapter 3.3. The purpose of this model is to explore whether the apparent German trading pattern is also present in other countries. The alternative model output is presented in Table 5.

Table 5: Alternative model regression equation 6 output.

Reform	β_1: **Pre-policy abnormal trading**	β_2: **Reform effect**
Austria 2015	0.00855	-0.00647
	(0.0053)	*(0.0088)*
Austria 2019	0.00310	0.02225 **
	(0.0067)	*(0.0086)*
Belgium 2019	0.01991 ***	-0.00034
	(0.0031)	*(0.0055)*
Denmark 2016	0.02305 *	0.00605
	(0.0111)	*(0.0134)*
Finland 2021	0.09982 ***	-0.06497 ***
	(0.0126)	*(0.0191)*
France 2019	0.05586 ***	-0.03881 ***
	(0.0054)	*(0.0074)*
Germany 2012	0.89160 ***	-0.7119 ***
	(0.1243)	*(0.1250)*
Germany 2016	0.17064 ***	-0.06776 ***
	(0.0131)	*(0.0152)*
Norway 2015	0.03917 ***	-0.01445
	(0.0110)	*(0.0132)*
Method	*Fixed effects (WLS)*	*Fixed effects (WLS)*
Stock specific intercept $\boldsymbol{a_i}$	*Company-level*	*Company-level*
Time adjusted dummy λ_t	*Date-level*	*Date-level*
Cluster-robust standard errors	*Company-level*	*Company-level*
		(Standard errors in parenthesis)

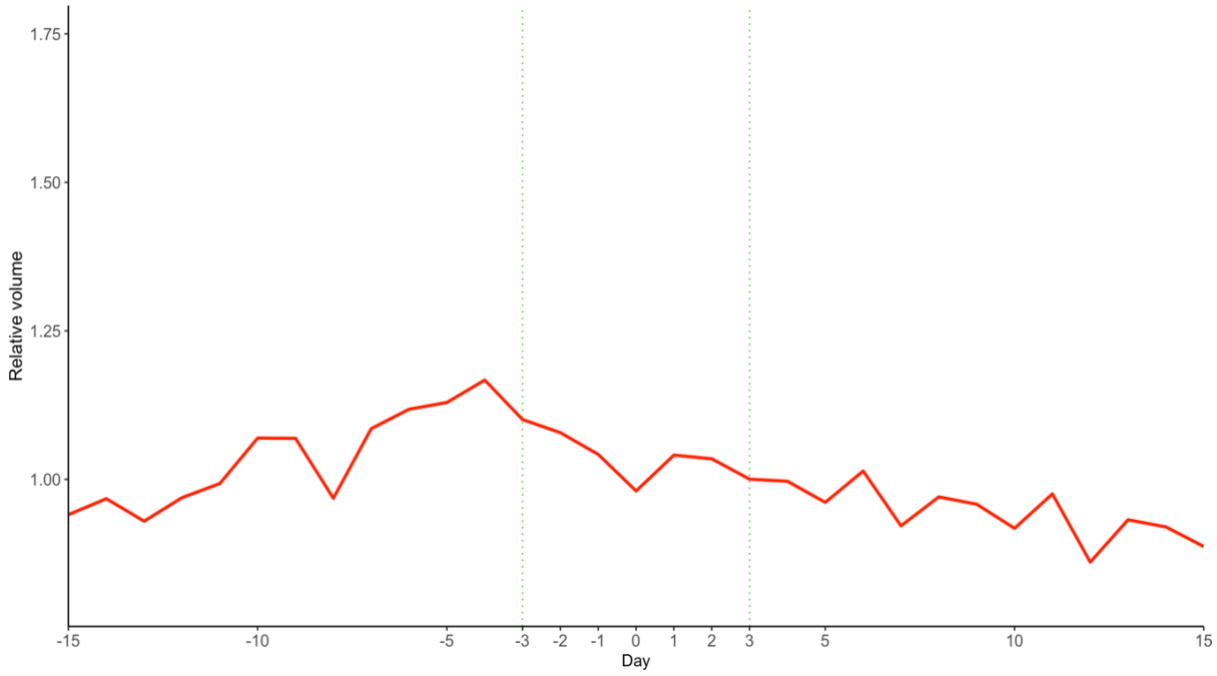
*Note: Significance level illustrations indicating p-value intervals: 0 '***' 0.001, 0.001 '**' 0.01, 0.01 '*' 0.05, 0.05 '.' 0.1, and 0.1 ' ' 1, where e.g. '*' is to be understood as "p-value between 0.01 and 0.05", satisfying a significance level threshold of 5 percent.*

In most cases, the alternative model generates considerably higher coefficients than before. For instance, Finland's β_1 coefficient is 0.09982 in contrast to 0.04883 in the original model, representing more than twice the abnormal trading detected by the original model. Similarly, other countries now have coefficients that have more than doubled in this new model.

Furthermore, Denmark's β_1 coefficient is now statistically significant. This alternative model demonstrates a further increase in abnormal trading around the ex-date.

5.1.2 Abnormal trading in the United Kingdom

To further examine whether this increased trading is due to WHT-schemes, we investigate trading around ex-dividend day in the UK. WHT-schemes are not feasible in the UK, as the country does not levy DWT (PWC, 2023). We can thus use the UK as a control group to which we can visually compare whether the trading pattern around the ex-dividend day is different from the countries that levy a DWT. Graph 10 depicts minimal to negligible abnormal trading activity in the UK in the event-window [-3,3]. We observe a decline in trading activity within the alternative event-window [-1,0]. This stands in stark contrast to the trading patterns observed in most of the countries analyzed in this thesis.



Graph 10: Mean-adjusted share turnover ratio, displaying data from The United Kingdom 01.01.2010 – 31.12.2022. The graph is centered at the ex-date denoted day 0.

5.1.3 Summing up

By comparing the alternative model output with the UK trading graph, our confidence is reinforced in the assertion that the abnormal trading volumes surrounding the ex-dividend

date can be attributed, at least partially, to WHT-schemes. The alternative model specifically builds on the abnormal trading behavior found in Germany, where WHT-schemes are well documented. Although less distinct, this trading pattern echoes in the patterns observed in other countries examined in this thesis, where a peak in share turnover in the alternative event-window is prevalent. This trading pattern is quite different from what we observe in the UK, where WHT-schemes are not feasible. We therefore infer that increased abnormal trading correlates with increased WHT-scheme activity.

5.2 Conclusions

In this this thesis, we set out to explore WHT-schemes by answering the following research question: *Is there evidence of abnormal trading volumes around the ex-dividend day, and is this affected by the implementation of tax policy changes to prevent WHT-schemes?* This research question can be considered two separate questions to which we want to give our final answer accordingly, where we first address whether we find evidence of abnormal trading, before we comment on the effect of policy changes. This aligns with the structure of the two separate hypotheses we explore in the thesis, and the two different beta coefficients we have estimated.

Regarding the question of whether there is abnormal trading around the ex-dividend day, we find evidence that Belgium, Finland, France, Germany, and Norway had abnormal trading around the ex-dividend day before policy implementations. When we apply a narrower event-window, as is the case with the alternative model, there is also evidence of abnormal trading around the event-window in Denmark. The abnormality is, without exceptions, an increase in share turnover, which means that there is increased trading activity around the ex-dividend date. We find no evidence of abnormal trading around the ex-dividend date in Austria.

To assess the effect of policy implementations to combat WHT-schemes, we have analyzed changes in how trading activity in the event-window relates to non-event trading before and after a policy is implemented. We observed a decrease in abnormal share turnover in Finland, France, and Germany (both in 2012 and 2016). The reform in Germany 2012 has proved most effective, with an estimated drop in abnormal trading of 82.05%, while the

Finnish “TRACE" reform is estimated to be the second most effective. The reform in Finland differs from the others as it was designed by the OECD, and it is therefore of special interest. Finland is the first country to test this system, and it is therefore especially interesting that this reform seems to have been successful.

We estimate that Germany 2016 and France experienced a drop in abnormal trading after their respective reforms. It is noteworthy that both reforms included a minimum holding period of 45 days to qualify for full WHT reimbursement. This type of reform will have an impact not only on WHT-schemes but also on dividend capture strategies like dividend stripping. Rational investors without special strategies relating to dividends will also be affected as their incentives to hold shares for longer periods are changed. Hence, the reduction in share turnover is probably not limited to reduced WHT-schemes.

The reforms implemented in Austria, Belgium, Denmark, and Norway do not appear to have had an impact on trading volumes. As mentioned, Belgium and Norway experienced significant abnormal trading before the reforms. Belgium introduced a "beneficial ownership" reform that required ownership of the stock to obtain a tax advantage. As previously mentioned with Denmark, this may lead to a rise in abnormal trading within the event window as investors attempt to engage in cum-cum trades through share purchases and sales, rather than relying on share lending. This could explain the absence of a decline in abnormal trading following the reform in Belgium. Regarding Norway, it is unclear whether the "reform" in 2015 can be regarded as a genuine one. Our understanding of the supposed reform is based on comments made by the former head of the Norwegian tax agency in interviews, as there are no official documentation available outlining Norway's efforts to tackle WHT-schemes. Nonetheless, we can infer that the “reform” did not reduce abnormal trading.

5.3 Future research

We firmly believe that this thesis provides valuable insights into the occurrence, extent, and prevention of WHT-schemes. That being said, we do not claim to provide a holistic view of the matter. WHT-schemes may reveal themselves in manners beyond the scope of this thesis, as seen in the different approaches from the diverse literature presented in Chapter 1.2.

For future research, we would advise analyzing not only trading volume data but also, e.g., share lending data, OTC transaction data, and even single stock futures. We have seen from previous studies that these are alternative data sources where WHT-schemes might reveal themselves, and it is conceivable that there are several more options to explore. Since WHT-schemes can unfold themselves through multiple different means of transactions, the problem of WHT-schemes cannot be narrowed down to a single stream of data. Instead, we find that the WHT-literature needs a comprehensive study where multiple types of data are analyzed simultaneously. Multiple sources of data will also have to be considered in order to measure the full effect of policy changes against WHT-schemes, beyond what we provide in this thesis.

Furthermore, much of the existing literature on cum-ex is based on the schemes utilized in Germany prior to 2012. Our ability to detect WHT-schemes relies on the increased number of transactions around ex-dividend day. If alternative WHT-schemes do not involve such transactions, they will go unnoticed. We therefore suggest that future researchers dive into the inner workings of alternative, nationally adapted cum-cum and cum-ex schemes. The discovery of cum-fake transactions in Denmark serves as an example, highlighting the potential existence of other, unknown variations of WHT-schemes. This calls for extensive qualitative and quantitative research to gain valuable insights and knowledge.

The literature on WHT-schemes has come a long way. As stated at the start of this thesis, however; “the arsenal of evasion techniques is highly adaptable, and constant innovation outpaces the ability of authorities to take counteractive measures” (Zingales, 2015). Researchers and tax authorities must therefore continue to work tirelessly to stay abreast of current and future developments in tax evasion strategies. The schemes we should be most worried about are likely not the ones presented in this thesis. Instead, it is the undiscovered and yet-to-be-invented schemes that have the potential to lead to even more severe consequences.

Bibliography

Al-Yahyaee, K. H., Pham, T. M., & Walter, T. S. (2011) 'The Information Content of Cash Dividend Announcement In a Unique Environment' *Journal of Banking & Finance*, 35, 606- 612

Arellano, M. (1987). Practitioners' Corner: Computing Robust Standard Errors for Within-groups Estimators. Oxford Bulletin of Economics and Statistics, 49 (4), 431-434.

Baltagi, B. H. (2005). Econometric analysis of panel data. West Sussex: John Wiley & Sons Ltd.

Bergløff, C, B., Creed, I., Sættem, J., & Vartal, R., (2018, 18 October) 'Norge rammet av europeisk skatteskandale' Retrieved from https://www.nrk.no/urix/norge-rammet-av-europeisk-skatteskandale-1.14253588

Biørn, E. (2017). Econometrics of panel data. Oxford: Oxford univerity press.

Buettner, T., Holzmann, C., Kreidl, F., & Scholz, H. (2020). Withholding-tax nin-compliance: the case of cum-ex stock market transactions. International tax and publick finance, 27, 1425 - 1452, https://doi.org/10.1007/s10797-020-09602-9

Cameron, A. C., & Miller, D. L. (2015). A Practitioner's Guide to Cluster-Robust Inference. Journal of Human Resources, 50(2):317–372.

Casi, E., Gavrilova, E., Murphy, D., & Zoutman, F. (2022, 18 February) 'Welfare effect of Closing Loopholes in the Dividend-Withholding Tax: The Case of Cum-cum and Cum-ex Transactions. Retrieved from https://openaccess.nhh.no/nhh-xmlui/handle/11250/2980688

Ciuara, B., Morris, D., & Reynolds, B. (2022, 22 September) 'The Dividend Payment Procedure Explained' Retrieved from https://www.suredividend.com/dividend-payment-process/

Correctiv. (2021, 21 October). CumEx Files 2.0 – 'The outrageous tax fraud goes on' Retrieved from https://correctiv.org/en/latest-stories/2021/10/21/cumex-files-2/

Dalsbø, O, A., & Solli, H. (2019) 'Tax-motivated Trading in the Scandinavian Countries' Retrieved from https://openaccess.nhh.no/nhh-xmlui/bitstream/handle/11250/2647155/masterthesis.pdf?sequence=1

Dasilas, A. (2007, 30 April) 'Ex-Dividend Day Stock Price Anomaly: Evidence from Greece' Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=981863

ESMA. (2020, 23 September) 'Final Report On Cum/Ex, Cum/Cum and withholding tax reclaim schemes'
Retrieved from https://www.esma.europa.eu/sites/default/files/library/esma70-155-10272_final_report_on_cum_ex_and_other_multiple_withholding_tax_reclaim_schemes.pdf

Frank, M., & Jagannathan, R. (1998) 'Why do stock prices drop by less than the value of the dividend? Evidence from a country without taxes,' *Journal of Financial Economics* 47, pp. 161–188.

Henry, T, R., & Koski, J, L. (2016) 'Ex-Dividend Profitability and Institutional Trading Skill' *Journal of Finance, Forthcoming.* Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2410534

Jensen, M, N., & Lassen, S, H. (2019) 'Cum-Ex Transactions in European Countries' Retrieved from https://openaccess.nhh.no/nhh-xmlui/handle/11250/2609772?locale-attribute=en

Kalay, A. (1982). "The Ex-Dividend Day Behavior of Stock Prices: A Re-Examination of the Clientele Effect". *The Journal of Finance*, Sep., 1982, Vol. 37, No. 4 (Sep., 1982), pp. 1059-1070. Published by: Wiley for the American Finance Association. DOI: https://doi-org.ezproxy.nhh.no/10.1111/j.1540-6261.1982.tb03598.x

Kromann-Reumert. (2021) 'Danish tax year 2020 in review' Retrieved from https://kromannreumert.com/files/media/document/EN percent20-percent20Danish percent20tax percent20year percent202020 percent20in percent20review percent20- percent20Februar percent202021.pdf

Lakonishok, J., & Vermaelen, T. (1986) 'Tax induced trading around ex-dividend days' *Journal of Financial Economics 16*, pp. 287–320.

Laturnus, V., Reichel, A,. & Wahrenburg, M. (2022, 30 April). 'Spillovers of cum-ex and cum-cum trading with single stock futures'
Retrived from: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3929997

Michaely, R., & Vila J (1995): 'Investors' heterogeneity, prices and volume around the ex-dividend day' *Journal of Financial and Quantitative Analysis 30,* pp. 171–198.

Milanez, A. (2017). OECD Taxation working papers, 32. Legal tax liability, legal remittance responsibility and tax incidence: Three dimensions of business taxation. Paris: OECD, https://dx.doi.org/10.1787/e7ced3ea-en

Milanos, N, T., & Travlos, N, G. (2021) 'The Ex-Dividend Day Stock Price Behavior in the Athens Stock Exchange'
Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=274080

Miller, M. H., & Modigliani, F. (1961): 'Dividend policy, growth, and the valuation of shares', *Journal of Business 34*, pp. 411-433.

Mitterlehner, M. (2022, 21 December) 'Consequences of the Cum-Ex Trades on WHT refund and relief in Austria'. Retrieved from https://wts.com/global/publishing-article/20221221-austria-consequences-of-the-cum-ex-trades-on-wht-refund-and-relief~publishing-article?language=en

Nicol, D (2021, 1 March) 'Cum-ex tax loophole isn't closed warns German tax expert' Retrieved from https://www.securitiesfinancetimes.com/serviceproviders/serviceproviderarticle.php?article_id=224579&articletype=In percent20the percent20news&companyname=ION&page=60&navigationaction=Service percent20providers&provider_id=148

OECD. (2023, Januar 30). Standard withholding tax rates. Stats OECD. Retrieved from: https://stats.oecd.org/Index.aspx?DataSetCode=WHT

Osborne, J. W., & Waters, E. (2002). Four assumptions of multiple regression that researchers should always test. Practical Assesment, Research and Evaluation - Volume 8.

Oxfam. (n.d) 'Inequality and poverty: the hidden costs of tax dodging'
Retrieved from https://www.oxfam.org/en/inequality-and-poverty-hidden-costs-tax-dodging

PWC. (2023) 'Withholding tax (WHT) rates' Retrieved from http://taxsummaries.pwc.com/ID/Withholding-tax-(WHT)-rates

Raquest. (n.d.). 'TRACE – Tax Relief and Compliance Enhancement'. Retrieved from. https://raquest.de/en/trace/

Riis, A. (2020, 10 June) 'Denmark – New withholding tax regime for dividend proposed' Retrieved from https://www.bdo.dk/en-gb/insights/tax-and-vat/denmark-new-withholding-tax-regime-for-dividend-proposed

Schreiber, U. (2013). International compoany taxation - An introduction to the legal and economic principles. Mannheim: Springer.

Shotter, J (2016, 11 May) 'Commerzbank to stop offering cum/cum trades' Retrieved from https://www.ft.com/content/741df8aa-178f-11e6-b197-a4af20d5575e

Slemrod, J. (2008). Does it matter who writes the check to the government? The economics of tax remittance. National tax journal, 61(2), 251-275. https://doi.org/ 10.17310/ntj.2008.2.05

Spengel, C. (2016). 'Sachverständigengutachten nach § 28 PUAG für den 4. Untersuchungsausschuss der 18. Wahlperiode' Retrieved from https://www.bundestag.de/blob/438666/15d27facf097da2d56213e8a09e27008/sv2_spengel- data.pdf

UN. (2016, 21 October). 'Tax evasion industry shocking says UN expert' Retrieved from https://news.un.org/en/audio/2016/10/618552

Vold, N. (2017, 27 November) 'Nye dokumentasjonskrav for krav om redusert kildeskatt på utbytte fra norske selskaper' Retrieved from https://wiersholm.no/publikasjoner/nye-dokumentasjonskrav-for-krav-om-redusert-kildeskatt-pa-utbytte-fra-norske-selskaper/

Wagner, M., & Wei, X. (2022, 16 November) 'Ex-dividend day price and volume: the case of cum-ex trading'. *Applied Economics*, Retrieved from 10.1080/00036846.2022.2141450

Wigan, D (2019 September) 'Case Study: The Cum-Cum and Cum-Ex Schemes' Retrieved from http://coffers.eu/wp-content/uploads/2020/03/D4.5-Case-Study.pdf

Zingales, L (2015) 'Presidential address: Does finance benefit society*?' The Journal of Finance 70(4*), 1327–1363

Appendix

Does size really matter?

We build our thesis on several strong assumptions relating to how WHT-schemes reveal themselves in trading data. We do, for instance, expect a given trading pattern from both cum-cum and cum-ex trading. These expected patterns are taken from previous literature that mostly builds on the well-documented German WHT-scheme methods, but they do not necessarily transfer to WHT-schemes in other countries (such as the Danish cum-fake variant). Based on the German methods, we also assume that most WHT-schemes take place in bigger companies due to regularities in dividend payouts and the advantage of being able to hide big transactions in plain sight. Due to this "assumption of size", we limit our data to the 100 most traded companies (in monetary value terms), and we apply the weighted least squares (WLS) regression method.

This appendix is a test of the size assumption specification we apply to equation 6 in the thesis. We challenge the assumption of size by approaching equation 6 from Chapter 3.3 from two additional angles: one model where we use a "weak" size assumption and another where we employ a "strong" size assumption. The "WLS 100" approach we use in the thesis is considered the middle ground between the two, with a "medium" strength size assumption. We then compare these three approaches.

The alternative approaches are presented in the two next subsections, which lead to a conclusion on the size assumption. The model description from Chapter 3.3 applies to all models, unless otherwise stated, and the interpretation of the output remains as per the example set in Chapter 4.1.

The "OLS 100" approach

In the weak assumption model, we perform what we have called the "OLS 100" approach. Here we apply the ordinary least squares (OLS) method instead of the WLS approach presented earlier. With the OLS method, all observations are considered equally important,

and the smaller companies in a dataset will be given the same weight ω=1 as the bigger ones. The reason we call this a weak size assumption and not a "no" size assumption is that the data samples are still determined by company size in cases where the total number of available companies exceeds 100. The OLS 100 model output is presented in Table 6. Descriptive statistics of the data samples from Table 2, Chapter 3.4, also apply to this model.

Table 6: Model output from regression model equation 6 with an OLS method.

Reform	β_1: **Pre-policy abnormal trading**	β_2: **Reform effect**
Austria 2015	0.0011023	0.0002956
	(0.0016271)	*(0.0028902)*
Austria 2019	0.003844	0.006158 .
	(0.002608)	*(0.003412)*
Belgium 2019	0.031889 ***	0.009977
	(0.004338)	*(0.008548)*
Denmark 2016	0.001232	0.050913 ***
	(0.007966)	*(0.010879)*
Finland 2021	0.017247 *	-0.008603
	(0.007749)	*(0.010041)*
France 2019	0.032774 ***	-0.035662 ***
	(0.002644)	*(0.004101)*
Germany 2012	0.16714 ***	-0.10874 ***
	(0.01646)	*(0.01738)*
Germany 2016	0.026167 ***	0.002393
	(0.005347)	*(0.006707)*
Norway 2015	0.011016	0.032842
	(0.008571)	*(0.025349)*
Method	*Fixed effects (OLS)*	*Fixed effects (OLS)*
Stock specific intercept a_i	*Company-level*	*Company-level*
Time adjusted dummy λ_t	*Date-level*	*Date-level*
Cluster-robust standard errors	*Company-level*	*Company-level*

	(Standard errors in parenthesis)

*Note: Regression model output (equation 6). Significance level illustrations indicating p-value intervals: 0 '***' 0.001, 0.001 '**' 0.01, 0.01 '*' 0.05, 0.05 '.' 0.1, and 0.1 ' ' 1, where e.g. '*' is to be understood as "p-value between 0.01 and 0.05", satisfying a significance level threshold of 5 percent.*

The "WLS 30" approach

For the "strong" size assumption model, we present a "WLS 30 approach". Here we use the same approach as in the WLS 100 model from the thesis, but we now reduce the data samples to the 30 biggest (in monetary trading value terms) companies. This has the same effect as giving all companies not among the 30 biggest the weight $\omega = 0$. The 30 remaining companies keep the same weight as before, where the biggest company has $\omega = 1$, and all other companies are given a weight equal to their relative average market value. The WLS 30 model output is presented in Table 7, and the relevant descriptive statistics of the modified data samples are presented in Table 8.

Table 7: Model output from regression model equation 6 with a WLS method and smaller sample size.

Reform	β_1: **Pre-policy abnormal trading**	β_2: **Reform effect**
Austria 2015	0.0044213	-0.0009439
	0.0035991	0.0078752
Austria 2019	0.005639	0.008001
	0.006962	0.007923
Belgium 2019	0.019913 ***	-0.000338
	0.003149	0.005546
Denmark 2016	0.009171	0.008008
	0.009481	0.010466
Finland 2021	0.053082 ***	-0.043919 ***
	0.007841	0.011930
France 2019	0.031170 ***	-0.012240 *
	0.003399	0.004788

Germany 2012	0.47429 ***	-0.38858 ***
	0.05994	0.06039
Germany 2016	0.082899 ***	-0.032074 ***
	0.007223	0.008578
Norway 2015	0.022384 **	-0.008381
	0.007753	0.008587
Method	*Fixed effects (WLS)*	*Fixed effects (WLS)*
Stock specific intercept $\boldsymbol{a_i}$	*Company-level*	*Company-level*
Time adjusted dummy λ_t	*Date-level*	*Date-level*
Cluster-robust standard errors	*Company-level*	*Company-level*
		(Standard errors in parenthesis)

*Note: Regression model output (equation 6). Significance level illustrations indicating p-value intervals: 0 '***' 0.001, 0.001 '**' 0.01, 0.01 '*' 0.05, 0.05 '.' 0.1, and 0.1 ' ' 1, where e.g. '*' is to be understood as "p-value between 0.01 and 0.05", satisfying a significance level threshold of 5 percent.*

Table 8: Descriptive statistics of "WLS 30" data samples.

Data sample	Companies	Observations	Dividend payouts		Mean share turnover outside the event-window *(%)*		Mean share turnover in the event-window *(%)*	
			Pre-policy	Post-policy	Pre-policy	Post-policy	Pre-policy	Post-policy
Austria 2015	30	65 534	132	112	0.11995	0.13573	0.11998	0.13124
Austria 2019	30	59 449	108	102	0.13076	0.12730	0.13071	0.13221
Belgium 2019	30	97 893	302	144	0.16542	0.15739	0.21403	0.18999
Denmark 2016	30	93 967	159	221	0.27156	0.26594	0.26620	0.28071
Finland 2021	30	88 072	320	90	0.31393	0.22608	0.36429	0.23718
France 2019	30	99 930	392	119	0.32042	0.24898	0.33249	0.23009
Germany 2012	30	45 810	58	115	0.59239	0.45821	0.99805	0.51482
Germany 2016	30	82 425	114	191	0.43821	0.38664	0.49571	0.41213
Norway 2015	30	91 720	164	285	0.23704	0.21280	0.27070	0.23568

Total	*270*	*724 000*	*1 749*	*1 379*	*-*	*-*	*-*	*-*

Note: All numbers rounded to 5 decimal points.

The verdict

When we apply a 5 % significance threshold, we find from β_1 that the OLS 100 approach presents evidence of abnormal trading around the ex-date in five data samples, where Norway, Denmark, and Austria are the exceptions. The WLS 100 and the WLS 30 approaches both suggest that there is abnormal trading in Norway. Furthermore, both WLS models produce higher β_1 coefficients than the OLS 100 output, except for Belgium and for France. Interestingly, the WLS 100 approach consistently produces slightly lower coefficients than the WLS 30 model.

As for reform effects, β_2, the OLS 100 model suggests that there has been a change in abnormal trading patterns in Denmark, France, and Germany in 2012. The WLS approaches give somewhat different conclusions, where there seem to have been some reform effects in Finland, France, Germany 2012, and Germany 2016. The models all conclude with significant negative β_2 coefficients for France and Germany 2012. There are no clear patterns in the coefficient values.

There are two interesting differences between the model outputs that we want to point out. First, the OLS model does not provide evidence of any reform effects from the German 2016 reform. This goes against the findings of literature presented in Chapter 1.2, and both WLS approaches in this thesis. Second, the OLS approach finds that there is an increase in event-window abnormal trading in Denmark after the 2016 reform. We find this to be an unconventional, but logical result, as the reform in Denmark aimed at reducing WHT-schemes through share lending. As found by Casi et. al. (2022), the reform proved to be successful in reducing WHT-schemes through share lending. A potential side effect of the reform could be that investors turned to buying and selling shares instead, which would lead to an increase in abnormal trading around the ex-date. If that is the case, however, it seems investors have not turned to the bigger companies, as the WLS models do not detect any increase in abnormal trading.

In conclusion, it seems company size does matter. Especially the apparent correlation between higher β_1 coefficients and increased assumption strength speaks in favour of this conclusion. The fact that the OLS 100 approach did not give evidence of an effect from the German 2016 reform, contrary to known literature, also supports this claim. However, as shown by the contradicting β_2 coefficients relating to the Danish 2016 reform, there are quite possibly other considerations besides company size that influence where investors choose to conduct their schemes.