Tax motivated ex-dividend trading goes dark

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Abstract

We use the extensive tax-motivated trading of equities around the ex-dividend day as a laboratory to investigate the changes to trading of Norwegian equities following the introduction of MiFID in 2007. We show that extraordinary trading around the ex-dividend day is extensive, and has after MiFID moved from the traditional exchanges to less regulated market places, such as dark pools.

Tax motivated trading of equities around ex-dividend dates is a well known phenomenon. If equity owners face different marginal tax rates, the incentive is for the lowest-taxed investor to be the official owner of the dividend claim. In effect equities are "parked" with the low marginal rate owners for a few days. The resulting trading pattern will involve extensive trading just before and just after the ex-dividend date. Such trading patterns have been extensively documented.[1]

In this paper we use this heightened activity in equity trading as a laboratory to shed some light on the changes in trading of European equities following the MiFID regulation. The goal of MiFID was to enforce competition between market places in financial trading, while maintaining a level playing field among exchanges. But MiFID is a complex piece of legislation, which may have unintended consequences. Looking at the trading patterns around dividend dates will investigate times when the equity markets are under stress.

Investigating ex-dividend trading is also of separate interest in light of the recent revelations of extensive tax fraud in Germany involving dividend tax credits.[2] We will investigate the Norwegian case, which have different tax treatment than Germany, but an

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[1] See the survey in Farre-Mensa, Michaely, and Schmalz (2014) for the international evidence, and Dai and Rydqvist (2009) for more specific evidence on Norway.

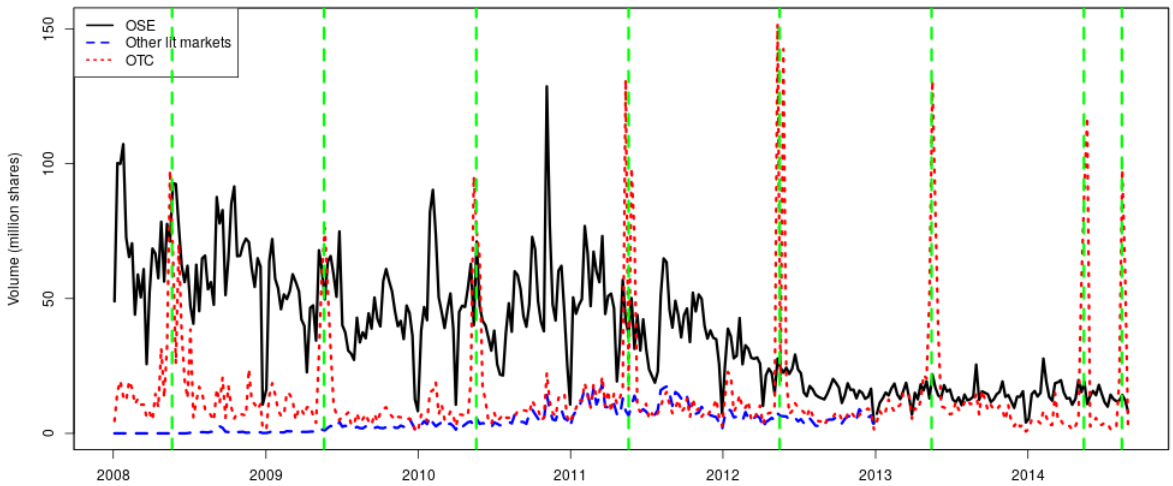
[2] *Taxing times: How Germany's fraud probe is spreading*, Financial Times 7 nov 2018. See e.g. Buettner, Holzmann, Kreidl, and Scholz (2019) for academic discussion of the various cum-dividend schemes in the German context.

Europe-wide search for tax loopholes (or straight illegalities) by traders may have added to the stress in trading of Norwegian equities also.

We show that ex-dividend trading in Norwegian equities is extensive, and that it has moved to the least regulated market places, known as OTC trading or "dark pool" trading. As an illustration, Figure 1 shows weekly trading volume, in millions of shares, of one stock, Statoil[3] at the OSE (black line), other European limit order markets (blue line), and post-trade reported trades at OTC type of venues (red line). In the figure, ex-dividend dates are indicated by vertical green lines. The striking feature of the picture is the spikes in OTC-trading around the ex-dividend dates. For those two weeks the trading volume at OTC venues dwarfs trading at the Oslo Stock Exchange. For example, in the 2012 case, in the week before the dividend the OTC volume was 152 mill shares, while the OSE volume was 28 million shares. In dollar terms the OTC volume that week was about 200 billion US dollars.

Figure 1 Weekly trading of Statoil at different trading venues

The figure shows weekly trading volume in million shares of Statoil. The volume is shown separately for the Oslo Stock Exchange (OSE-black line), a group of other public limit order markets (other lit markets-blue line), and post-trade reported trades from Markit (OTC-red line). The other public limit order markets are Chi-X, BATS, Turquoise and NASDAQ Stockholm.



The tax heterogeneity that is most likely behind these results is differences in dividend taxation depending on the country of origin of the equity owners. Norwegian owners are taxed differently from international owners, and there are also differences across countries.

We document that the Statoil case is not unique. We show that for the largest Norwegian companies paying dividend, the excess turnover (turnover above the typical turnover) around the ex-dividend date is about 300 percent for the whole market. Most of this trading is at post-trade reports from (OTC) market places, where turnover is 600 percent above the typical trading volume.

[3]Statoil is the largest listed company at the OSE. It has since changed name to Equinor.

In addition to documenting this excess volume, which is consistent with a tax explanation, we also investigate the stock price reaction around the ex-date. We show that there are differences in estimated tax effects, depending on whether the equity in question is traded only at the Oslo Stock Exchange, or is also traded outside of the OSE. The implied tax effects are smaller (and excess turnover is larger) for stocks constituting the OBX index of the 25 largest companies at the OSE. These companies are also those with the largest international ownership, and with sufficient trading interest to see trading outside of the OSE.

Given our finding of concentration of ex-dividend trading at the OTC venues, we discuss possible causes of this. Gomber, Sagade, Theissen, Weber, and Westheide (2016) notes a similar pattern in a sample of European stocks, and argue that it could be driven by traders desiring to signal that their trading is not motivated by information, which they achieve by trading in crossing markets (dark pools).

We discuss alternative explanations linked to illegal trading strategies. Such a strategy for traders would be to enter into a repurchase agreement with an agreed upon price around the ex-dividend date. This is illegal because the transaction would not be a *bona fide* transfer of ownership, and the transaction can be reversed by tax authorities. We speculate that the non-anonymous nature of trading at OTC type of venues can facilitate such forward agreements, either explicit or implicit.

While such agreements, by their very nature, are not discoverable from the public trade reporting, we investigate whether there is more indirect evidence of this going on. If traders are able to remove price risk, theory shows that the idiosyncratic volatility of a stock will no longer affect the decision to trade around the ex-date. We investigate this theoretical prediction in a regression framework, and show some evidence consistent with a risk-reduction explanation. We are however not able to conclusively argue that is the case.

That we can not rule out illegalities points to the interesting regulatory question implicit in our research. Is the possibility of such trading an unintended consequence of MiFID? One of the goals of MiFID is to keep the "playing field" as level as possible. Is the regulation of OTC markets such that it allows them to get around this intention?

The rest of the paper is structured as follows: We first discuss the relevant literature on tax and dividends and market fragmentation, giving the background for the analysis. Section 2 then give an overview of the evolution of trading in Norwegian shares in the period, starting with the MiFID regulation, and documenting the fragmentation of trading. We also discuss the relevant tax rules, the data sources and give some descriptive statistics. Section 3 shows that turnover is significantly larger around the ex-dividend date. In section 4 we estimate the price effect around the ex-dividend date. Section 5 discusses possible reasons for trading to concentrate in OTC markets, before we offer a conclusion.

1 Literature

The research in this paper is at the intersection of two litereratures. First, the literature on how taxes interact with dividends and stock prices at the date of dividend payments.[4] Second, the literature on equity market fragmentation.

1.1 Taxes and dividends

It is useful to go into the basics of the problem by simply looking at the cash flows involved. Suppose a stock is currently priced at S_t, and the stock is today paying a dividend of D per share, which means that tomorrows stock price S_{t+} is for the stock without a claim on the dividend. An owner of the stock faces two potential forms of taxation: A dividend tax (τ_d) and capital gains taxation (τ_g). The after tax cash flow from a dividend payment of D is are $D(1-\tau_d)$. The capital gain tax is based on the difference between the original purchase price (B, usually called the *basis*), and the selling price. The capital gains tax when selling the stock for S is $(S-B)\tau_g$.[5]

Consider now the situation for a stock owner just before the ex dividend date. Selling before the ex date, the after-tax cash flow received at the sale would be $S_t-(S_t-B)\tau_g$. The investor does however also have the option to wait till after the ex dividend date, and sell the shares at the later price S_{t+} which results in an after tax cash flow of $S_{t+}-(S_{t+}-B)\tau_g+D(1-\tau_d)$.

If markets are efficient, we expect the stock price to adjust so that the equity owners are indifferent between these two alternatives. Equating the two cash flows and simplifying results in the following relationship between the expected price change on the ex-dividend date, and the tax situation:

$$S_{t+}=S_t-D\frac{1-\tau_d}{1-\tau_g}, \tag{1}$$

the stock price is expected to decline by a "tax adjusted" dividend payment. This is not a strict arbitrage argument, as the future price S_{t+} can change for other reasons than the dividend. If for example an oil company makes a major find on the ex-dividend day, this will push the stock price up, independent of the dividend tax.

Rearranging (1), we find the expression for the so called "premium" at the ex date:

$$\text{premium}=\frac{S_t-S_{t+}}{D}=\frac{1-\tau_d}{1-\tau_g}. \tag{2}$$

If tax rates are zero, the premium should equal one. This relationship can also be used to make inference about implied tax rates. A common assumption is to set the tax on capital gain equal to zero, which means you can estimate the dividend tax rate as one minus the estimated premium. This estimate can be interpreted as the implied tax rate of the marginal equity trader, the trader instrumental in pricing the stock.

[4]For surveys of the broader literature on dividends and taxes we refer to Allen and Michaely (1995), Graham (2013) and Farre-Mensa et al. (2014).

[5]Note that this can be negative, which should be interpreted as a taxable loss that can be used to reduce other taxes. This assumes symmetric treatment of gains and losses.

The "premium" defined in (2) is the starting point for theoretical and empirical analysis. For example, in the very first work on this issue, Elton and Gruber (1970), found evidence of tax clienteles by showing that the estimated premium differed across dividend classes.

Elton and Gruber (1970) worked with a static notion of clienteles, essentially a buy-and-hold view. But, as pointed out by Kalay (1982), the static assumption is problematic. Instead, it is necessary to consider dynamic trading around the ex-dividend day. This is a situation with heterogeneous valuation of assets, induced by differences in taxation. Since valuation is based on after-tax cash-flows, investors with lower marginal tax rates will put a higher value on dividend-paying shares.

For our analysis we rely on the models of Michaely and Vila (1995) and Michaely, Vila, and Wang (1996), which models the determinants of trading volume and stock price around the ex-dividend date in a dynamic equilibrium setting. In their models, key determinants of trading volume and stock prices around the ex-dividend date are:

- The degree of heterogeneity among investors' tax treatment.
- The risk involved in the trading necessary to exploit tax differences.

  The primary source of risk for traders is that the stock price may move in the short period around the ex-date for other reasons than the dividend, but there is also a *regulatory risk*, that the transactions are not recognized as valid for tax purposes.
- Transaction costs also affect trading, both directly, as they change the cash-flows, and indirectly, as they affect the risk.

The model shows that there are two variables involved in the equilibrium.

- The price drop on the ex-day.
- The trade volume around the ex-day.

For our analysis, we rely on the empirical implications used in Michaely and Vila (1996):

- Trading volume increases in tax heterogeneity
- Trading volume increases in dividend yield
- Transaction costs lower trading volume.
- Trading volume decreased in idiosyncratic risk
- With transaction costs, trading volume decreases in market risk (beta) as well.

The source of tax heterogeneity in the U.S. literature is differences in tax treatments of dividends and capital gains. In our setting, in addition to this difference, a second source of tax heterogeneity is different tax rates depending on the country of origin of individual owners. This does however not change the major implications of the model.

1.2 Equity Market Fragmentation

The second literature we contribute to is the market micro-structure literature on equity market fragmentation.[6] Historically, equity trading was a monopoly of the *listing exchange* where a company had chosen to list. Gradually these monopolies have been challenged by competing market places. The proliferation of market places have two drivers: technology and regulation. Technological improvements in communications technology has moved equity trading onto completely electronic market places. At the same time regulatory incentives, such as Regulation NMS in the US, and MiFID in Europe, has mandated competition among market places in equity trading. The end result is a complex set of electronically connected equity markets.

Heterogeneity in trading rules is a part of the competition between market places. A key property of trading rules is the degree of transparency. We distinguish between pre-trade and post-trade transparency. The traditional exchanges have evolved into fully electronic, public limit order book markets, which is an example of a market with both pre-trade and post-trade transparency. Many of the new competitors are also public limit order book markets, but there is a number of other market types where trades only are reported after the fact (post-trade transparency). One example of such markets are crossing networks, where traders agree on trading quantity, relying on for example the listing market to provide prices.[7] There are numerous other trading arrangements, which we collectively term OTC markets or "dark pools." But all these markets need to report trades "after the fact".

Theoretically, the market micro-structure literature has argued that there are good reasons for trading to concentrate in a single market, due to network externalities and economics of scale. Well known theoretical micro-structure analyses, such as Chowdhry and Nanda (1991) and Glosten (1994), show that it is optimal for all types of traders to submit their trades to the most liquid market, and hence this market will dominate price discovery.

This conclusion is tempered by looking beyond a pure price discovery argument. Harris (1993) argues that with heterogeneity in trading needs, where traders differ with respect to patience, motives for trading, etc, we may see distinct market places coexisting. Market places can survive by offering unique features of their trading arrangements, catering to different clienteles.

The last twenty years has thus seen a great upheaval in the world of equity trading. The jury is however still out regarding the degree to which the resulting system is an improvement. On the one hand, measured trading costs for small investors have fallen dramatically.[8] But less and less of the world's equity is held by individuals. The large equity investors are pension funds and mutual funds. There is less agreement to which degree transaction costs have fallen for investors needing to trade larger quantities. There is also worry that the aggregate liquidity is more volatile in a world of high frequency traders,[9] and that we may see more "flash crashes" in the current market environment.

[6] A recent survey of this literature is given by Gomber, Sagade, Theissen, Weber, and Westheide (2017).

[7] See Næs and Ødegaard (2006) for an introduction to crossing networks.

[8] See Angel, Harris, and Spatt (2011, 2015) for the recent time trend in trading costs.

[9] See Menkveld (2016).

2 Market and data

The equities we study in this paper are stock in Norwegian companies with a main listing on the Oslo Stock Exchange. Let us first discuss the trading environment for trading of these stocks, before going over the specifics of dividend taxation.

Norway is a member of the European Economic Area (EEA) and its equity market is among the 30 largest world equity markets by market capitalization. The OSE is the only regulated marketplace for securities trading in Norway. Unlike the other Scandinavian exchanges, the OSE has remained relatively independent, but has been in strategic partnership with the London Stock Exchange (LSE) since March 2009. Since January 1999 the OSE has operated as a fully computerized limit order book.[10]

The distribution of firm size and trading volume at the OSE is heavily skewed. The OSE is dominated by a few very large companies, of which the largest, Statoil, an oil company, at the beginning of 2012 accounted for about 25% of OSE market capitalization. Two other companies, Telenor (telecommunications) and Den Norske Bank (integrated financial) each accounted for about 10% of OSE market capitalization. The large firms at the OSE dominate the trading volume at the exchange. Trading interest is concentrated in the constituents of the OBX index, which contains the 25 most liquid stocks at the OSE.[11]

As part of the MiFID[12] regulation, European legislators mandated competition in trading of equities. The traditional exchanges, such as the Oslo Stock Exchange, were exposed to competition from two new market types: Multilateral Trading Facilities (MTFs), and Systematic Internalisers (SIs). The primary difference is that MTFs are open to all traders and operate (typically transparent) electronic limit order books similar to those of the primary markets. Distinct from MTFs, the SIs are typically run by investment banks that match client orders either internally or against their own accounts, and are typically opaque in nature. The most important difference between these is that the MTF will offer pre-trade price transparency in the form of public limit order books, while the SI type of market will only offer post-trade transparency in the form of after-the-fact reporting of trades.

Post MiFID, the trading of stocks with a main listing at the OSE has become increasingly fragmented across various alternative market places. In the period we study, the largest European competitors with pre-trade transparency (i.e. limit order books), are Chi-X, BATS, and Turquoise. Norwegian stocks are also traded at the Stockholm Stock Exchange (Nasdaq OMX Nordic) and the London Stock Exchange (LSE), although the direct competition from the LSE is limited due to the strategic partnership between LSE and OSE.

In addition to these market places with pre-trade transparency, there are also numerous alternative market places facilitating OTC or dark pool trading, where transparency is only ex post. These market places are required to report their trades to a MiFID-compliant reporting facility. We use all trades reported through a major reporting facility,

[10]For further background on the trading at the OSE and the companies on the exchange, see Næs, Skjeltorp, and Ødegaard (2011), Skjeltorp and Ødegaard (2015), Jørgensen, Skjeltorp, and Ødegaard (2018) and Foley, Meling, and Ødegaard (2019)

[11]See Meling (2016) for more details on the OBX index.

[12]MiFID: Markets in Financial Instruments Directive.

Markit BOAT, to proxy for OTC trading in our sample of OSE listed stocks.

Not all stocks listed at the OSE are traded elsewhere. Only the larger companies on the exchange are interesting for the competing market places. The OSE lists between 200 and 300 stocks. In the period we analyze, only the 25 constituents of the OBX index have a significant amount of trading outside the OSE.

2.1 Data sources

For data on dividends (amounts, dates) and trading (stock prices, volumes) at the Oslo Stock Exchange we rely on data from the Oslo Stock Exchange data service. This data source is available in the period 1980–2018.

We also use the Thomson Reuters Tick History Database, which contains information for all European market places where stocks with a main listing at the OSE are traded. The Thompson Reuters data also include some information about OTC trading of OSE stocks, through the inclusion of trades reported through Markit BOAT. In the analysis we employ data for the first five post-MiFID years, 2008–2012.

2.2 Dividend tax rules

We will not go into the details of Norwegian dividend taxation, as the current analysis primarily relies on the presence of heterogeneity of tax treatment of dividends, but let us give a quick overview of the rules. Domestic individual owners are taxed at a flat tax rate, which has varied in the period.[13] Capital gains are taxed for domestic owners, but the capital gains taxation is complicated by a system of imputation-tax credits, which increases the basis for capital gains (and thus lower capital gains taxes).[14]

Foreign owners will pay a Norwegian withholding tax (kildeskatt) on dividend income, but the tax rate varies with country. The default withholding rate is 25%, but many countries have tax treaties with Norway which gives them lower rates. For many countries the rate is 15% instead of 25%. For foreigners capital gains are not taxed in Norway.

The above simplified survey of the tax rules show that there is heterogeneity in tax rates, and scope for trading to optimize over tax treatment.

2.3 Dividends of OSE-listed companies

Norwegian companies typically pay dividend once a year. Dividends are agreed on the annual shareholder meeting, in March/April of the year, before dividends are paid in April/May. Table 1 summarizes the dividend behaviour of OSE-listed firms in the period 2008–2012. Less than half of the listed companies at the OSE pay dividends each year. For the dividend payers, the average annual dividend yield varies between 5 and 9 percent.

[13]The present system was introduced in 2005. Before 2005 domestic owners were not taxed on their dividends.

[14]See Dai and Rydqvist (2009) for more detail on Norwegian dividend tax rules, particularly in the period before 2005.

Table 1 Summarizing dividends of OSE-listed companies

The table describes aggregate dividend behaviour of Norwegian listed firms in the period 2008–2012. We give the total firms listed, the number of which pays dividends, and the average annual percentage dividend yield, where the average is only calculated for the dividend paying firms. The dividend yield is calculated as the sum of dividends in a given year divided by the stock price at the start of the year.

	Year				
	2008	2009	2010	2011	2012
Number of listed stocks	286	266	258	253	243
of which pay dividend	115	78	95	108	98
Average dividend yield (%)	5.68	6.17	7.22	5.78	8.68
(Only for dividend payers)					

2.4 The fragmentation of trading of OSE-listed equities

As mentioned, post MiFID trading in OSE-listed equities gradually moved from an OSE monopoly to competing market places, where traders could choose between sending an order to a limit order book (OSE, Chi-X, BATS, Turquoise, Stockholm, London) or trade in one of several possible markets with post-trade transparency. To illustrate the aggregate evolution, we have collected the monthly trading volume (in NOK) for OSE-listed shares on these markets and aggregated them. Panel A of Figure 2 provides the breakdown (in billions NOK) of the different market places. A key feature in the figure is the gradual fall in trading volume at the OSE in the period. In addition to the numbers for lit markets we include the volume reported through Markit BOAT, which is the largest reporting facility for OTC trading. A visually striking observation is the "spikes" in OTC trading. While that is not obvious from the figure, those spikes are in May of each year, which happens to be the month when most dividends are paid.

To make the "specialness" of May even clearer, in Panel B of Figure 2 we translate the totals in Panel A to market shares: The percentage of the kroner volume in each month traded at each of the market places. These spikes represent they key result of the paper. We will show that they represent an trading volume around the ex-dividend date which is substantially above an estimate of the "normal" volume.

2.5 Descriptives for trading at the OSE.

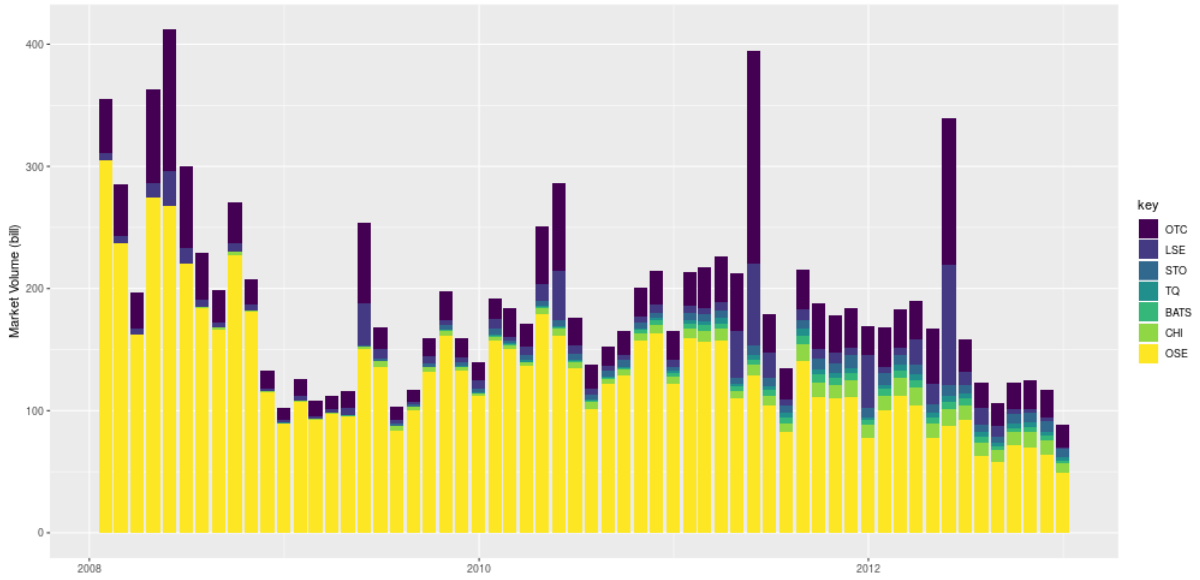
In the paper we will be analyzing aspects of trading at the OSE. For some perspectives of this, Table 2 provides some descriptives. In addition to the dividend yield, we provide a number of typical characterizations of the trading environment: The relative spread (the difference between the best bid and ask divided by the price), the volatility of stock returns, the number of trading days in the year, and the market capitalization of each stock. In the first column we give averages for all dividend-paying stocks.

For the later analysis we will group the stocks in the sample along several dimensions. First, we will treat separately the stocks in the main index at the OSE, the OBX 25. This contains the twenty five largest and most liquid stocks at the OSE. These stocks are also the stocks of most interest to international owners. We therefore provide separate statistics for companies in the OBX index. Clearly, these are much more liquid than the

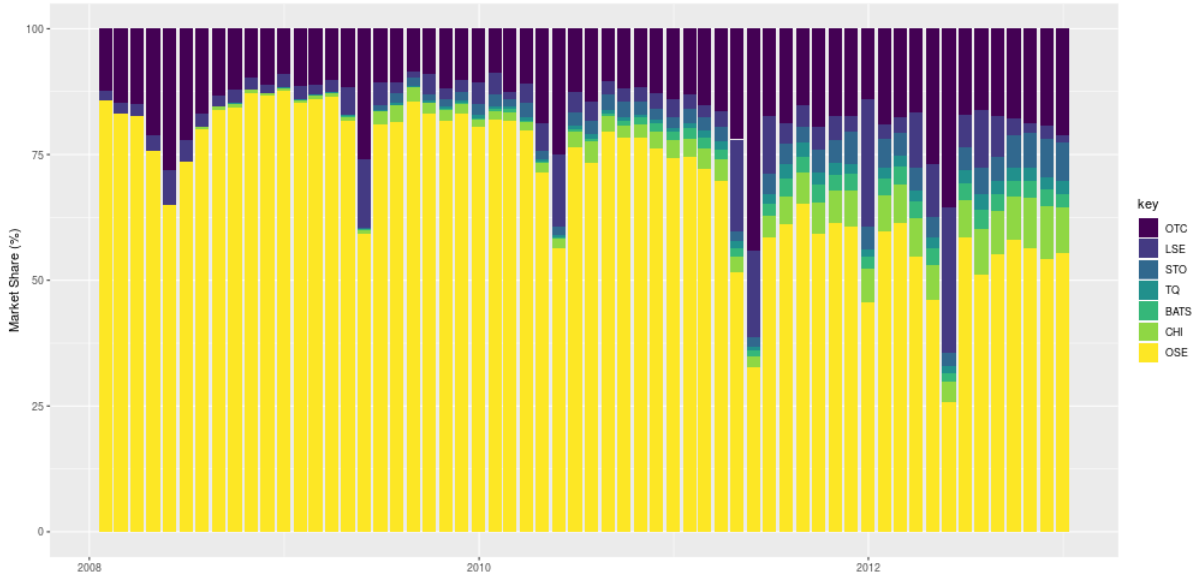
Figure 2 Fragmentation of trading of OSE-listed shares

Monthly trading volume for OSE-listed stocks. For each of the exchanges: OSE, Chi-X, BATS, Turquoise, LSE and Stockholm, we sum monthly volumes. We also add the monthly volume of OTC trades reported through Markit BOAT. The numbers in Panel A are billions NOK. In Panel B we show the monthly market share (in percent), based on the trading volume in panel A.

Panel A: Market Volume (NOK)



Panel B: Market Shares(%)



average stock, with a relative spread of 0.22%, as opposed to the average spread of 3.36 for all OSE stocks. OBX shares are also typically traded every day.

We will also consider firm size more general. To inform about this, the next four columns group the firms into four groups based on firm size. Group 1 is the smallest companies. The stocks in this group are illiquid, evidenced by the average company in this group only trading 109 days in a year, i.e. they trade less than half of the days in the year.

Table 2 Descriptives for equity trading at the OSE, dividend paying shares

Descriptives for trading of dividend-paying stocks at the OSE. For each year in the 2008–2012 period, we include all stocks paying dividend in the year. We calculate the following statistics: *Annual dividend yield* (Total dividends paid in the year divided by stock price at the beginning of the year.). The *relative spread* (the difference between the best bid and ask divided by the stock price). The *volatility* of stock returns. The number of *trading days* in the year. The *market capitalization* of each stock. In the first column we give averages for all dividend-paying stocks. The next column only uses stocks in the OBX index. The final four columns pick stocks from four size sorted groups, with group 1 containing the firms with lowest market capitalization, and group 4 with highest market capitalization.

	All	OBX	Firm Size Quartile			
	stocks	stocks	1(small)	2	3	4(large)
Number of observations	494	77	99	81	113	201
Dividend yield (%)	6.67	4.65	9.91	6.62	7.89	4.41
Relative Spread(%)	3.36	0.22	5.57	5.56	3.92	1.08
Volatility(%)	3.14	2.83	3.27	3.94	3.41	2.62
Trading Days	185	252	109	136	185	242
Market Cap (bill)	11.61	60.30	0.29	0.72	2.33	26.80

3 Is there extraordinary trading around the ex dividend date?

In this section we ask whether there is extraordinary trading around the ex dividend dates. The figure showing the aggregate trading broken down by month already indicated that there is something special with trading in May, in this section we test directly for whether this is linked to the ex-dividend date.

To define a notion of extraordinary trading around the ex dividend date, we follow the standard literature (Michaely and Vila, 1996; Henry and Koski, 2017) and use the eleven days around the ex date (date -5 to $+5$ relative to the ex dividend date (0) as the period with ex-day trading. The trading volume in this period is compared to trading volumes in the estimation period, dates $(-45, -6)$ and $(+6, +45)$ relative to the ex day. Each day t, for stock i, we calculate the daily turnover $\mathsf{TO}_{\mathsf{i},\mathsf{t}}$ as the trading volume divided by the number of shares outstanding. The *typical* trading volume for the stock is calculated as

$$\mathsf{ATO}_{\mathsf{i}} = \frac{1}{\mathsf{T}} \sum_{\mathsf{t} \in (-45,-6) \cup (6,45)} \mathsf{TO}_{\mathsf{it}}, \tag{3}$$

where T is the number of trading days for stock i in the period. Each day in the event period the abnormal volume is calculated as

$$\mathsf{AV}_{\mathsf{it}} = \frac{\mathsf{TO}_{\mathsf{it}}}{\mathsf{ATO}_{\mathsf{i}}} - 1 \tag{4}$$

For each dividend event we calculate an average abnormal volume:

$$\mathsf{AV}_{\mathsf{i}} = \frac{1}{\mathsf{T}_{\mathsf{i}}} \sum_{\mathsf{t}=-5}^{+5} \mathsf{AV}_{\mathsf{it}} \tag{5}$$

where T_{i} is the number of trading days in the ex-day period. The cumulative abnormal volume is the sum of the daily abnormal volume for the eleven days around the event:

$$\mathsf{CAV}_{\mathsf{i}} = \sum_{\mathsf{t}=-5}^{+5} \mathsf{AV}_{\mathsf{it}} \tag{6}$$

Note that these two notions of abnormal volume are relative numbers, which are comparable across stocks. If there is no abnormal trading around the ex date, they should equal zero.

In table 3 we give estimates of the abnormal turnovers. We provide observations for the 2008–2012 period. For comparison, table panel B shows corresponding numbers for the OSE in the period without competing market places, 2005-2007.

Let us start by looking at the first rows, where we provide estimates using trading volume summed for all markets. Looking at the cumulative abnormal volume, it has a mean of 479%. This is an extraordinary large volume compared to e.g. the estimates in Michaely and Vila (1996), which have an average $\mathsf{CAV}_{\mathsf{i}}$ in their sample of 100%. A potential cause of the difference is that in the US sample, dividend are paid quarterly, so the dividend yield each quarter is much less (in their sample the dividend yield was 1%.)

Note though that the in the Norwegian sample the median estimate is much lower than the average, a sign of a skewed distribution with a few very large CAV_i cases. We have also calculated averages separately for OBX stocks and other stocks. The CAV_i numbers for the OBX shares are large, also the median CAV is as high as 131%. The non-OBX shares are more skewed, a very high mean, but a *negative* median.

The evidence is thus that it is the OBX stocks for which there seem to be the strongest case for abnormal ex-dividend trading.

If we compare what happens at the OSE with the OTC-reports, it is clear that it is the OTC markets which have the most of the abnormal trading. For OBX shares, the mean (median) CAV_i is 603% (201%). Note that this is compared to the typical volume for OTC markets, only.

Hence, there is clear evidence of abnormal turnover around the ex-dividend date.

Table 3 Summarizing abnormal turnover

The table shows estimates of average abnormal volume (AV_i) and cumulative abnormal volume (CAV_i). These variables are defined in equations (6) and (6). These estimates are calculated for all markets (OSE, Chi-X, BATS, Turquoise, Stockholm, London and OTC) (rows 1 and 2), OSE only (rows 3 and 4) and OTC only (rows 5 and 6). They are also calculated separately for all stocks (columns 1-3), OBX stocks (columns 4-6) and non-OBX stocks (columns 7-9).

Panel A: All Markets, 2008–2012

	All stocks			OBX stocks			Non-OBX stocks		
	mean	median	n	mean	median	n	mean	median	n
All Markets									
AV_i (%)	71.8	3.6	559	37.9	15.7	127	81.8	-4.5	432
CAV_i (%)	479.9	24.4		318.2	130.9		527.4	-26.2	
Oslo Stock Exchange									
AV_i (%)	40.8	-5.3	558	11.4	4.3	127	49.5	-12.8	431
CAV_i (%)	242.9	-33.9		79.1	24.2		291.2	-61.9	
Post-trade reports									
AV_i (%)	219.8	24.3	244	79.5	36.3	95	309.2	14.7	149
CAV_i (%)	1094.3	138.1		603.5	201.7		1407.1	64.7	

Panel B: OSE 2005–2007

	All stocks			OBX stocks			Non-OBX stocks		
	mean	median	n	mean	median	n	mean	median	n
AV_i (%)	18.7	-11.6	369	14.8	12.8	74	19.7	-20.0	295
CAV_i (%)	110.6	-57.1		103.7	89.4		112.3	-108.8	

4 Estimates of the premium

As discussed in the theory section, to understand what happens in terms of price reactions to dividend payments, we estimate the "premium":

$$\text{premium} = \frac{S_t - S_{t+}}{D} = \frac{1-\tau_d}{1-\tau_g}.$$

We calculate this premium for dividend-paying shares at the OSE in the period 2005–2012, done separately for the period when OSE had a monopoly (2005–2007) and the post-MiFID competitive period (2008–2012).

Table 4 Estimating the price reaction to dividend payments

The table shows results of estimation of $x = \frac{S_t - S_{t+}}{D}$, where S_t is the stock price before the ex-date, S_{t+} the stock price just after the ex-dividend date, and D the dividend amount. We collect all dividend paying stock at the OSE each year, and estimate x for each stock. In the table we show the mean and median for these estimates, as well as the p-value of a test that $x = 1$. The final column contains the number of observations.

Panel A: 2005–2007

	Mean	t-test ($x = 1$)	Median	n
All stock	0.747	0.001	0.814	356
OBX stocks	0.997	0.992	1.166	68
non-OBX stocks	0.687	0.00001	0.800	288

Panel B: 2008–2012

	Mean	t-test ($x = 1$)	Median	n
All stocks	0.763	0.009	0.785	564
OBX stocks	1.485	0.094	1.026	126
non-OBX stocks	0.555	0.00000	0.727	438

Here we have clear evidence of differences in market reactions. For OBX stocks, we can not reject a null of no tax effects, the stock prices fall by the amount of dividends. For non-OBX stocks we clearly reject that null, prices fall by less than the amount of dividends.

5 Why do traders prefer OTC venues?

We have established that the abnormal volume around the ex-dividend date has moved to OTC type of venues. Why is this? We have mentioned two possible explanations. First, the Gomber et al. (2016) story that traders try to signal that trades are non-information based. Second, the more nefarious alternative, that there is a hidden buyback agreement, which will reduce the risk in transaction.

The ideal data to investigate this would include the terms of trade for all market participants across all market places. Are all transactions *bona fide* transfers of ownership? In the absence of such information we need to look for more indirect ways of distinguishing between these two alternatives.

There is a possible route to test: The second explanation reduces the (price) risk in the transaction, something that is not the case for the first explanation. To investigate this we can adapt the regression framework of Michaely and Vila (1996), which regresses the cumulative abnormal volume (CAV_i) on variables linked to the explanatory variables suggested by theory:

- Transaction costs (proxied by bid/ask spread)
- Risk of price movements for other reason than dividend (proxied by stock volatility)
- Dividend yield
- Firm size (control).

In the regression analysis of Michaely and Vila (1996), the abnormal volume (CAV_i) is significantly negatively affected by a measure of idiosyncratic volatility. In the theory, the explanation for that is driven by risk: more volatile stocks are more likely to have stock price changes driven by other events, not just the dividend. Trading to capture the dividend tax difference is thus more risky for high-volatility stocks.

Using our data from the OSE, we run similar regressions. Table 6 shows the results using all data. Of primary interest is the coefficient on the stocks volatility. This is negative, as predicted by theory, but not significant. The lack of significance is consistent with an explanation that risk is less important. However, there is an alternative possibility: The sample is much smaller than that employed in Michaely and Vila (1996), the lack of significance could be due to the smaller sample.

Table 5 Regressions explaining CAV. All dividend paying stocks, 2008-2012

Regressions with CAV_i as dependent variable. Explanatory variables: Dividend Yield, log of Market Capitalization, the relative bid/ask spread, the stock volatility, and a dummy for whether the stock in question also has OTC trades. Period: 2008–2012. Sample: All dividend paying stocks.

	Cumulative Abnormal Volume				
	All	OSE	Post Trade	All	OSE
DivYield	−0.87	−0.51	−22.51	−0.81	−0.55
	(5.86)	(5.64)	(40.67)	(5.86)	(5.65)
lnMktCap	0.47	−0.13	−2.34	−0.001	0.13
	(0.84)	(0.81)	(1.79)	(0.94)	(0.90)
BASpread	−4.93	−1.77	−103.72	3.93	−6.55
	(53.84)	(52.02)	(150.93)	(54.37)	(52.57)
StockVol	−55.41	−26.41	−287.09	−61.46	−23.09
	(71.62)	(69.07)	(195.88)	(71.79)	(69.30)
have OTC trading				3.53	−1.92
				(3.07)	(2.96)
Constant	−3.72	6.03	74.06*	4.97	1.30
	(19.33)	(18.63)	(43.66)	(20.74)	(20.01)
Observations	542	541	241	542	541
Adjusted R^2	−0.004	−0.01	−0.002	−0.003	−0.01
Note:				*p<0.1; **p<0.05; ***p<0.01	

We have also split the sample and run separate regressions for OBX shares and non-OBX shares, with results in Table 6. Here we see that the regressions for OBX shares

have signs that are closer to the US evidence. The sign on the dividend yield is positive and mainly significant. There is one exception, though. While the numbers are not significant, the sign on the coefficient on trading costs (bid/ask spread) is positive. That is counter to theory. Higher transaction costs should lead to less trading.

To summarize, our regression analysis is unfortunately unconclusive. We are not able to distinguish between the "sunshine trading" hypothesis of Gomber et al. (2016) and an alternative hypothesis of forward price agreements.

6 Conclusion

We have looked at how trading of Norwegian equities evolved after the introduction of MiFID in 2007. MiFID lead to a fragmentation of this trading. Some trading at the OSE moved to alternative markets which started appearing the year after MiFID. Chi-X, Turquoise and BATS were all pan-European all-electronic limit order markets which gradually expanded their market shares. These market places, by maintaining public limit order books, are all market places with pre-trade transparency. Traders observe the prevailing prices before trading. There are however alternative market places, where the terms of trade are less transparent (OTC/Dark Pool trading). Under MiFID these markets have to report their trades (post-trade transparency).

The prime contribution of the paper is the documentation that tax-motivated ex-dividend trading has moved from the traditional exchanges. We show extraordinary volume in OSE-listed shares around the ex-dividend date. This volume is primarily post-trade reports from OTC venues.

We speculate that the non-anonymous nature of the OTC venues may allow traders to get rid of the price risk involved in trading to let the less-taxed owners hold the dividend claim, and show one way to test it. Our results are however inconclusive.

The interesting regulatory question is whether this is an unintended consequence of the MiFID enforcement of competition between market places. Are there market places with rules that allows traders to get around the intended enforcement of price competition across markets?

Let us close by pointing to some venues for further research. A weakness of our data is that we use a summary of all OTC trading, the daily total reported through Markit, a trade aggregator. But this aggregation hides the identity of individual market places. A further breakdown on individual markets will identify exactly which OTC market has all this ex-day trading, which may let us identifying what aspect of that market place is particularly attractive for ex-day traders. Another venue for improving this study is to expand the sample, which may be to look at more countries (although this may be complicated by tax rule differences), and/or by looking at Norway post-2012.

Table 6 Regressions explaining CAV. Separate regressions for OBX and non-OBX shares, 2008–2012

Regressions with CAV_i as dependent variable. Explanatory variables: Dividend Yield, log of Market Capitalization, the relative bid/ask spread, the stock volatility, and a dummy for whether the stock in question also has OTC trades. Separate regressions for OBX and non-OBX shares. Period: 2008–2012.

Panel A: OBX shares

	Cumulative Abnormal Volume				
	All	OSE	Post Trade	All	OSE
DivYield	71.65***	4.97	93.23*	68.23***	4.54
	(22.48)	(10.22)	(48.11)	(22.08)	(10.27)
lnMktCap	1.14**	0.35	1.18	0.77	0.31
	(0.53)	(0.24)	(1.09)	(0.55)	(0.25)
BASpread	861.15	139.03	438.56	789.65	130.18
	(637.86)	(290.00)	(1,409.76)	(625.93)	(291.00)
StockVol	−135.87**	−12.53	−109.94	−138.88**	−12.90
	(54.18)	(24.63)	(129.45)	(53.13)	(24.70)
have OTC trading				2.84**	0.35
				(1.16)	(0.54)
Constant	−24.47*	−7.77	−23.28	−17.31	−6.88
	(13.74)	(6.25)	(28.47)	(13.78)	(6.41)
Observations	127	127	95	127	127
Adjusted R^2	0.15	−0.003	0.04	0.18	−0.01
Note:					*p<0.1; **p<0.05; ***p<0.01

Panel B: non OBX shares

	Cumulative Abnormal Volume				
	All	OSE	Post Trade	All	OSE
DivYield	−0.69	−0.36	−28.51	−0.65	−0.40
	(6.67)	(6.47)	(54.81)	(6.68)	(6.47)
lnMktCap	1.61	0.43	1.33	1.14	0.92
	(1.30)	(1.26)	(4.75)	(1.45)	(1.40)
BASpread	−12.96	−5.09	−134.77	−5.55	−12.64
	(63.40)	(61.63)	(213.23)	(64.22)	(62.41)
StockVol	−31.88	−17.93	−177.89	−37.67	−11.93
	(85.82)	(83.30)	(317.68)	(86.22)	(83.69)
have OTC trading				2.99	−3.07
				(4.05)	(3.92)
Constant	−27.32	−5.40	−7.04	−18.44	−14.52
	(28.64)	(27.78)	(109.61)	(31.07)	(30.14)
Observations	415	414	146	415	414
Adjusted R^2	−0.002	−0.01	−0.01	−0.003	−0.01
Note:					*p<0.1; **p<0.05; ***p<0.01

Table 7 Regressions explaining CAV. All dividend paying stocks, 2005-2007

Regressions with CAV_i as dependent variable. Explanatory variables: Dividend Yield, log of Market Capitalization, the relative bid/ask spread, the stock volatility, and a dummy for whether the stock in question also has OTC trades. Period: 2008–2012. Sample: All dividend paying stocks.

	Cumulative Abnormal Volume		
	All	OBX	non OBX
DivYield	−4.36	−9.76	−0.67
	(10.89)	(8.41)	(14.35)
lnMktCap	0.08	−0.46	0.28
	(0.27)	(0.43)	(0.41)
BASpread	−11.22	2.79	−8.98
	(19.24)	(314.19)	(21.80)
StockVol	20.75	−3.01	22.52
	(33.37)	(46.74)	(39.32)
Constant	−0.86	12.48	−5.32
	(6.28)	(11.53)	(9.31)
Observations	348	74	274
Adjusted R^2	−0.01	−0.01	−0.01
Note:		*p<0.1; **p<0.05; ***p<0.01	

References

Franklin Allen and Roni Michaely. Dividend policy. In R A Jarrow, V Maksimovic, and W T Ziemba, editors, *Finance*, volume 9 of *Handbooks in Operations Research and Management Science*, chapter 25, pages 793–834. North–Holland, 1995.

James J Angel, Lawrence Harris, and Chester S Spatt. Equity trading in the 21st century. *Quarterly Journal of Finance*, 1(1):1–53, 2011.

James J Angel, Lawrence Harris, and Chester S Spatt. Equity trading in the 21st century: An update. *Quarterly Journal of Finance*, 5(1), 2015.

Thiess Buettner, Carolin Holzmann, Felix Kreidl, and Hendrik Scholz. Witholding-tax non-compliance: The case of cum-ex stock market transactions. Working paper, available at SSRN, February 2019.

B Chowdhry and V Nanda. Multi–market trading and market liquidity. *Review of Financial Studies*, 4: 483–511, 1991.

Qinglei Dai and Kristian Rydqvist. Investigation of the costly-arbitrage model of price formation around the ex-dividend day in norway. *Journal of Empirical Finance*, 16(4):582 – 596, 2009. doi: 10.1016/j.jempfin.2009.04.001.

E J Elton and M J Gruber. Marginal stockholders' tax rates and the clientele effect. *Review of Economics and Statistics*, 1970.

Joan Farre-Mensa, Roni Michaely, and Martin Schmalz. Payout policy. In *Annual Review of Financial Economics*, volume 6 of *Annual Reviews*. Annual Reviews, 2014.

Sean Foley, Tom Grimstvedt Meling, and Bernt Arne Ødegaard. Tick size wars. Working Paper, University of Stavanger, May 2019.

L Glosten. Is the electronic limit order book inevitable? *Journal of Finance*, 49:1127–61, 1994.

Peter Gomber, Satchit Sagade, Erik Theissen, Moritz Christian Weber, and Christian Westheide. Spoilt for choice: Order routing decisions in fragmented equity markets. Working Paper, House of Finance, Goethe University, August 2016.

Peter Gomber, Satchit Sagade, Erik Theissen, Moritz Christian Weber, and Christian Westheide. Competition between equity markets: A review of the consolidation versus fragmentation debate. *Journal of economic surveys*, 31(3):792–814, 2017.

John Graham. Do taxes affect corporate decisions? A review. In George M Constantinides, Milton Harris, and René M Stulz, editors, *Handbook of the Economics of Finance volume 2B. Asset Pricing*, volume 21 of *Handbooks in Economics*, chapter 3, pages 123–210. Elsevier, Amsterdam, 2013.

Lawrence Harris. Consolidation, fragmentation, segmentation and regulation. *Financial Markets, Institutions and Instruments*, 2(5):1–29, 1993.

Tyler R Henry and Jennifer L Koski. Ex-dividend profitability and institutional trading skill. *Journal of Finance*, LXXII(1):461–492, February 2017.

Kjell Jørgensen, Johannes A Skjeltorp, and Bernt Arne Ødegaard. Throttling hyperactive robots - Order to trade ratios at the Oslo Stock Exchange. *Journal of Financial Markets*, 37(1):1–16, 2018.

Avner Kalay. The ex-dividend day behavior of stock prices: A re-examination of the clientele effect. *Journal of Finance*, 37(4):1059–1070, 1982. doi: 10.1111/j.1540-6261.1982.tb03598.x.

Tom Grimstvedt Meling. Anonymous trading in equities. Working Paper, University of Bergen, June 2016.

Albert J Menkveld. The economics of high-frequency trading: Taking stock. In Andy Lo and Robert Merton, editors, *Annual Review of Financial Economics*, volume 8 of *Annual Review of Financial Economics*. Annual Reviews, 2016.

Roni Michaely and Jean-Luc Vila. Investors' heterogeneity, prices, and volume around the ex-dividend day. *Journal of Financial and Quantitative Analysis*, 30(2):171–198, 1995. doi: 10.2307/2331116.

Roni Michaely and Jean-Luc Vila. Trading volume with private valuation: Evidence from the ex-dividend day. *The Review of Financial Studies*, 9(2):471–509, 1996.

Roni Michaely, Jean-Luc Vila, and Jiang Wang. A model of trading volume with tax-induced heterogeneous valuation and transaction costs. *Journal of Financial Intermediation*, 5(4):340–371, 1996.

Randi Næs and Bernt Arne Ødegaard. Equity trading by institutional investors. To cross or not to cross? *Journal of Financial Markets*, 9(2):79–99, 2006. doi: 10.1016/j.finmar.2006.01.003.

Randi Næs, Johannes A Skjeltorp, and Bernt Arne Ødegaard. Stock market liquidity and the Business Cycle. *Journal of Finance*, LXVI:139–176, February 2011.

Johannes Skjeltorp and Bernt Arne Ødegaard. Why do listed firms pay for market making in their own stock? *Financial Management*, pages 241–261, Summer 2015.