Norges Handelshøyskole

FIN11 Trading and Market Microstructure

Term paper

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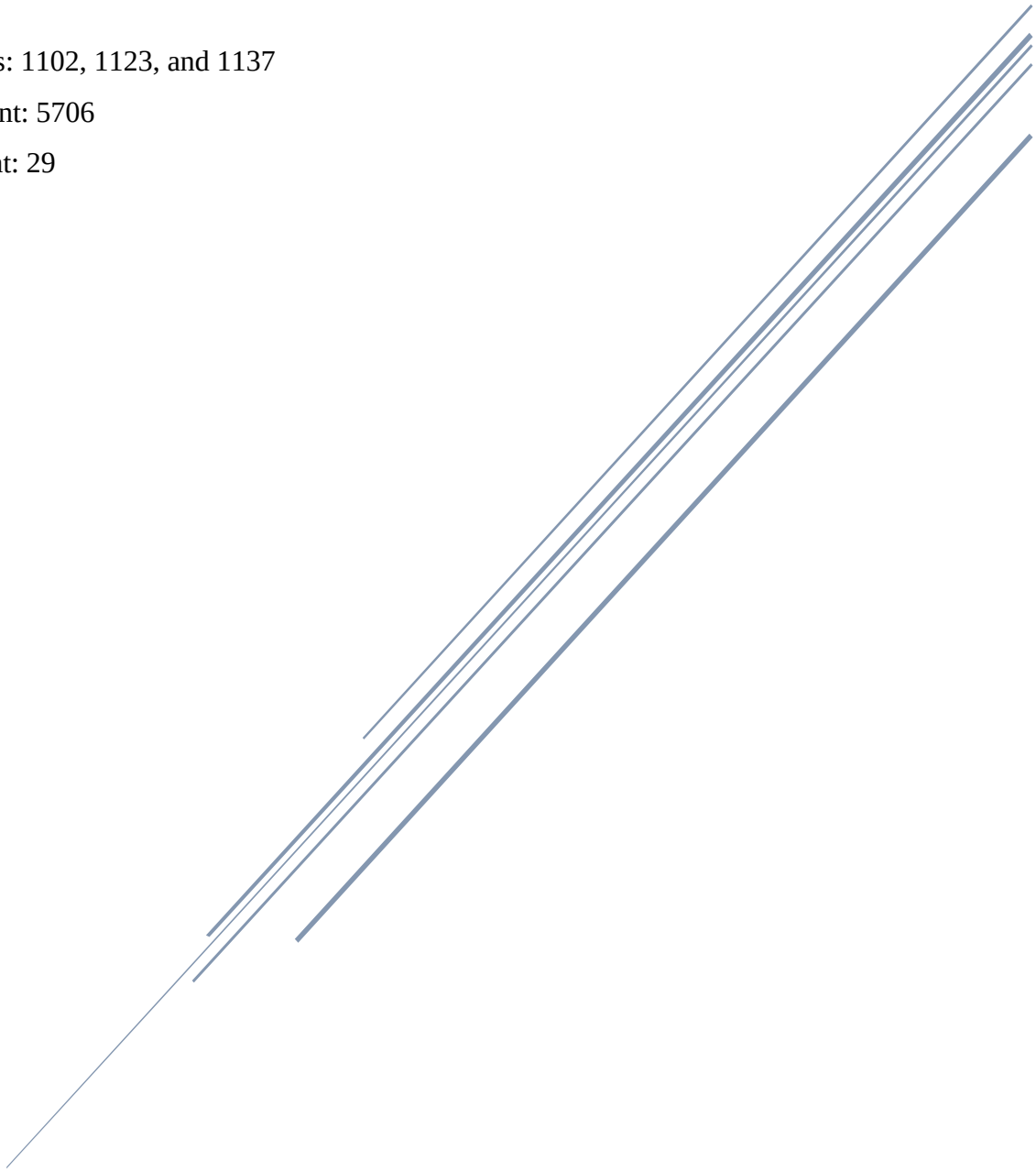
ANALYSING THE PROFITABILITY OF CUM-CUM TRADING ON THE NORWEGIAN STOCK EXCHANGE

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FIN11 – Trading and Market Microstructure

Abstract

This paper reports on the profitability of using cum-cum trading on the Norwegian Stock Exchange. Due to the lack of previous research on this topic, the hypothesis is based on trends of how stock prices generally move on and after the ex-dividend date. The main hypothesis for the paper researches whether there is a general upwards trend in the stock data after the ex-dividend date. This is a central assumption in the cum-cum trading model. The data used in the analysis is historical data for 118 stocks from the OBX and OB Match segment of Oslo Børs in 2018. We expected to find a significant ascending trendline through the data in the days following the ex-dividend date. If the trendline is ascending, it could be possible to profit from cum-cum trading on the Norwegian stock market. The results showed the presence of an ascending trendline, with a high margin of error. As all our data show the ascending trendline, and the p-value for the OB Match segment is much lower than the pre-determined statistical significance level; we conclude that it is possible to make a profit on the Norwegian Stock Exchange using the cum-cum trading strategy.

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Introduction

In mid-October 2018, a collaboration of European news media outlets discovered a large tax fraud scheme, where a network of banks, stock traders and lawyers had obtained billions from European treasuries through fraud involving dividend taxes. These findings, better known as the "CumExFiles", brought international attention to tax fraud and tax aversion schemes, mainly through cum-ex and cum-cum trading. Most papers published on these trading strategies centre around Germany, which was the country that lost the most amount of money (around $36.2 billion) on these tax-schemes. Published papers researching cum-ex trading are scarce, ones researching cum-cum trading are even scarcer.

Currently, cum-ex trading is illegal in most countries, whilst cum-cum trading is only illegal in Germany and still exists within the grey areas of the law in most other countries. We have been unable to find any information about cum-cum trading on the Norwegian stock exchange; therefore, the purpose of this paper is to investigate whether tax aversion schemes, in the form of cum-cum trading, are profitable in Norway (Harris, 2003). Working from our thesis question:

Is it possible to profit from cum-cum trading on the Norwegian stock exchange?

First, we will present some background information and the theoretical framework used later in the analysis, i.e. how dividend pay-outs affect stock prices, taxation of dividends and capital gain, and how cum-cum trading works. Hereafter, our hypothesis will be explained, and the methodology used to analyse our data will be described. Then, the findings of our analysis will be discussed and evaluated. In addition, limitations and weaknesses of our theory, methodology and findings will be presented. Lastly, we conclude and answers the thesis question

Theory

Dividend Pay-Outs

A dividend is a portion of companies´ earnings which is distributed to its shareholders. For the issuing companies, the dividend pay-out can be considered a compensation for the shareholders that encourages further investments, as well as a method of announcing the company´s success. For investors, dividends serve as a source of investment income. The amount of dividend investors receive depends on their ownership stake, and in most cases the dividend is issued in the form of cash or additional company stocks (Grant, 2019).

Important Dates and how they Affect Stock Prices

An important date regarding dividend pay-outs is the ex-dividend date or "ex-date", which is the first day the stocks are traded without the subsequent dividend value. In the period after the ex-date, the stock is traded as ex-dividend, without dividend. Investors are only entitled to the next dividend pay-out if the stock is bought prior to the ex-date, referred to as a "cum-dividend" stock. At this date, the stock price is expected to drop by the amount of the dividend.

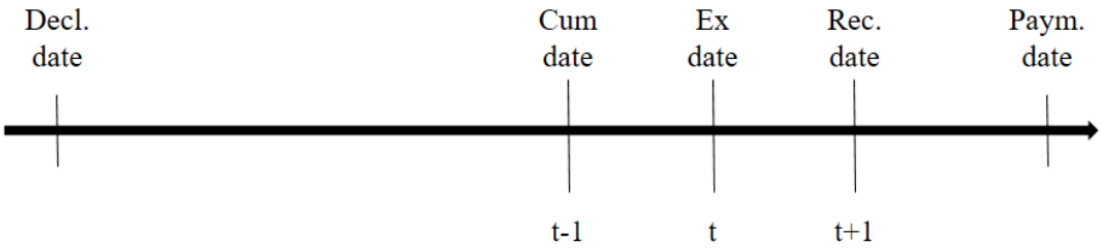


Figure 1 Dividend distribution period, Source: Arnesen & Berg, 2018

Furthermore, there are several other important dates surrounding the ex-date. The dates prior to the ex-date are the declaration-date and the cum-date, while the dates subsequent to the ex-date are the record-date and the payment-date. The declaration- or announcement-date, is where the company´s board of directors announce the planned dividend distribution. Any change in the expected dividend payment can cause the stock to rise or fall quickly as traders adjust to new expectations (Chen, 2019).

The day prior to the ex-date is commonly referred to as the cum-date and is the last day investors can buy cum-dividend stocks. This record-date is the day subsequent to the ex-date,

where the company registers which investors are entitled to the following dividend pay-out. As this does not affect the investors decisions in any way it should not affect the stock price. The day dividend is distributed to investors is known as the payment-date. Since this event is already known for the investors, it should not affect the stock price in any major way.

The size of the dividend is also a major factor in how much the stock prices change. Large dividend pay-outs tend to have a greater impact on the stock prices than smaller dividend pay-outs. In addition, companies who distribute dividends once a year tend to distribute larger dividends than the companies that distribute dividends multiple times a year. One could claim that companies who distribute dividends once a year experience larger fluctuation on their stock prices, than their counterparts who distribute dividends multiple times a year.

Dividend Taxation

According to the Norwegian taxation system, all individuals domiciled or permanently resident in Norway are subject to Norwegian income tax on their worldwide income (Deloitte, 2019). Dividends are considered as taxable income and are subject to a national tax rate of 22%. Additionally, income or losses due to ownership in companies are subject to a 1.44 multiplier before taxation, bringing the effective tax rate to 31.68%.

However, dividends received by a Norwegian limited company from another private limited company or a limited company within the EEA-area is subject to the exemption method and are 97% exempt from tax. The remaining 3% are subject to the standard 22% corporate tax rate. Moreover, the 97% exemption rate does also include dividend received from a non-EEA located private limited company, if the Norwegian company has held at least 10% of the shares for at least two years and the foreign country is not a low-tax country (Deloitte, 2019).

Private investors can be subject to the exemption rule if their shares are owned through a holding company. Even though the exemption method allows the private investor to shield 97% of the dividend from taxation, the method only works as a method of tax deferral. The dividend is only subject to taxation if the owner realizes the profits by withdrawing it from the holding company (Harris, 2003).

Capital Gain Taxation

Capital gains tax is a levy assessed on the positive difference between the sale price of the asset and its original purchase price (Kagan, 2019). However, whenever net profit is negative the taxpayer can deduct these losses.

Since the Norwegian Taxation Administration cannot levy taxes on the capital gains foreign investors have on Norwegian investments, they levy taxes on the dividends distributed to foreign investors in the form of withholding taxes. Foreign investors are therefore not only subject to capital gains tax in their resident country, but also taxation of dividends from Norway.

Withholding Taxes

Most OECD countries, including G20, apply withholding tax on dividends. This tax is levied when the dividends are destined to non-resident entities. Withholding taxes is not anti-avoidance rules but serve as a tool for restricting cross-border tax planning opportunities (Johansson et al., 2016).

Like Norwegian shareholders, foreign shareholders thus have a limited tax liability to Norway for dividends received from Norwegian companies. Norwegian limited companies must deduct 25% withholding tax on dividends from the company. However, this is commonly reduced due to tax treaties or Norwegian tax regulations, (The Norwegian Tax Administration).

Dividend on the Norwegian Stock Market in 2018

The Norwegian stock exchange consisted of 181 companies in 2018. The companies are segmented into the OBX, the OB Match, the OB Standard and the OB New, where the 25 most traded stocks make up the OBX-index. The least traded stocks make up the OB Standard and the OB New, whilst the OB Match segment is moderately liquid (Oslo Børs, 2019).

In 2018, 88 out of the 181 companies paid dividends. 20 companies from the OBX, 57 from the OB Match, and collectively 11 from the OB Standard and the OB New. Combined, the dividend paying companies paid 99 679 040 536.5 kr. The 20 companies in the OBX stood for 84 663 149 420kr (Oslo Børs, 2019).

Cum-Cum Trading

Cum-cum trading is an arbitrage method where the shareholder temporarily transfers cum-dividend shares to another investor, in order to exploit differences in the effective tax burden between investors (Jensen & Lassen, 2018). The savings of reduced taxation, or no taxation at all, is then split between the two participants. Cum-cum trading, unlike cum-ex trading, is not per se illegal, but is often considered illegitimate as the main goal is tax aversion. The idea behind cum-cum trading is profiting from transforming the initial withholding tax amount into different types of profits not subjected to source taxation. Cum-ex on the other hand is not about tax aversion, but the aim is to receive multiple tax reimbursements for the same withholding tax (Buettner et al., 2018).

As this paper will concentrate on the profits that can be obtained from cum-cum trading, we find it important to further explain the process behind cum-cum trading with an example, illustrated in Figure 2.

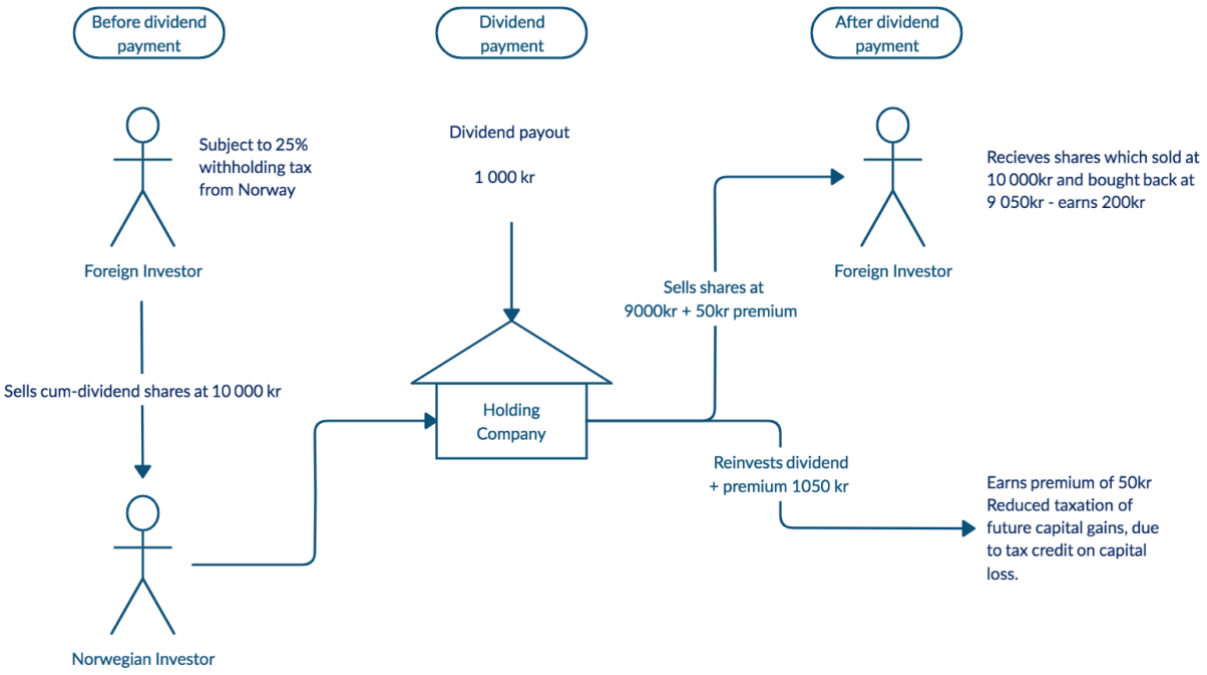


Figure 2 Illustration of a spot cum-cum transaction, own contribution

Let us imagine a foreign investor who owns shares in a Norwegian company, which is about to pay dividend to its shareholders. For illustration purposes, let us assume there is no tax

treaties or tax regulations between Norway and the foreign investor´s country, making the withholding tax rate at 25%.

The foreign investor sells his Norwegian shares before the dividend record date to a Norwegian investor who holds stocks through a holding company in Norway. Before the sale, the foreign investor and the Norwegian investor agree to a contractual obligation where the foreign investor is to buy back the shares ex-dividend. The Norwegian investor receives the shares, with the dividend entitlement. Ex-dividend, the foreign investor buys back the shares from the Norwegian investor without dividend entitlement. For better understanding of how the cum-cum transaction works, there will be a simplified example below.

A foreign investor buys shares on the Norwegian stock exchange. He later receives notice that the company will pay a cash dividend in the upcoming month. His shares are worth 10 000kr and will generate a dividend pay-out of 1 000kr. Cum-dividend, the foreign investor sells his shares with the dividend entitlement to a Norwegian investor, who buys the stocks through his holding company. Ex-dividend, the Norwegian investor receives the net dividend of 10 000kr into his holding company. Because the pay-out goes to the holding company, the Norwegian investor is not subjected to tax until he removes the money from the holding company. He is therefore able to reinvest the money without paying tax.

The foreign investor who sold the shares, repurchase the shares as the contractual obligation stated. (The price of the sale – the dividend pay-out + a small premium for the Norwegian investor). He buys the shares back at 9050kr and gains a capital income of 950kr instead of the net cash dividend of 750kr. The foreign investor receives the shares without any dividend entitlement, and the Norwegian investor receives a cash premium for the transaction.

The example above shows that the foreign investor makes a profit of 200kr (The difference between the capital income and the net cash dividend), whilst the Norwegian investor makes a profit of 50kr. The collected tax savings between the two investors are split during the transaction to set the premium the Norwegian investor receives, in this example the premium is simplified and set to 50kr. However, it is important to remember that the foreign investors are subject to capital gains tax on their capital income. The actual profit of the foreign investor is therefore 200kr (capital income of 950kr – capital gains tax – the net cash dividend of 750kr), as long as the stock price increase following the buyback of the shares is the same

amount as the initial decrease in stock price on the ex-dividend date. Whether cum-cum trading is profitable for a foreign investor or not will therefore also depend on the capital gains tax the foreign investors have to pay in their resident countries.

Theory Limitations

A major limitation to the theory presented is the limited amount of published material, online and in books, addressing cum-cum trading. It has also come to our attention that there is no published research addressing cum-cum trading in Norway. Whether this is because there is a lack of research done on the topic, or because it is a new phenomenon, we cannot state as a fact. However, it can be discussed whether the lack of material is due to tax authorities not wanting a lot of attention around the topic. An increase in attention could cause more people to use this trading method, which would not be beneficial for the tax authorities. Due to the lack of scientific research on the topic, it was rather difficult to find and present good examples of cum-cum trading.

Hypotheses

Because there is little to no research covering cum-cum trading on the Norwegian stock exchange, it is difficult to derive a hypothesis from pre-existing analysis. However, in our theory we have found trends of how stock prices generally move on and after the ex-dividend date. With our thesis, we want to explore whether there is a general upwards trend after ex-dividend day on the stock data.

$$H = The\ trendline\ for\ the\ stock\ data\ after\ the\ ex - dividend\ date\ should\ be\ ascending.$$

Our hypothesis looks at the general trend for all the data in the OBX and OB Match segment during the days following the ex-dividend date. We expect to find a significant ascending trendline through our data in the days following the ex-dividend date. If the trendline is ascending, it could be possible to profit from cum-cum trading on the Norwegian stock market.

Methodology

Data Source

To allow us to analyse whether cum-cum trading is a profitable trading strategy to implement on the Norwegian stock market, we gathered and structured historical data for all the OBX and OB Match stocks on Oslo Børs in 2018. We obtained all our historical data and historical ex-dividend dates from the Norwegian Stock Exchange's official website, that contains all public information about Norwegian stocks.

Sample Selection

After extracting the historical data for all cash dividend paying stocks on the Norwegian Stock Market for 2018, we had to exclude some of the companies. Initially we wanted to analyse all the stocks on the Norwegian market paying cash dividend in 2018, however after downloading all the data we had to exclude the stocks from the OB Standard and OB New segments as they weren't liquid enough around the ex-dividend dates.

Furthermore, some of the companies in the OBX and OB Match segments had merged or had been bought by other companies during the time period of 2018 to present. As there was data lacking for these companies and they do not exist anymore, we had to exclude them. We chose not to differentiate between cash dividend and special cash dividend, as they are both a cash pay-out and we assume they have the same effect on the stock price.

When choosing a time interval to analyse before and after the ex-dividend dates, we chose to look at 10 days prior to the ex-dividend date, and 10 days after. The time interval prior to the ex-date is based on the approximate average time between the dividend-notice dates and the ex-dividend dates of the companies being analysed. Whilst the short interval after the ex-dividend date is based on our assumption that the stock price would be able recover in a short amount of time after the initial price reduction on the ex-dividend date.

When using the linear regression model to analyse the data, we chose to look at the OBX and OB Match data separately. However, we did not separate the segments any further. This is because we wanted a general analysis of whether our data and trendlines were statistically significant for the two segments. As well as whether it would be more profitable to use the

cum-cum trading strategy on one of the segments versus the other, regardless of how many times the companies pay dividend. We chose to only use data from 2018 to simplify the analysis. In addition, we assume the general trend, based on companies from different segments and all sectors, will give a general depiction of the trend of how the market reacts to dividend pay-outs.

Descriptive Statistics

Our sample contains 9184 observations distributed between 21 trading days and 67 companies. All 67 companies paid dividends over the same period; Table 1 summarizes the distribution of dividend paid in 2018.

Number of dividends paid	*Stock frequency*	*Cumulative*
1	49	49
2	9	58
3	1	59
4	8	67
5	0	67
Total	67	67

Table 1 Summarized distribution of dividends

Dividend ex-dates often occur seasonally, because they usually occur in the same time period as quarterly reports. They will most regularly occur in April/May (Q1) and November (Q3). Table 2 summarizes the monthly distribution of the 118 dividend pay-outs in our sample selection.

Month	*Number of dividends paid*	*Percent*	*Cumulative*
January	0	0,00 %	0,00 %
February	6	5,08 %	5,08 %
March	6	5,08 %	10,17 %
April	25	21,19 %	31,36 %
May	35	29,66 %	61,02 %
June	8	6,78 %	67,80 %
July	1	0,85 %	68,64 %
August	5	4,24 %	72,88 %
September	7	5,93 %	78,81 %
October	6	5,08 %	83,90 %
November	17	14,41 %	98,31 %
December	2	1,69 %	100,00 %
Total	118	100,00 %	100,00 %

Table 2 Summarized monthly distribution of dividends

Method

To allow us to answer our thesis question, we want to analyse the general trendline of stock price movement prior to and after the ex-dividend date of the OBX and OB Match stocks on Oslo Børs. We want to analyse the collected historical data in groups where we differentiate between the two segments OBX and OB Match. This allows us to analyse if and how the cum-cum trading strategy would be more profitable implemented in either OBX or OB Match, as there is a difference in the liquidity in the segments We also differentiate between the companies paying dividend annually and multiple times a year. This allows us to analyse if, and how, the cum-cum trading strategy would be more profitable to implement in companies paying dividend once or multiple times a year.

Structuring of the Data

We extracted the historical data and ex-dividend dates from Oslo Børs' website for the 118 companies we were going to analyse as excel files. We used RStudio to extract the stock prices 10 days prior to the ex-dividend dates, and 10 days after, and entered the results in a table. Thereafter we extracted the OBX stocks and the OB Match stocks into different data frames. To allow us to analyse the changes in stock prices in group, we had to index the data, which we did by installing the "scales" package in R. We used the scale function from the

package to centre and scale the columns of the data frames. The scale function takes the root-mean-square of each column and is defined as

$$\sqrt{\sum(x^2)\,/(n-1)}$$

Equation 1, root-mean-square formula

X is the vector of the non-missing values and n is the number of non-missing values.

After scaling the data, using the package "dplyr" we set the scaled data back into a data frame using the "cbind" function.

Visualizing the Data

We graphed the data to see if we were able to spot any trendlines, using the "ggplot2" package in R. Adding a trendline, using the "geom_smooth" function, we were able to see the general trendline through the data. With the "geom_smooth" function we also added the margin of error with the confidence level set to 95%, to be able to visualise the error percentage of the trendline. We implemented this method for all the grouped data.

Data Analysis

After graphing the data and finding the general trendline of the stock prices, we wanted to further look at the statistical significance of our findings. To establish whether there is an increase in the stock price between the ex-dividend date and 10 days after, we utilise the following model. We use linear regression analysis, using the day count as an independent variable (the variable we believe to have an impact on our dependent variable) and the historical stock data as our dependent variable (the variable we want to understand). As we have already established a trendline, the regression analysis will allow us to identify whether a linear trendline is statistically significant.

The reason we chose linear regression and not nonlinear regression, is due that the trendline on the graphed stock data, following the ex-dividend date, seemed to be more linear than nonlinear.

To allow us to use linear regression to analyse the days following the ex-dividend date, we extracted the scaled data on the ex-dividend date and the data in the days following the ex-date. We then restructured the data into two columns; “Day nr” and “Stock prices”.

The linear regression model is based on the general mathematical equation:

$$y = ax + b$$

Equation 2 equation behind linear regression

where *y* is the independent variable and *x* is the dependent variable. *a* and *b* are constants called coefficients.

The formula behind the linear regression model in R is as follows:

$$Y = \beta_{1} + \beta_{2} X + \epsilon$$

Equation 3 linear regression equation in R

where $\beta 1$ is the intercept, and $\beta 2$ is the slope (Machinelearningplus.com).

Performance Measures

When running the linear regression model on our data, we use the following performance measures to evaluate our results.

Multiple R-Squared

Multiple R-squared is a measure of how well the linear regression model fits the actual data. We used the multiple R-squared value to evaluate whether the linear regression model is a correct way to analyse the stock data. R-squared measures the linear relationship between the independent and dependent variable. The value is always in the interval 0 to 1, which corresponds to a percentage from 0% to 100% of the variance that is found in the dependent variable, that can be explained by the independent variable. A high R-value indicates a high percentage of variance found, and a better fit of the linear regression model to our data (Rego, 2015).

P-Value

To evaluate the results, we are using the p-value output from the linear regression, to check the data for statistical significance between the upwards trendline and the rest of the data. There are two p-values in the regression analysis output in R, one is the p-value for the model, the other is the p-value of the individual predictor variables. We can consider the linear model to be significant only if both p-values are below a pre-determined statistical significance level of 0.05. If both p-values are below 0.05 the null hypothesis is rejected.

The null hypothesis, in linear regression, "is that the beta coefficients associated with the variables equal zero". (Machinelearningplus.com). The null hypothesis assumes the dependent and independent variable does not have a relationship by default. The alternative hypothesis is the opposite, that the coefficients do not equal zero. The p-value equation is given in Figure 3, where *P* is the probability, *E* is the effect and *H0* is the null hypothesis (Machinelearningplus.com).

$$P\ Value = P(E \mid H0)$$

Figure 3 The P-value

Limitations to the Methodology

The main limitation to our methodology lies in the data sample selection. Our only way to simplify this paper was to keep our data to one year only. This means that the trends seen in the data could potentially be caused by annual fluctuations and contain annual anomalies.

Analysis and Findings

Visualizing the Data

We initiate our findings by first presenting the graphical illustration of our analysis with illustrated trendlines, showing the decrease in stock prices on the ex-dividend date and the trended increase in stock prices in the days following. Figure 4 and 5 shows the trendline in the collective stock prices of the OBX and the OB Match respectively.

Day 11 in the OBX Figure shows the ex-dividend date.

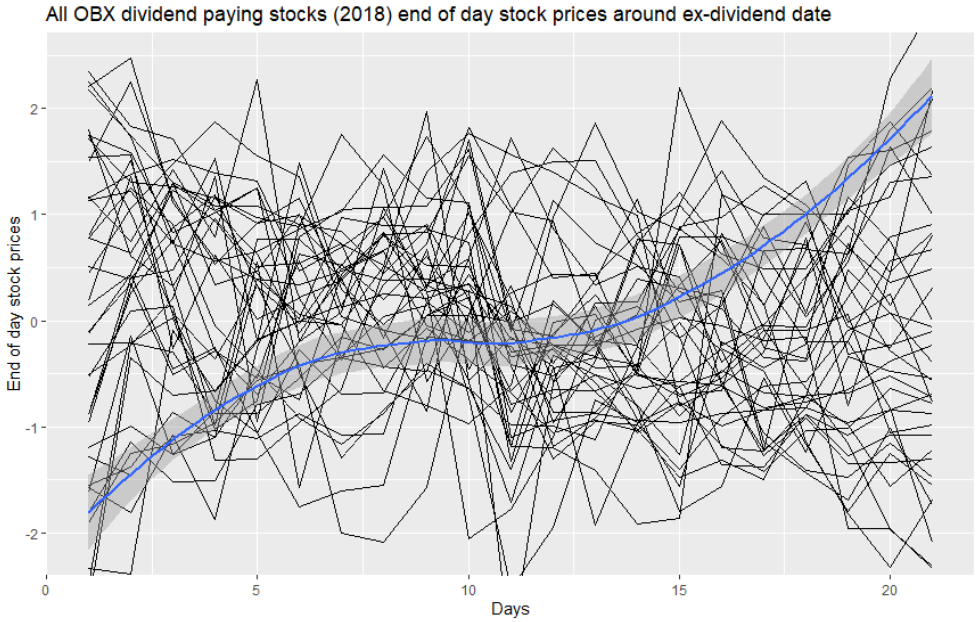


Figure 4 All OBX stock prices around ex-dividend date

Day 0 in the OB Match Figure shows the ex-dividend date.

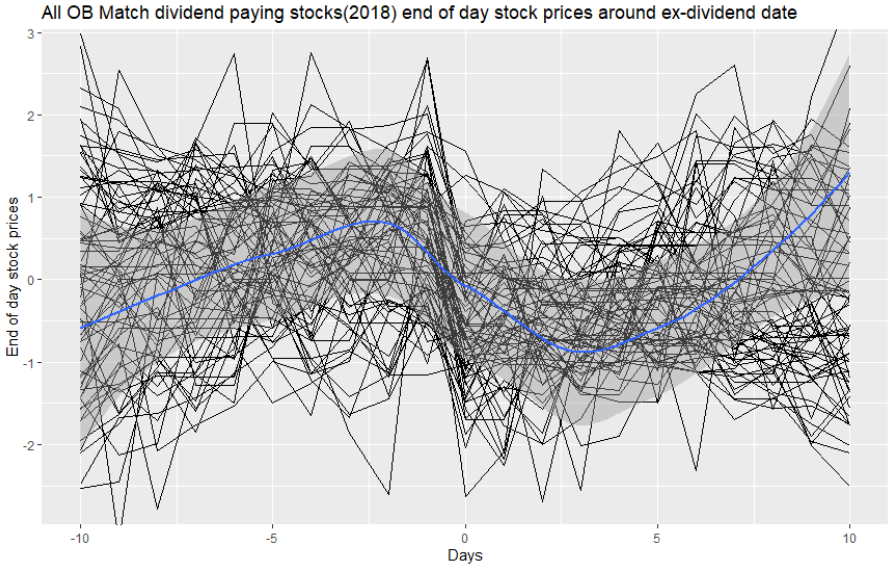


Figure 5 All OB Match stock prices around ex-dividend date

The blue line in the figures are the trendlines, whilst the shaded area around the trendline shows the error of the trendline at a 95% confidence interval. The trendline follows our

expectations on both figures above, where we expected an increase in the stock price in the days after the ex-dividend date. There is, however, a high margin of error around the trendline for the OB Match dividend-paying stocks. Whilst the margin of error on the OBX dividend paying stocks is lower, it is still significantly high at the 95% confidence interval.

Furthermore, we have divided the data into stocks paying dividend once a year and multiple times a year for both segments. Figure 6 and 7 show the OBX segment, with companies paying dividend multiple times a year and once a year respectively. Both figures include trendlines and error margins.

Day 11 in Figures 6 and 7 is the ex-dividend date.

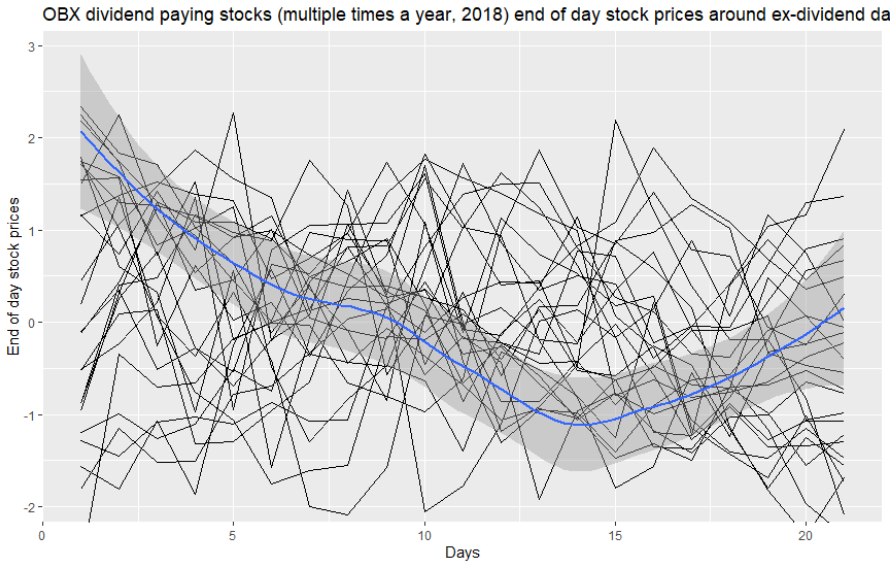


Figure 6 OBX segment, multiple dividend payments a year

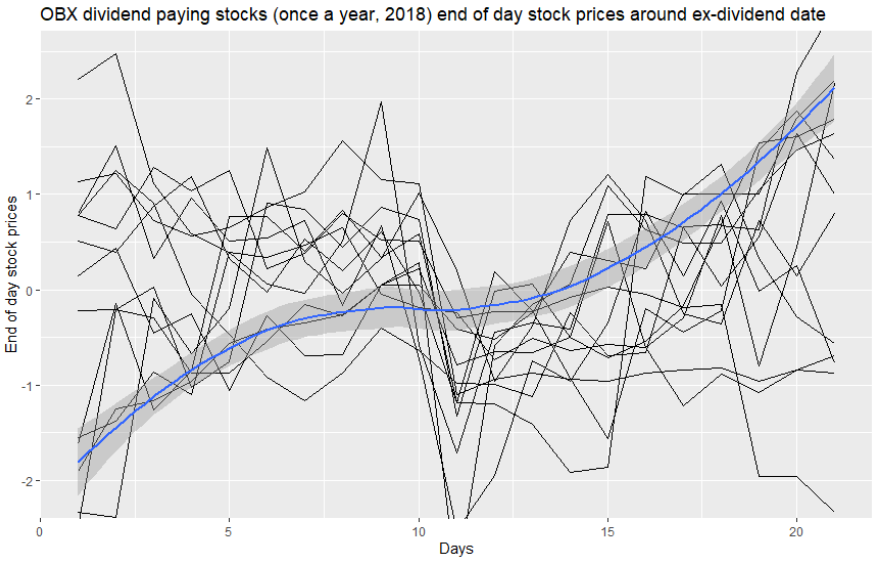


Figure 7 OBX segment, one dividend payment a year

The trendline for the OBX segmented stock prices both show an increase in the days after ex-dividend. The trendline for the OBX stocks paying dividend multiple times a year show a steeper slope. The slope of Figure 7 follows our hypothesis that the dividend pay-out for stocks paying dividend multiple times a year is steeper, because the dividend payments are often lower per dividend pay-out. The error margin of the data is also lower for Figure 7 than Figure 6. This could be a result of there being fewer stock prices to analyse, rather than there being a better fitted trendline for OBX dividend companies paying stocks multiple times a year, than the companies only paying dividend once a year.

Figure 8 and 9 show the OB Match segment, with companies paying dividend multiple times a year and once a year respectively. Both figures include trendlines and error margins.

Day 0 in the OB Match Figures 8 and 9 shows the ex-dividend date.

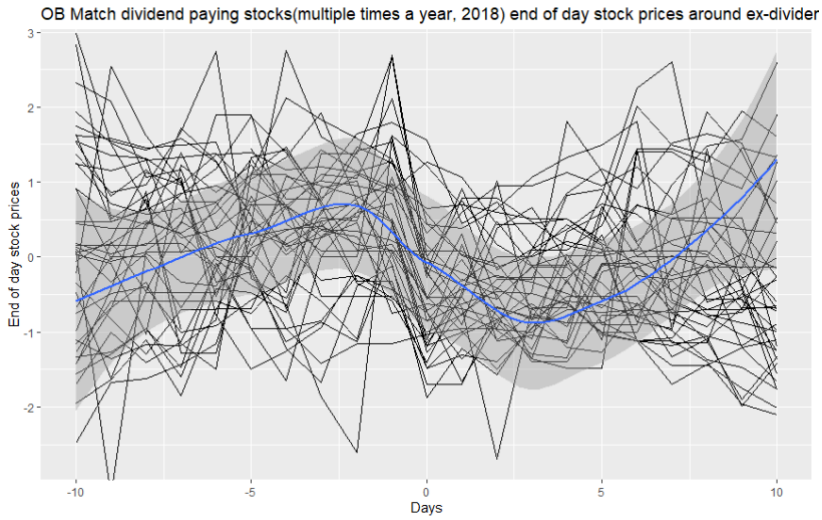


Figure 8 OB Match segment, multiple dividend payments a year

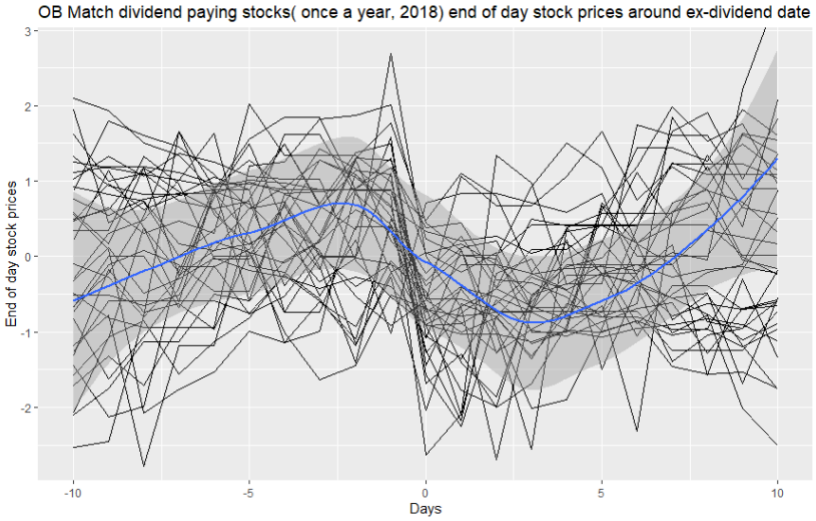


Figure 9 OB Match segment, one dividend payment a year

The trendline for the OB Match scaled stock prices both show the same trend as the OBX stock data, an increase in the days after the ex-dividend date. In difference from the OBX data, the error margins of the trendlines are relatively similar. The slope of the trendlines are also similar, if not almost identical.

It is important to note that even though there is a visible trend in the data, the error margins are quite high. It is easy to spot the trended increase in the data after the ex-dividend date, but there is also a noticeable spread between the different stock prices.

If we were to analyse the stock prices solely based on the graphed data, one could say that even though the error margins are visibly large, the ascending trendlines in the stock prices ex-dividend are similar for all the data. Because of this, the overall result would state that there is definitely a large possibility that cum-cum trading on the Norwegian stock market is profitable as long as the capital gain tax in the investors home country is relatively lower than the dividend tax for foreign investors in Norway.

Statistical Analysis

When previously analysing the graphs and establishing the general trendline in the data, we noticed there was a significantly large margin of error around the trendline. To further analyse the statistical significance of our data we used linear regression. The summary tables of the linear regression for the OBX and OB Match stock data is shown in table 3 and 4 respectively.

OBX all stocks regression analysis

r.squared	*adj.r.squared*	*sigma*	*statistic*	*p.value*	*df*
0.95207336523126	0.200583732057409	2.83078316607496	1.26691483581784	0.243368568483485	393

logLik	*AIC*	*BIC*	*deviance*	*df.residual*
-439.397060468104	1666.79412093621	3256.77380535096	200.333333333335	25

Table 3 Summary table for the linear regression analysis of all the OBX stock data

OB Match all stocks regression analysis

r.squared	*adj.r.squared*	*sigma*	*statistic*	*p.value*	*df*
0.856963470319635	0.287482628548739	2.67096573752164	1.50481527640994	0.000916176416394099	642

logLik	*AIC*	*BIC*	*deviance*	*df.residual*
-1283.11648254316	3852.23296508633	6866.84504615409	1148.58333333334	161

Table 4 Summary table for the linear regression analysis of all the OB Match stock data

The R-Squared Value

The first number in each of the summary tables 3 and 4 shows the value of the R-square. The R-squared value for the OBX segment is found to be 0.95, whilst the OB Match segment value is 0.86. These values are relatively high, and state that 95% of the variance that is found in the dependent variable, can be explained by the independent variable for the OBX segment. Whilst the percentage for the OB Match is 86%.

OBX	*OB Match*
r.squared	r.squared
0.95207336523126	0.856963470319635

Figure 10, OBX and OB Match R-squared values

These high numbers may suggest that the linear regression model is a good fit for the data in both segments.

The OB Match R-squared value is lower than the OBX R-squared value by nearly 10%. This could have been caused by the fact that the OB Match dataset contains more companies than the OBX, and thus likely has more anomalies in its data, rather than the linear regression model having a worse fit than the OBX.

The P-Value

To analyse our linear regression p-value we first must establish the null hypothesis and the alternative hypothesis. In this case the null hypothesis and alternative hypothesis are as follows

$$H_0 = There\ is\ no\ linear\ relationship\ between\ the\ days\ following\ the\ ex - dividend\ date\ and\ the\ stock\ data$$

$$H_A = There\ is\ a\ linear\ relationship\ between\ the\ days\ following\ the\ ex - dividend\ date\ and\ the\ stock\ data$$

The fifth value in the summary tables 3 and 4 show the p-value for the two segments, OBX and OB Match. The p-values are 0.24336 and 0.00092 respectively.

OBX	*OB Match*
p.value	*p.value*
0.243368568483485	0.000916176416394099

Figure 11 OBX and OB Match p-values

The p-values show a significant difference between the segments.

We cannot consider the linear model of the OBX to be significant as the p-value is much higher than the pre-determined statistical significance level of 0.05. This means that the null hypothesis for the OBX data is accepted and there is no linear relationship between the days following the ex-dividend date and the stock data for the OBX segment.

The OB Match segment p-value, however, is much lower than the pre-determined statistical significance level of 0.05. This means that the null hypothesis for the OB Match is rejected, and it can be stated that there is indeed a linear relationship between the days following the ex-dividend date and the stock data for the OB Match segment.

The significant difference in the p-values could be because of the sample sizes, as the OB Match has a greater number of observations.

Limitations to Analysis and Findings

There are multiple limitations to our analysis. Our entire data sample is from 2018, which was a good year for the Norwegian stock exchange, and this could be the reason behind the positive trends following the ex-dividend dates. The stock market is generally very volatile and therefore the analysis could be affected by high volatility in the period data sample. We have not back tested the data, which means checking whether these trends are applicable to other years with similar dividend-payments and companies.

Conclusion

This paper aims to analyse whether it would be possible to profit from cum-cum trading on the Norwegian stock exchange.

To allow us to analyse whether it is possible to profit from cum-cum trading on the Norwegian stock exchange, our focus was to determine whether there is an upwards trend in the stock prices following the ex-dividend date. This is a central assumption in the cum-cum trading model. If the stock price does not increase the same amount as the initial decrease in stock price on the ex-dividend date, the dividend gain is not fully transformed to capital gain. Our hypothesis, based on general trends in the stock prices in other countries, was as follows:

$$H = The\ trendline\ for\ the\ stock\ data\ after\ the\ ex - dividend\ date\ should\ be\ ascending$$

To answer the hypothesis, we have presented graphed data to look at trendlines as well as linear regression to test the statistical significance of the data.

The visualization of the data with the added trendline showed that both segments, OBX and OB Match have an ascending trendline following the ex-dividend date. The steepness of the trendlines after the ex-dividend date also gave us a sense of how fast the stock price would increase and regenerate the losses from the ex-dividend date. Both the OBX and OB Match segments show a steep ascending trendline allowing us to conclude that, even with a high percentage of error, our hypothesis is accepted.

The statistical analysis using linear regression on the other hand, gave some different results. The R-value for both the OBX (R-value = 0.95) and OB Match (R-value = 0.86) suggested that the linear regression model was a good fit. The p-value gave us mixed results. The OBX p-value was very high, 0.243, compared to the pre-determined statistical significance level of 0.05. The OBX p-value therefore suggests that there are no linear relationships between the variables.

The p-value for the OB Match, on the other hand, was very low, 0.0009, compared to the pre-determined statistical significance level of 0.05. Since the p-value of the OB Match was

significantly lower than 0.05, we were able to reject the null hypothesis and conclude a linear relationship between the variables.

To answer our thesis question, it is possible to profit from cum-cum trading on the Norwegian stock exchange. The graphed data for OBX and OB Match show a significantly steep trendline in the days following the ex-dividend date. The R-squared value shows that the linear regression analysis of the stock prices is valid, and the p-value shows us that the OB Match stocks have a linear and statistically significant increase in their prices following the ex-dividend date. Even though the p-value of the OBX does not show a relationship between the model variables, the graphed data show an ascending, significantly steep trendline in the days after the ex-dividend date. If an investor opts for cum-cum trading in the OB Match segment, our analysis supports that there is an opportunity to make a profit.

On a last note, even though the cum-cum strategy is not illegal in Norway, if an investor gets caught in a transaction buying or selling shares solemnly for tax aversion reasons in Norway, the Norwegian tax administration will make a cut (*gjennomskjæring*) and the transaction will be annulled. This means that even though its profitable, investors must be careful with how they implement the strategy on the Norwegian Stock Exchange.

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Appendix 1:

OBX companies 2018

OBX
Aker
Aker BP
Aker Solutions
Bakkafrost
BW Offshore Limited
DNB
DNO
Equinor
Gjensidige Forsikring
Golden Ocean Group
Grieg Seafood
Lerøy Seafood Group
Mowi
Norwegian Air Shuttle
NEL
Norsk Hydro
Orkla
Petroleum Geo-Services
SalMar
Schibsted ser. A
Storebrand
Subsea 7
Telenor
TGS-NOPEC Geophysical Company
Yara International

Appendix 2:

OB Match companies 2018

OB Match		
AF Gruppen	Funcom	Photocure
Arendals Fossekompani	Gaming Innovation Group	Polarcus
Akastor	Havila Shipping	Protector Forsikring
AKVA Group	Hexagon Composites	Prosafe
American Shipping Company	Hiddn Solutions	Questerre Energy Corporation
Apptix	Höegh LNG Holdings	RAK Petroleum
Aqualis	Havyard Group	Reach Subsea
Archer	IDEX	REC Silicon
Arcus	IMSK	Saferoad Holding
ABG Sundal Collier Holding	Insr Insurance Group	Salmones Camanchaca
Asetek	InterOil Exploration and Production	SAS AB
Atea	Itera	Sbanken
Austevoll Seafood	Jinhui Shipping and Transportation	Star Bulk Carriers
Avance Gas Holding	Kid	Selvaag Bolig
Awilco Drilling	Kitron	SeaBird Exploration
Axactor	Kongsberg Automotive	Schibsted ser. B
B2Holding	Kongsberg Gruppen	Seadrill
Borr Drilling	Komplett Bank	Seadrill
Bergen Group	Kværner	S.D. Standard Drilling
BerGenBio	Link Mobility Group	Shelf Drilling
Biotec Pharmacon	MPC Container Ships	Stolt-Nielsen
Bonheur	Magseis Fairfield	Solstad Offshore
Borgestad	Multiconsult	Solon Eiendom
Bouvet	Nordic Nanovector	Songa Offshore
Borregaard	Napatech	Spectrum
BW LPG	Navamedic	SpareBank 1 SR-Bank
ContextVision	NEXT Biometrics Group	The Scottish Salmon Company
Crayon Group Holding	Nordic Semiconductor	Scatec Solar
Cxense	Northern Drilling	StrongPoint
Data Respons	Norwegian Finans Holding	Techstep
Dolphin Drilling	Norwegian Energy Company	Thin Film Electronics
DOF	Norwegian Property	Tomra Systems
Eidesvik Offshore	NRC Group	Treasure
Ekornes	Norway Royal Salmon	Targovax
Element	Ocean Yield	Veidekke
Elkem	Odfjell ser. A	Vistin Pharma
Electromagnetic Geoservices	Odfjell ser. B	Voss Veksel- og Landmandsbank
Entra	Odfjell Drilling	Wallenius Wilhelmsen
Europris	Olav Thon Eiendomsselskap	Wentworth Resources
EVRY	Otello Corporation	Wilh. Wilhelmsen Holding ser. A
Fjord1	Oceanteam	Wilh. Wilhelmsen Holding ser. B
Fjordkraft Holding	Pareto Bank	XXL
FLEX LNG	PCI Biotech Holding	Zalaris
Frontline	Panoro Energy	