Norges Handelshøyskole

FIN11 Trading and Market Microstructure

Term paper

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CAPITALIZING ON THE OVERNIGHT GAP ON OSLO STOCK EXCHANGE

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Executive Summary

In this paper we research the topic overnight trading on Oslo Stock Exchange. We will examine this topic on 5 stocks and 2 indexes by comparing the risk and return in (1) a simple buy and hold strategy with (2) trading overnight (buy at close, sell at opening), and (3) overnight trading only executed after 2% decrease during intraday.

We find that the strategy (3) in general has a better risk-adjusted return, than both going long (2), and a simple overnight strategy (1). In addition, high volatility in the securities is required when capitalizing on overnight trading, as the gap between *close* and *open* needs to be higher than the transaction costs. Furthermore, the transaction costs, mainly the spread, has a big impact on the results. Liquidity of the stocks is therefore highly relevant when implementing an overnight strategy. Lastly, the study also suggests that a high percentage of individual investors in the securities traded can affect the overnight return to an extent.

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1. Introduction

In this assignment we will research the overnight return on the Oslo Stock Exchange. Our topic is based on the empirical study "Return differences between Trading and Non-Trading Hours: Like night and day" conducted by Cooper, Cliff & Gulen (2008). Their findings conclude that overnight returns are consistently higher than day returns among all individual stocks on the S&P 500 index at the given point of time between 1993-2006. We will therefore examine whether it's possible to capitalize on the potential overnight return at the Oslo Stock Exchange.

We will examine this topic by comparing the risk and return in (1) a simple buy and hold strategy with (2) trading overnight (buy at close, sell at opening), and (3) overnight trading only executed after 2% decrease during intraday. Transaction costs are included in all 3. The data examined will stretch from 1.1.2013 to 22.11.2019. We will conduct the study on the following instruments: NAS, XXL, NEL, MOWI, DNO, the OBX index, and the OSEBX index. The stocks being analyzed are chosen based on three criteria. These criteria are established based on empirical studies on overnight trading in the U.S. stock market.

We will start off by providing relevant theory to enlighten the reader on the topic and found the basis for our strategy. Furthermore, we will clarify the market fundamentals at the Oslo Stock Exchange, before explaining our method, strategy and calculations. Thereafter, we will back-test our strategy on the chosen stocks and analyze the results. Lastly, we will provide reflections on the strategy's limitations and weaknesses, followed by a conclusion.

1.1 Definitions

Terms	Definition
Institutional holding	Institutional holding (ownership) is referred to as the share of a company's stocks owned by large financial institutions. Examples are pension funds, investment firms, insurance companies or other large entities that manage investments on behalf of others. These kind of investors are often long-term orientated (Kenton, 2019)
Individual Investors	Every person who make investments on their own behalf. They manage their own money and have a lot less purchasing power than a financial institution (Palmer, 2019).
Overnight trading	Overnight trading is a strategy where you speculate on the direction of the stock price the next morning. The strategy mainly focuses on trading in the pre-market and after-market hours before and after the market is open. When you hold a position from the close auction until the next open you carry greater risk, but also greater opportunity for profit.
"*Overnight*"	The name of the strategy where we buy at close and sell at the opening every trading day from 1.1.2013-21.11.2019.
"*Strategy*"	The name of the strategy where we buy at close only those trading days where there has been a decrease of 2% or more the same intraday, and sell at the opening next trading day.
"*Long*"	A buy and hold strategy that includes buying 1.1.2013 and holding throughout the whole relevant period. Will reflect the stock's return.

The OBX index	The OBX Index consist of the 25 most liquid companies on the Oslo Stock Exchange, based on six months turnover rating (Oslo Børs, 2019)
The OSEBX Index	The Oslo Børs Benchmark Index comprises a representative selection of the most traded shares listed on Oslo Stock Exchange (Oslo Børs, 2019)
The S&P 500 Index	The S&P 500 Index is an index including 500 of the largest companies in the US.
XXL	XXL is a leading sports retailer with stores and e-commerce in the Nordics and Austria.
MOWI	MOWI, formerly Marine Harvest, is a seafood company, and the world's biggest producer of Atlantic salmon.
NEL	Nel is a company providing solutions for production, storage and distribution of hydrogen.
NAS	Norwegian Air Shuttle is Norway's largest airline. Operates in the low-cost business.
DNO	Det Norske Oljeselskap is a Norwegian operator of gas and oil.
Nordnet	A Scandinavian digital broker for investments and financial products.
Shareville	Scandinavia's biggest social network for investors and traders.
ETF	An Exchange Traded Fund is a collection of securities that that trade on an exchange. It can contain different types of investments including stocks, commodities and bonds.
Norne Securities	A securities entity operating with corporate finance, market making etc.

EBITDA	Earnings Before Interests, Tax, Depreciation, Amortization. For simplicity, we use this as a general term of the company´s profit, even though there are many other key figures that explains a company´s profitability.
Standard Deviation	Statistical measurement of average variance. Used in the measuring of volatility and Sharpe ratio.
Sharpe Ratio	Risk-return measurement. It is written as the average asset return subtracted by the risk-free rate and divided by the asset standard deviation.
Overnight Gap	The gap in price of security between the last price of yesterday and open price today.

1.2 Market Fundamentals

Oslo Stock Exchange Market Model

The Oslo Stock Exchange is an *order-driven* exchange. During the *regular trading* day (09:00-16:20), it is a *continuous market,* which means traders may continuously attempt to arrange their trades (Harris , 2003). Furthermore, the Oslo Stock Exchange operates with *pre-trading* (08:15-09:00), *closing auction call* (16:20-16:25) and *post close-trading* (16:25-17:30). Trades in Exchange Traded Funds, Exchange Traded Notes and warrants close at 16:20 without closing auction call (Oslo Børs, 2018).

Pre-trading is the trading activity that happens before the regular trading session. A lot of investors watch the pre-trading activity to judge the direction of the market in anticipation for the regular trading session. During pre-trading the market has limited volume and liquidity, as a result of this large bid and ask spreads are common. Members cannot manage or insert orders or trades during this session, and no orders are executed. If an order breaches the allowed price band tolerance, the order is automatically expired.

During the *Closing Auction Call* at Oslo Stock Exchange members may place, change and delete orders. All orders are published in accordance with their visibility, and the *Indicative Auction Price* and *Volume* is continuously calculated and published. No execution will take place before auction uncrossing.

At the end of the auction call, the uncrossing will occur, and eligible orders are executed in accordance with the auction execution algorithm. The uncrossing will take place on a random time from the scheduled end of the auction call. After this point, no order book updates will be published.

During the *post close* session at Oslo Stock Exchange, members may cancel orders, but may not place or change the content of the orders. The order book will not be published during the *post close* session.

2. Theory

2.1 Relevant Studies

The market microstructure of Oslo Stock Exchange is very similar to the exchanges that are representative for the S&P 500, where there is a pre-market, intraday market, and a post-market to trade stocks. As we are going to examine possibilities for capitalizing on overnight returns on the Oslo Stock Market, findings on the S&P 500 is therefore highly relevant for our research question.

Cooper, Cliff, & Gulen (2008)concludes in their study that overnight returns are consistently higher than intraday returns among all individual stocks on the S&P 500 index at the given point of time between 1993-2006. They found that the return overnight during the period was 554%, and significantly outperformed the intraday return of -39%.

In addition, an empirical study done by Berkman et al.(2012), and published in the *Journal of Financial and Quantitative Analysis,* implied that amongst the 3,000 largest U.S. stocks during 1996-2008, there was a significant return on overnight trades especially for stocks with high concentration of individual retail investors. They demonstrate that high-attention days for individual stocks are followed by high net retail buying at the start of the next trading day. This increased retail buying pressure results in opening prices that tend to be high relative to prices during the rest of the trading day. Moreover, the studies of Berkman et al. (2012) found that

even for the most overpriced stocks, the significant price inflation at the open was completely reversed during the regular trading day. In other words; the mean close-to-close return was not significantly different from 0. In addition, the study showed a significant overnight return from stocks with high recent volatility.

2.2 Volatility

Volatility is the tendency for prices to change unexpectedly. The stock-prices change in response to new information about values, and in response to the demand of impatient traders for liquidity (Harris , 2003). Volatility is therefore highly important when trying to capitilize on trading overnight, as the gap between *close* and *open* needs to be higher than the transaction costs. Sometimes prices are very volatile, other times, prices are very constant. Risk, losses and profit are often closely associated with volatility; therefore, traders are often very interested in, and concerned about, volatility. Volatility can be split into two main categories; *fundamental volatility* and *transitory volatility.* The former is due to unanticipated changes in instrument values, whilst the latter is due to trading activity by uninformed traders that makes prices diverge from fundamental value (Harris , 2003).

Any factor that determines the value of a trading instrument can cause the price of that instrument to change. Quality of management, market supply and demand conditions, interest rates, national inflation rates, macroeconomic policies, and change in resources and technologies can all generate *fundamental volatility* in the instrument (Harris , 2003).

2.3 Transaction Costs

Transaction costs involves all the costs associated with trading (Harris , 2003). It is mainly divided into three categories: explicit, implicit and missed trade opportunity cost. The explicit costs consist of broker commissions, exchange fees and taxes. The implicit costs consist of costs caused by price impact, for example paying the *spread.* When a big buy position forces the price up, the price impact of their trading is also a form of implicit transaction cost. Missed trade opportunity costs arises when traders fail to fill their order (Harris , 2003). For example, when a trader puts a limit buy order below the market price waiting for the price to drop, but then the price rises, and the trader must fill at a higher price than the original market price. The transaction costs can have a big impact on the outcome of a specific strategy, and it is important

to take into consideration when deciding the optimal trading strategy. Because an overnight trading strategy involves numerous trades over the relevant period, the transaction costs will affect the return much more than in a *long* strategy.

3. Forming the Strategy

3.1 Hypothesis

Our hypothesis is mainly based on the studies by Cooper, Cliff, & Gulen (2008). Barber & Odean (2005), and Berkman, Koch, Tuttle, & Zhang (2012). Stocks with high volatility, and a high concentration of individual retail investors, are more likely to have a bigger overnight gap. The theory implies that these traders have lower liquidity and a more loss-averse profile compared to institutional investors. Negative news will therefore initialize more trades than positive news. This generates a bigger fall in the stock prices, causing an overreaction in the market. As a result, the stock prices will be affected by a correction the day after the negative news, which the strategy will try to capitalize on.

3.2 Strategy

This paper seeks to find out if an overnight trading strategy at Oslo Stock Exchange, will beat a long term buy-and-hold strategy in the same period. In compliance with the theory, our overnight trading strategy will consist of finding highly traded volatile stocks with relatively high individual holdings at Oslo Stock Exchange. Based on the overreaction of a stock price caused by negative news, we will also add a specific trading criterion: If the stock price ***decreases 2% or more during intraday***, we will initiate the strategy. Due to errors in the historical open, close and last prices on the Oslo Stock Exchange before 2013, the simulation will take place in the period of 1.1.2013 until 22.11.2019.

3.3 Method

3.3.1 Criteria

According to the theory and strategy above, we had 3 main criteria picking the stocks to analyze; (1) they had to be amongst the biggest and most liquid stocks at Oslo Stock Exchange (minimum 2,5 billion in market cap), (2) they had to be volatile (Above 25 in volatility), and (3) they had to be traded by a great share of individual retail investors (Individual holdings above 0,8%).

3.3.2 Picking the stocks

To find the best stocks based on our criteria, we used Bloomberg Terminal to find information regarding share of individual holders, market cap and volatility for the stocks in the OSEBX. The volatility was calculated from the daily standard deviation for the whole period. We exported the data to excel and filtered away the stocks that didn't match our criteria until we were left with 12 potential stocks.

Ticker	Name	Ind. Own. (%)	MCAP (NOK)	Volatility
NEL	NEL ASA	1,07	9 373 528 064	87,5
NAS	Norwegian Air Shuttle ASA	1,85	6 143 252 480	54,2
XXL	XXL ASA	0,81	2 652 204 032	41,7
NOD	Nordic Semiconductor ASA	1,58	9 780 119 552	40,5
B2H	B2Holding ASA	1,94	3 906 657 536	37,3
TGS	TGS NOPEC Geophysical Co ASA	1,31	33 353 351 168	37,3
SSO	Scatec Solar ASA	1,93	13 013 382 144	35,8
NOFI	Norwegian Finans Holding ASA	2,43	17 545 336 832	35,1
EPR	Europris ASA	2,60	5 546 706 432	29,9
AKER	Aker ASA	1,29	37 569 699 840	29,3
SNI	Stolt-Nielsen Ltd	0,84	7 157 331 456	28,2
MOWI	Mowi ASA	0,94	118 211 592 192	25,6
DNO NO Equity	DNO ASA	0,05	11504687104	49,2

We chose to pick the top three based on the volatility, and the stock with the highest market cap. In addition, we wanted to pick a stock that didn't fulfill our criteria, but rather had a very low individual holding to test the hypothesis regarding the distribution of the shareholders.

Our choice was then: NEL, NAS, XXL and MOWI that fulfilled our criteria, and DNO that didn't. An important mention is that XXL wasn't listed on Oslo Stock Exchange before 2014, therefore XXL will only be analyzed from 2014. We will also conduct the analysis on the OBX and OSEBX indexes.

3.3.3 Assumptions

To make the strategy as realistic as possible, we will take the transaction costs into consideration. We will implement the costs of brokerage fees and the spread costs in our financial model. We assumed a fixed spread of 0,03 percent of the stock price. The spread cost range is based on the average spread of the picked stocks. In addition, we have assumed a fixed brokerage fee (BF) of 0,03 percent of the total trading price, based on Pareto Securities "Trader-Profile" (Pareto, 2019).

3.3.4 Risk and return measurement

We calculated the 0,03% spread directly into the open and last prices. Then, we calculated the percentage return after brokerage fee as using the "Formula for daily overnight return".

$$\frac{\text{Open*(1-BF) - Last*(1 + BF)}}{\text{Last*(1 + BF)}}$$

Figure 1 "Formula for daily overnight return"

To evaluate the performance of *long, overnight* and *strategy,* we will look at the metrics *cumulative return, annual return, standard deviation* and *Sharpe Ratio.*

The cumulative return shows the total return within each trading strategy (*long, overnight* and *strategy).* To get the cumulative returns in percentage we multiplied the daily percentage returns on the days we traded (according to our strategy) using the formula showed below.

$$(1 + r) * (1 + r_2) * \dots * (1 + r_n) = Cumulative\ return\ after\ n\ days$$
$$r = daily\ overnight\ return$$

Figure 2 "Total Return"

The average annual return is calculated as shown below. We have rounded off to 6 years for XXL and 7 years for the other stocks to simplify. The formula we have used is therefore:

$$\left(\frac{Value_{(21.11.2019)}}{Value_{(1.1.2013)}}\right)^{\frac{1}{years}} - 1 = Annual\ return$$

Figure 3 "Annual Return"

Standard Deviation is a statistic measurement of average variance and is a commonly used to describe the volatility. The metric shows the volatility of a value based on its historical average (Chen, 2019), including both systematic and unsystematic risk. A high standard deviation indicates high volatility in the instrument and a high risk, while a low standard deviation indicates low volatility and low risk. To measure the historical volatility, we quantified the daily returns and calculated the annual standard deviation with the use of 250 trading days.

$$standard\ deviation\ = \sqrt{250\ \cdot \frac{\left(\sum (r(t))^2\right)}{(N-1)}}$$

Figure 4 "Standard Deviation"

The Sharpe Ratio is another measure that allows investors to analyze the risk-return of an investment. It is relevant, because it takes the risk into consideration when measuring performance of the strategy. The annual return of a security represents the *asset return*, and the Norwegian 10-year bond yield represents the *risk-free rate*. The 10Y bond yield is calculated to the mean value of 1,92% (between 2013-2018) (Norges Bank, 2019).The annual standard deviation is calculated as shown above. In this case, the Sharpe ratio adjusts a stock's and a strategy's performance for the excess risk that was taken. The higher the score, the better selection of stock and strategy.

$$Sharpe\ Ratio = \frac{Rp\ - Rf}{\sigma p}$$

Rp=asset return Rf= risk-free rate σp= asset standard deviation

Results

The results from the suggested strategy, overnight and going long is represented in table 1. The results of risk and return of OBX, OSEBX, DNO, MOWI, NEL, NAS and XXL is illustrated below.

Risk measurment	DNO	MOWI	XXL	NAS	NEL	OBX	OSEBX
SD: long	47,24 %	24,60 %	39,87 %	52,08 %	55,06 %	15,57 %	14,69 %
SD: overnight	25,02 %	12,20 %	27,33 %	28,06 %	46,65 %	15,59 %	2,61 %
SD: strategy	13,13 %	3,87 %	5,39 %	12,89 %	27,81 %	7,20 %	0,86 %
:: Days of Trade	368	116	154,00	388	472	116	39
:: % of negative trades	50,00 %	53,45 %	42,86 %	44,59 %	49,15 %	7,76 %	97,44 %
Sharp Ratio: long	0,727184857	86,94851743	-54,5333941	-22,5954827	33,57252334	54,6921937	59,1950643
Sharp Ratio: overnight	49,74687547	-197,306382	-71,945547	100,1940406	110,8661323	-237,955874	-1111,7567
Sharp Ratio: strategy	-22,9747453	-49,4480647	124,1395613	152,2887444	67,1685619	341,8934032	-264,72364

Figure 5 "Risk measurements" (Sharpe ratio: Green = highest score, Yellow = Second highest score, Red = Lowest score).

Return	XXL	NAS	NEL	MOWI	DNO	OBX	OSEBX
Cum. Return: strategy	64,15 %	292,04 %	271,09 %	0,04 %	-7,43 %	419,74 %	-2,47 %
Annual E(p): strategy	8,61 %	21,55 %	20,60 %	0,01 %	-1,10 %	26,55 %	-0,36 %
Cum. Return: overnight	-69,02 %	528,78 %	1925,40 %	-82,61 %	152,57 %	-95,19 %	-90,29 %
Annual E(p) overnight	-17,74 %	30,04 %	53,64 %	-22,16 %	14,36 %	-35,17 %	-28,35 %
Cum. Return: long	-72,55 %	-51,68 %	267,39 %	330,15 %	17,79 %	100,37 %	101,07 %
Annual E(p) long	-19,82 %	-9,85 %	20,41 %	23,31 %	2,26 %	10,44 %	10,62 %

Figure 6 "Return measurements"

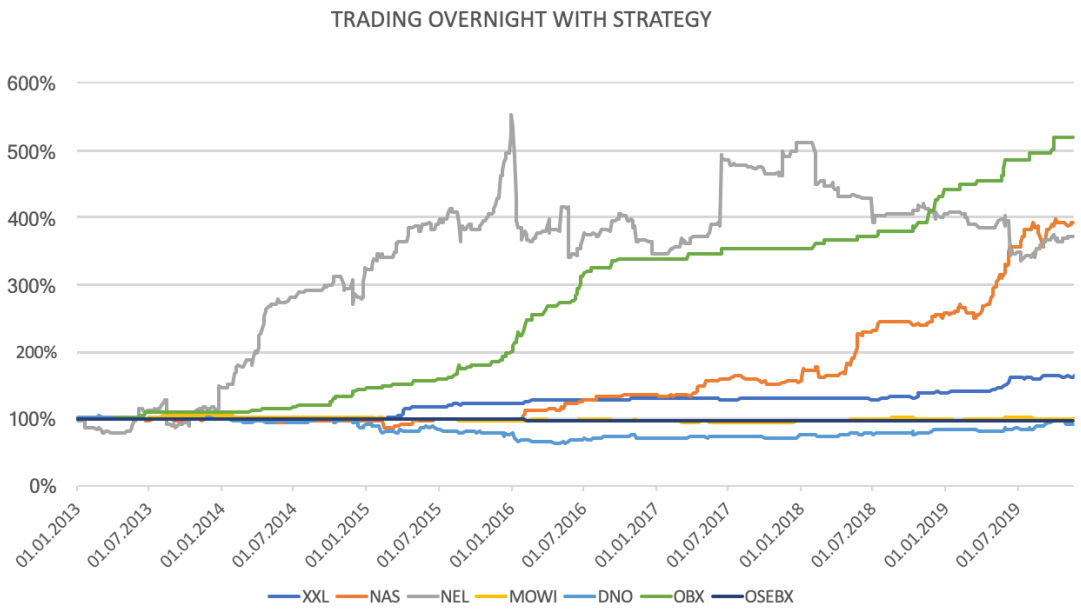


Figure 7: Total return of the selected securities

The results indicate that the strategy proposed offers a significant return for 3 of 5 stocks, between 01.01.2013 (2014 for XXL) and 21.11.2019. NEL, NAS and XXL had a cumulative return of 271,09%, 292,04% and 64,15%, respectively. In contrast, MOWI only had a return of 0,04%. Our "test"-stock DNO had a return of -7,43%. The index OBX rose significantly with return of 419,74%, compared to OSEBX which had a return of -2,47%.

The *strategy* also has significant less volatility compared to *overnight* and *long.* The average standard deviation of all the 7 instruments are 10,17% with *strategy*, 22,49% with *overnight,* and 35% with *long*. The Sharpe ratio will be discussed in the relevant parts of the analysis as there are negative values.

Average SD: long	35,59 %
Average SD: overnight	22,49 %
Average SD: strategy	10,17 %

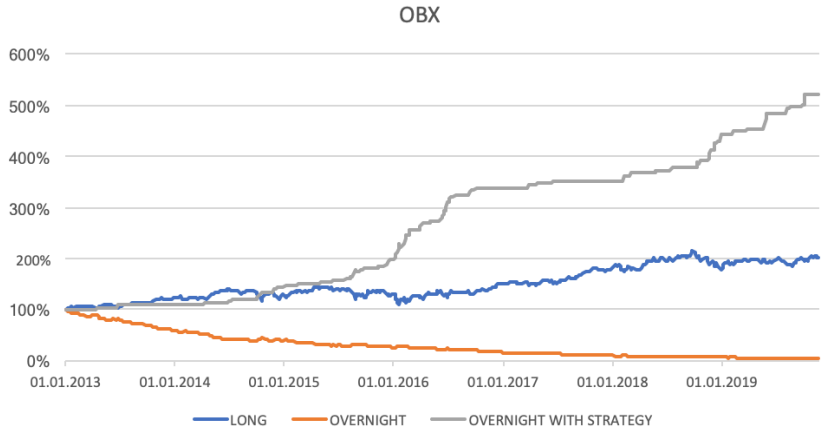
Figure 8 "Average SD"

4. Analysis

Firstly, the essay will conduct an analysis of the each of companies chosen, comparing the long- overnight- and our own strategy, to see if the strategy succeeds to maximize profit. We will analyze the return based on the criteria and establish a basis of whether each criterion is indeed relevant for maximizing returns. The analysis will be the basis for the conclusion in the ending part of this assignment.

OBX

The OBX index follows the 25 most traded securities with a six-month turnover on *Oslo Stock Exchange*. As the graph displays; trading overnight is not profitable if applied to the OBX-index. Throughout the period the strategy continuously loses value to the point where the position ends with a –95,19% return. As the *overnight* value decreases, the cumulative display of changes minimizes with the time. The graph reflects a decreasing exponential function, and strongly indicates that trading OBX ETFs *overnight* with the transaction costs given is not recommended. We can identify a mirroring effect between *long* and *overnight.*



OBX	Trades
Profitable	106
Unprofitable	9
Total Trades	115

Return	OBX
Cum. Return: strategy	419,74 %
Annual E(p): strategy	26,55 %
Cum. Return: overnight	-95,19 %
Annual E(p) overnight	-35,17 %
Cum. Return: long	100,37 %
Annual E(p) long	10,44 %

Figure 9 "Return OBX"

When comparing our *strategy* and going *long,* the cumulative returns are 419,74% and 100,37% respectively. Together with a lower annual standard deviation at 7,76%, compared to 15,57%, our *strategy* outperforms a simple buy and hold strategy. The algorithm of our *strategy* only executed 116 trades (overnight positions) throughout the simulation, and only 9 of them had a negative return. It's difficult to determine what causes the entire growth of the strategy, but it's impossible to exclude the effect of corrections. This supports the findings to Berkman et al. (2012) because of the attributes to the OBX index itself. If the OBX index falls 2% or more, there will be headliners. This draw attention to the dominating stocks on the index, which *can* artificially rise the opening price the next day.

If you want to trade the index, it has to be done through ETFs. The average spread on ETFs are much higher than individual stocks included in the Index. On the *DNB OBX* which is a commonly traded ETF, the spread is fluctuating around 0,4 –0,3% (Pedersen, 2018). This has a big impact on the cumulative return. The sensitivity analysis in Figure 10 "Sensitivity Analysis" demonstrates how such a change in the spread will affect the return. With a broker fee of 0,03%, the cumulative return goes from 419,74%, down to between 121,92% - 179,31%. Even though this is a huge decrease, this is still above the return for the long strategy *(*100,37%).

Spread \	Brokerage Fee					
519,74 %	0,01 %	0,02 %	0,03 %	0,04 %	0,05 %	0,06 %
0,01 %	569,82 %	556,87 %	544,21 %	531,83 %	519,74 %	507,92 %
0,02 %	556,87 %	544,21 %	531,83 %	519,74 %	507,92 %	496,37 %
0,03 %	544,21 %	531,83 %	519,74 %	507,92 %	496,37 %	485,09 %
0,04 %	531,83 %	519,74 %	507,92 %	496,37 %	485,09 %	474,06 %
0,05 %	519,74 %	507,92 %	496,37 %	485,09 %	474,06 %	463,28 %
0,07 %	496,37 %	485,09 %	474,06 %	463,28 %	452,74 %	442,45 %
0,09 %	474,06 %	463,28 %	452,74 %	442,45 %	432,39 %	422,56 %
0,12 %	442,45 %	432,39 %	422,56 %	412,95 %	403,56 %	394,38 %
0,15 %	412,95 %	403,56 %	394,38 %	385,42 %	376,65 %	368,09 %
0,20 %	368,09 %	359,72 %	351,54 %	343,55 %	335,74 %	328,10 %
0,25 %	328,10 %	320,64 %	313,35 %	306,23 %	299,26 %	292,46 %
0,30 %	292,46 %	285,81 %	279,31 %	272,96 %	266,75 %	260,69 %
0,35 %	260,69 %	254,76 %	248,97 %	243,31 %	237,77 %	232,37 %
0,40 %	232,37 %	227,08 %	221,92 %	216,88 %	211,94 %	207,12 %
0,45 %	207,12 %	202,42 %	197,81 %	193,31 %	188,92 %	184,62 %

Figure 10 "Sensitivity Analysis"

Risk measurment	OBX
SD: long	15,57 %
SD: overnight	15,59 %
SD: strategy	7,20 %
:: Days of Trade	116
:: % of negative trades	7,76 %
Sharp Ratio: long	54,6921937
Sharp Ratio: overnight	-237,9558744
Sharp Ratio: strategy	341,8934032

Figure 11 "Risk measurement OBX"

In addition to higher returns with the use of the *strategy,* it also offers a much lower standard deviation (7,20%) compared to long strategy (15,57%). A natural consequence is a much higher Sharpe ratio for the *strategy.* In addition, the low number of negative trades implies that this

strategy on the OBX index has a minimal downside. On the other hand, a small increase in trades with negative return can have a big impact on the final cumulative return. But if we assume that the percentage of negative trades is the same, the *strategy* offers a higher risk-adjusted return than the *long-strategy*. Therefore, the strategy *can* be attractive for investors with a long-term perspective, such as pensions funds.

OSEBX

OSEBX represents all investable stocks at the Oslo Stock Exchange. When applying the *overnight* strategy, the result is very similar to the OBX index. In the end of the period the cumulative return was –90,29%. The long-strategy had a cumulative return of 101,07%. We can see that the standard deviation of the OSEBX index is 14,69%, which is lower compared to the OBX (15,57%). As the OSEBX index represents enormous value divided amongst stocks operating in different segments, it's unlikely that the market will directly correct itself positively after a huge total decrease in the value of 2%. In fact, this is natural according to finance theory, as a more diversified portfolio will have lower unsystematic risk. This means that the volatility in a larger extent comes from factors affecting all stocks on the index (Bøhren & Gjærum, 2016)



OSEBX *Strategy*	Trades
Profitable	1
Unprofitable	38
Total	39

Return	OSEBX
Cum. Return: strategy	-2,47 %
Annual E(p): strategy	-0,36 %
Cum. Return: overnight	-90,29 %
Annual E(p) overnight	-28,35 %
Cum. Return: long	101,07 %
Annual E(p) long	10,62 %

Figure 12 OSEBX

For the *strategy*, the low volatility on the OSEBX index resulted in only 39 trades, where 38 of them had a negative return. However, the low volatility didn´t affect the value significantly, as the cumulative return after almost 7 years was only -2,47%.

Spread	Brokerage fee					
-2,47 %	0,01 %	0,02 %	0,03 %	0,04 %	0,05 %	0,06 %
0,01 %	0,62 %	-0,16 %	-0,94 %	-1,71 %	-2,47 %	-3,23 %
0,02 %	-0,16 %	-0,94 %	-1,71 %	-2,47 %	-3,23 %	-3,98 %
0,03 %	-0,94 %	-1,71 %	-2,47 %	-3,23 %	-3,98 %	-4,72 %
0,04 %	-1,71 %	-2,47 %	-3,23 %	-3,98 %	-4,72 %	-5,47 %
0,05 %	-2,47 %	-3,23 %	-3,98 %	-4,72 %	-5,47 %	-6,20 %
0,06 %	-3,23 %	-3,98 %	-4,72 %	-5,47 %	-6,20 %	-6,93 %
0,07 %	-3,98 %	-4,72 %	-5,47 %	-6,20 %	-6,93 %	-7,65 %
0,08 %	-4,72 %	-5,47 %	-6,20 %	-6,93 %	-7,65 %	-8,37 %
0,09 %	-5,47 %	-6,20 %	-6,93 %	-7,65 %	-8,37 %	-9,08 %
0,10 %	-6,20 %	-6,93 %	-7,65 %	-8,37 %	-9,08 %	-9,79 %
0,11 %	-6,93 %	-7,65 %	-8,37 %	-9,08 %	-9,79 %	-10,49 %
0,12 %	-7,65 %	-8,37 %	-9,08 %	-9,79 %	-10,49 %	-11,18 %
0,13 %	-8,37 %	-9,08 %	-9,79 %	-10,49 %	-11,18 %	-11,87 %
0,14 %	-9,08 %	-9,79 %	-10,49 %	-11,18 %	-11,87 %	-12,56 %
0,15 %	-9,79 %	-10,49 %	-11,18 %	-11,87 %	-12,56 %	-13,24 %

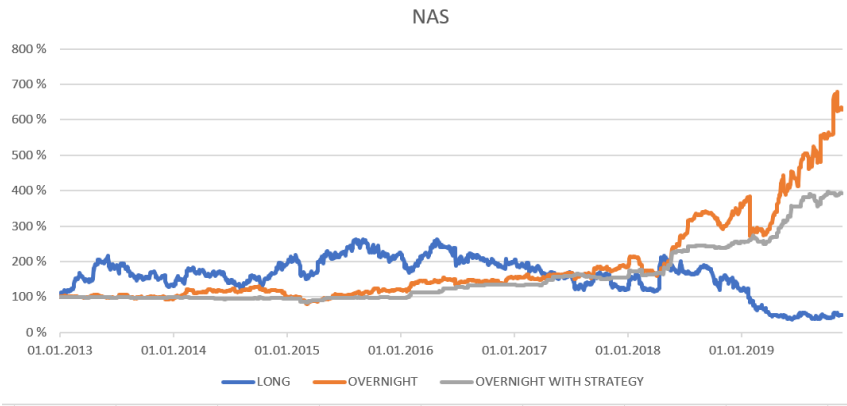
Risk measurment	OSEBX
SD: long	14,69 %
SD: overnight	2,61 %
SD: strategy	0,86 %
:: Days of Trade	39
:: % of negative trades	97,44 %
Sharp Ratio: long	1,277504433
Sharp Ratio: overnight	-1111,756677
Sharp Ratio: strategy	-264,7236364

Figure 13 Risk measurements and sensitivity

Looking at the sensitivity analysis, the *strategy* does not work on the OSEBX regardless of transation costs. The buy and hold strategy outperforms both *strategy* and *overnight.* The reason for the limited loss in the *strategy* compared to *overnight* is because a smaller amount of trades (39) wouldn't accumulate the same transactions costs.

NAS

Overnight return for NAS is for the most time lower than the *long* return. In this period the stock had a massive return reaching top levels of approximately 250% return at September 2015, compared to *overnight* which barely reached positive return in the same period. The three graphs also cross in April of 2018. From that month, *long* fell significantly compounding a total return of -51,68%, while *overnight* and *strategy* rose significantly to a cumulative return of 528,78% and 292,04%.



NAS *Strategy*	Trades
Profitable	215
Unprofitable	173
Total Trades	388

Return	NAS
Cum. Return: strategy	292,04 %
Annual E(p): strategy	21,55 %
Cum. Return: overnight	528,78 %
Annual E(p) overnight	30,04 %
Cum. Return: long	-51,68 %
Annual E(p) long	-9,85 %

Figure 14 NAS return

NAS is a company we have considered very volatile with a standard deviation on 52,08%, when going *long*. One of the main reasons for this is their low equity to debt ratio. News affecting changes in the expected EBITDA and cash flow have therefore a big impact on the stock price, as it impacts the equity to a larger extent, compared to a scenario with a lower debt ratio ((Norwegian, 2019); (Bøhren & Gjærum, 2016)). NAS is also hugely affected by the fuel costs which was 27,21% of the total operating costs in 2018 (Norwegian, 2019). The factors mentioned combined gives a lot of headliners which is results in high volatility compared to other stocks on the Oslo Stock Exchange. The volatility is also reflected in the high number of executed trades, compared to other stocks. The algorithm for the *strategy* executed 388 trades, where 44,59% were negative. The high number of executed trades indicates that there is a minor correction effect that Berkman et.al. (2012)describes in their study, which is backing the *strategy* proposed.

NAS is a good example of overreacted falls in price, resulting in a positive overnight gap. As we can see in the sensitivity analysis, a small spread increase will have a big impact on the total return.

Spread	Brokerage fee					
##########	0,01 %	0,02 %	0,03 %	0,04 %	0,05 %	0,06 %
0,01 %	434,74 %	394,81 %	357,86 %	323,68 %	292,04 %	262,77 %
0,02 %	394,81 %	357,86 %	323,68 %	292,04 %	262,77 %	235,69 %
0,03 %	357,86 %	323,68 %	292,04 %	262,77 %	235,69 %	210,62 %
0,04 %	323,68 %	292,04 %	262,77 %	235,69 %	210,62 %	187,43 %
0,05 %	292,04 %	262,77 %	235,69 %	210,62 %	187,43 %	165,97 %
0,06 %	262,77 %	235,69 %	210,62 %	187,43 %	165,97 %	146,11 %
0,07 %	235,69 %	210,62 %	187,43 %	165,97 %	146,11 %	127,73 %
0,08 %	210,62 %	187,43 %	165,97 %	146,11 %	127,73 %	110,73 %
0,09 %	187,43 %	165,97 %	146,11 %	127,73 %	110,73 %	94,99 %
0,10 %	165,97 %	146,11 %	127,73 %	110,73 %	94,99 %	80,44 %
0,11 %	146,11 %	127,73 %	110,73 %	94,99 %	80,44 %	66,96 %
0,12 %	127,73 %	110,73 %	94,99 %	80,44 %	66,96 %	54,50 %
0,13 %	110,73 %	94,99 %	80,44 %	66,96 %	54,50 %	42,96 %
0,14 %	94,99 %	80,44 %	66,96 %	54,50 %	42,96 %	32,29 %
0,15 %	80,44 %	66,96 %	54,50 %	42,96 %	32,29 %	22,41 %

Risk measurment	NAS
SD: long	52,08 %
SD: overnight	28,06 %
SD: strategy	12,89 %
:: Days of Trade	388
:: % of negative trades	44,59 %
Sharp Ratio: long	-22,59548268
Sharp Ratio: overnight	100,1940406
Sharp Ratio: strategy	152,2887444

Figure 15 NAS risk and sensitivity

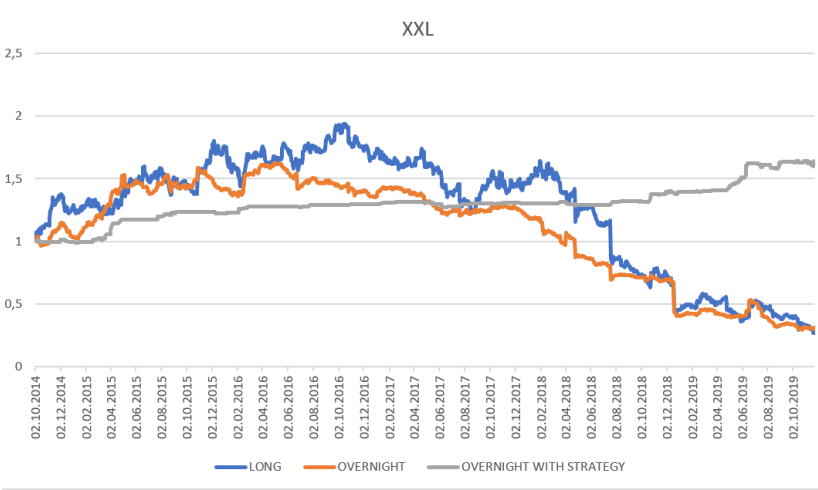
Because of the many trades, the transaction costs have a significant impact on the cumulative return. By increasing the spread with only 2 basis points, the total return falls with 6000 bp. The same increase in the strategy of OSEBX would only decrease the return by 150 bp.

In addition, comparing the standard deviation, we see that the *strategy* (12,89%) is much lower than *long* (52%) and *overnight* (28%). This indicates that the *strategy* has lower variation in return. Even though *overnight* has a cumulative return of 528,78%, the Sharpe Ratio shows us that the *strategy* has a better risk-adjusted return, with a score of 152,28, compared 100,2 for

overnight. Dependent on how risk averse an investor is, the *strategy* proposed, could therefore still be a better choice than *overnight* in this case.

XXL

The company have over the last years obtained a big market-share in the sports- and wilderness-equipment. However, the last 2 years the stock price has fallen to a fraction of what it was in the start of 2018, as the EBITDA margin has decreased significantly from 828 million NOK (2017) to 541 million NOK (2018) ((XXL, 2019). Together with big investments in Austria in 2017-2018 not paying off yet, high industry competition, and negative media exposure for their internal working environment, the cumulative return going *long* is -72,55%.



Return	XXL
Cum. Return: strategy	64,15 %
Annual E(p): strategy	8,61 %
Cum. Return: overnight	-69,02 %
Annual E(p) overnight	-17,74 %
Cum. Return: long	-72,55 %
Annual E(p) long	-19,82 %

Figure 16 XXL return

An interesting finding is how significant drops in the stock price is being followed by the *overnight* strategy. There is a significant drop intraday (instance August 2018, 120% to 75%), followed by a drop *overnight*. This implies that the market does not dear to correct for the potential overreaction because of the fear of further losses, which supports the loss aversion theory to Kahneman (2011)and other scientists. This suggests that smaller and more frequent drops do not have the correction effect necessary. On the other hand, looking at the development of the *strategy* with a cumulative return of 64,15%, its seems like the correction effect do happen when the drops are bigger than 2%. The findings in the XXL analysis is similar to NAS. The *strategy* has a lower return when the stock price development is positive. We can also see

that the drops in the stock price doesn't correlate with the strategy. As a result, the *strategy* avoids the big drops, and seems to be gaining on minor corrections the following day.

Spread	Brokerage Fee					
64,14530 %	0,01 %	0,02 %	0,03 %	0,04 %	0,05 %	0,06 %
0,01 %	85,52 %	79,93 %	74,50 %	69,25 %	64,15 %	59,20 %
0,02 %	79,93 %	74,50 %	69,25 %	64,15 %	59,20 %	54,40 %
0,03 %	74,50 %	69,25 %	64,15 %	59,20 %	54,40 %	49,75 %
0,04 %	69,25 %	64,15 %	59,20 %	54,40 %	49,75 %	45,23 %
0,05 %	64,15 %	59,20 %	54,40 %	49,75 %	45,23 %	40,86 %
0,06 %	59,20 %	54,40 %	49,75 %	45,23 %	40,86 %	36,61 %
0,07 %	54,40 %	49,75 %	45,23 %	40,86 %	36,61 %	32,50 %
0,08 %	49,75 %	45,23 %	40,86 %	36,61 %	32,50 %	28,50 %
0,09 %	45,23 %	40,86 %	36,61 %	32,50 %	28,50 %	24,63 %
0,10 %	40,86 %	36,61 %	32,50 %	28,50 %	24,63 %	20,87 %
0,11 %	36,61 %	32,50 %	28,50 %	24,63 %	20,87 %	17,23 %
0,12 %	32,50 %	28,50 %	24,63 %	20,87 %	17,23 %	13,70 %
0,13 %	28,50 %	24,63 %	20,87 %	17,23 %	13,70 %	10,27 %
0,14 %	24,63 %	20,87 %	17,23 %	13,70 %	10,27 %	6,95 %
0,15 %	20,87 %	17,23 %	13,70 %	10,27 %	6,95 %	3,73 %

Risk measurment	XXL
SD: long	39,87 %
SD: overnight	27,33 %
SD: strategy	5,39 %
:: Days of Trade	154,00
:: % of negative trades	42,86 %
Sharp Ratio: long	-54,53339407
Sharp Ratio: overnight	-71,94554703
Sharp Ratio: strategy	124,1395613

Figure 17 XXL risk and sensitivity

As we can see in Figure 17 XXL risk and sensitivity, the strategy has standard deviation of 5,39%, which is very low compared with *long* and *overnight.* The *strategy* executed 154 trades, where 42,86% of the trades were negative. Taking the risk into consideration, the *strategy* on XXL is scoring 124,14 points on the Sharpe Ratio, which is much higher compared to going *long* at the OBX, with a score on 54,69 points. This implies that the *strategy* used on XXL *can* therefore be attractive to risk-averse investors.

NEL

Figure 18 Return NEL

Return	NEL
Cum. Return: strategy	271,09 %
Annual E(p): strategy	20,60 %
Cum. Return: overnight	1925,40 %
Annual E(p) overnight	53,64 %
Cum. Return: long	267,39 %
Annual E(p) long	20,41 %

The development has been very profitable for the shareholders (267,4%), which is different from the stocks already analyzed. In contrast to NAS and XXL, NEL has never had positive EBITDA and is categorized as a risky investment among the investors (NEL, 2019). The stock price is therefore driven by exceeding expectations of future earnings. According to Norne Securities Analyst Karl-Johan Molnes, the positive return is mainly based on a big purchase order from Nikola Motors of NEL's technology, and future potential orders (Hovland, 2019). However, the *overnight* strategy outperforms both *long* and the *strategy,* with a huge cumulative return of 1925,40%. This implies that most of the stock return finds place overnight and not intraday. An interesting finding is how *overnight* is

extremely vulnerable to negative news outside regular trading hours. The date 10.06.2019, a hydrogen station outside of Oslo, exploded. This was on a Sunday resulting in a major loss in the cumulative return to *overnight*.

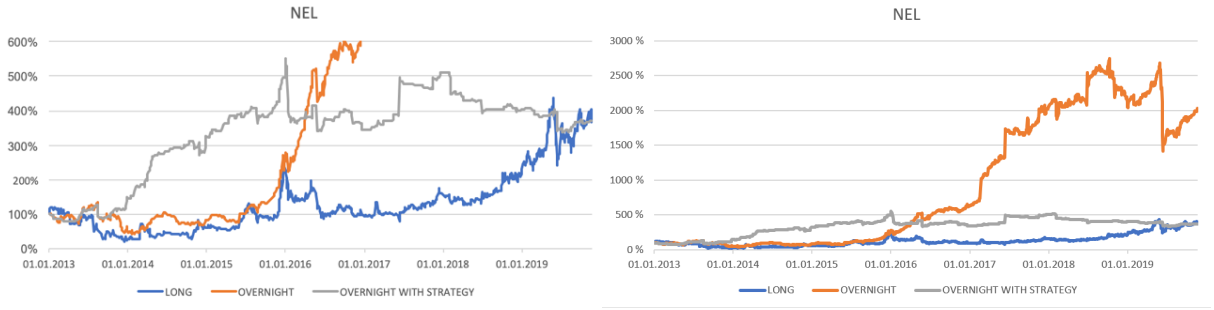


Figure 19 Return Nel Graphs

For the *strategy* the cumulative return was 271,09%. This was slightly higher than *long.* We do observe a significant profitable period from 2013 to 2016. In this period the stock seemingly corrected overnight after a 2% drop overnight, for the majority of the executed trades in this period. The strategy failed to capitalize on the extreme growth of the everyday overnight trade return from 2016 to mid 2018. One explanation *can* be because of the lack of trades executed as the stock rarely dropped 2% intraday, and growth in value continued overnight. From 01.2018 towards the end of simulation we see the reoccurring trend of the strategy mirroring the long position. As the *long* position increases value, the *strategy* does underperform. Considering the sensitivity analysis, the strategy is also very sensitive for higher transaction costs because of the high number of trades. However, NEL is a very frequently traded stock with good liquidity, as it positioned on the OBX Index. This indicates that the risk of a lowering spread is relatively small.

Spread	Brokerage Fee					
271,08607 %	0,01 %	0,02 %	0,03 %	0,04 %	0,05 %	0,06 %
0,01 %	441,33 %	392,57 %	348,20 %	307,82 %	271,09 %	237,66 %
0,02 %	392,57 %	348,20 %	307,82 %	271,09 %	237,66 %	207,24 %
0,03 %	348,20 %	307,82 %	271,09 %	237,66 %	207,24 %	179,56 %
0,04 %	307,82 %	271,09 %	237,66 %	207,24 %	179,56 %	154,38 %
0,05 %	271,09 %	237,66 %	207,24 %	179,56 %	154,38 %	131,47 %
0,06 %	237,66 %	207,24 %	179,56 %	154,38 %	131,47 %	110,62 %
0,07 %	207,24 %	179,56 %	154,38 %	131,47 %	110,62 %	91,64 %
0,08 %	179,56 %	154,38 %	131,47 %	110,62 %	91,64 %	74,38 %
0,09 %	154,38 %	131,47 %	110,62 %	91,64 %	74,38 %	58,67 %
0,10 %	131,47 %	110,62 %	91,64 %	74,38 %	58,67 %	44,38 %
0,11 %	110,62 %	91,64 %	74,38 %	58,67 %	44,38 %	31,37 %
0,12 %	91,64 %	74,38 %	58,67 %	44,38 %	31,37 %	19,54 %
0,13 %	74,38 %	58,67 %	44,38 %	31,37 %	19,54 %	8,77 %
0,14 %	58,67 %	44,38 %	31,37 %	19,54 %	8,77 %	-1,03 %
0,15 %	44,38 %	31,37 %	19,54 %	8,77 %	-1,03 %	-9,94 %

Risk measurment	NEL
SD: long	55,06 %
SD: overnight	46,65 %
SD: strategy	27,81 %
:: Days of Trade	472
:: % of negative trades	49,15 %
Sharp Ratio: long	33,57252334
Sharp Ratio: overnight	110,8661323
Sharp Ratio: strategy	67,1685619

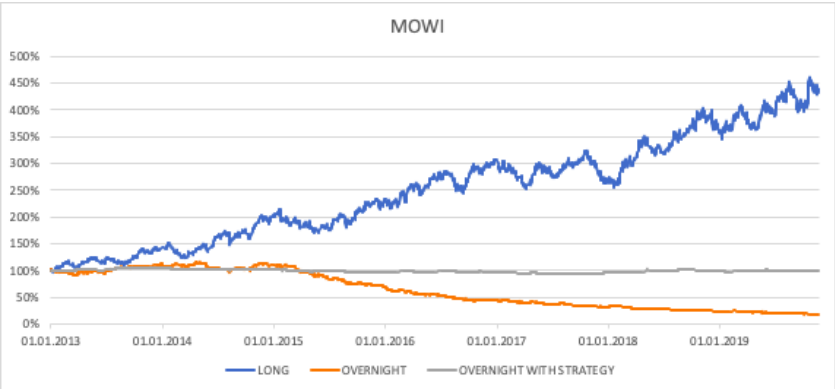
Figure 20 Risk and Sensitivity

As Figure 20 Risk and Sensitivity shows, the standard deviation for both *long* and *overnight* is

relatively high, which indicates high volatility and high risk. At Shareville, NEL is the most commented stock, and NEL is frequently in the news together with other ESG stocks (Environmental, social and corporate governance). This is also confirmed by Chief Economist in Nordnet, Mads Johannessen (2019). Valuating the stock can be difficult as NEL has never had a positive EBITDA. This implies that news and high percentage of retail investors can explain the volatility of the stock. In line with our hypothesis, the risk-adjusted return should be high when applying the *strategy* on the stock. The standard deviation to the *strategy* was 27,81%, which is lower compared to *long* and overnight. However, studying the Sharpe Ratio, *overnight* performs better than both *long* and *strategy,* because of the enormous cumulative profit. The *strategy* applied to NEL is only scoring 67,17 on the Sharpe Ratio, which is lower than XXL, NAS and the OBX.

MOWI

As the graph displays, going *long* have had solid profit with a cumulative return of 330,15%. The stock price has been growing consistently during the period. Nordnet's analyst Roger Berntsen (2019) explains the high return with rising salmon prices, solid market position as the number one producer of Atlantic salmon, and the company´s solid investment grade. Consequently, MOWI have enjoyed great media exposure and attracted the interest of retail investors. However, the transaction costs seem to be consequently higher than the overnight return of –82,61% when studying the graph.



Return	MOWI
Cum. Return: strategy	0,04 %
Annual E(p): strategy	0,01 %
Cum. Return: overnight	-82,61 %
Annual E(p) overnight	-22,16 %
Cum. Return: long	330,15 %
Annual E(p) long	23,31 %

Figure 21 MOWI return

When applying the *strategy,* the cumulative return was only 0,04%. This can be explained by the relatively low volatility, and a standard deviation of only 3,9%. This supports that volatility has a big impact on overnight return, and we should probably have set the minimum volatility

limit higher. The low volatility also explains the reason there were only 116 executed trades. When the stock price is rising consistently, drops above 2% would occur less often, and have a smaller correction rate.

Spread	Brokerage Fee					
0,04457 %	0,01 %	0,02 %	0,03 %	0,04 %	0,05 %	0,06 %
0,01 %	9,77 %	7,26 %	4,80 %	2,39 %	0,04 %	-2,25 %
0,02 %	7,26 %	4,80 %	2,39 %	0,04 %	-2,25 %	-4,49 %
0,03 %	4,80 %	2,39 %	0,04 %	-2,25 %	-4,49 %	-6,68 %
0,04 %	2,39 %	0,04 %	-2,25 %	-4,49 %	-6,68 %	-8,82 %
0,05 %	0,04 %	-2,25 %	-4,49 %	-6,68 %	-8,82 %	-10,91 %
0,06 %	-2,25 %	-4,49 %	-6,68 %	-8,82 %	-10,91 %	-12,96 %
0,07 %	-4,49 %	-6,68 %	-8,82 %	-10,91 %	-12,96 %	-14,95 %
0,08 %	-6,68 %	-8,82 %	-10,91 %	-12,96 %	-14,95 %	-16,90 %
0,09 %	-8,82 %	-10,91 %	-12,96 %	-14,95 %	-16,90 %	-18,81 %
0,10 %	-10,91 %	-12,96 %	-14,95 %	-16,90 %	-18,81 %	-20,67 %
0,11 %	-12,96 %	-14,95 %	-16,90 %	-18,81 %	-20,67 %	-22,49 %
0,12 %	-14,95 %	-16,90 %	-18,81 %	-20,67 %	-22,49 %	-24,27 %
0,13 %	-16,90 %	-18,81 %	-20,67 %	-22,49 %	-24,27 %	-26,00 %
0,14 %	-18,81 %	-20,67 %	-22,49 %	-24,27 %	-26,00 %	-27,70 %
0,15 %	-20,67 %	-22,49 %	-24,27 %	-26,00 %	-27,70 %	-29,36 %

Risk measurment	MOWI
SD: long	24,60 %
SD: overnight	12,20 %
SD: strategy	3,87 %
:: Days of Trade	116
:: % of negative trades	53,45 %
Sharp Ratio: long	86,94851743
Sharp Ratio: overnight	-197,3063816
Sharp Ratio: strategy	-49,44806475

Figure 22 MOWI risk and sensitivity

DNO

DNO was the only stock that did not fulfill all of our criteria. This was because the share of individual investors was too low. We can see that the stock price has been very volatile and ended up with a cumulative return of 17,79%, and a standard deviation of 47,24%. As this company's results are mainly affected by the oil price, the stock will fluctuate accordingly. The *overnight* development however shows us positive trend from the summer 2014 until the end of the simulation. This suggest that the overnight return including transaction costs are higher than intraday, with a cumulative return of 152,57%.

Return	DNO
Cum. Return: strategy	-7,43 %
Annual E(p): strategy	-1,10 %
Cum. Return: overnight	152,57 %
Annual E(p) overnight	14,36 %
Cum. Return: long	17,79 %
Annual E(p) long	2,26 %

Figure 23 DNO return

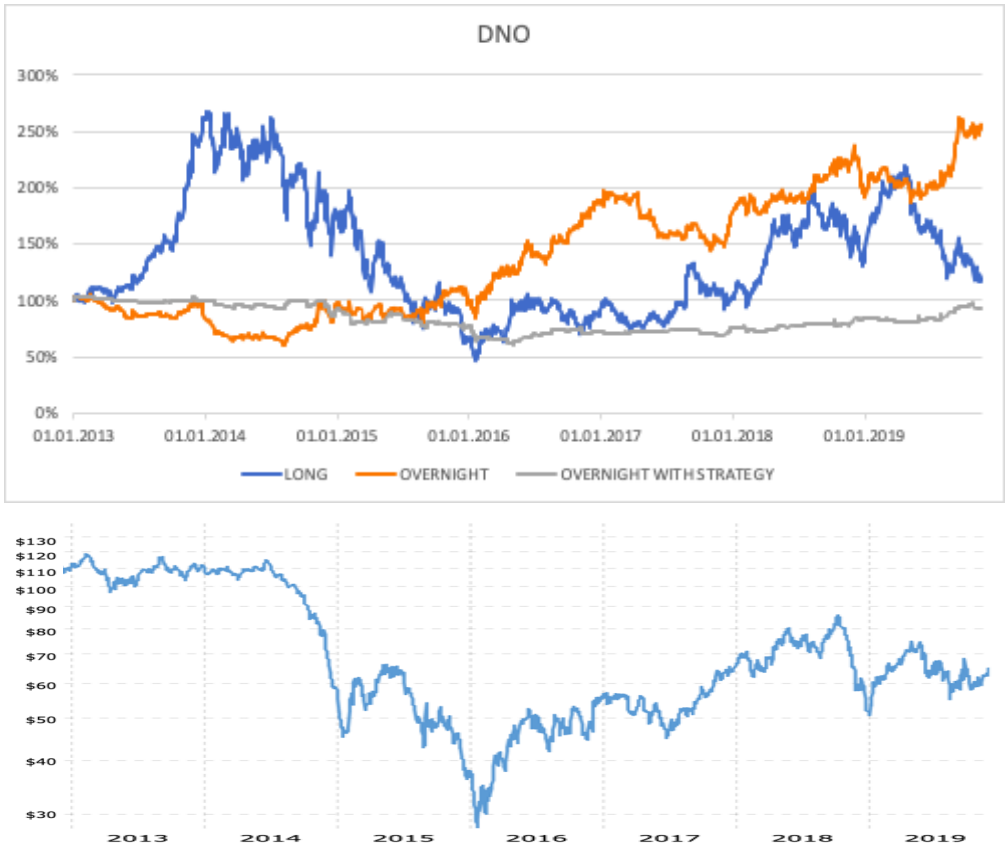


Figure 24 DNO return graph and Oil Price development

The *strategy* underperformed and ended up with –7,4% in cumulative return. Regardless of the relatively big volatility, the return ended up negative. Individual investors only represent 0,05% of DNO's shareholders. In compliance with the studies done by Barber & Odean (2005) the institutional shareholders seem to not overreact in the same manner as retail investors. This can be related to their ability to stomach larger fluctuations, as they often have a longer perspective for their investments. The low percentage of individual shareholders can possibly explain why there is no correction effect to capitalize on.

Spread	Brokerage Fee					
-7,43061 %	0,01 %	0,02 %	0,03 %	0,04 %	0,05 %	0,06 %
0,01 %	24,26 %	15,44 %	7,25 %	-0,36 %	-7,43 %	-14,00 %
0,02 %	15,44 %	7,25 %	-0,36 %	-7,43 %	-14,00 %	-20,10 %
0,03 %	7,25 %	-0,36 %	-7,43 %	-14,00 %	-20,10 %	-25,77 %
0,04 %	-0,36 %	-7,43 %	-14,00 %	-20,10 %	-25,77 %	-31,04 %
0,05 %	-7,43 %	-14,00 %	-20,10 %	-25,77 %	-31,04 %	-35,93 %
0,06 %	-14,00 %	-20,10 %	-25,77 %	-31,04 %	-35,93 %	-40,48 %
0,07 %	-20,10 %	-25,77 %	-31,04 %	-35,93 %	-40,48 %	-44,70 %
0,08 %	-25,77 %	-31,04 %	-35,93 %	-40,48 %	-44,70 %	-48,62 %
0,09 %	-31,04 %	-35,93 %	-40,48 %	-44,70 %	-48,62 %	-52,27 %
0,10 %	-35,93 %	-40,48 %	-44,70 %	-48,62 %	-52,27 %	-55,66 %
0,11 %	-40,48 %	-44,70 %	-48,62 %	-52,27 %	-55,66 %	-58,80 %
0,12 %	-44,70 %	-48,62 %	-52,27 %	-55,66 %	-58,80 %	-61,73 %
0,13 %	-48,62 %	-52,27 %	-55,66 %	-58,80 %	-61,73 %	-64,44 %
0,14 %	-52,27 %	-55,66 %	-58,80 %	-61,73 %	-64,44 %	-66,97 %
0,15 %	-55,66 %	-58,80 %	-61,73 %	-64,44 %	-66,97 %	-69,31 %

Risk measurment	DNO
SD: long	47,24 %
SD: overnight	25,02 %
SD: strategy	13,13 %
:: Days of Trade	368
:: % of negative trades	50,00 %
Sharp Ratio: long	0,727184857
Sharp Ratio: overnight	49,74687547
Sharp Ratio: strategy	-22,97474534

Figure 25 DNO risk and sensitivity

Looking at the sensitivity analysis, the *strategy* only has better return than long, when the spread is maximum 0,01%. Considering the stock's size and liquidity a spread this small wouldn't be realistic in the long run. And with such a big number of trades, the transaction costs would exceed too much of the return. Based on the Sharpe ratio, the *overnight* strategy performs better than the two other strategies. This comes mainly from the relatively high return (152,6%).

5. Limitations and weaknesses

This paper is written based on analysis of historical data, and an implementation of this strategy in the market can affect prices and make the strategy obsolete. It is not given that the market is going to continue with the same pattern in overnight gap in the future for any of the securities included.

Furthermore, we utilized the same spread for all securities to measure the performance. In reality, each security has a different bid-ask spread because of the differences in price, liquidity and trading volume. As the sensitivity analysis shows, small differences in the spread can have a big impact on the outcome of the strategy. This means that our conclusions may differ a lot from the reality a trader would face.

Another weakness is the duration of our simulation. As the analysis indicates, the strategy could potentially be attractive for long term investors. But because of the discrepancy in Oslo Stock Exchange's reporting of last, close and open price before 2013, we only had 7 years to base our findings on. How *overnight* and *strategy* would perform during financial crises could have made a big impact on the end result.

6. Conclusion

Return	DNO	MOWI	XXL	NAS	NEL	OBX	OSEBX
Cum. Return: strategy	-7,43 %	0,04 %	64,15 %	292,04 %	271,09 %	419,74 %	-2,47 %
Annual E(p): strategy	-1,10 %	0,01 %	8,61 %	21,55 %	20,60 %	26,55 %	-0,36 %
Cum. Return: overnight	152,57 %	-82,61 %	-69,02 %	528,78 %	1925,40 %	-95,19 %	-90,29 %
Annual E(p) overnight	14,36 %	-22,16 %	-17,74 %	30,04 %	53,64 %	-35,17 %	-28,35 %
Cum. Return: long	17,79 %	330,15 %	-72,55 %	-51,68 %	267,39 %	100,37 %	101,07 %
Annual E(p) long	2,26 %	23,31 %	-19,82 %	-9,85 %	20,41 %	10,44 %	10,62 %

Figure 26 Return all securities

Risk measurment	DNO	MOWI	XXL	NAS	NEL	OBX	OSEBX
SD: long	47,24 %	24,60 %	39,87 %	52,08 %	55,06 %	15,57 %	14,69 %
SD: overnight	25,02 %	12,20 %	27,33 %	28,06 %	46,65 %	15,59 %	2,61 %
SD: strategy	13,13 %	3,87 %	5,39 %	12,89 %	27,81 %	7,20 %	0,86 %
:: Days of Trade	368	116	154,00	388	472	116	39
:: % of negative trades	50,00 %	53,45 %	42,86 %	44,59 %	49,15 %	7,76 %	97,44 %
Sharp Ratio: long	0,727184857	86,94851743	-54,5333941	-22,5954827	33,57252334	54,6921937	59,1950643
Sharp Ratio: overnight	49,74687547	-197,306382	-71,945547	100,1940406	110,8661323	-237,955874	-1111,7567
Sharp Ratio: strategy	-22,9747453	-49,4480647	124,1395613	152,2887444	67,1685619	341,8934032	-264,72364

Figure 27 Risk measurement all securities

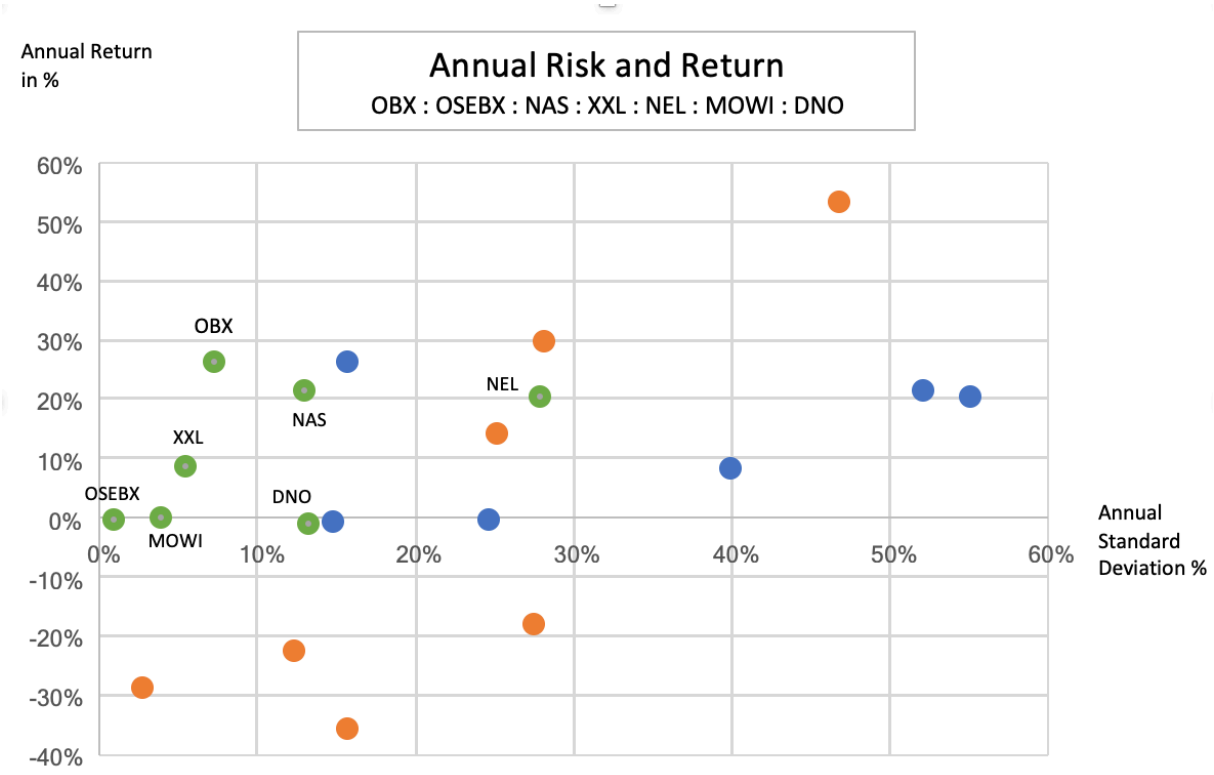


Figure 28 Annual Risk-Return (Green points = Strategy, Orange points = Overnight, Blue points = Long).

The findings of our study show that the overnight profit with transaction costs is very individual for each instrument (Orange points in Figure 28 Annual Risk-Return). Only DNO, NEL and NAS is considered to have positive total overnight returns, where NEL is extremely profitable. DNO, NAS and NEL are three very different companies in form of the shareholders and profitability. However, they are the three stocks with the highest score of volatility. This indicates that the volatility is the main driver for a positive overnight gap, and it is the first measure that should be taken into consideration when implementing the strategy in new stocks.

Studying the diagram, we see that the green points have collected itself in the upper left corner. This suggests that the *strategy* offers significantly risk adjusted return, compared to *long* and *overnight.* The *strategy* applied on XXL, NAS and NEL is outperforming going *long*. These

findings support our hypothesis as these companies has high volatility and a high percentage of individual investors. Even if the *strategy* misses out on profits in positive trends, it appears that the *strategy* capitalizes on the aftermath of overreacted intraday losses over 2%. As the *strategy* seems to minimize the downside, the compounding interest makes the *strategy* very profitable in the long run. In addition, the number of executed trades is relatively low per year, which requires it to be applied for the long run to see results. Therefore, it can be attractive for long term orientated investors.

MOWI and DNO did not respond well to our strategy. MOWI had the lowest volatility among the picked stocks. This supports our hypothesis that volatility is the most important criterion in the strategy. As the analysis indicates, *long* and the *strategy* is to some extent negatively correlated. When the stock price is rising, the strategy more often has low or negative return. This can also explain why MOWI was not receptive when applying the *strategy.* DNO on the other hand were very volatile during the simulation. However, our analysis prompts that their low degree of individual shareholders have been harmful for the overreaction effect, causing the transaction costs to be bigger than the returns.

The OBX index includes the 25 most traded securities on the Oslo stock exchange which prompts great liquidity, low volatility and a mixed holding between the companies listed. Applying the *strategy* suggested executed only 116 trades, due to the low volatility. However, the correction effect resulted in significant profits, were only 9 of the trades had a negative return. The OSEBX index was not volatile enough, as the strategy did only execute 39 trades. In contrast to the OBX index, there were only one trade with positive return on the OSEBX. This implies that the correction effect didn't apply to the OSEBX. One explanation can be the diversification of the index. Because the index includes 67 stocks, its more diversified compared to the OBX index. An overreaction in one company, followed by a correction, will therefore has smaller impact on OSEBX, compared to OBX.

The sensitivity analysis shows that liquidity is vital for overnight trading. Liquidity is the main input factor of a small spread. A big spread will result in massive transaction cost. In contrast of the fixed commission rate, the spread is a cost that will variate with the liquidity of the stock. Therefore, big turnover has displayed itself as one of the most critical factors, when conducting efficient overnight trading.

To summarize, the study suggests that volatility and big turnover is crucial to profit on overnight trading. It also suggests that high percentage of individual investors can affect the overnight return to an extent but does not solely determine the outcome. s

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