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The Influence of Financial News on Nordic Retail Investment Behaviour

An empirical study into the overpricing of Norwegian Air Shuttle

Oliver Lille Gustavson and Jonathan Myntti

Supervisors: Ingar Haaland and Ole-Andreas Næss

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NORWEGIAN SCHOOL OF ECONOMICS

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Oliver Lille Gustavson

Jonathan Myntti

Abstract

The purpose of this study is to investigate the influence of financial media on Nordic retail investment behaviour covering the overpricing of Norwegian Air shuttle during a period of crisis.

We utilise a mixed methods approach with both quantitative and qualitative elements, including longitudinal individual transaction data, cross-sectional portfolio data, and financial media articles.

We find that financial media with a negative sentiment does influence trading behaviour amongst Nordic retail investors at least to some degree, and estimate the change in Sales to Purchases ratio for the domestic population to be around 10 percentage points.

Keywords – Overpricing, Media influence, Retail investment

Executive Summary

The purpose of the study is to investigate the influence of financial media with a negative sentiment on Nordic retail investing behaviour, in an overpricing context. During most of 2020 and beginning of 2021 Norwegian Air Shuttle (NAS) was in a deep crisis, yet their stock price and trade volume did not completely reflect this. Following a detailed announcement regarding the financial restructuring of the company on January 14, 2021 where NAS publicised their intention of raising fresh capital causing a dilution of previous ownership to approximately 5%, retail investors were still buying the stock at a price almost ten times as high as the announced price would be in a few months' time. Simultaneously, the Norwegian media was during this time highly critical of this valuation and urged retail investors not to invest in the asset. Thus, the aim of the thesis is to establish whether this criticism had any effect on retail investment behaviour.

The crisis in NAS was largely caused by the groundings of the Boeing 737-MAX airplanes and the Covid-19 pandemic which severely restricted air travel and thereby cash flow during the years 2020 – 2021. The paper also discusses the behavioural biases that are associated with financial decision-making, along with asset valuation models, and the influence of financial media on investment behaviour.

The data used in the study consists of longitudinal individual transactions and a cross-section of their portfolios from retail investors affiliated with a large retail investing social media platform in the Nordics. For the media aspect, a database of media articles from different financial newspapers in the Nordics was created, and a sentiment variable was added for each article after a content analysis. Empirically, the thesis is a quasi-experiment due to its non-randomisation. A difference-in-differences method is used in the primary statistical analysis, with Norwegian investors as the treatment group and Finnish investors as control group due to their lack of coverage on the topic. Secondary analyses utilised a simple OLS method to further investigate the investors' response to financial media.

The country-level results show that financial media with a negative sentiment does influence trading behaviour amongst Nordic retail investors, and we estimate the change in Sales ratio for the domestic population to be around 10 percentage points. On an individual level, the results are inconclusive. The media response amongst retail investors suggests an increase in trading in NAS given financial media attention, regardless of sentiment.

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1 Introduction

Looking at the customer growth in large trading platforms across the Nordics in recent times, we see that participating in the stock market has become more common (Magnus and Johannesen, 2021). A contributing factor to this increase is arguably the simplicity and availability of trading platforms today. However, along with the positive consequences of additional focus on savings and investments for the broader population, there are some potential drawbacks of this development as well. With more retail investors participating in the stock market, a plausible scenario is that they are both less financially literate and more prone to be influenced by external factors compared to professionals. This could possibly lead to uninformed sub-optimal financial decision making (Odean, 1999), with potentially significant negative personal welfare consequences (Guiso and Sodini, 2013). As a result, they could intermittently come to challenge the capital market's valuation efficiency (Lamont and Thaler, 2003).

With this newfound interest in the financial markets amongst the general public, it is imaginable to think that more people would pay attention towards financial news and media attention that involves their private economy and investments to a larger degree than before. However, there is reason to believe that retail investors do not have the time to keep up with news to the same degree as a professional investor, i.e. to filter through actual news and non-news (Barber and Odean, 2007). While the act of paying attention to news reports is not detrimental in and of itself, the more impressionable retail investors might interpret non-news events differently - which then requires subsequent action that in the long run might harm their portfolio returns (Grinblatt and Keloharju, 2000). In an alternative case there is also concern for the reverse effect, where retail investors perhaps see large news stories regarding a company as a purchasing opportunity, when in reality the news are already incorporated in the price of the asset. These scenarios could all have a detrimental effect on individual investors' personal finance, and it is therefore worth investigating to what extent financial media plays a role in this decision-making process.

As we present our specific case and our research question in the next section, we try to investigate to what extent these investors are influenced by financial media and whether media sentiment has a potentially directional effect on trading of Norwegian Air Shuttle

(NAS). We do this by looking at trading behaviour in two countries, Norway and Finland, and estimate the effect media sentiment and coverage had on investments in the respective countries.

1.1 Background

In this study we utilise an extraordinary event that happened in the Norwegian stock market around 2020 – 2021, when NAS was in the middle of a deep crisis. The airline had already been through a restructuring in May 2020 during the beginning of the Covid-19 pandemic because of the Boeing 737-MAX groundings and the prompt shutdown of air traffic due to increasing infections. As NAS had financed their rapid growth into becoming one of the biggest airlines in Europe using leverage, they were highly exposed to this massive decrease in air travelling (Milne, 2020). For these reasons, NAS was on the verge of bankruptcy, and had to apply for funding from the Norwegian government at the end of 2020 which they were subsequently denied. However, in January 2021 the Norwegian government agreed to join the restructuring of NAS conditional on other investors also contribute with fresh capital and the rescue plan gets approved in court.

On January 14, 2021, NAS announced that they were to make an equity issue in May the same year (Norwegian Air Shuttle ASA, 2021c). To make the equity issue attractive for private investors, the new shares were to be issued at a price of NOK 5-7, a big discount from the price of NOK 50-70 which the stock traded for in January 2021. To raise enough capital for the rescue plan to go through, the existing shareholders would be diluted to approximately 5 percent of the company. The creditors would get their debt converted to 25 percent of NAS, while the new shareholders were to acquire the remaining 70 percent. (Norwegian Air Shuttle ASA, 2021d)

On March 26, 2021, an Irish court approved the restructuring plan of NAS, and on April 12, 2021, the Norwegian government also accepted the plan with the condition that NOK 4.5 billion was raised in fresh capital. Out of the 4.5 billion NOK raised, around three billion in shares were given to six cornerstone investors for share price of NOK 6.26. The new shares started to trade on May 27, 2021.

1.2 Problem formulation

Throughout this process, and especially after January 14, 2021, Norwegian financial news were highly vocal in their criticism of the NAS pricing. Simultaneously, the other Nordic countries' financial news were not as critical nor gave the issue nearly the same amount of attention. The company also had a change in ownership structure during these times, where the company at the end of the process was majority owned by small retail investors. This gives us an excellent opportunity to see whether these variations in media attention have affected retail investing behaviour, as trading was predominantly done by individual investors.

According to common fundamental valuation methods from standard economic theory the NAS stock valuation was difficult to justify, with a market capitalisation a few weeks before the emission announcement of 3.5 billion NOK. Through the dilution of ownership after the reconstruction process, the current shareholders would be left with approximately 400 million NOK (Jensen, 2021). The inflated market capitalisation remained up until the new shares were released on May 27, 2021, after which the valuation reverted to more justifiable levels.

While this was a topic covered continuously and with an unconventionally negative sentiment by the Norwegian financial media, it was not as prevalent in the other Nordic countries' media environment. Finnish media in particular, while the topic of NAS restructuring was brought up occasionally, did not criticise the valuation to the same degree even though a significant number of Finnish investors were actively trading the stock throughout the period.

We argue that the dispersed ownership of NAS, coupled with the investors' assumed limited knowledge and attention, made this an extraordinary situation where the media narrative had more influence than previously recognised. Since NAS was and had not been for a long time a viable investment for most institutional investors, we are able to assume that the large majority of trading was conducted by small private retail investors and therefore created a unique setting in the market without interference with large players.

The relevance and contributions of this study are therefore threefold:

Firstly, the benefits of showcasing and studying phenomena of overpricing and market

malfunctions. Although rare occurrences, the market does falter occasionally and whenever that happens it is essential to investigate the causes and conditions behind their occurrence. While the results of this study do not provide concrete evidence of exactly why these situations arise (nor is it within the scope), the extraordinary circumstances around the event gives us valuable insights in how the influx of retail traders can impact the previously standard financial economic theories.

Secondly, the influence of financial media in inter-country retail investing, and the potential information advantage within the domestic population. As this is a lot less studied topic compared to the one above, the novelty of the research is highly relevant and timely. Although the theories behind an efficient market are explained in detail in the upcoming literature review, the price should theoretically reflect all available information at any given point in time, meaning that on an average country-level, different countries' individual investors should trade in unison.

Thirdly, the role of financial media in an increasingly retail-saturated capital market. With more individual investors entering the market with arguably less experience and financial literacy, the importance of accurately reported information in financial media and its impact on investors are of immediate interest. While professionals usually trade without personal consequences, individual investors risk their personal savings which could potentially have larger societal complications. The question therefore remains whether financial media coverage amplified or mitigated the issues by their negative sentiment.

1.2.1 Research question

In our attempt to further investigate the phenomena presented above, we constructed the following research question:

Research question:

Does financial media coverage with a negative sentiment of overpricing influence retail investing behaviour within the Nordic countries?

With this research question in mind we formulate the following null-hypothesis:

H_0 = *Financial media coverage of overpricing situations has no influence on retail investing behaviour.*

1.3 Demarcation

The scope of this study includes the period 1.11.2020 to 30.6.2021, when the overpricing of NAS was arguably the most salient. While there are many events in the history of NAS that are directly related to this case, the aim of this study is to look for changes in trading behaviour as a result of different media attention. Therefore, the period before the concrete plans of a restructuring falls outside of the scope.

A natural limitation to studies like this is that they are unique in nature, which limits the external validity of the results. Situations like the one investigated in this paper are rare and usually context-specific, meaning that the results might be contingent on a distinct characteristic that we have no means of controlling for. We have however still decided to formulate the research question in a general sense, as we believe that these occurrences are not case specific in nature and could arise again given the right circumstances.

A clear limitation with using media data without looking at the attention the specific media outlet is getting is that there is no guarantee that the number of articles directly translates to more attention amongst the readers. To gain a more accurate description of the actual exposure the articles are getting, there are established methods of measuring this in the literature. These methods include (amongst others) self-reports, cross-media exposure, and interactive metrics (de Vreese and Neijens, 2016). However, due to privacy concerns, the sheer amount of data collected and the purpose of this data, these are not feasible options to include in this study, nor are they necessary to answer the research questions proposed in the section above. By assuming that more coverage on the same topic, both within and outside the country, results in more investor attention we can bypass these obstacles. We also support this assumption by including Google Trends data, which serves as another proxy for attention and is heavily correlated with media coverage.

There is also an argument to be made that investors would trade NAS on news covering the airline market as a whole. While this might be true, it falls outside of the scope as the

aim of the study is to see whether the coverage of overpricing in the media is enough to influence trading behaviour, and not financial news in general. Therefore, articles about the industry as a whole that mention NAS falls within the scope of the study.

2 Literature

In the following chapter, we introduce some critical concepts from financial and behavioural literature that are needed for our analysis later on in the paper. The chapter starts off with a thorough background of NAS and the important events surrounding the reconstruction process to gain a firm grasp of the overpricing issue, followed by a discussion surrounding valuation methods and its implications for NAS. A subsequent exploration into the behavioural aspects of financial decision making, along with behavioural biases commonly found in the literature is then presented. The reader is finally guided through previous studies of media influence on trading behaviour with parallels to our specific case, and media influence in general.

2.1 Company background

Norwegian Air Shuttle (NAS) was founded in 1993 as a Norwegian low-cost airline. During the 2000's NAS grew rapidly, and started to operate on regional flights in Europe. After the global financial crisis NAS exploited the situation to expand further by acquiring 222 of the new fuel-efficient airplane-models from Airbus and Boeing, which they announced on January 25, 2012 (Solheimsnes, 2019). This was the biggest order of airplanes ever in Europe. The expansion made it possible for NAS to expand to intercontinental flights to the Americas and Asia, and in 2018 NAS was the 5th largest low-cost airline in the world (Valderhaug, 2021a).

This swift expansion was mainly funded by debt, and NAS was described as "the world's most levered listed airline" by analysts at HSBC in 2020, and had a net debt to EBITDA ratio of 7.1 while other European low-cost airlines had an average of 0.5, according to analysts at ABG Sundal Collier (Milne, 2020). The debt burden lead to financial distress when the airline's planes picked up persistent operational issues with the engine problems of the Boeing 787 Dreamliners in 2018 and the groundings of all 787 Max planes between March 2019 and December 2020, after several crashes with the model. The crisis was further aggravated by the Covid-19 pandemic, which hit the airline industry especially hard. In May 2020 NAS shareholders approved a plan to convert debt to equity, and adjust the strategy by shifting the focus to more profitable domestic flights.

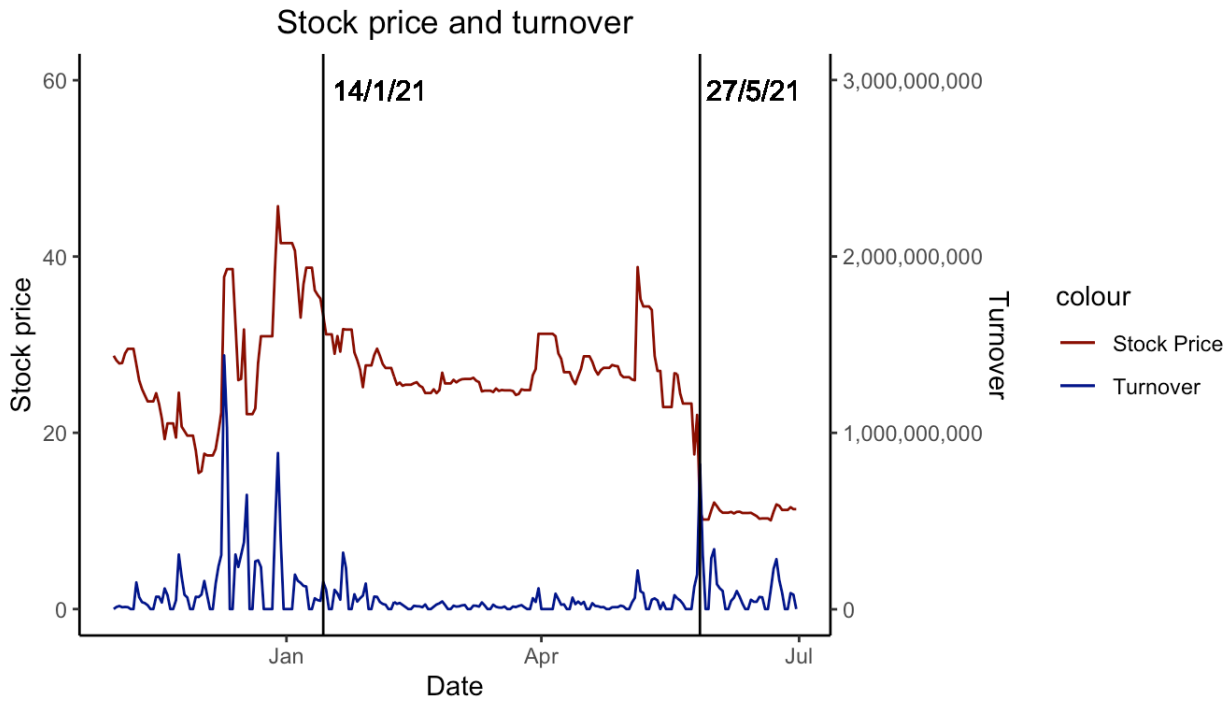
Figure 2.1: Timeline

TIMELINE 1: *A brief history of Norwegian Air Shuttle*

May 2020	Debt-to-Equity conversion as part of the rescue plan
9 November 2020	The Norwegian government rejects NAS's appeal for additional support
Nov 2020 - Jan 2021	Speculation and criticism of NAS pricing
14th January	Stock Exchange announcement outlining the restructuring plan
26th March	Bankruptcy protection granted in Ireland
14th April	Stock Exchange announcement detailing the dilution of share capital
5th May	Ex. date for subscription rights
27th May	New shares are released to the market

In the timeline above we can see the major events related to NAS in a chronological order starting from the debt-to-equity conversion already mentioned, until the new shares hit the market as a result of the restructuring process. On November 9, 2020 the government denied NAS further financial support, citing that the company was not fiscally sustainable even more before the crisis (Kurki-Suonio, 2020). Simultaneously the stock price fluctuated heavily, as we can see in figure 2.2 below.

Figure 2.2: Stock price and turnover for NAS



On December 10, 2020 NAS hit the previous all-time high records in trade volume of a single stock on Oslo Børs, with over 103 thousand transactions conducted in a single day after increasing almost 60% (Risbakken and Alexandersen, 2020). According to an article published in Finansavisen on December 11, 2020, over 50% of the trading during 7th and 8th of December 2020 was conducted by Nordnet investors, to a value to 191 million NOK (Risbakken and Degernes, 2020a). The high trade volume is likely related to the approval of bankruptcy protection for NAS from the Norwegian Government on December 9, 2020, which was positively met by retail investors.

On January 14, 2021 the company officially announced their indicative restructuring plan after getting it approved by the shareholders on an extraordinary shareholder's meeting on December 17, 2020 (Norwegian Air Shuttle ASA, 2020). This outlined the plan to decrease debt by 20 billion NOK, while also raising 4-5 billion NOK in new capital. The capital would be raised through a combination of a private placement, a hybrid instrument, and a rights issue to current shareholders. The proportions outlined in the plan are approximately 5% to the current shareholders in an addition of an offer of participation in the rights issue for 400 million NOK. Creditors would receive 25%, and the remaining 70% would be held by a few large new investors (Norwegian Air Shuttle ASA, 2021c)

On March 26, 2021 an Irish court granted NAS bankruptcy protection for their Irish subsidiaries, and the decision was followed by a Norwegian court that on April 12, 2021 granted them protection in Norway as well. On April 14, 2021 the company announced the more detailed plan where they set a maximum price for the new shares at 6.99 NOK, and also increased the capital raise to 6 billion NOK (Norwegian Air Shuttle ASA, 2021d). This led to current shareholders being diluted to approximately 4.6 to 3.7 percent of the post-restructuring shares. On the 3rd of May the company announced the detailed plan of the upcoming share emission, confirming the final share price of 6.26 NOK(Norwegian Air Shuttle ASA, 2021b). They also define the rights issue, where each existing shareholder would be granted three subscription rights for every two shares held as of the expiry of May 4, 2021. Furthermore, the six cornerstone investors subjected to speculation throughout the period were officially published, being allocated a 2.85 billion NOK share in the post-structured NAS. On May 27, 2021 the new shares were released.

In figure 2.2 we see the *adjusted* share price and trading volume of NAS throughout the

period. The price in this figure is adjusted for the reverse split on December 18, 2020 and the addition of subscription rights later in the period. During the more volatile period before January 14, 2020 the Norwegian media were highly vocal in their criticism of NAS's current valuation. Phrases like *"utopian pricing"*, *"better odds to win the lottery"*, and *"banaNAS valuation"* were all headlines during this period. (Risbakken and Degernes, 2020b; Giæver, 2020)

The ownership structure of NAS during these times has increasingly been small retail investors. In an article from March 21, 2021 in Dagens Næringsliv, Investment Economist Mads Johannesen at Nordnet discloses that they already received 43 045 new customers in total in Norway this year, an increase of 162 percent compared to the same period last year. Out of these investors, 27 000 are between 22 - 40 years old. Moreover, the most popular stock amongst these were NAS and Rec Silicon. At this point in time, Nordnet's Norwegian customers in NAS were equal to 25 000, the majority below 40 years of age. (Magnus and Johannesen, 2021)
On a general level, Valderhaug reported January 12, 2021 in the digital financial newspaper*E24* that NAS had 67 400 shareholders, with two out of three shares held by Scandinavians. (Valderhaug, 2021b)

In another article from Dagens Industri on May 21 2021, Johannesen and another ex-Nordnet economist Joakim Bornold reiterates the recommendation for retail investors to sell before it is too late, as *"math will prevail in the end"*. They also claim that in practice, based on the calculations made available by the emission announcement, the stock has *increased* by more than 100% during the reconstruction process. In the article the number of retail customers invested in NAS on the trading platforms Nordnet and Avanza is also published, showing that 67 000 and 58 000 customers respectively still had positions in NAS just days before the restructuring is finished and the new shares are released in the market. A back-of-the-envelope calculation would thereby suggest that the number of unique owners in NAS has *at least* doubled since the announcement, most of them private retail investors. (Höiseth, 2021)

2.2 Asset pricing

There are multiple models of pricing an asset in financial literature. These models determine the present value and fair market price of assets, often based on the future expectations and/or book values. Research has also found that other factors, such as shorting constraints and behavioural biases also affect the valuation of assets.

2.2.1 Efficient market hypothesis

A common assumption in economic and financial theory is that the market participants are rational, and that security prices reflect the available information. These assumptions are the foundation of the Efficient Market Hypothesis (EMH), that states that it is not possible to make excess returns in an efficient capital market according to Fama (1970). Fama further claims that all assets are priced at their fair value, which means that finding an undervalued or overvalued asset is impossible. The only way to make higher returns would be to invest in riskier assets.

EMH has three different forms, weak, semi-strong and strong. Each form represents how much information is incorporated into asset prices.

Weak form is a state where all former asset prices are accounted for in the pricing of an asset, which suggests that technical analysis is not an effective method to choose investments. Fundamental analysis could although be used to determine which assets are mispriced, and make it possible to obtain excess returns.

Semi-strong form suggests that all publicly available information is used to price assets, and that researching a stock is not an efficient way to determine whether an asset is priced correctly. Only information that has not been made public yet could be used to discover assets that are not priced at a fair value.

In the **Strong form** of the EMH all information is accounted for in asset prices, including inside information. This implies that generating excess returns is not achievable.

As mentioned above an important assumption in the EMH is that the market participants are rational, and incorporate the available information into asset prices, which may not always be the case. We will discuss how markets are not always rational more thoroughly

later in the chapter.

2.2.2 Valuation

When pricing an asset one generally starts by determining the fundamental value through a valuation model, which based on various parameters and information available represents the starting point. A common assumption in these models is that the value of money today exceeds the value of money in the future. One of the most used valuation methods is the Discounted Cash Flow model (DCF), which uses the future expected free cash flows discounted to estimate the present value of an asset.

Equation 2.1 shows how the value of an asset is calculated in DCF. V_0 represents the value today, E_0 is the expectations at the same time. FCF_t is the free cash flow at time t, which is discounted by discount rate r_t, the asset's Weighted Average Cost of Capital (WACC) (Jennergren, 2011).

$$V_0 = E_0 \sum_{t=1}^{T} \frac{FCF_t}{(1 + r_t)^t} \tag{2.1}$$

As the DCF, like most other valuation models, is based on assumptions about the future it is error-prone and could produce unrealistic valuations, as the people utilising the model may not always have realistic expectations about the future.

In the NAS case, it was common knowledge that by the announcement on January 14, 2021 the existing shareholders would be diluted to 5% of the ownership of the company after the restructuring, while the current market capitalisation was approximately NOK 2.7 billion. Given that this sum is equal to approximately 5% of the restructured company, the market effectively valued the company at NOK 54 billion (Jensen, 2021). Due to NAS's negative *FCF* in recent years, the assumptions needed regarding their future growth to defend this valuation might not seem completely reasonable, as shown by the equation 2.2 below. In this simple DCF valuation we assume a WACC of 7% and a perpetual FCF growth of 2%. The WACC assumption is based on the NAS annual report where their expected long-term WACC is around 7% (Norwegian Air Shuttle ASA, 2021a). While the company utilises a growth rate of 0 percent beyond a four-year period in their calculations, we decided for conservative reasons to assume a perpetual growth rate equivalent to the

average growth rate of the economy. By setting the *FCF* as an unknown variable in equation 2.2 we are able to work out that the FCF in the first year has to be NOK 2.7 billion to justify a valuation of NOK 54 billion.

$$\begin{aligned} 54\,000 &= \sum_{t=1}^{\infty} \frac{FCF_1(1+2\%)^{t-1}}{(1+7\%)^t} \\ 54\,000 &= \frac{FCF_1}{(7\%-2\%)} \\ FCF_1 &= 2\,700 \end{aligned} \tag{2.2}$$

Alternatively, using peers to value the company could produce a better estimate of the fundamental value of NAS. A valuation of 54 billion is more than Turkish Airlines (NOK 10.1B), SAS (NOK 12.8B), Finnair (NOK 7.5B), Air France-KLM (NOK18.8B) and Icelandair (NOK 0.06B) combined at the time. Supposedly, it is difficult to justify the valuation of an airline with 50 airplanes and revenues of NOK 6.5 billion in 2020 is fairly valued at NOK 54 billion, when Turkish Airlines alone had revenues of NOK 57 billion in 2020. We argue therefore that the pricing of NAS during this period is inflated and is hard to rationalise by any fundamental valuation. While the overpricing in this period is not as severe throughout the whole period, the price does not show resemblance to the actual fair value price until after the restructuring has taken effect.

$$P_0 = E_0 \sum_{t=1}^{T} \frac{Div_t}{(1+r_t)^t} \tag{2.3}$$

One could also utilise the Dividend Discount Model (DDM) first introduced by Williams (1938) to value NAS stocks. The DDM formula from equation 2.3 could be rewritten to equation 2.4 to better reflect the NAS case. The future stock price is P_1, and it was common knowledge that it would be substantially lower than a market price of NOK 50-70 in January 2021, when the new shares were released to the market for NOK 6–7.

$$
\begin{aligned}
P_0 &= E_0\frac{Div_1}{1+r_1} + \frac{E_0}{1+r_1}\sum_{t=2}^{T}\frac{Div_t}{(1+r_t)^t} \\
P_0 &= E_0\frac{Div_1}{1+r_1} + E_0\frac{P_1}{1+r_1} \\
P_0 &= E_0\,\frac{Div_1 + P_1}{1+r_1}
\end{aligned}
\tag{2.4}
$$

In the formula 2.4 above, Div_1 represents the dividend in the period 1, and $E_0(Div_1) = 0$. The CAPM required rate of return is $r_1 \geq 0$. Given an expected $P_1 \approx 10$, it is therefore hard to argue that a $P_0 \approx 50$ is rational. Assuming a standard $r_1 = 15\%$, that would require a $Div_1 \approx 47.5$ according to the DDM method. Given NAS' no dividend history and at the time financial position, this scenario does not seem plausible.

2.2.3 Shorting constraints

Around the time of the announcement of the equity issuance, the amount of NAS stocks shorted was below 1%, which is in stark contrast to the previous shorting levels according to historical data found on Finanstilsynet. Before the pandemic NAS was one of the most shorted shares on the Oslo Stock Exchange, with over 20% of total stocks shorted on several occasions previously (Skarsgård, 2017). One of main reasons of the low shorting levels was arguably the high short-interest rate, reportedly being as high as 120% in a short email interview with a senior Nordnet official who wishes to remain anonymous.

Moreover, Barber and Odean (2007) show in their study that retail investors generally do not sell short, meaning that they only sell stocks they already own. As mentioned previously in the background, the ownership of the company was spread amongst a sizable number of small retail investors. Due to this dispersed ownership structure of NAS during the relevant period, the stocks available for shorting was potentially limited. This absence of shorting opportunities could therefore arguably lead to difficulties for non-owners to influence the stock price with their views. As only the investors with a positive view (i.e. the existing owners) get to influence the stock price, one could argue that these are extraordinary conditions for overpricing to take form. (Jones and Lamont, 2001)

2.3 Behavioural finance and overpricing

The implementation of human psychology into economic models stems back approximately 40 years, when Kahneman and Tversky (1979) introduced Prospect Theory. They argued that humans are not perfect expected utility maximisers like the ones described in von Neumann and Morgenstern (1947), nor are they actively diversifying their portfolios along the efficient frontier like Markowitz (1952). They claim that there are systematic errors and biases that can be identified and modelled, leading to models that more accurately describe how investors actually behave.

The main arguments advocates of Behavioural Finance (BF) have in their favour are the relatively large number of discrepancies between the normative accuracy of standard financial economic models and actual human behaviour in capital markets. The existence of long-term stock market bubbles and asset overpricing are readily available examples of conflicts between the EMH and the reality of capital markets. A few of these instances are included in a study by Lamont and Thaler (2003), where they investigate how identical assets can have different prices in different markets and whether this holds under the EMH. They find that limits to arbitrage opportunities are prevalent in all of their studied cases, but simultaneously find the cases *'grossly'* violate the law of one price, and that it can take longer than expected for the price to revert back to normal.

Opponents of behavioural finance's more descriptive explanations on the other hand argue that investors who suffer from biases and consequently act irrationally would eventually be forced out of the market by rational actors. The claim is that even though anomalies do occur, the market forces will bring the prices back to a rational market equilibrium, implying irrational behaviour is simply a temporary state of confusion and therefore irrelevant. (Rubinstein, 2001)

Although the exact conditions that are needed for situations of overpricing to arise is yet to be discovered, the descriptive features of BF can help us understand the reasons behind their occurrence. Evidence of individuals using heuristics to take financial decisions (Thaler and Benartzi, 2007) and not always behaving rationally (Lo, 2005) does imply that situations might arise when these heuristics could cause a discrepancy between the *'correct'* price of an asset versus the actual price. It is therefore not that unreasonable to

believe that assets with a higher proportion of *non-rational* actors could pose a higher risk of leading to an overpricing scenario.

2.4 Behavioural biases in financial decision-making

Faced with complex financial decisions, humans with their limited cognitive abilities and information processing tend to use simplified versions of the actual problem. The use of heuristics amongst private individuals in financial decision making has been studied extensively in the literature (Thaler and Benartzi, 2007; Tversky and Kahneman, 1974). While heuristics and intuition have a central function and are quite effective in ordinary decision making, they can potentially lead to systematic and predictable biases when applied to financial decisions that are of more complex nature.

With some exceptions, an investor who outperforms the market also means that someone else is underperforming due to the *adding-up constraint* of financial markets (Odean, 1999). Nevertheless, while previous studies have shown that individual investors on average perform below the market average, there is also significant variation within the data that should be considered (Barber and Odean, 2013). The factors influencing these individuals are abundant and largely ephemeral, but studies have suggested that some are more prevalent than others. As with most things connected to human behaviour, many of these biases are intertwined with each other. Nevertheless, the influences and biases most frequent in the literature causing these departures from rationality are presented (briefly) below, although with a slightly simplified distinction between them:

Loss aversion is one of the key principles in Prospect Theory introduced by Kahneman and Tversky. Loss aversion can be simplified to describe people's tendency to weigh losses subjectively more than the equivalent objective gain. The formal representation of the value function is defined as the mapping from objective value (x) to subjective utility of the objective value $u(x)$ from a neutral reference point, represented in equation 2.5 below:

$$If \;\; x \geq 0, \quad u(x) = x^p \; and \; if \;\; x < 0, \; u(x) = -\lambda(-x)^p \tag{2.5}$$

where λ is the loss aversion coefficient and p is the level of individual risk aversion. Given a standard, concave utility function in the gain domain this yields a bent *S-shaped* value

function, as the curvature is steeper in the loss domain (although diminishingly so). In another study by Tversky and Kahneman (1992) where they attempted to advance the theory introduced in 1979, they found the mean loss aversion to be 2.25, implying that the preferred monetary gain in a potential equal-probability lottery would have to be 2.25 times larger than the potential monetary loss for it to be considered proportionate.

Mental accounting is a phrase coined by Thaler (1985), which represents people's tendency to account for monetary wins and losses in context of their purpose. By combining cognitive psychology and microeconomics, Thaler constructed a model based upon the value function from Prospect theory which can be applied to both pricing decisions, marketing, and household budgeting. An illustrative example is presented in the study, where a couple has saved $15 000 towards a house in a money market account yielding a 10% annual return. Simultaneously, they recently bought a new car for $11 000 financed by a three-year loan at a 15% interest rate. By labelling the money this way, the couple is violating the property of fungibility within economics (to the detriment of their personal finances). The violation in this case is arguably caused by an *"appreciation of the household's own self-control problems"* (Thaler, 1985 s.2). In the case that the money for the car would be taken from the money market account holding the money for the new house it would perhaps not be repaid, but the institution issuing the car loan will make sure the loan payments are made. (Thaler, 1985)

Disposition effect refers to the phenomena first discussed in 1985 by Shefrin and Statman. Here they explore the general reluctance individual investors have to realise losses. This leads to the aforementioned Disposition effect, where investors sell winners too early and hold on to losers too long. They argue that the combination of prospect theory, mental accounting, regret aversion, and self-control are the contributing factors that lead to this behaviour. The loss aversion from prospect theory can be identified in the sense that given a slight decline of a stock, people tend to wait it out for a price reversal instead of realising the 'loss' (without any indication a reversal is coming), since the current price is perceived to be a loss relative to the earlier, higher reference price. This reluctance to sell is therefore also related to *mental accounting*, as the action of *closing* that specific account at a loss is seen as failure, when the appropriate perspective is to evaluate the portfolio as a whole. In closing an account at a loss, the investor also admits the faulty

judgement the investment decision was based upon, possibly inducing regret. Closing at a gain seems to be easier, as that arguably induces pride (the opposite of regret). As regret is the arguably stronger feeling of the two, in the pursuit of pride the asymmetry in strength between regret and pride is therefore in favour of inaction (Thaler, 1985). Regarding self-control one only need to acknowledge the routine use of stop-loss orders among professional investors. While marketed to be an instrument to limit risk, their main advantage may be to force an investor to realise losses at a predetermined point. (Shefrin and Statman, 1985)

Limited attention is also a cornerstone property of behavioural explanations in finance. While the term *Limited attention* is relatively new, the concept was arguably first discussed by Herbert Simon in his article determining bounded rationality from 1955. In the article Simon questions the human brain's capacity to continuously find the expected utility maxima or minima, and theorises that the physiological and psychological limitations could be constraining enough to sway away the actor from perfect rationality. In practice, this represents the limited cognitive processing ability that humans possess, and that it therefore is thought of as a scarce resource. This is even more so for retail investors that are limited in their time and effort dimension as shown by Barber and Odean in 2007. Compared to institutional investors whose decision regarding buying and selling is identical due to their ability to also sell short, individual investors also simply own less stocks. This leads to fewer options for selling, while the purchase options remain constant for both investor groups. For these reasons, Barber and Odean argue that attention-grabbing stocks are more likely to be considered by individual investors. The authors further concluded in their paper that individual investors tend to be net buyers of attention-grabbing stocks, with the amount of purchases as high as twice the amount of sales on high-attention days. Even in the absence of new information regarding a company grabbing the attention of the broader population, extreme results (both positive and negative) were also found to stimulate purchasing and thereby generate additional momentum from individual investors.

Overconfidence in one variety is the belief that an individual knows more than they do. This is commonly studied by *precision tests*, where subjects are asked for a best guess to a question, and then asked to provide 90% confidence intervals to the same question. On

average, a well-calibrated subject should therefore provide intervals containing the answer nine out of ten times. The actual number when these studies have been conducted are however much lower. (Barber and Odean, 2013)

In a study conducted by Grinblatt and Keloharju (2009), they showed that an inflated sense of one's own abilities has been shown to be correlated with more active trading, in turn leading to decreased overall performance (Guiso and Sodini, 2013). They also find that another psychological trait, *sensation-seeking*, is correlated with those who trade frequently. This has been shown to be linked to the psychology of gambling, famously illustrated by a lab experiment from 1975 that when presented within a gambling context with an element of choice, subjects increasingly tend to interpret random outcomes as reflective of their own choice, giving them the *illusion of control* (Langer and Roth, 1975).

In another study conducted by Graham et al. (2009) they investigate whether people are more willing to bet on own abilities when they feel more competent and knowledgeable. They find that while investors who feel more qualified have a higher transaction frequency, male investors are disproportionately represented in this group along with investors with larger portfolios and higher education. They conclude that *"overconfident investors tend to perceive themselves to be more competent, and thus are more willing to act on their beliefs, leading to higher trading frequency"*. Excessive trading or *Over-trading* has been repeatedly shown to reduce overall performance (Guiso and Sodini, 2013), and is especially prevalent within the group of retail investors (Odean, 1999). Odean suggest that overconfident investors trade excessively due to multiple reasons, including the human cognitive processing constraint due to the abundance of choice alternatives, by their tendency to let attention be directed by outside factors such as financial media, the *disposition effect*, and the unwillingness to sell short.

In an additional finding Graham et al. (2009) also find a connection between the *competence effect* and international diversification, meaning that when an investor feels more confident, they are more likely to invest in foreign assets. The same is true for the reverse scenario, i.e. when an investor feels less confident in their own ability they are more likely to exhibit a *familiarity* or *home* bias. (Graham et al., 2009)

Familiarity bias refers to individuals' tendency to over-invest in familiar, well-known stocks. According to Huberman (2015) this bias is not only limited to the home country,

but also local businesses or employers. While there are psychological and even economical explanations for investing in the familiar (like lower asymmetric information), there are negative diversification consequences that do not compute with a rational choice model. To illustrate, take employee's tendency to either invest themselves, or to keep employer issued shares in the company they work for. Given the unfortunate event that the company defaults, instead of only losing their investment in the company the individual is now additionally unemployed, and in some cases without a pension (Benartzi, 2001). The same is true on a country-level, where foreign assets provide excellent diversification opportunities and an unwillingness to do so is generally in detriment to the portfolio performance (Grubel, 1968).

Anchoring bias is a heuristic which occurs when an individual is presented with an initial value before making a decision. While this starting point is perhaps of no significance for the decision at hand, studies have shown that there is *insufficient adjustment* from the initial value, regardless of what the initial value is. One demonstration of this effect is featured in the study by Tversky and Kahneman (1974), where they ask subjects to estimate various quantities. In the example, the subjects are asked to estimate the percentage of African countries in the United Nations. For each subject, a spinning wheel of fortune determined a number between 0 and 100. Their first task was to estimate whether the percentage lies above or below this arbitrary number they were presented with, and then indicate the actual value by moving upwards or downwards from that number. The results of this experiment showed that the arbitrary spins had a significant effect on the estimates, seeing as the median estimates of the percentage of African countries in the UN were respectively 25 and 45 for groups presented with a number of 10 and 65 as starting points. (Tversky and Kahneman, 1974)

In a recent large-scale experimental study, this was also tested in a financial context where participants were to estimate the stock price of Tesla in a week. The groups were then subjected to information regarding different historical Tesla stock prices. The results show that the there are significant differences between the estimates depending on what information is presented. (Yasseri and Reher, 2022)

Herding or herd behaviour is commonly referred to investors' tendency to imitate the action of other investors, while ignoring other information or own beliefs. While still

prevalent in both investor groups, i.e. individual versus institutional, herding behaviour is more present in the first group. Barber et al. (2008) investigate in their study from 2009 whether retail investors' trading patterns are correlated, and whether this holds for significant amounts of time. They find that individuals' trades are both positively and significantly correlated, while also exhibiting persistence over time. Applying the results to standard financial models, it could lead to irrational traders driving stock prices away from the fundamental price - meaning when uninformed traders actively buy, the asset become overpriced (and vice versa). (Barber et al., 2008)

2.5 Media and financial influence

Many studies have already found evidence of correlations between media narratives and subsequent stock performance (Tetlock, 2007; Engelberg and Parsons, 2011; Tetlock et al., 2008). However, the difficulties in establishing a causal relationship between media coverage and stock market reactions are plentiful and challenging to overcome. The number of unobservable and uncontrollable factors surrounding coverage decisions and investor behaviour seems to cause an identification problem. As the media companies are profit-driven themselves, there is non-randomisation in what events are covered that is subject to internal biases which cannot be contained. How are we ever to be certain that the market response is changed due to the media coverage, or whether it is some unrecognised external factor driving both the market and the media attention?

In the literature there have been two methods of dealing with this issue, namely by decoupling the determinants of media coverage and market response completely (Huberman and Regev, 2001), or by having a cross-sectional approach (DellaVigna and Kaplan, 2007). The cross-sectional approach used by DellaVigna and Kaplan is by today's standard the most scientific and looks for a causal link by dividing the treatment and control group, the treatment in their case whether the area broadcasts Fox News. The control group (the other areas) is then the baseline from which any deviations in voting patterns in the presidential election is due to treatment. They find that even though these are the same *information events*, the republican presidential candidate gained 0.4 to 0.7 percentage points in towns that were treated. Their estimate thereby imply that simply by broadcasting Fox News in an area, 3 to 28 percent of its viewers were convinced to

vote Republican.

Engelberg and Parsons (2011) take the same approach as DellaVigna and Kaplan, but do so within the context of financial markets and retail brokerage accounts. They identify 19 local, non-overlapping trading markets in major US cities, and a local information source (in this case the daily newspaper). By looking at earnings announcements for large companies trading in all of the local markets, they find that an earnings announcement picked up and covered by the local newspaper increased the daily trading volume of local retail investors by 8 to 50%. This effect was especially strong for buying activity, however still statistically significant for selling activities. (Engelberg and Parsons, 2011)

In contrast to our paper, seeing as the Engelberg and Parsons study was conducted between 1991 and 1996, the internet was a non-factor and the local communities were smaller. In our case of NAS, the local community is all of Norway and all of Finland, with a natural barrier in between (language). Because of the availability of financial news media within both countries, we also utilise specialised media outlets that targets investing-interested readers instead of daily newspapers. Moreover, our study does not have the luxury of having the link between media coverage and trading disrupted or broken, giving no ability to test for underlying determinants of investor demand.

Regarding media sentiment, García (2013) finds evidence supporting the theory that coverage does play a role in asset performance. By studying the *New York Times* financial coverage over the 1905 to 2005 period, they find that positively or negatively worded pieces have a direct effect on underlying asset performance. This is especially true during recessions and uncertain times, where the predictive ability is estimated to be up to 12 basis points change in the DJIA. They do however alert to the fact that during most of these times, the only financial news were the *New York Times* and *Wall Street Journal*. Nevertheless, these results are reinforced by a large psychological literature which shows that emotions heavily influence people's decision making (Tiedens and Linton, 2001).

Gino et al. (2012) strengthen these results by conducting eight psychological experiments, showing that anxiety strongly increases the probability of seeking and relying on advice from others. They also find evidence that anxious individuals are incapable of discerning good from bad advice, in addition to the already harmonious claim that anxiety impairs information processing overall. All of these results are highly relevant and directly related

to our case simply because the period of interest is during the Covid-19 pandemic, when according to a meta study conducted by Santabárbara et al. (2021) the overall levels of anxiety were three times the global standard.

In conclusion, while standard economic and financial models assume rationality from all investors, there are external factors that could possibly cause biased financial decisions that in aggregate lead to over- or under-priced assets. In our specific case, financial media is arguably one of the more visible factors of which we can attempt to investigate the potential effect it has on individual investors.

3 Data

The data collection process consisted of two categories: the quantitative data which included all the transactions and portfolio data, and the more qualitative type of data in a media database. All the quantitative data stems from a large social platform for retail investors in the Nordics, with over 285 000 unique members. The quantitative data is split into *Portfolio data* and *Transaction data*, both subsections below. They were split into subsections to get a better picture of how the analysed data was put together and the reason for a small amount of data attrition, where customer IDs lacked a match in the corresponding dataset. As our primary focus in the study is the media treatment effect in Norway, that is where most of the focus lies. Finland is also frequently featured, as it plays a crucial role in our analysis method later on in the paper.

3.1 Portfolio data

This cross-sectional subset of the larger dataset includes the general holdings and past results of every customer within the database. The portfolio data (PD) includes the positions of each account and account holder, with a maximum limit of 24 stocks meaning the holdings in each account over 24 stocks is lost. To know for sure the right people are included in the analysis, a separate subset from the original source was pulled where all the transactions of NAS were made. This is presented in the next subsection named "*Transaction data*".

The variables included in the PD are standard return variables with various time horizons, as well as the platform's portfolio rating system, country of origin, and followers on the platform. The time horizons for returns are 3y, 1y, Year to date (YTD), 6m, 3m, 1m, and 1w whenever possible (many newer customers lack longer historical return data). The platform's portfolio rating system is in form of stars, ranging from 0 to 3 based on the portfolio Sharpe ratio. A rating of 3 stars means you are amongst the top 10% of users on the platform, 2 stars means top 50%, and 1 star means a positive return on the portfolio. The variables of interest within this subset that were later exported are the return variables, rating, and country of origin. The date of the cross-section is 15.02.2021, and thus the individual historical returns and other variables are based on that date.

3.2 Transaction data

This part of the database includes the historical details of every trade that were made by members of the platform, including type (Buy or Sell), the exact date of the transaction and the corresponding price of the share originating back to April 2014. The exact number of shares is however not included in the data, and we therefore need to assume that every trade on both sides is in aggregate equal in size to make comparisons viable. A summary of the data is presented below in 3.1.

Table 3.1: Portfolio and Transaction descriptive data summary

Category	Source	Norway	Finland	Sweden	Denmark
Total amount of customers	PD	61 109	80 893	83 592	59 635
NAS customers	TD	14 004	4 338	X	X
Customers trade (within period)	TD	6 400	2 182	X	X
NAS transactions (within period)	TD	25 463	7 190	X	X
Avg trades (within period)	TD	4.0	3.3	X	X

Note: Sweden and Denmark are merely illustrative examples of the breadth of the social media platform from which the data is gathered, and will not be analysed further in the paper.

As one can derive from the table above, Norway has about 61 000 customers on the platform to Finland's 81 000 as of February 15, 2021. The number of customers that have bought or sold NAS during the period April 2014 - February 2021 is 14 004 and 4338. Due to the expected familiarity bias, Norway clearly has a larger percentage of the customer base invested in NAS than Finland, with 22.9% and 5.4% respectively. The participation rate in both countries, calculated as the percentage of total NAS customers divided by Customers trade (within period), is 46% and 50%. The average number of NAS transactions within the analysis period (1.11.2020 - 30.06.2021) is 4.0 for Norwegian customers and 3.3 for Finnish customers.

3.3 Media database

The database consists of 467 articles from the largest financial newspapers in the Nordics; *Dagens Næringsliv* and *Finansavisen* from Norway, *Kauppalehti* and *Taloussanomat* from Finland, *Dagens Industri* from Sweden, and *Børsen* from Denmark. The reasoning behind picking these in particular is that the stories that run in these newspapers should be able

to also cover the general consensus of the other, smaller newspapers. The two of the largest financial newspapers were chosen in Norway as NAS and the Norwegian market is monitored more closely by domestic press. For reasons unbeknownst to us, the Finnish media did not cover the Norwegian market as extensively as the other Nordic countries' media and thus we chose to include two newspapers to gain a broader view of that environment. A summary table of the full database can be seen in Table 3.2 below.

Table 3.2: Mediadatabase - Summary

Country	Articles	Newspapers
Norway	254	2
Denmark	95	1
Sweden	79	1
Finland	39	2
Total	467	6

The articles were gathered through a thorough archive search in each of the newspapers' own archives that included search terms such as *"Norwegian Air Shuttle", "NAS", and "Norwegian"*. The resulting articles were reviewed manually, summarised, and catalogued in our database. Manual checks by finding articles regarding NAS through other means than the archive were also conducted to assure that every article was indeed included.

As we can see in Table 3.2 above, Norway has a lot more coverage on NAS during the period compared to Finland. Denmark and Sweden have relatively the same amount of coverage, although Sweden's coverage is marginally higher. Because of this discrepancy in coverage, the differences between Norway and Finland were particularly interesting to look at and was the primary focus of the study.

Additional variables were also introduced into the database to represent the characteristics of the articles in an attempt to quantify the qualitative nature of the data:

Sentiment was quantified by the variable *media score* ranging from -2, meaning a highly sceptical and negative view of the company, and +2 representing a highly positive attitude towards NAS, the current price, and its future. A score of 0 represents a neutral or no stance taken in the article. An example of typical media scores in this case would be to explicitly mention and criticise the valuation (-2), a unfavorable article mentioning their negative cash flow or future challenges (-1), a favorable article where potential upsides and

news regarding how the successful restructuring could benefit the company is discussed (+1), and a shift in analyst recommendations from hold to buy or predictions of high future stock prices (+2).

This variable allows us to get an overall picture how NAS was represented by the media on any given day, providing us with valuable insights into what the general consensus were in the media on any given day in any given country. To counteract the subjectivity of this variable and to limit biases and external influences, the articles were first independently assessed by both researchers. Any disagreements within the scoring were later discussed and resolved by conducting a thorough re-reading of the article, with supplementary discussion on perspective and reasoning behind the scoring. All scores are therefore unanimously agreed on between both researchers.

To showcase the downward slope of media attention in the subsequent days of it being published, we constructed the model in equation 3.1 below. The daily media score is discounted by 20 percentage points each day following the publishing date, giving each day a value comprised of the combined score of the four previous days subjected to a discounting factor.

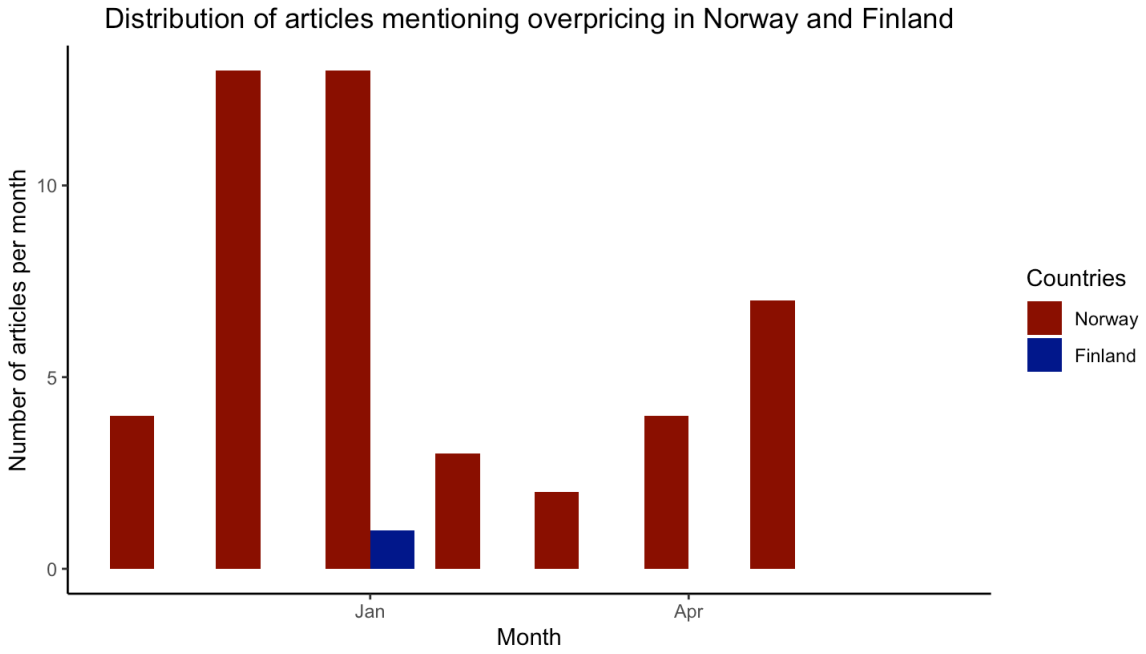
$$\begin{aligned} Sentiment_t = \sum Media\,score_t + 0.8 \times \sum Media\,score_{t-1} + 0.6 \times \sum Media\,score_{t-2} \\ +0.4 \times \sum Media\,score_{t-3} + 0.2 \times \sum Media\,score_{t-4} \end{aligned} \tag{3.1}$$

We argue that this model creates a more *"present biased"* moving average that in our opinion better represents the reality of the ever-changing nature of the news environment, and people's tendency to forget news quite rapidly. Seeing as the date of the article in our data is for the online version and not the printed one, we argue that emphasising the breaking of the story is more important than a standard moving average. This approach also better captures the potential lag in readership in case the articles are published late in the day, limiting the online readership and the potential impact on trading.

The variable ***Overpricing*** represents whether any overpricing of the NAS stock is

mentioned in the article. This is a simple binary variable to show on which days the media are effectively telling readers that the price of NAS is wrong, usually in the context of an expert's opinion. This variable shows that 52 articles explicitly or implicitly tell the reader that the price is unreasonable, and that there is hardly any financial theory backing up the current valuation.

Figure 3.1: Distribution of overpricing-articles across Norway and Finland



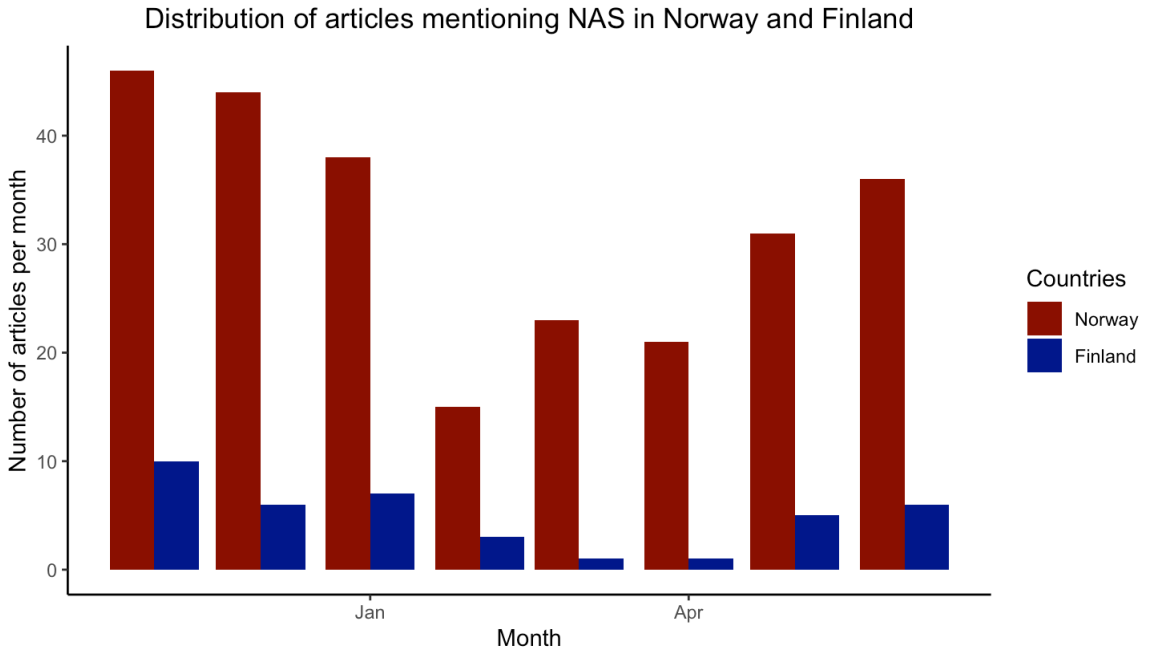
Number of articles in Norway and Finland explicitly mentioning overpricing.

In figure 3.1 above we see the distribution of the articles on a monthly basis in our two main countries of interest. Here we clearly see a discrepancy in coverage regarding the pricing of NAS, where Norwegian financial media continuously protests the valuation of the company while Finnish media exclusively mentions it when it covers the January 14th announcement. Although the month of June is also included, no articles mentioning overpricing were published during this month.

Datecount is the number of articles on any given day that mentions NAS within the period of interest. This gives us an indication of how popular of a theme NAS was during certain periods and is used as one of the proxies for investor attention. In figure 3.2 on the next page the distribution of articles mentioning NAS is presented. Here we see the coverage of NAS in Norway and Finland on a monthly article basis. Both countries seem to largely follow the same pattern, but with expected differences in absolute article

numbers.

Figure 3.2: Distribution of articles mentioning NAS across Norway and Finland

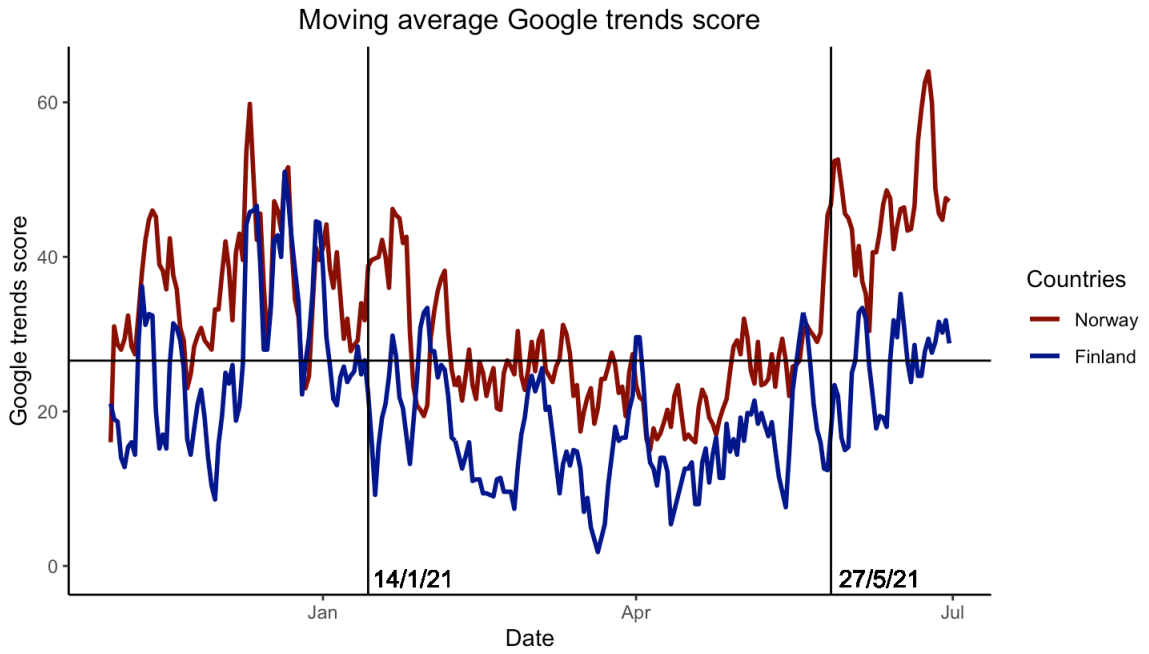


Number of articles covering NAS from November until June.

3.4 Google trends

The data from Google Trends was collected by doing individual searches for "Norwegian Air shuttle" in each country. The result is a relative score based on each country's highest scoring day, which equals to 100. All remaining days are scored as a percentage relative to that score. As the graph is the five-day moving average, none of the days reach a value above 60. The benefit of graphing the moving average of trend searches is that we get a clearer picture how the interest in general was during the period, without the highly fluctuating daily data interfering with our inference. The benefits of including Google Trends score in our data are to reliably measure attention within the population and increase robustness of our media database when the two are combined. The reasoning behind this is simply that a day with a large number of articles could potentially be a coincidence, but coupled with a high trending day the probability of that being an overall high attention day is larger.

Figure 3.3: 5 day Moving Average Google Trends data



In figure 3.3 above we clearly see a difference in interest taken by the two countries' population. While the pattern is strikingly similar for both countries, the search data clearly supports the theory that investors are generally more concerned with the domestic market. The Finnish trend scores are continuously lower in comparison to Norwegian scores, although with a few irregularities. We also see a drop in interest during the period between our two key dates, which correspond quite accurately with traded volume during these times (see 2.2).

3.5 Ethical concerns

As is the standard with the type of data used in this study, all the data was anonymised before it was further handled to prevent any breach of personal information. This means there was no way of identifying the person behind the customer or account number during any point of the research process, nor are any revealing details presented in the paper that would lead to recognition of any single individual. Furthermore, none of the data was shared with anyone outside of the research process and access to the database is restricted to the researchers and supervisors.

Moreover, while this study would be unethical to conduct in a controlled experiment,

seeing as the subjects are staking and in many cases losing real money during the period, we argue that this format does not pose the same ethical or moral dilemmas. The data is purely of historical events that has already happened, with no further impact on the subject's personal finance today.

4 Methodology

In this chapter we discuss the chosen research methodology along with the reasoning behind the decisions regarding strategy, analysis, and limitations. The chapter is structured in the following order; first the research philosophy, type, and empirical strategy is presented to the reader consecutively. The relevant time horizon and sampling strategy are then discussed, along with a short summary of the already presented data collection method. In the final part, the data analysis method and methodological limitations are explained in detail before the results are presented in the following chapter.

4.1 Research design

As the purpose of the study is to establish whether financial media influences human behaviour, and if so to what extent, the research design, philosophy, and approach is explained in detail. The research design section is structured in the following way: in the first half of the section, a presentation of the general research philosophy, ontology, and approach is given. In the second half, the more empirical strategy, structure, and sampling is described.

4.1.1 Research philosophy

Due to the quantitative nature of the data and the underlying theories the research questions are based on, a positivist research philosophy was deemed the best fit for this type of study. According to Bryman and Bell (2011) the doctrine of positivism is the epistemological position that aims to imitate the natural sciences research method to social sciences' reality, requiring the testing of one or multiple hypotheses against a null. Applied to our study, positivism focuses on the *explanation* of investor behaviour in contrast to the opposite position interpretivism, where the focus is on the *understanding* of human behaviour.

However, due to the subjectivity of the media sentiment variable, referring to the fact that it has been subjectively evaluated, this study does have some predisposition towards interpretivism. Since there is simply no approach to confidently assess the sentiment or attitude with which the general public would interpret the financial articles without

seriously widening the scope of the study, we deem it necessary with some flexibility within the positivistic framework. The study could therefore be classified as a mixed methods study, but with strong inclination towards quantitative methodology due to the lack of qualitative data and subsequent qualitative results.

Furthermore, the ontological position deemed most compatible with the scope of the study was objectivism. This position allows for an analysis of social phenomena ´´independent of social actors", implicating that the potential link of a causal relationship between financial media and retail investing behaviour could be generalised for a larger part of the population or as a concept on its own. Nonetheless, recognising the subjectivity, of assessing the discourse within the articles included in the media database, there is also a demand for some constructionist views confined to that particular area. Discourse analysis is in general deemed constructionist and should therefore be recognised as such. (Bryman and Bell, 2011)

To reiterate, in an attempt to cope with this subjectivity, the articles have been assessed independently by both researchers. We argue therefore that objectivism still is the most appropriate position despite the clear subjectivity in one of our smaller data components.

The research approach most compatible with this philosophy was deemed to be of the *deductive* type, with some elements of qualitative reasoning implemented specifically in the media database. Deductive research is synonymous with theory-based research, where the hypothesis is formulated out of prior research and later subjected to various forms of scrutiny (in our case empirical-deductive scrutiny) (Bryman and Bell, 2011). We therefore claim that the deductive approach fits the purpose of this study better than the opposite, *inductive* approach. Inductive research reverses the order of data collection and theory, trying to formulate alternative hypotheses and theories to explain the already collected data (Bryman and Bell, 2011). Due to the lack of qualitative data from the subjects themselves, the naturally occurring quantitative data, and the formulated research questions, this was not regarded as a viable option.

4.1.2 Empirical strategy

The empirical strategy adopted in this study was due to its attributes a *natural experimental study*. A natural experiment uses observational data that allows for partition of subjects

into groups based on non-randomised characteristic to answer certain questions. Because of this natural non-randomisation, the study can also be characterised as a quasi-experimental study, which will be used hereafter. This simply means in our case that the subjects in the two countries are not thought to be completely equivalent, meaning there could be underlying, unobserved differences in characteristics, behaviour, and culture. Any estimated differences between these groups could therefore be caused by pre-existing qualities. (Leatherdale, 2019)

While natural experiments pose threats to the potentially causal link that is being tested, it can yield suggestive or plausible evidence of an intervention effect. In cases like ours when the intervention already has happened, and there is no viable (nor ethical) approach to conduct a similarly structured controlled experiment with proper randomization, natural experiments with strong evidence of an intervention effect is the closest thing one can hope for to establish causality. Quasi-experiments can also be studied on a larger scale and in a more realistic environment than a controlled experiment, enhancing their generalisability and relevance. In a natural experimental study, the Treatment Group (TG) is subjected to a treatment outside of the researcher's control and intervention and compared to a Control Group (CG) that during the same time horizon did not receive the treatment. The result of this comparison is simply observed and analysed.

The time horizon chosen (November 2020 - June 2021) was regarded as a suitable period for the purposes of this study. It includes the months preceding the announcement 'event' on the 14th of January, when speculation was running wild amongst traders. It also includes the stabilisation period after the new shares hit the market, i.e. after May 27th. The cut-off times were decided after reviewing the media discourse both before and after this term, and regarded as less relevant due to off-topic content. During these months there was a focus on previous troubles for NAS, especially the previous stock emission in May 2020, and the future of airlines during and eventually the post Covid-19 era which falls outside of the scope.

As a result of our data collection methods, the sampling in our quantitative data was based on those who had traded NAS during our chosen period. Naturally, one could argue that due to the source of the data this is a non-randomised sample of subjects. However, we argue that specifically because we include everyone who traded NAS that

were on the social media trading platform from which the data was gathered, this is a representative sample for our population of interest, namely Nordic retail investors. We argue that there is no reason to believe that the subjects on this platform would behave differently than any other retail investor on any other platform catered to the same target population. However, some caution should be taken into consideration due to the possibility of differences in behaviour between the individuals that partake in social platforms catered to retail investors, and those who do not.

We nevertheless determined it an unnecessary restriction to lower the sample size based on some other characteristic (e.g. those who traded most frequently, or historical returns), as the purpose was to get a general sense of the behavioural pattern when subjected to the treatment. Although the overall results of our analysis are not restricted to any particular group, the descriptive characteristics of our dataset give us some insight into how different groups of traders behave during the period. The sampling for the media data was also non-discriminatory, meaning we collected every article from the chosen media outlets during our period regardless of length, type, or author. The news-sources were as previously mentioned chosen based on reach and influence.

4.2 Data analysis

4.2.1 Qualitative data

The method used when creating the media database, which included content analysis similar to the process described by Altheide (1996). Altheide describes this process as an *Ethnographic Content Analysis*, where the researcher is in focus in the construction of meaning in texts and documents. This process allows categories and themes to emerge, while keeping the context in which it is being analysed intact (Bryman and Bell, 2011). This is a vital component for our study, seeing as the *sentiment* variable in the media database is built upon the assumption that this is representative of how the common retail investor would interpret the news. By choosing a scale from 1-5 (or -2 to 2 in our case) we argue that we are fairly certain the independently assessed sentiment is interpreted at least close to what the consensus of the broader population is. By choosing a wider or smaller scale we either loose precision in the analysis or increase the risk of

misjudgement in the content analysis due to our own biases. The reason behind evaluating and quantifying the media sentiment is the need of implementing it with the rest of the data, allowing us to use quantitative analysis methods on both the 'qualitative' part and the main, quantitative data.

4.2.2 Quantitative data

The chosen format for the data in the quantitative analysis is panel data. A panel data format allowed us to construct a dataset that includes a time-series dimension for each cross-sectional individual, where trading patterns can then be observed for each individual subject (Wooldridge, 2009) along with the other, more qualitative variables. Being able to group individuals together based on country of origin facilitates the use of a TG (Norway) and a CG (Finland), to examine whether they in aggregate change trading patterns due to differences in media narratives in the respective countries. The daily time-horizon means that we can both analyse to what extent treatment (*sentiment*, *mispricing* etc.) influenced daily trading, and overall impact on the two groups in general.

The panel data was created by combining all of the data collected through the various means explained in the previous chapter in the statistical package R. Matching the customer IDs from both sets led to a small number of customers that lacked a match in the corresponding dataset. The data attrition was in total 935 subjects for Norwegians, down from 6400 to 5465, and 8 for Finnish subjects, down to 2174 from 2182. This puts the final number of individuals included in the analysis to 7639. The data attrition from the two groups was seemingly random. While the Norwegian data suffered more relative data attrition, we were unable to find any obvious reasons for this during our data transformation process.

In R we were able to preserve the individual variance by repeating all dates within our period for each individual customer. By matching the data from the two sets based on customer ID and date we were then able to combine all necessary data for our analysis. By keeping the individual variance in the panel, it allows us to estimate the treatment effect clustered on both individual and country-level.

4.2.3 Difference-in-differences

The main analysis method applied in our study used the *Difference-in-differences* (DiD) method, a common and established statistical analysis method when handling quasi-experimental panel data (Card and Krueger, 2000). The richness and the availability of cross-country data allowed us to use more sophisticated analysis methods (such as DiD), compared to a simple Ordinary Least Squares (OLS), for our main analysis. Given that the causal mechanism is undefined and inconclusive, comparing the changes *across* investor groups instead of *within* improves our ability for establishing a potential causal relationship. Additionally, the absence of control variables in quasi-experimental studies limits the accuracy of an OLS approach in this case.

DiD estimation captures the effects of a change (treatment) on a group of individuals, by comparing it to a CG that continues the pre-treatment trend. This includes both a pre- and post-treatment comparison. The treatment can also be referred to as an exogenous source of variation that can be quantified and measured by an outcome variable that is either affected directly, or indirectly by some predetermined proxy. While the CG does not necessarily have the same starting point graphically speaking, the main criteria is that the development (i.e. the slope) should be parallel to the TG before the treatment began. This group is then used as a proxy for the TG, had it not received the treatment. The treatment effect is calculated by taking the average post-treatment of the outcome variable on the treated group (or individual), compared to the CG given that the pre-treatment trend is continued undisturbed. (Angrist and Pischke, 2009)

Applied to our study, the treatment was the media narrative regarding NAS overpricing and general media sentiment. Norwegian subjects are treated by the continuous coverage of the overpricing in financial media presented in the Data chapter, while the Finnish subjects act as the CG based on the lack of coverage in their media environment. A necessary assumption is therefore that the Norwegian investors are in fact subjected to this treatment, i.e. they follow domestic financial news to some degree. While we are unable to verify whether this assumption holds in reality due to privacy concerns, we argue that being on a social media platform for savings and investments increases their likelihood of following financial news significantly.

In equation 4.1 below, we introduce our generic model for the DiD-analysis. The outcome variable Y_{it} represents some kind of transaction (either absolute or ratio) for individual i in time t. D_t is a dummy variable for the treatment period, D_i the dummy for whether the individual i is in the treatment group, D_{it} is the difference-in-differences variable that captures the effect of the treatment on the treated, and the individual error term ϵ_{it} that captures the residual for individual i in time t. This generic DiD-model can be changed based on the desired clustering level by changing the individual dimension i to country c, as we investigate both individual and country-level results later in the analysis. A linear probability model is used for the model in our analysis to boost interpretability. All reported standard errors are calculated using the White standard error method, to ensure against heteroskedasticity between pre- and post for the same individual or group.

$$Y_{it} = \alpha + \beta_1 \times D_t + \beta_2 \times D_i + \beta_3 \times D_{it} + \epsilon_{it} \tag{4.1}$$

4.2.4 Diff-in-diff assumptions

The DiD method does come with some identifying assumptions. The model is built upon the *parallel trends* assumption, meaning that the TG and CG are assumed to have developed in parallel with regards to the outcome variable absent of treatment. This assumption ensures internal validity, and while it is impossible to statistically test whether the assumption holds, visual analysis on the pre-treatment patterns can ease the sceptic to some degree. Particularly in time-series data with many observations (like in our case), the visual parallel trend can be graphed quite accurately and thereby satisfy the assumption. These visual representations can be found under *Summary statistics* in the Analysis chapter. A violation of this assumption would bias the estimated treatment effect and leave the study ineffective, as the internal validity would be reduced. While the parallel trend can be visually satisfied, we also argue that due to the similarities in culture, economic policies, demographics, and coordinated Covid-19 policies across Finland and Norway the premise of parallel development is a plausible assumption in our case.

Moreover, DiD requires that the allocation of treatment is unrelated to the outcome to produce unbiased estimates. In our study, the allocation of treatment is geographically determined and subjects are therefore assigned to treatment groups based on nationality,

thereby not violating the assumption. The DiD method also implies that the composition of the two groups ought to be balanced and stable throughout the study. While we have a comparatively large number of new investors, we see the same trend in both countries. There is also no reason to believe that the composition on new investors in any of the countries would differ materially.

Spillover effects or diffusion could also complicate the causal inference in the study. While we draw the necessary distinction that no Finnish subject is exposed to any Norwegian financial news, there is the possibility that they follow Norwegian media as well as the domestic media or that they were exposed to the information through other channels. While the language barrier is undeniably higher between Norway and Finland compared to any other Nordic country, there is also a language minority of Swedish-speaking Finns that comprise of approximately 5% of the Finnish population that poses a risk to this assumption, in addition to the general population's other language skills. However, we argue that the probability of a minority of that size having an effect to the extent of distorting the general estimates is quite negligible. The other factor to consider is an indirect, external news source that would be influenced by Norwegian domestic news and reported in English for Finnish investors to read. While this is imaginable, a quick look into the countries' Google trend data clearly favour the idea that Finnish investors generally search financial news (on NAS specifically) in their native language rather than in English or another foreign language. Any potential spillover effects would in our case likely result in lower treatment estimates, as the trend in Finland would partly follow the Norwegian trend due to some Finnish investors getting treated and possibly follow the same pattern as treated Norwegian subjects. It is therefore not likely to be an issue of overestimation, and thus the estimates are considered to be conservative.

Another potential threat is the possibility of reverse causality when it comes to media treatment. Given that the media treatment is assumed to be an exogenous treatment, the possibility of the media profit motives where articles and coverage is *caused* by investor attention challenges this assumption. While in some periods, particularly in the pre-announcement period where reports of excessive trading were relatively frequent and the articles were discussing the unusual speculation that occurred in NAS, there is an argument to be made for trading behaviour *causing* media treatment. However, while the

coverage was *caused* by the shifts in trading patterns in this period, we do not see the same level of attention-driven reporting during the treatment period. While it may be the case that NAS continued to be on the radar for the media companies *because* of the previous attention the stock had gotten and therefore the differences in media between our two countries is large, a look into historical archives shows that NAS were generally a popular topic for financial media.

Moreover, when we analyse the individual-level differences the assumption that Norway is collectively treated changes to individual level treatment. The implied assumption that every single individual investor would have been treated during the period is however unlikely, and the accuracy of the individual estimates should therefore be interpreted with more scrutiny.

Lastly, although unlikely due to the unique characteristics of the case, there is the possibility that the results of the study are driven by a general trend in the data. This would mean that the observed trading behaviour for individual investors in Finland and Norway is no different than in any other large Norwegian company during this period, or that the two investor groups simply behave differently in the market. Both of these scenarios would be problematic with regards to our assumptions discussed above.

4.2.5 Ordinary Least Squares

Our secondary analysis method, OLS, is more focused on the media aspect of the data. OLS is a linear least squares model, which aims to build a regression function to best fit the data in a given dataset to predict a dependent variable given an independent variable (Stock and Watson, 2020). We use this method to better understand the relationship and predictability between our media variables *Articles* and *Sentiment* and transactions, which we cannot do to the same degree with our DiD-analysis.

To be able to get an estimated model that is the Best Linear Unbiased Estimate (BLUE), some necessary assumptions are needed. The assumptions required to have causal inference when utilising OLS are only briefly presented below, as it is a highly popular analysis method within economics and likely already familiar to the informed reader: (1) the residual term has a mean of zero, (2) the variables (X_i,Y_i) given $i = 1,...,n$ are independently and identically distributed, (3) Large observational outliers are unlikely, (4) Uncorrelated

error terms, (5) Homogeneity of variance in the error term. (Stock and Watson, 2020; Wooldridge, 2009)

While many of the concerns of our primary analysis method DiD also carries over to OLS, the main consideration regarding our secondary analysis are the assumptions (1) and (3). Assuming zero conditional mean is unlikely to hold, since several variables are omitted from the regression (and data) that are correlated with our independent variable. This could lead to biased estimates, which affects the accuracy of the coefficients and limits predictability. Furthermore, the prevalence of large transactional outliers in December also poses a risk for assumption (3). These outliers could possibly push the estimates in an upwards direction, but a large part of the media coverage was during this irregular period which makes it an important part of the analysis.

While we recognise these issues, the purpose of the secondary analysis is to give a more of directional, broadly predictive notion of the media response in our two countries and not to establish a causal relationship between our media variables and transactions. We also aim to see to what extent the Finnish trading behaviour can be explained by Norwegian media, to support our use of it as an appropriate control group for our primary analysis.

4.3 Methodological limitations

As in all research, validity and reliability are the cornerstones that needs to be maintained for any convincing inferences to be drawn. Although closely related, the two concepts represent different properties of the measuring instrument. The aim of these concepts is to increase transparency, while ensuring the integrity and quality of the instrument. A measurement can be reliable and invalid, but rarely valid and unreliable.

4.3.1 Reliability

Reliability in research refers to the stability and consistency of the measuring instrument over time, observers, and the measurement itself. A reliable study should be able to be repeated under the same conditions as the original study. As we handle real-world data from actual trades, there is little concern over the reliability of the quantitative data in general. All data collection was consistent, standardised, and easily replicated given access to the main database.

Where there could be reliability concerns is the qualitative assessment of the media narrative. The potential issue could be that given wrongly interpreted articles, any result or inference that is brought forward related to the sentiment cannot be accurately replicated and could cause issues with internal reliability. While the media sentiment variable was indeed highly subjective, predetermined rules were laid out before judging and quantifying the attitude and tone of the article. There were also standardised rules when e.g. articles reported only stock market irregularities, or neutral lists that only mentioned NAS briefly, that ensures the consistent treatment of articles regardless of the researcher's frame of mind. The final argument against any reliability concerns is the overpricing variable, which is a categorical variable that could easily be replicated. We therefore attempt to use these two variables in unison to alleviate any reliability doubts.

4.3.2 Validity

Validity refers to the accuracy of the measuring instrument on the intended concept, and the integrity of the conclusions generated. A valid instrument should produce estimates or results that correspond to real properties of the research phenomenon of interest. There are many different forms of validity in the literature (e.g. *Predictive validity*, *Concurrent validity*, *Construct validity*), and while we hope to have established *face validity* (meaning our measure *apparently* reflects the content of the concept in question) at this point in the thesis, we have yet to discuss the *measurement validity* of the study. (Bryman and Bell, 2011)

According to Bryman and Bell measurement validity is concerned with *"whether or not a measure of a concept really measures that concept"*. They present an illustrative example of the debate surrounding IQ tests, and whether the tests actually measure the person's level of intelligence - questioning the measurement validity of IQ tests in general. With regards to our study, the transaction data is not under any validity scrutiny as they have de facto happened in reality. The issue remains whether the subjects in this study were ever subject to the treatment during the treatment period, or whether the variation picked up by the regression is caused by something else.

Biases in research design can impact both internal and external validity (Cook and Campbell, 1979). Biases in natural experiments are a valid concern, because unlike

randomised control trials or controlled experiments which have effective ways of dealing with biases, natural experiments are more vulnerable. As we have already discussed that the parallel trend assumption must hold for internal validity, there are also additional internal validity challenges to overcome. Confounding, (and especially positive confounding) meaning when the treatment effect is biased away from the null by another unobserved factor, is of particular significance in our case as there are an incalculable number of unobserved factors to consider (Leatherdale, 2019). In our particular study that could be e.g. a change in courtage for either country, leading to changes in trading behaviour that would get picked up by our study and falsely accredited to the treatment. Another possible confounding factor could be the Covid-19 policies during the period, e.g. one of the countries suddenly loosens up the travel restrictions whereas the other remain closed - sparking a lot of attention to airline stocks in general.

To combat the argument for confounding, we study the correlations in table 4.1 below. Here we see the Pearson correlation between the different media variables and the two countries' trading behaviour from the start of November until end of June 2021. The correlations are calculated using the daily data, less weekends. Here we can note that the relationship between e.g. articles in Norway and trading in both countries is moderately positive, while the *Overpricing* in Norway and trading is bordering a strong, positive correlation of around 0.47. The Finnish *Overpricing* variable was omitted as it only happened once during the period.

Table 4.1: Correlation table

Correlations	Articles NOR	Articles FIN	OP NOR	Sentiment NOR	Sentiment FIN	G Trends NOR	G Trends FIN
Trans FIN	0.28	0.17	0.46	-0.37	-0.14	0.39	0.48
Buy FIN	0.33	0.17	0.46	-0.38	-0.16	0.40	0.47
Sale FIN	0.20	0.16	0.44	-0.34	-0.09	0.35	0.48
Trans NOR	0.36	0.16	0.47	-0.28	-0.07	0.45	0.49
Buy NOR	0.41	0.17	0.43	-0.25	-0.07	0.48	0.46
Sale NOR	0.28	0.14	0.50	-0.31	-0.07	0.40	0.50

The media sentiment in Norway also seems to have a stronger correlation with trading overall than the Finnish sentiment. Google trends is moderately positively correlated with trading, which is to be expected. Nevertheless, we clearly see a connection between our chosen variables and supposed treatment and investment behaviour for our subjects, and therefore conclude that there is a definite relationship between the two. We also

investigated possible changes in courtage, Covid-19 policies, and other financial reforms that could potentially bias our results and could not find anything of significance.

Conclusively, while there are various concerns and methodological limitations with the research design and strategy, the reality is that observational data are seldom perfect. Since a randomised control trial in this case is not a viable option for many reasons already mentioned, a quasi-experimental study of this nature is in our opinion the second-best option.

5 Analysis

In this chapter we present the results of our statistical analysis. The chapter is structured as follows: First, we present the summary statistics of the data, along with more relative comparisons of the differences between the two countries. Secondly, the primary results of our study using the difference-in-differences approach is displayed on a country-level, along with a more thorough examination of the media influence on the two countries using a simple OLS regression. Following this section, the individual-level results are presented together with estimations of treatment effects per period. Finally, an exploratory analysis on the within-group differences in response to media treatment is presented to showcase the variance in reaction amongst the different investor groups.

5.1 Summary statistics

Figure 5.1: Media sentiment

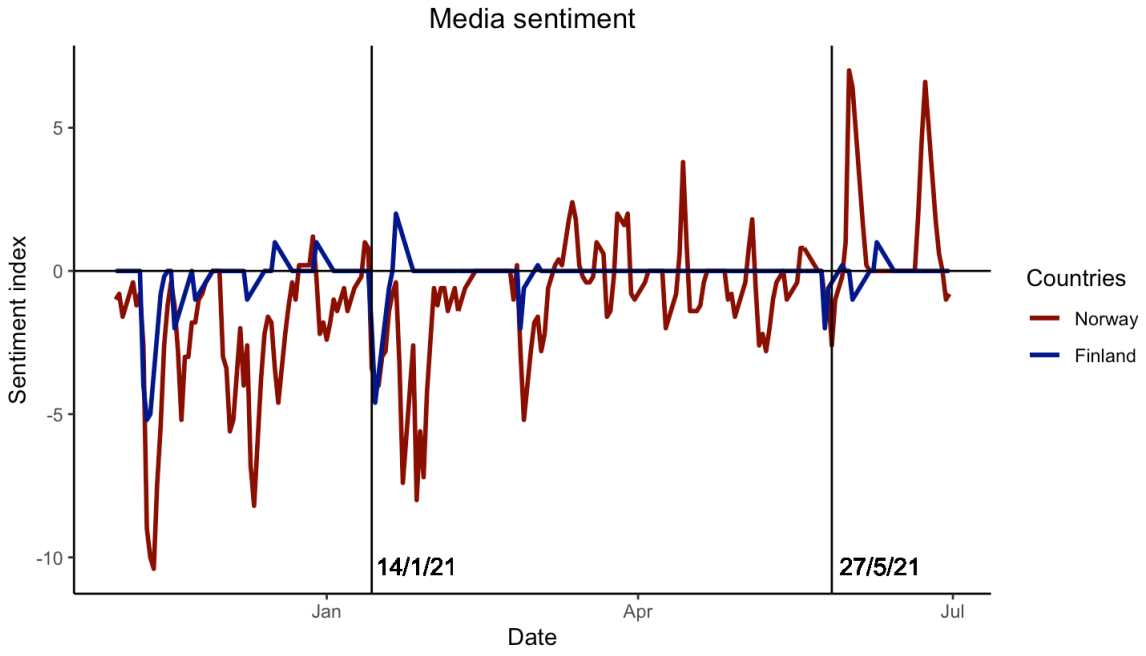


Figure 5.1 above shows the difference in media sentiment between the two countries of interest. Keep in mind that Norway has over six times as many articles on the topic than Finland, and Norway will thereby naturally have a steeper curve when large news stories pierce both markets. However, the striking part of the figure is the continuous Norwegian

media coverage with a negative (or at times positive) sentiment between the two dates that does not seem to penetrate the Finnish news. Looking at the large negative values in January, we already can see the uninterrupted narrative (after the explicit announcement of an emission on the 14th of January) regarding the pricing of the asset.

It is also apparent in the figure that the negativity in media sentiment is slowly reverting back to positive, from being highly negative in November, December, and January. This corresponds quite accurately the progress of the restructuring of NAS, and the decreasing risk of bankruptcy and uncertainty. The distinct moment when the narrative goes from negative to positive also happens immediately after the new shares are released in the market and the view among professionals is that the company is ultimately saved.

At this point we could also speculate that the choice of what is covered in the papers is driven by the interest amongst the population as a direct result of the media corporations' profit motives, and while there seems to be a slight interest in NAS within the Finnish media environment, the lack of coverage during the *within*-period shows that only major events cross the barrier.

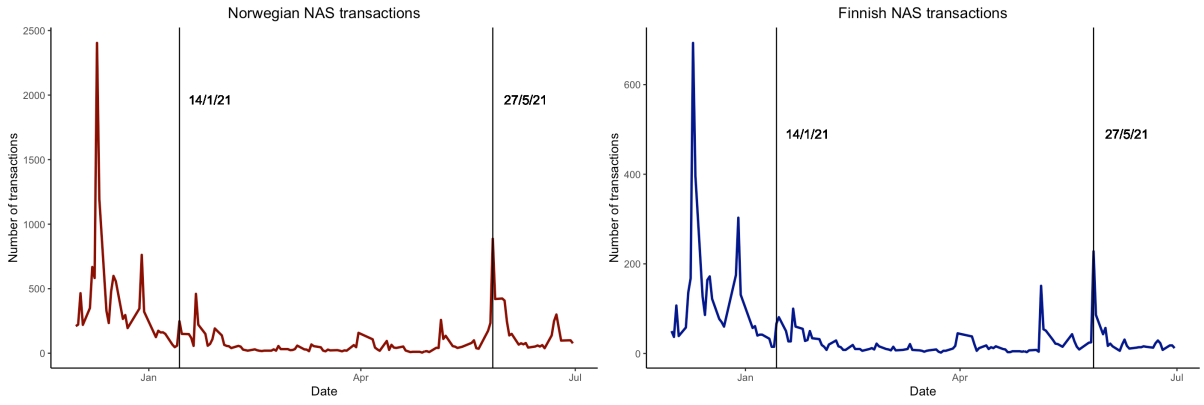
In the table 5.1 below a summary of the total and average media score and the frequency of overpricing is presented. Here we can identify that while both Sweden and Denmark have twice the number of articles that Finland has, the total media score is quite similar. This results in Finland having the lowest average media score, showing that on average every article has a negative media score of -0.36. This could of course be a consequence of a higher news barrier between Norway and Finland compared to the other countries, indirectly causing the articles that do find their way to the Finnish newspapers to be of more importance or higher news 'value' - which during this period correlates heavily with negativity.

Table 5.1: Summary of Mediavariables

Country	Total media score	Avg media score	Overpricing
Norway	-81	-0.32	46
Denmark	-14	-0.14	0
Sweden	-18	-0.22	5
Finland	-14	-0.36	1

The *Overpricing* variable in the table is also interesting, seeing as a vast majority of the discussion regarding overpricing of NAS is only featured in Norway, with only a single mention in Finnish news. Sweden is the only other country that brings up the questionable valuation more than once besides Norway, and although they are the country with the second-most number of articles, the average media score is still substantially lower than in Finland. This is interesting because, as mentioned previously in the methodology chapter, every overpricing article that explicitly discusses the problematic valuation of NAS is automatically coded with a media score of -2. It would suggest that Finland manages to have a highly negative average media score without explicitly mentioning the overpricing, a position none of the other comparable countries manage to do. Another possible explanation is the barrier theory proposed above, where the Finnish media environment is harder to penetrate and stories therefore requires more significance.

Figure 5.2: Trade volume among retail investors in Finland and Norway



(a) Norwegian trade volume

(b) Finnish trade volume

Figure 5.2 shows how volume among Norwegian and Finnish retail investors develop throughout our period. Both countries' volumes follow closely the same pattern, but the absolute number of transactions differ by a substantial margin. We also see the substantial drop in traded volume during the *within*-period between the two key dates, where the daily volume is merely a fraction of what it was during the peak. It is worth noting however that the months preceding the announcement date the volume was abnormally high and therefore an anomaly.

Figure 5.3: Histogram over trade frequency

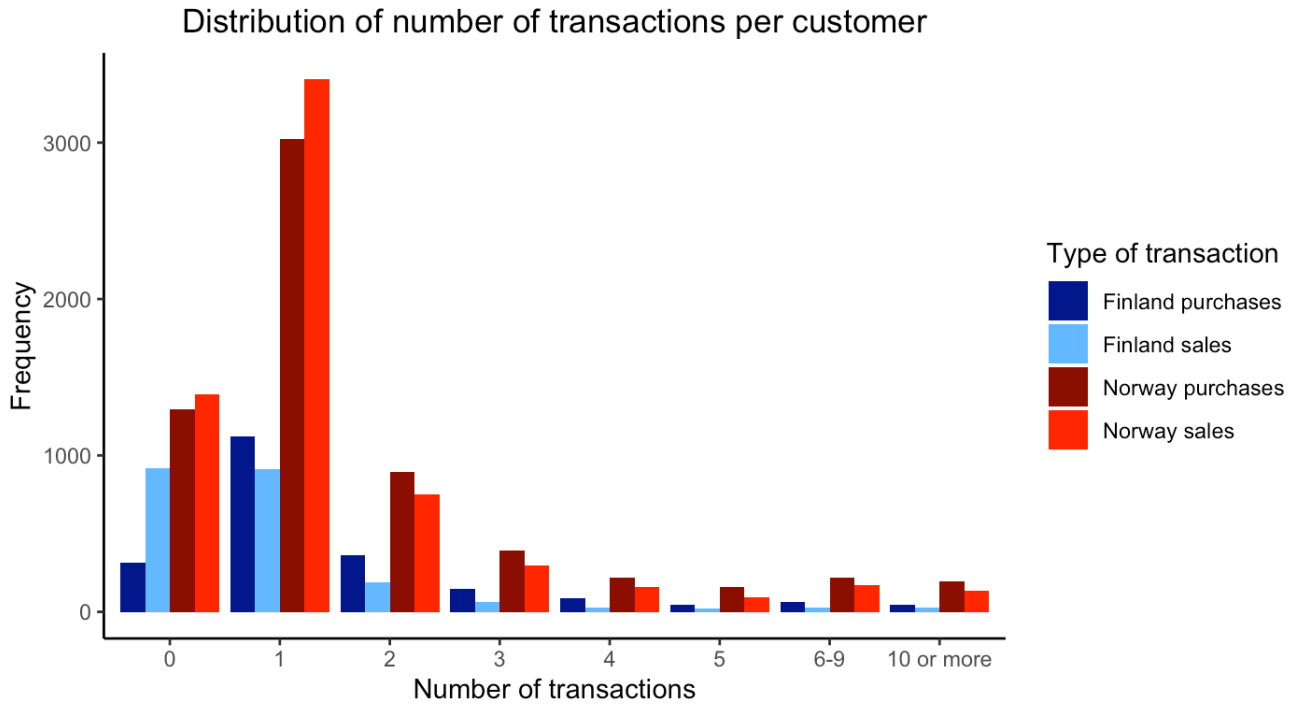


Figure 5.3 shows how frequent the retail investors in our dataset have traded the NAS stock from the start of November 2020 until the end of June 2021. As we can deduce from the figure, the majority of investors have not traded NAS actively during the period. The overall shape of the figure is comparable to a chi square distribution, as both countries' mean is one transaction in both directions that tapers off quickly. This implies that most of the estimates based on this individual data would be driven by those who trade once or twice during the period.

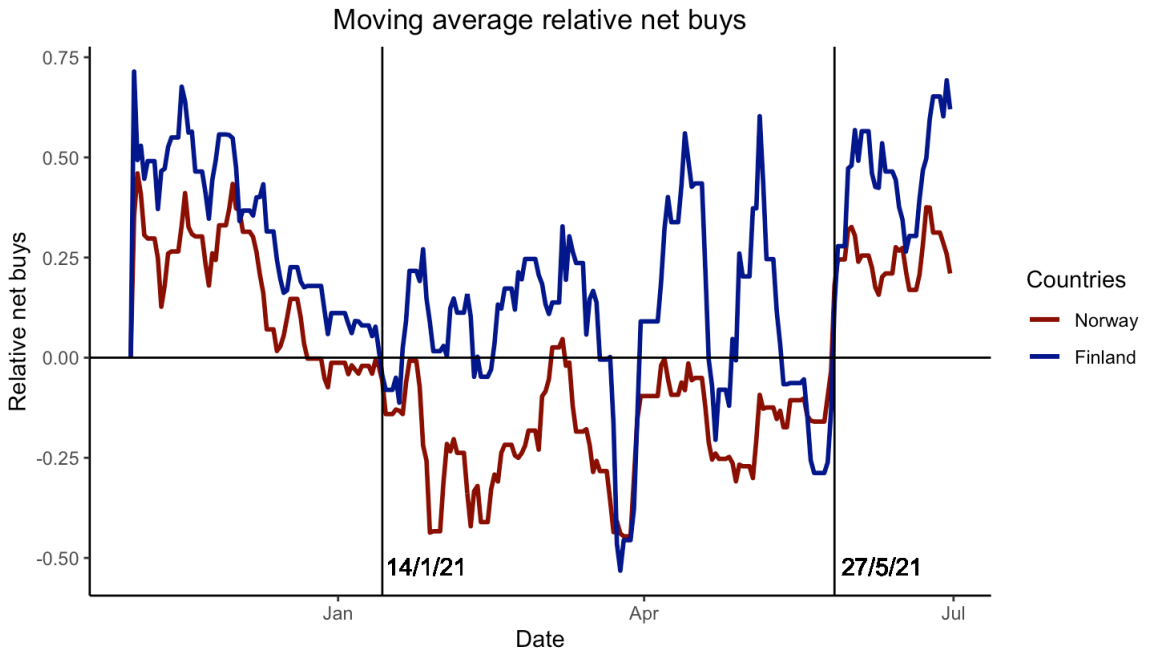
Another observation we can note in the table is that the purchases and sales seem to be relatively balanced for both countries, with the anomaly of Finnish subjects having considerably lower null-purchases than null-sales. This however is to be expected, as we saw many new Finnish investors open up accounts during this particular period making it impossible for them to be in the 0-purchase bar.

5.1.1 Relative comparisons

Since the absolute numbers of our two countries of interest differ, it is worth looking at the relative numbers for proper comparison. The *relative net buys*, presented extensively

in this section, is calculated by dividing the *Net buys* by the *Total Volume of Trades* that day. This way we get a sense of proportion in which direction both countries traded on any given day.

Figure 5.4: Net relative purchases



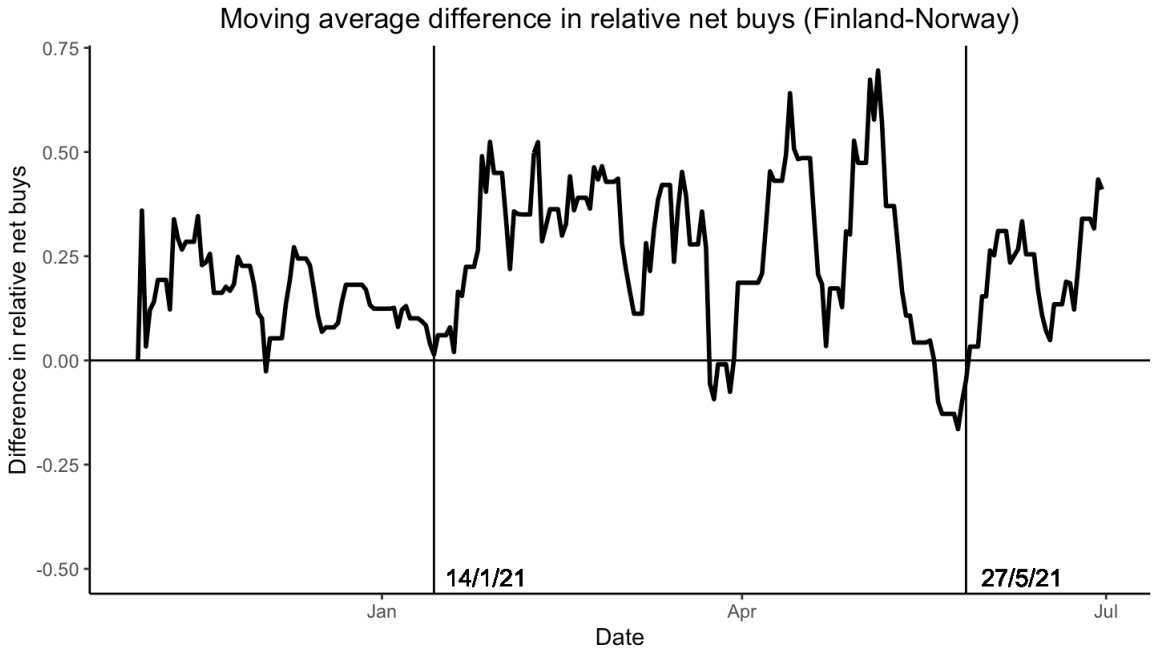
From the figure 5.4 above we can see that Finnish investors on average are relative net buyers throughout the period, with only a few exceptions. A clear correlation can visually be seen before the announcement date, where Norwegian and Finnish trade almost in unison, strengthening the argument for parallel trends during the pre-treatment period. The correlation before the January 14th is calculated to be 0.73, whereas the correlation in the *within*-period is 0.39.

We also see a shift in the Norwegian pattern during our period of interest (between 14.01.2021 - 27.05.2021). During this period Norwegian subjects are net relative sellers whilst Finnish investors generally are above the line, with a few exceptions. It is worth mentioning however, that the number of trades for Finnish investors is substantially lower during the period between the lines, meaning the shifts in direction will be disproportionately sharper compared to the Norwegian numbers.

To better emphasise the differences between the countries, we take the absolute difference between the moving average for the two countries. The figure 5.5 depicts this below. In

this figure we see clearly the difference between the two countries, and the apparent shift in behaviour before and after the highlighted dates. The figure takes the value for Finland less the corresponding value for Norway for each date, highlighting the days where they are on opposite sides, and depressing the days where they are trading in the same direction.

Figure 5.5: Difference in net relative purchases



Although we see variation in the difference of relative net buys within the period, on average it lies above both the pre-treatment and post-treatment levels. We also see a comparatively stable first half between 14.01 and 27.05, with a lot more fluctuation during the second half.

To further investigate the relative differences between the two countries, we look at the historical moving average during a longer time period (2019 - 2021) in figure 5.6.

Figure 5.6: Historical Net relative purchases

From figure 5.6 we observe that the difference in relative net buys increases during the period after the announcement of the emission. We see an average difference in relative net buys of 0.13 in the two years preceding the event date, to 0.29 during, before it is reduced to 0.25 after the new NAS shares are released in the market.

The outlier surrounding the end of 2019 is striking, but likely caused by a combination of Finnish trading volume as low as 1-2 trades per day, and the launching of the Equity Savings Account on 1.1.2020 in Finland. This made trading in foreign markets a lot more accessible (and profitable), and the increase in NAS trade volume can easily be identified in the data. For these reasons the fluctuations before the second half of 2020 should not be interpreted with the same preciseness as the second half of the figure. An overall influx of new traders also contributes to the significant difference in relative net buys between Finland and Norway historically, as only previously held position can be sold while a small amount of new traders in Finland will force the relative numbers upwards.

Table 5.2: Descriptive statistics for daily levels and changes in transactions per country

	Means with standard deviations in parentheses:					
	Norway			**Finland**		
	Before	**After**	**Change**	**Before**	**After**	**Change**
Purchases	293.89	35.09	-258.80	73.64	9.95	-63.70
	(314.04)	(48.25)		(85.31)	(10.34)	
Sales	246.14	40.18	-205.96	50.50	7.80	-42.70
	(291.46)	(40.99)		(56.42)	(9.15)	
Sales ratio	0.46	0.56	0.10	0.42	0.44	0.03
	(0.09)	(0.11)		(0.10)	(0.20)	

Note: before period includes 1.12.2020 - 13.1.2021, the after period 14.1.2021 - 4.5.2021.

Table 5.2 presents data from December 1, 2020 until May 4, 2021, where January 14 is the day of the first treatment. The table shows that transaction volume among retail investors decreases considerably in both Finland and Norway in the period after NAS announces their emission. It is worth mentioning that the volume of the NAS stock in general was very high in December, as one can see in figure 2.2 on page 8. The sales ratio increases more in Norway than in Finland, making Norwegians net sellers during the period while the Finnish retail investors remain net buyers, although to a smaller extent than before January 14. May 4 was decided to be the cut-off for treatment, as it is the final day to claim NAS subscription rights in the following stock emission. After this date the price of the stock should no longer be affected by the emission. However, there was a lot of speculation in the subscription rights after the deadline which affected the stock price and caused a lot of noise. Therefore, the media effect we are looking for drowns in the noisy trading in the subsequent period after the subscription rights were released on the market, and was thus not included in the analysis.

5.2 Statistical analysis

The main statistical analysis in this study is conducted on two levels: country-level and individual level. Dividing the analysis this way allows for deeper insight into the overall effects of the treatment, complimenting the difference in treatment effects on a larger country-wide scale with the variance of individual decision-making. Furthermore, to gain

a more extensive insight into group level differences in treatment effects within the treated group we conduct an additional exploratory analysis.

5.2.1 Difference-in-differences on country-level

The DiD analysis on country-level is calculated by adjusting the generic formula in 4.1 on page 38. The modified regression is presented in equation 5.1. Subscript i refers to the two countries Finland and Norway, t the period 1.12.2020 - 4.5.2021, *Dummytime* the treatment period 14.1.2021 - 4.5.2021, and the binary variable *Treatmentgroup* where 1 is Norwegian.

$$\begin{aligned} Sales\,ratio_{it} = Constant + \beta_1 \times Dummytime_t + \beta_2 \times Treatmentgroup_i \\ +\beta_3 \times (Dummytime_t \times Treatmentgroup_i) + \epsilon_{it} \end{aligned} \tag{5.1}$$

The sales ratio formula can be found below in equation 5.2 and refers to the percentage of sales over total transactions.

$$Sales\,ratio_{it} = \frac{Number\,of\,sales_{it}}{Number\,of\,transactions_{it}} \tag{5.2}$$

The results of the difference-in-difference regression is presented in table 5.3. The analysis shows the estimated effect on aggregated retail trades at a country-level in Finland and Norway. The period consists of 103 days in total, times the two countries which leaves us with 206 observations. From this table we can derive how the sales ratio of the NAS stock is affected by the media treatment in Norway during the period of overpricing. We see in the *treatmentgroup* variable that Norwegian investors have a slightly higher Sales ratio than Finnish investors overall, and from the *dummytime* variable that on average the *Sales ratio* is higher within the treatment period than in the pre-treatment period, however statistically insignificant. From the constant we can also derive that on average the sales ratio for the two countries combined lie below the 0.5 line - putting them in the net purchase category.

The coefficient of the interaction term between treatment group and the time of the overpricing on the other hand is both positive and statistically significant at the 1% level. This variable captures the difference between the constant, comparable trend in Finland

against the development in Norway given treatment during the period. This would suggest a link between negative media coverage on overpricing and the sales ratio of NAS.

Table 5.3: Difference-in-difference analysis on country-level.

	Dependent variable:
	Sales ratio
treatmentgroup	0.062**
	t = 2.419
dummytime	0.025
	t = 0.845
treatmentgroup:dummytime	0.102***
	t = 2.793
Constant	0.416***
	t = 21.783
Observations	206
R^2	0.228
Adjusted R^2	0.217
Note: Reported estimates are absolute ratio changes	*p<0.1; **p<0.05; ***p<0.01

Due to the significant interaction variable in our main diff-in-diff analysis, we can reject our null-hypothesis that financial media coverage has no influence on retail investing behaviour. Our first main result can therefore be summarised as follows:

Results 1. Financial media coverage with a negative sentiment could in aggregate possibly have a directional impact on investor behaviour. Our model estimates that in the case of NAS, the media treatment effect on Sales ratio is approximately 10 percentage points.

These results are contingent on the assumptions presented in the Methodology chapter being met. While we showed that the parallel trend assumption held visually during the pre-treatment period, there is no way of guaranteeing that the two countries would have developed and behaved uniformly. Moreover, as with any quasi-experimental study the possibility of an exogenous, uncontrolled factor driving the results still remain. The results may also be driven partly by the periodically low volume in Finland, leading to

some transactions done on low-volume days having more weight in the analysis. With lower volume, every purchase or sale counts for disproportionately more and could lead to days where we only have one type of transaction making the *Sales ratio* either 0 or 1.

5.2.2 Country-level response to media treatment

To showcase the difference in trading behaviour in the two countries with regards to the Norwegian media environment, we create separate OLS regressions for the dependent variables *Net buys* and *Transactions* on the independent variables Norwegian sentiment and articles in both countries. In table 5.4 below we see the clear differences in estimates on both dependent variables. Finland should in this case, according to our assumptions, not necessarily follow the Norwegian sentiment nor react as strongly to Norwegian media articles. Similar to placebo groups in clinical trials, we are interested in the differences in estimates for the dependent variables where Finland is the baseline.

Table 5.4: Intersectional comparison of OLS regressions

	Dependent variable:			
	Net buys		Transactions	
	(NOR)	(FIN)	(NOR)	(FIN)
Sentiment	−1.192	−4.429**		
	t = −0.475	t = −2.244		
Articles			82.930***	21.213***
			t = 3.066	t = 2.728
Constant	−0.544	3.227**	53.201***	21.461***
	t = −0.207	t = 2.023	t = 2.981	t = 3.623
Observations	104	104	104	104
R^2	0.004	0.173	0.130	0.093
Adjusted R^2	−0.006	0.164	0.121	0.084
Note:				*p<0.1; **p<0.05; ***p<0.01

Finnish investors seem to trade largely against media sentiment, and has a significantly positive constant. Norwegian investors do not seem significantly influenced, at least not directionally, by sentiment in financial media. The R-square is also substantially higher for Finland compared to Norway, suggesting lower individual variance within. The

higher R-square of Sentiment on *Net buys* is likely a result of lower transaction volume in Finland and therefore does not necessarily reflect the predictability of the Finnish trading behaviour even though the estimate more accurately captures the variance.

From the *Transactions* columns we can see that the effect of articles on transactions seems to suggest a difference in attention shown by the two investor groups, where both estimates are significant at $p < 0.01$. The large discrepancy in estimates between the countries is however likely partly due to the differences in transaction volume. To get a more accurate reflection of the impact, we calculate the relative effect of articles on transactions, when articles are increasing from 0 to 1 over the constant. This value arrives at 1.9 for Finland, compared to the 2.6 of Norway.

Combining the general results of our response to media treatment, we summarise it as follows:

Result 2. Finnish investors seem to trade against the Norwegian media sentiment to a larger degree than Norwegian investors, supporting our main assumptions regarding separation of treatment and control group and treatment spillover. The results also suggest an uptick in transaction volume with media coverage, which is in line with previous research on attention.

Although the results are mostly in line with previous research, there are methodological limitations to consider. Firstly, there are several omitted variables that are not considered in these simple OLS regressions: e.g. differences in stock market returns in the two countries, the performance of domestic competition to NAS, or differences in financial climate. Secondly, the large transaction outliers in December are the sole cause for some of the articles and sentiment in the data, which poses a reverse causality risk. This could possibly make our estimates non-indicative of the whole period. Nevertheless, this reverse causality does not necessarily carry over to the Finnish population as we assume they are not subjected to Norwegian media to the same extent.

Continuing on the media response within the countries, in table 5.5 below we see a aggregated t-statistic table with results from repeated event studies. The values are calculated by taking the standard deviation of net purchases for a period including an

event day, five days prior, and the five days following, for every day between December 1, 2020 and May 4, 2021. The t-statistic *(T)* is calculated by dividing net purchases on day t by the standard deviation of the 10-day period. The general formula for these calculations can be found in equation 5.3 below.

$$T_t = \frac{Net\ purchase_t}{St.\ dev_{[t-5,t+5]}} \tag{5.3}$$

To give a more nuanced analysis we also calculated the mean t-statistic dependent on certain criteria, here *Article days* meaning days where the respective countries published articles mentioning NAS, *Neg. Sent. days* meaning days where the *Sentiment* variable is negative, and *Overpricing days* when *Overpricing* is mentioned in any of the two countries. The purpose of this analysis is to showcase to what extent the two countries either change the direction of trading in the before and after period within themselves, or whether there are significant differences in the changes between the countries.

Table 5.5: Aggregated event study

Means with standard deviations in parentheses:

	Norway			**Finland**		
	Before	**After**	**Change**	**Before**	**After**	**Change**
Average t-statistic	0.43	-0.61	-1.04	0.69	0.42	-0.27
	(1.05)	(0.96)		(0.94)	(1.01)	
t-statistic Article days	0.43	-0.63	-1.06	1.47	0.22	-1.26
	(1.03)	(1.06)		(0.54)	(0.97)	
t-statistic Neg. Sent. days	0.42	-0.49	-0.91	2.22	-0.43	-2.65
	(1.03)	(1.00)		(1.30)	(0.48)	
t-statistic Overpricing days	0.70	-0.11	-0.81	1.26	0.68	-0.58
	(1.08)	(0.90)		(1.03)	(0.99)	

Note: before period includes 1.12.2020 - 13.1.2021, the after period 14.1.2021 - 4.5.2021.

From the values we see that Finnish investors are generally above the Norwegians, implying they were net buyers on most days during our period. This is also true for when the t-statistic is dependent on the days NAS is mentioned in the news. Finnish investors were on average statistically significant net buyers in the pre-period on the days with negative sentiment as seen in table 5.5 above. However, the value for *Neg. Sent. days* for Finland is based solely upon the record-breaking anomaly period of 9-11.12, meaning the value should not be interpreted with any statistical accuracy nor an indication of general

trading behaviour in the before period. We should also note the high standard deviations (within the parentheses) indicating that the variance in the individual t-statistics is also quite high. It is also noteworthy, although expected, that the average t-statistics for net purchases decrease in the post-period. This reflects previous results seen in other parts of the analysis, where we see both lower transaction volume and higher sales ratio.

5.2.3 Difference-in-difference on individual level

In this analysis we change the subscript i from countries to individuals in formula 5.1 on page 38. We also change the outcome variable from Sales Ratio to the outcome variables *Purchase* and *Sale* to look at the absolute individual changes from the treatment. Both *Purchase* and *Sale* are dummy variables, and thus the coefficient should be interpreted accordingly. The estimates are unlike standard DiD analyses read like the change in daily probabilities due to treatment on the outcome variable.

Table 5.6 indicates as mentioned the effect the treatment has on the treated investors on an individual level. The interaction term between *treatmentgroup* and *dummytime* suggest that Norwegians do not have any significant deviation in their purchasing behaviour during the post period. However, the results also suggest that Norwegian individuals are reducing their number of sales by a coefficient of 0.005 compared to the Finnish subjects. In contrast to the purchasing behaviour, this interaction term is also significant at the 1% level.

According to the regression table solely being in the treatment group (i.e. Norwegians) has no effect on purchases, but a positive effect on sales. *Dummytime* is highly statistically significant and negative, which suggests that trading decreased during our treatment period among retail investors both in Finland and Norway. This reduction in volume is also clearly visible in the stock price and volume figure presented in 2.2 on page 8. Total observations included in the regression is 793 997. The reason it does not completely add up (taking the 103 days times the 7639 subjects equals 786 817) is due to some subjects placing multiple trades during the same day, pushing the number of observations up.

Columns (1) and (2) include all investors that have traded the NAS stock in our period, while (3) and (4) include investors with more than 3 trades. We decided to conduct additional analyses constrained to more active investors to observe whether these investors

Table 5.6: Difference-in-difference analysis on individual level

	Dependent variable:			
	Purchase	Sale	Purchase	Sale
	(1)	(2)	(3)	(4)
treatmentgroup	−0.0005	0.006***	−0.004	0.005**
	t = −0.551	t = 8.890	t = −1.455	t = 1.975
dummytime	−0.028***	−0.019***	−0.093***	−0.071***
	t = −38.636	t = −30.980	t = −33.503	t = −28.891
treatmentgroup:dummytime	−0.0003	−0.005***	0.001	−0.006**
	t = −0.315	t = −6.955	t = 0.329	t = −2.055
Constant	0.033***	0.023***	0.106***	0.080***
	t = 46.122	t = 37.996	t = 39.342	t = 33.823
Observations	793,997	793,997	184,649	184,649
R^2	0.014	0.010	0.049	0.038
Adjusted R^2	0.014	0.010	0.048	0.038
Note: (3) and (4) ≥3 trades				*p<0.1; **p<0.05; ***p<0.01

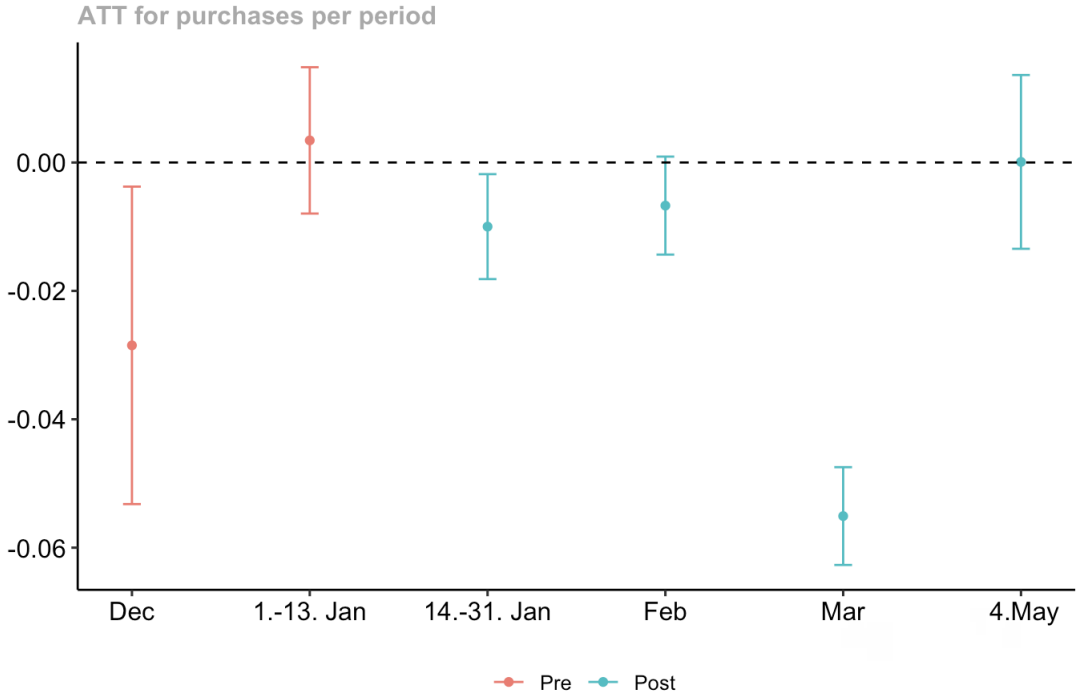
were influenced differently by the media treatment, which does not seem to be the case. The main difference here being that the coefficients for *dummytime* decrease in both regressions, which is sensible given the general decrease in volume during our period, as seen in figure 2.2 on page 8. One should also notice that the interaction term between *treatmentgroup* and *dummytime* becomes positive for *Purchase*, although it is still statistically insignificant.

However, individual treatment is not as convincing as country-level treatment in our case, as it assumes every single individual receives treatment during the period which is likely not to be the case. These results are therefore most likely biased downwards and potentially even misleading. Many trades were also made in the month preceding the treatment, leading to the analysis reporting that those individuals technically did not respond to any treatment as they lack transactions in the after period. In our case the higher trade volume in Norway also forces the shift in trade direction to be significantly larger in terms of absolute numbers relative to the Finnish shift for any investor. Therefore, due to the noisiness of the data, the imbalance in ownership before the relevant period for the Finnish subjects, and the uncertainty surrounding individual treatment, the individual-level regression results possibly do not accurately reflect the general media treatment effects.

Nevertheless, the individual analysis can still yield valuable insights in how the treatment effects evolves within the period. Figures 5.7 and 5.8 on the following pages show how our columns (1) and (2) from regression table 5.6 above evolves from before the treatment period up until the deadline for owning stocks to receive subscription rights. This analysis is done to better understand how Norwegian and Finnish trading behaviour evolve throughout the period, in addition to examining the period as a whole. The figures show at the Average Treatment effect on the Treated (ATT) on a nearly monthly basis, with shorter periods surrounding the start of treatment.

The implications from figure 5.7 is that purchases decrease slightly after the treatment starts in mid-January, although the ATT reverts back to 0 in February. The figure does however show a large negative effect on purchases in Norway compared to Finland in March. In April and during the start of May purchases in Finland and Norway do not deviate significantly. It is also worth pointing out that Norwegians purchase less in December before the treatment begins. Note also that the confidence intervals in periods with more speculation (such as December and May), indicating more variance in the direction subjects have traded.

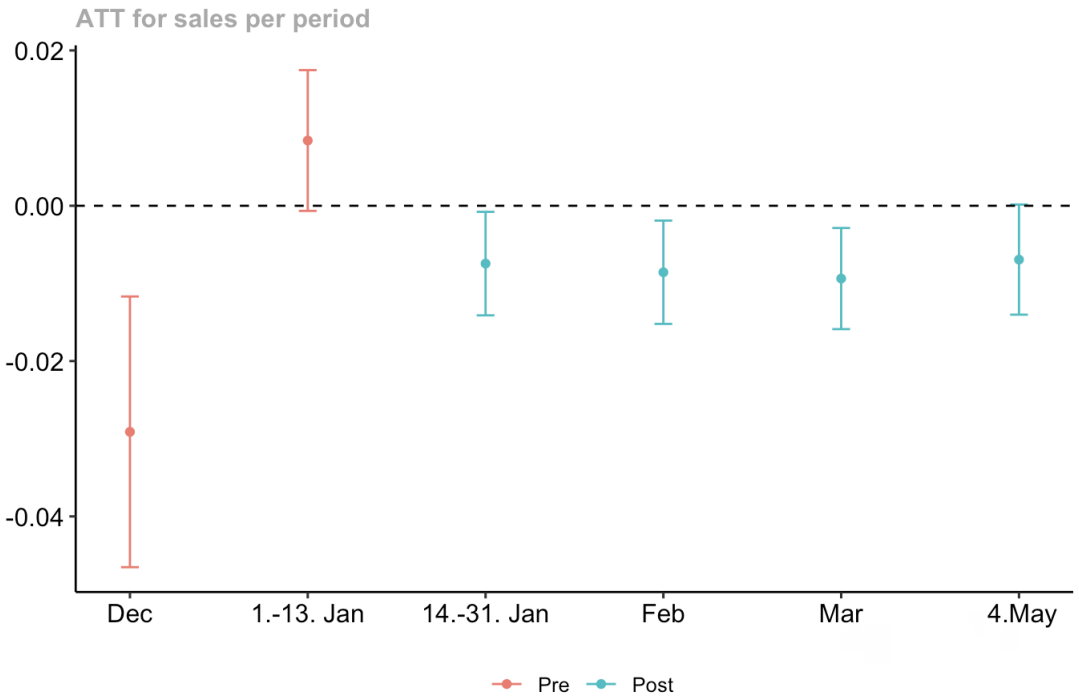
Figure 5.7: Average treatment effect on purchases for the treated per period



Note: December, February, and March refer to the whole months. The final period is the month of April and ends on May 4.

Looking at figure 5.8 depicting the ATT on sales below, we see that Norwegian retail investors' amount of sales generally decrease every period after NAS announce the emission relative to Finnish investors. The Norwegians sell more in January prior to the announcement, although the ATT is not significantly different from 0. The overall sales pattern in the figure is quite similar to the purchasing pattern in 5.7 above, indicating that there are no large differences in individual behaviour for buying or selling NAS. The only large disparity between the two figures is the month of March, where sales follow the same decreasing trend as the other months but purchases suddenly deviate from the pattern. The reasons for this discrepancy are unknown to us, but likely to be caused by the combination of low transaction volume in Finland during this period, and an average relative net ratio close to 0.

Figure 5.8: Average treatment effect on sales for the treated per period



Note: December, February, and March refer to the whole months. The final period is the month of April and ends on May 4.

In the analysis on the individual level, we summarise the results as follows:

Results 3. There seems to be no significant effect of financial media coverage regarding overpricing on an individual level. On the contrary, although the coefficient is small, treated individuals seem to lower their sales probability compared to the control

during treatment. We also see no difference in individual treatment effect on individuals with higher transaction volume. A periodic look into the average treatment effect on the treated on sales and purchases shows a slight descending pattern, although mostly statistically insignificant to one another.

5.2.4 Exploratory analysis

To further analyse how the media coverage of NAS affects different investor groups in Norway we conduct additional exploratory analyses specifically targeting the media aspect of our data, and how treatment effect varies within the group. We execute this analysis by splitting the Norwegian NAS investors into three different groups based on their average portfolio rating, before utilising a simple OLS-regression. Because of the noise in both trading and media during the month of November the period analysed in this section is also limited to 1.12.2020 - 4.5.2021.

Group 1, 2 and 3 consist of people with average portfolio ratings below 1, between 1 and 2, and above 2 respectively. The rating assigned to each individual is as previously mentioned based upon the Sharpe ratio of each portfolio, where 1 equals a positive return, 2 equals higher than the median portfolio Sharpe ratio, and 3 a Sharpe ratio in the 90th percentile.

The summary statistics presented in table 5.7 show the differences among the rating-based groups. Group 1 and 2 trade more both relatively and in absolute numbers than group 3, while group 3 generally decrease their NAS holdings during the period, unlike group 1 and 2 who are net buyers.

Table 5.7: Summary statistics over rating-based groups

Group	**1**	**2**	**3**
Transactions	3919	7080	2360
Sum net buys	129	72	-78
Number of investors	1195	3020	1250
Transactions per investor	3.28	2.34	1.89

Equation 5.4 illustrates the regression formula used in table 5.8, where Y_{gt} is the dependent

variable net buys in time t for group g , α_g the intercept, X_t the media sentiment variable in time t, and $\epsilon_{g,t}$ the error term

$$Y_{g,t} = \alpha_g + \beta_1 X_t + \epsilon_{g,t} \tag{5.4}$$

Table 5.8 presents the OLS regressions on the different groups from December 1, 2020 until May 5, 2021. Although none of the coefficients are statistically significant, we find several interesting results in the table. It seems as if group 1 generally increase their holdings in NAS when the media sentiment is negative, and decrease their holdings when it is positive, while group 3's trading pattern seems to reflect the media sentiment more accurately. On the other hand, the small t-value indicates that media sentiment does not seem to have a significant effect, especially for group 2. In the *Tot.Net Buy* column, the subscript g is dropped from the formula 5.4 above and the estimate therefore includes all Norwegians during the same period as before. Based on the contrasting estimates between grouped and total net buys it seems like the individual variation is quite large within the groups, producing a lower estimate for the total population than any of the segregated group estimates.

Table 5.8: OLS regression on net buys for rating-based groups

	Dependent variable:			
	Grouped Net buy			Tot. Net buy
	(1)	(2)	(3)	(4)
Sentiment	−1.040	−0.705	1.142	−1.192
	t = −1.645	t = −0.481	t = 1.346	t = −0.475
Constant	0.008	−0.143	0.603	−0.544
	t = 0.011	t = −0.100	t = 0.815	t = −0.207
Observations	104	104	104	104
R^2	0.052	0.005	0.065	0.004
Adjusted R^2	0.043	−0.005	0.055	−0.006
Note:				*p<0.1; **p<0.05; ***p<0.01

Switching out the variables in equation 5.4 gives us the possibility to study the relationship between the number of articles and the number of transactions across the different rating-

based groups. In table 5.9 below, Y_{gt} represents the number of transactions, while X_t represent the number of articles mentioning NAS in Norway.

The results from table 5.9 show that the number of articles seems to have a relatively strong relationship with transaction volume, as all of our estimates are significant at the 1% level. For across-group comparisons we calculate the effect relative to the constant, due to the differences in size. This gives us a relative effect of how much the different group increase their trading when an article is published about NAS. The results suggest that group 1 and 2 almost triple their number of transactions when the article count in Norway increases from 0 to 1, while group 3 *only* doubles the number of transactions in the same scenario (the relative numbers being 2.8, 2.7, and 2.0 respectively). The *Tot. Transactions* column also suggests that on average, there seems to be a strong connection between articles discussing NAS in financial news and the number of transactions taken.

Table 5.9: OLS regression on transactions for rating-based groups

	Dependent variable:			
	Grouped transactions			Tot.Transactions
	(1)	(2)	(3)	(4)
Articles	21.314***	37.545***	10.090***	82.930***
	t = 2.900	t = 3.190	t = 3.120	t = 3.066
Constant	11.655**	22.229***	10.371***	53.201***
	t = 2.371	t = 2.847	t = 4.137	t = 2.981
Observations	104	104	104	104
R^2	0.114	0.143	0.122	0.130
Adjusted R^2	0.105	0.134	0.114	0.121
Note:				*p<0.1; **p<0.05; ***p<0.01

The results also show that the constant in group 1 and 3 are quite similar, although their reaction to the number of articles published vary. Group 2 has the largest constant by a large margin, which is possibly due to it being a significantly larger investor group than the two others (as the average transaction per person within the groups did show a descending pattern based on rating in table 5.7).

6 Discussion

6.1 Country-level results

Looking at the DiD-coefficient in table 5.3 on page 54, we see a significant positive impact of media treatment and sales ratio. This would suggest that the prevalence and discussion around the pricing of NAS does have an effect on trading behaviour, i.e. Norwegian retail investors sell the NAS stock to a larger extent than the Finnish retail investors due to there being a discourse questioning its valuation. In our specific study, this estimate is equal to a 10 percentage point change in sales ratio, which in our case gives us a shift from being a net buyer to a net seller.

As discussed in the literature financial media has historically had an impact on investments, especially in evoking buying behaviour. Given the insignificant coefficient in table 5.4, the negative media sentiment in the news does not seem to have directional influence on trading. A natural premise would be that more attention to a stock draws more buyers than sellers due to there being substantially more potential buyers than potential sellers. This is however not the case with NAS during this period according to our diff-in-diff analysis, which suggests that the media coverage does increase the sales ratio and thereby contradicting the theory of attention-given asset appeal. While one could speculate whether the same change in sales ratio would have happened had NAS not gotten the same amount of attention in the domestic media, there seems to be a clear distinction that purely or mostly negative media attention and criticism could have a persuasive effect on retail investment compared to neutral or positive coverage. While this is still plausible, one also ought to remember that the *Sales ratio* is calculated using sales *actions* and not share numbers. Given the scenario presented earlier in the paper, where investors buy in small increments but sell larger portions, the estimates in our analysis would be the lower limit of a treatment effect.

Moreover, the prevalence of a documented overpricing is also important to consider. While financial media can have simultaneously scattered or even contradicting opinions on assets, the narratives during our period were exceptionally analogous. Whereas in our case the media outlets were mostly unanimous in their denunciation of the NAS valuation, other

cases will presumably not have the same preconditions for studying a media treatment effect.

Furthermore, looking at the comparison table 5.4 the results would suggest that articles in Norwegian media does not have the same effect on Finnish transactions as it does in Norway. These estimates can arguably be interpreted as displaying signs of the aforementioned information barrier discussed in the Methodology chapter. In a perfect information environment there would be no significant differences in trading behaviour between the two countries given the same circumstances (disregarding any cultural, financial literacy, or other exogenous factors influencing trading behaviour). Naturally these results are the fallout of many other unobserved factors, but the implications could strengthen the validity of our assumptions drawn in the primary analysis.

Conclusively, we saw in the aggregated event study that Finnish traders generally were more likely to be net purchasers compared to Norwegians, further consolidating the conclusions from our country-level DiD analysis. Here we see that while both countries generally had positive average t-statistics for the before period, the Norwegian values turned negative while the Finnish values mostly remained positive, although lower.

6.2 Individual level results

Looking at the regression table 5.6 on page 59, we see that the results from the individual level analysis in table seems to contradict the results from the country-level analysis. Here the coefficient is negative for sales, meaning that individuals subjected to treatment seemingly lowers their sales volume relative to the control group – the opposite of what we see on a country-level analysis. While the effect is negligible, the direction is still counter-intuitive and in contradiction with the group-level results.

However, this individual level analysis has several inadequacies that needs to be taken into consideration. First and foremost, the individual data is quite noisy. According to the frequency table 5.3 presented in page 48, close to one third of treated individuals only has one transaction in total. The Finnish control group also shows that approximately half of its subjects traded only once. Naturally, this has a larger impact on the individual analysis than on a wider, country-level scale. In contrast to the country-level analysis, we look at the absolute change on individual trades instead of changes in ratios. As a large

portion of the control and the treatment groups only have occasional, isolated trades like in our data the estimated shift in the slope coefficient for the treatment group is likely to become skewed.

In an attempt to combat this, we also conducted the alternative regression restricted to investors who traded more frequently. While this regression yielded similar results as the unrestricted one, the statistically insignificant interaction-term for *Purchase* changed sign to positive. These results would suggest that there is no difference in media influence across trade volume on the sell side, whereas there could be marginal differences between frequent and quiet investors when it comes to purchasing.

Furthermore, as our outcome variable is a dummy variable and not a ratio, this makes it harder to intuitively interpret the coefficient. The coefficient in this case shows the shift in *probability* for the individual placing a trade on any given day during the period compared to the control group. This would suggest that there is a 0.5 percentage point shift in likelihood a Norwegian subject places a sell order on that particular day due to the received treatment. While this result holds for both the total population and the sample with ≥ 3 transactions, the uncertainty of the individual treatment assumption should still be considered. We argue therefore that the country-level analysis is generally a better fit for the scope and purposes of this study and will be the primary focus from which we draw general conclusions.

6.3 Implications of exploratory analysis

Based on the average transaction per investor in the three groups in table 5.7, we see a clear negative relationship between rating on the platform and average trades in NAS. A plausible interpretation from both the descending average trades and the sum of net buys in the three groups would be that less trades in NAS during our period is beneficial for your portfolio rating, which can be corroborated by looking at the historical stock prices from this time.

While we cannot prove the groups are subjected to the same amount of media exposure, looking at the results in table 5.8 and 5.9 would suggest that from an optimising your portfolio Sharpe ratio perspective, trading less in NAS and in the same direction as the media sentiment seems to be beneficial. In line with the literature, group 3 also seems

to show the least amount of sensitivity to news regarding NAS. As many of the articles included in the data do not present any new information and can therefore be classified as *non-news*, a high relative transaction count would potentially imply that at least some behavioural biases are present.

7 Conclusion

According to the combined final results of our study, financial media coverage and possibly sentiment seem to have an effect on trading, and we can therefore reject our null hypothesis with relatively high probability. Looking at the country-level results, we estimate that in aggregate the media treatment in Norway on NAS did influence the trading behaviour of Norwegian investors. After the announcement of the emission we see a shift in trading pattern that does not seem to follow the general trend of investing behaviour in a representative control group, and cannot be fully explained by other exogenous factors. Our estimates suggest a country-level treatment effect of 10 absolute percentage points, meaning the increase in Sales ratio is approximately 0.10. Consequently, the increase shifts the Norwegian retail investors on average to be net sellers. Moreover, in the event that our assumption regarding equally proportionate buy- and sell orders does not hold, i.e. the more likely scenario of buying in smaller batches and selling whole positions is more prevailing, the estimated treatment effect would potentially be even larger.

Regarding aggregate response to media treatment, we see that transaction volume is affected by media coverage regardless of country, although the effect is larger domestically. Our sentiment analysis also suggests that domestic investors follow domestic media sentiment more closely than foreign investors, supporting the findings from the primary analysis.

On an individual level the results of the analysis are inconclusive. We estimate a negative shift in selling-probability for the treatment group while the change in purchasing remains unchanged. These results would suggest an opposite effect to the country-level estimates, but contains a number of caveats. The assumption of treatment on an individual level lacks credibility, and the presence of high-volume days prior to the announcement complicates the results. Moreover, trade volume differs significantly between the two groups which in an absolute, individual comparison is problematic, compared to the ratio analysis on aggregate country-level.

Furthermore, as showcased by the country-level response to media and in line with previous research in both economics and psychology literature, the subjects in our study seem to react highly different to financial news. Due to this noisiness of the data and obvious

methodological limitations, the ability to draw valid conclusions from the individual analysis is questionable at best.

In the way of broader conclusions of media coverage of overpricing and its influence on retail investment behaviour in the Nordics, we refrain from expressing any absolute estimates in general. The case investigated in this study is highly specific and arguably does not translate directly to other assets, countries, or situations. However, supported by previous research of media influence and the results presented in this study, we conclude that financial media coverage of overpriced assets on average likely does have a direct impact on retail investment behaviour, either by persuasive sentiment or simply by the increased attention the asset gets.

Suggestions for further research related to this topic could firstly be to conduct a more qualitative study on the reasoning behind keeping NAS in one's portfolio, as the underlying thought processes are not within the scope of this thesis. While one can speculate to what degree simple inattentiveness is to blame, it surely is not the sole explanation. Secondly, it would be interesting to examine the reasons and beliefs of the investors that invested more into the asset long after the announcement, as we clearly saw happen in the study. Moreover, it would also be interesting to see whether the actual language barrier between our two countries contributes significantly to the results by looking at the other Nordic countries' trading pattern during the same period, and comparing those results to ours.

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