IN THE EYE OF A PANDEMIC

AN EVENT STUDY OF THE SWEDISH STOCK MARKET REACTIONS TO THE COVID-19 PRESS CONFERENCES

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Abstract

Using intraday trading data for the Swedish stock market, this paper examines the stock market reactions to The Public Health Agency of Sweden's daily press conferences covering Covid-19. Our results indicate that stock returns immediately drop at the 1% significance level when negative news are announced. When no additional restrictions are introduced, the stock returns steadily increase across the press conference. Trading volume increases at the 1% significance level, independent by sentiment, when the press conference ends. Additional tests on the industries in our sample show significant increases in stock returns, but no significant decreases. Moreover, the industry analysis shows that the "Health Care" industry faces the largest change in trading volume during the press conferences. We relate these results to previous research on trading behaviors in times of uncertainty and theories within behavioral finance. The discussion also covers the implications of the debated Swedish Covid-19 strategy of keeping society and businesses running despite the ravaging pandemic. Our results suggest that investors attribute value to the press conferences, in addition to the news presented, proposing that sentiment among investors is an important factor when explaining the trading behavior at this time.

Keywords

Sweden, Covid-19, News Announcements, Behavioral Finance, Sentiment

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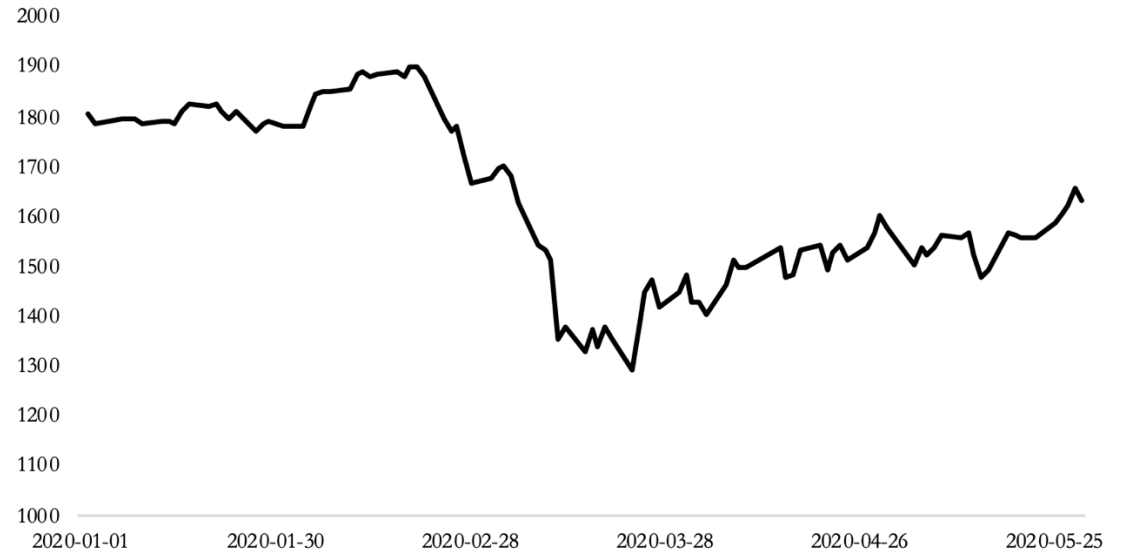
1. Introduction

In late 2019, a new virus by the name SARS-CoV-2, or simply Covid-19, started to spread in the city of Wuhan, China. In the beginning of 2020, Covid-19 hit countries at a rapid pace, and by the 11th of March 2020, the World Health Organization labeled the disease a pandemic (World Health Organization, 2020). The rapid spread and lack of knowledge regarding its contagiousness and lethal consequences led many counties to introduce strict restrictions and lockdowns in the urge to stop the virus (Financial Times, 2020). As a result, businesses found themselves without customers and international trades were put on hold (Statista, 2021). The world faced the worst recession since the Great Depression in 1929 and stock markets dropped rapidly in the first months of 2020 (International Monetary Fund, 2020). Consequently, the Covid-19 crisis imposes an interesting and important new area of economic research. In this study we investigate if, and how, the Swedish stock market reacted to early news about the virus. More specifically, we investigate the stock market reactions to the press conferences held by the Public Health Agency of Sweden (PHAS). We use the event study methodology suggested by Busse and Green in the article *Market Efficiency in Real Time* (2002).

Graph 1. OMXS30 Index



The graph reports the historical closing prices of the OMXS30 index in the beginning of 2020. Prices are in SEK.

(Nasdaq, 2021)

Sweden reported its first case of Covid-19 on January 31st, and by March 6th, just over a month later, nearly 90 cases had been reported. March 6th marked the first day when a press conference on the topic was held by PHAS (Folkhälsomyndigheten, 2020). The Swedish strategy of tackling the virus was early on seen as the outlier strategy. After recommendations from PHAS, the Swedish regulatory authorities aspired to keep the society open with only few restrictions, in an attempt to also consider the broader aspects of public health and the economy. This Swedish strategy became widely debated, where some claim it to be a success while others describe it as a disaster (Time Magazine, 2021; Bloomberg, 2020; Reuters, 2020; Oxley, David, 2021). The way in which PHAS influenced the spread of Covid-19 information, as well as the Swedish decision makers, was another way in which Sweden stood out with its Covid-19 approach. Rather than politicians taking the lead in informing the public on the situation, experts on communicable diseases took an important role in delivering facts and suggesting actions for the regulators to adopt (Dagens Nyheter, 2021). One of the most prevalent persons on this matter soon became Anders Tegnell, State Epidemiologist

in Sweden and most frequent speaker during the PHAS press conferences. He quickly became a lead figure in media and someone many relied on for facts and directives on how to handle the crisis (Svenska Dagbladet, 2020).

Statistics by the public service television data indicates that the number of viewers during PHAS's press conferences were high and increased in the early stages of the pandemic (SVT, 2021). Watching what Anders Tegnell and his colleagues had to say became an important interruption during the day. In times of high news flows and with an entire world covering the latest updates regarding the virus, the press conferences became a valuable source of up-to-date and legitimate information in times of uncertainty (Dagens Industri, 2020). The press conferences by PHAS were held daily at 14.00 over the first three months of the pandemic, and then twice a week for the continuation of the year. Due to the press conferences being such a widely watched event, as well as the characteristics and impact of the news, these press conferences make up an interesting phenomenon to study in relation to market reactions. In this paper we study the stock returns and trading volume of the 30 stocks with the largest turnover on the Stockholm Stock Exchange around the time of these press conferences. More specifically, the paper aims to answer the following research questions:

i. *Does the volume and return of the OMXS30 stocks significantly change in immediate response to the daily Covid-19 press conferences held by the Public Health Agency of Sweden?*

ii. *How much of the change in volume and stock return can be explained by the increased number of Covid-19 cases in Sweden, the presenter during the press conference, number of viewers, and changes in Swedish societal restrictions?*

Previous research regarding news and trading behavior has either studied the stock market effects of macroeconomic news announcements, such as interest rate announcements by the Federal Open Market Committee (FOMC), or firm specific news announcements in media. Additionally, research has been made on the topic of investor sentiment and risk attitudes in times of uncertainty or crises. This research extends on these findings by cross sectionally studying the stock market reactions in immediate relation to the daily PHAS press conferences held in the beginning of the Covid-19 outbreak in Sweden. The Covid-19 pandemic is a new area of research and little has been studied in the direct relation to its impact on the Swedish market. Furthermore, we distinguish ourselves from previous areas of study by investigating news coverage in a crisis which is not a direct financial crisis, but nevertheless has vast indirect economic implications.

We study the Nasdaq OMX Stockholm 30 (OMXS30) stocks, and their reaction to PHAS's press conferences held in March and April 2020. OMXS30 contains the 30 most actively traded stocks with the largest turnover in Sweden, and the composition of stocks is revised every six months (Nasdaq, 2021). Due to this, we expect to see a larger impact on the trading activity of these particular stocks. Moreover, the reason for studying the months of March and April particularly, is due to the importance of these early press conferences as little was known about the behavior and ramification of the virus during this time, resulting in uncertainty, fear, and a spike in directed attention, in this early phase of the pandemic.

Using intraday trading data from the Nasdaq Data Administration, we perform tests on significant differences in trading volume and stock return during and after the press conferences. Our results show significant changes in stock returns over the course of the press conferences, as well as significant increases in trading volume after the governmental authorities have spoken. These findings are confirmed by the results from our difference-in-differences robustness test. Additionally, our findings indicate that prices drop significantly at the 1% level when negative news are presented. When the sentiment is neutral, returns grow less and less negative and is significantly larger after the conference than beforehand. This is also significant at the 1% level. Tests on specific industries indicate that the stock return significantly increases during

the press conferences for 50% of the industries in OMXS30. None of our results show that stock returns significantly decrease for any of the industries in our study. Furthermore, trading volume significantly increases after the press conference for a majority of the industries. The findings open up for interesting discussions on how this type of information is perceived by the market participants. Due to the high level of uncertainty and flow of information at this time, we argue that the trading behavior can be explained by theories in the behavioral finance literature, such as sentiment trading, herding behavior, and mortality beliefs. Our findings deepen the understanding of trading behavior during times of crisis and how governmental announcements with indirect economic implications impact the stock market.

2. Theoretical Framework & Literature Review

To study the impact of the PHAS press conferences on the stock market during the pandemic, we have found some helpful prior areas of research to relate to. One area of interest covers market reactions to news reports. Other relevant research covers trader sentiment and market reactions in times of financial instability, uncertainty, and crisis. Other areas of study that is of much interest are recent studies made on the Covid-19 pandemic and its economic implications. Since the crisis is still ongoing at the time this thesis is being written, and the consequences on the economy and health are not yet possible to evaluate in its entirety, there is not much research published on this topic. However, the few financial papers examining some of the early effects of Covid-19 are of interest to this study.

2.1 Economic Announcements and Trading Behavior

Economic announcements can be divided into two subgroups of firm-specific announcements and macroeconomic announcements. Many studies have been conducted on the subject of firm specific news. In their study, Mitchell and Mulherin (1994) find a direct relation between the number of news announcements by Dow Jones & Co. and market activity variables such as trading volume and the absolute value of firm specific stock returns. Kim et al. (1991) and Chae (2005) also study firm specific news announcements and the impact of information asymmetry on market activity and price reactions. One of Chae's findings is for example that cumulative trading volume decrease before a scheduled earnings announcement. Moreover, Kalev et al. (2004) study intraday trading data from the Australian Stock Exchange and find a positive and significant impact of selected corporate news on stock return volatility. Nofsinger (2001) also finds that trading activity increases around the time of firm specific news announcements and adds to the discussion by including that the sentiment of the news impact the trading behavior differently for private and institutional investors, suggesting that private investors tend to trade less on bad information.

Nofsinger (2001) also conduct research on macroeconomic news announcements and finds that both good and bad macroeconomic news are related to higher trading volume among both private and institutional investors. Bessembinder et al (1996) find that macroeconomic news announcements impact trading volume of large firms, but not of small firms. Ederington et al. (1993) conducts research on how volatility is affected by macroeconomic news and finds a significant increase in volatility in the first 15 minutes after an announcement, which stays moderately effective over several hours thereafter. Cieslak et al. (2019), Zhu (2021) and Rigobon and Sack (2004) have all conducted research on the stock market implications of the interest rates announcements by FOMC and conclude that these announcements impact stock returns as well as changing volume dynamics, suggesting lower volume prior to announcement and higher volume post announcement.

The vast majority of this paper is based on the article *Market Efficiency in Real Time*, written by Busse and Green and published in The Journal of Financial Economics in 2002. The

authors investigate if and how the financial news, during the "Morning Call" and "Midday Call" on CNBC, impact the price and trading volume of the stocks being mentioned. During the time of their research, CNBC was one of the most watched cable TV channels for financial news. The Morning and Midday Call segments provided analysts view of stocks and covered topics such as rumors of earnings statements or predictions regarding upcoming company meetings, with the purpose to provide market participants with information on certain stock developments, as well as the market as a whole. Busse and Green wanted to test the Efficient Market Hypothesis (EMH) developed by Fama (1970), in order to see how fast markets incorporate new information in prices. Being published in 2002, this paper was one of the first papers testing the EMH on an intraday level, analyzing how stocks react only seconds after an announcement. Today, it is still frequently cited as an influential paper on the topic.

After determining the sentiment of the announcements and then measuring the immediate price and volume response, Busse and Green perform a sentiment analysis of the news announcements and find a significant relationship between positive (negative) news regarding a stock, and a positive (negative) return for the same stock. For negative news, they find that stock returns fall slow and steady, while returns spike within the first 15 seconds after a positive announcement and then immediately drops back to a value equivalent to the fundamental value. Additionally, they find a significant increase in trading volume following the announcements. The fundamental research question in Busse and Green contains many similarities to the ones in this study, but several important differences as well. In the paper, the researchers study the immediate impact on stock returns and trading volume, directly following company specific news broadcasts. Despite differences with regards to the nature of the announcements themselves and the way that the news are being presented, the methodology of measuring the impact is nevertheless similar. Furthermore, the research presented in the article is performed during a time where the stock market faced few chocks and disturbances. This is an apparent contrast when comparing to our research, which in essence builds on the consequences of the global crisis imposed by the Covid-19 pandemic. Due to this, we will also draw much inspiration and knowledge from papers discussing trading activities during times of crisis and the impact of investor sentiment on the stock market.

2.2 Indirect Economic Announcements and Trading Behavior

All news announcements may not be as directly economic as earnings- or FOMC announcements. Other influential announcement, such as announcements by the Government or legal authorities, may not have a directly economic purpose, but nevertheless have important indirect economic implications. Pástor and Veronesi (2012) wrote the article *Uncertainty about Government Policy and Stock Prices* published in the Journal of Finance, which covers many topics of interest for our study. Pástor and Veronesi propose that governmental policy news contains two types of uncertainties, namely uncertainly of whether the policy will be imposed (political uncertainly), and uncertainty of what the implications of the policy will be (implication uncertainty). They differentiate between positive and negative announcements and argue that positive announcements tend to be more widely anticipated by the public and hence the stock price reactions tend to be smaller. Negative announcements, on the other hand, tend to come with more surprise and generate a larger price reaction. The direction and extent of the price jump, depends on the extent to which the announcement was unexpected by the public. If there is no uncertainty related to the policy announcement, there will be no price reaction. Additionally, they also suggest that if there is no change in current policies at the announcement, then stock prices tend to jump up, and vice versa, if the policy does change, then there will be a downward price jump. This results from the risk premium of holding stocks at the time of the announcement. Do to the implied larger price reaction from negative announcements, Pástor and Veronesi conclude that policy announcements will cause

a negative price reaction on average. Lastly, they suggest that some firms are more widely exposed to the policy change, and hence these firms generally face larger reactions.

Zhang (2006) also published an article in the Journal of Finance related to the topic of information uncertainties and stock returns. He suggests that a greater level of information uncertainty should generate higher expected returns following good news and lower expected returns following bad news. Additionally, Zhang concludes that there is a level of underreaction to news announcements that is consistent with the level of uncertainty concerning the firm value implications, stemming from the announcement. Just like Hirshleifer (2001), Zhang also suggest that a greater level of uncertainly leaves more room for psychological biases, such as overconfidence, conservatism bias or underreaction to new information, when valuing securities.

2.3 Sentiment and Trading Behavior in Times of Crises

Since the early work by Kahneman and Tversky (1979), extensive research within the field of behavioral finance has shed light on the relationship between investor sentiment and stock returns. In the Prospect Theory and notion of Risk Aversion, Kahneman and Tversky show how people make decisions under risk, suggesting that people tend to behave irrational, based on the means of the neoclassical model. Kahneman and Tversky suggest that people dislike moving away from certainty (the certainty effect) and place much more weight on losses, in terms of utility, than they do for gains. Other studies on sentiment investigate stock returns across different types of firms while controlling for sentiment (Baker & Wurgler, 2006; Al-Awadhi, Alsaifi, Al-Awadhi, & Alhammadi, 2020). Furthermore, sentiment caused by weather conditions has proven to impact stock market returns, implying that the actors on the market are not always acting rationally (Hirshleifer & Shumway, 2003; Loughran & Schultz, 2004).

Sentiment caused by various crises or other chocking events seem to evoke negative emotions, change our perceptions of risk, and impact our trading behavior. Such events could for example be airplane crashes, financial crises, or the discovery of new pernicious diseases. In their study, Kaplanski and Levy (2010) find that aviation disasters enhance the perceived risk and hence the volatility increases. This occurs without an actual change in the underlying fundamental value. They also find a positive significant relationship between the event of an aviation disaster and a drop in stock prices. Furthermore, much research on trading behavior during times of financial crises has shown that the investor sentiment highly impacts trading behavior, e.g., pessimistic sentiment among investors in times of crisis enhance the net-selling pressure on the market (Chiu, Chung, Ho, & Wu, 2018). Moreover, Christie and Huang (1995) suggest that individuals tend to suppress their personal set of information in turbulent times on the market, and instead resemble the investment behavior of other actors on the market, which augments the herding behavior.

Some research on infectious diseases, and in particular the spread of disease-related news and their market implications, suggest that sentiments induced by disease-related news significantly impacts investment decisions among investors in the pharmaceutical sector (Donadelli, Kizys, & Riedel, 2017; Haroon & Rizvi, 2020). Additionally, Young et al. (2013) find that diseases which receive more attention in popular media are perceived to be a greater threat to the population, regardless of its actual severity. Despite novel, some research projects and papers have been issued covering the Covid-19 pandemic and its economic implications. Haroon and Rizvi (2020) find in their research on price volatility and sentiment generated by Covid-19-related news, that uncertainty and overwhelming panic caused by news are linked to the volatility seen on the market. Suneson (2020) disclose which sectors have faced the largest loss in returns during the pandemic, suggesting that the retail, travel, and transportation sectors are the most affected. And lastly, Al-Awadhi et al. (2020) find a significant negative correlation between the number of confirmed cases and deaths in Covid-19 and stock returns across all companies studied on the Chinese stock market.

Finally, studies on mortality beliefs suggest that optimism (pessimism) toward one's longevity has great impact on investment decisions, savings, and stock market participation. One could reason that an event like the Covid-19 pandemic makes people question the probability weighting on rare events and re-evaluate their own mortality as a result of the increased death rates across countries (Heimer, Myrseth, & Schoenle, 2019). Puri and Robinson (2007) construct a measurement of optimism based on people's miscalibration of their life expectancy and conclude that more optimistic people tend to show more self-control, invest more in individual stocks, and save more. If the outbreak of Covid-19 cases a more pessimistic perspective of one's mortality, then this could also impact the stock market behavior.

2.4 Contribution

This study contributes to the previously mentioned literature in several aspects. Using the methodology of Busse and Green, we investigate the market reaction to the daily announcements held by PHAS in early 2020 on the topic of Covid-19. However, in contrast to Busse and Green, the announcements of interest are held by state authorities and have only indirect economic purposes and implications. We therefore apply and build on the conclusions covering policy announcements by Pástor and Veronesi (2012) and Zhang (2006) for our analysis. Furthermore, these announcements are also taking place in the context of a global crisis. By combining these fields of research, our study becomes unique in a new dimension. Much research has previously covered sentiment and trading behaviors under risk and uncertainty during times of crisis. However, due to the recency of the events around Covid-19, this specific crisis is a fairly unexplored area of research, which makes our study even more unique. Lastly, the study is conducted on Swedish data, which is of particular interest due to the well-renowned crisis strategy of the country. To our knowledge, the connection between Covid-19 and trading behavior in Sweden has not been studied before.

3. Hypotheses

i. We expect the stock return to decrease in the intervals following the start of the press conferences.

Pástor and Veronesi (2012) suggest that the stock return is negative on average following a government announcement. We expect to see a similar development when testing the return across all conference days and all stocks. Additionally, we expect the overall sentiment of fear and risk related to the pandemic, to further impact the negative returns. This argument is in line with Chiu, Chung, Ho and Wu (2018).

ii. We expect to see a negative stock return following press conferences with a negative sentiment and a slight increase after press conferences with a neutral sentiment.

Following the findings by Zhang (2006) and Pástor and Veronesi (2012), the uncertainty regarding the negative information and the level to which it was unexpected, would result in negative stock returns on average following a negative announcement. Furthermore, this prediction is in line with the findings in our benchmark study by Busse and Green (2002). Additionally, as Chiu, Chung, Ho and Wu (2018) suggests, the sentiments of fear, uncertainty, and pessimism during this crisis would evoke a selling pressure on the market, pushing prices down. Zhang, Pástor and Veronesi predicts the reverse reaction following a positive announcement. Nevertheless, as much uncertainty prevails at the time of the announcements, we expect the price reaction following a neutral announcement to be only moderate.

iii. We predict to see a greater decrease in stock return among firms in the industries "Industrial Goods and Services", "Automobiles and Parts" and "Retail"

This hypothesis is based on the findings by Pástor and Veronesi (2012), and Suneson (2020). Pástor and Veronesi suggest that firms that are the most impacted by the policy announcement will experience the greatest change in stock return. The direction to which the stock return changes depends, according to Pástor and Veronesi, to which extent the policy change was anticipated. Suneson reports which sector in the US market that were the most impacted in the beginning of the pandemic and concluded that "Transportation", "Retail" and "Travel" faced the largest downturns. The OMXS30 industries that are the most similar to these industries are "Industrial Goods and Services", "Automobiles and Parts" and "Retail". The "Travel and Leisure" industry in the OMXS30 is slightly contradicting as it only contains the company Evolution Gaming AB. Thus, in contrast to Suneson, we do not expect this industry to perform poorly with more restrictions and time spent at home.

iv. We anticipate trading volume to increase in the intervals during and after the press conference. We expect this pattern to be consistent also when controlling for sentiment and industry. More specifically, we believe the "Health Care" industry to experience the highest trading activity during and after the press conference.

This hypothesis is in line with the conclusions by Cieslak et al. (2019), Zhu (2021) and Rigobon and Sack (2004). They find a decrease in trading volume in anticipation to a FOMC announcement followed by an increase in activity post announcement. Despite differences in announcement and information characteristics between FOMC and PHAS announcements, we predict to see a similar pattern. Additionally, we expect the volume pattern to be consistent when controlling for sentiment and industry indications. However, based on the findings by Donadelli et al. (2017) and Haroon and Rizvi (2020), we predict that the "Health Care" industry will receive the most attention and hence have the largest increase in trading volume during and after the press conference.

v. We hypothesize that the independent regression variables "SVT viewers", "Change in Covid-19 Cases", and "New Restrictions/Recommendations" will have a negative correlation with the dependent return variable. Furthermore, we hypothesize that the variable "Government Announcement" will weakly correlate with return, while the variable "Anders Tegnell" will have a stronger positive correlation with return.

The prediction for SVT viewers is based on the studies by Pástor and Veronesi (2012) and Chiu, Chung, Ho and Wu (2018). If the stock return after a public announcement is negative on average, we expect this effect to be more prominent during the events which receives much attention by the public. This hypothesis also builds on the conclusions by Young et al. (2013), which states that diseases that attract more attention in media is perceived as a greater threat to the public, regardless of its severity. Al-Awadhi et al. (2020) suggests that there is a correlation between conformed Covid-19 cases and stock returns when conducting research on the Chinese market. We believe to find a similar effect. An increase in recommendations and restrictions is predicted to negatively correlate with the return variable, based on theories of negative sentiment. An increase in restrictions is a signal that PHAS and the government perceives the risk to be higher, and hence project a negative sentiment on the public. As suggested by Chiu, Chang, Hu and Wu (2018) and Zhang (2006), we expect this negative sentiment to negatively correlate with stock returns. With this in mind, we predict the government dummy coefficient to be close to zero. Furthermore, in the benchmark article by Busse and Green (2002), they control for the news presenter in the regression and find that the person delivering the news significantly correlated with returns. Similarly, we hypothesize that Anders Tegnell is perceived as a knowledgeable and trustworthy presenter, and that the returns therefore will positively correlate with him.

vi. We predict that the independent variables "SVT viewers", "Change in Covid-19 Cases", "New Restrictions/Recommendations" and "Anders Tegnell" will have a positive correlation with the dependent volume variable. Meanwhile, we predict the variable "Government Announcement" to negatively correlate with trading volume.

Similar to the hypothesis for the return variable, the number of SVT viewers is expected to positively correlate with volume. With more viewers, we predict more people to engage on the stock market based on the information presented. Like the findings of Donadelli, Kizys and Riedel (2017) and Haroon and Rizvi (2020), sentiment induced by disease-related news significantly impacts investment decisions. Hence, with an increase in number of confirmed Covid-19 cases, the uncertainty and pessimistic sentiment is also expected to increase which should generate more activity and a selling pressure on the stock market (Chiu, Chung, Ho, & Wu, 2018). The similar is expected for the variable regarding new recommendations and restrictions. With more uncertainty and fear generated by the implied risk levels caused by heavier restrictions, we expect more people to trade on the stock market. The variable for if the government has held a press conference just before PHAS is expected to make the news on the PHAS conferences more anticipated and hence less informative. Based on the theory of EMH, the press conferences should have little impact on stock return if the information has already been disclosed. When the news are more anticipated, we expect the stock market activity to be lower and hence have a negative correlation. Lastly, when Anders Tegnell is the presenter, we expect the trading volume to increase. Busse and Green (2002) found that one of the presenters in their research was perceived as more knowledgeable, which correlated with higher trading activity. Based on this finding, the expertise that Anders Tegnell possesses is expected to impact the trading volume positively.

4. Data

4.1 Press Conferences

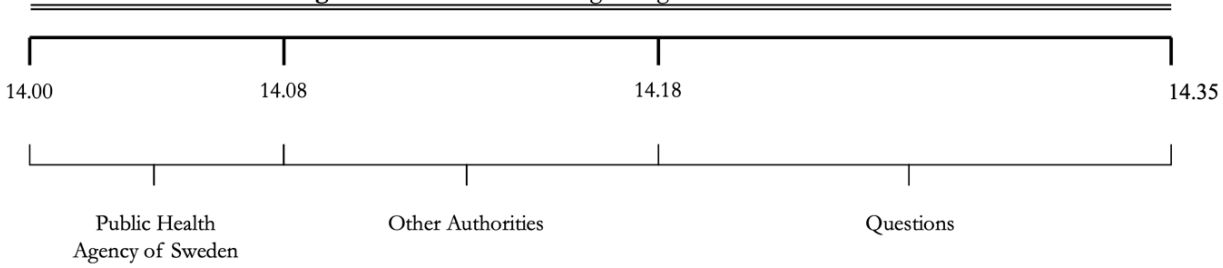
The PHAS works to ensure that the Swedish population is protected against communicable diseases and other threats against the national health. Thus, PHAS has the overall national responsibility for public health issues, including the Covid-19 pandemic (Folkhälsomyndigheten, 2021). Due to their role during the pandemic, PHAS held 121 press conferences on the topic of Covid-19 during 2020, starting on the 6th of March 2020. The purpose of the press conferences was to communicate the latest and most important information about the virus to the Swedish population in a fact-based and reliable way. The press conferences have been one of the most important information channels during the Covid-19 crisis and has been referred to as "one of the largest information campaigns in modern time". While press conferences on Covid-19 were not unique for Sweden specifically, the Swedish strategy stood out among other countries, since most information was delivered by experts on the subject, and not by politicians (Dagens Nyheter, 2021). The Swedish government also held press conferences regarding Covid-19, but these were separated from the conferences by PHAS.

We follow the methodology used by Busse and Green in their article *Market Efficiency in Real Time* (2002), but while they study daily financial news on CNBC, this study investigates the press conferences by PHAS. The press conferences were held every weekday from the 6th of March 2020 to the 9th of June 2020. They were thereafter held twice a week during the remaining months of the year, on Tuesdays and Thursdays. The press conferences always started at 14.00 and aired live on Sveriges Television (SVT), which is the Swedish public service television company. SVT is, together with the Swedish public service radio, the most trusted Swedish media channel and enjoys good support from the Swedish audience (Sveriges Television, 2021). Additionally, the press conferences could be followed on various other media platforms such as YouTube, and

information could be received through live updates and smartphone notifications by large newspapers and other information channels.

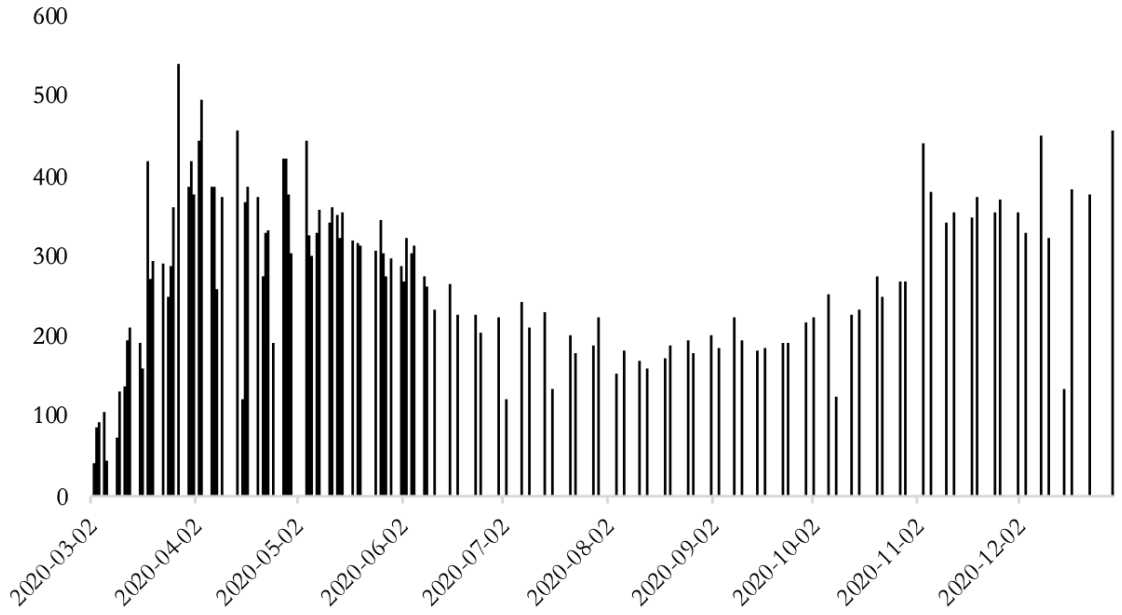
Each press conference varied in length but were on average 35 minutes in total. They were generally divided into three distinguishable parts. First, PHAS held a presentation where updated information and recommendations regarding the virus are presented to the public. These news were based on daily assessments of the development of the Covid-19 pandemic with input from other responsible sources such as the World Health Organization (Folkhälsomyndigheten, 2021). Generally, the presenter started with an update of the global status. They then moved on to the domestic situation and presented the number of Covid-19 cases both in Sweden in total and in certain deviant counties, the total number of deaths, and the number of hospitalized patients. The section ended with a presentation of new restrictions and recommendations. This first part was either presented by Anders Tegnell, the Swedish State Epidemiologist, or by another representative from PHAS. The second part consisted of presentations held by other Swedish authorities, generally by the National Board of Health and Welfare (NBHW) and by the Swedish Civil Contingencies Agency (SCCA). The presenter from each authority provided the public with updated information from their own departments. Typically, NBHW explained the current capacity in the intensive care system and the inventory of protective equipment for medical staff, and SCCA reported on various topics, usually regarding public safety and dissemination of information. The third and last part was allotted to questions from reporters.

Figure 1. Structure and Average Length of Press Conferences



Due to the scope of the study, we have chosen to analyze the trading behavior during the press conferences the first two months of the pandemic in Sweden; March and April 2020. We excluded the press conferences on 9th, 10th, and 13th of April 2020, as these were not complete trading days due to the Easter holiday. In total we analyzed 36 press conferences. The reason for choosing this period was because of the large uncertainty in the very beginning of the pandemic and its consequences on the stock market. In their article about the investor reaction to the 2008 financial crisis, Hoffman, Post and Joost (2013) find that the investors' stock return expectations and risk tolerance decrease, and that their risk perception increase, during the first and worst months of a crisis. This can be linked to the stock market's initial reaction to Covid-19 where prices dropped rapidly (Nasdaq, 2021). Furthermore, the number of viewers who watched the broadcasts live on SVT give us an indication of the overall interest in the press conferences and their potential impact on the stock market. The average number of SVT viewers steadily increased in March and April and then decreased from May and forward. Thus, the interest for the press conferences increased in March and April and started to decrease towards the summer of 2020. The viewers then increased again after the summer and steadily increased from September to November (SVT, 2021). These viewer numbers are consistent with the reported number of Covid-19 cases in Sweden (see Graph 3 in Appendix). Just as the number of viewers, the number of cases increased during spring 2020 and fall 2020, representing two "waves" as the periods have been called by both experts and media. Taken together, the first Covid-19 wave is expected to have the largest and most significant impact on the Swedish stock market and thus we have chosen to analyze this period.

Graph 2. Number of SVT Viewers



The graph reports the number of SVT viewers during each press conference in 2020. Viewers are in thousands. The press conferences were held daily until June 2020 and were thereafter held twice a week.

(SVT, 2021)

Although this study covers a similar type of event methodology as Busse and Green, our data set differs from theirs in several aspects. The data set used by Busse and Green (2002) consisted of financial news segments that were usually less than two minutes. During this short event, they timed the exact mentioning of a specific stock. We do not have any equivalent mentioning or piece of information to study in more detail. The events in this study are, on the contrary, 35 minutes on average and consist of a continuous flow of information about the virus and its implications. In an ideal scenario we would want to study an event that is more similar to the one studied by Busse and Green, where it is possible to look at the mentioning of a more precise piece of information for more comparable results. This implies that the focus of our study will be slightly different from that of Busse and Green. While they investigated how fast the market reacted to the announcements, we study if the market reacts to the announcement at all. Furthermore, our data differs from Busse and Green's since they actively chose to study a period where the market was relatively flat. We, on the other hand, chose to study a period when the market is unstable. By also choosing to analyze the beginning of the pandemic, we study the part of the crisis when stock prices dropped the most rapidly. The risk of performing an event study during financial turbulence is that one might end up catching noise and that it is uncertain if the identified effect is a result of the event studied. However, due to the extensions of our study, and our aim to research the trading behavior during the most critical part of the Covid-19 crisis, it becomes inevitable for us to study the market when unstable. In order to control for noise and to better analyze the effects of the press conferences, we have chosen to deviate from the data set of Busse and Green by also including the same period for 2019. We hope that including this contrafactual data set in a robustness test will help to determine whether there is an effect. Moreover, during this global crisis there has been a high flow of information and many platforms actively cover the latest updates regarding the virus, which makes it difficult to isolate the effect of the press conference. In an ideal dataset, there would be no other information regarding the Covid-19 situation globally. If that was the case, we could more accurately isolate whether the effects could be derived from the

information presented at the press conferences. However, our data differs from this ideal set of data, as we cannot control for all other news sources covering the topic of covid-19.

4.2 Trading Data

In order to analyze the influence of the PHAS press conferences on the Stockholm stock market, intraday trading data was collected from the Nasdaq Data Administration. The intraday trading data, to the nano-second precision, included all finalized trades for the 388 stocks on the Swedish stock market for each day, composing over 100 million trades for the chosen period. The data included 36 columns with information about each trade, including date, timestamp in milliseconds, instrument type, ISIN number, price, volume, turnover, participants, and trade type. In a first filtering of the data, we extracted only the information that we considered relevant for this study: date, time, ISIN number, price, and volume.

While the trading data used in this study is very similar to the one used by Busse and Green, the selection of stocks differs. In their paper, Busse and Green (2002) only analyze the reaction of the stocks that are mentioned during the events. Since no stocks are mentioned during our events, we study the reaction of a chosen set of stocks. Due to the scope of the paper, we have chosen to delimit our study to the OMXS30 stocks. OMXS30 is an index of the 30 stocks on the Stockholm stock exchange that are traded in the largest volume and total turnover (Nasdaq, 2021) and we have chosen this set of stocks since we believe that any effect of the press conferences will be most prominent among these. We base this decision on the research by Bessembinder et al (1996) who conclude that macroeconomic announcements mainly impact the trading volume of large firms and not small. While this is a natural delimitation of our study, in an ideal scenario, our data set would include more stocks as more observations would probably improve our results, making them more accurate. In total, we analyze 30 stocks during 36 trading days in 2020, summing up to 1080 observations. Furthermore, we include similar trading data for 2019 for our robustness test. For this test we include the same stocks and the same trading days. However, note that three of the 30 OMXS30 stocks were excluded in the 2019 data due to data loss. The stock Swedbank A was not traded during one of the days in 2019 due to suspended trading (SVT Nyheter, 2019).

4.3 Variables

4.3.1 Dependent Variables

4.3.1.1 Return and Volume

Following the article by Busse and Green (2002), we have chosen to analyze price change (return) and volume as the two independent variables of this paper. Volume, V, is simply calculated as the aggregated volume per minute for each stock. Return, R, is calculated as the percentage change over each minute interval for all stocks, where P is the price for a given stock x, and n is a specific minute:

$$R_{xn} = \frac{P_{xn} - P_{xn-1}}{P_{xn-1}} \qquad \text{Eq. 1}$$

4.3.1.2 Intervals

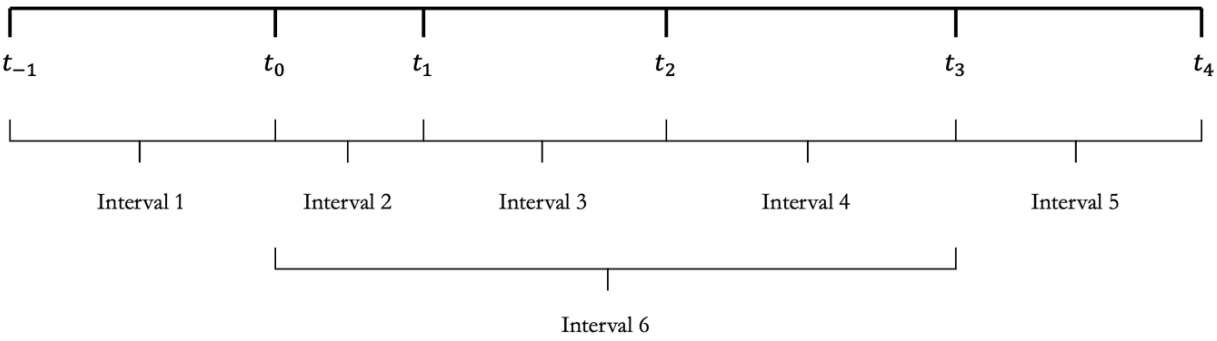
In order to interpret the dependent variables during the press conferences, we split the time frame of the press conferences into smaller intervals. Due to the large event window of the press

conferences and due to the fact that all press conferences differ in their length of time, a regular event study time-axis based on calendar times would not be sufficient for comparing reactions. Thus, we chose to divide the press conference into customized sub-events and intervals, corresponding to certain parts of the press conference and not specific times. For example, the time t_1 could some days be at 14.05 and other days at 14.13. The following comparable sub-events have been specified in this study:

t_{-1} = 13.30, 30 minutes before the press conference
t_0 = 14.00, the start of the press conference
t_1 = End of PHAS's presentation, beginning of the other authorities' presentations
t_2 = End of the other authorities' presentations, beginning of the questionnaire
t_3 = End of the entire press conference
t_4 = 30 minutes after the end of the press conference

Based on these six sub-events, we created five customized intervals shown in Figure 2. Additionally, we created a sixth interval which is the sum of interval 2, 3 and 4, representing the entire press conference.

Figure 2. Intervals



In order to create these customized intervals, several steps had to be made. As described earlier in the data section, our variables were prepared by aggregating the trades from nanoseconds into minute intervals, where volume was calculated as the aggregated volume per minute for each stock and return as the percentage change over each minute for each stock. Next, we watched all the press conferences and noted the exact time of the predetermined t_n on each day (see Table 14 in Appendix). With 30 stocks, 36 press conferences and six intervals during each press conference, there were 6480 distinct intervals in total. Lastly, we sectioned our minute data into intervals and calculated the average return per minute and average volume per minute for each interval and stock, where $\bar{R}_{xi}$ is the average return per minute in interval i for stock x and $\bar{V}_i$ is the average volume per minute in interval i for stock x:

$$\bar{R}_{xi} = \frac{R_{x1} + R_{x2} + \cdots + R_{xn}}{n} \quad \text{Eq. 2}$$

$$\bar{V}_{xi} = \frac{V_{x1} + V_{x2} + \cdots + V_{xn}}{n} \quad \text{Eq. 3}$$

Table 1. Descriptive Statistics Dependent Variables

Variable	N	Mean	SD	Min	Max
Return	6480	-0.00147%	0.03262%	-0.27070%	0.18640%
Interval 1	1080	-0.00374%	0.02130%	-0.08100%	0.08550%
Interval 2	1080	-0.00644%	0.04199%	-0.27070%	0.18640%
Interval 3	1080	0.00044%	0.04119%	-0.14710%	0.18350%
Interval 4	1080	-0.00020%	0.03452%	-0.26070%	0.12160%
Interval 5	1080	0.00378%	0.02737%	-0.12320%	0.16240%
Interval 6	1080	-0.00264%	0.02166%	-0.10170%	0.07750%
Volume	6480	5770	8286	45	112988
Interval 1	1080	5336	7952	156	112988
Interval 2	1080	5354	7865	45	91833
Interval 3	1080	5264	7733	94	109782
Interval 4	1080	6070	8243	113	68745
Interval 5	1080	6938	10067	127	106308
Interval 6	1080	5658	7485	125	82812

The table reports the descriptive statistics for the dependent variables in each interval. Return is calculated as percentage price change and volume is in absolute terms. The data covers 30 stocks and 36 trading days, composing 1080 observations in each interval.

4.3.2 Independent Variables

4.3.2.1 Sentiment

Similar to Busse and Green (2002), we perform a sentiment analysis on the information of the events. Though these types of analyses are built on subjective interpretations, we perform the analysis in several steps in order to debias the process from the most prevalent pitfalls. Individual and independent analysis of the overall sentiment of each press conference was made before cross checking the interpretations. The vast majority of the perceived sentiments were interpreted in the same way, which gave confidence to the analysis. However, for interpretations that were diverging, we carried out additional analysis consisting of secondary viewing and the use of sentiment algorithms trough the website FinSentim, which works to interpret the financial sentiment of a written source. This analysis resulted in a total of 20 press conferences with negative sentiment and 16 with a neutral sentiment. The choice of labeling was a result of the severeness of the information presented and the context and purpose of the press conferences. Due to society facing a multifaceted crisis, we decided to not label any news in the first two months of the pandemic as positive. At the same time some of them were not negative, hence we labeled them as neutral. While we consider the chosen labeling of the sentiments accurate for our study of the first two months of the pandemic, not having a clear distinction between negative and positive news can be problematic and can impose a limitation for our study.

4.3.2.2 Industries

With inspiration taken form the article by Suneson (2020), we add an industry analysis to our paper. This is a deviation from Busse and Green (2002), who do not include industries in their analysis except for when having a dummy variable for technology or internet stocks, in one of their tests. Because of the nature of the Covid-19 crisis and how it has been affecting different type of businesses and industries (Deloitte, 2020; Suneson, 2020), we believe that an industry analysis will positively contribute to our paper and add valuable insights. The OMXS30 stocks represent 14 different industries according to Nasdaq's own industry classification (see Table 13 in Appendix).

As explained above, the rather small sample of stocks imply a limitation for our study. With 30 stocks and 14 industries, some of the industries only constitutes of one stock. In an ideal scenario we would want to analyze more stocks within more industries and have more stocks within each industry, as this would make our results more informative and credible. However, the analysis will give insights to how the 30 largest stocks have been impacted over these news events and if there is any variation to be drawn for different types of industry. Additionally, one must acknowledge that the "Travel and Leisure" industry is rather contradictory. Travel and leisure are being combined into one single industry by Nasdaq, but one would believe that pure travel companies would be affected by Covid-19 in a different way than leisure companies, such as gaming companies. The industry classification and the fact that this only includes the company Evolution Gaming AB for OMXS30, could therefore potentially be somewhat misleading.

4.3.2.3 Regression Variables

Consistent with the article by Busse and Green, we perform a regression analysis where we investigate the cross-sectional determinants of the size of the return and volume response to PHAS's press conferences. Busse and Green (2002) include eight different independent variables in their regression, of which five were variables concerning the characteristics of the stocks being mentioned during the broadcasts, and three were concerning the characteristics of the event. Since the events studied in this paper are rather different from the ones analyzed in the article by Busse and Green, we have chosen other variables. Furthermore, since the analysis continuously covers the same set of stocks, we chose variables that concern the characteristics of the events and not characteristics of the stocks. The independent variables are the following:

SVT = Number of SVT viewers
$Cases$ = The percentage change in Swedish Covid-19 cases
$Rec.$ = Dummy variable for new restrictions or recommendations
$Gov.$ = Dummy variable for whether the Swedish government has held a press conferences before PHAS's press conference
$Anders$ = Dummy variable for whether Anders Tegnell is presenting or not

The first variable SVT is simply the number of SVT viewers each press conference. Busse and Green did not include a similar variable in their analysis, but we chose to add this since we believe that it would be interesting to analyze as the press conferences were a new phenomenon and the number of viewers steadily increased as the virus spread during the first wave. The second regression variable $Cases$ is the percentage change in the number of Swedish Covid-19 cases, and it is calculated as the absolute change from the previous press conference. While the information on cases is available on PHAS website, it is only updated once a day, which is in connection to the press conferences. Thus, the information regarding the number of Covid-19 cases presented during PHAS press conference was the most recent and accurate information. Next, we included the dummy variable $Rec.$ for whether any new restrictions or recommendations that were presented during the press conference. This is important to include since such information will not only affect people's everyday behavior but also the perceived uncertainty and severeness of the crisis. Also connected to the informativeness of the press conference is the fourth variable $Gov.$, which is a dummy for the press conferences by the Swedish government. While PHAS was among the leading institutions in the work against the virus and can issue recommendations, the Swedish government still held the supreme power to impose new restrictions and legislation. As opposed to PHAS, the Swedish government did not have reoccurring press conferences scheduled every day. Instead, they held them whenever there was new information to present. Therefore, one could expect the press conferences by PHAS to not have the same news value when the Swedish government held a press conference of their own just before. We have thus chosen to include a dummy for whether the

Swedish government held a press conference six hours or less before PHAS - that is, from 08.00 the same day. The last variable, $Anders$, is a dummy for whether Anders Tegnell was the presenter of the press conference or not. The reason for including this variable is because Anders Tegnell was highly debated in Swedish media, both praised and criticized, and thus it would be interesting to see if he had a larger effect on the dependent variables than his colleagues. The decision to include this dummy is in line with Busse and Green (2002), who also included a dummy variable for one of the presenters of the news segment, who received considerable attention in the media, similarly to Anders Tegnell. (For the regression variable data for each press conference, see Table 15 in Appendix).

Table 2. Descriptive Statistics Independent Variables

Variable	N	%	Mean	SD	Min	Max
Sentiment	36	100%	N/A	N/A	N/A	N/A
Negative	20	56%	N/A	N/A	N/A	N/A
Neutral	16	44%	N/A	N/A	N/A	N/A
Sector	30	100%	N/A	N/A	N/A	N/A
Automobiles and Parts	1	3%	N/A	N/A	N/A	N/A
Banks	4	13%	N/A	N/A	N/A	N/A
Basic Resources	3	10%	N/A	N/A	N/A	N/A
Construction and Materials	2	7%	N/A	N/A	N/A	N/A
Consumer Products and Services	1	3%	N/A	N/A	N/A	N/A
Financial Services	2	7%	N/A	N/A	N/A	N/A
Food, Beverage and Tobacco	1	3%	N/A	N/A	N/A	N/A
Health Care	2	7%	N/A	N/A	N/A	N/A
Industrial Goods and Services	7	23%	N/A	N/A	N/A	N/A
Personal Care, Drug and Grocery Stores	1	3%	N/A	N/A	N/A	N/A
Retail	1	3%	N/A	N/A	N/A	N/A
Technology	1	3%	N/A	N/A	N/A	N/A
Telecommunications	3	10%	N/A	N/A	N/A	N/A
Travel and Leisure	1	3%	N/A	N/A	N/A	N/A
Recommendations/Restrictions	36	100%	N/A	N/A	N/A	N/A
Up	18	50%	N/A	N/A	N/A	N/A
Stable	18	50%	N/A	N/A	N/A	N/A
Government Announcements	36	100%	N/A	N/A	N/A	N/A
Yes	16	44%	N/A	N/A	N/A	N/A
No	20	56%	N/A	N/A	N/A	N/A
Anders Tegnell	36	100%	N/A	N/A	N/A	N/A
Yes	23	64%	N/A	N/A	N/A	N/A
No	13	36%	N/A	N/A	N/A	N/A
SVT Viewers	36	N/A	307	123	45	541
Cases Change	35	N/A	20.4%	39%	3%	236%

The table reports the descriptive statistics for the independent varibles. For variables based on the press conferences, the data covers 36 observations except for the variable "Cases Change", where one of the sample days has been omitted when calculating percentage change. The variable "Sector" is based on the stocks in our sample and covers 30 observations.

Table 3. Correlation Matrix

Variables	1	2	3	4	5	VIF
(1) SVT Viewers	1					1.3777
(2) Cases Change	-0.4473***	1				1.3847
(3) Recommendations/Restrictions	-0.3710***	0.2871***	1			1.2910
(4) Government Announcements	-0.0010	-0.1484***	0.2236***	1		1.1442
(5) Anders Tegnell	0.1420***	-0.1604***	0.0578***	-0.0259**	1	1.0708

The table reports the correlation of each independent variable in the regression model. The Pearson Product-Moment Correlation tests are performed as two-tailed tests.
*** p-value<0.01, ** p-value<0.05, * p-value<0.1

We test our regression model and its independent variables for multicollinearity by calculating the Variance Inflation Factors (VIF). No VIF value is above the standard threshold value of 10, and we thus conclude that multicollinearity is not a problem for our regression model (Pallant, 2013).

5. Methodology

5.1 Event Study

Following the methodology of Busse and Green, this study is performed as a traditional event study in which the dependent variables are analyzed before and after a specific event. The event study is an empirical analysis tool developed by Fama et al. (1969) and it is used to examine the impact of an event on a security in order to test the EMH. An event study can be conducted in two different ways. One can either analyze the dependent variables through a regression analysis, or they can simply be directly interpreted and compared as they are. In this study, we follow the methodology of Busse and Green, and thus use the direct interpretation method and compare the constructed event intervals by performing several t-tests.

5.2 Statistical T-tests

Like Busse and Green (2002), this event study is conducted using Welch's t-tests for unequal variances, which is used to test if two populations have equal means. For this study, this implies to test if the equally weighted means of the stocks, in each interval during and after the press conference by PHAS (interval 2-6), are statistically different from the interval before the press conference (interval 1). We test this by calculating the test statistic and analyzing the corresponding p-value. The test statistics is given by the calculation laid out by Newbold et al (2013), where $\bar{x}$ and $\bar{y}$ are the sample means, s is the sample variance and n is the sample size:

$$t = \frac{\bar{x} - \bar{y}}{\sqrt{\frac{s_x^2}{n_x} + \frac{s_y^2}{n_y}}} \qquad \text{Eq. 4}$$

In the first part of the study, we test if the average return and volume per minute for all 30 stocks and all 36 trading days in a given interval is statistically different from that of the first interval. The tests are performed as two-tailed t-tests with the following null and alternative hypothesis for average return differences and average volume differences:

$$H_0: \bar{R}_i - \bar{R}_1 = 0$$
$$H_1: \bar{R}_i - \bar{R}_1 \neq 0$$

$$H_0: \bar{V}_i - \bar{V}_1 = 0$$
$$H_1: \bar{V}_i - \bar{V}_1 \neq 0$$

Next, the tests are perform on the different subsets of data. The first test is on sentiments, where we perform t-tests for differences in average return and volume per minute for both neutral and negative press conferences. While the t-tests on volume are performed as two-tailed t-tests, the t-tests on return are here performed as one-tailed t-tests. As explained in section 3, the hypothesize is that the return will decrease following a negative press conference, and increase following a neutral press conference.

Negative sentiments:

$$H_0: \bar{R}_i - \bar{R}_1 \geq 0$$
$$H_1: \bar{R}_i - \bar{R}_1 < 0$$

Neutral sentiments:

$$H_0: \bar{R}_i - \bar{R}_1 \leq 0$$
$$H_1: \bar{R}_i - \bar{R}_1 > 0$$

The last t-tests are performed on industries, where we test for differences in average return and volume per minute for all 14 industries represented in the OMXS30. These t-tests on industries are, just as the baseline t-tests on all 30 stocks and all 36 press conferences, performed as two-tailed t-tests.

5.3 Cross-Sectional Regression

Following the methodology of Busse and Green (2002), we perform a cross-sectional regression analysis through which we investigate the cross-sectional determinants of the dependent variables. While Busse and Green only performed such regression analysis on their return variable, we also include an identical regression on our volume variable. As described in the data section, we test the following independent variables:

SVT = Number of SVT viewers
$Cases$ = The percentage change in Swedish Covid-19 cases
$Rec.$ = Dummy variable for new restrictions or recommendations
$Gov.$ = Dummy variable for whether the Swedish government has held a press conferences before PHAS's press conference
$Anders$ = Dummy variable for whether Anders Tegnell is presenting or not

The regressions is performed as ordinary least squared (OLS) linear regressions. The first regression tests the relationship between average return per minute and the independent variables for each interval, during and after the press conference. The second regression tests the relationship between average volume per minute and the independent variables for each interval, during and after the press conference.

$$R = \beta_0 + \beta_1 SVT + \beta_2 Cases + \beta_3 Rec. + \beta_4 Gov. + \beta_5 Anders + \varepsilon \quad \text{Reg. 1}$$

$$V = \beta_0 + \beta_1 SVT + \beta_2 Cases + \beta_3 Rec. + \beta_4 Gov. + \beta_5 Anders + \varepsilon \quad \text{Reg. 2}$$

5.4 Difference-in-Differences

We have additionally included a difference-in-differences test in our study, as a robustness test. Busse and Green (2002) did not include such test in their study since the relationship between the events and stocks that they study is less ambiguous. The direct relationship between the news announcement and the stock market reactions is much vaguer in our study than in Busse and Green's, as the scope of PHAS announcements are much broader and are not primarily economic. To test if our findings are a result of noise or actual changes in behavior at this specific time, we perform this robustness test.

Difference-in-differences is a statistical method through which you study the differential effect of a treatment on a treatment group compared to a control group (Angrist & Pischke, 2009). In our study, we compare the trading behavior of the current OMXS30 stocks in 2020 with the trading behavior of the same stocks in 2019. Within these two years, we also compare the trading behavior before the time of the press conferences with the time during and after the press conferences. Thus, the treatment is the time of PHAS's press conferences, the treatment group is the year 2020 and our control group is the year 2019, before the Covid-19 outbreak. As explained in the data section, we study the same trading days and the same stocks in 2019 with a few exceptions due to missing data. The difference-in-differences method includes a parallel trends assumption, which is an assumption that the year 2019 provides an appropriate counterfactual trend that the OMXS30 stocks in 2020 would have followed, if it were not for the Covid-19 press conferences. Without Covid-19 and the corresponding press conferences, we expect the trading behavior of the OMXS30 stocks to be parallel before and after 14.00 in 2019 and 2020. With Covid-19 we, however, expect the trading behavior to differ. We test for this differential effect through a difference-in-difference regression analysis. We create one dummy variable for the year, one dummy variable for the time of the press conference, and one difference-in-differences variable which is the product of the two dummy variables. We then run the regression on both dependent variables.

$DateDummy$ = 0 if 2019, 1 if 2020
$IntervalDummy$ = 0 if interval 1, 1 if interval 2-6
$DiD = DateDummy \times IntervalDummy$

$$R = \beta_0 + \beta_1 DateDummy + \beta_2 IntervalDummy + \beta_3 DiD + \varepsilon \quad \text{Reg. 3}$$

$$V = \beta_0 + \beta_1 DateDummy + \beta_2 IntervalDummy + \beta_3 DiD + \varepsilon \quad \text{Reg. 4}$$

6. Empirical Results

Table 4. Interval T-Test Results

Interval	Return	Volume
1	-0.00374%	5336
2	-0.00644%*	5354
3	0.00044%***	5264
4	-0.00020%***	6070**
5	0.00378%***	6938***
6	-0.00264%	5658

The table reports the average return and volume per minute before, during and after PHAS's press conferences. Return is calculated as percentage price change and volume is in absolute terms. The data covers 30 stocks and 36 trading days, composing 1080 observations in each interval. The Welch's two-tailed t-test is preformed by comparing each interval to interval 1.
*** p-value<0.01, ** p-value<0.05, * p-value<0.1

Table 4 shows the t-test results from measuring how stock return and trading volume in each consecutive interval is different from interval 1. When performing this test, all stocks and all days are included, without controlling for sentiment or industry. Starting with return, we see that stock returns decrease in anticipation to the press conference and continues to fall in the second interval when PHAS is presenting. This decrease is significant at the 10% significance level. The direction of the stock returns then changes back and forth throughout the continuation of the conference, but overall, it becomes larger. Intervals 3, 4 and 5 are all significant at the 1% level but in different directions. Across the entire press conference, the stock return is on average negative, however, not significantly different from interval 1. For volume, we only find significant values in interval 4 and 5, which is when PHAS and all other authorities have finished their presentations. The most significant result is in interval 5, that is after the entire press conference. This value is significant at 1%. Again, there is no significant difference when comparing the entire conference to the interval before the start of the event.

Table 5. Sentiment T-Test Results

	Neutral		Negative	
Interval	Return	Volume	Return	Volume
1	-0.00436%	4413	-0.00324%	6075
2	-0.00336%	4727	-0.00890%***	5856
3	-0.00469%	5036	0.00455%	5448
4	-0.00350%	5856***	0.00245%	6241
5	-0.00095%***	5490**	0.00757%	8096***
6	-0.00393%	5206**	-0.00161	6021

The table reports the average return and volume per minute before, during and after PHAS's press conferences. Return is calculated as percentage price change and volume is in absolute terms. The data covers 30 stocks and 36 trading days, of which 20 have a negative sentiment and 16 have a neutral sentiment. In total, the negative sentiment intervals composes 600 observations and the neutral sentiment intervals 480 observations. The Welch's t-tests is preformed by comparing each interval to interval 1. The tests on return are one-tailed and the tests on volume are two-tailed.
*** p-value<0.01, ** p-value<0.05, * p-value<0.1

Table 5 shows the results when dividing the conferences into subgroups based on sentiment. The one-tailed t-tests for the return and the two-tailed t-tests for volume tests if each consecutive interval is significantly different from the value in interval 1, prior to the conference. For negative sentiment, the test is constructed to assess if the values in intervals 2-6 are significantly lower than that in interval 1. For neutral sentiments, the tests measures if the values are significantly higher than return prior to the conference.

Return is negative across all intervals for the neutral sentiment and does not become significantly larger than interval 1 until after the press conference, in interval 5, where it is significant at the 1% level. We predicted stock return to increase in the neural sentiment. The results show that returns do not turn positive, but nevertheless, becomes less negative on average, and has the smallest negative value is interval 5. For negative sentiment, we note that returns in interval 2 are lower than in interval 1 at the 1% significance level. This result matches our hypothesis that returns would decrease following a negative announcement. However, returns then become positive, which was not anticipated.

For trading volume in the neutral sentiment, we note that the pattern is in line with our hypothesis. However, the values are significant first in interval 4, which is after PHAS and other agencies have spoken. During interval 4, trading volume is significantly higher at the 1% level, and in interval 5, volume is significantly higher at the 5% level. When looking at the whole conference in interval 6, we see that trading volume is significantly higher at the 5% level. There are no significant results for volume in the intervals during the press conference, for the negative sentiment. However, in interval 5, which is after the conference, the volume is significantly higher at the 1% level. This is partly aligned with our hypothesis, where we assumed that volume would increase both during and after the conference.

Table 6. Industry T-Test Results for Return

Interval	1	2	3	4	5	6
Automobiles and Parts	-0.00467%	-0.01843%	0.00063%	-0.00993%	0.00562%	-0.00679%
Banks	-0.00396%	-0.00607%	-0.00112%	0.00313%**	-0.00136%	-0.00088%
Basic Resources	-0.00470%	-0.00260%	0.00677%**	-0.00026%	0.00333%**	-0.00117%
Construction and Materials	-0.00334%	-0.00337%	0.00196%	-0.00333%	0.00467%**	-0.00316%
Consumer Products and Services	-0.00101%	0.00358%	-0.01095%	0.00237%	0.00108%	-0.00352%
Financial Services	-0.00441%	-0.00347%	0.00467%*	-0.00063%	0.00512%***	-0.00226%
Food, Beverage and Tobacco	-0.00421%	-0.00614%	0.00371%	0.00250%	0.00290%	0.00140%
Health Care	-0.00334%	-0.01256%	-0.00491%	0.00070%	0.00195%	-0.00480%
Industrial Goods and Services	-0.00388%	-0.00708%	0.00116%*	0.00153%**	0.00508%***	-0.00204%
Personal Care, Drug and Grocery Stores	-0.00339%	-0.01012%	-0.00705%	-0.00250%	0.00419%	-0.00474%
Retail	-0.00723%	-0.00422%	-0.00371%	0.00249%	0.00917%**	-0.00358%
Technology	-0.00106%	-0.00752%	0.01088%	-0.00265%	0.00722%	-0.00047%
Telecommunications	-0.00288%	-0.00637%	0.00118%	-0.00367%	0.00218%	-0.00324%
Travel and Leisure	-0.00259%	-0.01078%	-0.01112%	-0.00309%	0.01306%**	-0.01004%

The table reports the average return per minute for each industry before, during and after PHAS's press conferences. Return is calculated as percentage price change. In total, the data covers 30 stocks and 36 trading days, composing 1080 observations in each interval. For number of stocks within each industry, please see Descriptive Statistics. The Welch's two-tailed t-tests are preformed by comparing each interval to interval 1.
*** p-value<0.01, ** p-value<0.05, * p-value<0.1

Table 7. Industry T-Test Results for Volume

Interval	1	2	3	4	5	6
Automobiles and Parts	701	691	556	960*	1080***	787
Banks	10930	9863	9793	11899	13675**	10858
Basic Resources	3527	3693	3697	4156*	4622***	3932
Construction and Materials	3145	3417	3115	3162	3728	3209
Consumer Products and Services	2324	2206	1889	2313	2671	2189
Financial Services	2217	2040	2013	2391	2603	2193
Food, Beverage and Tobacco	1089	972	1104	1398	1392*	1136
Health Care	1747	2633	2105	2375**	2391**	2571*
Industrial Goods and Services	4055	3996	3974	4662	5165***	4296
Personal Care, Drug and Grocery Stores	2927	2868	2852	3064	3766*	2973
Retail	8592	9386	9213	10197	11400*	9656
Technology	1478	1250	1281	1518	1689	1370
Telecommunications	14842	15678	15656	17360	20711**	16211
Travel and Leisure	1551	1529	1529	2016*	1844	1758

The table reports the average volume per minute for each industry before, during and after PHAS's press conferences. Volume is presented in absolute terms. The data covers 30 stocks and 36 trading days in total, composing 1080 observations in each interval. For number of stocks within each industry, please see Descriptive Statistics. The Welch's two-tailed t-tests are preformed by comparing each interval to interval 1.
*** p-value<0.01, ** p-value<0.05, * p-value<0.1

In Table 6 and 7, we provide the results from the industry analysis. For the return tests, we hypothesized that "Industrial Goods and Services", "Automobiles and Parts" and "Retail" would have a significantly lower stock return in the intervals during and after the press conferences compared to the interval before. Our results show that all industries indeed have a negative stock return in interval 2, which is the first part of the press conference, and all industries except the "Food, Beverage and Tobacco" industry have a negative stock return in interval 6, which is the entire press conferences. However, none of these results are significant. All significant results are in interval 3, 4 or 5, with most significant results in interval 5, that is after the press conferences. Half of the industries have one or more significant results and among these are the "Industrial Goods and Services", and "Retail" industries. However, note that all significant results in the return test are for positive stock returns and not negative. This goes against our hypothesis. "Automobiles and Parts" did not have any significant results.

For the volume variable, significant results are observed toward the end of, and after, the conference. The majority of the significant results are found in interval 5 and no industry show significant results in intervals 2 and 3, indicating that trading volume does not increase when the agencies are presenting. This partly contradicts what was predicted but is consistent with our findings in the previous tests. Additionally, there are some industries that have no significant results at all, namely "Construction and Materials", "Consumer Products and Services", "Financial Services" and "Technology". In our hypothesis we explicitly predicted that "Health Care" would be the industry that experienced the most significant increase in trading volume, which also is what our results show. "Health Care" is significant in interval 4, 5 and 6 at the 5%, 5% and 10% level, respectively. The highest significance levels are found in interval 5 for the industries; "Industrial Goods and Services", "Automobiles and Parts" and "Basic Resources" where the volume increases at the 1% level for all three industries. All in all, we find very few indications that volume increases during the press conference. However, there are significant increases for the majority of the industries after the conference.

Table 8. Regression Results for Return

	Dependent Variable:				
	Return				
Interval	2	3	4	5	6
SVT viewers	-0.00002%	-0.00006%***	0.00006%***	0.00003%***	0.00002%**
	(0.00001%)	(0.00001%)	(0.00001%)	(0.00000%)	(0.00000%)
Cases Change	-0.00703%*	-0.00511%	-0.00100%	0.01481%***	-0.00236%
	(0.00387%)	(0.00384%)	(0.00311%)	(0.00254%)	(0.00193%)
Recommendations/ Restrictions - Up	-0.01521%***	-0.01020%***	-0.00213%	-0.00422%**	-0.00917%***
	(0.00287%)	(0.00286%)	(0.00231%)	(0.00188%)	(0.00143%)
Government Announcements - Yes	0.01145%***	-0.00563%**	-0.01119%***	0.00627%***	-0.00368%***
	(0.00271%)	(0.00270%)	(0.00218%)	(0.00178%)	(0.00135%)
Anders Tegnell - Yes	0.01653%***	0.01407%***	0.00011%	0.01032%***	0.00906%***
	(0.00271%)	(0.00269%)	(0.00218%)	(0.00178%)	(0.00135%)
Constant	-0.00659%	0.01974%***	-0.01469%***	-0.01455%***	-0.00658%**
	(0.00523%)	(0.00520%)	(0.00421%)	(0.00343%)	(0.00261%)
Observations	1050	1050	1050	1050	1050
R^2	0.07696	0.05095	0.08708	0.06359	0.13400
Adjusted R^2	0.07254	0.04641	0.08271	0.05911	0.12980

The table reports the regression results for interval 2-6, with average return per minute as dependent variable. Return is calculated as percentage price change. The data covers 30 stocks and 35 trading days, composing 1050 observations in each regression. One of the 36 trading days was omitted due to calculations of cases change. Standard errors are in parenthesis.
*** p-value<0.01, ** p-value<0.05, * p-value<0.1

Table 8 shows the results from the return regression. Starting with SVT viewers, we see that the direction of the coefficient is negative in the first two intervals, when the authorities are presenting, and then turns positive towards the end of the press conference. All intervals except interval 2 are significant. Results in intervals 3, 4 and 5 are significant at 1% and for interval 6, that is the entire press conference, we notice a positive significant correlation at the 5% level, which is contradicting to our hypothesis. We predicted negative correlations, which we only see significant results for in interval 3. Next is the variable for change in Covid-19 cases. In the part of the conference where the Covid-19 cases are presented, in interval 2, the coefficient is negative at the 10% level. For the continuation of the conference there are no significant results. After the conference, in interval 5, the change in cases shows a significant negative correlation with stock returns at the 1% level, which is in line with the findings by Al-Awadhi et al. (2020). The results of the variable for increases in recommendations and restrictions indicate a strong negative correlation with stock returns across all intervals except interval 4. When observing the entire conference in interval 6, this relationship holds true at the 1% level and is in line with our hypothesis. For the government variable, all intervals are significant at the 1% level, except for interval 3, which has a 5% significance level. However, the coefficients for this variable change direction throughout the press conference, but the conference as a whole has a negative correlation which is significant at 1%. Our hypothesis of a weak correlation between government announcements and interval returns meant that we expected to see an unsignificant correlation coefficient close to zero. However, since all intervals are significant at either 1% or 5%, this suggest that the coefficient is significantly

different from zero, which contradicts our hypothesis. Lastly, the dummy variable for Anders Tegnell is positively correlating with stock returns and all intervals except interval 4, are significant at 1%. This result is also in line with our prediction in hypothesis 6.

Worthy to note is that interval 4 has the fewest significant coefficients throughout the conference of all intervals. Here only the variable for SVT viewers and government announcements are significant. Furthermore, we observe that the R^2 is very low, meaning that the model covers only a small fraction of the variables necessary to explain the entire variation. This can be expected from the model that only includes five variables and aspires to explain a complex phenomenon like the stock market movements in times of crisis. However, the fact that the majority of the coefficients show significant coefficient tells us that the included variables add value in explaining at least some of the variation in stock returns. Lastly, we perform Breusch-Pagan tests for heteroscedasticity for all regressions on stock returns. The tests shows that we reject the null hypothesis of homoscedasticity in the error terms. Despite heteroscedasticity being a common issue for cross-sectional regressions due to the large variety with the cross-sectional data, this still imposes a limitation for our regression results (see Table 16 in Appendix) (Froot, 1989).

Table 9. Regression Results for Volume

	Dependent Variable:				
	Volume				
Interval	2	3	4	5	6
SVT viewers	-3	-4	-3	-9***	-4*
	(2)	(2)	(3)	(3)	(2)
Cases Change	2047***	866	725	2509***	958
	(719)	(731)	(779)	(937)	(701)
Recommendations/ Restrictions - Up	1751***	1604***	1788***	1975***	1657***
	(535)	(543)	(579)	(697)	(521)
Government Announcements - Yes	-281	-162	522	486	180
	(505)	(513)	(547)	(658)	(492)
Anders Tegnell - Yes	298	149	-138	816	12
	(504)	(512)	(545)	(656)	(491)
Constant	4935***	5559***	6007***	7616***	5835***
	(973)	(989)	(1054)	(1268)	(948)
Observations	1050	1050	1050	1050	1050
R^2	0.03820	0.02359	0.02405	0.04945	0.02907
Adjusted R^2	0.03360	0.01892	0.01938	0.04489	0.02442

The table reports the regression results for interval 2-6, with average trading volume per minute as dependent variable. Volume is presented in absolute terms. The data covers 30 stocks and 35 trading days, composing 1050 observations in each regression. One of the 36 trading days was omitted due to calculations of cases change. Standard errors are in parenthesis.
*** p-value<0.01, ** p-value<0.05, * p-value<0.1

In the volume regression, fewer coefficients are significant compared to the return regression. Table 9 presents the results for all variables in the regression. The dummy variables for government announcements and Anders Tegnell indicate no significant results, suggesting that these two does

not add value to the regression model for trading volume. For the remaining three variables, we do note some significant results. For number of SVT viewers, there is no significant correlation coefficient in the first three intervals of the conference. However, after the conference is over, there is a significant correlation with trading volume at the 1% level. Looking at interval 6, we also see a significant coefficient at 10%. The correlation coefficients are negative for this variable, indicating that trading volume is lower, when the number of viewers is high, which goes against our hypothesis that trading would increase when more people have watched the announcement. For change in Covid-19 cases, we observe highly significant positive correlations in the interval 2 and 5, suggesting that trading volume increases when the number of cases are disclosed as well as after the conference. This confirms our hypothesis that an increase in cases would negatively correlate with trading volume but is limited to interval 2 and 5. The variable with the strongest correlation is the recommendations and restrictions variable. All coefficients have positive correlation coefficients and are significant at the 1% level, suggesting that trading volume significantly increases when there are news restrictions or recommendations. This is completely in line with our hypothesis.

Once again, the R^2 low. This indicates that our model explains quite little of the total variation in trading volume. Furthermore, the dummy variables for government announcements and Anders Tegnell have no significant explanatory value. However, the other variables are significant which suggest that they are valuable additions to the model, even if the impact they pose is small in the context of the entire variation. Just like in the return regression, we perform Breusch-Pagan tests for heteroscedasticity. The results in these tests tell us that we cannot reject the null hypothesis of homoscedasticity in any interval except interval 5 (see Table 16 in Appendix). This suggests that heteroscedasticity is less of an issue for the volume regression.

Table 10. Difference-in-Differences Results for Return

	Dependent Variable:				
	Return				
Interval	2	3	4	5	6
Date Dummy	-0.00404%***	-0.00404%***	-0.00404%***	-0.00404%***	-0.00404%***
	(0.00117%)	(0.00114%)	(0.00100%)	(0.00085%)	(0.00075%)
Interval Dummy	0.00351%***	-0.00065%	0.00268%***	-0.00287%***	0.00199%**
	(0.00120%)	(0.00117%)	(0.00103%)	(0.00087%)	(0.00077%)
DiD	-0.00621%***	0.00484%***	0.00086%	0.01038%***	-0.00089%
	(0.00166%)	(0.00161%)	(0.00141%)	(0.00120%)	(0.00106%)
Constant	0.00030%	0.00030%	0.00030%	0.00030%	0.00030%
	(0.00085%)	(0.00083%)	(0.00073%)	(0.00062%)	(0.00055%)
Observations	4102	4102	4102	4102	4102
R^2	0.02120	0.00451	0.01110	0.02319	0.01911
Adjusted R^2	0.02048	0.00378	0.01038	0.02247	0.01840

The table reports the difference-in-differences regression results for interval 2-6, with average return per minute as the dependent variable. Return is calculated as percentage price change. The data covers 6480 observations in year 2020 and 5826 observations in year 2019, summing up to 12306 observaitons in total. Since only two intervals are compared in the regressions, the model include 4102 observations. Standard errors are in parenthesis.

*** p-value<0.01, ** p-value<0.05, * p-value<0.1

Table 11. Difference-in-Differences Results for Volume

	Dependent Variable:				
	Volume				
Interval	2	3	4	5	6
Date Dummy	1842***	1842***	1842***	1842***	1842***
	(293)	(291)	(291)	(321)	(279)
Interval Dummy	152	12	346	539	227
	(300)	(299)	(299)	(329)	(286)
DiD	-134	-83	388	1063**	95
	(414)	(411)	(412)	(454)	(395)
Constant	3495***	3495***	3495***	3495***	3495***
	(212)	(211)	(211)	(233)	(202)
Observations	4102	4102	4102	4102	4102
R^2	0.01769	0.01835	0.02519	0.03270	0.02237
Adjusted R^2	0.01697	0.01763	0.02447	0.03199	0.02165

The table reports the difference-in-differences regression results for interval 2-6, with average volume per minute as the dependent variable. Volume is presented in absolute terms. The data covers 6480 observations in year 2020 and 5826 observations in year 2019, summing up to 12306 observaitons in total. Since only two intervals are compared in the regressions, the model include 4102 observations. Standard errors are in parenthesis.

*** p-value<0.01, ** p-value<0.05, * p-value<0.1

We include the difference-in-differences test as a robustness test to see whether the results we have picked up from year 2020 are significantly different from what was seen in the previous year. The variable "Date Dummy" shows if there is an overall difference in returns/volume between 2020 and 2019, and the "Interval Dummy" shows if there is a difference in return/volume between interval 1 and the intervals after 14.00. The difference-in-differences method combines these two variables to see if the product of the differences is significant. If so, we can say that the trading behavior after 14.00 in 2020 develops differently from that of 2019, and thus the results from our tests do not only pick up noise, but is rather a unique finding.

For the test on return, we note that the DiD-variable is significant in intervals 2, 3, and 5. Going back to the primary results in table 4, we note that these are the same as in the difference-in-differences regression, which strengthens our findings that there is a significant difference in stock returns between 2019 and 2020 during the time of the press conference. We cannot expect to find a significant DiD-variable for the intervals that were not significant in our primary tests, which is also what we see in the difference-in-differences regression. For interval 4, the results differ from our primary findings. The return was significantly different from interval 1 at the 1% level in our t-tests, which the difference-in-differences regression does not support. In the primary t-test for trading volume, we saw significant increases in interval 4 and 5. We do not register any significant results for interval 4 in the DiD-variable, however, we note a significant result at the 5% level for interval 5. This strengthens our initial finding that trading volume increases after the press conference and indicates that these results are not merely noise that could also be found in the benchmark year of 2019.

7. Discussion

7.1 Analysis

Like presented in the results section, the findings from the first t-tests give somewhat mixed indications. We note that the tests that control for sentiment give a better idea of what is occurring with the return and volume. For the neutral sentiment we see that stock returns are continuously negative, but becomes less and less negative over time, and are significantly larger than the first interval in interval 5. This means that returns are gradually increasing for the neutral sentiment. For the negative sentiment, we observe a deep dip in returns in the immediate start of the conference, only to later turn positive in aa more stable manner. Interestingly, this finding is the precise opposite of what Busse and Green (2002) finds. In their study, they find that positive announcements are followed by an overreaction and spiking prices, while stock returns from negative sentiment slowly but steadily decreased. A reason for this difference could be because PHAS's announcements are generally negative, while the majority of observed announcements in Busse and Green were positive. Due to the characteristics of the announcement, as well as the overall sentiment in society at this time, one could assume that different expectations for the news exists. In the prospect theory, Kahneman and Tversky (1979) argues that people evaluate outcomes relative to a reference point before determining the relative gains and losses. Based on expectations, certain news can hence be perceived as positive, neutral, or negative, depending on what reference point the market participants have at the time. Therefore, one could explain the inverse results, compared to Busse and Green, as a result of different reference points. Market participants at the may at this time expect the news to be very bad, for example that more restrictions would come as many other countries at the time introduced such. However, when there was no clear indication that more restrictions were coming or the cases were not spiking (neutral sentiment), then based on the reference point, this was perceived as quite good, and the market reacted slowly, but steadily, upward. However, when negative news was presented, the market reacted quickly. The returns fell fast, but quickly recovered which is the equivalent but inverse pattern that Busse and Green found in their research. Additional explanations for the steep fall in return following negative news can be found in theories around herding behavior and mortality beliefs. As the perceived market risk and risk for one's own lives increases, market participants may move their assets from the stock market, leading returns to decrease (Heimer, Myrseth, & Schoenle, 2019; Puri & Robinson, 2007; Chiu, Chung, Ho, & Wu, 2018). As more market participants behave in this way, this further increases the perceived risk and return falls further and faster. Christie and Huang (1995) showed that people tend to forego one's own rationale and instead follow the behaviors of others. The drop comes early on during the conference, when PHAS discloses the information of confirmed cases and death rates. This result resembles the findings of Al-Awadhi et al. (2020) on the Chinese market. Which factor that plays the biggest role in causing the drop we cannot say, however, our results resemble findings in research on herding behavior, mortality beliefs, increasing perceptions of risk and pessimistic sentiment around crises, and one could hence argue that the market reactions to some extent can be attributed to these phenomena.

When moving on to the volume results, we find that volume only increases in the later part of the press conference. In our hypothesis we stated that we expected to see this pattern, but we also expected to notice an increase during the press conference, which is not the case. In the literature, researchers find that volume increases *after* the announcement (Cieslak, Morse, & Vissing-Jorgensen, 2019; Zhu, 2021; Rigobon & Sack, 2004). However, in this case, the event window is substantially longer that most events in previous literature, which is an important difference to note. Compared to the majority of previously studied announcements, the PHAS conferences have no distinct announcement, but rather a continuous flow of news. Despite our division of intervals, the time that should be defined as *after* can be quite diffuse. One could say that we in fact have three *afters*; after PHAS have spoken, after other agencies have spoken and

after the questionnaire. We can conclude that the increase in trading volume does not happen after PHAS, but first after other agencies has presented and after the questionnaire for the neutral sentiment. For negative sentiment, the increase happens only after the questionnaire. From this, we could conclude that the trading volume for neutral sentiment increases before the entire conference is finalized, indicating either that investors do not perceive the information from the questionnaire to add any additional value to trade on, or it could be the exact opposite, that the information of the questionnaire adds much valuable information to trade on. However, the fact that trading volume increases only after the questionnaire for the negative sentiment indicates that the investors collect all information during the conference and trades first after it has been finalized. With this line of reasoning, it would imply that investors do not expect more information of value to come during the questionnaire when the sentiment of the press conference has been neutral and no drastic information were disclosed in the previous sections.

In our industry return analysis, we found that all industries, except the "Food, Beverage and Tobacco" industry, has a negative stock return on average during the press conferences. While this is in line with our hypothesis and the results by Suneson (2020), these results are not significant. Instead, all significant results are for the positive stock returns, which is opposite to what we hypothesized. We believed that three industries would be more severely affected by the Covid-19 news than the other industries, based on the findings of Suneson. Two of these industries, namely "Industrial Goods and Services" and "Retail", did in fact have significant results, but again, these were positive and thus the opposite of what we expected. This unexpected result could be because Suneson simply disclosed which sectors faced the largest loss during the pandemic in general. He did not link the negative stock returns of these sectors to a specific event or a certain time of the day. Our studies are very different in that sense. The industries that we hypothesized would see a negative stock return might have had a negative stock return on average during the pandemic but saw a small increase at the time of the press conferences. This could indicate that the information being presented during the press conferences have a positive impact on these industries, in contrast to their general downward trend. The Swedish Covid-19 strategy stands out from many other countries' by having a greater focus on general public health and on the economy, with a "business as usual" approach. From a stock market perspective, this approach is probably a good thing for the Swedish companies (Bloomberg, 2020; Oxley, David, 2021; Reuters, 2020). Related to the discussion on the Swedish Covid-19 strategy is the prospect theory and the notion of reference dependence (Kahneman & Tversky, 1979). With many other countries introducing strict restrictions and even lockdowns where all non-essential businesses are being closed, one might assume that many expected Sweden to introduce similar measures, especially in the beginning of the pandemic when there was a lot of uncertainty. Having other countries and their Covid-19 strategies as a reference point, the press conferences by PHAS, during which the Swedish Covid-19 strategy is being laid out, becomes positive news for the Swedish companies. For example, when presenting fewer restrictions than expected, the press conferences by PHAS should become positive news for the "Retail" industry since people can continue visiting stores as they please. Therefore, it is reasonable that the stock return increases significantly for some industries during certain parts of the press conferences.

For the industry volume analysis, we get most significant results in interval 5, which is after the press conferences. As mentioned in the previous volume discussion on the sentiment results, this is both in line with our hypothesis and the literature on trading volume around news announcements. According to the previous research, trading volume should increase when the news are disclosed. This makes intuitive sense since one would want to trade on relevant information. Knowing that new information is going to be disclosed, one would postpone trading until that information has been published. However, what is interesting is that the "Health Care" industry starts to trade sooner than the other industries. The trading volume of the "Health Care" industry increases already in interval 4, which is after the authorities have presented, during the questionnaire. Consequently, the increase for the "Health Care" industry is also significant in

interval 6, which is the entire press conference. This result is consistent with our hypothesis and the findings by Donadelli et al. (2017) and Haroon and Rizvi (2020). While the news on Covid-19 assumably have widespread effects on many industries and parts of the society, the "Health Care" industry is undoubtedly in the center of this disease-related crisis and the information presented during the press conference has great implications for this industry. Consequently, the "Health Care" industry has a larger increase in trading activity both during and after the press conferences on Covid-19 than many other industries and reacts more quickly to the news.

For the return regression analysis, there are many significant results. For three of the five dependent variables, the return coefficient goes in opposite direction throughout the different intervals, which makes these results more difficult to interpret. The dummy variable for government announcements is one of them. However, while it is difficult to interpret this variable, we still feel it is worth discussing its significance. This variable is 1 if the Swedish government has held a press conference on Covid-19 six hours or less before the press conference of PHAS. We included this dummy since we believed that the most important information would already be disclosed if the Swedish government had just held a press conference. This should imply that the information is already incorporated into the prices and therefore there should be no, or only a small, reaction to PHAS's press conference, according to the EMH (Fama E. F., 1970). Hence, we hypothesized that the government announcement coefficient would be close to zero. However, the results show that all coefficients are significantly different from zero. Therefore, the return is affected during the press conferences by PHAS even though the Swedish government has disclosed similar information just a couple of hours before. One plausible explanation for this unexpected result is that PHAS present additional information that the government did not present during their press conference, which would be consistent with the EMH. Another explanation could be that the stock market reaction to PHAS press conferences is more emotional than rational. As discussed in section 2, the stock market can react strongly to sentiment caused by crises or chocking events without there being a change in underlying fundamental value. An example of this can be found in the study by Kaplanski and Levy (2010), where they find that aviation disasters increase the stock market volatility and lead to a significant drop in stock prices, without the disclosing of any new relevant information about fundamental value. Based on this, we could also assume the change in stock return to be an emotional reaction to the sentiment of the press conferences.

The two return regression variables with a constant direction are the recommendation/restriction variable and the Anders Tegnell variable. The dummy variable for new recommendations and restrictions has a negative coefficient in all intervals, meaning that the stock return decreases throughout the press conferences, during those days when new restrictions and/or recommendations are being presented. This is in line with what was hypothesized. The recommendations and restrictions have a clear societal and economic impact and an increase in these will have a negative impact on most companies. This does not have to be true for all businesses. Some businesses, for example online businesses, might thrive when new restrictions are introduced and more people spend all their time at home (Deloitte, 2020). However, the vast majority of the companies will probably not benefit from restrictions and recommendations and thus we see a negative correlation with stock return. The Anders Tegnell dummy variable had a positive coefficient in all intervals, meaning that Anders Tegnell has a positive impact on stock return. In the article by Busse and Green (2002) they found that a presenter who is perceived to have a greater ability to obtain relevant information has a positive impact on return. Being the State Epidemiologist of Sweden and an expert on communicable diseases, it can be assumed that Anders Tegnell, just like the presenter in the article by Busse and Green, is perceived as a trustworthy person with an ability to obtain more relevant information than other presenters (Svenska Dagbladet, 2020). Furthermore, we believe that he affects the stock return positively since he has a rather laid-back approach and is the personification of the Swedish Covid-19 strategy. By urging people to continue as usual, we believe that the many investors would perceive Anders Tegnell and the news that he is conveying in a positive manner (Bloomberg, 2020; Oxley, David, 2021; Reuters,

2020). Being a person to whom many turn for guidance and who deliver positive news, Anders Tegnell symbolizes stability in a time of crisis. This discussion can be linked to previous studies on mortality beliefs, which suggest that optimism and pessimism have a large impact on investment decisions (Puri & Robinson, 2007). By addressing the pandemic in the way that he does, it is possible that Anders Tegnell contributes to a reduced level of uncertainty and perceived risk, and thus a decreased pessimism.

The regression results for volume are less significant than for return, similar to what we found for the t-tests. SVT viewers, change in cases and new recommendations/ restrictions are the three variables with a one or many significant results. Once again, the most significant results are found for the recommendations/restrictions variable, where the results are significant in all intervals. This implies that during the days when new recommendations and restrictions are being presented, the volume is positively affected in all intervals. Just as with the regression analysis for return, this can be linked to the fact that recommendations and restrictions have an obvious societal and economic impact. The variable for changes in number of cases affect volume in interval 2, which is when information about cases is being presented, and in interval 5, which is after the press conference. The information about number of cases does not have the same direct impact on society and the stock market as new recommendations/restrictions. However, the change in cases will most likely affect the policy making and therefore has indirect societal and economic implications. With a large increase in the number of cases, one can probably expect more restrictions in the future. Furthermore, the information on number of cases will also affect the perceived uncertainty and risk of the virus, and one's mortality beliefs. With more people becoming seriously ill in Covid-19, people might re-evaluate their own mortality (Heimer, Myrseth, & Schoenle, 2019; Puri & Robinson, 2007). Thus, the trading volume is likely to increase when the number of cases increases.

Table 12. Hypotheses Results

Hypothesis	1	2	3	4	5	6
Result	Partly	Confirmed	Rejected	Confirmed	Partly	Partly

The table summarizes whether the hypotheses were rejected, confirmed or partly confirmed.

7.2 Limitations

There are some apparent challenges with the study-environment as a whole. Despite performing a difference-in-differences robustness test, it is difficult to completely isolate the effects to the press conferences. Countries, societies, and stock markets are in an unstable state during this time and much uncertainty prevails in general. One must therefore be aware that our significant results may also be a caused by the many fluctuations in the stock market all together. The benchmark of 2019 tells us that we do not pick up any noise that were to exist in a more stable time. However, the comparability between the years 2019 and 2020 is certainly debatable, as we do not control for other events occurring at these times. This could impact our findings, and one could hence question if 2019 provides an appropriate counterfactual trend. Thus worth noting is that the flow of information at this time is problematic. Like mentioned in the data section, the ideal environment would be one where no other information about the topic was available. Then we could isolate the effects to this specific event. The reality is different. News flow at incredible speed across many different platforms, which both decreases the news value of the information presented during the press conference and makes it more difficult to isolate the effects. Furthermore, as the conferences are held every 24 hours, it makes the risk of information drift more prevalent and again makes the pure news value questionable and causes difficulties in isolating the effects to the specific event. Despite the results being significant in many different tests and in our robustness checks, these are still important limitations to keep in mind.

There are decisions made regarding the method that also causes some limitations to our study. The study is limited to the OMXS30 as these stocks have the largest total turnover on the Swedish stock market. However, this can potentially give a skewed perspective of the stock market in its entirety, as we do not include the impact on mid and small cap stocks in our analysis. Hence, we cannot extrapolate the result onto the whole market. Lastly, in addition to the sentiment analysis being a subjective estimation, it is important to note that the analysis also has been constructed months after the actual events. Despite our efforts to debias the process of this analysis, the ideal would be to conduct a widespread survey of the perceived sentiment among viewers right after watching the press conference.

Lastly, like mentioned in the results, the R^2 in our regression analyses were low. This means that our model is far from exhaustive. In this complex setting, many factors play a role in explaining the return and volume, and our model captures only few of them. Nevertheless, the variables included in the model are for the most part significant, implying that they add value to the model, even if the effect size is rather small. Additionally, the tests for heteroscedasticity among the error terms in our regressions tell us that heteroscedasticity is a prevalent issue, especially for the return regressions. Nevertheless, heteroscedasticity is a common problem in cross-sectional regressions as the data often has very large variations, and hence this was somewhat expected. However, it shows a clear limitation to our regression results.

8. Concluding Remarks

8.1 Conclusion

The early stages of the Covid-19 pandemic brought high levels of uncertainty and fear into our societies. The rapid spread of the virus and the lack of knowledge regarding its contagiousness and lethal consequences led many counties to introduce strict restrictions and lockdowns in desperate attempts to stop the virus. As a result, the economy faced the worst recession since the Great Depression and stock markets dropped rapidly in the first months of 2020. Hence, the Covid-19 crisis imposes an interesting and important new area of economic research from which there is much to learn. In this study we investigate if and how the Swedish stock market reacted to early news about the virus. More specifically, we study the stock returns and trading volume of the OMXS30 around the time of the daily press conferences held by PHAS. Additionally, we include a sentiment and industry analysis for more insights. We also include a regression analysis to test the correlation between a selection of independent variables and the return and volume variable respectively. With few previous studies on the topic, we base our research on literature covering news announcement and incorporate findings from studies on trading behavior in times of crisis.

We find significant results for both changes in returns over the course of the conference, and increases in volume after the press conference. These findings are confirmed by our robustness test, giving us more confidence that the press conferences actually play an important role in explaining the changes in returns and volume increases found in this specific time. The sentiment analysis gives a more nuanced picture of how the trading is influenced by the overall sentiment in the press conferences. We find that stock returns significantly drop initially, and then quickly bounces back when the sentiment is negative. During neutral press conferences, stock returns develop slowly and becomes less and less negative over the course of the press conference. These relationships are the inverse of what Busse and Green find in the benchmark study. In all conferences, trading volume significantly increases at the end, after all agencies have spoken.

When controlling for industries, we expected retail and industrial firms to experience the largest decreases in stock return. Our results show the opposite. All significant results in the return test, imply that returns increase for the stocks in theses industries. The finding suggests that the renowned Swedish Covid-19 strategy has been beneficial for some Swedish stocks. As many

societies close down, PHAS has recommended a responsible "business as usual" strategy, which potentially gives Swedish firms a better chance of surviving the crisis (Bloomberg, 2020; Oxley, David, 2021; Reuters, 2020). Furthermore, the "Health Care" industry has the most significant results among all industries in the volume study, indicating that this particular industry is at the center if this crisis and that investors perceive the information disclosed to have important implications for this industry.

The regression results for volume show some significant results. The most significant results are found for the recommendations/restrictions variable, where the volume has a positive coefficient throughout the entire press conference. This implies that the volume is being positively affected when new recommendations and/or restrictions is being presented. This can be linked to the clear societal and economic effect of the recommendations and restrictions. The regression results for return show many significant results. In this analysis, the recommendation/restriction variable negatively correlates with return. Once again, this variable has a clear societal and economic impact and an increase in these will have a negative impact on most companies. Another very significant variable is the Anders Tegnell variable, which has a significant positive correlation with stock return. This implies that Anders Tegnell, the State Epidemiologist of Sweden, symbolized stability in a time of crisis. As an expert on Covid-19 and as the personification of the Swedish Covid-19 strategy, he contributes to a stability and reassurance (Svenska Dagbladet, 2020). Lastly, the government announcement variable indicates that the press conferences by PHAS still have an impact on trading activity, although the Swedish government has just held a press conference on the same topic. This means that most information is already disclosed, but we still see a stock market reaction. This goes against EMH and we instead relate our finding to literature within behavioral finance. Our results resemble findings in research on herding behavior, mortality beliefs, increasing perceptions of risk and pessimistic sentiment around crises, and one could hence argue that the market reactions to some extent can be attributed to these phenomena.

To conclude, this study finds that in times of much uncertainly and incredibly high flows of information, people require legitimate information sources to rely on. Our results suggest that investors attribute much value to the press conferences, despite much of the information already being disclosed, implying that sentiment among investors plays an important role in explaining the trading behavior at this time.

8.2 Future Research

Covid-19 is a new and consequently largely unexplored area and more research on the topic is needed. While the crisis is primarily a global health crisis, it has created the worst economic recession since the Great Depression in 1929 (International Monetary Fund, 2020). It is therefore of great interest to understand the market behaviors during the pandemic, and its implications. For future research within the field of Covid-19 and trading activity, we believe that it will be important to obtain a larger data set where more stocks and more trading days are included. This will be important in order to obtain more significant results and to validate the results of this study. A more detailed analysis should not only include more companies but to also include more industries. As previously discussed, we believe that our study is lacking due to the few observations within each industry and because of the few of industries. Due to the nature of the Covid-19 crisis, one would expect different industries to be affected in different ways, and thus a more extensive industry analysis would be useful. Additionally, it would be interesting to study a different part of the crisis. We chose to analyze the first wave since the uncertainty regarding the virus was the largest in the beginning of the pandemic, and thus we believed that the effect on the stock market would be the most prevalent in this period. However, it could also be interesting to see how the stock market has behaved as the pandemic has progressed, perhaps by also studying the second wave or the time of the vaccination process. Furthermore, future research could focus on different type of Covid-19 news, preferably announcements. While the daily press conferences by PHAS

were an interesting and new phenomenon to study, a more traditional event study of specific announcements could contribute with other important findings. Lastly, our first t-tests results indicated that the stock return seemed to be somewhat fluctuating during the press conferences. Therefore, it would be interesting to include not only return and volume, but also volatility, in future studies in Covid-19.

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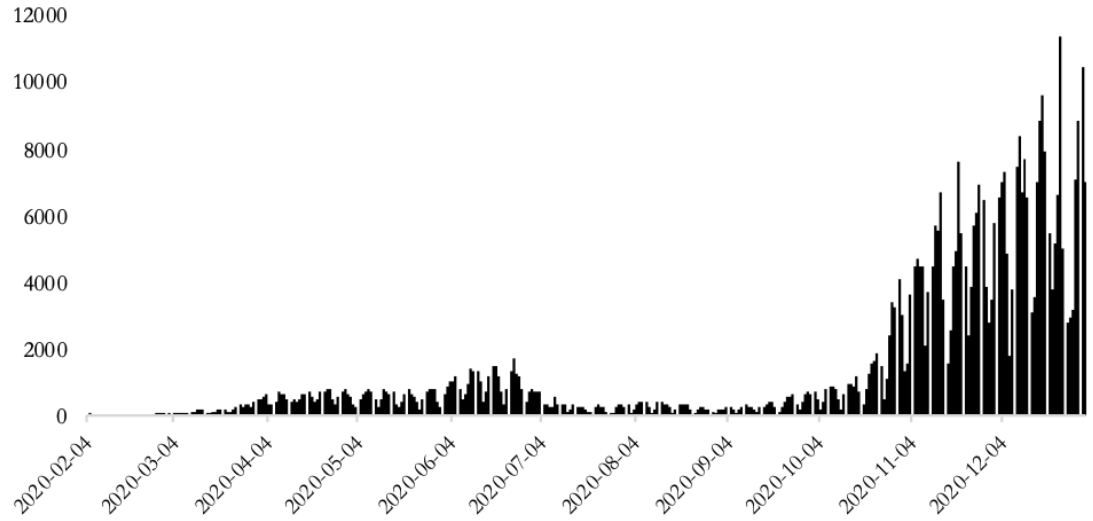
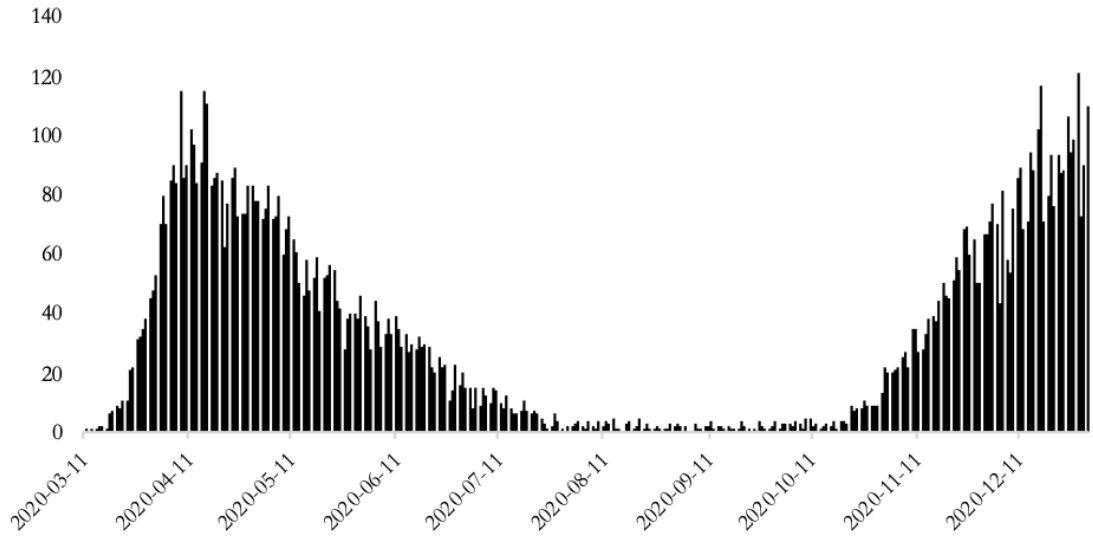
Appendix

Graph 3. Number of Covid-19 Cases



The graph reports the number of Covid-19 cases in Sweden each day of 2020.

Graph 4. Number of Covid-19 Deaths



The graph reports the number of Covid-19 deaths in Sweden each day of 2020.

Table 13. OMX30 Companies

Company	ISIN	Sector
ABB Ltd	CH0012221716	Industrial Goods and Services
Alfa Laval	SE0000695876	Industrial Goods and Services
ASSA ABLOY B	SE0007100581	Construction and Materials
AstraZeneca	GB0009895292	Health Care
Atlas Copco A	SE0011166610	Industrial Goods and Services
Atlas Copco B	SE0011166628	Industrial Goods and Services
Autoliv SDB	SE0000382335	Automobiles and Parts
Boliden	SE0012455673	Basic Resources
Electrolux B	SE0000103814	Consumer Products and Services
Ericsson B	SE0000108656	Telecommunications
Essity B	SE0009922164	Personal Care, Drug and Grocery Stores
Evolution Gaming Group	SE0012673267	Travel and Leisure
Getinge B	SE0000202624	Health Care
Hennes & Mauritz B	SE0000106270	Retail
Hexagon B	SE0000103699	Technology
Investor B	SE0000107419	Financial Services
Kinnevik B	SE0013256682	Financial Services
Nordea Bank Abp	FI4000297767	Banks
Sandvik	SE0000667891	Industrial Goods and Services
SCA B	SE0000112724	Basic Resources
SEB A	SE0000148884	Banks
Securitas B	SE0000163594	Industrial Goods and Services
Skanska B	SE0000113250	Construction and Materials
SKF B	SE0000108227	Basic Resources
Svenska Handelsbanken A	SE0007100599	Banks
Swedbank A	SE0000242455	Banks
Swedish Match	SE0000310336	Food, Beverage and Tobacco
Tele2 B	SE0005190238	Telecommunications
Telia Company	SE0000667925	Telecommunications
Volvo B	SE0000115446	Industrial Goods and Services

The table reports the OMX30 companies as of February 2021. All companies have been used in the 2020 data set. Evolution Gaming Group, Kinnevik B and Boliden was not included in the 2019 data set.

Table 14. Press Conferences

Date	End of PHAS	End of Agencies	End of Questionnaire	Time Total
2020-03-06	14.10	14.18	14.21	21min
2020-03-09	14.06	14.15	14.24	24min
2020-03-10	14.10	14.19	14.30	30min
2020-03-11	14.07	14.10	14.31	31min
2020-03-12	14.08	14.14	14.21	21min
2020-03-13	14.16	14.36	14.52	52min
2020-03-16	14.09	14.17	14.33	33min
2020-03-17	14.06	14.23	14.37	37min
2020-03-18	14.09	14.18	14.35	35min
2020-03-19	14.09	14.18	14.28	28min
2020-03-20	14.16	14.28	14.47	47min
2020-03-23	14.09	14.28	14.40	40min
2020-03-24	14.08	14.19	14.38	38min
2020-03-25	14.07	14.13	14.33	33min
2020-03-26	14.06	14.20	14.47	47min
2020-03-27	14.07	14.15	14.28	28min
2020-03-30	14.07	14.24	14.37	37min
2020-03-31	14.05	14.18	14.29	29min
2020-04-01	14.17	14.28	14.45	45min
2020-04-02	14.08	14.18	14.34	34min
2020-04-03	14.04	14.18	14.39	39min
2020-04-06	14.09	14.19	14.31	31min
2020-04-07	14.05	14.27	14.49	49min
2020-04-08	14.09	14.18	14.37	37min
2020-04-14	14.06	14.09	14.36	36min
2020-04-15	14.05	14.16	14.30	30min
2020-04-16	14.09	14.18	14.34	34min
2020-04-17	14.09	14.23	14.58	58min
2020-04-20	15.06	14.17	14.29	29min
2020-04-21	14.07	14.13	14.40	40min
2020-04-22	14.04	14.08	14.40	40min
2020-04-23	14.08	14.17	14.36	36min
2020-04-24	14.08	14.18	14.30	30min
2020-04-27	14.03	14.14	14.38	38min
2020-04-28	14.05	14.13	14.32	32min
2020-04-29	14.06	14.19	14.34	34min

The table reports the dates and times of all studied press conferences.

Table 15. Press Conferences Extended Data

Date	Sentiment	SVT viewers (1000)	Cases Change	Recommendations /Restrictions	Governement announcement	Anders Tegnell
2020-03-06	Negative	45	-	Up	No	Yes
2020-03-09	Negative	73	2.3562	Up	No	No
2020-03-10	Negative	132	0.3306	Up	No	No
2020-03-11	Negative	136	0.4141	Up	Yes	Yes
2020-03-12	Negative	195	0.3449	Up	No	Yes
2020-03-13	Neutral	211	0.2177	Up	No	No
2020-03-16	Negative	190	0.4026	Up	Yes	Yes
2020-03-17	Negative	159	0.1020	Up	Yes	Yes
2020-03-18	Negative	417	0.0960	Stable	Yes	Yes
2020-03-19	Negative	271	0.1126	Up	Yes	Yes
2020-03-20	Neutral	293	0.0914	Up	Yes	No
2020-03-23	Neutral	292	0.2981	Up	Yes	Yes
2020-03-24	Neutral	250	0.1270	Up	Yes	No
2020-03-25	Neutral	288	0.1048	Stable	No	No
2020-03-26	Negative	360	0.1179	Stable	No	Yes
2020-03-27	Negative	541	0.0855	Up	Yes	Yes
2020-03-30	Neutral	385	0.3224	Stable	No	Yes
2020-03-31	Negative	419	0.1010	Up	Yes	No
2020-04-01	Negative	376	0.1154	Up	Yes	Yes
2020-04-02	Negative	445	0.1047	Stable	Yes	Yes
2020-04-03	Neutral	494	0.1122	Stable	No	No
2020-04-06	Negative	385	0.1856	Up	No	Yes
2020-04-07	Neutral	387	0.0676	Up	No	Yes
2020-04-08	Negative	257	0.0944	Stable	No	Yes
2020-04-14	Neutral	457	0.2521	Stable	No	Yes
2020-04-15	Neutral	122	0.0421	Stable	Yes	No
2020-04-16	Neutral	366	0.0514	Up	No	Yes
2020-04-17	Neutral	387	0.0539	Stable	Yes	No
2020-04-20	Neutral	375	0.1181	Stable	No	Yes
2020-04-21	Neutral	273	0.0369	Stable	No	No
2020-04-22	Negative	330	0.0445	Stable	No	Yes
2020-04-23	Negative	332	0.0469	Stable	No	No
2020-04-24	Negative	192	0.0485	Stable	Yes	Yes
2020-04-27	Neutral	422	0.0774	Stable	Yes	No
2020-04-28	Neutral	423	0.0367	Stable	No	Yes
2020-04-29	Negative	377	0.0347	Stable	No	Yes

The table reports extended data on all studied press conferences.

Table 16. Heteroscedasticity Results

Interval	2	3	4	5	6
Return	13.225**	22.678***	41.429***	24.447***	31.463***
Volume	6.511	4.607	6.825	16.114***	5.999

The table reports the Breusch-Pagan heteroscedasticity results for all regressions. Significant results indicate that we reject the null hypothesis of homoscedasticity. *** p-value<0.01, ** p-value<0.05, * p-value<0.1