Haaga-Helia
University of Applied Sciences

Investor Behaviour During COVID-19 Crisis in Finnish Stock Market

Joonas Hyvönen

Bachelor's Thesis
Degree Programme in
International Business
2021

Haaga-Helia
University of Applied Sciences

Abstract

20.5.2021

Author(s)
Joonas Hyvönen

Degree programme
International Business

Thesis title
Investor behaviour during COVID-19 crisis in Finnish stock market

Number of pages and attachment pages
47 + 4

The COVID-19 crisis has been an unprecedented event, with an unprecedented impact on economies around the world, financial markets internationally and investor sentiment globally. The crisis is still surrounded by many unknowns. This thesis sought to investigate how the COVID-19 crisis affected investor behaviour in the Finnish stock market in order for investors, decisionmakers and other stakeholders to better understand the influence and consequences of investor behaviour in time of such crisis on financial markets and beyond.

The thesis aims to answer the question by approaching the problem from macro-economic, statistical and behavioural perspectives. The timespan researched was demarcated as the first half of the year 2020, and as such, focuses on the first wave of COVID-19 crisis. The research was three part: First, a descriptive study was conducted on the macro-economic consequences of the crisis in Finland, to better understand how the economic shock affected the stock market. Second, a statistical analysis was performed on the OMX Helsinki 25 index development and trend indicator of output to observe causality between them to understand the shock's possible effect. On OMX Helsinki 25 index, a further analysis for historical volatility was performed. Thirdly, a final descriptive study combining earlier results, with a timeline of significant news entering the market and CBOE Volatility Index was performed, and then reflected on established theory on investor behaviour.

The results of the study were, in a corresponding order that: COVID-19 presented an unprecedented multi-faceted shock on Finnish economy, disturbing flow of income by both medical and economic consequences, and by affecting the expectations of both consumers and industries. These effects exhibited simultaneously characteristics of both supply and demand shock, with a measurable and clear negative shock observable on Finnish trend indicator of output. The economic shock did not however seem to extend to stock market. On the contrary, it seems that the stock market developments anticipated the economic consequences of the crisis, as implied by the unprecedented level of uncertainty, and the plummeting OMX Helsinki 25. This thesis argued that the unprecedented uncertainty on financial markets possibly amplified the investor reaction to news entering the market, by intensifying the effect of herding, and different cognitive and emotional biases, obstructing rational investment decision-making process.

In conclusion, the COVID-19 crisis did not affect investor behaviour through the economic shock mechanism. Rather, investors anticipated the possible economic consequences of the crisis, generating a global uncertainty shock that influenced financial markets worldwide, worsening investor sentiment and skyrocketing market volatility.

Keywords
COVID-19, Economic Shock ,Behavioural Finance,

Table of contents

1 Introduction

This is a research type bachelor's thesis for the Degree Programme in International Business in the major specialisation of Financial Management at Haaga-Helia University of Applied Sciences.

This chapter aims to introduce the content of this thesis. Firstly, this chapter explains the background for this topic, as well as for the benefits of the research on the topic for the stakeholders of this thesis. Secondly, the research question (RQ) of this thesis is established and followed by the three investigative questions (IQs) that form the structure of this research. Thirdly, the demarcation of this thesis is disclosed in detail. Fourth, a mini dictionary is provided for the relevant keywords for this thesis. Finally, a risk analysis on the thesis process closes the chapter.

1.1 Background

The COVID-19 is a truly global crisis with potentially devastating worldwide political, economic and social effects (United Nations Development Programme 2020). The crisis has a severe effect on the world economy. The pandemic and the regulations issued by governments around the world in efforts to slow the progress of the pandemic, are stalling economies and driving the world towards global recession (Carlsson-Szlezak, Reeves & Swartz 2020b). Naturally, this crisis has had its effect on the Finnish economy, and more specifically the Finnish stock market. This thesis aims to research how this crisis and its effects have affected the investor behaviour on the Finnish stock market. Investor behaviour is an interesting viewpoint as all the effects of the crisis cannot be explained by just economical models, as those models are bound by the assumption of rational behaviour of the investors, while this is rarely observed in real life.

Understanding investor behaviour better in crisis conditions such as COVID-19 crisis would naturally be beneficial for both private and professional investors and would help them to make more accurate decisions in the future, by both understanding the investment decisions of others as well as their own better.

For the author of this thesis, researching the phenomenon is an invaluable opportunity to utilise all the skills learned so far during his studies, as well as to develop new skills and theoretical knowledge necessary for the research.

1.2 Research Question

This thesis aims to improve the understanding of the investor behaviour in the Finnish stock market during the COVID-19 crisis. The outcome of this thesis will be a study on how the investor behaviour can be explained. This study can be used by financial professionals as well as by private investors to better understand investor behaviour in similar crises.

The research question (RQ) can be worded as: how did the COVID-19 crisis affect investor behaviour in the Finnish stock market?

RQ is divided into investigative questions (IQ) as follows:

IQ 1. What kind of COVID-19 related external shocks affected Finnish financial market from an economic point of view?
IQ 2. How did these shocks affect the stocks listed in Nasdaq Helsinki during January to June 2020?
IQ 3. How can the investor behaviour be explained from the point of view of behavioural finance?

Table 1 below presents the theoretical framework, research methods and results chapters for each investigative question.

Table 1. Overlay matrix

Investigative question	Theoretical Framework	Research Methods	Results (chapter)
IQ 1. What kind of COVID-19 related external shocks affected Finnish financial market from an economic point of view?	Novel research on the macro-economic consequences of COVID-19 crisis.	Desktop research	4.1
IQ 2. How did these shocks affect the stocks listed in Nasdaq Helsinki during January to June 2020?	Novel research on how COVID-19 crisis has affected the financial market.	Quantitative research	4.2
IQ 3. How can the investor behaviour be explained from the point of view of behavioural finance?	Well-established theory on behavioural finance	Desktop research	4.3

1.3 Demarcation

This thesis will focus on the investor behaviour from the financial, economic and behavioural point of view. The external shocks related to COVID-19 crisis are researched only from the economic point of view, and the research is based solely on established theories. The research on the developments on the Finnish stock market will focus on the time span between January and June 2020. Estimations of future developments are excluded from this thesis in order for the thesis to remain objective and factual. The investor behaviour is researched purely from the point of view of behavioural finance, and all results are based firmly on established theories on the subject.

1.4 International Aspect

This thesis is inherently international as it is focused on a truly global crisis, and the external effects of that crisis on the Finnish stock market, and how those effects reflect on the investor behaviour. Further, even though this thesis is demarcated to Finnish stock market, the companies are public and the investor base international.

1.5 Benefits for Stakeholders

This thesis is beneficial to the field of business administration, as it aims to improve understanding on the behaviour of investors in the Finnish stock market during the COVID-19 crisis. The results of this thesis can be useful in estimating the future effects of global crises on the stock market. Additionally, this can help investors and professionals in finance to better understand their own behaviour during COVID-19 or similar crisis.

This thesis is beneficial for me as a developing professional, as it will deepen my understanding on stock markets and investor behaviour, as well as the effect of COVID-19 on the Finnish stock market.

1.6 Key Concepts

COVID-19: is a novel virus that has caused a global pandemic. The infectious disease COVID-19 originates from Wuhan, China. Common symptoms for the virus are dry cough, fever and tiredness with around fifth of the afflicted succumbing to more serious symptoms such as breathing difficulties. (WHO 2020.)

Economic Shock: is an event that has unexpected and major impact on economy. Economic shocks are caused by external forces that cannot be predicted (Constable 2019).

Behavioural Finance: studies the effect of psychological biases on financial decision making. Traditional finance sees investors as rational decision makers, while behavioural finance acknowledges that investors do not always act rationally in their decision making, and as such the field studies the range of psychological biases that might affect the decision-making process of an investor. (Vanguard 2013.)

1.7 Risk Analysis

Due to the ongoing nature of the crisis, big sudden developments in the situation might pose a challenge, as they could lead to a complete re-research and rewrite of some sections. This risk can be managed by demarcation of the timespan researched, timely scheduling and by committing for a schedule of consistent timely research.

Motivation risk is naturally present during the writing process of a thesis as is the risk of falling behind schedule. These risks can be managed by project management, scheduling work and creating clear sub-goals along the process.

Risk of scope is an important one to manage in a thesis like this and it is related to both time and motivation risk. It can be managed by careful demarcation and a clear research process.

2 How the COVID-19 crisis shocks the economy and the financial market

The theoretical framework can be though as an iceberg that highlights how the investor behaviour drives the market reaction. Further, it helps visualise the increasing obscurity as the thesis moves from describing the observable economic shocks of COVID-19, to estimating the financial market response, and how that response relates to those shocks. Finally, the thesis aims to understand the investor behaviour that similar to the bottom of the iceberg, cannot be observed, and how it might have influenced said market reaction.

Iceberg diagram of the COVID-19 effect on investor behaviour

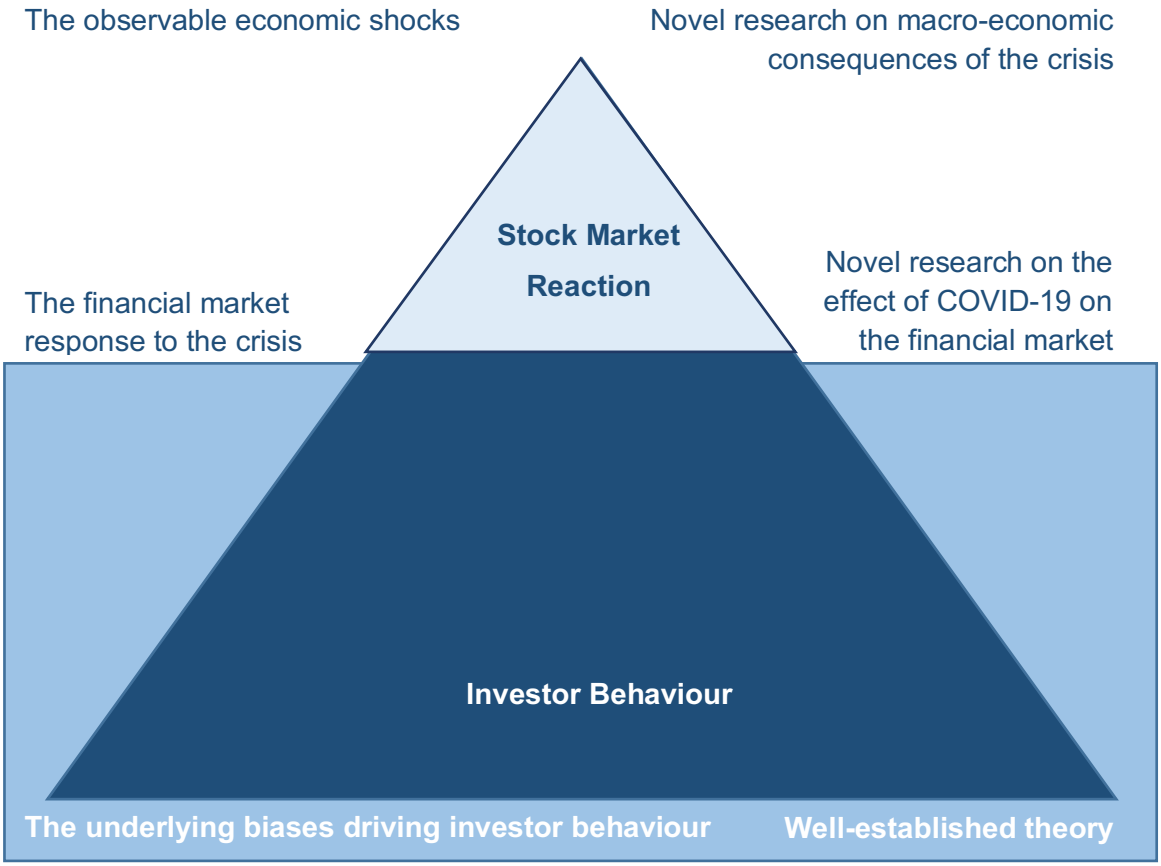

Figure 1. Iceberg diagram of the COVID-19 effect on investor behaviour

The diagram represents the central logic of this thesis. As the underlying investor behaviour cannot be measured or observed directly, the thesis takes a top-down approach. Moving from the visible and observable to the obscure. This is mirrored by the theoretical framework. The economic shocks are described by novel research on the COVID-19 crisis, but as the framework moves further down the diagram, this thesis relies increasingly on well-established theory, and how it reflects on the current situation.

2.1 How the crisis induced shocks affect the economy

To understand how the COVID-19 might affect investor behaviour, the nature and characteristics of the economic effects of the crisis must be understood. The COVID-19 crisis has had an enormous and unprecedented impact on the global economy. Due to the novelty and ongoing nature of the pandemic, research on the economic effects of the crisis is sparse. The appliable theoretical research cited in this thesis is predominately of American and European origin. The main contributors of timely research on the subject are the London based Centre for Economic Policy Research (CEPR) and the National Bureau of Economic Research (NBER) based in Cambridge, Massachusetts.

2.1.1 Observing the economic effects of the pandemic through shock geometry

Carlsson-Szlezak, Reeves & Swartz from Boston Consulting Group, in their article published by Harvard Business Review suggest that a good starting point for assessing the economic effects of the COVID-19 crisis is to observe the historical development of a given economy's supply output, and especially the shape of the output when visualised as a timeseries on a line chart. This is called shock geometry. Major disruptive crises such as COVID-19 can be observed as three different possible shapes: the V-shape, the U-shape and the L-shape. The shapes describe the severity of the impact attributed to the shock, and the path to recovery. V-shape implies the although the shock impacted the supply output, it recovered back to its original growth soon after, a desirable outcome as it implies the smallest loss of supply of the three. The U-shape implies that the production recovered back to its original growth path, but with a delay, causing irrecoverable loss of output. While the worst scenario, the L-shape, means that the production fails to recover, implying that the shock has caused permanent structural damage on the given country's supply output. (Carlsson-Szlezak & al. 2020b.)

The shock's intensity might vary, but these basic shapes provide valuable insight into the very real economic effects the shock might have. The authors argue that the greater the damage on supply output, the more the shock disrupts capital formation of national economy. This might lead to disrupted credit intermediation and stagnation or even decline of growth in capital stock. These effects hamper the recovery from the shock, which translates to a flatter and widening shock geometry curve, turning V-shape to a U-shape and so forth. In real economy this means workers exiting workforce, lost productivity and skills. And as such, the shock can become structural, causing irreversible damage on the country's ability to produce. (Carlsson-Szlezak & al. 2020b.)

Utilising shock geometry, rough estimates can be made on the shock's short- and long-term economic effects, but it does offer a highly simplistic view, as it considers only one variable, or facet of the complex phenomenon. The authors agree as well that, this is the traditional way how economic shocks work, damaging the production, or supply side of the economy, while COVID-19 is an unprecedented crisis with multiple unknowable aspects. (Carlsson-Szlezak & al. 2020b.)

2.1.2 The unprecedented nature of the crisis

While observing the supply side of the economy offers a logical starting point estimating the effects of the novel crisis on economy, other authors question the validity of such estimates. Bofinger & al. argue that as an unprecedented crisis, COVID-19 should not be compared to financial crises that have preceded it, as COVID-19 is far more complex due to it presenting simultaneously characteristics of both supply and demand shock. (Bofinger, Dullien, Felbermayr, Fuest, Hüther, Südekum & Weder di Mauro 2020, 170.) Similarly, Carlsson-Szlezak & al later expanded their shock geometry-based estimates by incorporating the assumption of a more complex crisis exhibiting both signs of supply- and demand shock to their subsequent article (Carlsson-Szlezak, Reeves & Swartz 2020a.) The developing crisis proved these expectations largely correct. According to economist Gita Gopinath the economic impact of the pandemic is clear on the countries affected and both supply and demand shocks can be attributed to the pandemic (Gopinath 2020, 41).

In their later article Carlsson-Szlezak, Reeves & Swartz argue that the crisis might affect the supply and demand side of the economy simultaneously by firstly, the supply side of the economy being struck by the crisis: shutting down production and supply chains, possibly leading to bigger problems such as: halted production, furloughs and layoffs. And secondly, the demand side of the economy being affected by both direct and in-direct hit on customer confidence. (Carlsson-Szlezak & al. 2020a.) As the crisis progressed Gopinath offered a more specific view on the mechanics of these shocks. She argues that on the supply side the COVID-19 crisis has the ability to disrupt businesses by: directly and indirectly reducing the available workforce, reducing the utilisation rate of the total output capacity due to lockdown & quarantine efforts, and thirdly, through both domestic and international disruptions along the supply chains. (Gopinath 2020, 41-44.) While the effects of the crisis on the supply side can be severe Carlsson-Szlezak & al note though, that the effect varies greatly between economies and industries and would need a prolonged crisis to have a significant impact on the economy. (Carlsson-Szlezak & al. 2020a.)

Looking at the demand side of the economy: Gopinath argues that the crisis can decrease spending through: firstly, the consumer's loss of income, fear of contagion & and heightened sense of uncertainty, Secondly, by reducing the overall capacity to spend due to layoffs, and finally, by creating expectation for lower demand, worsening consumer & business sentiment, and reducing their spending and investment. (Gopinath 2020, 41-44.) Carlsson-Szlezak & al similarly agree that the virus can directly decrease demand by keeping the consumers at home, hesitant of spending and unsure of their long-term prospects. Additionally, they warn that the indirectly the crisis could have an effect of a traditional exogenous shock, transmitting to real economy by falling financial markets that lead to falling household wealth and rising household savings rates which naturally decreases consumption. Warning that the effect is particularly powerful in advanced economies, but it would require a steep and sustained decline. (Carlsson-Szlezak & al. 2020a.)

2.1.3 How COVID-19 disrupts the flow of income

To better understand how the COVID-19 crisis induced economic shock impacts a given nation's national economy, it is important to explore the different critical functions of the economy, and how the crisis affects them. Here, this is achieved by investigating how the crisis disrupts the flow of income of national economy.

Baldwin and Weder di Mauro have argued that the COVID-19 crisis has three facets, it affects the economy by three simultaneous shocks: *medical shock, economic shock and expectations shock.* (Baldwin & Weder di Mauro 2020a, 11-17.) Economist Richard Baldwin, a professor from the Graduate Institute of Geneva, has investigated how these three shocks disrupt the flow of income inside the national economy. The first two shocks echo the work of both Gopinath and Carlsson-Szlezak & al, affecting the economy by firstly, through the medical shock forcing workers out of the workforce. And secondly by, the economic shock of the containment measures. The third, expectations shock brings in a new variable: behaviour, especially wait-and-see behaviour exhibited by both consumers and the companies. The figure 2 exhibits how the three shocks disrupt the flow of income at various different points.

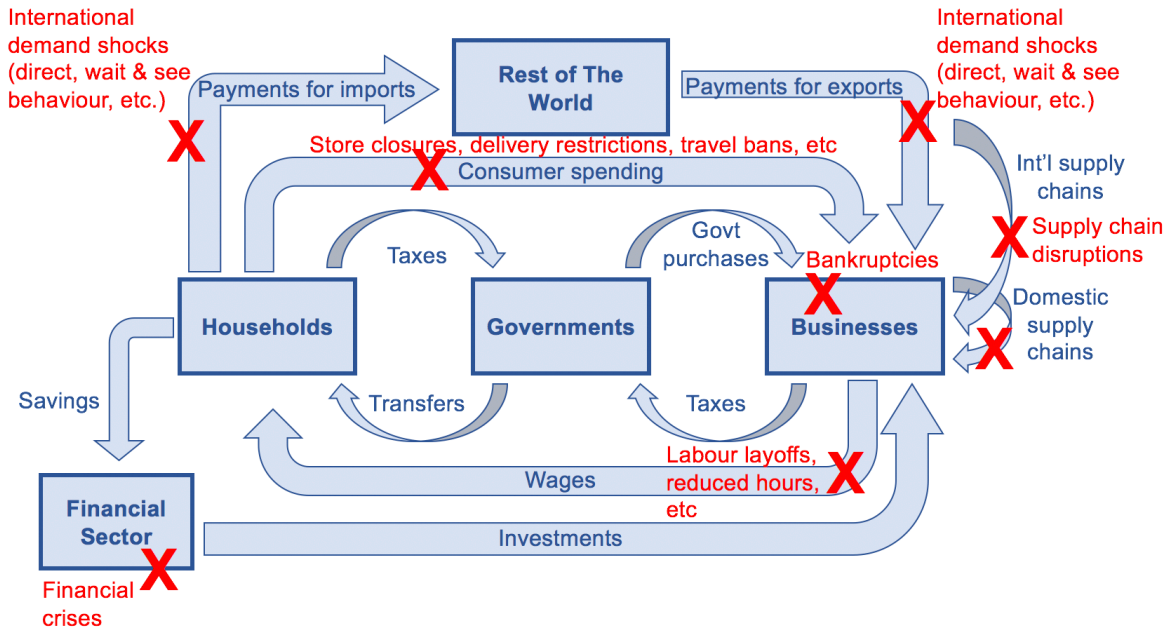

Figure 2. COVID19's multiple strikes in the circular flow of income diagram (Baldwin 2020)

The circular flow of income is a well-known model that offers a simplified view on how an economy works on a national level. Essentially, as long as income flows, as described by the arrows on the model, the economy is functioning as expected. If however, the flow is disrupted somewhere along the model: the whole economy can expect slowdowns. As described by the figure 2: the three faceted shock disrupts the flow at various points. Firstly, the flow of wages is disrupted by all three shocks: the medical shock forcing workforce on sick leaves, containment measures such as quarantines and both the economic and expectations shock causing layoffs. Secondly, consumer spending is disrupted accordingly, as the disrupted wage flow can lead to financial distress among households. Additionally, consumer spending is further disrupted by the containment measures and wait-and-see behaviour. As consumers spend less on businesses, especially businesses with high debt, the reduced cashflow further disrupts the flow of money, as the businesses struggle to pay their employees and creditors. This might lead to bankruptcies, and potentially, as the business cannot pay their suppliers and/or offer their goods and services to buyers: further bankruptcies along the line.

All this affect and is affected by the rest of the world as well. If domestic demand is reduced, due to the decreased spending of consumers and businesses, the demand shock can affect import as well. The reduced import leads to reduced incomes in the importing countries, which in turn reduces the spending in those countries on domestic exports. Additionally, the reduced demand and/or the direct supply shocks can further lead to disruptions on international and domestic supply chains. Disruptions on said supply chains can then worsen the domestic supply shock, as businesses are struggling to produce and/or

sell their goods and services. The effect is especially oblivious in the manufacturing sector as the companies might lack vital components for their production and can be prone to wait-and-see behaviour, as it might be more profitable to postpone their processes, than to carry on production in the worsened climate. (Baldwin 2020.)

Finally, while Baldwin is clear that this crisis is not a banking crisis (Baldwin 2020). As exhibited by the flow of income model, decreased household savings and financial crises disrupt the flow of investments. Carlsson-Szlezak & al argued on the onset of the crisis that the pandemic has already strained capital markets as evident by the forceful response from central banks. They further warned that persisting liquidity problems and real economy problems leading to write-downs, can lead to capital problems, and ultimately the financial system starving out real economy of credit. These financial risks can be made worse by the real economy bankruptcies further straining the financial system. Meanwhile, the real economy could face a prolonged “freeze” due to public health measures, which would have its capital formation suffer, and eventually, overall labour participation and productivity growth. (Carlsson-Szlezak & al. 2020b.)

2.2 How the financial market reacted to the crisis

What can be summarised from this forefront research is that COVID-19 has posed a completely unprecedent crisis from the economical point of view by simultaneously causing shocks in both the demand and supply side of the economy, disrupting the flow of income at multiple points, and further fuelled by disruptions of international supply chains, trade and financial markets, as the effects are synchronised across multiple countries. (Gopinath 2020, 45.) Having understood the economic implications of this novel crisis, based on current research. The possible effects of these unprecedented shocks on the financial markets can be explored with reasonable clarity.

According to authors Carlsson-Szlezak, Reeves & Swartz: on the financial market the effects of COVID-19 was felt globally during week 9 of 2020 (24.2- 1.3). This was due to the valuation of safe assets taking a sharp downturn, although the authors note that simultaneously the valuation of risk assets did not show as uniform impact (credit spreads and equity valuations), these variations in valuation of different assets underlining the uncertainty around the epidemic. A sharp reaction to COVID-19 was seen on volatility, similarly as volatility has reacted on any other dislocation in the past 30 years. (Carlsson-Szlezak & al. 2020b.)

Although the sharp reaction of market volatility can be seen as typical reaction for recent financial crises, according to a working paper analysing how the U.S. stock market reacted to COVID-19: the reaction was in fact once again: unprecedented. According to the research: previous pandemics since 1900 have only left mild traces to the stock market compared to COVID-19 pandemic. While COVID-19 skyrocketed volatility and plummeted equities around the world rivalling or even surpassing volatility levels of October 1987 and December 2008, none of the past pandemics have attained any substantial effect on volatility, including the devastating Spanish Flu. (Baker, Bloom, Davis, Kost, Sammon & Viratyosin 2020.)

Authors Wagner and Ramelli have observed the COVID-19 effect on stock markets closely and have divided the first quarter of 2020 to three periods of distinct investor behaviour: Incubation (2nd of January to 17th of January), Outbreak (20nd of January to 21st of February) and Fever (24th of February to 6th of March and beyond). The incubation period sets off when first reports of pneumonia cases originating from Wuhan were reported by WHO. The period lasted until the Chinese health authorities confirmed that the novel coronavirus transmitted from human to human. This marked the beginning of the outbreak period. The authors define the start of the fever period as Italian authorities reported lockdown in Lombardy on the 23rd of February. (Ramelli & Wagner 2020a.)

Ramelli and Wagner argue that during the outbreak period, companies involved in international trade, and especially companies exposed to China, experienced lower CAPM-adjusted returns. Additionally, the authors uncovered that there was a small but statistically significant negative response already in the incubation period, suggesting that more sophisticated investors had concerns over supply chain disruption already during this period. (Ramelli & Wagner 2020a.)

In the fever period the authors argued that investors became concerned over the possibility of the crisis induced recession amplified by financial channels. These concerns resulted in companies with high debt and/or low cash, essentially companies with weak financial positions being negatively associated with stock returns. Simultaneously, internationally oriented companies were viewed more favourably as the crisis moved to Europe and U.S. and the situation in China developed for the better. (Ramelli & Wagner 2020a.)

Davis, Hansen & Seminario-Amez expand on this COVID-19 news driven, feverish market volatility by having studied firm-level returns during the period. Their research suggests that up to half of the firm-level variation in returns can be explained by negative news related to COVID-19 crisis. Contradicting Ramelli and Wagner, their data suggests that also

during the fever period, internationally oriented companies, namely companies with high exposure to travel, lodging, traditional retail, energy and aircraft production, suffered abnormal negative returns triggered by negative news. Additionally, real estate investment trusts, residential construction and restaurants among others, faced abnormal negative returns.

While especially internationally oriented companies suffered, exposure to drug trials, e-commerce, basic foodstuffs, web-based services, video games and financial management among others, seemed to instil trust in investors as these companies enjoyed positive abnormal returns triggered by the same news. (Davis, Hansen & Seminario-Amez 2020.)

Based on this forerunner research, news seemed to have a significant influence on both the volatility and especially on the company level returns, and research by Baker, Bloom and others seem to confirm similar causalities on market level as well, with the early stock market jumps in late February and early March correlating with news on the course of the pandemic in the U.S, with later responses similarly correlating with news on the policy responses on the pandemic. (Baker & al. 2020.)

2.3 How human behaviour limits rational investor behaviour.

As the fever period saw the markets experience unprecedent volatility for a pandemic event, Ramelli and Wagner noted that despite relatively little new fundamental information entering the market each day, the market continued its feverish whipsaw pattern of aggregate returns. (Ramelli & Wagner 2020b.) While also Davis, Hansen & Seminario-Amez agreed that their model could only explain up to half of the variation in returns to stem from news entering the market. (Davis & al. 2020.) Ramelli and Wagner suspect herding behaviour had gripped the investors. (Ramelli & Wagner 2020b.) Academic research on investor behaviour suggests that outside of the rational economic models, in the real-life scenarios, a degree of often irrational human behaviour has influence on the events that unfold.

Behavioural finance might help understand this irrational human behaviour, instead of traditional financial theories. Traditional finance is based on two fundamental assumptions. First, it assumes that people make rational decisions, and secondly, that people are unbiased in their predictions about future. Behavioural finance argues that in reality people don’t always act rationally and in the own best interests, but instead can be irrational and make predictable errors based on behavioural biases. (Nofsinger 2018, 1-3.)

Investor behaviour during the 2008 financial crisis prove a good example of this phenomenon: on a very general level traditional finance theory takes it granted that rational investors aim to sell high and buy low in order to gain profit on investment. During the crisis however the investors were still selling stocks in the first quarter of 2009 after the market had declined for over 50% in the past year, 150 billion dollars' worth of mutual funds in fact in the last quarter of 2008 and first of 2009 in total, most of it near market bottom. The same individual investors were net buyers of 11 billion dollars in stock mutual funds during the month of market top. Even though some of it can be explained by ill-informed or poorly trained investors on the market timing their trades poorly, psychological biases and emotions play a large part, especially during times of large market swings. (Nofsinger 2018, 1-2.)

These underlying behavioural biases can be divided into cognitive and emotional biases. The following sections begin with an overview of the following cognitive biases: confirmation bias, anchoring and recency bias, and then continues to define the following emotional biases: familiarity bias, loss aversion, regret aversion and overconfidence. Finally, this chapter is concluded with an overview of herding behaviour of investors. (PIMCO 2020.)

2.3.1 Cognitive biases

Confirmation bias is a cognitive bias of humans tending to focus on information that supports our beliefs. This can lead to an investor focusing on searching and remembering information that supports the investors beliefs or interpreting information in a way to supports those beliefs, offering a biased, and possibly too narrow view on the subject. (PIMCO 2020.) Investor under confirmation bias can dismiss any information that conflict with preconception, while simultaneously over-emphasizing information that reinforces preconception. (Montier 2002, 4.)

Anchoring bias prevents investors accurately estimating value, by making the investor anchor the estimates to a reference value or point that can be completely arbitrary. An example would be an investor estimating a current value of an asset based on past purchase price. (PIMCO 2020.) Common anchors for investors on stock market might be the purchase price of the stock, or the recent highest stock price. (Nofsinger 2018, 6.)

Finally, investors might make judgements influenced by recency bias. Investor might act short-sighted as they might cognitively be more influenced by recent developments active in their short-term memories, instead of past events in their long-term memory. In practise

this might influence investors to make short-sighted assessments on market developments, believing that for example declining markets will continue their decline (PIMCO 2020).

2.3.2 Emotional biases

Investors might be emotionally biased sticking to familiar stocks even when it might not be the rational choice for them. The biased investor behaviour can, on a larger scale result in over allocations in certain stocks, industries and countries. (PIMCO 2020.) There is plenty of evidence that investors invest in stocks that they are familiar with, and often in one's that are from their own country. Studies show that investors often contradict the modern portfolio theory with these familiarity influenced investment decisions. As it can be argued that familiarity bias seems to be a common one among investors, several studies suggests that investors aggregate behaviour might have an impact on capital markets. (Nofsinger 2018, 118-125.)

Loss aversion might influence investors to sell too early when the stock is rising, or to hold an investment too long in fear of a loss. Loss averse investor is hurt more by a loss than satisfied by a similar win, leading to irrational aversion of potential losses over potential wins. Investors might also be influenced by regret aversion leading them to avoid the possible regret of poor decisions. This regret might be caused by a loss from investment that goes down, or not buying into a stock that is going up. (PIMCO 2020.) Financial economists Shefrin and Statman talk about disposition effect, the effect of investors seeking pride and fearing regret leading them to sell stock going up too early and hold stocks going down for too long. (Nofsinger 2018, 32-33.)

Investors might be overconfident. Overconfident investors can overestimate their ability to predict when to enter the market or exit, and what stock to pick, leading to possible irrational and overconfident market timing. (PIMCO 2020.) According to research overconfident investors trade more, and overconfidence can lead to excessive trading. Additionally, online brokerage accounts might have also increased overconfident investor behaviour when compared to past. Finally, several researchers believe that aggregate overconfidence shows on the market. Seen especially after overall stock market increases, investors may come to feel that the success was due to their own skill instead of recent market performance, leading to overconfidence. In the market this may be seen as overall increased trading volume. (Nofsinger 2018, 17-29.)

Finally, all the above biases, and others, can be magnified by herding. Humans are by nature social and prone to be influenced by the behaviour of others. Investors often follow

investing related content on various medias, and quickly find out about recent developments. When a social consensus about a given situation on stock market forms, individual investors might be influenced in their decisions by the herd. Herding can lead to investors acting short-sighted, reacting too quickly to news or reacting to insignificant news. (Nofsinger 2018, 141-145.)

3 Research Methods

This is a quantitative research, as the measurement of statistical data will ensure the objectivity of an empirical investigation of this size. For this thesis, market data for Nasdaq Helsinki is needed from the observed time period for the statistical data. More specifically, this thesis focuses on the development of stock values during the period. As the research question is: how did the COVID-19 crisis affect investor behaviour in the Finnish stock market? Statistical analysis of the market data provides an objective answer as it measures the outcomes of the individual investors decisions during the crisis with those decisions translating to trades on the market.

The quantitative research is conducted to answer the second investigative question. First question serves the purpose of building up the theoretical base for answering question 2 and 3. For that reason it is purely theoretical in nature, and as such it is conducted as a desktop research. The third question seeks to evaluate the quantitative research by reflecting it on the theory. This is achieved by another desktop research.

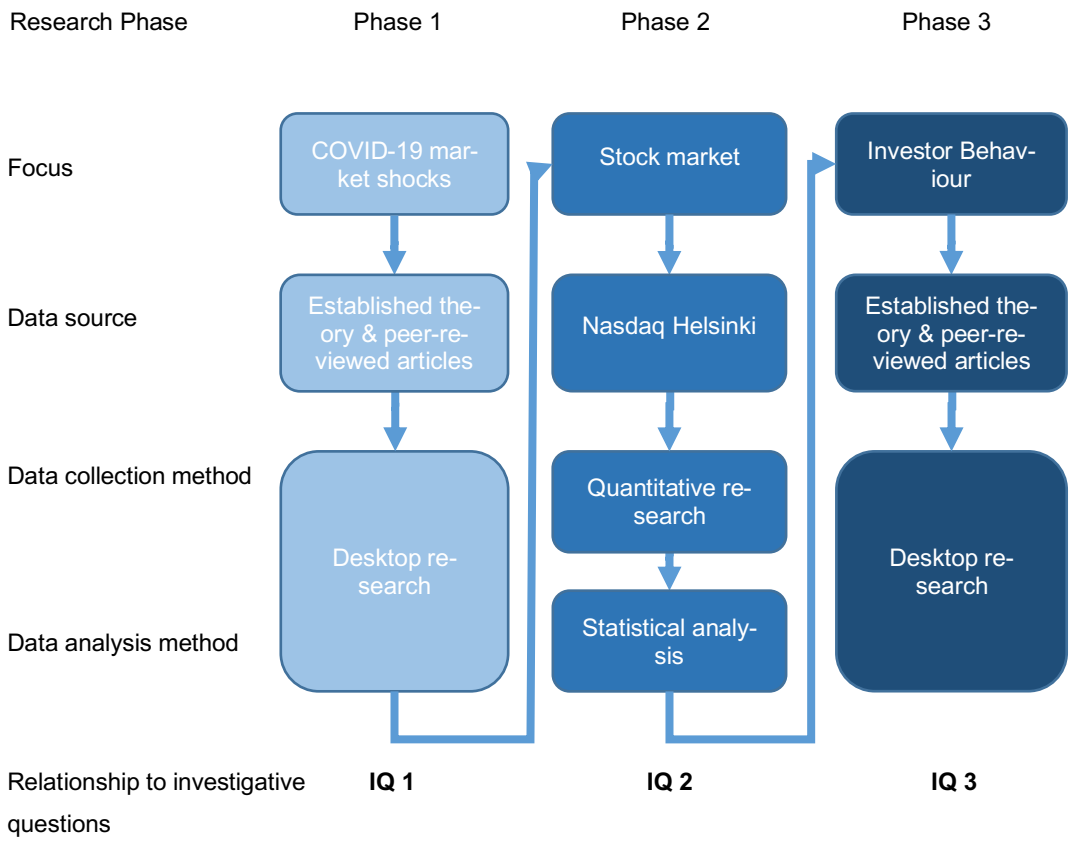

Figure 3. Research methods.

3.1 Research design & methods

The first phase of the research was a theory-driven desktop research on the nature of the COVID-19 related macro-economic external shocks on Finnish economy. The research was largely descriptive in nature, and it aimed to answer the investigative question: What kind of COVID-19 related external shocks affected Finnish financial market from an economic point of view?

The data source for this research was the established theory and peer-reviewed articles presented on the theoretical framework. Macro-economic data from the period was collected, and if evidence of external shocks was found from the data: their nature was described and assessed based on the theoretical framework.

The second phase of the research was an empirical research. A quantitative research, based on the findings of the first phase, was conducted in order to find correlation with the external shocks and the developments on the Finnish stock market. This phase aimed to answer the question: How did these shocks affect the stocks listed in Nasdaq Helsinki during January to July 2020?

This phase was data-driven. Price data from the stock market was collected and a statistical analysis was conducted, to find if correlation exists between the stock market and the macro-economic shocks.

This last phase of the research aimed to answer the question: How can the investor behaviour be explained from the point of view of behavioural finance? This was achieved by a theory-driven desktop research. The research was largely descriptive in nature.

The data source for this research was both the established theory and peer-reviewed articles presented on the theoretical framework, as well as the results of the previous chapters. Further desktop research was then conducted, on market developments and factors affecting them such as news from the period. Finally, the collected data, the results of earlier phases was described and assessed based on the theoretical framework.

3.2 Data Collection

For the first phase of the study macro-economic data was collected from Statistics Finland. Gross domestic product would have provided the optimal values as a time series for the purposes of this thesis, as it would have provided the most accurate image of Finnish total output during the period, but due to the novelty of the topic the trend indicator of output was the only reasonable choice, a monthly updated data series compiled by Statistics Finland that aims to forecast the developments of the national economy (Statistics Finland 2020a).

Additionally, data from the period concerning: manufacturing production, imports, exports, unemployment, layoffs, household spending, consumer sentiment and household total earnings, was collected from Statistics Finland. Finally, as part of the desktop research, additional news and reviews published by Finnish government, Statistics Finland and YLE were used for research purposes.

For the second phase, in order to determine the causes behind investor behaviour during the pandemic, developments on the Finnish stock market were chosen as the focus of the study. For research purposes, OMX Helsinki 25 index has been chosen to best represent the developments on Finnish stock market during the observed period. OMX Helsinki (OMXH25) is the leading share index of Helsinki Stock Exchange, a capitalisation weighted stock price index of 25 most traded stocks, the index is well suited for benchmarking more diverse Finnish stock portfolios due to its great liquidity. (Nasdaq 2020.) For this research, daily close prices of OMXH25 from January 2015 to June 2020 was extracted from the source. For further analysis selected close prices from 2010 to 2015 was extracted similarly. Additionally, the macro-economic data from previous phase was used during this phase.

For the third, and final phase of the research, the data and results collected from prior phases was utilised. Additionally, closing prices from the range of 2nd of January 2020 to 2nd of July 2020 of Chicago Board Options Exchange's CBOE Volatility Index (VIX) was collected from Yahoo finance. VIX was chosen to represent the overall uncertainty experienced by the financial markets during the period. As the index is, not only often used for that purpose, but it also historically correlates strongly with OMX Helsinki, making it ideal for comparison (Lindblad, Sariola & Silvo 2020). Finally, desktop research was conducted to find relevant significant news related to the Finnish stock market from the period.

3.3 Data Analysis

Due to the nature of the desktop research conducted in phases 1 and 3 the analysis of the collected data is presented in the following results chapter. The rest of this chapter is concerned solely on the phase 2, and the quantitative research conducted as a statistical analysis during that phase.

The first step of the analysis was to prepare the data. The trend indicator of output data range of 1/2015 to 6/2020 was prepared first by downloading it, and then choosing the monthly working day adjusted trend indicator of output for further analysis, as it most accurately represents the economy. Then the OMX Helsinki 25 index was retrieved from the past ten years from 1.1.2010 to 31.6.2020. Closing prices were then separated from the rest of the data for the purposes of this research. Geometric analysis as well as series of statistical analysis's was conducted to better understand the data. As the macro-economic data is monthly, it was necessary to formulate monthly median close prices from the range. To make these time-series comparable with each other. Now that the data was ready for Granger testing to find if any causality exists.

For the Granger test, the data series used were the monthly median close price of OMXH25 and monthly working day adjusted trend indicator of output. The data range was from January 2015 to June 2020. The requisite for the test is that the data is stationary, both of these series were not. As such, monthly change as a time-series was calculated from both series of data. The time-series suitability for Granger-test was now tested utilising augmented Dickey-Fuller test. The test confirmed both series as stationary and suitable for the test. The series were tested on both direction for causality, and on different lags, from 1 to 6. The lag in the context of this test can be interpreted as a one-month interval between the timeseries. The results of the test are explained in the results chapter.

Finally, the OMXH25 daily close prices from the period were analysed for volatility. First, daily logarithmic returns were calculated from the time-series, and then the standard deviation from those returns using a three-day period. Three-day period was chosen as it takes recent developments into account, while still highlighting the daily volatility. For reference values: the OMXH25 index from the past ten years was analysed for historical volatility. Due to technical reasons, the analysis was conducted using daily close prices from the first and second quarter of the year from the past ten consecutive years. The methodology was exactly the same for the historical three-day volatility. From the volatility a yearly median was calculated, and from the yearly median, a median of the period.

3.4 Reliability, Validity and Relevance

The reliability of the research methods used is upheld by ensuring that the methods used are based on established theory and used correctly. Only primary data from reliably and well-established sources shall be used to ensure the reliability of the data. Even so, as the subject is novel, the data used, especially the macro-economic data, has its pitfalls that have been assessed in this thesis.

Utilising proven methods and reliable data is essential for the validity of the results. To reach as strong as possible validity for the results, the data used in this thesis is based on theory researched on this thesis. This is an important principle to uphold to ensure relevance as well. During the thesis process, all data of questionable relevance has been demarcated from the research, in order to convey as accurate as possible picture of the researched topic.

4 Results

This chapter introduces the compiled results of the research conducted for the thesis. These results aim to answer the main research question of the thesis: how did the COVID-19 crisis affect investor behaviour in the Finnish stock market? Through the three investigative questions: first, what kind of COVID-19 related external shocks affected Finnish financial market from an economic point of view? Second, how did these shocks affect the stocks listed in Nasdaq Helsinki during January to July 2020? And third, how can the investor behaviour be explained from the point of view of behavioural finance?

4.1 COVID-19 Related External Shocks That Affected Finnish Financial Market

This results chapter begins with an assessment on what kind of COVID-19 related external shocks affected Finnish financial market from an economic point of view. First, the Finnish output of the period is observed in the context of shock geometry. Then, a closer analysis on the effects of the pandemic on both the supply and demand side of the economy is given in the light of statistics from the period. Finally, this chapter concludes with an analysis of the possible ways the crisis might have disrupted the Finnish flow of income during the period.

4.1.1 Effects of COVID-19 on the Finnish production and demand

By assessing the development of the trend indicator of output of Finland, the timeliest data available on the development of Finnish production, the geometry of the shock can be analysed from the time series as explained by Carlsson-Szlezak, Reeves & Swartz. (2020a.)

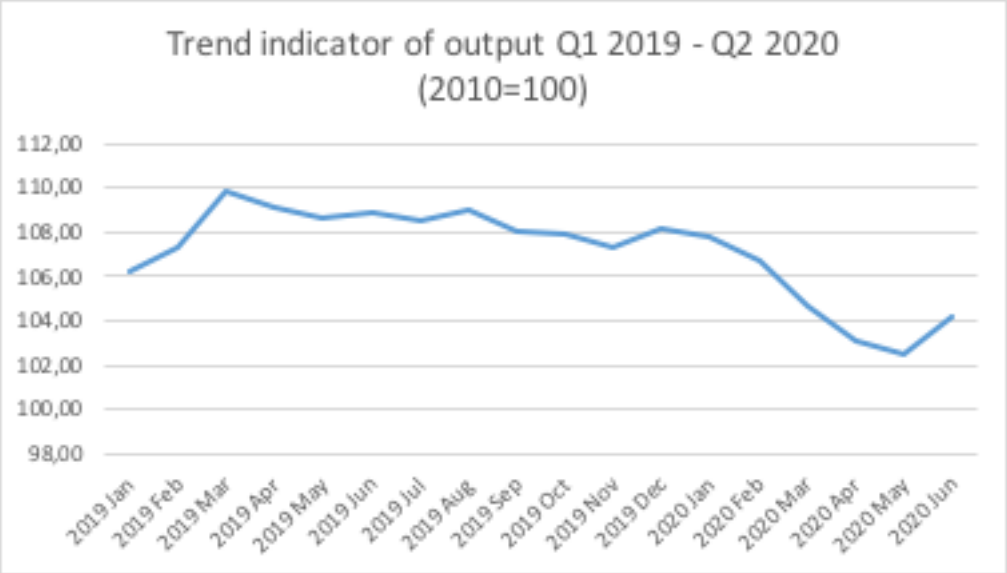

Figure 4. Trend indicator of output, Finland Q1 2019- Q2 2020

At the end of second quarter of 2020: the development of production seems to take form somewhere between the V- and U-shape. According to Carlsson-Szlezak, Reeves & Swartz (2020a.) this shape implies that Finnish production was definitely impacted by the COVID-19, declining 3,46% from the beginning of 2020, the loss of supply seems to be moderate, but sustainable as the production seems to be returning to its original growth path. Still, the shape does imply permanently lost production during the spring, and an uncertain outlook for growth in the near future. The decline begun in January as the production had a slight decline of 0,30%, falling further 1,05% in February. March saw the single largest drop: 1,95%, falling further 1,46% in April, until finally setting at the bottom of the curve in May with a drop of further 0,54%. The production finally started to recover in June, rising 1,54% from May.

The theory suggests that serious damage to supply such as this disrupts Finnish capital formation and can lead to disrupted credit intermediation stagnating the growth of capital shock. According to the theory there is a risk of the shock geometry curve widening and flattening, leading to a risk of the shock carrying a structural legacy. (Carlsson-Szlezak & al. 2020b.)

While the wave of bankruptcies was feared during the spring, the threat failed to materialise, alleviating strain from financial system. What did materialise was the prolonged real economy freeze as Finland faced strict public health measures, especially at the service sector. (Statistics Finland 2020b.)

The demand saw similar development during the spring. As Gopinath (2020). described on general level, statistics confirm that Finland endured demand shocks as well. Household spending decreased 11% from the past year in the second quarter of 2020, with 7% fall from the last quarter (Statistics Finland 2020b). Additionally, consumer sentiment suffered an unprecedented hit as it fell in April to the historical (1995-2020) lowest point ever recorded by Statistics Finland. The sentiment recovered in the summer back to roughly the level same level as in previous year (Statistics Finland 2020b). The decline in consumer sentiment was definitely steep, but lacks any sustained decline currently, implying that it might have been mostly caused by both the virus and containment methods keeping consumers home and hesitant of spending.

Finally, Baldwin (2020) argues that the reduced demand and the supply shocks caused by the crisis can further disrupt both domestic and international supply chains across the board, which can further worsen the supply shock affecting Finnish production. (Baldwin 2020.)

4.1.2 Effects of COVID-19 observed in relation to flow of income in Finland

Baldwin and Weder di Mauro (2020a. 11-17.) presented the theory of the three simultaneous shocks caused by COVID-19: Medical, economical and expectations shock. Through these three avenues COVID-19 disrupts the flow of income in national economy at various points. During the first two quarters of 2020, Finnish economy has experienced relatively mild effects of the medical shock described by Baldwin & Weder di Mauro. The workforce has naturally experienced sick leaves, but according to Yle: the direct medical effects of the pandemic have been considerably lesser in Finland compared to the EU countries in general. The relatively low level of infections is seen to be due to the workforce seamlessly transferring to distant work made possible by the high level of digitalisation in Finland, and by the strict and timely governmental response on the pandemic. (Yle 2020a.)

However, the same governmental response that has lessened the impact of the medical shock has amplified the economic shock, due to the strict containment efforts enforced. In March the government announced a state of emergency in Finland and utilising the emergency powers granted to it, applied a wide range of containment efforts. For the sake of the topic the relevant efforts were: the restriction on gatherings (max 10 persons at a same space), recommendation to prefer distance work, shutdown of restaurants and travel restrictions. The shutdown of restaurants decreased sales radically on the industry, -70% according to Nordea credit card data during the spring. Additionally, the unemployment and layoffs combined increased over 400% during April compared the past year. (Finnish Government 2020a, 26-28.) In total the amount of unemployed grew by a total of 119 000 from the past year at the end of the second quarter, while the total workhours decreased by 6,4% during the period from the past year. The total amount of layoffs in the country was also at its highest during the April with 164 000 workers. The amount decreased to 82 000 at the end of the period, still 71 000 more than the past year, with additional 18 000 workers working shortened workweeks. Finally, the household total earnings decreased by 4,4% during the second quarter from the past year. (Statistics Finland 2020b.)

The expectations shock is much harder to measure and perceive than the previous two. The shock on demand is clear as presented in the previous chapter, and the consumer sentiment fell to record depths during the period. In early spring Comparisons were drawn between the looming economic effects of COVID-19 crisis and the 2008-2009 financial crisis, and fears of waves of bankruptcies similar to financial crisis surfaced. Ultimately the fears failed to materialise, with ultimately 1549 bankruptcies less between January and July compared to 2019. (Statistics Finland 2020b.) Similarly, according to YLE, Finnish

economists expected a decrease of 6-10 percent on GDP, while current data suggests a far milder contraction of 4-5% (Yle 2020a). All this suggests that the general mood in the spring can only be described pessimistic, and the general populace had a grim outlook, with Finnish populace and experts alike estimating the economic effects of COVID-19 far worse in the spring than they actually were. A possible direct evidence of the expectations shock's effect was witnessed during the spring as Finnish Government reported that the layoffs and decreased sales began to develop already before the shutdown of restaurants (Finnish government 2020a, 27). According to Baldwin & Weder di Mauro's theory this would imply a prevalence of wait and see behaviour, both among customers and industries, due to the fears and concern for the future. (Baldwin & Weder di Mauro 2020a, 11-17). On manufacturing industry Baldwin (2020), argued that due to supply chain disruptions and therefore worsened business climate the industry is especially prone for wait and see behaviour, postponing production for a more favourable time (Baldwin 2020). This could partly explain Finnish manufacturing production reaching to almost 7% reduction in production by June (Statistics Finland 2020b).

Baldwin (2020) presented the theory of COVID-19 crisis disrupting the flow of income simultaneously on multiple points. According to the theory: firstly, the Finnish flow of wages have been disrupted by the layoffs caused by both the economic and expectations shocks. The theory suggests that the medical shocks would force employees on sick leaves, but as discussed earlier this has mostly been not the case in Finland. Secondly, as the household earnings decreased the consumer spending was disrupted accordingly, further amplified by the containment measures preventing consumers to spend on certain services. Finally, the consumer spending is further disrupted by the wait and see behaviour due to the expectations shock. Based on the theory, it seems that ultimately: the disruptions were not strong enough, the government offered sufficient relief financing, or the businesses had sufficiently healthy financial standing in general to withstand the reduced cashflow, as these disruptions did not lead to increased bankruptcies. (Baldwin 2020).

On international level, research show that during the first two quarters Finnish imports decreased 19%, while exports decreased 17%. (Statistics Finland 2020b.) Baldwin (2020), argues that as the consumer spending decreases, so can the spending on imports leading to reduced income in the countries of the import's origin. On a global scale this can lead to reduced spending in those countries on Finnish exports. (Baldwin 2020). Reduced exports can have a considerable further effect on the flow of income as 500 000 Finnish jobs rely either directly or indirectly on Finnish export (Statistics Finland 2020b).

In conclusion, the COVID-19 crisis has had unprecedented shock effects on the Finnish economy by disturbing the flow of income on multiple different points, and by that mechanism displaying characteristics of both supply and demand shock simultaneously. Alarmingly, assessing the geometry of the shock from the trend indicator of output, the shock on production is U-shaped on short-term implying permanently lost production during the spring of 2020. Finally, overall sentiment during the onset of the crisis suggests that in Finland the crisis has shown multiple characteristics of an expectations shock. Implying that the crisis has both directly and indirectly affected the behaviour of both the households and the industries, that have then further amplified other effects of the shock by their own behaviour.

4.2 Effect of The External Shocks on Stocks Listed in Nasdaq Helsinki

While the aforementioned significant simultaneous supply and demand shock shook the Finnish economy, it seems that Finnish stock market had similar developments, with the leading share index of Helsinki Stock Exchange: OMX Helsinki 25 (OMXH25) plummeting sharply in March.

Figure 5. OMXH25 Closing Price 1.1.2020 – 30.6.2020

The index price fell from 4041,56 in the beginning of March to 2905,76 at its lowest on 18th of March, a reduction of almost 30% in value. In total the monthly median price fell 23,5% in March, far beyond normal variation, implying a hefty external shock to the stock market. The monthly median price stayed at a new low for April as well, only recovering 2,3%. During May the index started to recover, rising 7,6%, and 7,3% in June.

Examining the index, there is little visible correlation to be seen with the theory of Wagner and Ramelli (2020) regarding the incubation or outbreak period. Fever period instead is clearly visible, with the index clearly beginning its descent around 24th of February. It seems the investors on the Finnish stock market were grasped by the same fears and worries that according to Wagner and Ramelli gripped investors worldwide at the onset of the fever period. (Ramelli, Wagner 2020a.)

4.2.1 Real economy's influence on the Finnish stock market

To accurately assess the influence of the investor behaviour on Finnish stock market, it is necessary to understand how the real economy shock affected the stock market. As discussed in the previous chapter, the COVID-19 crisis has been a multifaceted shock on Finnish national economy, delivering a simultaneous shock effect on both supply and demand by disturbing the flow of income on multiple different points at the same time. The clearest both observable and measurable effects are the developments on total production and demand of Finland. However, due to the novelty of the crisis only total production yields current enough data to be applicable for the purposes of this thesis. Thus, statistical

research was conducted to understand if there can be found any causal relationship between the index developments and the total production.

The hypothesis for this research was that: in order for the developments on the market to be caused by the external real economy shock caused by COVID-19, the real economy developments should forecast the developments on the stock market. This was tested with a Granger causality test. The time series used for test were monthly median close price of OMXH25 and monthly working day adjusted trend indicator of output. The data range was from January 2015 to June 2020. The data was tested on 1 to 6 lags, one lag meaning one-month interval. Using monthly data for the test is hardly ideal as the stock market experienced rapid and significant daily fluctuations, still the same fluctuations are clearly visible on the monthly data as well. The decision to use monthly data was forced as macro-economic data is not available for a shorter time period.

Table 2: Granger causality tests

Lags	OMXH25>PROD	PROD>OMXH25
1	0,010285673	0,444031159
2	0,073439442	0,227493097
3	0,140210075	0,085779274
4	0,189651271	0,167134269
5	0,132114860	0,278144558
6	0,217054623	0,162507688

To interpret the above results: the first column represents the different lags used, the second and third column represent the p-values on different lags when testing the monthly median close price of OMXH25 and monthly working day adjusted trend indicator of output (PROD) for granger-causality, and the other way around respectively. The p-value describes the likelihood of granger-causality existing. The smaller the value the greater the probability. The only p-value of statistical importance from this test is observed on 1 lag of OMXH25>PROD. For this test the value means that there is approximately 1,029% change for this result being random. It is significantly small enough that it suggests that there is Granger-causality between the timeseries, meaning: OMX25 index seems to Granger-cause the trend indicator of output developments on the lowest possible, one-month delay. The rest of the values support the null-hypothesis: the assumption that if the p-value is marginally significant or not significant there is no evidence of Granger-causality and the results might be random.

The results of the research indicate a couple of key observations. Firstly, the initial hypothesis of the relationship between real economy and stock market was false according to the Granger causality test, as there is no significant evidence based on the test, that the developments of the trend indicator of output would Granger-cause the developments of the OMXH25 index. What the test seems to suggest however is that the developments of OMXH25 index could Granger-cause developments on the trend indicator of output. If the stock market developments cannot be attributed to developments of the real economy, the developments must be influenced by something else. To better understand the magnitude and timing of the market developments, the market was analysed for volatility during the period.

4.2.2 Volatility of the Finnish stock market during the period

As theory tends to connect market volatility with investor behaviour, observing the market volatility of the period was the logical next step for the research. As described by Davis, Hansen & Seminario-Amez (2020.), the market volatility associated with COVID-19 crisis is unprecedented. The figure 6 illustrates the 3-day historical volatility of OMXH25 between January 2020 and June 2020. The larger columns represent weeks and the smaller columns days.

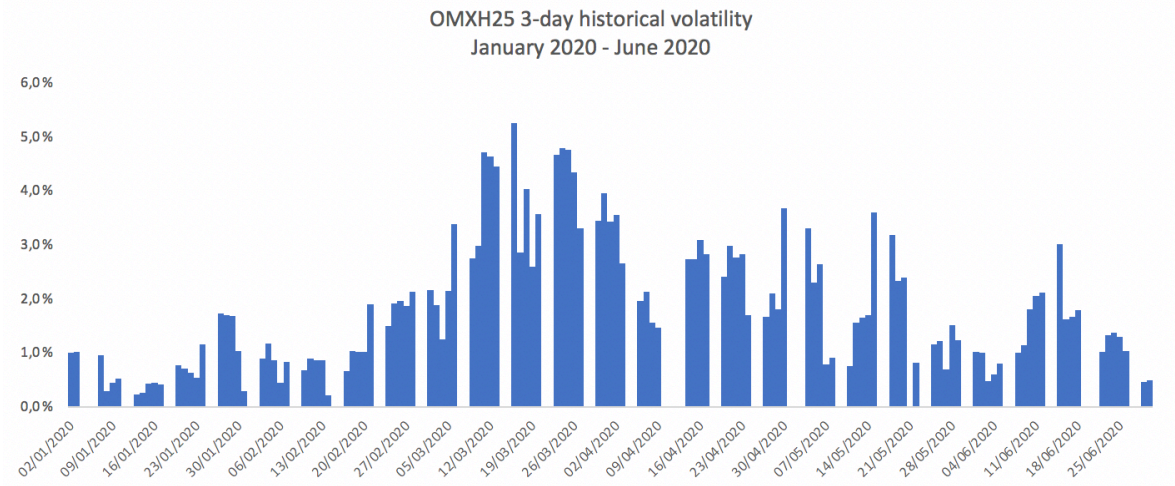

Figure 6: OMXH25 3-day historical volatility, January 2020 – June 2020

The figure displays high correlation with the fever period as described by Ramelli and Wagner (2020a). The volatility spiked on 24th of February, and soared to unprecedented hights during March, and while the volatility seemed to calm in the following months it stayed high until the end of the period. For comparison, the median 3-day historical volatility of OMXH25 was calculated for the first and second quarter of the past ten years. The median of the ten years excluding 2020 was 0,92%. If the 0,92% is considered as the normal volatility of OMXH25, the volatility levels reached during the first and second quarter of 2020 can be seen as extremely high and highly unusual. The volatility reached 5,3% at

its highest, and it has stayed well beyond normal level for most of the fever period. In fact, out of 87 trading days after the market entered fever period, on 77 days the volatility was above 0,92% and on 45 days, above 2,00%.

To conclude this chapter, reflecting on the investigative question this chapter aimed to answer: How did these (macro-economic) shocks affect the stocks listed in Nasdaq Helsinki during January to June 2020? Not much, if observed solely through the lens of traditional economics. Through statistical analysis, the research concludes that the production shock did not, at least Granger-cause the market developments. And the possible effects of the demand shock are not feasible to assess, due to the lack of accurate enough data at the time of writing. However, the research does suggest that the stock market developments might actually Granger-cause Finnish output, implying that the stock market reaction might have foretold, or maybe anticipated the real economy consequences of the crisis. The research did uncover an unprecedented level of volatility during the period, which does imply a significant disturbance on the market. Ramelli and Wagner (2020a), Davis, Hansen & Seminario-Amez (2020) and Baker, Bloom and others (2020) all seem to agree that the increases in volatility was in part caused by news entering the market. Still, Ramelli and Wagner (2020b) observed that the market continued to react feverishly despite little new fundamental news entering the market, while Davis, Hansen & Seminario-Amez (2020) could only connect half of the variation in returns to news. If the real economy had little influence on OMXH25, and the unprecedented levels of volatility cannot be explained by it, the reasonable next step would be to investigate if the news entering the market influenced the developments on the market, and from there: assess what influence investor behaviour might have held on it?

4.3 Explanation for The Investor Behaviour

In this last section, the thesis explores through observing the OMXH25 index, how investor behaviour might have had an influence on the Finnish stock market during the observed period. As part of the research, select remarkable news that might have influenced the market have been gathered, and will be overlaid as a timeline of events over the index, to assess the investors reaction to said news. Additionally, the index developments are compared to well-known indicator of implied volatility, and overall investor sentiment: the VIX index. Finally, findings will be reflected upon established theory on investor behaviour.

4.3.1 News driven investor response

As established in the last chapter, there is little evidence that the COVID-19 related real economy shocks would have affected the OMXH25 index directly. Instead, there is significant research made during 2020 that connects the market performance with COVID-19 related news entering the market. To better understand how the news affected the OMXH25 index, in the following chapter a brief summary of significant events is given and compared to the developments on the market.

According to research conducted for this thesis, the notable days of the period with significant news relevant for the purposes of this thesis were:

- **2nd of January:** Reports of pneumonia cases originating from Wuhan reported by WHO. Start of the Incubation period (Ramelli, Wagner 2020a).
- **9th of January:** Finnish institute of health and welfare reports that the cases of pneumonia found in Wuhan region of China are possibly related to a novel coronavirus (Ilta-Sanomat 2020a).
- **20nd of January:** Chinese authorities confirmed that the novel coronavirus transmitted from human to human. Beginning of the Outbreak period (Ramelli, Wagner 2020a).
- **29th of January:** The first case of novel coronavirus confirmed in Finland. The infected was a tourist from Wuhan travelling in Lapland region of Finland (Yle 2020b).
- **23rd of February:** Italian authorities reported lockdown in Lombardy. Beginning of the fever period (Ramelli, Wagner 2020a).
- **6th of March:** The three-year pact between OPEC and Russia falls apart plummeting oil prices (Reuters 2020).
- **11th of March:** The daily COVID-19 infections are on the rise in Finland (Yle 2020b).
- **12th of March:** United States president Trump declares European travel ban (Yle 2020a).
- **13th of March:** President Trump declares national emergency (Yle 2020b).
- **16th of March:** European union declares plans for temporary restriction on non-essential travel to the EU (Yle 2020b)
- **17th of March:** Finnish government passes state of emergency powers act, restricting gatherings to maximum 10 persons, among other actions. (Finnish Government 2020b)

- **24th of March:** White house and senate reached agreement over the $2tn stimulus bill. (CNBC 2020)
- **26th of March:** The Finnish government promises billion euros in subsidies for struggling companies.(Yle 2020c)
- **3rd of April:** Finnish government declare lockdown of the Uusimaa region and temporary close-down of restaurants. (Finnish Government 2020)
- **29th of April:** The Finnish technology industry is in crisis, reporting the lowest invitations for tenders in April since the financial crisis, and requiring multiple billions worth of direct financial stimulus to survive (TS 2020).
- **6th of May:** The Finnish government announces a hybrid strategy that aims to keep the country and its economy open, while combatting the virus by other means (Ilta-Sanomat 2020a).
- **14th of May:** The Finnish government has decided to offer business cost support to businesses regardless of the industry concentrating on the businesses worst affected by the crisis (Iltalehti 2020).
- **15th of June:** The Finnish government declares the end of emergency conditions in Finland (Ilta-Sanomat 2020a).

Additionally, the following OMXH25 constituent companies gave a profit warning during the period:

- **23rd of January:** Nokian Renkaat Oyj (Yle 2020d).
- **18th of March:** Kesko Oyj (Kesko 2020).
- **23rd of March:** Kone Oyj (Arvopaperi 2020a).
- **26th of March:** Konecranes Oyj (Konecranes 2020).
- **26th of March:** Telia Oyj (Tekniikka ja talous 2020).
- **27th of March:** Cargotec Oyj (Ilta-Sanomat 2020b).
- **27th of March:** Huhtamäki Oyj (Arvopaperi 2020b).
- **30th of March:** UPM Kymmene Oyj (Kauppalehti 2020a).
- **16th of April:** Valmet Oyj (Kauppalehti 2020b).

The figure 7 offers a timeline of events as the significant news days listed above are overlaid on a combined graph of both the daily OMXH25 closing price and the VIX index. The incubation, outbreak and fever periods as presented by Ramelli and Wagner (2020a) are overlaid on the graph to represent the wider international investor response to COVID-19.

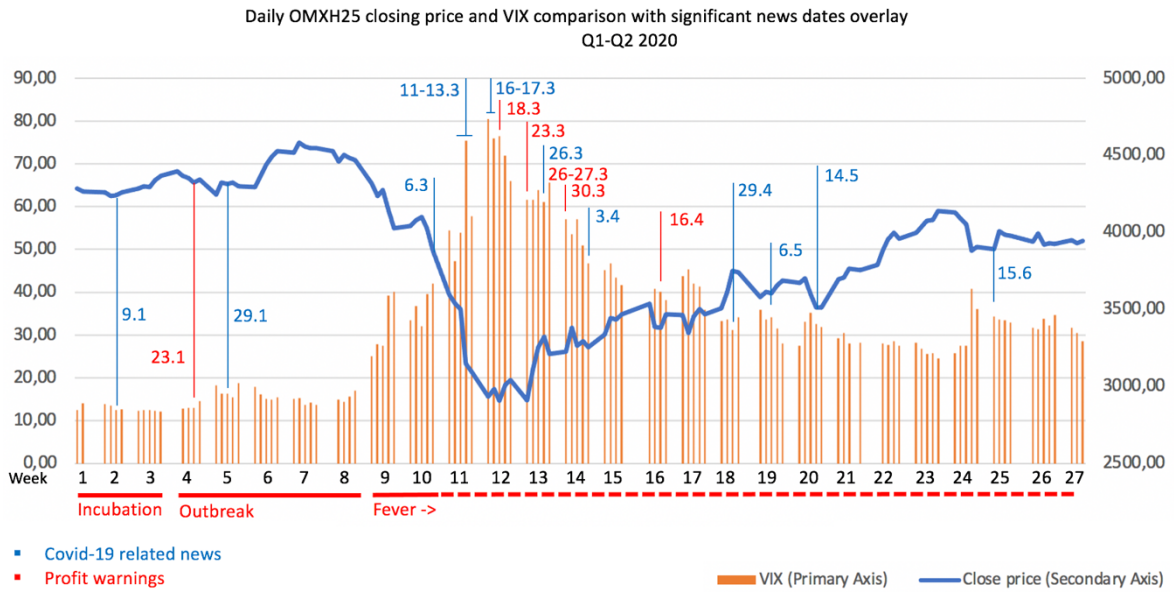

Figure 7: Daily OMXH25 closing price and VIX comparison with significant news dates overlay Q1-Q2 2020

The developments in January had little notable change on either the closing price or the volatility, implying that the early news about the novel coronavirus had little influence on the decision making of investors on the market. Even as news spread about the developing epidemic in Wuhan and the confirmation of its capability to spread from human to human, the VIX index did not see any great increases, while the OMXH25 index was actually going up from week 6 onwards. The outbreak period seems to be mostly uneventful in total, both on Finnish stock market, and abroad, as implied by the relatively low VIX during the period.

At week 9 as the news from Italy came and investors gradually realised that the epidemic was turning into a pandemic, OMXH25 declined sharply (-6,74% during the week), and the VIX index doubled during the week from the incubation and outbreak periods. The first two weeks of Fever period saw the OMXH25 decline over -10%, while little substantial news entered the market. The high implied volatility during the same period suggests that internationally the rapid succession of events combined with little news might have left the investors at unease, providing plenty of room for irrational investor behaviour. These two weeks closed with substantial news for the market as the 3-year pact between OPEC and Russia collapsed, due to disagreement on COVID-19 related measures, plummeting oil prices (-10%) (Reuters 2020).

The week 11 opened with the aftermath of the OPEC news, the index falling -7,3% on 9th of March from previous close. By the middle of the week OMXH25 entered near free fall, as the end of the week brought daily grim news. Reports of the virus infection spreading in

Finland on an increasing rate came from Wednesday onwards. While President Trump declared travel ban from EU to US on Thursday and state of emergency in US on Friday. The index fell over -11,7% during those three days, while the VIX closed at 75,47, having reached similar levels of volatility as seen during the 2008 financial crisis.

During week 12, as EU planned to close its borders, and the Finnish government passed state of emergency powers act, the index reached the bottom of the period, where it stayed for the remainder of the week. At the same time, VIX reached truly unprecedented levels, surpassing any prior crises of its recorded history, closing at 82,69 on March 16, an all-time high (Li 2020). OMXH25 was at its lowest of the total period, possibly pushed over the edge by Kesko Oyj giving out a profit warning, on 18th of March.

Week 13 saw the index finally rebound, as investor confidence was boosted by the news of the planned US stimulus bill. The week 13 opened however in a completely different mood, as the index hit its second lowest of the period in the aftermath of Kone Oyj giving out a profit warning. As there is little other news during the rest of the week, while the market continued to climb, it is reasonable to assume that the ascent can be attributed to the rebounding US market, and the investors regained confidence thanks to both the anticipated US stimulus bill and the subsidies planned by the Finnish government. The US stimulus bill was finally signed on 27th of March (The New York Times 2020). The week ended in a downturn, as four different companies, part of the index, gave profit warnings. VIX calmed somewhat from the previous week, closing around 60 throughout the week, implying a slightly calmed, but still very much fearful sentiment.

The market's rebound was further dampened at the beginning of week 14 by the UPM Kymmene Oyj profit warning, but overall, the week proved to be less eventful than the hectic weeks before it. It seems as if the calmness resonated to the investors as well, as VIX steadily fell from previous heights to below 50 by the end of the week. Surprisingly, the market seemed to react favourably to the news of Uusimaa region's lockdown and closure of restaurant industry, as while the index slightly fell on the day of the news, the next week Monday closed 2,5% up.

For the next few weeks, the market seemed to have relatively calmed down, as VIX gradually declined to 30-40 range. The index exhibited the whipsaw aggregate returns, as described by Ramelli and Wagner well into May, while gradually rebounding from the fall. The market seemed to have showed significant negative responses to both the news of Valmet Oyj giving out profit warning as well as to the blight of Finnish technology industry. On the contrary, it seems that the news of Government financial support for companies on

14th of May, managed to turnaround a downturn experienced on the week 20, and possibly those news, and brightening sentiment as implied by VIX, contributed for the steady climb of the index from week 21 to 23.

During week 24 the mood on the US market turned sour due to Federal Reserve's updated policy statement (MarketWatch 2020). It seems that the effects were felt in Finland as well, as the index fell by over 4,2% between the 11th and 10th of June. The worsened climate seems to have clouded the rest of the period, as the climbing market remained fairly stationary for the rest of the period despite the no-doubt good news of Finnish government ending emergency conditions on 15th of June.

In conclusion, the fever period naturally stands out as the one with most the activity. Originally the fever period was described to have begun at 23rd of February and lasted until the time of Ramelli & Wagner publishing their research. Evidence suggests that the period continued in some form far beyond those early weeks of the crisis. This thesis argues that the fever period has continued until the end of the observed period on Finnish stock market, as beyond Ramelli & Wagner's research the developments on the stock market have been just as, if not more erratic throughout the rest of the observed period. Further, VIX implies that the volatility has stayed at least on the same level throughout the observed period as to where it spiked on the beginning of week 9.

The influence of news on the market are undeniable from the developments listed on this chapter, while the market reactions on individual news, or different categories of news demand further research. However, for this thesis purposes the research discussed so far in this chapter, directs attention to the fever period, and especially to three distinct phenomena observed during the period. First, *the great fall* recorded during weeks 9 to 11: compared to the rest of fever period, these early weeks were characterised with huge market developments as the index dissolved 28% from 24th of February to 13th of March, while at the same time there was relatively little significant news entering the market. Nevertheless, the few news that did enter the market during those weeks seemed to have a vast impact.

Second, *the stagnation at the bottom* of the period during week 12. This one week saw the VIX reach its highest level ever recorded, the OMXH25 reaching its lowest point of the period and few pieces of dire news. Especially interesting is both the sustained unprecedented level of implied volatility, and how the index lingered near that bottom throughout the week and even through the first trading day of the following week.

Third, *the whipsaw recovery path*, seemingly triggered by the onset of planned and later realised governmental action to alleviate the fears of both businesses and investors alike while simultaneously hampered at multiple points by a series of bad news and profit warnings from constituent companies of the index. In the following chapter, this thesis aims to explore how investor behaviour might have influenced these phenomena.

4.3.2 How investor behaviour might help understand the feverish market?

Assessing the market developments during the period, it is reasonable to conclude, that the market swings during the period were immense, and as the statistical research utilising granger causality suggests, largely separated from real economy. What has driven the market, is news entering it, both on international level and domestically, but as the research of Davis, Hansen & Seminario-Amez (2020) concluded: news could explain only half of the variation in returns. And as prior research suggests, psychological biases and emotions can have a substantial influence on the investment decisions of investors during times of large market swings. (Nofsinger 2018, 1-2.) Thus, this concluding chapter aims to assess: how investor behaviour might help understand the feverish market?

This chapter explores the influence of investor behaviour through the three phenomena defined in the earlier chapter: *the great fall*, *the stagnation at the bottom* and *the whipsaw recovery path*.

The phenomenon this thesis describes as *the great fall* took place between weeks 9 and 11. It seems that the market anticipated the real economy consequences of COVID-19 crisis and set to a sharp decline on 24th of February. The decline continued uninterrupted until 11th of March, when series of bad news seemingly set the index in a freefall, until it finally stagnated on week 12. As has been stated before, news entering the market did have an influence on the developments, but if news alone are accountable for the decline, can the decline until 11th of March truly be explained only by the news from Lombardy, and why did the news from 6th of March have little effect on the trajectory of the decline, even if they were arguably significant from the financial market point of view? This thesis argues that uncertainty affecting market sentiment might have amplified the decline by obstructing rational investor behaviour.

From the results of prior research, an ultimately unprecedented increase in VIX can be observed from 23rd of February onwards, as the Lombardy lockdown was announced. According to research, grasping the attention of the market towards the developing pandemic, now threatening Europe. (Ramelli & Wagner 2020a.) An index combining both VIX

and Economic Policy Uncertainty (EPU) -index, measuring the global level of macro-economic uncertainty similarly grew to unprecedented level during March, implying a strong growth of uncertainty during March both in Finland and abroad. (Lindblad & al. 2020.)

Research of Ramelli & Wagner (2020a) argues that there is strong evidence that the quick market reaction on the onset of fever period is linked to the investor's concerns over the economic consequences of the COVID-19 crisis. Further, the investors were concerned about the possibility of COVID-19 turning into a financial crisis. As such, concerns over corporate debt and cash holdings surfaced. While these concerns might have set the index to a sharp decline, Ramelli & Wagner shared their concerns over the whipsaw pattern of aggregate returns that continued despite relatively little new information entering the market, as has been stated before. They conclude that herding behaviour might have gripped the investors.

As uncertainty grew throughout the period, it is reasonable to assume that the fears described by Ramelli & Wagner could have only intensified, leading to possibly to the herd growing larger and larger. As, herding can lead to investors act short-sighted, react too quickly to news or react to insignificant news (Nofsinger 2018, 141-145), and arguably general uncertainty about the situation feeds this behaviour, it is reasonable to assume that during the early weeks the investors might have been influenced by the barrage of arguably insignificant daily news, about the progress of the pandemic, daily number of infections in Finland and so on. It is known to established theory that emotions have a clear influence on investor behaviour, and studies show that overall negativity in news correlate with negative stock market performance. (Nofsinger 2018, 146-163.) The negative effect of news is of course highlighted on 11th to 13th of march as series of negative news of objectively huge significance directly relating to the crisis enter the market, plunging the market to freefall.

The great fall phenomenon as such is the outcome of an uncertainty shock that shook the overall investor confidence causing a market sentiment shock, shifting the market into a sustained sharp decline, further amplified by alarming news of lockdowns and travel restrictions. Research implies that herding behaviour further fed the effect, and as theory suggests herding might additionally magnify underlying behavioural biases that further obstruct rational investor behaviour.

The stagnation at the bottom describes the period where VIX, and by extension uncertainty was at its highest, while the stock market hit rock bottom and lingered there for the

whole of week 12. It is impossible to say why the falling market levelled at this point exactly, but the theory this thesis presents is that due to the investor sentiment shock caused by the uncertainty shock, for the pessimistic investors: this was the new point of equilibrium for the market. The unprecedented implied volatility, combined with both the market staying at a relatively steady level throughout the week, having stagnated to the new equilibrium and the high historical volatility of OMXH25 during the week: all imply that the market was buzzing with nervous buying and selling. This somewhat mirrors the behaviour seen during the 2008 financial crisis. Traditional finance theory takes it for granted that investors should sell high and buy low, which obviously is only partly the case here. Naturally, the market was ripe for arbitrage for an investor behaving rationally, but similarly throughout the week investors were selling against their best interests at the market bottom, and more importantly this went on for a whole week, until the market started to rebound.

A possible explanation for the phenomenon is the theory stated above. The investors can be inhibited from rational estimation of the situation by both the negative overall investor sentiment, and emotional biases fuelled by uncertainty and further amplified by herding. Such as: the uncertainty, and risk-aversion caused by it leading investors to sticking to familiar stocks even when it might not be the rational choice for them, due to familiarity bias, and by displaying both regret aversive and loss aversive behaviour, which can be intensified by the colossal market swings and herding behaviour.

Additionally, realistic view of the market is further obstructed by individual cognitive biases such as: confirmation bias over-emphasising information confirming the already negative investor sentiment, and assuring the investor that the market will decline even further, anchoring distorting the investor's assessment of asset value so that the investor might value the stock based on recent prices on the bottom of the market, and recency bias causing the investor to make short-sighted assessments of the market, believing that it will continue to decline, as it has declined for three weeks.

The whipsaw recovery path describes the third key phenomena. During week 13 the market finally rebounded and began its jagged path back to its growth path. During the first week the market soared as the market anticipated long-awaited financial stimulus from US government internationally, and from Finnish government locally. The recovery however was cut short by a series of profit warnings from the constituent companies of the index. From the initial soar, the market continued on a more moderate growth path on average for the rest of the period, as described in the previous chapter. Throughout the period the

market seemed to exhibit whipsaw aggregate returns alike those described by Ramelli & Wagner.

After promises of government action and later, realised financial stimulus, the level of uncertainty, according to VIX was on a steady decline, stabilising on a still very high level, but at much lower than what was experienced during weeks 10 to 12. Seemingly the government response calmed down investors, alleviating possibly the worst fears of the possible serious financial crisis. Underlining the effect uncertainty had on the market during the total fever period.

As described in the earlier chapter, during this recovery period a fair amount of the ups and downs in the market can be connected to news entering the market, but the research on the two previous periods indicate, that due to the persisting uncertainty and the restless market, herding and both cognitive and emotional biases might have influenced the market developments. Especially as the market rebounded, investors encouraged by the positive news, and possibly previous wins buying low as they should during previous weeks, might have become overconfident, leading to excess trading. This excess trading can be translated to the overall market as increased trading volume.

In conclusion of this last chapter of the results section of this thesis, overall, the research suggests that investor behaviour might have played an integral part amplifying the developments seen at the Finnish stock market during the period, the unprecedented uncertainty on the market seemingly being the driving force feeding the behaviour. While the research shows that there is reasonable evidence that the behaviour rationally stemmed mostly from the news entering the market, the uncertainty, herding, and different cognitive and emotional biases likely intensified the market reaction to news, and obstructed rational decision making of the investors.

5 Discussion

In conclusion of this thesis, this final chapter summarises the key findings of this thesis. After these conclusions, recommendations for further research are given. Finally, validity, reliability and relevance of this thesis is assessed, before reflection on learning, which concludes this thesis.

5.1 Key Findings

The research conducted by this thesis suggesting that the effect of COVID-19 crisis on the investor behaviour on Finnish stock market was as unprecedent and complicated as it was on Finnish economy. An unprecedented event, with an unprecedented impact on economies around the world, financial markets internationally and investor sentiment globally. The crisis is still surrounded by many unknowns, and this thesis can but offer suggestions based on the research and established theory on how the crisis might have influenced investors.

This thesis set out to uncover how investor behaviour might have affected the Finnish stock market. First, a macro-economic analysis was conducted in order to better understand the nature of the economic shock posed by the crisis. The research concluded that by disturbing the flow of income of Finnish economy simultaneously on multiple points, the crisis had concurrently characteristics of both supply and demand shock. Based on this knowledge, a statistical analysis followed, seeking to uncover possible causality between the economic shocks and Finnish stock market developments. Based on the analysis, no significant evidence was found on the possibility of the economic shocks causing developments on the market. Conversely, the analysis found significant evidence that the stock market might forecast the supply side of Finnish economy on one-month interval. Hinting that the unprecedented stock market reaction might have been in anticipation for the economic consequences of the crisis.

Finally, building on these findings, the thesis sought to understand the possible ways how investor behaviours might have influenced the market. The research suggested that: firstly, the unprecedented level of uncertainty felt globally on financial markets throughout the period amplified herding behaviour, and different cognitive and emotional biases among investors, leading to short-sighted decision-making and magnified market reactions to news, both significant and insignificant entering the market. Secondly, the anticipation shock witnessed in the real economy of Finland, could have spilled over as implied by the aforementioned uncertainty and actions of the investors, as they seemed to have

anticipated the possible economic effects of the crisis. And thirdly, the negative news during the period possibly supplemented by the uncertainty contributed to a negative sentiment shock on the market, leading to pessimistic investors and risk-averse market behaviour, which when combined with the short-sightedness shifted the market equilibrium of the stock market.

5.2 Suggestions for Further Research

Many aspects of this thesis would welcome more research in the future as more data is available. Especially, the macro-economic effects and consequences of COVID-19 in Finland can be approached from numerous different points of view. The themes of this thesis and the research conducted could be expanded upon, as more data and research surface concerning the period. The more longer reaching effect of the developments during the first half of 2020 offers plenty of different approaches as well, and finally, as we know now, this thesis concerns only the first wave of coronavirus in Finland, obviously all that is stated already apply for the later developments of the crisis.

5.3 Validity, Reliability and Relevance

Due to the novelty and unprecedented nature of the crisis, forerunner research on the topic is sparse, and the applicability of established theory mostly concerning the different themes of this thesis on normal, stable conditions, is arguably questionable. This thesis can only offer suggestions on the possible course of events, and the influence any given phenomenon might have had. As such, while all the research presented on this thesis is grounded on established theory and reliable sources, the nature of the topic demands a level of speculation, as especially investor behaviour is notoriously hard to measure, and any attempts to do so properly would be well beyond the scope of this thesis. Therefore, the research itself is mostly of descriptive nature.

5.4 Reflection on Learning

The process of writing this thesis while adjusting to the constant semi-quarantine the year 2020 brought with it, has been an arduous one. The topic itself was incredibly challenging at times due to its novelty, and as such, the lack of research on it. The greatest challenge was to figure out ways of meaningful research on the investor behaviour, as at the same time the only reliable and established theory on the topic was only available on very general level. At the same time, accurately measuring behaviour, especially on a market scale, was far beyond the scope of a bachelor's thesis.

On the actual process side of the matter, the process of writing a thesis in itself seemed like a tall mountain to climb but writing it while all routine dissolved from the daily life owing to distance work and study, was something else. The past year has taught a lot about project management, and especially self-management to achieve long-term goals. One of the key-findings of the year was Pomodoro technique, for which, without a doubt this thesis owes its success.

References

Arvopaperi. 2020a. Kone antaa tulosvaroituksen: ”Liikevaihto laskee tai on parhaimmassa tapauksessa vakaa verrattuna vuoden 2019 liikevaihtoon”. URL: https://www.arvopaperi.fi/uutiset/kone-antaa-tulosvaroituksen-liikevaihto-laskee-tai-on-parhaimmassa-tapauksessa-vakaa-verrattuna-vuoden-2019-liikevaihtoon/af424841-43e3-47b3-97b7-bae125b2fbb8. Accessed: 20 January 2021

Arvopaperi. 2020b. Huhtamäki peruu toistaiseksi näkymänsä – yhtiön hallitus esittää osinkoon lykkäystä. URL: https://www.arvopaperi.fi/uutiset/huhtamaki-peruu-toistaiseksi-nakymansa-yhtion-hallitus-esittaa-osinkoon-lykkaysta/1df6d97c-ea31-4b76-99c1-ddd10fea5983. Accessed: 20 January 2021

Baker, S. Bloom, N. Davis, S. Kost, K. Sammon, M. & Viratyosin, T. 2020. The Unprecedented Stock Market Reaction to COVID-19. National Bureau of Economic Research. Cambridge, MA. URL: https://www.nber.org/papers/w26945. Accessed 14 October 2020.

Baldwin, R. 2020. Keeping the lights on: Economic medicine for a medical shock. URL: https://voxeu.org/article/how-should-we-think-about-containing-COVID-19-economic-crisis. Accessed: 10 August 2020.

Baldwin, R. & Weder di Mauro, B. 2020a. Introduction. In Baldwin, R. & Weder di Mauro, B. Economics in the Time of COVID-19, pp. 1–31. CEPR Press. London. URL: https://voxeu.org/system/files/epublication/COVID-19.pdf. Accessed: 10 August 2020.

Baldwin, R. & Weder di Mauro, B. 2020b. Introduction. In Baldwin, R. & Weder di Mauro, B. Mitigating the COVID Economic Crisis: Act Fast and Do Whatever It Takes, pp. 1–25. CEPR Press. London. URL: https://voxeu.org/system/files/epublication/COVIDEconomicCrisis.pdf. Accessed: 10 August 2020.

Bofinger, P. Dullien, S. Felbermayr, G. Fuest, C. Hüther, M. Südekum, J. & Weder di Mauro, B. 2020. Economic implications of the COVID-19 crisis for Germany and economic policy measures. In Baldwin, R. & Weder di Mauro, B. Mitigating the COVID Economic Crisis: Act Fast and Do Whatever It Takes, pp. 167–179. CEPR Press. London. URL: https://voxeu.org/system/files/epublication/COVIDEconomicCrisis.pdf. Accessed: 10 August 2020.

Carlsson-Szlezak, P, Reeves, M & Swartz, P. 2020a. Understanding the Economic Shock of Coronavirus. URL: https://hbr.org/2020/03/understanding-the-economic-shock-of-coronavirus. Accessed: 25.5.2020

Carlsson-Szlezak, P, Reeves, M & Swartz, P. 2020b. What Coronavirus Could Mean for the Global Economy. URL: https://hbr.org/2020/03/what-coronavirus-could-mean-for-the-global-economy?referral=03758&cm_vc=rr_item_page.top_right. Accessed: 3.6.2020

CNBC. 2020. House unlikely to vote on historic $2 trillion coronavirus stimulus bill Wednesday. URL: https://www.cnbc.com/2020/03/24/coronavirus-updates-congress-gets-closer-to-a-deal-on-massive-stimulus-bill.html. Accessed: 8 January 2021

Davis, S. Hansen, S. & Seminario-Amez, C. 2020. Firm-Level Risk Exposures and Stock Returns in the Wake of COVID-19. National Bureau of Economic Research. Cambridge, MA. URL: https://www.nber.org/papers/w27867. Accessed 14 October 2020.

Gopinath, G. 2020. Limiting the economic fallout of the coronavirus with large targeted policies. In Baldwin, R. & Weder di Mauro, B. Mitigating the COVID Economic Crisis: Act Fast and Do Whatever It Takes, pp. 41–49. CEPR Press. London. URL: https://voxeu.org/system/files/epublication/COVIDEconomicCrisis.pdf. Accessed: 10 August 2020.

Finnish government. 2020a. Valtioneuvoston kokonaisarvio COVID-19-toimien vaikutuksista. URL: https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/162525/VN_2020_COVID19_toimien_vaikutusten_kokonaisarvio.pdf?sequence=1&isAllowed=y. Accessed: 14 November 2020

Finnish Government. 2020b. Pääministeri Marinin puhe eduskunnassa 17.3.2020. URL: https://valtioneuvosto.fi/artikkeli/-/asset_publisher/10616/paaministeri-marinin-puhe-eduskunnassa-17-3-2020. Accessed: 8 March 2021

Finnish Government. 2020c. Ravintolat sulkeutuvat koko maassa perjantaina puolen yön aikaan koronavirusepidemian vuoksi. URL: https://valtioneuvosto.fi/-/1410877/ravintolat-sulkeutuvat-koko-maassa-perjantaina-puolen-yon-aikaan-koronavirusepidemian-vuoksi. Accessed: 8 March 2021

Ilta-Sanomat. 2020a. Suomi menee taas tänään kiinni – IS:n jättigrafiikka kertoo, mitä kaikkea poikkeusvuoden aikana tapahtui. URL: https://www.is.fi/kotimaa/art-2000007846665.html. Accessed: 8 March 2021

Ilta-Sanomat. 2020b. Cargoteciltä tulosvaroitus: ”Näkyvyys on heikko”. URL: https://www.is.fi/taloussanomat/porssiuutiset/art-2000006455152.html. Accessed: 10 March

Ilta-Sanomat. 2020b. Cargoteciltä tulosvaroitus: ”Näkyvyys on heikko”. URL: https://www.is.fi/taloussanomat/porssiuutiset/art-2000006455152.html. Accessed: 20 January 2021

Kauppalehti. 2020a. UPM peruu arvionsa vuoden 2020 näkymistä – ”Joidenkin tuotteiden kysyntä saattaa heikentyä”. URL: https://www.kauppalehti.fi/uutiset/upm-peruu-arvionsa-vuoden-2020-nakymista-joidenkin-tuotteiden-kysynta-saattaa-heikentya/f81ae49c-ae37-4616-b93b-10f680e3bfbe. Accessed: 20 January 2021

Kauppalehti. 2020b. Valmet peruu ohjeistuksensa .URL: https://www.kauppalehti.fi/uutiset/valmet-peruu-ohjeistuksensa/904acb78-fa2b-48c8-a9f7-0b51b1a6828f. Accessed: 20 January 2021

Kesko. 2020. KESKO OYJ ANTAA TULOSVAROITUKSEN: COVID-19 JA TALOUDEN MAAILMANLAAJUISEN EPÄVARMUUDEN VUOKSI YHTIÖ PERUUTTAA AIEMMIN ANTAMANSA LIIKEVAIHTO-OHJEISTUKSEN JA MUUTTAA LIIKEVOITTO-OHJEISTUSTA. URL: https://www.kesko.fi/media/uutiset-ja-tiedotteet/porssitiedotteet/2020/kesko-oyj-antaa-tulosvaroituksen-COVID-19-ja-talouden-maailmanlaajuisen-epavarmuuden-vuoksi-yhtio-peruuttaa-aiemmin-ant/. Accessed: 20 January 2021

Konecranes. 2020. KONECRANES OYJ: TULOSVAROITUS: KONECRANES PÄIVITTÄÄ KYSYNTÄNÄKYMIÄÄN KORONAVIRUSPANDEMIAN (COVID-19) VUOKSI JA PERUUTTAA TALOUDELLISEN OHJEISTUKSENSA VUODELLE 2020. URL: 20 January 2021https://www.konecranes.com/fi/press/releases/2020/konecranes-oyj-tulosvaroitus-konecranes-paivittaa-kysyntanakymiaan-koronaviruspandemian-COVID-19-vuoksi-ja. Accessed: 20 January 2021

Li, Y. 2020. Wall Street’s fear gauge closes at highest level ever, surpassing even financial crisis peak. https://www.cnbc.com/2020/03/16/wall-streets-fear-gauge-hits-highest-level-ever.html. Accessed: 20 February 2021

Lindblad, A. Sariola, M. & Silvo, A. 2020. Koronaepävarmuus pitkittää ja pahentaa talouden taantumaa. In Suomen Pankki. Euro & Talous, pp 53-62. Suomen Pankki. Helsinki. URL: https://eurojatalous.studio.crasman.fi/file/dl/a/duzH_Q/OaZFyEHRG3I7T6SkYf-TyoA/ET120.pdf. Accessed: 15 December 2020

Montier, J. 2002. Behavioural finance : insights into irrational minds and markets. Wiley. West Sussex.

MarketWatch. 2020. Signs of panic-like selling emerge in the stock market Wednesday morning even as tech shares climb. URL: https://www.marketwatch.com/story/signs-of-panic-like-selling-emerge-in-the-stock-market-wednesday-morning-even-as-tech-shares-surge-2020-06-10. Accessed: 8 January 2021

Nofsinger, J. 2018. The psychology of investing. Sixth edition. Routledge. New York, NY.

Nasdaq. 2020. OMX Helsinki 25 (OMXH25). URL: https://indexes.nasdaqomx.com/Index/Overview/OMXH25. Accessed: 28 August 2020

PIMCO. 2020. Behavioral Guidance During Market Volatility. URL: https://www.pimco.com/handlers/displaydocument.ashx?fn=Advisor%20ED_Behavioral%20Finance%20LB_secured.pdf&id=HJ5qpKe0z3R27SmRuw8JBlPSEJE6SWY1uRKCUFmPYN8OL-PItR6pRe2QV5xh42zc1XeEfsw97PACmz64w0h4xeJwvi%2BsIaeQt64%2BrYkHjcjJjunlt-FDp2ymw7BFIpubY7mlKj036TLXvQOmxQeZtrbTVUnog6L%2FSaiYU-JSRjWPKtKJ0P%2BUG%2FOmcx2rRWhb%2B1E%2BakehsEF9uiXIzSJz1FtuWCBCjKQ4n3KNyfzusNe%2FjSZ7Sf4Aa7HQOkAGT9%2BT2GfIZ1tdJO1MLePjDJ0q88JxGR2Rt0jpERIgrln4DaDCzi%2Bl9vCEcSK5vi8ymEnrLWqPCuO-qNFMUbN0qM8p8ZlYw1e%2B2D%2BdEAgJP%2FJ3OCApL-WeJvvD%2F0UGnK5JnIvrYiSlOjATGVCPwj%2BzPK3MzricJKgPr%2F1lenl6LEn-wFbnY%2BQ2Rs63%2FEDpYCyIEPyTCGdDYo. Accessed: 9 November 2020.

Ramelli, R. & Wagner, A. 2020a. Feverish Stock Price Reactions to COVID-19. URL: https://academic.oup.com/rcfs/article/9/3/622/5868420. Accessed: 18 September 2020.

Ramelli, R. & Wagner, A. 2020b. What the stock market tells us about the consequences of COVID-19. In Baldwin, R. & Weder di Mauro, B. Mitigating the COVID Economic Crisis: Act Fast and Do Whatever It Takes, pp. 63–71. CEPR Press. London. URL:

https://voxeu.org/system/files/epublication/COVIDEconomicCrisis.pdf. Accessed: 10 August 2020.

Reuters. 2020. OPEC's pact with Russia falls apart, sending oil into tailspin. URL: https://www.reuters.com/article/us-opec-meeting-idUSKBN20T0Y2. Accessed: 8 Jan 2021

Statistics Finland. 2020a. Trend Indicator of Output. URL: https://www.stat.fi/meta/til/ktkk_en.html. Accessed: 6 August 2020

Statistics Finland. 2020b. Talouden tilannekuva. URL: https://web.archive.org/web/20200923003829/http://www.stat.fi/ajk/koronavirus/koronavirus-ajankohtaista-tilastotietoa/miten-vaikutukset-nakyvat-tilastoissa. Accessed: 17 October 2020

Vanguard. 2013. Behavioural Finance. URL: https://www.vanguard.co.uk/documents/portal/literature/behavourial-finance-guide.pdf. Accessed: 18 May 2020.

Wall Street Journal. 2019. What Is Economic Shock. URL: https://www.wsj.com/articles/what-is-economic-shock-11570413600. Accessed: 18 May 2020.

WHO. 2020. Q&A coronaviruses (COVID-19). URL: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/q-a-coronaviruses. Accessed: 18 May 2020.

The New York Times. 2020. $2 Trillion Coronavirus Stimulus Bill Is Signed Into Law. URL: https://www.nytimes.com/2020/03/27/us/politics/coronavirus-house-voting.html. Accessed: 8 January 2021

Tekniikka ja talous. 2020. Telialta tulosvaroitus – urheilutapahtumien peruminen iski kovaa. URL: https://www.tekniikkatalous.fi/uutiset/telialta-tulosvaroitus-urheilutapahtumien-peruminen-iski-kovaa/7464a031-d5d0-4935-851f-7616305a1939. Accessed: 20 January 2021

Yle. 2020a. Suomi selvisi koronakeväästä voittajana EU:ssa – Pahin voi olla taloudessa jo ohi, ekonomistit arvioivat Ylen kyselyssä. URL: https://yle.fi/uutiset/3-11503219. Accessed: 5 January 2021

Yle. 2020b. Taistelu tuntematonta vastaan – Näin hallitus sulki Suomen seitsemässä päivässä. URL: https://yle.fi/uutiset/3-11267255. Accessed: 8 March 2021

Yle. 2020c. Valtiovarainministeri Kulmuni: Yrityksille tulossa miljardin tukipotti, rahat halutaan liikkeelle nopeasti. URL: https://yle.fi/uutiset/3-11277385. Accessed: 8 March 2021

Yle. 2020d. Nokian Renkaat julkisti tulosvaroituksen. URL: https://yle.fi/uutiset/3-11173577. Accessed: 10 March 2021

Appendices

Appendix 1. The results of Granger tests on 1 to 6 lags on monthly working day adjusted trend indicator of output & monthly median close price of OMXH25. (P values and F statistics)

GRANGER_TEST[1]		p-value
Lags	OMXH25>PROD	PROD>OMXH25
1	0,010285673	0,444031159
2	0,073439442	0,227493097
3	0,140210075	0,085779274
4	0,189651271	0,167134269
5	0,132114860	0,278144558
6	0,217054623	0,162507688

GRANGER		F Statistic
Lags	OMXH25>PROD	PROD>OMXH25
1	7,013121137	0,593529398
2	2,732470264	1,519084905
3	1,900641117	2,315707646
4	1,594583598	1,686644838
5	1,791283021	1,302931305
6	1,44874902	1,622408027

[1] Differenced time series of monthly working day adjusted trend indicator of output & monthly median close price of OMXH25 were tested for Granger-causality in both directions. The time period tested was from February 2015 to June 2020.

Appendix 2. Example of the differenced time series and the regression analysis of the time series in both directions on 1 lag

Differenced time series 2/15-6/20		
Time	OMXH25	PROD
2015 Jan	-	-
2015 Feb	9,22 %	0,40 %
2015 Mar	4,64 %	1,41 %
2015 Apr	1,19 %	-0,35 %
2015 May	-5,19 %	-0,38 %
2015 Jun	-1,78 %	0,94 %
2015 Jul	1,12 %	0,01 %
2015 Aug	-0,57 %	-0,53 %
2015 Sep	-8,59 %	0,49 %
2015 Oct	3,57 %	0,00 %
2015 Nov	7,40 %	-0,06 %
2015 Dec	-1,46 %	1,30 %
2016 Jan	-4,84 %	-1,14 %
2016 Feb	-2,49 %	1,58 %
2016 Mar	2,76 %	-0,72 %
2016 Apr	-1,02 %	1,48 %
2016 May	-1,71 %	-0,57 %
2016 Jun	4,01 %	0,35 %
2016 Jul	3,33 %	0,71 %
2016 Aug	1,98 %	-0,69 %
2016 Sep	1,44 %	0,65 %
2016 Oct	1,52 %	-0,22 %
2016 Nov	-1,73 %	0,59 %
2016 Dec	6,05 %	0,61 %
2017 Jan	1,17 %	1,98 %
2017 Feb	0,76 %	-1,21 %
2017 Mar	1,47 %	0,19 %
2017 Apr	0,73 %	-0,04 %
2017 May	5,24 %	0,83 %
2017 Jun	1,38 %	0,33 %
2017 Jul	-1,36 %	0,12 %
2017 Aug	-2,80 %	-0,18 %
2017 Sep	1,39 %	0,42 %
2017 Oct	2,69 %	0,58 %
2017 Nov	-2,38 %	0,35 %
2017 Dec	-1,02 %	0,59 %
2018 Jan	3,22 %	-0,37 %
2018 Feb	1,72 %	-0,74 %
2018 Mar	-0,77 %	0,41 %
2018 Apr	-0,83 %	-0,56 %
2018 May	5,41 %	0,76 %
2018 Jun	0,65 %	-0,08 %
2018 Jul	-1,49 %	-0,14 %
2018 Aug	1,18 %	0,33 %
2018 Sep	0,29 %	0,26 %
2018 Oct	-6,98 %	-0,02 %
2018 Nov	-1,46 %	0,21 %
2018 Dec	-3,97 %	-0,13 %
2019 Jan	4,71 %	-0,99 %
2019 Feb	3,68 %	1,10 %
2019 Mar	0,75 %	2,30 %
2019 Apr	1,02 %	-0,63 %
2019 May	-6,30 %	-0,51 %
2019 Jun	0,30 %	0,23 %
2019 Jul	1,40 %	-0,27 %
2019 Aug	-3,84 %	0,37 %
2019 Sep	5,00 %	-0,84 %
2019 Oct	0,85 %	-0,07 %
2019 Nov	1,48 %	-0,55 %
2019 Dec	-0,09 %	0,77 %
2020 Jan	4,88 %	-0,30 %
2020 Feb	4,11 %	-1,05 %
2020 Mar	-27,66 %	-1,95 %
2020 Apr	6,80 %	-1,46 %
2020 May	6,80 %	-0,54 %
2020 Jun	7,83 %	1,54 %

Regression analysis of time series in both directions on 1 lag					
OMXH25>PROD			**PROD>OMXH25**		
PROD-1	OMXH25-1	PROD	OMXH25-1	PROD-1	OMXH25
0,40 %	9,22 %	1,41 %	9,22 %	0,40 %	4,64 %
1,41 %	4,64 %	-0,35 %	4,64 %	1,41 %	1,19 %
-0,35 %	1,19 %	-0,38 %	1,19 %	-0,35 %	-5,19 %
-0,38 %	-5,19 %	0,94 %	-5,19 %	-0,38 %	-1,78 %
0,94 %	-1,78 %	0,01 %	-1,78 %	0,94 %	1,12 %
0,01 %	1,12 %	-0,53 %	1,12 %	0,01 %	-0,57 %
-0,53 %	-0,57 %	0,49 %	-0,57 %	-0,53 %	-8,59 %
0,49 %	-8,59 %	0,00 %	-8,59 %	0,49 %	3,57 %
0,00 %	3,57 %	-0,06 %	3,57 %	0,00 %	7,40 %
-0,06 %	7,40 %	1,30 %	7,40 %	-0,06 %	-1,46 %
1,30 %	-1,46 %	-1,14 %	-1,46 %	1,30 %	-4,84 %
-1,14 %	-4,84 %	1,58 %	-4,84 %	-1,14 %	-2,49 %
1,58 %	-2,49 %	-0,72 %	-2,49 %	1,58 %	2,76 %
-0,72 %	2,76 %	1,48 %	2,76 %	-0,72 %	-1,02 %
1,48 %	-1,02 %	-0,57 %	-1,02 %	1,48 %	-1,71 %
-0,57 %	-1,71 %	0,35 %	-1,71 %	-0,57 %	4,01 %
0,35 %	4,01 %	0,71 %	4,01 %	0,35 %	3,33 %
0,71 %	3,33 %	-0,69 %	3,33 %	0,71 %	1,98 %
-0,69 %	1,98 %	0,65 %	1,98 %	-0,69 %	1,44 %
0,65 %	1,44 %	-0,22 %	1,44 %	0,65 %	1,52 %
-0,22 %	1,52 %	0,59 %	1,52 %	-0,22 %	-1,73 %
0,59 %	-1,73 %	0,61 %	-1,73 %	0,59 %	6,05 %
0,61 %	6,05 %	1,98 %	6,05 %	0,61 %	1,17 %
1,98 %	1,17 %	-1,21 %	1,17 %	1,98 %	0,76 %
-1,21 %	0,76 %	0,19 %	0,76 %	-1,21 %	1,47 %
0,19 %	1,47 %	-0,04 %	1,47 %	0,19 %	0,73 %
-0,04 %	0,73 %	0,83 %	0,73 %	-0,04 %	5,24 %
0,83 %	5,24 %	0,33 %	5,24 %	0,83 %	1,38 %
0,33 %	1,38 %	0,12 %	1,38 %	0,33 %	-1,36 %
0,12 %	-1,36 %	-0,18 %	-1,36 %	0,12 %	-2,80 %
-0,18 %	-2,80 %	0,42 %	-2,80 %	-0,18 %	1,39 %
0,42 %	1,39 %	0,58 %	1,39 %	0,42 %	2,69 %
0,58 %	2,69 %	0,35 %	2,69 %	0,58 %	-2,38 %
0,35 %	-2,38 %	0,59 %	-2,38 %	0,35 %	-1,02 %
0,59 %	-1,02 %	-0,37 %	-1,02 %	0,59 %	3,22 %
-0,37 %	3,22 %	-0,74 %	3,22 %	-0,37 %	1,72 %
-0,74 %	1,72 %	0,41 %	1,72 %	-0,74 %	-0,77 %
0,41 %	-0,77 %	-0,56 %	-0,77 %	0,41 %	-0,83 %
-0,56 %	-0,83 %	0,76 %	-0,83 %	-0,56 %	5,41 %
0,76 %	5,41 %	-0,08 %	5,41 %	0,76 %	0,65 %
-0,08 %	0,65 %	-0,14 %	0,65 %	-0,08 %	-1,49 %
-0,14 %	-1,49 %	0,33 %	-1,49 %	-0,14 %	1,18 %
0,33 %	1,18 %	0,26 %	1,18 %	0,33 %	0,29 %
0,26 %	0,29 %	-0,02 %	0,29 %	0,26 %	-6,98 %
-0,02 %	-6,98 %	0,21 %	-6,98 %	-0,02 %	-1,46 %
0,21 %	-1,46 %	-0,13 %	-1,46 %	0,21 %	-3,97 %
-0,13 %	-3,97 %	-0,99 %	-3,97 %	-0,13 %	4,71 %
-0,99 %	4,71 %	1,10 %	4,71 %	-0,99 %	3,68 %
1,10 %	3,68 %	2,30 %	3,68 %	1,10 %	0,75 %
2,30 %	0,75 %	-0,63 %	0,75 %	2,30 %	1,02 %
-0,63 %	1,02 %	-0,51 %	1,02 %	-0,63 %	-6,30 %
-0,51 %	-6,30 %	0,23 %	-6,30 %	-0,51 %	0,30 %
0,23 %	0,30 %	-0,27 %	0,30 %	0,23 %	1,40 %
-0,27 %	1,40 %	0,37 %	1,40 %	-0,27 %	-3,84 %
0,37 %	-3,84 %	-0,84 %	-3,84 %	0,37 %	5,00 %
-0,84 %	5,00 %	-0,07 %	5,00 %	-0,84 %	0,85 %
-0,07 %	0,85 %	-0,55 %	0,85 %	-0,07 %	1,48 %
-0,55 %	1,48 %	0,77 %	1,48 %	-0,55 %	-0,09 %
0,77 %	-0,09 %	-0,30 %	-0,09 %	0,77 %	4,88 %
-0,30 %	4,88 %	-1,05 %	4,88 %	-0,30 %	4,11 %
-1,05 %	4,11 %	-1,95 %	4,11 %	-1,05 %	-27,66 %
-1,95 %	-27,66 %	-1,46 %	-27,66 %	-1,95 %	6,80 %
-1,46 %	6,80 %	-0,54 %	6,80 %	-1,46 %	6,80 %
-0,54 %	6,80 %	1,54 %	6,80 %	-0,54 %	7,83 %

Appendix 3. The test for granger-causality in both directions and the results on 1 lag with added glossary of terms used

PROD>OMXH25

R-sq full	0,016650285	=RSquare(L3:M66;N3:N66)
R-sq red	0,007082302	=RSquare(L3:L66;N3:N66)
dfRes	61,00	=COUNT(N3:N66)-R6*2-1
dfReg	1	=COUNT(L3:L3)
F	0,593529398	=(R3-R4)*R5/(1-R3)/R6
p-value	0,444031159	=FDIST(R8;R6;R5)

OMXH25>PROD

R-sq full	0,117180808	=RSquare(H3:I66,J3:J66)
R-sq red	0,015683792	=RSquare(H3:H66,J3:J66)
dfRes	61,00	=COUNT(J3:J66)-R15*2-1
dfReg	1	=COUNT(H3:H3)
F	7,013121137	=(R12-R13)*R14/(1-R12)/R15
p-value	0,010285673	=FDIST(R17;R15;R14)

Glossary of terms used

PROD(t)	Monthly working day adjusted trend indicator of output
OMXH25(t)	Monthly median close price of OMXH25
*The two time series are differenced for the purposes of this test	
R-sq full	R-Squared full, accounting both time-series
R-sq red	R-Squared Reduced, accounting only the first series
dfRes	Residual degrees of freedom (Here the number of samples)
dfReg	Regression effective degrees of freedom (here the number of lags)
F	F statistic
p-value	P value

Appendix 4. Example of the regression analysis in the direction of trend indicator of output > OMXH25 on 6 lags

Regression analysis of time series in the direction of PROD>OMXH25 on 6 lags													
OMXH25-1	OMXH25-2	OMXH25-3	OMXH25-4	OMXH25-5	OMXH25-6	PROD-1	PROD-2	PROD-3	PROD-4	PROD-5	PROD-6	OMXH25
1,12 %	-1,78 %	-5,19 %	1,19 %	4,64 %	9,22 %	0,01 %	0,94 %	-0,38 %	-0,35 %	1,41 %	0,40 %	-0,57 %
-0,57 %	1,12 %	-1,78 %	-5,19 %	1,19 %	4,64 %	-0,53 %	0,01 %	0,94 %	-0,38 %	-0,35 %	1,41 %	-8,59 %
-8,59 %	-0,57 %	1,12 %	-1,78 %	-5,19 %	1,19 %	0,49 %	-0,53 %	0,01 %	0,94 %	-0,38 %	-0,35 %	3,57 %
3,57 %	-8,59 %	-0,57 %	1,12 %	-1,78 %	-5,19 %	0,00 %	0,49 %	-0,53 %	0,01 %	0,94 %	-0,38 %	7,40 %
7,40 %	3,57 %	-8,59 %	-0,57 %	1,12 %	-1,78 %	-0,06 %	0,00 %	0,49 %	-0,53 %	0,01 %	0,94 %	-1,46 %
-1,46 %	7,40 %	3,57 %	-8,59 %	-0,57 %	1,12 %	1,30 %	-0,06 %	0,00 %	0,49 %	-0,53 %	0,01 %	-4,84 %
-4,84 %	-1,46 %	7,40 %	3,57 %	-8,59 %	-0,57 %	-1,14 %	1,30 %	-0,06 %	0,00 %	0,49 %	-0,53 %	-2,49 %
-2,49 %	-4,84 %	-1,46 %	7,40 %	3,57 %	-8,59 %	1,58 %	-1,14 %	1,30 %	-0,06 %	0,00 %	0,49 %	2,76 %
2,76 %	-2,49 %	-4,84 %	-1,46 %	7,40 %	3,57 %	-0,72 %	1,58 %	-1,14 %	1,30 %	-0,06 %	0,00 %	-1,02 %
-1,02 %	2,76 %	-2,49 %	-4,84 %	-1,46 %	7,40 %	1,48 %	-0,72 %	1,58 %	-1,14 %	1,30 %	-0,06 %	-1,71 %
-1,71 %	-1,02 %	2,76 %	-2,49 %	-4,84 %	-1,46 %	-0,57 %	1,48 %	-0,72 %	1,58 %	-1,14 %	1,30 %	4,01 %
4,01 %	-1,71 %	-1,02 %	2,76 %	-2,49 %	-4,84 %	0,35 %	-0,57 %	1,48 %	-0,72 %	1,58 %	-1,14 %	3,33 %
3,33 %	4,01 %	-1,71 %	-1,02 %	2,76 %	-2,49 %	0,71 %	0,35 %	-0,57 %	1,48 %	-0,72 %	1,58 %	1,98 %
1,98 %	3,33 %	4,01 %	-1,71 %	-1,02 %	2,76 %	-0,69 %	0,71 %	0,35 %	-0,57 %	1,48 %	-0,72 %	1,44 %
1,44 %	1,98 %	3,33 %	4,01 %	-1,71 %	-1,02 %	0,65 %	-0,69 %	0,71 %	0,35 %	-0,57 %	1,48 %	1,52 %
1,52 %	1,44 %	1,98 %	3,33 %	4,01 %	-1,71 %	-0,22 %	0,65 %	-0,69 %	0,71 %	0,35 %	-0,57 %	-1,73 %
-1,73 %	1,52 %	1,44 %	1,98 %	3,33 %	4,01 %	0,59 %	-0,22 %	0,65 %	-0,69 %	0,71 %	0,35 %	6,05 %
6,05 %	-1,73 %	1,52 %	1,44 %	1,98 %	3,33 %	0,61 %	0,59 %	-0,22 %	0,65 %	-0,69 %	0,71 %	1,17 %
1,17 %	6,05 %	-1,73 %	1,52 %	1,44 %	1,98 %	1,98 %	0,61 %	0,59 %	-0,22 %	0,65 %	-0,69 %	0,76 %
0,76 %	1,17 %	6,05 %	-1,73 %	1,52 %	1,44 %	-1,21 %	1,98 %	0,61 %	0,59 %	-0,22 %	0,65 %	1,47 %
1,47 %	0,76 %	1,17 %	6,05 %	-1,73 %	1,52 %	0,19 %	-1,21 %	1,98 %	0,61 %	0,59 %	-0,22 %	0,73 %
0,73 %	1,47 %	0,76 %	1,17 %	6,05 %	-1,73 %	-0,04 %	0,19 %	-1,21 %	1,98 %	0,61 %	0,59 %	5,24 %
5,24 %	0,73 %	1,47 %	0,76 %	1,17 %	6,05 %	0,83 %	-0,04 %	0,19 %	-1,21 %	1,98 %	0,61 %	1,38 %
1,38 %	5,24 %	0,73 %	1,47 %	0,76 %	1,17 %	0,33 %	0,83 %	-0,04 %	0,19 %	-1,21 %	1,98 %	-1,36 %
-1,36 %	1,38 %	5,24 %	0,73 %	1,47 %	0,76 %	0,12 %	0,33 %	0,83 %	-0,04 %	0,19 %	-1,21 %	-2,80 %
-2,80 %	-1,36 %	1,38 %	5,24 %	0,73 %	1,47 %	-0,18 %	0,12 %	0,33 %	0,83 %	-0,04 %	0,19 %	1,39 %
1,39 %	-2,80 %	-1,36 %	1,38 %	5,24 %	0,73 %	0,42 %	-0,18 %	0,12 %	0,33 %	0,83 %	-0,04 %	2,69 %
2,69 %	1,39 %	-2,80 %	-1,36 %	1,38 %	5,24 %	0,58 %	0,42 %	-0,18 %	0,12 %	0,33 %	0,83 %	-2,38 %
-2,38 %	2,69 %	1,39 %	-2,80 %	-1,36 %	1,38 %	0,35 %	0,58 %	0,42 %	-0,18 %	0,12 %	0,33 %	-1,02 %
-1,02 %	-2,38 %	2,69 %	1,39 %	-2,80 %	-1,36 %	0,59 %	0,35 %	0,58 %	0,42 %	-0,18 %	0,12 %	3,22 %
3,22 %	-1,02 %	-2,38 %	2,69 %	1,39 %	-2,80 %	-0,37 %	0,59 %	0,35 %	0,58 %	0,42 %	-0,18 %	1,72 %
1,72 %	3,22 %	-1,02 %	-2,38 %	2,69 %	1,39 %	-0,74 %	-0,37 %	0,59 %	0,35 %	0,58 %	0,42 %	-0,77 %
-0,77 %	1,72 %	3,22 %	-1,02 %	-2,38 %	2,69 %	0,41 %	-0,74 %	-0,37 %	0,59 %	0,35 %	0,58 %	-0,83 %
-0,83 %	-0,77 %	1,72 %	3,22 %	-1,02 %	-2,38 %	-0,56 %	0,41 %	-0,74 %	-0,37 %	0,59 %	0,35 %	5,41 %
5,41 %	-0,83 %	-0,77 %	1,72 %	3,22 %	-1,02 %	0,76 %	-0,56 %	0,41 %	-0,74 %	-0,37 %	0,59 %	0,65 %
0,65 %	5,41 %	-0,83 %	-0,77 %	1,72 %	3,22 %	-0,08 %	0,76 %	-0,56 %	0,41 %	-0,74 %	-0,37 %	-1,49 %
-1,49 %	0,65 %	5,41 %	-0,83 %	-0,77 %	1,72 %	-0,14 %	-0,08 %	0,76 %	-0,56 %	0,41 %	-0,74 %	1,18 %
1,18 %	-1,49 %	0,65 %	5,41 %	-0,83 %	-0,77 %	0,33 %	-0,14 %	-0,08 %	0,76 %	-0,56 %	0,41 %	0,29 %
0,29 %	1,18 %	-1,49 %	0,65 %	5,41 %	-0,83 %	0,26 %	0,33 %	-0,14 %	-0,08 %	0,76 %	-0,56 %	-6,98 %
-6,98 %	0,29 %	1,18 %	-1,49 %	0,65 %	5,41 %	-0,02 %	0,26 %	0,33 %	-0,14 %	-0,08 %	0,76 %	-1,46 %
-1,46 %	-6,98 %	0,29 %	1,18 %	-1,49 %	0,65 %	0,21 %	-0,02 %	0,26 %	0,33 %	-0,14 %	-0,08 %	-3,97 %
-3,97 %	-1,46 %	-6,98 %	0,29 %	1,18 %	-1,49 %	-0,13 %	0,21 %	-0,02 %	0,26 %	0,33 %	-0,14 %	4,71 %
4,71 %	-3,97 %	-1,46 %	-6,98 %	0,29 %	1,18 %	-0,99 %	-0,13 %	0,21 %	-0,02 %	0,26 %	0,33 %	3,68 %
3,68 %	4,71 %	-3,97 %	-1,46 %	-6,98 %	0,29 %	1,10 %	-0,99 %	-0,13 %	0,21 %	-0,02 %	0,26 %	0,75 %
0,75 %	3,68 %	4,71 %	-3,97 %	-1,46 %	-6,98 %	2,30 %	1,10 %	-0,99 %	-0,13 %	0,21 %	-0,02 %	1,02 %
1,02 %	0,75 %	3,68 %	4,71 %	-3,97 %	-1,46 %	-0,63 %	2,30 %	1,10 %	-0,99 %	-0,13 %	0,21 %	-6,30 %
-6,30 %	1,02 %	0,75 %	3,68 %	4,71 %	-3,97 %	-0,51 %	-0,63 %	2,30 %	1,10 %	-0,99 %	-0,13 %	0,30 %
0,30 %	-6,30 %	1,02 %	0,75 %	3,68 %	4,71 %	0,23 %	-0,51 %	-0,63 %	2,30 %	1,10 %	-0,99 %	1,40 %
1,40 %	0,30 %	-6,30 %	1,02 %	0,75 %	3,68 %	-0,27 %	0,23 %	-0,51 %	-0,63 %	2,30 %	1,10 %	-3,84 %
-3,84 %	1,40 %	0,30 %	-6,30 %	1,02 %	0,75 %	0,37 %	-0,27 %	0,23 %	-0,51 %	-0,63 %	2,30 %	5,00 %
5,00 %	-3,84 %	1,40 %	0,30 %	-6,30 %	1,02 %	-0,84 %	0,37 %	-0,27 %	0,23 %	-0,51 %	-0,63 %	0,85 %
0,85 %	5,00 %	-3,84 %	1,40 %	0,30 %	-6,30 %	-0,07 %	-0,84 %	0,37 %	-0,27 %	0,23 %	-0,51 %	1,48 %
1,48 %	0,85 %	5,00 %	-3,84 %	1,40 %	0,30 %	-0,55 %	-0,07 %	-0,84 %	0,37 %	-0,27 %	0,23 %	-0,09 %
-0,09 %	1,48 %	0,85 %	5,00 %	-3,84 %	1,40 %	0,77 %	-0,55 %	-0,07 %	-0,84 %	0,37 %	-0,27 %	4,88 %
4,88 %	-0,09 %	1,48 %	0,85 %	5,00 %	-3,84 %	-0,30 %	0,77 %	-0,55 %	-0,07 %	-0,84 %	0,37 %	4,11 %
4,11 %	4,88 %	-0,09 %	1,48 %	0,85 %	5,00 %	-1,05 %	-0,30 %	0,77 %	-0,55 %	-0,07 %	-0,84 %	-27,66 %
-27,66 %	4,11 %	4,88 %	-0,09 %	1,48 %	0,85 %	-1,95 %	-1,05 %	-0,30 %	0,77 %	-0,55 %	-0,07 %	6,80 %
6,80 %	-27,66 %	4,11 %	4,88 %	-0,09 %	1,48 %	-1,46 %	-1,95 %	-1,05 %	-0,30 %	0,77 %	-0,55 %	6,80 %
6,80 %	6,80 %	-27,66 %	4,11 %	4,88 %	-0,09 %	-0,54 %	-1,46 %	-1,95 %	-1,05 %	-0,30 %	0,77 %	7,83 %