The impact of Covid-19 and Russia-Ukraine war on the technology sector in Finland- A stock market analysis

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Description

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Covid-19 Pandemian ja Venäjä-Ukraina sodan vaikutus Suomen Teknologiasektoriin – Osakemarkkina-analyysi

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Tiivistelmä

Covid-19 pandemia sekä Venäjän ja Ukrainan välinen sota olivat merkittäviä tapahtumia, ja niillä oli suuri vaikutus maailmanlaajuisesti. Nämä tapahtumat koskettivat yksilöitä, maita sekä yrityksiä ja näiden tapahtumien vaikutuksista on tehty paljon tutkimustyötä. Teknologiasektori on ainutlaatuinen sen kehittymisnopeutensa suhteen, joten tutkija näki tilaisuuden tutkailla näiden tapahtumien vaikutusta tähän nopeasti kasvavaan sektoriin Suomessa.

Tämä tutkimus pyrki vastaamaan kysymyksiin liittyen siihen miten ja kuinka paljon nämä tapahtumat vaikuttivat viiden suomalaisen teknologiasektorin yritysten tuloihin sekä riskitasoihin vuosien 2019 ja 2023 välillä. Kun näihin kysymyksiin pystytään vastaamaan, se parantaa yritysten kestokykyä tulevaisuudessa.

Tutkimuksen toteutuksessa käytettiin kolmea erilaista mittaria selvittämään yritysten riski- ja tulotasoja edellämainittujen vuosien aikana. Pääoman tuotto, vuositason tuotto, ja beta-kerroin olivat tässä tutkimuksessa sovelletut mittarit. Toteutuksessa vertailtiin vuosien 2019 ja 2022 arvoja muihin vuosiin, ja etsittiin eriäväisyyksiä niiden välillä.

Tutkimuksessa onnistuttiin keräämään arvokasta tietoa teknologiasektorin toiminnasta näiden tapahtumien aikana, ja tulokset osoittivat Covid-19 pandemian sekä Venäjä-Ukraina sodan vaikuttaneen negatiivisesti sektorin riskitasoon sekä tuloihin.

Avainsanat

Covid-19, Venäjä-Ukraina sota, Teknologiasektori

Muut tiedot (Luottamukselliset tiedot)

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Abstract

Covid-19 and the Russia-Ukraine war are both shocking events that had major consequences on a global scale. Both of these events affected individuals, countries and companies and there was large amounts of research done regarding these events. Technology is a fast-paced sector when it comes to growth and evolution, therefore it was seen necessary to study the effects of these events on the mentioned field.

The research seeked to provide answers to how and to what extent these effects affected the five technology companies' returns and risk inside the timeframe. By finding answers to these questions, it improves future resilience to these types of global disturbances.

The implementation of the research was the utilization of three metrics to evaluate these companies inside the timeframe. Return on Equity, beta and annualized rate of return were used to evaluate these companies risk and return levels. The main idea was looking at the years of Covid-19 and Russi-Ukraine war, specifically 2019 and 2022, and putting them into comparison with the year after to see fluctuations in the used metrics.

The study achieved to assemble valuable data concerning the technology sector, and how it was affected by the mentioned events. The data provided indication that the sector's risk and return were affected by these events.

Keywords/tags (subjects)

Covid-19, Russia-Ukraine War, Technology sector

Miscellaneous (Confidential information)

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Contents

1 Introduction

The motivation for this research emerges from the events of recent years, namely Covid-19 and the Russia-Ukraine conflict. While these events have been a global disturbance in a variety of ways to individuals and communities, the author wanted to take another point of view into this time-line. Combining the business aspect with these events we are able to gain insight to how these events affected a certain sector in the Finnish economy.

This work focuses on finding and analysing the impacts of Covid-19 and Russia-Ukraine war on the technology sector in Finland. Five companies are analysed utilizing return indicators and betas from years 2019 to 2023. The importance of this thesis is not only to analyse and to compare, but to find the impacts the war and Covid-19 had on this quickly evolving sector.

This thesis provides a thorough literature review, covering past disturbances to stock markets and the impacts of Covid-19 and Russia-Ukraine war on the stock market overall. It gives a glimpse into the Finnish economy and the Finnish stock market movements from past years. The literature review ends with the critical review of finance theories. In the Third chapter, methodology is explained, along with the methods of gathering and analysing the data. In the Fourth chapter, the results are presented with corresponding graphs, seeking to provide answers to the research objectives. The research objectives of this thesis are found below.

1. To study the stock market return of the tech sector in Finland in the light of Covid-19.

2. To study the stock market risk of the tech sector in the light of Covid-19

3. To study the stock market return of the tech sector in Finland in the light of Russia-Ukraine war.

4. To study the stock market risk of the tech sector in the light of Russia-Ukraine war

2 Literature review

2.1 Global disruptions and impact on stock markets

This piece of research examines the impacts of two major disruptions on the global economy. It is important to note, these are not the only events which have affected economies. In march, 2011 a large scale earthquake took place in Japan, referred to as GEJE (Great East Japan earthquake). It was one of the largest disruptions global supply chains have seen. Six different prefectures of Japan were impacted, and these areas hold around 6000 factories alone. Only a quarter of these factories reported no damages. The factories in question were producing semiconductor chips, flash memory, microcontrollers, car components or paint pigments. Due to this, domestic and global supply chains using these products, were disrupted. (Hendricks et al., 2017) After GEJE, the risks and vulnerabilities of global supply chains were under debate. Some strategies utilized by businesses, concentration of plants, suppliers or holding multiple inventories inside the same region were questioned. It has been argued that by clustering the suppliers together, global sourcing or reducing the quantity of supply bases the disruption susceptibility increases.

The discussion started, seeking for a solution. It was agreed that there was a trade-off, between maximizing profits, and protecting the supply chains from disruptions. The main point here, is that the firm will be closest to full efficiency in regular circumstances, creating value, while simultaneously leaving the supply chains more prone to events that destroy value. To conclude, the most effective way to achieve supply chain resilience, would be to adopt a centered approach, not too heavily leaning on efficiency, yet also not over-investing to protecting supply chain resilience. (Hendricks et al., 2017)

The earthquake was a meaningful disruption to the Japanese economy, as well as the global economy. In research paper written by Hendricks et al., 2017, a global sample of 460 firms was taken, and it was found that on average all firms affected by GEJE globally or locally, lost 3.73% of their

shareholder value inside the first month after the earthquake. This loss measurement stays around the same levels up until hitting the fourth month after the crisis. This indicates that all the companies affected by GEJE, lost nearly 4% of their value per month, three months in a row. (Hendricks et al., 2017)

The great recession of years 2008 to 2009 was a major disruption to the US economy, as well as global economy. The GDP of The United States decreased by 4.3%, unemployment reached a peak of 10% and the house prices fell around 30%. When The crisis was at its worst, the well-known S&P 500 index was 57% lower than it's historical peak at the time. The years leading to 2008, banks and mortgage lenders started to give out loans, with fewer restrictions. This led to a situation, where most citizens gained easy access to loans. This in turn, led to a steep increase in construction of houses, since the quantity of mortgage owners went up, and houses were in large demand. This caused an increase on the house prices. (Duggan, 2023)

These Subprime mortgages were often based on adjustable rates, meaning that the interest on the mortgage can fluctuate between periods. From 2004 to 2006, the U.S Federal reserve increased their federal funds rate to 5.25% from 1%, an increase of 4.25%. (Duggan, 2023) This caused the rates on all subprime mortgages with adjustable rates (ARMS) to increase beyond the borrower's paying capacities. Banks also started to sell credit default swaps (CDS) as insurance to the MBS owners, since they estimated the chance of default to be nearly non-existent. For the banks, this was a way of making more money without seemingly any risk involved. CDS is simply a form of insurance for the MBS owners, meaning that if those bonds default, they will be compensated based on the level of CDS, Equity, Mezzanine or senior, from lower payouts to higher payouts in mentioned order. Some citizens were analysing the market and noticed the underlying assets (Houses) to be misvalued, and thus bought multitudes of cheap Credit default swaps. These CDS's created synthetic exposure, meaning that you do not need to own the underlying asset, to carry the risk of defaulting. (Duggan, 2023)

Other countries were affected by the seemingly isolated event inside The United States. Most commonly the countries affected saw deceleration of economical growth, ranging from minor to major in different countries. However, some countries went into recession due to this event, and the most affected countries include Armenia, South Africa, Mexico, Turkey, The Baltic states and

Ukraine. It should be mentioned that some countries avoided the crisis effects, such as India and China. When US went into Recession in year 2007, more advanced economies went into recession as well, specifically countries that were exposed to risk through financial, and trade channels. For example, the European Union took a hit of -4% on their Annual GDP growth. (Verick & Islam, 2010)

The countries that saw their economy contract most extensively, were Lithuania, Latvia, Armenia, Estonia and Ukraine, measured by estimated drops in GDP growth rate. The forementioned countries were estimated to see a contraction of 14% or higher in their GDP growth rates. Contractions of this scale can be interpreted as a start of depression in the economy. Other countries that contracted in terms of GDP growth include Romania, Iceland, Seychelles, Moldova and Botswana. In these countries, the contraction was estimated at around 8%, except for Botswana with an estimate of 10.5%. (Verick & Islam, 2010)

These events and their consequences tie into my research, demonstrating the complexity and extent of consequences an isolated crisis can have on a global scale. Globalization and global integration have made countries interdependent, while global supply chains pose the issue of increased vulnerability.

2.2 COVID-19 & Impact on stock markets

Covid-19 majorly disrupted economies all over the world, causing damage to all sectors in its way. However, it is important to understand the extent of these damages varied field by field, therefore the impact was inequal among the sectors. The sectors that took most damage were retail, arts and personal services. (Lin & Falk, 2021) This is explained by the nature of abovementioned sectors, since they require personal contact and interaction with the customers, hence suffering substantial damages.

Covid-19 was throughout its whole reign a threatening factor to individuals, as well as companies, countries and even governments. It had a direct effect on how companies could be operated, due to lockdowns put in place. In many countries, hair salons, cinemas, restaurants and even gyms

were fully closed during the lockdowns, and hence caused major financial damage to these firms. The effects of Covid-19 were different depending on your place of residence since each country had their own measures to combat the consequences of the pandemic.

Covid-19 is not the first crisis affecting stock markets and companies, and it has already happened on multiple occasions before. The damage that covid was able to make, was not limited to only economical damage, but furthermore it indirectly increased inequality substantially. (World Bank Group, 2023)

The technology sector was a very significant element in combating Covid-19 and its effects because data analytics, communication and cloud storage options became more important than ever during the crisis. Suddenly, when lockdowns were enforced by governments, the usual means of seeing your relatives or family, were made impossible. This is the reason, why technology was so crucial during these events. A great example of technology's value is the fact that many individuals would have lost their jobs completely if cloud services didn't make remote work a possibility. (Corporation, n.d.)

In the United States of America, the hospitality & entertainment services lost more than 70% of their market capitalization, while volatility of these markets kept increasing. As mentioned earlier, the software firms and cloud services were a crucial factor in high demand during Covid-19, and increased their market capitalization, and had a below average increase in their volatility. (Lin & Falk, 2021)

Airline industries suffered greatly from Covid-19, due to lockdowns and quarantine rules, most people were not able to fly, and the individuals who could had no reason to do so. This concluded in a capacity decrease of around 60-80% for the airlines in March 2020, specifically discussing the Nordic markets. This also resulted in a decrease of 30-50% in the amount of flight searches, indicating a downwards trend and interest in flying. (Lin & Falk, 2021)

The pandemic had an extreme yet complex impact on international trading, supply and demand. The pandemic forced small businesses to adapt fast or go bankrupt. Larger corporations equipped with deep resources still had to combat the effects in some way. It should also be noted, looking at

Finland specifically, the country's location is remote, hence the supply chains are relatively more important, when compared to a less remote country. (Vehviläinen, 2023)

When Covid-19 started, it was considered the great lockdown, and it was expected to contract the global economy by 3%, hence it was expected to be more severe than the famous global financial crisis of 2008-2009. (Khan et al., 2020)

When reviewing stock prices or their movement during the COVID-19 pandemic, the factors can be complex. In a study written by Engelhardt et al. 2021, it was proposed that differing levels of societal and governmental trust can be linked to the volatility reactions in stock markets. In the mentioned study, 47 different national stock markets were used as the sample and World Values Surveys (WVS) were used to indicate each country's trust levels.

In this study, it was found that while COVID-19 did lead to a large quantity of uncertainty on global stock markets, the levels of trust were supporting the stock movements. It was concluded that Volatility spikes were lower in countries with high-trust levels, for governmental and societal trust. (Engelhardt et al., 2021) This study is very insightful when trying to unfold the exact effects of the pandemic, since it affected a multitude of sectors in the society.

In another piece of research made by Cox et al. 2020, the main objective was to find an explanation to the high fluctuations during the start of the pandemic. The effects of the pandemic start were rather unintuitive, since by February 2020 it had pushed unemployment rates to 14,7% in the United states of America. Next the S&P 500 dropped 33,7% from February 19th to March 23rd, hence bringing it down over a third of the original value, but it suddenly surged by 29%, regaining almost everything it had lost from March 24th to April 17th.

The most likely reason for the V-shaped movement caused in the early days of COVID-19 was concluded to be pricing of stock market risk, caused by large changes in risk aversion or sentiments which are unrelated to the economy and interest rates by themselves. This study argues that the high volatility in the S&P 500 was caused by sentiment and investor attitudes, rather than market forces. (Cox et al. 2020)

2.3 Russia Ukraine War & Impact on stock market

When Russia entered to armed conflict with Ukraine, it did not only affect these two countries, but the effects were massive across the world. Ukraine lost around 30-35 % of their Gross domestic product during the first year of the conflict, causing a substantial wound in their economy. (Kilfoyle, 2023) The war itself also caused incomes to decrease massively for the population of Ukraine, and the percentage of people living in poverty has risen from 5,5%, to 24,2% of the whole population. To grasp the real scale of the problem, this indicates the war to have put around 7,1 million Ukrainians to live under the poverty line, cancelling all progress Ukraine has done to combat the issue for the past 15 years. (Kilfoyle, 2023)

In a conflict of two countries, that were the two largest contributors to producing food and agriculture globally, this war had major consequences. To better understand the depth of this problem, 55% Ukraine's total land territory was utilized for farming, and it was responsible for 45% of their export revenue. (Kilfoyle, 2023)

The timing of the conflict has relevance because the world had just dealt with a pandemic, and economies were still in an injured state, at the time of Russia's attack. Some examples of these effects experienced worldwide, were increasing doubts about having enough nutrition, and products becoming more expensive in regular markets. This was caused by large supply chain disruptions, since the countries in question were the largest food producers on a global scale. When the war started, many infrastructurally significant elements such as loading docks, factories or fields were destroyed. The supply chain disruptions, and hence higher production costs for companies, left the producers no other option than passing these cost increases onto the consumers. This increased the cost of living dramatically around the world, affecting some countries more than others, but the consequences had global reach. (Kilfoyle,2023)

Following the invasion, other consequences of the war could be seen. Monthly inflation rates increased in many countries, thus negatively impacting the cost of living. As an example, UK experienced a peak of 2.5% monthly inflation during April 2022, which is the highest it has reached in the last twenty years. Simply put, this demonstrates that individuals need to spend more of their financial resources to obtain the same amount of goods as before, hence the buying power has decreased. The invasion by Russia also caused increases in oil and food prices, while increasing the cost of living due to mortgage deductibles, cars and lighting costs rising simultaneously. Finland experienced electricity price shocks and developing countries relying on European energy imports took a hit there. Developing countries had to buy the energy for a higher price, and the cost increases then materialized as higher local gas prices and food prices while income levels did not budge. The combination of these elements was very detrimental to the affected countries. (Ozili, 2022)

Some of the war consequences are not purely economical, yet they are still linked to economic factors. Not only were factories and economic infrastructure destroyed, but due to mass enlistments by the military, it damages the workforce of Ukraine. Furthermore, the war casualties pushing into tens of thousands, and individuals removed from their households add up to 10 million Ukrainians who have been displaced from their homes. It should be stated that the mentioned statistic includes 3.5 million Ukrainians, who fled to foreign countries. During just the first month of the war, half of all business in Ukraine had to shut down. An estimate tells us that even up to 90% of this country's population could fall under the poverty line. (Ciuriak, 2022)

Putting the effects into perspective is most efficient using data. In year 2021, the number of individuals in a food crisis, was 193 million among 53 countries. After the war started, the same metric was 258 million individuals among 58 countries. This is an increase of 33,7% in the number of people in a food crisis, adding 65 million individuals into the food crisis pool. (Kilfoyle,2023)

The rest of the world did not accept Russia's invasion, therefore facing substantial pressure to act. In late February 2022 there is 14354 sanctions applied against Russia. Part of these sanctions were purely economical, but it should be noted that some of them were political, not directly aimed to hinder their economy. The main imposers of these sanctions were The United States, Europe, and the United Kingdom. As an example, Europe prohibited Russia from importing coal or other fossil

fuels, The United States together with a few members of WTO (World Trade Organization) Revoked Russia's status as most favoured nation. Furthermore, Germany also put a stop to the ongoing certification for the Nord Stream 2 gas pipe, along with Europe banning a multitude of Russian Banks from the SWIFT. The most favoured nation status stands for a clause created by the WTO, stating that if any country is given the privilege of paying lower tariffs on imports for example, then this privilege has to be given to all other members of the WTO. This essentially means that when Russia's status was revoked, it hinders the country's ability to perform economically, since it is cut out from the member treatment. (Tran, 2023)

The imposed sanctions are expected to affect Russia's economic development very negatively. Russia's Gross Domestic Product (GPD) growth rate was estimated to drop by around 3.4% in year 2022, and continually reduce by 2.3% in year 2023. The World bank and OECD (Organization for economic co-operation and development) together estimated that in the window of 2021-2023 the Russian GDP will reduce by 8.1% from 2021 to 2022, and by 9.5% from 2022 to 2023. Consumption is also expected to decline, since war creates uncertainty in the consumers, and throughout the whole country. Russia's Inflation rate estimates look very concerning, when compared to other countries. Russia's inflation rate estimates for years 2022 and 2023 were 14%, lowering to around 6% for the following year. These estimates were made by IMF (International Monetary Fund), World bank and OECD, and the estimates were unanimous. These rates are directly impacting consumers in Russia since it essentially projects a steep 21% increase in the average price of goods in a window of two years. (Tran, 2023)

Russia greatly suffered from the war because it is an export-driven country. All the sanctions imposed affected their capabilities for perform international trade. Before the conflict took place, Russia was one of the largest economies when specifically talking about international trading. In year 2020, Russia's exports were worth 337$ billion, and imports were 231$ billion. This essentially means a 106$ billion surplus in their account during 2020. Now taking the sanctions into consideration, Russia's customers were banned from importing goods into their country, such as gold or oil. It was estimated that Russia's imports and exports drop by 19.2% and 16% in year 2022. In year 2023 the imports were estimated to recover by 5.6%, but exports would continue to drop by

3%. This is logical under the assumption that most countries judge Russia's actions and will not accept products coming from Russia, but importing goods into Russia doesn't necessarily make more money for the country held accountable. (Tran, 2023)

Multinational companies (MNC's) started exiting business and relations with Russia quickly after the incident. The first movers caused a so called "Exit-wave" indirectly encouraging others to follow the example. Over one thousand western companies have closed their locations in Russia, and fully paused the business operations. A well-known company SHELL also announced their exit of joint ventures with Gazprom, a large Russian oil and gas company. Even though this exit was estimated to cost around 4 to 5 billion dollars. Russia made efforts to combat this exit wave by re-starting productions of older fighting vehicles, and Moskvitch cars, technology dating back to the Soviet Union. The Russian stock market saw substantial damages as well, after the sanctions were imposed. When the first sanction package was applied on 24th of February 2022, the main index inside the Moscow stock exchange took a drop of 30% in just a day. In addition Sberbank, Russia's largest bank, decreased 99% in value during a window of 3 months, starting in the beginning of year 2022. (Tran, 2023)

2.4 Finnish Economy

Finland has for long been known as a western wellbeing country. The history of Finnish economy is extensive, having gone through multiple phases. Finland is a part of the world economy, having business operations worldwide, and co-operating with other countries. This means that external factors such as pandemics will affect Finnish economy as well. The Finnish economy is described to

be transparent and honest, while still following the universal guidelines for ethical trade, and entrepreneur protection measures. Finland has its differences from other European countries, since Finnish companies aren't commonly successful multinational corporations, but rather mid-sized companies on the world-scale. The culture of entrepreneurship has always been strong in Finland, and in the recent years, more and more Finnish startups are seen all over the world. (Kallinen, 2021)

The latest economical crisis in Finland before the events of COVID-19, was the great recession in 2008. European financial institutions possessed bonds from the United States, and their market value was being questioned. When the housing market collapsed in the U.S, returns on the bonds were compromised, due to underlying asset values going down. These effects could be seen all around Europe, and the first bank to see them was the Royal bank of Scotland. This firm was close to bankruptcy, but the Britain government was able to provide remedy by buying 81% of it's business operations. This was the beginning of a crisis, eventually leading to a recession in Europe. In Finland the crisis showed through halting the flow of capital between banks, and the interest rates dropping substantially. The GDP of Finland went down, and unemployment was on the rise. Finland was able to accomplish its growth by focusing on exports. This crisis decreased demand for Finnish export products, therefore hindering the economy. The production rate went down around 7-10%, caused by the drop in demand. Investors felt large uncertainty about the future of Finnish economy at time of the recession, hence lowering the quantity of investments. (Kallinen 2021)

2.5 The Impacts of Covid-19 on the Finnish Economy

Finland saw the pandemic as a real threat, closing the borders and suggesting the citizens to avoid contact with others. In comparison to the rest of the world, Finland had relatively much less cases,

hence the damage mitigation measures were effective to an extent. Many individuals lost their jobs, or were laid off, increasing the number of borrowers applying for grace-periods on their loans. The number of citizens applying for governmental benefits. This led to the Finnish government taking on more debt in the scale of billions, to keep financing the country. To explore the severity of the issue, the number of laid off workers was 160 000 by the end of April 2020, which is ten-fold in comparison to one year earlier. The fields that had the highest number of layoffs were customer service, salespeople, restaurant & bar workers, construction, and production workers. At the start of 2021, the unemployment rate in Finland grew to 8.4%. However, this is not the worst unemployment rate historically, in comparison to the recession of 1990 it is only 50% of the peak. During the first wave of the pandemic, the overall consumption went down by 50% according to Finnish banks. The Wood and metal exports are cornerstones for the Finnish economy, and the dropping demand during the pandemic was hindering the country's economy. This can be explained due to countries being busy combating the pandemic consequences, therefore halting most construction projects at that time. However, Finland has other exports such as information technology & services, which saw substantial growth in the last quarter of 2020. This growth brought positive expectations for the post-pandemic economy. In the economy review created by the Finnish bank at the end of 2020, it was stated that the recession level in Finland will stay less severe in comparison to Euro-zone on average. After the first news about Covid vaccines the stock market started rising, implying an extent of consumer trust in the vaccinations, and their effectiveness. (Kallinen, 2021)

Many analysts have pointed out the potential of Covid-19 to be more severe than the financial crisis of 2008 and it could be more comparable to the recession of 1990, including a domestic banking crisis, and substantial losses concerning export revenue. Firstly, it negatively affects consumer sentiments, leading to lower consumption and investments. It is also worth noting, that as mentioned in the chapter above, unemployment increased due to Covid-19, hence lowering tax incomes for the government. According to research made by Tiirinki et al. it seems probable, that the pandemic caused acceleration in the sector of digitalized health services, and electronic health. During Covid-19, a digital self-assessment tool was created, able to provide you an estimate whether you're infected or not, by answering a line of questions that target the main symptoms. This was effective in avoiding unneeded hospital visits since this sector was shorthanded to begin with. (Tiirinki et al., 2020) This holds high relevance to my research, because the technology

sector held answers to the consequences of the pandemic, hence making it a unique sector inside the timeframe.

2.6 Finnish Stock market

Looking at Finland's economy helps to understand the stock movements better. In 2023, Finland's GDP contracted by 0.5%, and is expected to contract by 0.2% in 2024. The financial markets are expecting decreasing interest rates going forward, and the Finnish export markets are also expected to recover gradually, thus boosting the GDP. (Finland's Bank, 2024)

Figure 1. Price movements of OMXH25 from 2019 to 2024. (Yahoo finance, n.d.)

Analysing this graph considering the two global disruptions it is possible to find linkages. Finland had it's first case of COVID-19 in late January of 2020. (Kajander,2020) Looking at the OMXH25 performance, we can see the price still going up when the year changes to 2020, but then the index starts decreasing rapidly. The Change seen in the graph, is from around 4300,08 down to 3382,46. The higher value is from January 2020, and the former is from March 2020. This tells us, that the index dropped by 21.34% in 2 months. This demonstrates the financial damage this event had on the best performing Finnish companies.

However, going forward the index seems to be recovering nearly as steeply as it fell, and by August 2020, the index reaches 4308,80 surpassing the value from January 2020. Here onwards it is quite steadily increasing, reaching its peak value inside the timeframe, 5669,94 in August of 2021.

Russia invaded Ukraine on 24th of February 2022, and we can find connections from the graph. (Valtiovarainministeriö, n.d) In January 2022 the index value was at 5301,80 and in February still at 4891,77. Looking into a more specific timeframe inside the graph, we notice that February to May 2022, the index barely moves at all. After this stagnant period, the graph seems more volatile, demonstrated by the price drop of 7,5% between May and June.

The index sees heavy fluctuation during Covid-19, and the escalation of Russia-Ukraine war, therefore implying that these events could have influenced the index. It should be noted however, that when looking at impacts of specific events, the data will be more accurate when looking at individual stocks, rather than a bundle. This is because some firms inside the index could've been mildly affected, and others substantially. These differences in damages among the individual stocks, will affect how drastic the price drops or rises present themselves.

2.7 Critical review of finance theories

The financial theories used to value and price stocks are crucial for this research, hence these are explained in detail below.

Firstly, the portfolio theory created by H. Markowitz in 1950's. This theory utilizes probability and optimisation theories to predict the behaviour of variables during economic changes. What this theory achieves is to maximize returns on investments, while simultaneously minimizing the risk. According to this theory, the return is viewed as a mean, while risk is demonstrated as the variance inside a portfolio with securities. The fundamental foundation of the theory is that an investor should not only care about the returns of their investments, but the risk of an investor's position must be taken into consideration. To elaborate on the risk analysis of the theory, it is represented as the standard deviation of the portfolio's return. (Parida & Sahoo, 2015)

Secondly, The Risk-Return trade-off. This theory describes a positive risk-return relationship. To elaborate, this means a positive relationship between conditional variance of a market's return and its expected return. The key fundamental to this theory, is that when an investment includes low or no risk, it cannot be expected to produce high returns. The positive relationship risk and return, hence when the amount of risk increases, the expected return rises as well. This fundamental has been studied very thoroughly and put to the test by many researchers. Using empirical methods, multiple studies have confirmed this theory to hold its ground. (Barroso & Maio, 2017)

Thirdly, The Capital asset pricing model. This theory is utilized to find out whether an investment is worth the risk it includes. It states that only systematic risk and marker risk affect the return of an investment, but this can also be viewed as a limitation of the theory. One of the main Criticisms this formula has received, is that it accounts for two types of risk, but also other risks could be involved. However, the justification for only measuring these two types of risk, is the argument that unsystematic risk or asset risk, could be negated by the process of diversification inside given portfolio. The formula utilizes beta as the measure of risk, beta being a finance measure for volatility, where a result over 1 implies higher volatility in comparison to market, and a result under 1, implies the stock is less volatile, in comparison to market. (Putra et al., 2023) To elaborate, the beta of an individual stock tells how sensitive the stock is to the overall movements inside the market.

Even though the formula has its limitations, it is widely used due to its simple nature, relative to its usefulness. (Hundal et al., 2019)

Lastly, the Arbitrage pricing theory. Similarly to CAPM, this model seeks to evaluate a stock's return based on macroeconomic factors, the difference being the quantity of factors. This model was created by Stephen Ross as an alternative to CAPM. Where the CAPM model uses Beta to take the stock's volatility into account, the arbitrage pricing theory considers multiple macroeconomic factors. The question of which macroeconomic factors to utilize inside the formula has been under debate ever since it was created, but the most common ones include inflation rates, exchange rates and interest rates. (Nyanga & Qutieshat, 2022)

3 Methodology

Methodology is an important pillar of any research, combining the goals of the study with the practices used to achieve them. Choosing the correct methods is of high importance in order to increase the reliability and validity of results. (Jurvanen, 2023)

3.1 Research Approach

Research often utilizes either a qualitative approach, a quantitative approach or a mixed approach using both. The idea of qualitative approach is for example using surveys including open-ended questions to gather opinions and answers from individuals inside a certain age group. Qualitative data answers to the why or how a certain phenomenon is happening. (Fullstory, 2024)

Quantitative data is about answering questions that require numerical answers. In other words, this type of data can always be counted in a set unit, which can be dollars, kilograms or numbers et cetera. One of the main differences between qualitative and quantitative data, is how they can be processed. Quantitative data has the advantage of being easily processed through mathematical operations. This brings along the fact, that the data can be validated through its' mathematical properties. (Fullstory, 2024)

In this research, the author is utilizing solely the quantitative approach, due to the research being finance oriented. To precisely meet the research objectives regarding stock market risk and return on technology sector, the answers are found from numerical data.

3.2 Collection of Data

The research framework of this paper is exclusively based on secondary data and analysis. Data has been extracted from the five chosen companies' annual financial statements as given in the annual reports to perform calculations according to CAPM. Data has been taken from all the years ranging from 2019-2024 because both Covid-19 and the Russia-Ukraine conflict fit inside the same frame. The data from this timeframe has been managed, used to perform calculations, and finally utilized to find any abnormalities, or differences between regular business years, and times of global disruption.

The data from all companies inside the timeframe 2019-2024 has been analysed, and the data from the significant years of 2019 of the pandemic, and year 2022 when the Russia-Ukraine conflict escalated is the key for this research. The data from times of global disruptions when compared to regularly operated business years gives us indications of whether these companies struggled financially. Through the analysis, calculations and comparison, a conclusion can be found to whether the global disruptions impacted these companies negatively or positively.

The companies I chose to study in my research were all Finnish technology companies and to increase variety, they all produce different types of services and products inside the same sector. To view the impacts of these events inside the whole sector, it's beneficial to choose companies producing different technology.

Table 1. Companies and their products & services

Company Name	**Products & Services**
Nokia Oyj	Communication Equipment
Withsecure Oyj	Software-infrastructure, information security
Gofore Oyj	Digital service design
Tietoevry Oyj	Cloud services, ICT-services
Digia Oyj	ICT-services, finance services

The technology sector was chosen for this research because it had a unique role during the time of Covid-19. The pandemic caused increased unemployment in multiple countries, but technology solutions were the key for remote working possibilities. When many sectors and companies were struggling, technology was the sector that provided remedy. This unique role of the sector during global disruptions is why it is intriguing to find answers, whether this sector could have benefited financially from the global disruptions, or if they took damages as well.

3.3 Data Analysis

All the companies chosen are public, and therefore access to their annual reports was utilized to find the raw data, to then analyse their risk and return during Covid-19 and the start of Russia-Ukraine war. The historical price data of these companies' stocks has been retrieved from NasdaqOMX nordic, and then used to evaluate market risk (Beta) for the time periods during Covid-19, and the Russia Ukraine war. I have performed the comparison according to CAPM, to view the companies value during Covid-19, and Russia-Ukraine war, during regularly operated business years. Through the comparison, we can see whether these events affected the technology sector, and if there are individual differences between impacts on the companies.

The companies' annual reports were utilized to calculate operating ratios for each company, from years 2019 to 2024.

The calculations have been performed in the Excel software, after the data had been managed, cleaned up, and organized.

Expected return = Risk-free rate + Beta * (Market return- risk-free rate)

In the formula above, The expected return on an investment is calculated by adding the product of multiplying market premium by beta, onto the risk free rate. The risk premium is calculated by subtracting the risk-free rate from the market return rate, and these are explained in more detail in the chapter below. (Garg, 2019)

My research is set to study the risk of technology sector, hence understanding what exactly risk is, becomes of high relevance. The risk-free rate refers to a rate of return on an investment, that can be achieved without taking on any risk at all. This could be a treasury bond, or another very secure investment that has small or no chance to fail. It is often used as a comparison when considering an investment, since if the return rate of a specific investment would be lower than the available risk-free rate then there would be no point in investing at all. A term called risk premium could be defined by the extra risk on an investment, or how much risk if left, after we subtract the risk-free rate from it. By subtracting risk-free rate from the expected rate of return on an investment, the amount left is the risk premium, when compared to investing the money into a government bond instead. It should be noted, that when taking on a riskier investment, the chances of high returns increase, while simultaneously the chance of higher losses increase. The very foundation of risk is the uncertainty about the difference between realized return and expected return. When the realized return ends up larger than the expected return, a profit has been made, but when the realized return falls short of the expected return, they take on the losses. (Doan, 2017)

Beta β is a finance measure that tells how volatile an investment is, relative to the market volatility. For example, if a stocks beta is 1.4, it would indicate that the stock's returns are 40% more volatile than the market. However, if a stock's beta is 0.7 this implies that the stock is 30% less risky in comparison to the market. The foundation of beta is that it seeks the answer to how much does a

specific stock react, when the market goes up or down, essentially measuring a stock's sensitivity, to price changes inside the market. A Beta <1 indicates the stock to be less volatile than the market, whereas a Beta >1 indicates it to be more volatile in comparison to the market. (Garg, 2019) The formula for calculating Beta is found below:

$$Beta, \beta = \frac{COV(Ri, Rb)}{VAR(Rb)}$$

As demonstrated above, Beta can be calculated by finding out the covariance between the stock's return, and the chosen indexes return, then divided by the variance of the benchmark's return value. (Garg, 2019)

The Capital asset pricing model takes systematic risk into account by using beta to measure it. The argument for only considering systematic risk, is that all other risk can be accounted for by diversifying portfolio. In other words, beta is the variable used to represent systematic risk, inside the formula. (Salovaara, 2023)

One of my research objectives is to study the stock market return of the technology sector in Finland, therefore it's relevant to understand what rate of return is. The rate of return is a finance metric, that calculates the returns or losses on a certain stock. Annualized return is a metric that comes from taking rate of return in a certain period, for example a business quarter, and then multiplying it with the quantity of those periods in a year. This changes the rate of return inside a quarter, into an annualized rate. This is often utilized to compare the rates of return between two investments, that have different holding periods. Standardizing both rates to the annualized return format, allows the opportunity to compare them. (Salovaara, 2023)

Earnings per share (EPS) is an indicator used to estimate the amount of profit available to shareholders of a certain company, after operational expenses, taxes and interest are subtracted from the equation. (Moseri, 2024) The formula for calculating EPS can be found below.

$$\frac{Net\ income - Preferred\ dividends}{Amount\ of\ ordinary\ shares\ outstanding}$$

In the formula the net income represents a company's profit since net income represents income after taxes. The amount a company pays in preferred dividends is subtracted from net income, and then divided by the total amount of shares outstanding. Changes in EPS ratio have high influence on company's share price because the share price of a company often increases simultaneously with the company's earnings. This correlation works vice versa as well, meaning if the company's earnings decline, the share price follows. (Kumar, 2017)

Table 2. Metrics utilized for companies

Ratio	**Formula**	**Source**
Operating return on Equity	$\frac{Operating\ profit}{Shareholder's\ equity\ (Book\ value)}$	Annual report
Beta	$\frac{Covariance\ (Ri, Rb)}{Variance\ (Rb)}$	Historical stock price data (Nasdaq OMX Nordic)
Annualized rate of return	$\frac{(End\ of\ year\ price - Start\ of\ year\ price)}{Start\ of\ year\ price}$	Historical stock price data (Nasdaq OMX Nordic)

4 Results

In the previous sections of this thesis, the framework for my research was built through the literature review and methodology chapters. In this chapter, the five technology companies will each have graphs plotted on certain operating ratios, to allow more insight into their financial performance during the times of Covid-19 and Russia-Ukraine war. By looking at the ratios through years

2019-2023, the years can be compared with each other, hence giving indication whether the years of crisis were different than regularly operated business years.

The annualized rates of return have been calculated for the firms, throughout years 2019-2023 to gain insight into their returns during the two events. The data has been extracted from Nasdaq OMX Nordic, utilizing their historical price feature. The data was taken from the last five years, starting from January 1st, 2019 and annualized returns were found for each year. In Addition, the daily returns have been calculated for the period of 2019-2023 and a benchmark index called N Technology EUR GI was used to evaluate systematic risk. The beta values were calculated for each year, hence concluding 5 values per company. Possible fluctuation in the beta measures could implicate an increase or decrease in systematic risk, while also indicating the price sensitivity of these stocks to market movements.

4.1 Gofore Oyj

As shown in the graph below, the operating return on equity (ROE) for Gofore Oyj has seen fluctuations during this timeline. In year 2019 the ROE was at 20,41%, and moving to year 2020, it has increased by 3,84%. Russia invaded Ukraine in February of year 2022. However, comparing year 2021's ROE of 20,74% to 2022 & 2023, the value kept increasing even after the invasion. In 2022 the value was 21,82% and in the last year of the timeline it took a steep climb to the peak of 26,87%. According to this graph, negative impacts cannot be interpret for the company's ROE value in light of the global disturbances.

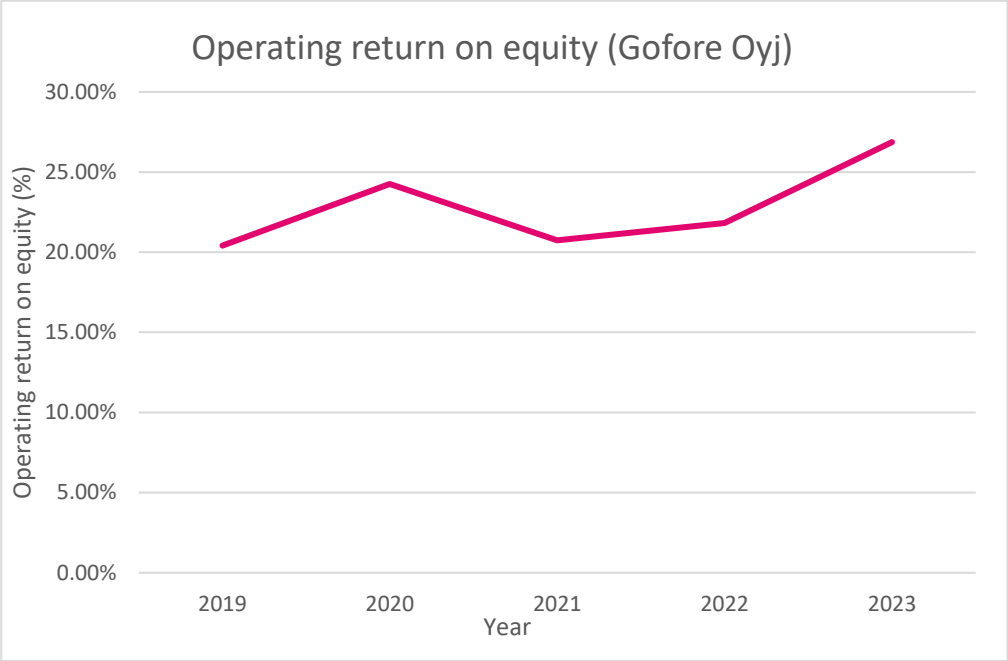

Figure 2. ROE values of Gofore Oyj in 2019-2023

Table 3. Annualized rates of return, Gofore Oyj

Annualized rate of return	Gofore Oyj
2023	0,89%
2022	-11,90%
2021	39,53%
2020	129,89%
2019	-11,66%

The table above shows the annualized returns for Gofore Oyj, demonstrating the extent of returns the company makes for investors in each given period. As can be seen, in year 2019 the return was negative, at -11,66%. At the start of year 2020, the stock price was very low in comparison to other years, but had made a significant increase towards the end, hence the return was abnormally high. The most important years to consider in the scope of this study, are 2019, 2020, and 2022. Looking at 2019 and 2020, the impact of Covid-19 can be interpreted, but it seems that if Covid-19 impacted this stock negatively in 2019, it had made a major recovery, demonstrated by the high return percentage in the following year. In year 2022, the stock's annualized return

turned negative, although it was healthy at 39,53% in 2021. This sudden drop could indicate, that the Russia-Ukraine conflict escalating into war, negatively impacted the stock's return.

Table 4. Beta values, Gofore Oyj

Year	Beta (Gofore)
2023	-0.12
2022	0.19
2021	0.08
2020	0.09
2019	-0.01

The betas have fluctuated significantly over the years, as can be interpret from the table. In 2019 and 2023 the measures were negative, which implies that the stocks increase in price, when the market is decreasing. Overall, this stock has been minorly volatile in comparison to the technology index. From 2019 to 2020, the beta increased and reached positive, therefore their systematic risk increased during the period of Covid-19. Furthermore, comparing 2021's 0.08 beta, to the 0.19 from 2022, the beta of the former year is over two times larger. This increase could indicate that systematic risk increased, during the period of Russia-Ukraine conflict.

4.2 Withsecure Oyj

In 2019 the ROE of Withsecure was at 4,7% and made a steep increase to 16,2% in year 2020. After the first two years, there appears an abnormal decrease on ROE, since it turns heavily negative. Without the context it seemed significant, but the Company went through a demerger in 2022, where F-secure kept on handling the consumer-security business and Withsecure would handle the corporate side security. This Demerger took place in 30th of June 2022, therefore it heavily affects their ROE, due to splitting into two separate entities. This substantial decline on ROE cannot be interpret as consequence from the Russia-Ukraine war. (Withsecure, n.d) From 2019 to 2020 the ROE value increased, yet it decreased by 1,9% going from 2020 into 2021, hence it could implicate impacts by Covid-19 concerning their ROE value. The graph for ROE is found below.

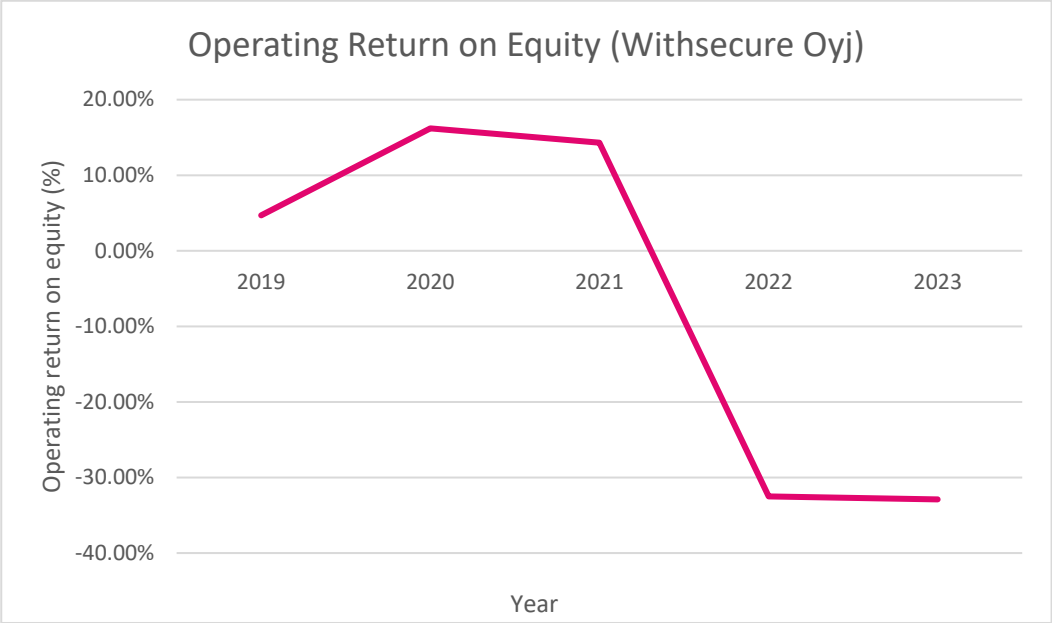

Figure 3. ROE values of Withsecure Oyj in 2019-2023.

Table 5. Annualized rates of return, Withsecure Oyj.

Annualized rate of return	**Withsecure Oyj**
2023	-25,41%
2022	-72,48%
2021	28,63%
2020	25,12%
2019	26,88%

The table above shows a steady Annualized return for Withsecure from 2019 to 2021, yet the value takes a major decline when going from 2021 into year 2022. In the case of this company, the de-merger had to have impact on the stock price, since the company was split into two different entities, therefore affecting their company thoroughly. The table did not indicate any major impacts for years 2019-2021, therefore Covid-19 did not impact their annualized rate of return.

Table 6. Beta values, Withsecure Oyj

Year	Beta (Withsecure)
2023	0.06
2022	0.03
2021	0.08
2020	0.18
2019	0.07

This company's betas have been positive for all the years studied, unlike some of the other studied companies. An increase of systematic risk can be seen between 2019 and 2020, because the beta has increased significantly. This increase could indicate that Covid-19 affected their stock negatively. Concerning the Russia-Ukraine conflict, the data does not indicate negative effects for the company since the beta value has decreased between 2021 and 2022. Overall, the data showed that Withsecure has been majorly less volatile than the market, in the past five years.

4.3 Nokia Oyj

The data from Nokia was very intriguing for this research. In the graph a steep increase in ROE is seen from years 2019 all the way into 2021 where the graph peaks at a value of 12,36 %. From 2021 onwards a decline takes place landing at 10,82% in 2022, and then 8,18% in 2023. It could be interpreted from the ROE movements, that COVID-19 did not impact the company negatively, since the ROE kept on a steady increase through 2019 and 2020, then reaching it's peak in 2022. From 2021, it had already started a decline, and kept on the same trajectory going from 2022 to 2023. This decline of 2,64% could be caused by the economic shocks of Russia-Ukraine conflict. The graph demonstrating ROE is found below.

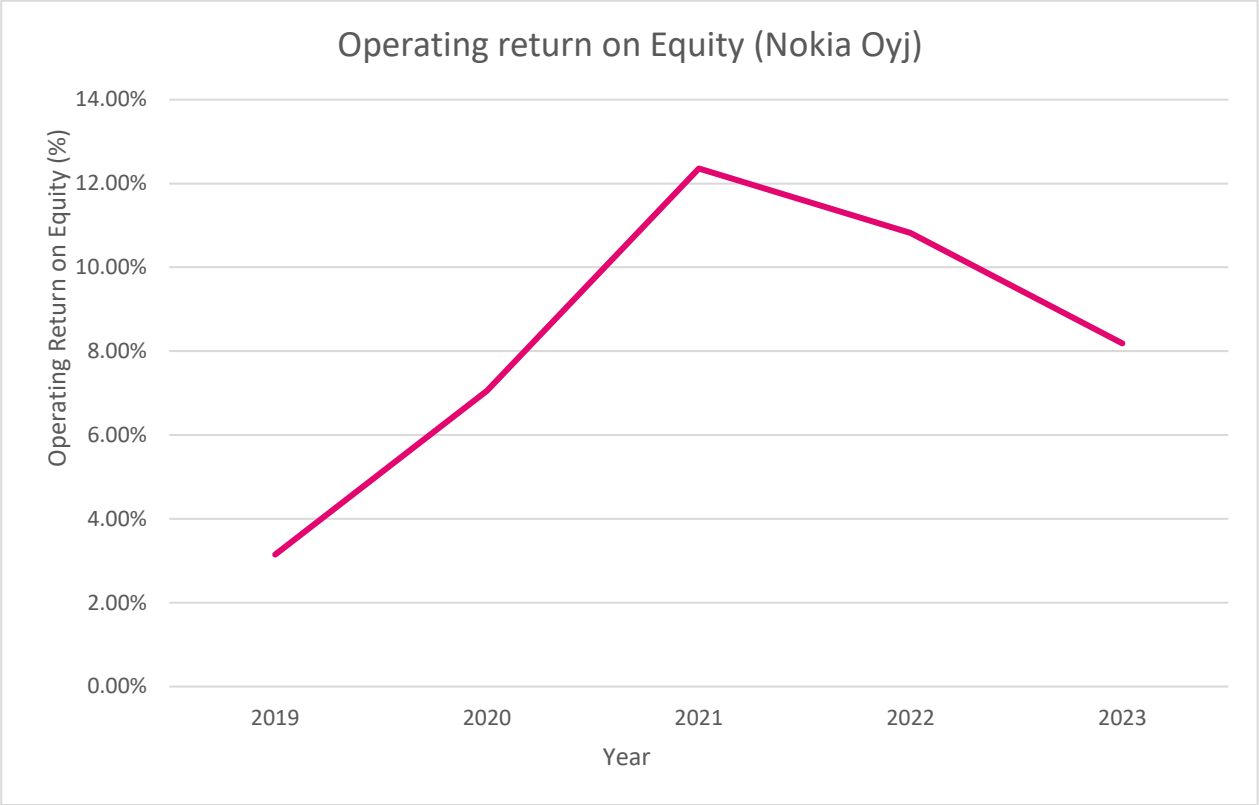

Figure 4. ROE values of Nokia Oyj in 2019-2023

Table 7. Annualized rates of return, Nokia Oyj

Annualized rate of return	**Nokia Oyj**
2023	-31,25%
2022	-22,40%
2021	76,11%
2020	-9,04%
2019	-34,16%

The annualized returns for Nokia seem to have been rather unstable in the past 5 years. In Year 2019, the value is negative, at -34,16% but it does climb to -9,04% at the end of 2020. It is difficult to interpret whether Covid-19 had a negative impact on this company, since the value starts negative from 2019, but since the changes towards 2020 were positive, the negative impact cannot be concluded. This stock's return heavily increased in 2021, being the only year with a positive annualized return, at a value of 76,11%. The stock then took a decline in 2022, going as low as -22,4%, therefore it seemed that Russia-Ukraine war had a negative impact on the stock. In 2023, the stock hasn't recovered, and fell slightly more.

Table. 8 Beta values, Nokia Oyj

Year	Beta (Nokia)
2023	-0.02
2022	0.13
2021	-0.03
2020	0.12
2019	-0.05

Three years inside Nokia's data were negative, 2019, 2021, and 2023. The beta has increased from 2019 to 2020 which could indicate that Covid-19 increased their systematic risk since it increased in the matching time period. Furthermore, this company's beta increased from 2021 to 2022 as well, supporting the argument that Russia-Ukraine conflict also increased their systematic risk.

4.4 Tietoevry Oyj

Tietoevry's data starts from a relatively low ROE value of 7,36% in 2019. It then increased by 1,66% entering 2020. Similarly to Nokia, Tietoevry reached its peak value in 2021, being 20,98%

for this company, which is 8,62% higher than Nokia's peak. The similarity is still demonstrated by the starting decline in year 2021 for both companies. The main difference between the two, is that while Nokia's ROE kept declining further after 2022, Tietoevry's ROE saw a minor increase in the timeframe of 2022-2023. It increased from 15,5% to 15,86%, hence the increase was 0,36 %. The data did not demonstrate negative impacts by Covid-19, but the ROE value had decreased from 2021 to 2022, implying negative impacts from Russia-Ukraine conflict. The graph demonstrating the ROE is found below.

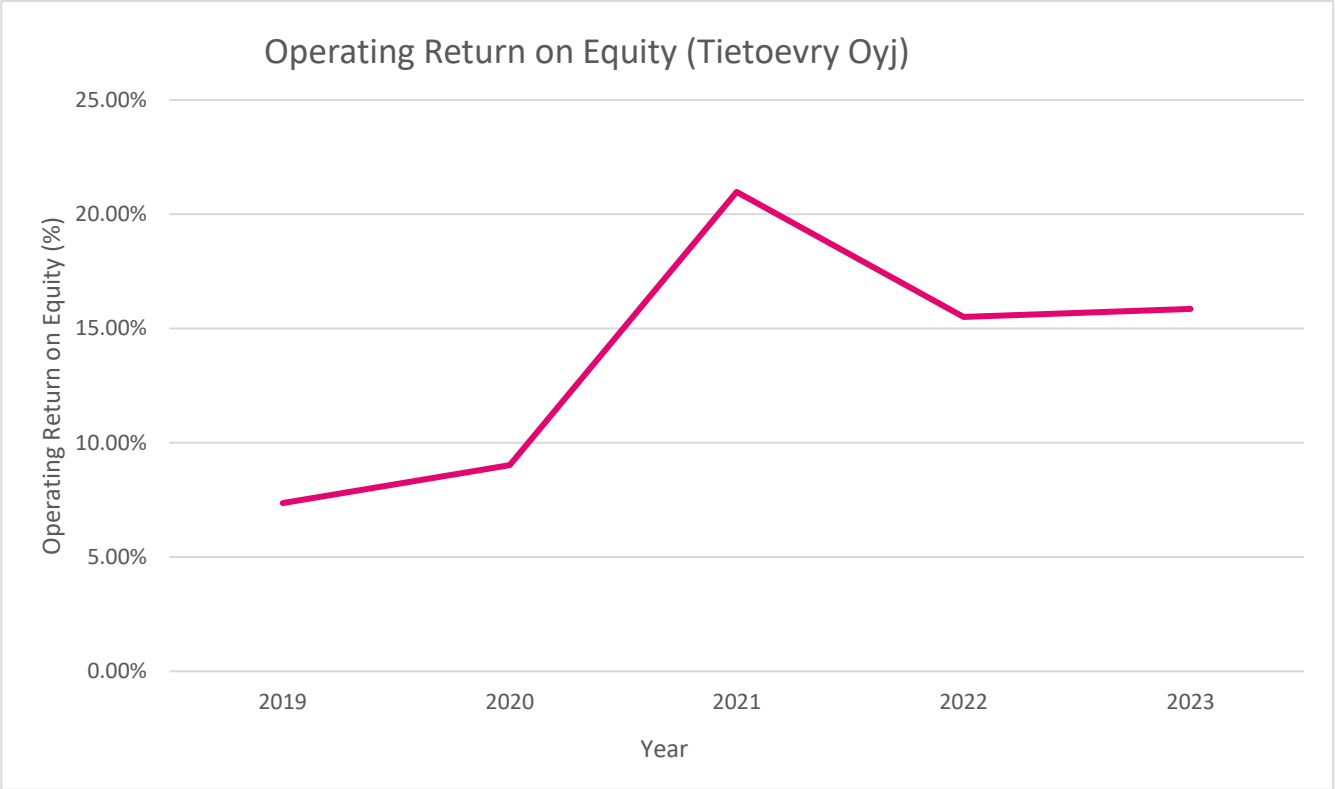

Figure 5. ROE values of Tietoevry Oyj in 2019-2024

Table. 9 Annualized rates of return, Tietoevry Oyj

Annualized rate of return	**Tietoevry Oyj**
2023	-19,99%
2022	-3,98%
2021	2,08%
2020	-3,59%

2019	15,79%

The data for Tietoevry demonstrated a decline in annualized rate of return, between 2019 and 2020. This drop is significant enough to make the return enter negative, therefore Covid-19 could have had a negative impact on their return. The value just climbed back to positive in 2021, reaching 2,08%, yet it decreased to -3,98% in 2022. This decline took place in the same year as Russia-Ukraine conflict escalated, hence this conflict could also have impacted their return negatively. In year 2023 the value declined to -19,99%, hence not demonstrating signs of recovery.

Table. 10 Beta values, Tietoevry Oyj

Year	Beta (Tietoevry)
2023	-0.06
2022	0.07
2021	0.12
2020	0.03
2019	-0.10

The data has two negative betas inside the timeframe, in 2019 and 2023. The betas showed a high-level of fluctuation, and the systematic risk has increased from 2019 to 2020. This could indicate that Covid-19 increased their systematic risk, since this change happened inside the matching timeframe. Analysing the values from the perspective of Russia-Ukraine conflict, the beta has decreased from 2021 to 2022. The value decreased for 2023, hence it cannot be concluded that Russia-Ukraine conflict would have increased their systematic risk.

4.5 Digia Oyj

Digia's data follows along the same pattern set by Nokia and Tietoevry. An increase concerning ROE from 2019's high measure of 20,69% reaching its peak of 26,34% in year 2020. However, the decrease going into 2021 was not significant, dropping to 26,06% indicating a drop of under 1%. The pattern of a starting decline from 2021 onwards repeats itself in this company's case as well, dropping by 3,93% moving into 2022, and then 3,79% when entering 2023.

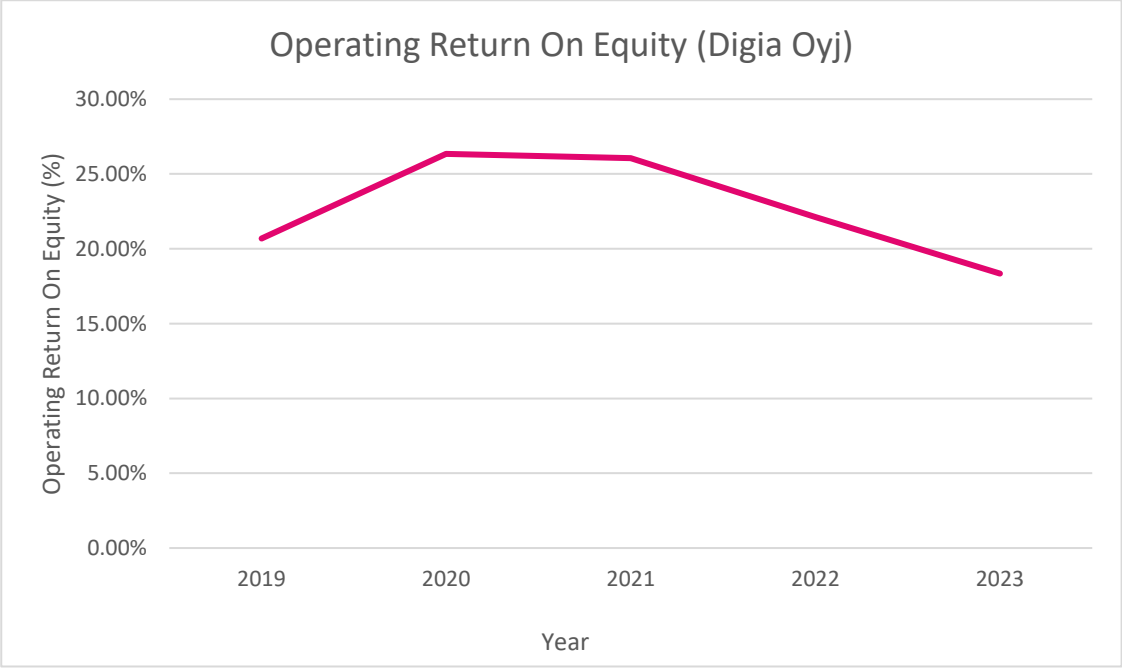

Figure 6. ROE values of Digia Oyj in 2019-2024

Table 11. Annualized rates of return, Digia Oyj

Annualized rate of return	Digia Oyj
2023	-7,22 %
2022	-20,14 %
2021	-8,57 %
2020	83,86 %
2019	40,49 %

From year 2019 into 2020, Digia's annualized return doubled in value, therefore it does not show any signs of having been impacted negatively by Covid-19. Then in 2021, their annualized return plummeted, going negative from the last year's high oh 83,86%. Afterwards the value saw a further decrease going from -8,57% in 2021, to -20,14% in 2022. This decrease in annualized return showed indication of negative impacts from the Russia-Ukraine conflict. The value has shown a short extent of recovery in 2023, yet the return is still negative.

Table 12. Beta values, Digia Oyj

Year	Beta (Digia)
2023	0.11
2022	0.03
2021	0.14
2020	0.19
2019	-0.07

The table above shows the beta values for Digia from the past five years. There is not a linear increase to be seen since the values fluctuate substantially inside this timeframe. The analysis of these results has indicated that this stock has not been more volatile than the technology index, for the past five years. As mentioned in chapter 3, a beta >1 indicates less volatility in comparison to market, whereas a beta <1 indicates the stock to be less volatile in the same comparison. All of the measures from 2019-2023, are significantly under 1, the highest measure being 0.19 in year 2020. In 2020, the beta has increased from negative to it's peak value, therefore an increase of systematic risk. Between 2021 and 2022, the beta has decreased, indicating a decrease in systematic risk.

After the analysis of these companies by the use of ROE, there is one pattern that emerged, being the decline of ROE starting from 2021. This could indicate that Russia-Ukraine conflict has affected these companies negatively, in terms of their ROE %. Three companies out of the studied five followed this pattern.

Table. 13 Annualized rates of return, all companies & Index (Bold)

Annualized rate of return	2023	2022	2021	2020	2019
N Technology EUR GI	**11.47%**	**-40.23%**	**21.11%**	**54.10%**	**0.93%**
Gofore	0.89%	-11.90%	39.53%	129.89%	-11.66%
Withsecure	-25.41%	-72.48%	28.63%	25.12%	26.88%
Nokia	-31.25%	-22.40%	76.11%	-9.04%	-34.16%
Tietoevry	-19.99%	-3.98%	2.08%	-3.59%	15.79%
Digia	-7.22%	-20.14%	-8.57%	83.86%	40.49%

The table above was constructed to clearly demonstrate the differences between the N Technology EUR GI index, and the chosen technology companies in the last five years. The bolded numbers represent the indexes annual returns, allowing for easy comparison between the companies and the index. In 2019, three companies had higher values than the index. In 2020, just two companies surpassed the index returns. However, only two companies saw a decrease in their annualized returns moving from 2019 to 2020. 2021 and 2022 were the significant years to analyse concerning Russia-Ukraine conflict, and in 2022 all the companies had negative annualised returns. In the following year, only Gofore had gone positive. After the analysis of annualized returns, it concluded that Covid-19 did not have a major impact throughout the sector concerning the returns, but Russia-Ukraine conflict could have caused economical damage throughout the sector. Further data that supported the argument was the fact that 4 of out of these 5 companies had positive annualized returns in 2021, but the values plummeted in 2022, along with the index.

5 Discussion, Conclusions and Limitations

This chapter aims to establish a conclusion for this research, and to discuss the results and data in relation to the literature review. This chapter also provides answers to the research questions, which were first stated in the introduction.

5.1 Discussion

The motivation for this research was to find out how the technology sector was affected by these global disruptions, since this sector has a unique nature in comparison to others. As mentioned in the literature review, Covid-19 caused increased unemployment, but the fast-adapting technology was able to provide remote-work possibilities. It was also stated in the literature review, that multiple companies went bankrupt, or took financial damage during Covid-19, hence it became interesting to find out, how the technology sector was affected by these events. In this research, the literature review covered past global disturbances such as the great recession of 2008-2009 and discussed how those affected the economy, globally and locally. The overall impacts of Covid-19 and Russia-Ukraine conflict were discussed along with their effects on economies to build a foundation for this research. The research then narrowed the scope, by looking at the effects of these global events on the technology sector in Finland.

5.2 Conclusion & Limitations

The measures used to evaluate the five technology companies in the last five years, were ROE, Annualised returns and Beta values. To analyse the Covid-19 impacts, from 2019-2020, no company had a negative movement in ROE. From 2020 to 2021, which was the important time period, having considered that Finland's first case of Covid-19 took place at the start of 2020. From 2020-2021, three of the five companies saw a decrease in their ROE value. The difficulty was that correlation does not indicate causation, but the data does support the argument that Covid-19 affected those companies returns negatively. For 3 out of 5 companies, the ROE decreased between 2021 and 2022, which could indicate that Russia-Ukraine conflict also affected their return negatively.

The data did not indicate that Covid-19 affected the annualised rates of return negatively, however it showed a clear change between years 2021 and 2022. From 2021's value of 21,11%, the index dropped to -40,23%. This drop indicated large negative impacts by Russia-Ukraine conflict. Furthermore, 4 out of 5 stocks had a positive annual rate of return in 2021, but they had all turned negative in 2022. The negative return of the index in combination with all the stocks' returns plummeting in the same timeframe showed strong support for this argument.

The beta in this study was the metric to evaluate systematic risk in the companies. From 2019 to 2020, all of the companies saw an increase in their beta, hence an increase in systematic risk. This increase supported the argument that Covid-19 increased these companies' systematic risk. From 2021 to 2022, only two out of five companies saw an increase in their beta, thus it cannot be argued that Russia-Ukraine conflict would have increased their systematic risk.

The research objectives were to study the risk and return of the Finnish technology sector considering Covid-19 and Russia-Ukraine war. After the research it concluded that Covid-19 would have increased all these companies' systematic risk, since all the beta values had increased. There was not strong evidence for Russia-Ukraine conflict to have increased the systematic risk inside the tech sector, since only two of the five companies saw a beta increase from 2021 to 2022.

The data did not strongly support the hypothesis that Covid-19 had affected the tech sector returns negatively. The returns from the period of Russia-Ukraine war showed strong support for the hypothesis that Russia-Ukraine conflict had affected the tech sector returns negatively. It was hard to answer the questions concerning data-anomalies, such as three of five companies experiencing a decreasing ROE during Covid, but two of the companies did not. From speculation, it could be interpret that management differences, or perhaps product differences could affect their vulnerability levels concerning these disruptive events. Some product- or service-lines could be affected more than others in these cases, and as mentioned before the companies were chosen with increased variety, hence they do not all produce the same products.

The limitations of the study were the number of metrics used to evaluate the companies, and the number of companies as well. Studying the whole sector proved difficult with five companies, since naturally the five companies cannot mirror the whole sector. Even if these companies were negatively affected by the global disruptions, it does not prove that the whole sector experienced the effects. Furthermore, using more complex metrics as indicators of risk and return, could provide more reliable data.

There have been large amounts of research written about Covid-19 and Russia-Ukraine war, but this thesis has created a great framework for further research. These possibilities could include,

studying other sectors utilizing a similar goal, hence allowing for comparison between different sectors and how the impacts differ.

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