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**Market uncertainty and monetary policy during
and after COVID-19**

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Abstract

The purpose of this thesis is to examine the relationship between the macroeconomic situation and the stock market returns. When the COVID-19 started, governments took drastic measures to help the economies of their respected countries. During COVID-19 the money supply was grown, and this helped the stock markets to recover their lost value. These also had the effect of speeding up inflation which caused the Federal Reserve and the central banks to raise the interest rates. These measures are expected to have statistically significant effect on the stock market returns.

With the expansive monetary policy, investors are expected to see good returns. However, with the high interest rates and high inflation, the stock market returns are expected to be lower. With higher risk-free returns, investors are usually levitating towards safer investments, which causes the stock market returns to be lower. The stock market returns in unusual times are generally driven by macroeconomic factors. This thesis sheds light into the main factors driving the impact.

Historically the stock market volatility has decreased during the times of the FOMC and ECB meetings, but this was not the case during the COVID-19, especially with FOMC meetings having an increasing effect on VIX. VDAX shows similar decrease following the ECB meetings as previous studies indicate. This results with VIX lead the thesis to show that interest rates do not have a statistical significance on the S&P 500. However, the inflation shows negative correlation with the stock market returns on both indices. Finally, the money aggregate shows positive correlation with the stock market returns.

Keywords: Inflation, stock market, COVID-19, monetary policy

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Tiivistelmä

Tutkielma keskittyy tutkimaan makrotalouden tilanteen vaikutusta osakemarkkinoiden tuottavuuteen. Kun koronavirus alkoi vuonna 2019, valtiot tekivät suuria toimia auttaakseen oman maan taloudellista tilannetta. Koronaviruksen aikana valtiot kasvattivat rahamääriään, mikä auttoi osakemarkkinoita palauttamaan koronan aikana menetetyn arvon. Näillä elvytystoimilla oli vaikutuksia makrotaloudelliseen tilanteeseen, kun inflaatio kasvoi. Tämä puolestaan johti Yhdysvaltojen ja Euroopan keskuspankkien ohjauskoron nostamiseen. Näillä toimilla oletetaan olevan tilastollisesti merkittävä vaikutus osakemarkkinoiden tuottavuuteen.

Elvyttävä talouspolitiikka, mitä tehtiin myös koronaviruksen aikana, on yleensä johtanut sijoittajien hyviin tuottoihin osakemarkkinoilla. Vastapainoksi korkojen nousu ja inflaation kasvu johtavat yleensä huonompiin tuottoihin osakemarkkinoilla. Riskittömän tuoton ollessa korkealla, sijoittajat yleensä siirtävät omistuksiaan turvallisempiin kohteisiin, mikä johtaa osakemarkkinoiden tuoton laskuun. Osakemarkkinoiden tuotto epävarmoina aikoina on yleensä riippuvainen makrotalouden tilanteesta. Tämä tutkielma avaa sitä, mitkä näistä makrotalouden tilastoista ajavat osakemarkkinoiden tuottavuutta.

Aikaisemmin osakemarkkinoiden volatiliiteetti on laskenut FOMC ja ECB tapaamisten seurauksena, mutta tämä ei ollut huomattavissa koronaviruksen aikana: FOMC tapaamisilla oli positiivinen korrelaatio VIX-indeksin kanssa. ECB tapaamiset puolestaan näytti samanlaisen VDAX-indeksiä laskevan vaikutuksen, mitä aikaisemmat tutkimukset osoittavat. Tulokset VIX-indeksin kanssa johtavat tutkielmaa osoittamaan, että koroilla ei ole merkittävää vaikutusta S&P 500 indeksin tuottoihin. Huomioitavaa kuitenkin on, että inflaatio osoittaa negatiivista korrelaatiota molempien osakemarkkinaindeksien tuottojen kanssa. Lopuksi tutkielma osoittaa, että rahavarantojen kasvattamisella on osakemarkkinoiden tuottoja kasvattava vaikutus.

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1. Introduction

In the December of 2019, the World Health Organization (WHO) got a report from Wuhan, China which informed about the COVID-19 (WHO 2020). On the 18th of February 2020, there had been 73 345 cases of corona virus (COVID-19) including 1 874 deaths. As of the 29th of September 2020, there had been over 33 million cases and the pandemic had caused over a million deaths. Naturally, it had a substantial impact to the world (Worldometer 2020). In March of 2020, the stock market in the United States dropped. However, it bounced back in few months. On February 19th 2020, the S&P 500 index closed at 3386,15, and then it started to lose its value. On March 23rd of 2020, the index closed at 2237,40. Having lost almost 34% of its value the market started to gain value again. On September 2nd of 2020, the S&P 500 index once again reached an all-time high. (Yahoo Finance 2023.)

The Federal Reserve (FR) lowered the interest rate in order to help the economy during the pandemic. The first time the interest rate was lowered on March 3rd of 2020, and the second time was on March 16th 2020 (Federal Reserve 2020). However, as mentioned before, the stock markets regained their value and markets started to settle. The decisions made during the COVID-19 and the governmental actions influenced the financial markets, as the interest rates were lowered, to increase cash flow. This caused additional cash on the markets with quantitative easing, which eventually led to higher inflation. To combat the inflation the interest rates were raised. However, the annual inflation rate of the United States went from 1,4% in 2020 to 7% in 2021 (CPI Home 2023).

United States grew their national debt substantially during the COVID-19. According to Cline (2021), the United States' national debt grew on three different decisions. First it grew in March-April of 2020, totaling an amount of 3,1 trillion dollars. To this they added 900 million in December of 2020 and 1,9 trillion in March of 2021. With these amounts, the total amount of debt they increased to battle the COVID-19 was 5,9 trillion dollars.

Dehmene, Boughrara and Slim (2021:693) mention that the monetary shocks have a clear effect on the investor sentiment. According to their study, having 5,9 trillion dollars added to United States' national debt will create an impact in the stock market.

In the United States, the federal funds rate determines the interest rate that is applied, when depository institutions lend funds to each other overnight (Federal Reserve 2020). Euribor that is determined by the European Central Bank (ECB) works similar in Europe (European Central Bank 2020). These rates are used to increase or decrease the liquidity of depository institutions (Federal Reserve 2020; Eurostat 2020). Generally, the rates have had effects on the stock markets and Kurov (2010) shows that the effects have been more significant in bear markets. The global pandemic has caused volatility on the markets, which is covered later in this thesis and the interest rates may have affected the volatility, since this is shown to be true by Krieger, Mauck, Vazquez (2015).

1.1. Background and motivation

Lee, Jais and Chain (2020) mention that the COVID-19 has affected the Malaysian stock markets. This shows that the COVID-19 has had large effect on stock markets causing them to lose the value that was mentioned earlier. Monetary policies were activated in order to stop the bear markets and bring back the lost value, as well as securing the economy and saving companies. However, the changes in the interest rates may not have been the driver that led to the quick recovery in the markets. The changes could not have been large, since prior to the COVID-19 the interest rates were at 2,38% and were dropped to near zero. Since 2022 the interest rate has risen to 4,57%.

COVID-19 started with the number of cases slowly rising all over the world. Europe became the center of the COVID-19 pandemic. However, during 2020 the numbers in the United States started to grow more rapidly and the center of the pandemic shifted. During the summer of 2020, the numbers started to see a decrease in the Europe. However,

during the fall time, the numbers grew rapidly and new records on daily cases were seen daily in different countries in the world. During the first wave of COVID-19, the number of new cases were around 35 000 in the United States. During the summer of 2020, the cases were around 70 000 in the United States. However, during the fall, the number of cases exceeded over 300 000 new daily cases. (Worldometer 2020.)

Since COVID-19 started, there has been multiple variables that could have influenced the stock markets; the monetary aggregate has grown, the inflation rate has jumped, the interest rates have increased and the prices in the energy sector have grown a lot. This thesis focuses on the different news investors seem to focus on with the current uncertainty. Investors make decisions based on new information that becomes available. This thesis attempts to show, which information drives the decision making.

This thesis measures the effects of monetary policy decisions and other driving factors in the stock markets. Kurov (2010) uses the Federal fund rates to determine the influence that monetary policies have on the stock markets. He mentions that the federal fund rate has larger effect during bear markets which would mean that it affected the markets in March 2020. He also states that there are two goals with monetary policies which are economic growth and the stability of prices. With inflation growing up to seven percent, the interest rate has grown to 4,57%, to counteract the inflation, and this is expected to have influenced the stock markets.

Federal funds rate is affected by the buying and selling of securities by the federal reserve. The goal the federal reserve is trying to reach is set by the federal open market committee (FOMC). Federal funds rate is used to direct the markets and to reduce the volatility. Changes in the rate affect different kinds of loans which also affect the investor sentiment. (Federal Reserve 2020.) Negative Euribor rates and low federal fund rates increase the difficulty to affect the market volatility with changes in the rates. Generally, in bull markets the interest rates are raised in order to fight the inflation and in bear

markets the rates are lowered in order to increase the inflation. Jareno, Ferrer and Miroslavova (2016) study the effect of interest rates and mention that during the financial crisis, the changes in nominal rate have significant effect especially in extreme market conditions like during the financial crisis.

Since COVID-19, the governments started to do quantitative easing. These actions were expected to provide the support the markets needed in order to regain their value. FOMC and European Central Bank (ECB) set up the action plan that seemed to calm down the investors' reactions and regain trust in the stock markets. However, two years later the inflation rate increased, and the ECB and FOMC had to shift their focus from quantitative easing and expansive monetary policy to restrictive monetary policy and to the interest rates. Investors made good returns on the stock markets during the quantitative easing, but their reactions to the inflation and interest rates have not been as easily noticeable, since the 50% growth from March to October in 2020 is larger than the movements after the expansive monetary policy.

Prevailing theory on financial markets is that the interest rates are one of the key driving factors in asset pricing. However, during expansive monetary policy, there were interest rate drop of 2,3% and the markets gained 50% in value. Since then, there have been an increase in interest rate of 4,5% and the stock markets have lost some value, but the movements have been relatively smaller. Quantitative easing can in this case be seen as the driving factor in stock market returns. (Yahoo Finance 2023.)

1.2. Purpose of the study

The purpose of the study is to determine the driving factors of investors' decision making. When there is new information coming in, investors react to it (Fama 1991.). With the different macroeconomic statistics showing high volatility, there is expected to be movement in the markets that shift investors' focus to gain the best profits. In the past,

a lot of studies like the ones from, Dehmene, Boughrara and Slim (2021:693) and Krieger, Mauck, Vazquez (2015), that have been focusing on inflation rates, interest rates and other monetary policies and these are to be discussed in this thesis. This study focuses on many of the monetary policy measures to determine, which are the driving factors when these macroeconomic variables appear at the same time in a short time span.

1.3. Market behavior

The two indices chosen for this study are the S&P 500 from the United States and the DAX from Germany. S&P 500 is a stock market index that is constructed from 500 large companies in the United States and DAX is similarly constructed of 40 selected companies in Germany (Yahoo Finance 2023). The initial market reaction to COVID-19 was a sharp drop from the index values. With in a year after the COVID-19 started in the beginning of 2020, the US indices hit an all-time high. This indicates that the investors gained confidence to the stock markets after they lost it during the spring of 2020. After that the stock markets levelled and the driving factors are harder to see directly in the market reactions. During the quantitative easing, it is easier to pinpoint, when the decisions were published. These kinds of movements are absent in restrictive monetary policy.

1.4. Hypotheses

The first hypothesis focuses on the FOMC meetings to determine if the markets have similar behavior as they have had in the past. Vähämaa and Äijö (2011) measured these effects and saw that the FOMC meetings had a decreasing effect on VIX. The first hy-

potheses measures, if these effects are still present after COVID-19. The European markets are added to measure these effects also in Germany. The first hypothesis is as follows:

H0: FOMC and ECB meetings do not have a decreasing effect on the volatility.

H1: FOMC and ECB meetings have a decreasing effect on the volatility.

The second hypothesis focuses on the monetary policy decisions and the direct effects seen in the stock markets. The first portion investigates the inflation rates, energy prices and the interest rates and their effect on the stock markets. The second hypothesis is as follows:

H0: Stock markets do not correlate negatively with interest and inflation rates.

H1: Stock markets correlate negatively with interest and inflation rates.

The third hypothesis focuses on the money aggregate. The amount of money in circulation can be seen as an expansive policy to give confidence to the investors that the government sees the companies as a priority, because this saves jobs and drives the economy. These movements are usually seen in the stock markets. The third hypothesis is as follows:

H0: The monetary aggregate does not affect the stock market returns.

H1: The monetary aggregate affects the stock market returns.

1.5. Contribution

The COVID-19 started a wave of macroeconomic events in the 2020. The macroeconomic environment was again changed and same economic factors, such as interest rates and inflation were increased with Russia's attack to Ukraine in February 2022. These events offer a unique situation to study the driving factors of the stock market returns. In the past, the raise of interest and inflation rates have decreased the stock market returns (Kaminska & Roberts-Sklar (2018); Jammazi, Ferrer, Jareno and Hammoudeh (2017); Jareno, Ferrer & Miroslavova (2016)). This thesis studies similar factors to the previously mentioned. However, in this thesis these factors are being studied in different times. Eventually this thesis attempts to prove if the correlation between interest rates and inflation with stock market returns were similar during Covid 19 as they have been generally in the past.

The first portion of this thesis will show, how the volatility index has behaved around the FOMC and ECB meetings. According to Vähämaa and Äijö (2011), these have had a calming effect in the stock markets. With the quick recovery from COVID-19 the first meetings seemed to have calming effect that lowered volatility. With the change from expansive monetary policy to restrictive monetary policy, these meetings can have different effects, and this thesis will show if this change affects the volatility.

The last portion of this thesis will then focus on the decisions made in the FOMC meetings and the current status of the markets. The thesis will focus on the question if investors are more interested in the inflation and interest rates, or if the quantitative easing is the driving factor of investors' confidence. The increase of money aggregate shows if the government and central banks are focusing on the economy with expansive monetary policy, while the interest rate shows the results with restrictive monetary policy. The stock market returns show how investors react to the macroeconomic status and the monetary policy.

2. Background and theory

In this thesis, the focus is to see how the actions taken during COVID-19 affect the stock markets after the pandemic. The theories focused on in this section show different financial theories that are tied to the asset pricing and how these actions can be reviewed and measured. The changes in stock market performance can be, caused by the new information. The new information can confirm investors' suspicions or change their viewpoint of the current status completely. If the quantitative easing continues, investors can rely on government to support companies that will help to gain better results, and if not, the companies will have to provide better profits. The risk-free rate grows and the risk premium with it. This is tied to the risk-free rate changing.

2.1. Theory of asset pricing

Amihud, Mendelson and Pedersen (2012:1) mention the basic idea that investors link the returns into risk in asset pricing. In the other words, this means that the higher the risk is, the higher the expected returns need to be. Fama and French (2004:25) talk about the origin of capital asset pricing model (CAPM) and they label it as the birth of the asset pricing theory. According to Fama and French, the CAPM model is still the centerpiece of the investment education even today tai foundation of the financial modelling. The relation between the risk and the expected return is well explained within the CAPM. CAPM follows the work of Harry Markowitz and in his model of portfolio choice, investors are risk averse. The investors are supposed to choose the maximum expected returns given the variance.

The expected return $E(R_i)$ is calculated based on the risk-free rate R_f , the risk premium $(E(R_m) - R_f)$ and the market Beta. The beta is the multiplication for the risk premium and

is usually measured as the comparison to the market volatility. Below the function is displayed, however, it is important to acknowledge its shortcomings.

$$E(R_i) = R_f + \beta_i (E(R_m) - R_f)$$

With 0% interest rates, the investor needs to expect positive returns to benefit from investing in securities. However, with increased volatility investors expect higher returns for their investments. This is visible in the risk premium in CAPM model, and the beta indicates the stock's own relation with the market risk. With risk-free rates growing, investor's expected market returns need to account for that, so that the risk premium is kept at the investor's preferred level. Kaminska and Roberts-Sklar (2018) mention that the key factor for equity pricing is the risk-free rate.

2.2. Efficient market hypothesis

Efficient market hypothesis (EMH) is based on research by the economist Eugene Fama, which means that the markets act in an efficient way. Fama (1991) mentions three different forms of efficient market hypothesis. He mentions that in the strong version of the efficient market hypothesis, all the information is available to all parties. He also mentions a weak form, where the markets reflect the past information. In the semi-strong form, the markets reflect the past information and the new public information. There is also a mention that there are no transaction costs. Fama himself mentions that the strong version is false. (Fama 1991.) All the information is not available and there are transaction costs which means that the strong version is not something that is used in this study.

Efficient market hypothesis mentions that new information should influence the stock markets. It should be seen as changes in the stock prices, either as negative or positive change. Within the three different levels of efficient markets, the one commonly used to be the semi-strong form. This means that the stock markets show all information

available to public as well as the historical information. (Born, Myers & Clark 2017.) Ever since COVID-19, the new information that should affect the stock markets has happened in high frequencies, with new macro-economic data and the war in Ukraine.

The information that is reflected in the stock price as a change, should be unexpected. The information that was expected, should already be visible in the stock markets meaning that the news has already had an effect to the stock markets. Even in the cases of expected news the confirmation of the news should have some effect to the markets. (Born, Myers & Clark 2017.) The rise of COVID-19 cases may have been expected and their decline as well, hence it may be hard to see the effect to the markets. However, the actions taken to the pandemic as well as the macroeconomic situation that follows the pandemic could be easier to see in investors' reactions to the publications of new reports.

Poutachidou and Papadamou (2021) show that quantitative easing has a statistically significant effect on the stock market returns. The FOMC announcements usually provide confidence to the investors and positive stock market returns. With higher inflation rates and the raise of interest rates, the stock market reactions to the new information are harder to predict. Based on EMH, the new information should show reactions on the stock markets, unless all this information was already in the stock market values. Even with these being largely in the values Born, Myers and Clark (2017) mention that the confirmations should shift the markets as well.

2.3. Investor sentiment

Stambaugh, Yu and Yuan (2012) mention that for a long time, based on empirical evidence investors have reacted on sentiment. According to them numerous studies have shown this in short selling in the stock markets. They mention the behavioral biases of the investors. These indicate that the financial theories that institutions are working

with, are not present in all situations. Investors that are acting in an irrational way force other investors to look at the stock market returns from a behavioral aspect as well. With irrationality in the stock markets and the behavioral biases, the stock market returns, vary based on the investor sentiment.

Burton, Shah S. and Shah S.N. (2013:25;43) mention that the efficient market hypothesis became under scrutiny in 1987 when the stock market behavior was abnormal. They mention different factors that affect the investor sentiment, such as the the way of speaking about an investment target. This focuses on noise traders which are traders who base their decision making on what they hear. This leads to irrational investment decisions since the decisions may not be based on facts but more on rumors.

Burton, Shah S. and Shahs S.N. (2013:45) divide the investors into two categories. Into rational and irrational investors. The difficulty in this method arises from the fact that rational investors should make their decisions also based on how irrational investors behave. This creates a difficulty also for research, when trying to figure out what factors drive the stock markets. Considering rational traders, who attempt to follow irrational traders, the irrational movements of stock markets are increased. This is what follows noise trading and makes it hard to find reasons for stock market performance.

Based on the investor sentiment Burton, Shah s. and Shah S.N. (2013:45) mention, that it is important to study these effects when looking at the COVID-19 affects. Governments have taken a lot of actions to secure their citizens and to help with the economy. With quantitative easing, investors see the market stronger with risk-free rates being close to zero. However, if the stock market movements are due to irrational investors, it is extremely hard to study what government actions affect the stock market returns.

3. Literature review

The literature review starts by looking into the federal fund rate and the monetary policy that is being guided with the federal fund rates. The changes in the federal fund rates are usually seen in the interest rates, which adjust inflation to the target level. The importance of these rates and their effect to the inflation and the stock market returns is being analyzed based on prior literature. However, since the financial crisis and especially since the COVID-19, quantitative easing has been prevalent on the markets. The investors' reactions to the quantitative easing and the change in restrictive monetary policy, that has now happened has been studied in the past in times when these changes have not been simultaneous and with this magnitude.

The global pandemic was seen in the interest rates with Federal Reserve aiming to lower the interest rates, to ease the flow of credit to businesses (Federal Reserve 2020). However, the interest rate had been low prior to the pandemic as can be seen in figure 1. The federal fund rate describes the rate that is used when there is overnight trade of federal funds between depository institutions. Federal funds are being held at the Federal Reserve Banks. The federal fund rate has been higher in the past (figure 1). Before the terrorist attack of 9/11, the rate was over 6% and before the financial crisis the rate was over 5%. Since then, it has been extremely low.

The rate was lowered federal reserve prior to the COVID-19 crisis but fell near 0 after it started. However, after the summer of 2021, the inflation started to increase, and this caused the United States' government to investigate the interest rate in order to lower the inflation. Measures were taken once the inflation started to increase and the federal fund rate was raised. Federal fund rate shows the target amounts for the interest rates in the markets, which is one of the factors to direct the economy. (Federal Reserve 2023.) The interest rate is also one of the measurements used in CAPM model to value asset prices. When the federal fund rate is higher, it is harder for institutions to get loans,

and the risk-free rate grows, since the risk-free rate is usually tied to the interest rates, which decreases the stock prices. When it is lowered, this usually provides better stock market returns (Jammazi, Ferrer, Jareno and Hammoudeh 2017).

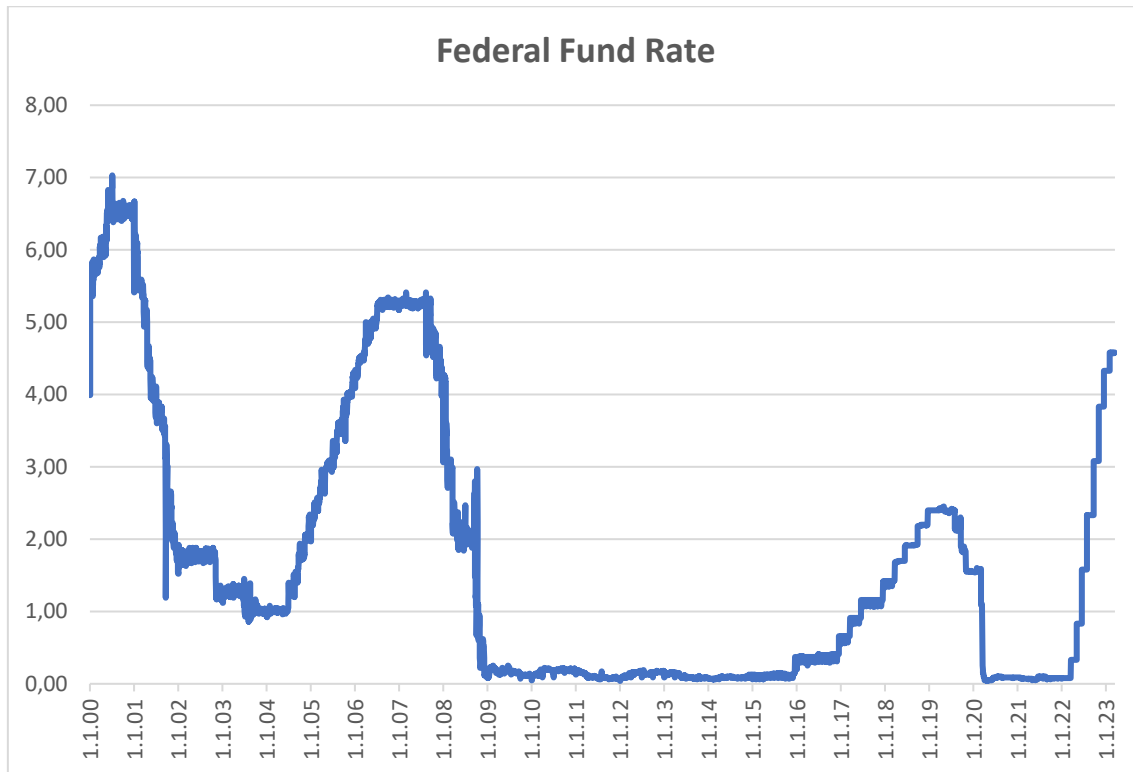


Figure 1. The federal fund rate over last two decades (St. Louis Federal Reserve 2023).

3.1. Monetary policy

Monetary policy means the actions taken to reach economic goals. These targets include optimal employment, stable prices and moderate long-term interest rates. For example, in 2022 the goal is to reach stable prices, the interest rate is being raised in order to slow down the inflation. These actions taken are based on previous literature and the financial theories that show, how markets react to different macroeconomic situations. (Federal Reserve 2023.)

Mankiw (1994) collected multiple studies, to research how the monetary policy could be conducted and what effects the monetary policy could have. Mankiw (1994), Kashyap and Stein (1993), Hall and Mankiw (1994) and Ball (1993) were some of these studies and they tie together the interest rates, inflation and employment targets. He also mentions the general idea of the increased interest rates and their negative relation to inflation. Hall and Mankiw (1994) mention that one of the main monetary policies targets is to target nominal income. According to Hall and Mankiw (1994), the nominal income targets are closely related to the price and inflation levels.

Spending is to be decreased by raising the interest rate and this will eventually lower the inflation. This is also seen as reduction in lending, which will be seen as reduction in the amount of money in the markets. Kashyap and Stein (1993) mention that if the banks will cut back on the amount of loans they give out, it will decrease the investments. They also mention that the changes in interest rates usually provide sufficient explanation to economic cycles. With high interest rates, the economy needs to slower down, and this is made with the cost of capital for the investments. With low interest rates, the economy needs a boost, and the interest rates are lowered to make it more affordable to do investments.

Mankiw (1994) talks about the slow adjustments of prices and mentions that it will cause a temporary high unemployment and low output. This is the sacrifice to be made when battling inflation. Ball (1993) finds out that the sacrifice is lower when more drastic measures are taken. This causes a quick disinflation, and the sacrifice does not have time to be that damaging. This means that the more drastic the actions taken during the COVID-19 were, the smaller the negative impact for the economy should have been. Most of the research that was collected by Mankiw (1994) is showing the targeted results with monetary policies that are resulted around the availability of funds in the markets.

3.1.1. Inflation and interest rates

Jammazi, Ferrer, Jareno and Hammoudeh (2017) study the relation between the interest rates and the stock market returns and they show significant relationship between the interest rates and the stock market returns. They show that when the interest rates are raised, the stock market returns are decreased. This is also seen in the CAPM model. Similar results are visible in the study Dixit and Gupta (2020), where their study shows statistically significant negative correlation with interest rates and stock market returns.

Lutz (2015) studies the effects of monetary policy changes in the United States to investor sentiment. He mentions the positive and negative shocks have an effect to the investor sentiment. In his paper, he shows how the investors view the changes in the interest rates. He mentions that the positive effects are visible even during the times of low interest rates. Lutz (2015) also mentions the positive change in the investor sentiment when there is a shocking drop in the interest rates. These are the areas included in this thesis.

Galariotis, Makrichoriti & Spyrou (2018) study similar effects compared to Lotz. However, their study focuses on the European markets and the effects of Euribor. They divide the countries into the countries that are presumably affected the most and to the peripheral countries that are not affected as much. They discover that the effect of the changes in Euribor is the largest in the core Eurozone countries. They also discover that the investor expectations are more affected in the core Eurozone countries. Their results that the monetary policy is more focused on in the core Eurozone countries leads me to use DAX index in this study, which reflects the stock market situation best within the Central European area.

Caetite et al. (2022) studied how banks react to higher interest rates. Their study focuses on the lending habits of banks in Brazil, where they found out that banks give out fewer loans in during the times of high interest rates. Banks raise their requirements when the

interest rates are high, which results them giving fewer loans. Vera (2004) finds similarities in times of high interest rates. Banks tend to be less willing to give out loans and this reduces the availability of money in the markets.

Gambacorta, Hofmann & Peersman (2014) mention the increase in the banks' balance sheet. They focus on the time right after the financial crisis and discover that the increase in banking activity increases the economic activity. The financial crisis was the last large crisis we faced globally, and the monetary policy actions that were taken can be seen as repeated during the pandemic. COVID-19 had a negative impact to the economy and the monetary policy can be seen at least as a temporary solution to increase economic activity.

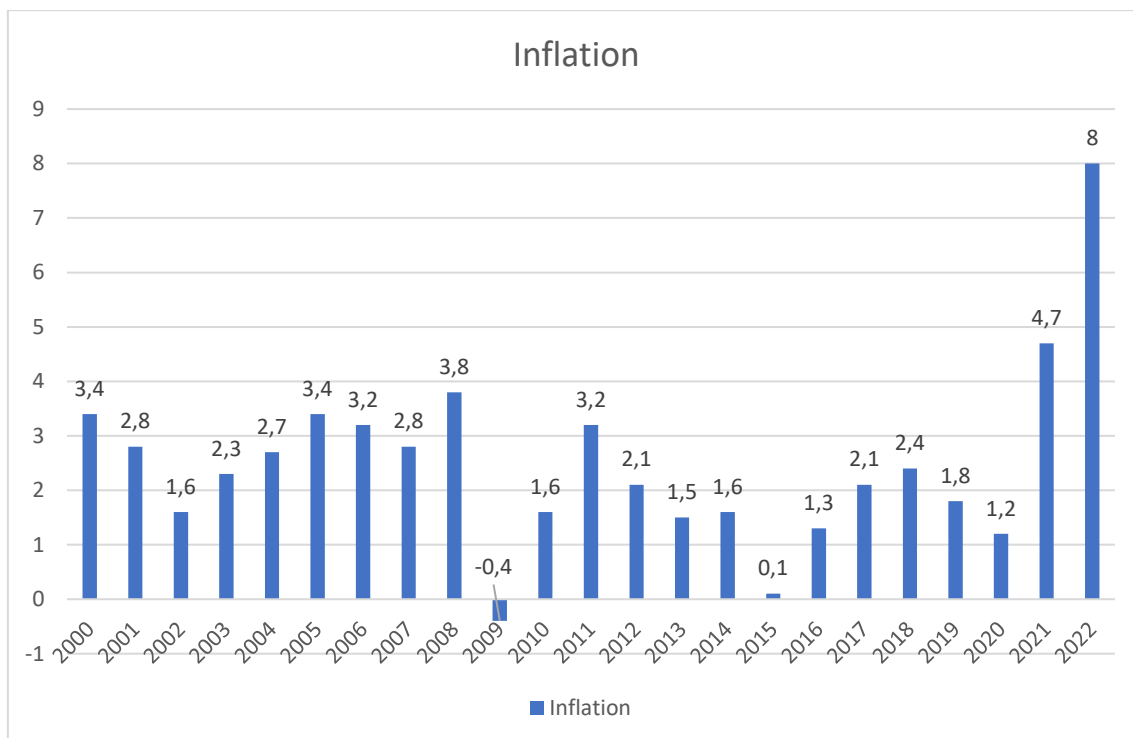


Figure 2. The inflation rate over last two decades (CPI Home 2023).

Inflation is the highest it has been in the past 20 years as can be seen in figure 2. The graph shows the average inflation for each year over the last 22 years. As was mentioned earlier, the United States increased their national debt by 5,9 trillion during the COVID-19. Based on the monetary policy, this does increase the risk of inflation. The last time

interest rates were on the rise during the financial crisis. But as we can see here, inflation was not the reason for the high interest rates during the financial crisis.

3.1.2. Monetary policy meetings

Vähämaa & Äijö (2010) study the monetary policy decisions and show that the Federal Open Market Committee (FOMC) meetings influence the implied volatility. They show that the volatility generally decreases after the FOMC meetings. However, if there are surprises between the target and the outcome, there is a positive correlation with market uncertainty and the FOMC meetings. Their findings suggest that expansive policy shows more significant reactions in the markets. Their findings also indicate that during restrictive policy, the meetings themselves do not influence the implied volatility.

Krieger, Mauch and Chen (2012) study the FOMC meetings' effects on VIX and find out that VIX generally decreases after the FOMC meetings. They mention that this is mostly because of getting information that decreases the uncertainty. Krieger, Mauck and Vazquez (2015) also find that VDAX, which is the German implied volatility index, also decreases on the day of the European Central Bank (ECB) meetings. Their findings also indicate that FOMC meetings have a statistically significant effect on VDAX.

Poutachidou and Papadamou (2021) study the effects of the FOMC meetings during quantitative easing and their research shows that the meetings have a positive effect on the stock market returns. Meaning that during times of expansive monetary policy, the stock market returns grow as a result of the FOMC meetings. Tawardos and Moose (2022) also studied the effects of quantitative easing. However, their results suggested that even though there is a significant effect of the quantitative easing on the United States stock markets, there is also something else affecting these returns.

Investor's tendency to take risk, is also tied with the attitude to quantitative easing. Fassas, Papadamou and Philippas (2020) show that investors are more likely to make riskier decisions on the stock markets around the quantitative easing announcements. This ties the focus back on the investor sentiment. If the investors become more likely to take risks during the times of quantitative easing, this means that the effects the easing has, are shifting investors to riskier assets, which increases the stock prices.

3.1.3. Effects of low interest rates to stock markets

The Federal Reserve (2020) aimed to raise its targets for the interest rates in 2015. However, this goal changed during the pandemic. This was originally a part of an unusual way of handling the financial crisis, which was said to be normalized. The unusual way was buying the securities to drop the interest rates to near zero. This improved the economy after the financial crisis. The Federal Reserve managed to improve the stock markets which is one of the goals they are trying to reach. In this thesis, this unusual method for quantitative easing and its effects on the interest rates is also one of the areas of study.

Jha (2011: 127) mentions that the longer the interest rates remain low, while the economy grows, the growth is based on potential growth. Potential growth indicates the growth expectations, rather than the actual growth of the economy. This indicates that the economic growth we have seen during the last decade is based on potential growth. Jha (2011:126) also talks about the inflation expectations and how they direct the economic cycles. Inflation expectations have been low, and the economy has been growing steadily. However, now the inflation rates are higher than during the last two decades and the interest rates are back on high levels. What happens to the stock market values, that are based on the growth expectations, rather than the actual growth of their economic value.

Delis and Kouretas (2011) study the effects the low interest rate has on risk taking and their findings indicate that banks are more likely to take risks with the low interest rates. This means that there are riskier loans given, which can hurt not only the loans available in the future, but also the banks position in the markets. Hauner and Kumar (2011) also talk about the low interest rates. However, their study is focused on the effect that the budget deficit has on the long-term rates. This study shows that when G7 countries are prone to increase their debt, the long-term rates will stay low or decrease. From 2007 to The September of 2020, the national debt of the United States has gone from about 9 trillion dollars to almost 27 trillion dollars (Statista 2020). Based on Hauner and Kumar's (2011) study, this indicates that the rates cannot be raised too fast. They also mention that the adjustment of the interest rates seems to be gradual. However, in 2020 we have seen that there has been a negative progress on this front.

Delis and Kouretas (2011) focus on the reasons for the financial crisis and mention that the low interest rates before the crisis accelerated banks willingness to take a risk. Even though they mention that the low interest rates cause acceleration in the economy, they also state that the banks riskiness should be taken into consideration. Now we have had the low interest rates for much longer than before the financial crisis. This raises a lot of questions about the amount of risky assets with banks.

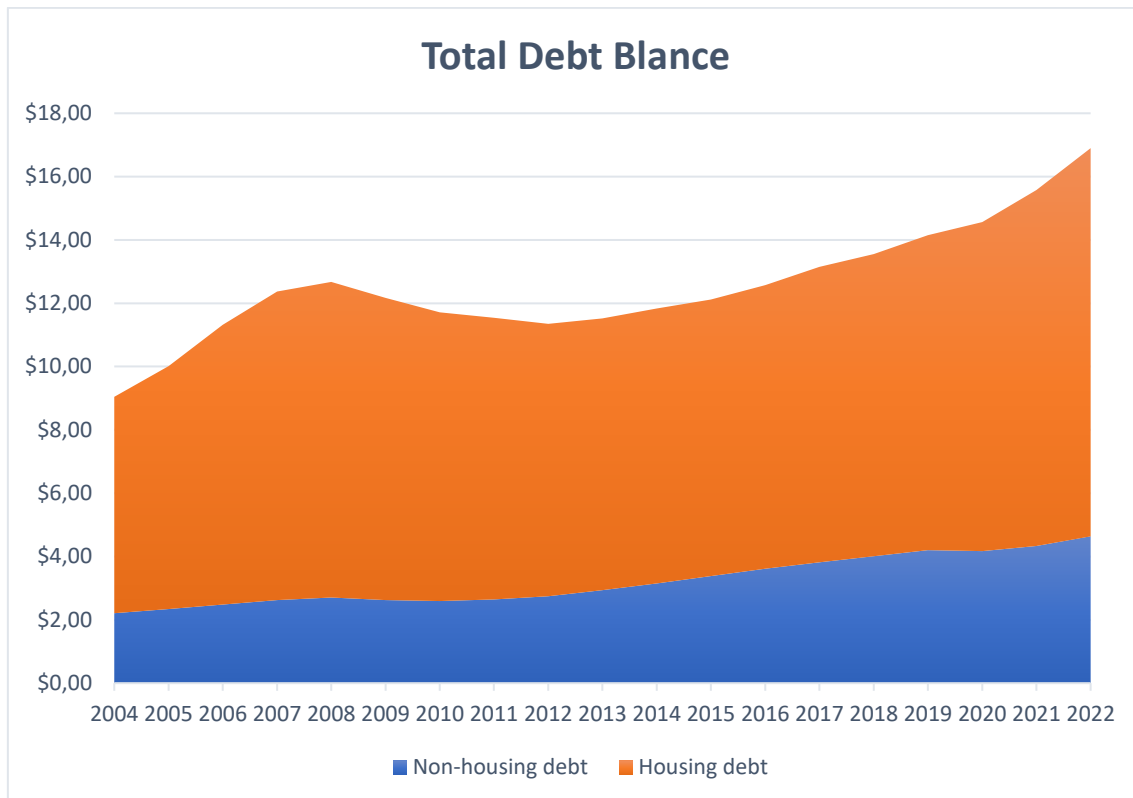


Figure 3. The United States' debt balance (Federal Reserve bank of New York 2023.)

As seen in figure 3. the amount of household debt in United States has not been higher in the last 18 years. The Y axis is in trillions, which means that the US household debt reached 16,9 trillion dollars by the end of 2022. This provides further evidence that the monetary policy that has been prevalent since the financial crisis has increased the amount of lending by banks. Based on Mankiw (1994) combination of research mentioned earlier, the increased lending by banks will speed up the inflation. The amount of household debt, both housing and non-housing debt are much higher than they were during the financial crisis. Going through the literature review from the time before financial crisis, it was very likely for something to start the inflation, after a situation of continues quantitative easing and low interest rates that increased the investors' risk and debt.

3.2. COVID-19 and the economy

COVID-19 started at the end of 2019. Wuhan was the first area that saw the restrictions that were caused by COVID-19. Transportation in and out of the city were stopped once the disease was seen as extremely dangerous. It was not announced as a pandemic until March 11th of 2020. The first effects were seen in China since the virus originated from there. However, there were some spillover effects to the global markets. The virus had negative effects to the European and the United States' stock markets before the virus spread more widely. However, the effects to these stock markets intensified once the virus spread to Europe and the United States. (He, Liu, Wang & Yu 2020.)

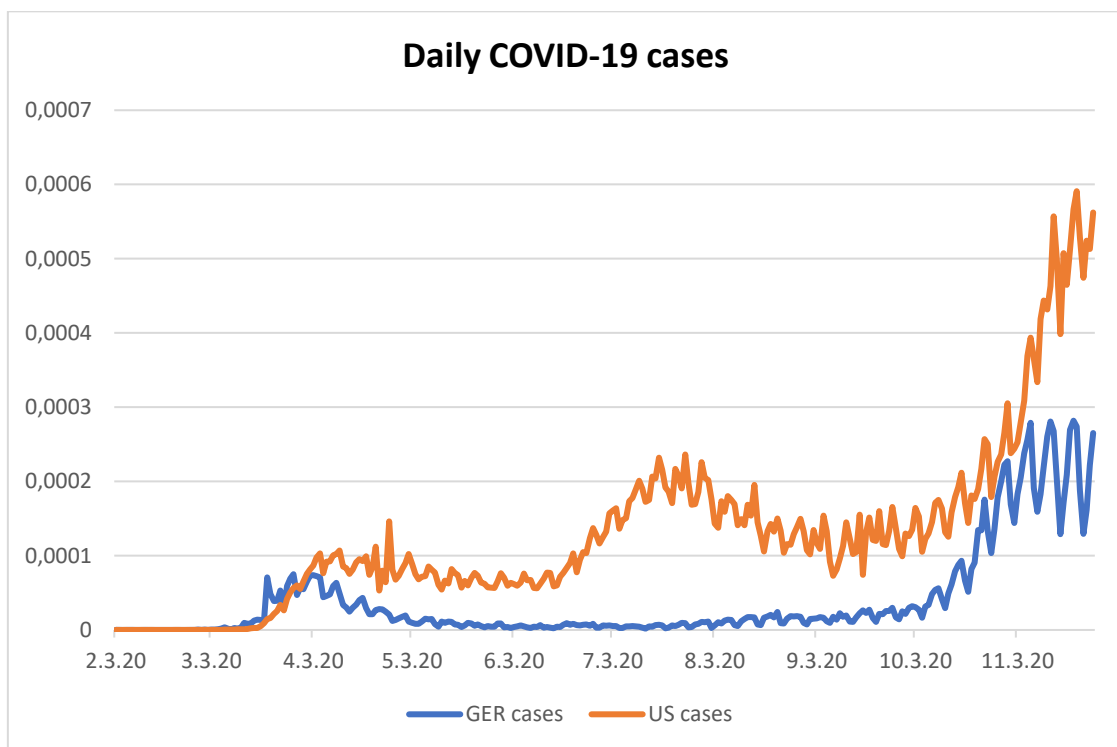


Figure 4. Population adjusted daily new COVID-19 cases Worldometer (2020).

The numbers on the left column of the figure 4. show the decimal of the population that was affected during the date of observation. The United States' highest value was in the the November of 2020, when 0,06% of the population was infected in a day. When looking at the springtime of 2020 the cases were seen as devastating and drastic measures were taken in different countries. Later in the thesis, the index values are shown, and

the springtime had a greater effect to the markets than the fall. During the fall time the cases vastly outnumber the springtime cases.

Ashraf (2020) shows the effects to the economy based on different government policies. His study shows similarity to other studies with the correlation between COVID-19 cases and the stock market performance. The focus of the study was the effects of lockdowns and social distancing. He mentions that even though the increase of stricter policies does show negative correlation with the stock market performance, it also increases the stock market performance indirectly, since investors expect the cases to go down.

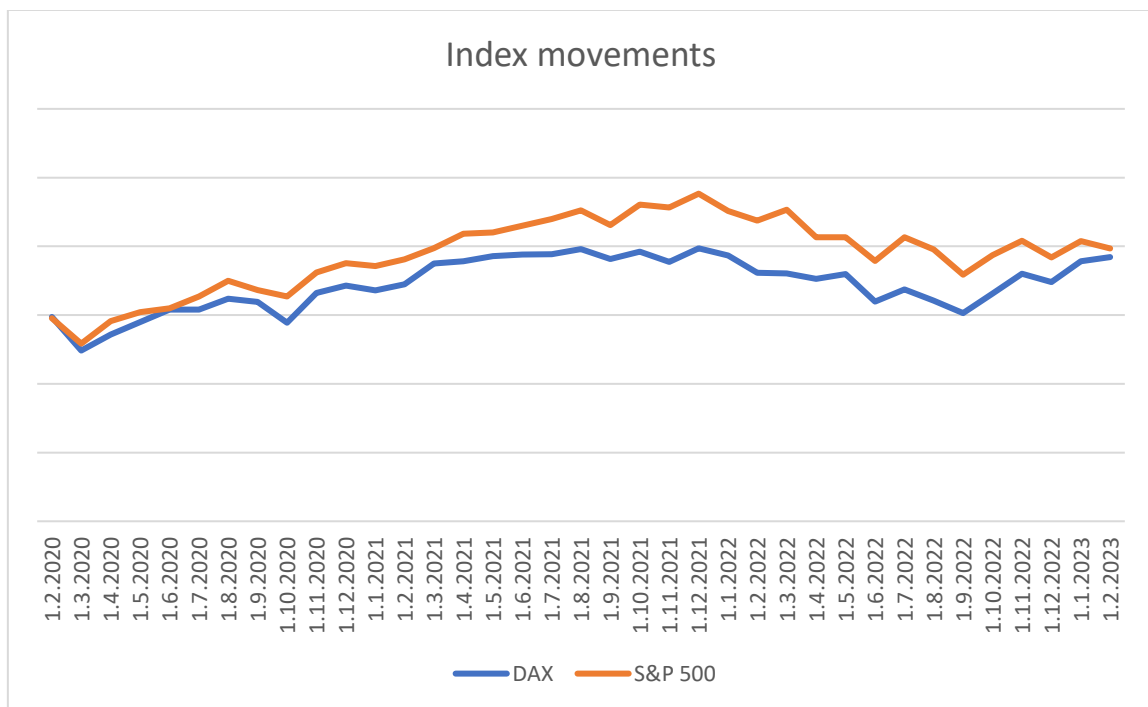


Figure 5. The index values of the stock market (Yahoo Finance 2023).

Figure 5. represents the movements of the indices as it helps to identify the movements during the pandemic with value adjustments. When looking at the movement of the indices, they are modified to see the effects clearly. The figure 5. shows that, all lost value during the early stages of COVID-19 was regained in few months. They did bounce back and as previously mentioned, the S&P 500 hit an all-time high quickly after the start of COVID-19. After the start of the pandemic, the federal fund rate and the 12-month Euribor was lowered.

When comparing the indices and the cases shown above in figure 4 and in figure 5, there are some co-movements in the figures. Especially, a little drop in the fall time of 2020 during the increase in COVID-19 numbers. However, the cases have been growing and the indices are reaching higher peaks than before the COVID-19. There have been different factors that could affect the current situation. The previous research shows the effects of COVID-19 as already mentioned. The figure 4. and figure 5. show that the measures taken during COVID-19 did provide the support that investors were looking for and the drop in index values was not long-term.

Chaudhary, Bakhshi and Gupta (2020) also show the negative results in stock market returns during the first wave of COVID-19. This is also what Ashraf (2020b) shows. He's study shows strong correlation with the cases and the stock market returns, but a weaker correlation with the deaths caused by COVID-19. This indicates that the initial number, which are the cases, have a larger effect than the deaths that are reported after the cases started to increase. Ashraf's (2020b) results are based on the efficient market hypotheses, since the deaths should have been expected after the increase in COVID-19 cases. Zhang, Hu and Ji (2020) also mention the uncertainty the COVID-19 has caused in the stock markets.

After the indices regained their value in 2020, the stock market started to show some decrease. However, the values are still higher than before the COVID-19. Inflation and interest rates are higher than they have been in years, and the markets have not seen a significant decrease. This will raise the question on whether the stock market returns are affected by the interest and inflation rates. This is followed in this thesis to see if the effects of the interest rates and inflation to stock market development are statistically significant.

3.2.1. COVID-19 and government actions

Narayan, Phan and Liu (2020) studied the effects of government actions and support packages during the pandemic. They mention travel bans, lockdowns and stimulus packages and their research shows positive effects to the government actions. The stimulus packages show mainly positive returns. However, there are negative values in the mix. This could mean that the stimulus packages were smaller than expected. Travel bans and country lockdowns also had mixed effects to the stock markets. These effects could have been anticipated since the news could have been expected and investors expected future returns based on the order the news came in.

Phan and Narayan (2020) add the business reactions, which happened before the governmental actions based on necessity. They mention that the positive effects of government actions were seen in lockdowns and stimulus packages. Investors' reactions were focused on the positive outcomes of government actions that could hurt businesses. Phan and Narayan (2020) mention the difficulties of continues research since the government actions differ a lot and the investors' reactions could be the sum of many different factors.

3.2.2. Volatility

Selmi, Hammoudeh, Errami and Wohar (2021) study the anxiety in the markets caused by the COVID-19. They mention that after the start of the COVID-19 uncertainty and anxiety grew to be extremely high. Uddin, Moshfique, Anderson and Chauhduri (2021) link the increase in volatility directly to COVID-19. The lockdowns increased uncertainty as well as other actions taken to fix the economic situation. Uddin et. al. (2021) also mention that the developed countries were better at handling the increase in volatility. This indicates that these results should be visible in this study as well.

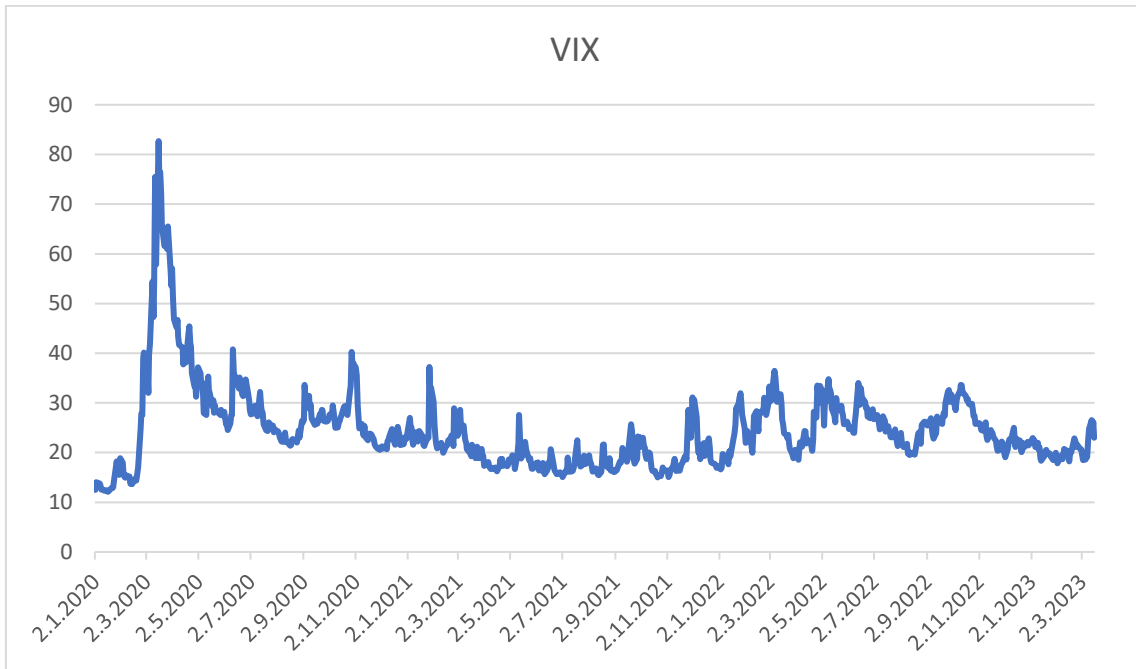


Figure 6. The volatility index of the United States' stock markets (Yahoo Finance 2023).

As can be seen in figure 6., the volatility index has been extremely high during the selected time period. The last time something like this was a scene, was during the financial crisis. As can be seen, the volatility index skyrocketed in March 2020 and started to decline slowly. Even though it has been slightly high, it has been declining since the early surprises in March 2020. Since the spike during COVID-19 the VIX has been moving between 15 and 40, which is less than half of what it was during COVID-19.

3.3. Returning the value

Chen, Filardo, He and Zhu (2016) study quantitative easing in the aftermath of the financial crisis. They mention the benefits of the quantitative easing to the economy and how it increased the stock market value. The quantitative easing methods done in the United States had a significant spillover effect to other countries' economies. The growth of US national debt is shown in figure 5. The US national debt started to grow in 2008 and there have been years with slower and faster growth since the financial crisis. After the COVID-19 pandemic there have been a substantial growth of the national debt.

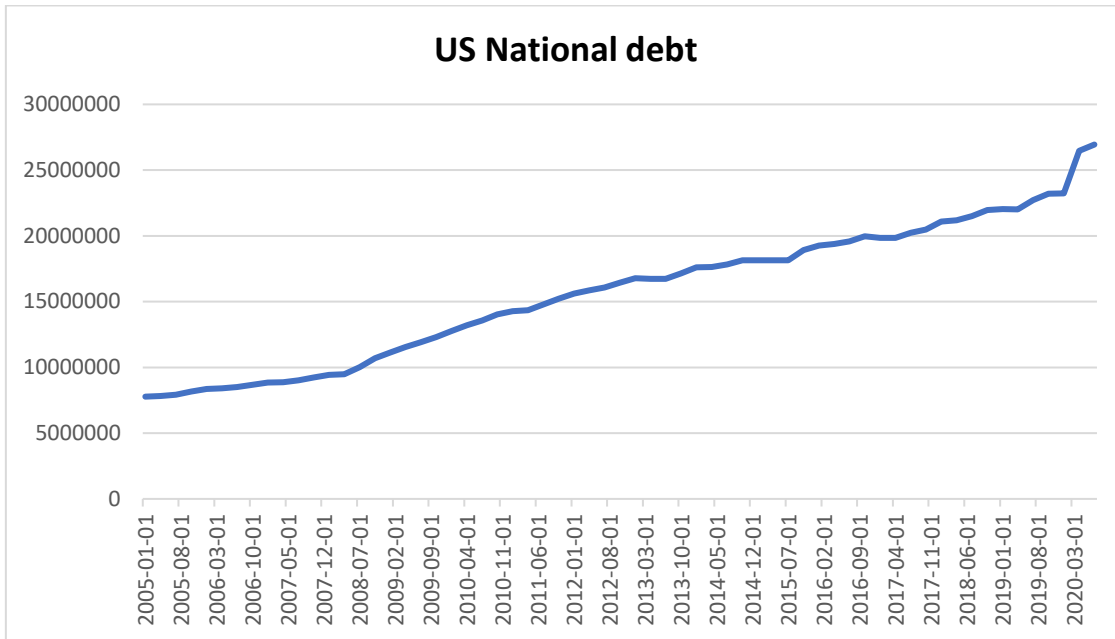


Figure 7. The growth of US national Debt (U.S. Treasury 2023)

Looking at the figure 5 shown earlier the markets gained a lot of its value after the first wave of the COVID-19. Ashraf (2020) mentions that there is a correlation between the decrease of cases and stock market performance, which largely explains this. However, there were also many support packages different countries issued that increased the stock market performance. These included extensions on loans and funding for household bills.

Chaudhary, Bakhshi and Gupta (2020) mention that the speedy recovery of the stock market may not be linked to the assistance given to the markets. They mention the positive news and the possibility of eagerness in investors could be causing a bubble. They find higher volatility than normal in the stock markets, which is the increased risk. However, the daily returns prove to be positive. They theorize that the situation could be based on the success of others and envy on others. This is leading to irrational behavior and a possibility of a bubble in the markets.

3.4. Quantitative easing

As mentioned earlier, quantitative easing has direct and indirect effects on the stock market returns. As we can see from figure 7., the quantitative easing has been present since the financial crisis. However, during COVID-19 it was strong. Earlier it was mentioned that there was 5,9 trillion dollars added to the United States national debt during the COVID-19, which means that the United States grew its debt by about 20%. Based on the previous literature and theories earlier mentioned in the thesis, this means that the quantitative easing made during and before COVID-19 is a portion of the base for the current inflation.

Fassas, Papadamou and Philippas (2020) mention that the investors are increasing their investments during quantitative easing and are likely to choose riskier assets during these times. Earlier it was also mentioned that during the low interest rates, banks are more likely to give out riskier loans, which means that the availability of additional funds increases in the markets. These funds are riskier which means that banks are also more likely to increase their risk, during quantitative easing.

Kabundi and De Simone (2022) focus on the quantitative easing and especially the unconventional monetary policy, with buying back securities, to push down the interest rates. They mention that this has been more effective to boost inflation than bank lending. This means that the quantitative easing that has been the practice, does open the risk for inflation. These methods are also more likely to push banks to riskier lending, which in turns, means that they are more vulnerable in a time of high interest rates.

COVID-19 drove central banks and governments increase the quantitative easing and focusing their efforts to save the economy from going into a crisis. This was made with quantitative easing which in terms grew risk in the financial markets. There was a risk that based on previous literature mentioned in this thesis that showed the correlation

between quantitative easing, inflation and higher risk in the stock markets. But this risk was not focused on. In figure 2., the inflation is shown to have jumped from 1,2 to 8% from 2020 to 2022. This led to a situation where central banks were forced to start increasing interest rates. Investors are usually prone to move their investments in less risky assets during the more volatile times, and the stock market value is likely to decrease. This is expected to be visible in this thesis as well.

4. Data and methodology

4.1. Data

Data used for the thesis focuses on two indices which are DAX and S&P 500. VDAX and VIX are also added to the thesis to study the implied volatility in Europe and in United States. FOMC and ECB meetings are looked at as dummy variables. The independent variable is the dummy variable for the FOMC and ECB meetings. The dependent variable for these is the volatility index VIX for the United States and the volatility index VDAX for the Germany. German index and volatility index is used to show the movements also in Europe. The time period is from the start of 2020 up until the date of 17th of March 2023. Data is gathered from Yahoo Finance, Investing.com, St.Louis Federal Reserve, Federal Reserve and from Eurostat.

Following the research, the movements of the indices are studied using additional variables that are energy prices, interest rates, inflation and the money aggregate. Energy prices are depicted as oil prices. The interest rates which are depicted as the 12-month treasury bill for United States and the 12-month Euribor rates for Europe. Inflation is measured as the consumer price index for Europe and for the United States. Money aggregate values are used as monthly values for Europe and the United States.

4.2. Descriptive data

The descriptive statistics as shown below in table 1., show the amount of ECB and FOMC meetings and the different range of values for volatility indices. The table shows also shows the volatility indices and their descriptive statistics. The FOMC have more values than the ECB since the FOMC meeting dummy also includes the next day, to calculate the Europe's reaction to the FOMC meetings. The time difference allows United States

to show the reactions on the same day, but with Europe the next day is added to show the effects.

Table 1. Descriptive statistics

	FOMC	ECB
Amount of dummy variables	61	27
	VIX	VDAX
Mean	24,57	25,49
Median	22,84	23,84
Variance	73,20	79,99
Std. Dev	8,55	8,94
Maximum	82,69	86,01
Minimum	12,1	12,08
Observation	807	821

In table 1., the VIX shows a high variance, which is to be seen earlier in the figure 6. during the COVID-19. The minimum values are to be seen before COVID-19 and the maximum values during COVID-19 which was shown in the figure 6. The stock market movements were strong during the time of the COVID-19, which was shown earlier figure 5. The time before the COVID-19 had strong movements with the volatility and the market indices. However, the FOMC and ECB decisions can be seen to have their long-term effects starting after COVID-19.

Mean value is a lot closer to the minimum values than the maximum values which indicates that there is likely a high peak in the volatility during the measuring period. This peak as said before was seen during the COVID-19. The similar values with VIX and VDAX indicate that the movements of the two indices are similar. VDAX shows slightly stronger movements, but the differences are negligible.

Table 2. Descriptive statistics

	S&P 500	DAX
Mean	3866,50	13786,87
Median	3962,58	13854,94
Variance	295719,50	2326181
Std. Dev	543,80	1525,182
Maximum	4766,18	15884,86
Minimum	2584,59	9935,84
Observation	38	38

Table 2. shows the descriptive statistics for the stock indices. The movements have been strong and the difference between the S&P 500 minimum and maximum value is 84,4%. With DAX the difference between maximum and minimum value is 60%. There are 38 observations with both indices, which means that there are 38 different monthly values used in this portion of the thesis. The months are from January 2020 to February 2023. The high movements in the short time frame, should have driving factors. These are shown in the following table.

Table 3. United States Descriptive statistics

	Lag	CPI	12-month treasury bill	Oil	Money aggregate
Mean	3847,05	4,73 %	1,24 %	67,87	19979,41
Median	3913,49	5,40 %	0,18 %	71,52	20755,80
Variance	305963,20	0,09 %	0,03 %	606,20	3438935,67
Std. Dev	553,14	2,99 %	1,61 %	24,62	1854,44
Maximum	4766,18	9,10 %	4,70 %	114,84	21703,20
Minimum	2584,59	0,10 %	0,05 %	16,55	15396,00
Observation	38	38	38	38	38

Table 3. shows the descriptive statistics for the variables that are used to evaluate the index movements and the driving factors. The lag has similar statistics to the S&P 500, but the rest of the variables show large movements. Inflation has a minimum value of close to zero and a maximum value of 9,1%. The maximum value is 91 times higher than the minimum value. Similar statistics are seen in the interest rate, with the maximum value being 94 times higher than the minimum value. The money aggregate has also grown by over 40% in the measured time period.

Table 4. European Descriptive statistics

	Lag	CPI	12-month Euribor	Oil	Money aggregate
Mean	13731,2	3,99 %	0,27 %	67,87	14979992,0
Median	13752,5	2,60 %	-0,31 %	71,52	15092513,5
Variance	2263492,2	0,14 %	0,02 %	606,20	863780137233,8
Std. Dev	1504,5	3,75 %	1,25 %	24,62	929397,7
Maximum	15884,9	10,60 %	3,53 %	114,84	16211491,0
Minimum	9935,8	-0,30 %	-0,50 %	16,55	13043264,0
Observation	38,0	38,00	38,00	38,00	38,0

Table 4. shows similar statistics with the table 3. but the figures in table 4. are for the European values. The inflation was negative during the measured time period and grew to over 10% which shows the magnitude of movements. Interest rates were at their maximum at 3,53% but they also were negative during the measured time period. In Europe the money aggregate grew by 24,3%. The energy prices grew by almost 7 times higher than it was during the lowest point. These figures show the magnitude of movements during and after COVID-19.

4.3. Methodology

The methodology has been structured to study first the effect of FOMC and ECB meetings to VIX and VDAX. Vähämaa and Äijö (2011) measured similar situation in their study, which was used to show the effects of FOMC meetings in expansive and restrictive monetary policies. Their method of using GARCH, works well with this thesis, since the ARCH effect is usually visible with measuring volatility. The GARCH model is structured as:

$$Y_{c,t} = \alpha_{c,t} + \beta_1 (\text{Dummy Variable}) + \varepsilon_{c,t}$$

Dummy variable in theses is used for the date of the ECB meeting and for the date of the FOMC meeting. With FOMC meetings the dummy variable is added for the following date as well. Here the Y index shows the daily changes of the volatility indices. This regression shows the effects the meetings have for the volatility.

The thesis continues to look more deeply into the driving factors for the stock market indices. The meetings had different outcomes and were held in different economic situations. These situations had different effects on the stock market returns. Monthly movements are added in the regression to see how investors are reacting to the macroeconomic factors. The regression for this is modelled after Tetteh (2020), who study the macroeconomic and their effects in Africa. The OLS in this study is structured as:

$$Y_{c,t} = \alpha_{c,t} + \beta_1 (\text{SM Index})_{c,t-1} + \beta_2 (\text{CPI})_{c,t} + \beta_3 (\text{Interest rate})_{c,t} + \beta_4 (\text{Oil})_{c,t} + \beta_4 (\text{Money aggregate})_{c,t} + \varepsilon_{c,t}$$

Here the Y is the index that is studied depicts the monthly stock market returns at a time t. The lag value is added to show how the stock market movements are dependent on their previous values. CPI here shows the inflation. The interest rates are measured by the 12-month T-Bill which shows the interest rates in the United States and in Europe it is the 12-month Euribor. Oil prices are used to see how the energy prices correlated with the stock market returns. Money aggregate is the final variable, and it shows the direct

effect of the expansive monetary policy. The results of these regressions are shown in the next portion of this thesis.

5. Empirical results

In this section the results are provided from different regressions, based on the data provided previously. The first regression examines the effects of the FOMC and the ECB meetings. Generally, the meetings have had a statistically significant effect on the volatility indices in the markets. FOMC and ECB meetings are measured as a dummy variable and the volatility investigates the daily changes of the local volatility index. The effect of the FOMC and ECB meetings to daily changes in the volatility indices provide the ARCH effect, which justifies using GARCH model.

Table 5. GARCH results for the effects of monetary meetings to volatility.

	FOMC	ECB
VIX	1,24**	-1,01
	2,82	-0,34
VDAX	-1,02**	-1,03**
	-1,99	-2,10

(*,**,***) Indicates significance at 10%, 5% and 1% level.

Above in table 5. we can see the results from a GARCH (1,1) model. Like Vähämaa's and Äijö's study, the FOMC meetings do have a statistically significant effect on the VIX. However, contradictory to Vähämaa & Äijö (2011) and Krieger, Mauck and Chen (2012) studies, ever since COVID-19 started, the meetings seem to increase VIX. However, the results about VDAX are in line with the finding of Krieger, Mauck and Vazquez (2015) where VDAX sees similar decreases on the days of FOMC and ECB meetings as it did in their study. This causes us to reject the first hypothesis for the United States, which provides the need to study further on the results.

FOMC meetings have a positive correlation with the volatility index. The movement in the index indicates that the outcome of the meetings is something that was not expected with the investors. Based on the theories provided earlier, new information does

resonate with the investors, which would increase the volatility. The differences in results with ECB and FOMC indicates the differences of expectations with investors in Europe and United States. In Europe, the results were expected which calmed the investors and lowered the volatility, however, in the United States the results, show the opposite effect.

The effects of the meetings are significant but since the results are not in line with the previous literature such as Vähämaa & Äijö (2011), there is a clear need examine the correlation further. The next step is to focus on the changes that happened after the meetings. The situation is being studied by adding variables for the money aggregate, oil prices, interest rates, inflation and the previous stock market index closing values. As mentioned earlier, these include a lot of the information that are covered in FOMC reports.

5.1. Investor reactions to macroeconomic statistics

Table 6. OLS results for the macroeconomic factors on the stock market indices.

	S&P 500	DAX
LAG	-0,364**	-0,275
	(-2,343)	(-1,649)
CPI	-7123,46***	-28022,24***
	(-2,972)	(-2,831)
Interest	469,68	41212,02**
	(0,187)	(2,484)
Money Aggregate	0,093**	0,0007**
	(2,707)	(2,307)
R-Squared	0,277	0,221

(*, **, ***) Indicates significance at 10%, 5% and 1% level.

The regression is modelled in a similar format what Tetteh (2020) uses in his study that was focused to examine the macroeconomic factors in the stock markets in Ghana and

Nigeria. He uses an OLS model that is similarly used here. Some of the variables are changed so that this thesis can focus on some of the specific factors during and after the COVID-19.

Contradictory to his study, after the COVID-19, interest rates do not have statistically significant effect to the S&P 500. Inflation, however, does have a statistically significant effect on both indices. There is no stationary with variables but with first lag all variables seem stationary. Oil prices showed multicollinearity with inflation, so the oil prices are removed from the regression.

The lag which indicates the previous months stock value have a statistically significant effect on S&P 500, but not on the DAX. S&P 500, however, On the other hand, S&P 500 has a negative correlation with the lag of its own value, which means that during the selected time period, if the index values were lower on one month, the value of the index was increased in the next month. This indicates that the investors saw the lower value in one month as a good position on buying into these indices to get the profits, on the following month.

With asset pricing, the values should react to the interest rates since they are one important factor to the CAPM model. Theoretically, the investors' expected rate of return should increase to keep the same risk premium in the CAPM model. However, with the interest rate not having significant effect on the S&P 500 and having a positive correlation with DAX, this means that the investors were not focusing on the interest rates. The CPI having a strong statistical significance with the stock market returns indicates that the investors were following the inflation rates and expected the interest rates to follow. This could be why the interest rate in Europe provided positive returns, because it confirms the expectations of higher interest rates after the increase in inflation rates.

Galariotis, Makrichoriti & Spyrou (2018) and Lutz (2015) mention the reactions to the interest rates, and its significance, but the importance of interest rates can be seen as

secondary or predictable when we compare the effect of interest rates to the inflation rate. The low interest rates may have led investors to be riskier, and once the inflation started to increase, people made quick decisions to shift their investments to safer assets. This may be the reason we cannot see the effect of the interest rates being negatively correlated with stock market returns as expected.

Born, Myers & Clark (2017) mention that confirming the expected news, does have a positive effect on the markets, which is visible here visible in the table 6. This means that with the high inflation rates, investors are expecting the interest rates to increase and when they are announced, it confirms what they were expecting, or that the increase of interest rates were lower than expected. The risk tied to the interest rates, is already added to the index values when the CPI information has been released. Then when the increase on the interest rates is announced, investors are not concerned with it. This does confirm the second hypotheses about the inflation. However, it does not confirm the second hypothesis for the interest rate.

The money aggregate shows governments support for the economy and this is statistically significant for the time that is studied here. This was to be expected and confirms the third hypotheses. Investors see the money aggregate as a support for the financial markets since the money aggregate has a positive correlation with the index values. Investors are more prone to move onto the riskier investments during the times where governments are increasing the supply of money in the markets, which leads in the value increase in the stock market indices. These findings are in line with the results of Fassas, Papadamou and Philippas (2020).

The low R-Squared values were to be expected, since during these times there have been COVID-19 which is acknowledged in this thesis but not added to the study, since the effects of COVID-19 are showed earlier. Also, Russia's invasion of Ukraine has caused investors to re-evaluate their investments, but this is also not included directly into this

thesis because Russia's invasion's impacts are included to the inflation, which started to increase rapidly in Europe, once the energy prices increased.

5.2. Robust

With the robust check, the values are crossed to see how the inflation, interest rates and money aggregate of the other's respected markets affect their own stock market returns. Meaning that how the macroeconomic statistics in Europe affect S&P 500 and how the statistics in the United States affect DAX. As we can see from the R-squared values, the United States shows better results with their own macroeconomic data. However, Germany shows more accurate data with the United States' macroeconomic data. This means that investors are more interested in the data that is coming from the United States, even though they are looking at a European index. Results are similar with table 6., since the macroeconomic situation in Europe and the United States has been a like. With the other's data we can still see that the inflation rate is the dominant significance, when the investors are choosing assets.

Table 7. OLS results for the macroeconomic factors of the previous month on the stock market indices.

	S&P 500	DAX
LAG	-0,356**	-0,296*
	(-2,155)	(-1,964)
CPI	-6550,51**	-35051,34***
	(-2,502)	(-3,992)
Interest	6005,98	18204,89**
	(1,385)	(1,993)
Money Aggregate	0,00*	0,468***
	(1,863)	(3,731)
R-Squared	0,207	0,338

6. Conclusion

This thesis focuses on the stock market performance after the start of COVID-19. The volatilities spiked, and large actions were taken. COVID-19 caused drastic movements in the markets, and the stock markets reacted to these in different ways. The pandemic caused an unprecedented course of events which were followed with high ups and downs in the stock markets. In order to learn from what happened for the future, it is important to better understand the reasons and factors driving the impacts in the stock markets during and after the COVID-19. This study sheds light to the correlation between different actions and events with the stock market development

It is important to understand the limitations for this study that was conducted still during the high inflation and interest rates, made with still high inflation and interest rates. The governmental actions have still not had the full effect on the stock market returns. The stock markets show the initial reactions to the macroeconomic statistics, but not the long-term effects.

The GARCH shows the effects of the FOMC and ECB meetings to the volatility. Unlike the previous studies of Vähämaa and Äijö (2011) and Krieger, Mauch and Chen (2012), the FOMC meetings have an increasing effect on the volatility. This shows that the stock market reactions are not what they were before the start of COVID-19. When studying the effect in the European markets, the results are in line with the previous studies conducted before the start of COVID-19. With the drastic changes in the short-term effects of FOMC meetings to VIX, the change in the markets is visible with FOMC meetings not having the expected calming effect and the thesis follows to show that investors react to specific news.

The OLS regression shows how investors react to different macroeconomic statistics since COVID-19. Like in the results of Gultekin (1983), inflation rate shows statistical significance even after COVID-19 and with the high increase of it, the stock markets have reacted accordingly. When the inflation rate has increased, investors have reacted, and the stock market values value have gone down. This in turn means that investors have been focused on the higher prices and shifted their assets. Based on the asset pricing, investors have anticipated how this is related to the future monetary policy changes and were expecting specific results from interest rates.

The OLS includes the variables for the interest rates as well. Unlike with Jammazi, Ferrer, Jaren and Hammoudeh (2017) who show the statistically significant effect of interest rates to the stock markets, these are not visible with the time period after the COVID-19. These results impress the importance of this thesis as the results shows that the markets are not reacting to the same changes anymore. Interest rates show no statistical significance for S&P 500 and a positive effect on the DAX, even with the increase of interest rates. Investors were more focused on CPI and realized that the interest rates were going to go up. These reactions are not what CAPM model and the financial theories about risk suggest. This means that investors are not as focused on the risk-free assets, or that they already shifted to them based on inflation and were expecting the interest rates to follow.

The fourth variable used to explain the different movements in the in the stock markets is the money aggregate. The money aggregate shows the governments reactions to the current situations on the markets. With the money supply being increased on multiple different occasions, investors saw this as government trying to save the economy with quantitative easing. The statistically significant effect of the money aggregate to the stock markets shows that investors are interested in the government's view of the economy. Increasing money supply shows that government is focusing on expansive policy, and this shows support for the economy. This in turns increases company profits, lowers the interest rates and increases investors' confidence on the stock markets.

With the robust check, we can see that investors in Europe and in the United States are more interested in the macroeconomic situation in the United States than in Europe. The United States tai S6P 500 index had higher T-values for CPI and for money aggregate for Dax. The statistical significance is in both; however, when looking at the tables 6. and 7., the values in table 7. seem to better show the effects of the macroeconomic situations.

With previous results not being visible in a situation where multiple such variables as the inflation, interest rates and money aggregate are being focused on at the same time, in a short time period. In recent history it has been rare, to see high inflation, high interest rates and quantitative easing in a short time period and for this reason it is important to see, which variables are the driving factors for investors decision making. To predict the stock market returns in the future, this thesis provides variables that have seen drastic changes, and the effects that those have had effect on the markets. With large changes in the markets, not all changes show statistically significant effects not all changes are statistically significant. However, the governments' position on expansive or restrictive policy on money supply seems to be the most significant in terms of determining the stock market returns during unstable times.

The thesis has limitations, since when studying the stock market reactions for a short period of time, there are many possible variables that could affect the market performance. When looking at the R^2 values, there are a lot of possible variables missing. During the study, there were a lot of news about COVID-19 and the effect of these news is hard to measure. The Russia's war on Ukraine could have affected the investor sentiment. With the current uncertainties on the markets, this thesis focuses on certain variables, but there are multiple variables, like the sanctions on Russia that could have affected the market returns during these times.

Ideas for future research on the subject boils down to changing the variables and finding the ones that have the largest affect to the stock market performance during and after the COVID-19. Possibilities for future research could go to two directions. Studying the extremely low interest rates and does its changes have direct effects to the markets in the long term. Also, the long period returns of the money aggregate from COVID-19 to the future does provide additional areas of research. Finally, additional research could be made to the effects of inflation during these times and how it is related to the company profits and market returns.

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