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MASTER THESIS

THE IMPACT OF MONETARY POLICY ON STOCK RETURNS IN UNITED STATES OF AMERICA

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Nicosia 2023

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Abstract

Covid 19 pandemic has caused changes in the scale level of the business, the economical and the financial uncertainty and excessive damages around the world. This study analyzes the impact of monetary policy on the equity market return in the USA. The aim of this research is to identify the effect of the monetary policy on the S&P500 Index, as well as the magnitude of the impact of the Covid 19 pandemic. To find these effects, a VECM model is developed after cointegration among the variables. The period of the analysis started from the 1st of January 1980 and ended up to 31st of December 2022. Due to fact that in this period has happened several and crucial crises, then it divided into subperiods. These sub-periods did not include any significant event that would affect the S&P 500 returns. Overall, the econometric results indicate a negative and statistically significant impact of the CPI on the S&P500 Index. In addition, a positive and statistically significant impact of the M_3 on the stock market returns. Furthermore, for better understanding of the effect of Covid 19 pandemic, this analysis was also applied to the period of the spread of the pandemic. Finally, for the effect of Covid 19 pandemic, the PR variable has been used. The results showed that the PR variable has a negative and statistically significant effect on the equity market return.

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List of abbreviations

Definition	Abbreviation
3 month treasury bill rate	T – bill
Akaike Information Criterion	AIC
Augmented Dickey – Fuller	ADF
Autoregressive Integrated Moving Average	ARIMA
Best Linear Unbiased Estimator	BLUE
Broad Money	M_3
Capital Asset Pricing Model	CAPM
Coefficient of Determination	R^2
Consumer Price Index	CPI
Ebola Virus Disease	EVD
Feasible Generalized Least Squares	FGLS
Federal Fund Effective Rate	FFER
Federal Fund Futures	FFF
Federal Fund Target Rate	FFTR

Federal Funds Rates	FFR
Federal Open Market Committee	FOMC
Federal Reserve	FED
General to specific sequential likelihood ratio	LR
Generalized Autoregressive Conditional Heteroskedasticity Model	GARCH
Gross Domestic Product	GDP
Hannan – Quinn Information Criterion	HQIC
Heteroskedasticity and Autoregressive Consistent standard errors	HAC
Industrial Production Index	IPI
Integrated of order one	I(1)
Lagrange Multiplier	LM
Money Supply 2	M_2
Multiple Linear Regression	MLR
Newey – West method	HAC
Ordinary Least Squares	OLS
Phillips – Perron	PP

Positive Rate	PR
Real Broad Effective Exchange Rate	RBEXR
Schwarz’s Bayesian Information Criterion	SBIC
Severe Acute Respiratory Syndrome	SARS
Small sample correction	SLR
Standard and Poor’s 500 Industrial Average Index	S&P 500
The Organization for Economic Cooperation and Development	OECD
United Kingdom	UK
United States of America	USA
Variance Inflation Factor	VIF
Vector Autoregressive Model	VAR
Vector Error Correction Model	VECM

1 Introduction

Central Banks have a lot of goals to achieve like price stability, optimal employment and sustained economic growth. Monetary policy can affect the equity rate of return as well as the equity market. This impact concerns the market participants and the policy makers. However, their reaction to this monetary policy determined whether this policy is expected or unexpected. In addition, monetary policy affects the macroeconomic variables such as inflation, economic growth and employment, but this impact is indirect. Monetary policy has a direct influence on financial markets and more specific, on asset prices and rate of return. The policy makers try to influence the economic behavior in a way that they will achieve their goals. Understanding the relationship between monetary policy and equity markets is very crucial because it determines the policy mechanism that the Central Bank will follow.

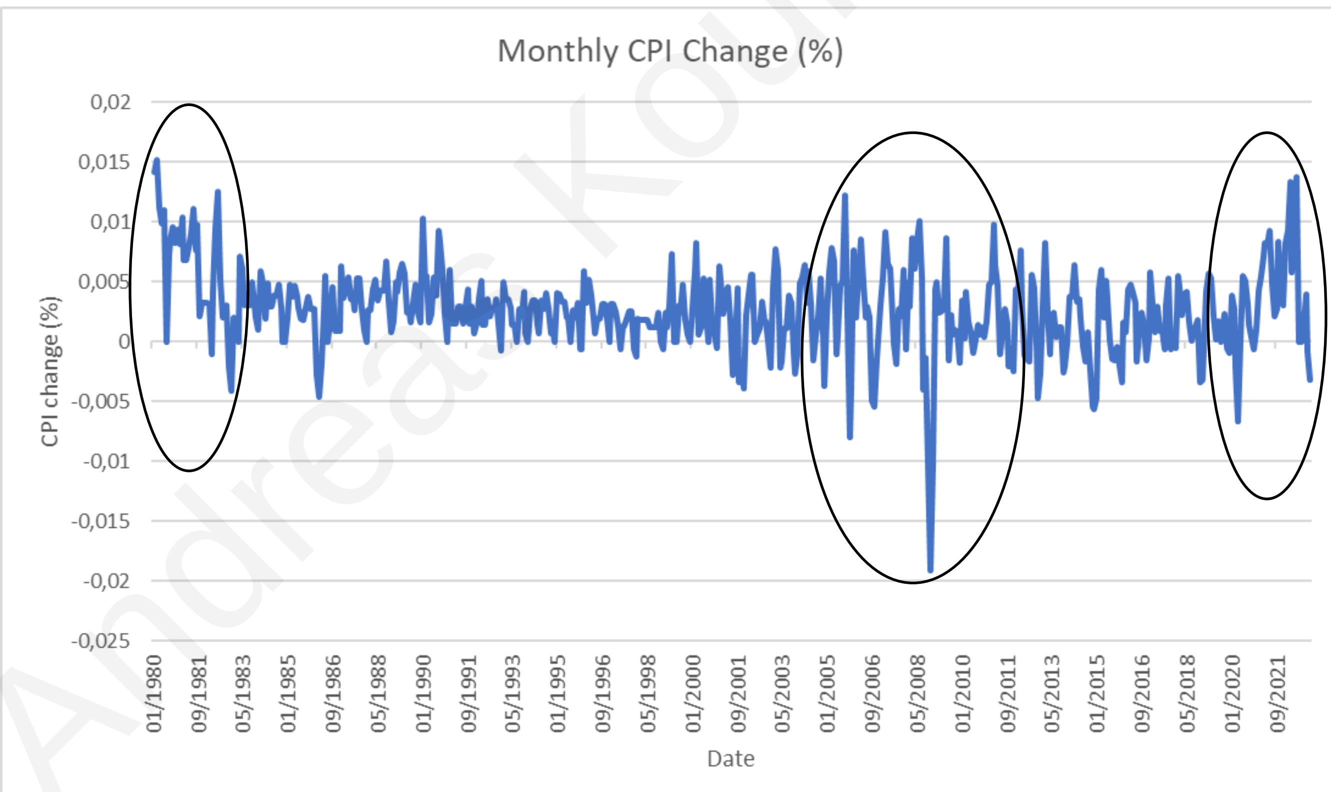
Moreover, monetary policy news has a share of responsibility for changes in the stock market. That is, the policy that will be implemented, as well as the size of the monetary policy could show the magnitude of the reaction (Norfeldt, 2014a). Important information about the present and future situation in the economy can be gleaned by the macroeconomic variables. As a result, changes in these variables could change the expectations of the investors.

One key macroeconomic variable is inflation. It is a macroeconomic issue that concerns most of the policymakers as well as Central Banks. Their main aim is to stabilize the economy in a manner that inflation does not change much over time. Diagram 1 below presents the monthly inflation rate in the USA for the period between the 1st of January 1980 and the 31st of December 2022. This index measures the percentage changes in the CPI of goods and services in the USA for a certain period. The data was obtained from the OECD (OECD, 2022).

The horizontal axis of diagram 1 shows the period which is monthly and the vertical axis presents the rate of change in the monthly CPI. As we can see from diagram 1, there are a lot of fluctuations over time. Specifically, for the period between 1st of January 1980 until 31st of December 2022, there are three (3) major crises that occurred regarding these periods, which cause larger fluctuations in the S&P500 Index. For these periods they had happened several and crucial recessions both in USA and around the world. The first main crisis was in 1980 and is considered as one of the worst recessions in the USA since the Great Depression. This downturn was triggered as the FED followed tight monetary policy, that is, the FED increased the interest rates in order to manage the high inflation. The second largest recession was in 2007 which was also called subprime mortgage crisis. It was caused by the expansion in the housing sector and the excessive increase in the loans. As the housing bubble burst, the prices followed a downward trend. As a result, there were a lot of loans in default, which caused some financial institutions to fail and go bankrupt. The third major crisis is about the recent pandemic crisis due to Covid 19 which forced the prices to decline since were imposed strict policies which affected the financial sector.

In contrast, according to diagram 1, for the period between 1st of January 1987 until 31st of December 2000 smaller changes are observed in the monthly percentage change of CPI. More specific, this index did not change much because during this period nothing had happened in order to have a significant impact on the prices. This result can be verified from the diagram 1since these fluctuations lasted for a short time.

Diagram 1: Monthly CPI change in United States of America



Notes: This diagram shows the percentage change in the monthly CPI in the United States of America. The period of the analysis starts from the 1st of January 1980 and ends up to 31st of December 2022. The source of the statistical data was obtained from the OECD

The degree of a bank's reaction to monetary policy depends on whether it is expected or unexpected from the financial sector. If this policy is expected, then investors incorporated them when they calculate their rate of return. However, when a policy is unanticipated or there is a shock in the economy, investors do not include these effects when they calculate their return, because it was something that they do not expect. Monetary policy can affect the economy through financial markets and more specific, through the equity market, because monetary policy leads to the reallocation of resources through the influencing of the investor's return expectations. Macroeconomic variables can help investors to predict the current situation as well as the future path of the economy. As a result, a change on these macroeconomic variables can affect investor's expectation about the economy. For rational investors this change can affect their information set and their decisions and they are forced to change their behavior when they make investments (Norfeldt, 2014a).

Stock prices can be volatile for some reasons which influence the functioning of the economy. As we have observed in previous years and from recent events, the economy was highly affected by the global financial crisis with the striking example is the financial crisis of 2007. This caused changes in various and crucial macroeconomic indicators. Stock prices are influenced from changes in macroeconomic variables, shocks in the economy and unanticipated monetary policy announcements. This shifts the focus on the Central Bank, more specific, if it can manage such a situation as well as the extent to which it can limit and reduce the effects of this unanticipated event.

Also important is the extent to which it can prevent effects that an unexpected event would have on the economy. Companies can value their future flows by using the discount rate which can express future value into current value. In addition, stocks play an important role both at the individual level and at the business level, because individual stocks can correlate with their wealth, in a manner that an increase in stock prices can increase their wealth and in turn it can increase their consumption. As a result, this action can raise the GDP (Norfeldt, 2014a). For business, an increase in stock prices affect positive the business operations since this action influences the business's capitalization and as a result this increases the market value of that business. However, if the price of the stocks decreases, then this fact negatively affects the business and its capital investments, because the fall in the price leads the value of the stock to decrease and this causes funding problems (COURAGE, 2021).

There are many studies which examined the impact of monetary policy on the equity market. Research from Bernanke and Kuttner (2003) uses a sample period from June 1989 until December 2002. They estimated the possible impact of unexpected monetary policy on the equity market. They found that there is a strong and consistent effect of unanticipated monetary policy using the Federal Funds Rate data in order to measure the policy expectations. In addition, they found that an unanticipated rate cut by 25 basis points leads to an increase in stock prices of 1 percent. Another important result is that the equity market reacts more to monetary policies that are considered permanent. Furthermore, industries responses differently, with the most sensitive high tech and telecommunication industries reacting to a greater extent. Finally, they found that their results were consistent with the predictions of the standard CAPM (Bernanke and Kuttner, 2003a).

Chordia, Sarkar, and Subrahmanyam (2003) is another research which was conducted for the *Federal Reserve Bank of New York Staff Reports* and they examined the relationship between monetary policy and stock and bond market liquidity. They found that the existence of a shock in one market influences both markets. Also, the level of return volatility affects liquidity. Furthermore, the innovation both in equity market and the bond market with the volatility seems to be significantly correlated. In addition, an expansion monetary policy increases the liquidity in the equity market in period with financial crisis. Finally, they concluded that an unanticipated increases in the Federal Fund Rate leads to decrease the liquidity (Chordia, Sarkar and Subrahmanyam, 2003).

Assenmacher-Wesche and Gerlach (2009) examined the reaction of residential property, equity prices, inflation as well as the economic activity to the monetary policy shocks in 17 OECD countries for the period between 1986 until 2007. They use the single country VARs as well as the panel VARs in order to distinguish the groups of countries and their financial systems. The panel VAR analysis shows that the effect of monetary policy is predictable and large on residential property prices. The important fact is that these effects largely reflect the effects of monetary policy on real economic activity. As a result, monetary policy can be used to prevent financial crisis. This implies that interest rates should be increased, however this increase would decrease the real GDP. In addition, they found that there is cost by using monetary policy to decrease the asset price movements in order to sustain the economic activity which is the impact on real output. Another significant result they found is that monetary policy shock decreases the equity prices about the same as the reduction of the monetary policy shock on the residential property prices. However, equity prices change directly rather than residential prices, as a result economy due to the different timing can not stabilize both equity prices and residential prices. Finally, they conclude that the impact of monetary policy on equity prices has a level of uncertainty. This implies that Central Bank might not want to affect stock prices (Assenmacher-Wesche and Gerlach, 2009).

Jensen and Johnson (1995) found that monetary policy can related with the stock return. Specifically, the long term equity returns are higher and more stable when they follow decreases in the discount rates, than the long term returns when they followed increases in the discounted rate. Moreover, they used discounted interest rates as a proxy for the attitude of monetary policy because discounted rate considered as a signal of the monetary policy and for the economic growth (Jensen and Johnson, 1995).

It is generally accepted that the financial sector is exposed to external events, like environmental developments as well as natural disasters and natural phenomenon. Furthermore, financial markets counter to pandemics occurred in the economy. Some of them are Ebola Virus Disease (EVD), HIV pandemic outbreaks. Specifically, a study from Chen and Marinč (2009), revealed that the Ebola news negatively affected stock prices. Moreover, on the day of the event, the SARS had a negative impact on the material sector, tourism sector and the capital market sector. However, it had a positive effect on the biotechnology sector in Taiwan (Ichev and Marinč, 2018).

The most recent pandemic occurred in late 2019. Specifically, this pandemic was officially declared as a global pandemic on the 11th of March 2020. This pandemic refers to the *Covid 19 pandemic*. This current event has generated a crisis which has not happened again in recent years, in terms of the degree of the uncertainty produced in the people in the economy. Also, unpredictability and concern of the efficiency of the restrictions imposed by the government as well as the treatment measures. In addition, there was a fear of the spread of the pandemic in the banking and financial sector which was vulnerable since the high leverage (Caporale *et al.*, 2022).

In the US stock market was observed high volatility since it was driven mainly by changing in the investor's expectations as well as by changing the attitude towards the risk. Almost all of the governments announced policies in order to protect the financial sector, by providing to the household and to the firms some loans. Moreover, they guaranteed to lenders to avoid the possibility of bankruptcy. An important fact was that the stock prices had a strong predictive picture in terms of the collapsing of the economic activity since the existence of the Covid 19 pandemic. Finally, the restriction imposed by the governments in order to limit the virus, caused employment and consumer spending to follow a downward trend (Caporale *et al.*, 2022).

This thesis is structured as follows. The second chapter is the literature review, which in this section past studies summarized their econometric method and their empirical results. The third chapter is about the methodology. In this section, the descriptive statistics are presented. Also, a brief description of the variables that are going to being included in the model. In addition, a description of the econometric method and the econometric model are being presented. The fourth chapter is about the empirical results. In this section the main results of the econometric model are being presented. Furthermore, in this section there are presented robustness tests for the validity of the model. The last section are the conclusions. In this section the main empirical findings of the econometric analysis are summarized. In addition, this section includes some limitations of the analysis and suggested future research. The main question that should be answered in this study is how the actions of the Central Bank by using the monetary policy as well as in which extent the Covid 19 pandemic affected the stock market return in the USA.

2 Literature Review and Analysis of the Literature

The impact of monetary policy on the equity market pushed the researchers to try to find the relationship between these two. This section gives an overview, in order to conduct a comparative review of some important key variables that affect the stock returns. In the literature review 12 studies are analyzed. The two of them used the same theoretical approach, which was the CAPM, while the other study used the discounted cash flow model. Also, most of the studies used the VAR method. The last two studies showed the impact of Covid 19 on monetary policy and this in turn affects the equity returns. These studies differ since they used different approaches as well as different variables, however the aim of these studies is converging.

Patelis (1998) studied if changes in monetary policy can be responsible for the observed predictability in excess stock prices. The methodology that the author followed was to use a long horizon regression, as well as short horizon vector regression. Finally, he used variance decomposition to estimate the impact of monetary policy on individual parts of the excess returns. In order to examine the impact of monetary policy on excess equity returns in the USA he used monetary policy instruments, as well as financial variables. According to Bernanke and Blinder (1992), the FFR was an important variable since it's sensitive to shocks to the supply of bank reserves. Following, he estimated the long horizon multivariate regressions. It was based on the French Fama (1989) stock return predictability. According to the author, to account for possible heteroskedasticity and autocorrelation consistent errors, the estimation was based on the HAC standard errors method. The results from the regressions showed that the monetary policy variables were statistically significant predictors of excess returns for different periods. The author used exclusion tests, while the results showed strong evidence by rejecting the hypothesis that excess returns were unpredictable either if it used monetary variables or financial variables (Patelis, 1998).

Moreover, he conducted a VAR model for the short horizon. According to the author, this way was preferred because it avoided the biases due to the small sample. The results from the VAR model showed that using monetary policy indicators in the short run there was a stock return predictability. Another result was that tightening monetary policy today led to lower excess stock return in one month ahead. The result based on the GARCH model was that the model could not help to predict the stocks, that is the stock returns were unpredictable. Next step, he estimated a forecasting variable at 4, 8, 12, 18 and 24 months. The results from these estimations were that a large shock in the federal fund rate or a decrease in the portion of nonborrowed reserve growth orthogonal to total reserve growth which shown a more tighten monetary policy, predicted a lower future excess stock return, however in the following period the future excess stock return increased. This result was valid for both monetary policy variables. Furthermore, the above results were statistically significant up to 24 months. Finally, the author did the variance decomposition. He presented that the monetary policy variables influenced more the variance of the dividend growth component. In contrast, the monetary policy variables seemed to have low impact on the future expectations of the real interest rates (Patelis, 1998).

Rapach (2001) examined and estimated the impact of money supply, aggregate spending as well as aggregate supply shocks on the real stock prices in the USA by using a VAR model. According to the author, the key objective of this was to estimate the contribution of these macro shocks to real stock prices fluctuations. In addition, he used long term restrictions in order to estimate the macro shocks based on the model developed by Blanchard and Quah (1989). The results from the unit root test of the implicit GDP deflator, the S&P 500 index, the nominal interest rate and the real output were non stationary. On the shorter horizon, the portfolio shock explains more of variation in the real stock prices. In addition, in the long horizon, when the money is neutral, the money supply shocks are more essential and determine the real stock prices in the short run. In the intermediate horizon, the money supply shocks, as well as the portfolio shocks lose their impact on the real stock prices. However, the supply shocks seemed to increase its impact. Finally, in the long term, the aggregate supply shock determined more of the variation of the real stock prices (E.Rapach, 2001).

The sensitivity analysis followed by imposing some restrictions. According to the author, the results remained robust at long horizons, however for a specific period. Furthermore, the response of real stock price to a portfolio shock is smaller, however, the response of real stock price to an aggregate spending shock was larger in absolute values. According to the author, the oil price shock explained more of the variation of the real stock prices at long horizon (E.Rapach, 2001). Finally, he presented the real stock price historical decomposition. According to the results, the expansionary aggregate supply shock was more responsible for the increase in the real stock prices. Moreover, the expansionary money supply shock positively influenced the real stock prices. In contrast, the aggregate spending shock had little influence on the real stock prices (E.Rapach, 2001).

Bernanke and Kuttner (2003) analyzed the effects of an unanticipated monetary policy to equity prices. Also, to identify the magnitude of this reaction, as well as the reasons for the reaction of the market to this monetary policy. This analysis conducted for broad stock market indices and for individual industries (Bernanke and Kuttner, 2003b). According to the authors, for possible existence of endogeneity, they would solve it by using the instrumental variables procedure, proposed by Rigobon and Sack (2002). Regarding the surprise in the target rate on the stock prices, they found that the stock prices reacted more in the unexpected monetary policy than the expected monetary policy. Also, the unexpected target rate had a negative and statistically significant impact, however, the expected target rate had a positively and statistically significant effect, however with small magnitude. Following, they estimated the impact of the surprise in the target rate on individual industries. The same results applied for the monthly data however, the expected monetary policy had negatively influence on the stock prices (Bernanke and Kuttner, 2003b).

Next, they presented the reasons why stock prices reacted to the unexpected monetary policy by using a VAR model. According to the results of the VAR model, in the case where the excess stock returns were the dependent variable only the relative bill rate had a significance impact. Next, they presented the variance decomposition of stock returns. According to the authors, the results they found were very similar to the results that were reported by Campell and Ammer (1993). Specifically, they found that the excess returns as well as the real interest rates were not sensitive when the sample period changes, while there were changes in the model specification. Finally, they presented the effects of the monetary policy shock in the stock prices. They conducted a VAR model and they used the surprise in monetary policy as an exogenous variable. According to the results of this analysis, a one percent surprise in the target rate led to a 9.1 percent decline in the excess returns for several periods of months with negative excess returns. In contrast, after six months it was presented that the excess returns had a small positive rate of return. This decrease in the excess returns also led to an increase in the dividend to price ratio. In addition, the results showed that the contractionary monetary policy surprise led the relative bill to have an upward trend. An important result was that the real interest rate presented a downward trend because of the unexpected increase in rates which related to higher expected inflation. Finally, they found that, the impact of monetary policy shock on the stock prices comes essentially through the effect of the monetary policy shock on the expected future excess returns (Bernanke and Kuttner, 2003b).

In contrast, Ioannidis and Kontonikas (2006) studied the impact of monetary policy on stock return in thirteen countries in OECD, while the theoretical approach they followed was the discounted cash flow model. Regarding the period of the research, started from 1972 until 2002 and the data was monthly. The countries that were included in the data were the countries from G7 and other European economies. They stated that Central Banks through monetary policy can affect equity returns and as a result can influence the investors' expectations about the future economic outlook by changing the discount rate. In addition, they used modern monetary policy effects to the equity return and considered that these data were non normal due to the structure of the international financial markets. According to the results, there was a positive association between average returns and stock market returns. Moreover, in ten of the thirteen countries there was evidence that higher interest rates were correlated with lower stock returns. For the UK, France, Canada and Italy the return in expansive monetary policy exceeded the return in restrictive monetary policy (Ioannidis and Kontonikas, 2006).

Furthermore, they showed that large real interest rate differences were correlated with higher interest rates mainly for France and UK. It is a good point to mention that when they included real returns, the intercept had a statistical insignificant effect on the stock markets. These results corresponded for all the sample of countries except Sweden compared with the case of nominal returns. Another important result was that contractionary monetary policy can affect inflation adjusted stock returns. Also, they showed that there was a negative effect of the tightening monetary policy. Moreover, they showed modern monetary impact on stock returns in seven countries which were Belgium, Canada, France, Italy, Netherlands, UK and USA. One of the results they found in these sensitivity analyses was that stock market valuation can be affected by modern monetary policy. Following this, they estimated the impact of monetary policy on the expected nominal stock returns. According to the results, a positive return is expected from the stock market investment. Secondly, for France, Italy, Finland, Switzerland, UK and USA they found that monetary policy can be used to predict expected equity return. Specifically, restrictive monetary policy decreases the equity returns, however expansionary monetary policy leads the stock returns to increased (Ioannidis and Kontonikas, 2006).

Finally, they presented the results on the relationship between expected stock returns and monetary policy dummy variable. They found that the countries where there was significant relationship between local monetary policy and expected nominal equity return, then there was significant relationship local monetary policy and expected real equity return. However, when they used real returns, Italy and Japan presented negative relationship between monetary policy and expected equity return. Finally, they showed that, when the monetary policy makers tend to follow expansionary monetary policy as the economy is in a recession, then the investors may want higher expected return in order to invest in the stock market. This implies that, when the economy follows expansionary monetary policy when economy has slow growth, then investors would require higher rate of return in order to invest (Ioannidis and Kontonikas, 2006).

Bjørnland and Leitemo (2009) studied the relationship between monetary policy and the stock market in the USA by using a VAR model. For the VAR model they imposed equivalent restrictions for the relationship between the stock price with the five macroeconomic variables. As a result, the macroeconomic variables did not react immediately to the equity price shock, while the equity price changed at the same time to all macroeconomic variables. Regarding the impulse response, they found that a change in the monetary policy shock increased interest rate by one percent in the first month. In addition, a stock price shock increases real stock prices by one percent in the first month. Furthermore, they found that neither the monetary policy shock nor the stock market shock had a significant contemporaneous effect on the other macroeconomic variables. Regarding the structural model, they estimated the impulse response for the FFR, real stock prices, CPI and the IPI from the monetary policy shock and the stock price shock. The analysis of the structural model showed that, when there was a monetary policy shock, in the short term the interest rate increased. In addition, in the short term the output decreased which in one year and a half it reached the minimum level. Specifically, for the first four years this negative relationship was significant. Another important result was that after four to six years, inflation decreases, as well as in the long run, prices declined as the monetary policy shock was contractionary. However, in the case of the real stock shock, they found that stock prices decreased, as the interest rates increased. Finally, in their results, they showed that positive stock price shock increases in short term inflation and output gap. According to the authors, the upward trend of real stock prices affects positively the consumption due to the wealth effect as well as the investment (C.Bjørnland and Leitemo, 2009).

In contrast with the above studies, Norfeldt (2014) used the CAPM approach. He examined the effects of monetary policy action on the US stock market. He used the US stock market, which includes S&P500 and the data was monthly. Furthermore, he measured the monetary policy by using monetary policy change and distinguishes it in to expected change and unexpected change as well as he used the M_2 growth. Following this, he examined the Central banks as an agent, that is, they set the interest rate and adjust the money supply in a manner to achieve equilibrium in the money market. According to the author, the interest rate played an important role in the valuation of the assets and making decisions, specifically when pricing financial assets. He presented that in inflationary periods the relationship between Year on Year return as a percent of S&P500 and the yearly change on US yield was negative. However, for deflationary periods there was a positive relationship. The final aspect of this theoretical approach was asset price. Periods that investors buy assets the demand increases as well as the prices. Moreover, this leads the value of the assets did not equal with the fundamental value of this asset (Norfeldt, 2014b).

Furthermore, he followed the method of Kuttner (2005) and he found that an expected increase by 1%, leads to an increase by 3,35% on the returns of S&P500. However, an unexpected increase by 1%, increase the returns of S&P500 by 7,52%. According to the results from the VAR model, all the coefficients were not statistically significant. An important result according to the impulse response was that only the expected increase in the FFTR decreased the equity returns. The results from the regression showed that an actual increase of 1%, this will increase the returns on S&P500 by 5,4 percentage points and 1,99 percentage points for Dow Jones. He stated that these results were different from the traditional ones because these two indices reacted differently to unexpected changes of the interest rate. According to the results, for the S&P500 he found that an expected increase by 1% in the interest rate, this decreases the return by 5,44%. Moreover, they showed that an increase by 1% in the M_2 growth leads to a decrease by 2,86% in the returns in the first period. Finally, he found that an increase in the FFTR led to a decrease in the slope of the yield curve and thus an expectation for lower risk free return in the future (Norfeldt, 2014b).

Yoshino, Hesary, Hassanzadeh and Prasetyo (2014) examined the response of equity market to monetary policy for the Tehran Stock market. According to the authors, equity prices are affected by money, exchange rate and inflation. In this paper the monetary policy was exogenous and the period of the study started from the first quarter of 1998 and ended up to the second quarter of 2013 (Yoshino *et al.*, 2014).

Regarding the Cointegrating analysis, the first step was to select the lag order. The optimal lags were seven. According to the cointegration test, all the variables were cointegrated, therefore, they conducted a VECM and they included the trend and the intercept. They found that the Real

GDP had a positive and significant effect on the Tehran Stock Exchange Price Index in the second, the third and the fifth lags. Moreover, the real exchange rate between dollar and Iran rial, had some positive effects, which were higher than the negative effects on the Tehran Stock Exchange Price Index. Finally, the CPI had a significant and positive impact on the seven lags on the Tehran Stock Exchange Price Index. Finally, they presented the variance decomposition analysis. According to the results, the exchange rate was the important monetary variable, because it accounts for 52,63% of the Tehran Stock Exchange Price Index forecast error variance after 10 periods, as well as it accounts for 46% of the Tehran Stock Exchange Price Index forecast error variance after 20 periods (Yoshino *et al.*, 2014).

Hojat and Sharifzadeh (2017) studied the impact on monetary policy on equity market. The period they examined started from 2005 until 2015. Specifically, they examined the effects of monetary policy instruments such as the change in M_2, the change in FFR and the change in FFF on the equity market for the USA. To determine this impact, they used the theoretical framework of CAPM. As well as this model explains the relationship between rate of return and risk (Hojat and Sharifzadeh, 2017).

The results from the regression were consistent with the CAPM theory. They found that company size and the market rate of return had statistically significant effect on the equity rate of return. In addition, the result showed that with the other variable constant, small firms on average had a 1.22% higher rate of return than larger firms. However, the results from the model estimation showed an unanticipated outcome. Specifically, the monetary policy instruments did not have any statistically significant effect on the companies' rate of return. A possible reason was the existence of multicollinearity between some of the independent variables. Since the monetary policy instruments were not significant predictors of stock returns, the authors chose to solve this problem by using these variables as moderators and mediators. The results from the analysis where that the monetary policy variables were moderator factors showed that all the monetary policy instruments had moderation effect on the relationship between market rate of return and companies' rate of return on equity. Specifically, M_2 had positive moderation effect, however, FFR and FFF had negative moderation effect. Moreover, they examined if these variables were mediators on the relationship between market rate of return and companies' rate of return on equity (Hojat and Sharifzadeh, 2017).

According to the results, a change in M_2 was not a mediator variable. More specific, M_2 did not have an indirect effect on the relationship between market rate of return and companies' rate of return on equity. However, a change in FFR and a change in FFF were mediator variables. Finally, they found that FFF was the best indicator for future economic outlook and future trend of monetary policy. Furthermore, when the investors were going to make an investment decision the best criterion was the FFF, since it can predict future economic perspective as well as trends that might appear from monetary policy. FED can use market rate of return as a sign to see how healthy the economy is as well as market rate of return can be used as a signal to change its policy for FFR. Since FFR and FFF were mediator factors then both showed the effects of interest rates and price assets which was consistent with leaning against the wind theory (Hojat and Sharifzadeh, 2017).

Cieslak, Morse and Vissing-Jorgensen (2018) studied the stock returns over the FOMC Cycle. They studied whether a monetary policy news and the FOMC announcements affect the stock prices in United States of America. Firstly, the authors estimated the stock returns over the FOMC Cycle. The period of this analysis was between 1994 and 2016, date 0 was the day which the FOMC meeting was scheduled. According to the results, when the weeks were an even number, then the average excess return was positive in FOMC cycle time. However, when the weeks was an odd number, then the average excess return was negative in FOMC cycle time. They found that the excess stock returns on average was higher by 12 basis points when the weeks were even numbers than the weeks with odd numbers (Cieslak, Morse and Vissing-Jorgensen, 2018).

Apart from the financial side, they also tested the economic significance. To apply this, they compared three strategies. They found that, based on the strategy which the investors invest in the stock market when the weeks were even number, the Sharpe ratio as well as the average excess stock returns were the highest compared the other two strategies. According to the results in the case of the international stock returns over the FOMC cycle, the excess stock returns in the even weeks were positive and statistically significance for developed markets and for the emerging markets excluding the USA. Also, they found that this result holds for economic and statistical terms, as well as in the even weeks the excess stock returns were positive rather than the odd weeks which were negative. Moreover, they found that the security marker line in even weeks was positive, while for the odd weeks was negative, using industry sorted portfolios. Following this, they ruled out some arguments which showed non Fed explanations about the linkage between the FOMC cycle and the excess stock returns. In contrast, they presented some facts and evidence about the linkage between the FOMC cycle and the excess stock returns. According to the authors, for the first argument, they found that the inclusion of variables which control for macroeconomic data releases, they did not have any statistically significant effect on the FOMC dummies for the even weeks, also even after they controlling for the corporate earnings announcement. In the case of the second argument, they found that, FED used informal communication with media and financial sector as a possible explanation that news about the monetary policy was leaked in the market (Cieslak, Morse and Vissing-Jorgensen, 2018).

Furthermore, they found that stock returns that did not have a good performance predicted decline in the Federal Funds target. According to the authors, they used data for the past one year and they found that high stock returns in the even weeks can predict reductions in the Federal Funds rate. Moreover, they have shown how the FED moves the stock market. More specific, they showed evidence that unexpected reductions in the equity risk premium in the even weeks led to high realized even weeks stock returns. Furthermore, they presented that the FED decreased the equity premium in association with lower downside risk. Finally, according to the authors, the markets systematically underestimate the magnitude of the policy adjustment when the markets followed a downward trend (Cieslak, Morse and Vissing-Jorgensen, 2018).

Asiedu, Oppong and Gulnabat (2020) studied the impact on monetary policy on the equity market for Africa. The period of the analysis started from 1993 and ended up to 2019 and included 10 African countries. According to the results of the regression, the broad money growth had a significant effect on the S&P Global Equity Index. In addition, inflation had a significant negative impact on the stock market performance. According to the sub regional results, they found that the broad money growth had a positive and statistically significant effect on the stock market performance in west African countries. Moreover, there was a significant negative impact of real interest rate on the stock market performance for the West African countries (Asiedu, Oppong and Gulnabat, 2020).

Following this, the authors did the VECM. According to the results, the response on the broad money growth showed that a shock on the S&P Global Equity Index had a moderately positive effect on the broad money growth in the long run. Regarding the response to inflation, the results showed that shocks in the S&P Global Equity Index had a positive effect on inflation in the short run and in the long run. Also, according to the response to the interest rate, in the long run the broad money growth will cause a decrease in the interest rate. The results of the response on the exchange rate showed that, in the short run, as well as in the long run, a shock in the S&P Global Equity Index will positively affect the exchange rate. Finally, regarding the response on commercial banks and other services, the results showed that, in the short run and in the long run, a shock in the in the S&P Global Equity Index will have positive effect on the commercial bank and lender serving (Asiedu, Oppong and Gulnabat, 2020).

Compared to the above studies, Iyke and Maheepala (2022) examined the impact of the pandemic of Covid 19 on the equity prices for emerging markets and to what extent the conventional monetary policy mitigated this effect on the stock returns. According to the methodology, the authors collected data from 23 emerging markets, while the data was on a daily basis and was available from the date that the first Covid 19 case was announced. Following, they tested the argument that the Covid 19 affect the stock returns. According to the authors, they included only the new Covid 19 deaths instead of the new Covid 19 cases, because the new deaths compared to the new cases, causes more fear and panic to people. In the case which they included the growth of the new Covid 19 deaths, according to the results, they found that it had negative and statistically significant impact on the stock returns. In the second alternative indicator, they used as an independent variable the difference of the growth of the new Covid 19 deaths. In this case they found that it had a negative and statistically significant effect on the stock returns of the emerging equity markets. Specifically, they found that, in all the alternative indicators of the Covid 19, they found that the pandemic had a negative and statistically significant effect of the equity returns for the emerging stock markets (Iyke and Maheepala, 2022).

In addition, they stated that the stock returns were being affected by macroeconomic indicators. As a result, they estimated the impact for the Covid 19 on the equity returns by controlling oil prices and the exchange rates. According to the results, the Covid 19 maintained a strong and negative effect on the equity returns, which this impact strengthened after controlling for the oil prices, as well as for the exchange rates. The authors stated that monetary policy can moderate the negative effects of the pandemic on equity prices. According to the results, the interaction of the growth of the new Covid 19 deaths did not have a significant effect. Moreover, this result indicated that a conventional monetary policy was not effective during low interest rates. Also, the exchange returns had a negative impact on the stock return, implying that a depreciation of the local currency compared to the foreign currency causes negative effects on the local stock returns. In the case of oil price, had a positive effect on the emerging stock market. The authors did robustness check in order to show the validity of their results. According to the results, there was a negative and statistically significant impact of Covid 19 on the equity returns on the emerging stock markets. However, this statistically significant effect of Covid 19 on the emerging stock markets seems to disappear in the come up of the conventional monetary policy.(Iyke and Maheepala, 2022).

Finally, Caporale, Kang, Spagnolo and Spagnolo (2022) examined the effect of the Covid 19 on the equity markets returns and their volatility for the G20 countries. Moreover, they estimated this impact for the G7 countries, as well as for the non G7 countries. According to the authors, in order to estimate the impact of the Covid 19 and the policy responses on the stock market returns they used monthly dynamic panel data with fixed effects and they estimated various models. The first model and the second model examined the impact of Covid 19 on the equity market returns and volatilities. Moreover, the third model adds the interaction between the Covid 19 Index and the lockdown periods. They showed that, for the G20 countries, the pandemic had negative effects on the stock returns, while on the stock market volatilities, the pandemic had a positive impact. Furthermore, the new Covid 19 deaths, as well as the new Covid 19 cases impact negatively on the equity market returns. The Covid 19 had a negative effect on the stock returns related to the health news for the 20 worst hit countries. In addition, the lower economic activity due to the lockdowns had a negative effect on the stock returns. In the case of fiscal policy and when there was additional spending, this impact positively on the stock returns. According to the results, government restrictions, such as school closures, workplace closures and travel bans impact negatively on stock market returns. Finally, in the case of the short term shadow rates during to an unconventional monetary policy had negative impact on the equity stock prices, however, increases the stock market volatilities (Caporale *et al.*, 2022).

Following this, they estimated this effect for the G7 countries. According to the results, the government restrictions seemed to have negative impact on the stock returns. However, this indicator, and the severity of the Covid 19 had positive effects on the stock volatilities. Furthermore, the interaction between the Covid 19 and the lockdowns had an impact on the stock volatility as well as on the stock returns. The fiscal policy measure during the pandemic led to an increased trend in the stock returns, without increasing the stock volatility. The short term shadow rates for the G7 had a negative effects on the equity market returns, but increased the stock volatility. Finally, the authors presented the results for the non G7 countries. According to the results, the severity of the Covid 19 increased the stock volatility and decreased the stock returns to a significant level. The fiscal policy had a positive effect on the stock market volatility. In addition, the short term shadow rate had not a significant impact on the stock returns, as well as on the stock market volatility (Caporale *et al.*, 2022).

The next section will present the methodology. This chapter includes a brief description of the variables that will be used in the econometric model. Specifically, a descriptive statistic will be presented which summarizes the data, while a pairwise correlation matrix will be presented too. In addition, a description of the econometric model and a description of the econometric model will be shown. Also, figures and tables that show some characteristics of the variables that are going to be used in the econometric model for a complete presentation. Finally, in the case of econometric problems, possible solutions are presented.

3 Methodology

3.1 Description of the Methodology

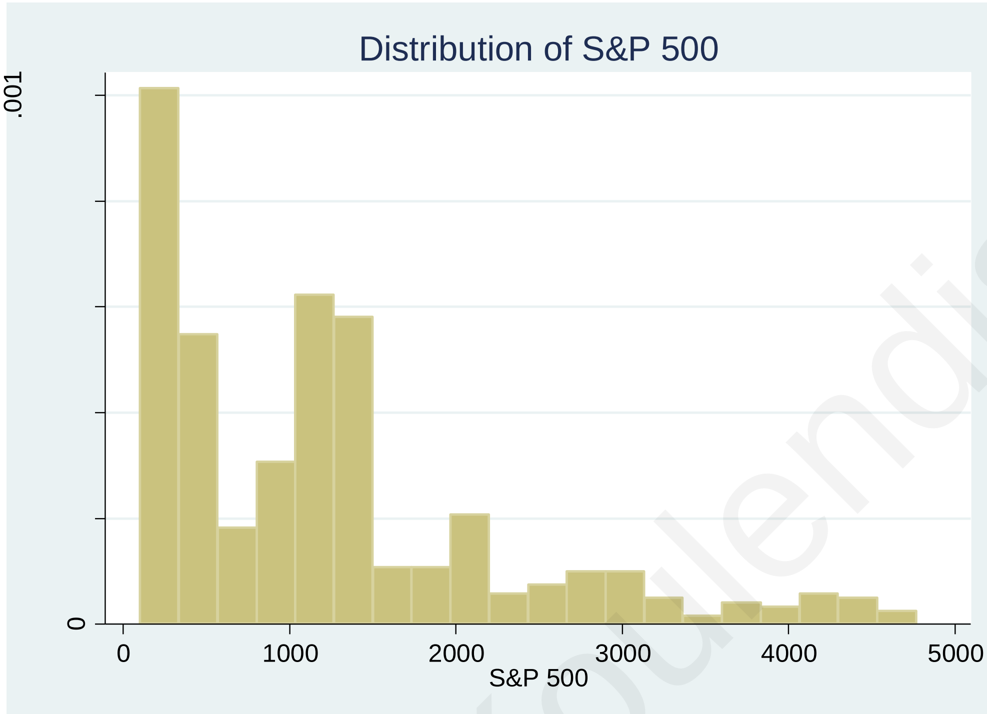
This chapter presents the methodology which will be used to analyze the impact of monetary policy on stock prices for the United States of America. Following this, a brief description of the variables that will be used in the model will follow. In addition, a preliminary analysis using descriptive statistics is presented. Furthermore, a comprehensive analysis of the econometric method and the model is presented. Also, in the case of non stationarity, endogeneity, serial correlation and heteroskedasticity, this chapter includes and presents ways to solve these issues. Also, figures and tables regarding the results of the descriptive statistics.

In order to examine the relationship between the monetary policy and the stock returns in the USA, data were used from the Federal Reserve Bank of St. Louis, the Trading Economics. Also, from the OECD and the Our World in Data. The data is a monthly time series and the period of the analysis starts from January 1st of 1980 and ends up to December 31st of 2022. The data is time series since it refers a sequence of statistical data for a specific period of time. In this study the following five (5) variables were used:

Standard and Poor's 500 (S&P 500) stock market Index

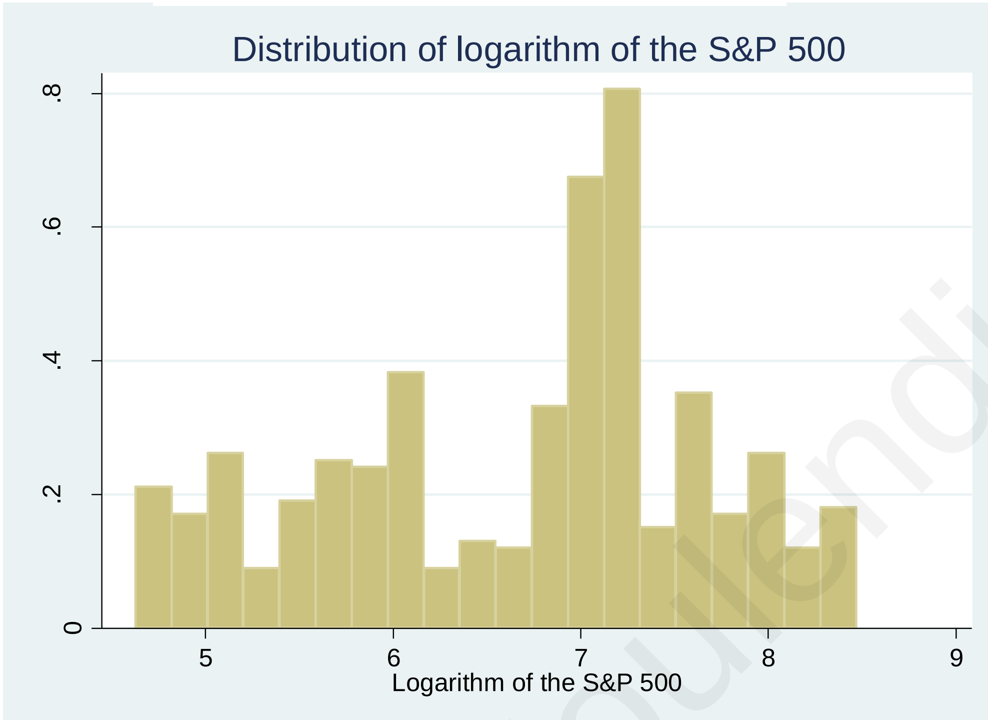
The stock return is the dependent variable in the model. It is measured by the S & P 500, which is a stock market index tracking the stock performance of the 500 largest companies listed on the stock exchange in the USA. The data of this variable has been taken from the Trading Economics. Figure 1 shows the histogram of the S&P 500. The histogram is a useful statistical tool, which shows with an approximation the distribution of a random variable. In the vertical axis is the density. Moreover, on the horizontal axis is the S&P 500 stock market Index. As we can see from figure 1, the distribution of S&P 500 is skewed to the right. Specifically, the S&P500 has positively skewed distribution, since, most of the values of the S&P500 are clustered around the left nail of the distribution (CFI Team, 2022).

Figure 1: The distribution of S & P 500



Since the S&P500 is right skewed, a way to fix it is by transforming the variable in logarithm. More specific, taking the logarithm mitigates the outliers. Most of the time helps to ensure normality and homoskedasticity and the slope coefficients of logarithm variables are invariant to rescalings. According to figure 2, the distribution of the logarithm of the S&P500 is close to normal distribution. Specifically, there is a central humpback. Furthermore, there are tails, however, they do not dying out. It seems to be more symmetrical.

Figure 2: The distribution of logarithm of the S&P 500



Broad Money 3

The M_3 is a store of value, that is, people can save money and they can use it whenever they want. This variable includes currency, deposits with a maturity of at most two years, money market funds and debt securities with up to two years. The M_3 is measured as a seasonally adjusted Index and the basis year is 2015. The data for this variable starts from the 1st of January 2020 and ends up to 1st of December 2022. Also, the statistical data has been taken from the Federal Reserve Bank of St. Louis.

3 Month Treasury Bill Rate

The 3 month treasury bill rate (T - bill) is the yield that investors get when investing in the government issued treasury security with a maturity of 3 months. The T – bill is expressed in logarithm form and the statistical data has been taken from Federal Reserve Bank of St. Louis.

Inflation

Inflation (CPI) refers to the Consumer Price Index. That is, the change in the consumers' prices based on a representative basket of goods and services that an average household needs to survive. This variable in this study is in logarithm form. The statistical data has been taken from the OECD.

Real Broad Effective Exchange Rate

The Real Broad Effective Exchange Rate (RBEXR) is an average of the bilateral Real Exchange Rates between the country and each of their trading partners and it is weighted by the respective trade shares of each partner. This variable is measured as a not seasonally adjusted Index and the basis year is 2020. The statistical data has been taken from the Federal Reserve Bank of St. Louis.

Covid 19 variable

Positive Rate

This variable refers to the number of positive diagnostics tests during a day divided by the total number of diagnostics tests which performed in that specific day. This variable is expressed in percent. The data for this variable starts from the 1st of January 2020 and ends up to 1st of December 2022. Also, the statistical data has been taken from the Our World in Data (Mathieu *et al.*, 2022).

3.1.1 Descriptive Statistics

Following will be presented a table which summarizes the main characteristics of the variables that will be used in the study and may give a first picture of the variables. The period of this analysis starts from the 1st of January 1980 and ends up to 31st of December 2022. Furthermore, the variable that corresponds to the Covid 19 pandemic, the data starts from 1st of January 2020 and ends up to 1st of December 2022. Table 1 shows the summary of the descriptive statistics of the main characteristics of the variables. As we can see from table 1, the maximum number of observations is five hundred sixteen (516). In the case of the logarithm of S&P 500 Index, the maximum number of observations is five hundred sixteen (516). Moreover, the independent variable CPI shows high dispersion from its mean. However, the dependent variable and the remaining independent are more stable around their means.

Furthermore, as we can see from table 1, the variable CPI has the highest mean value, in contrast, the variable $\ln M_3$ has the lowest mean value. Also, the variable CPI has the highest standard deviation value, while the variable lnRBEXR has the lowest standard deviation value. In addition, the variable T - bill has the highest skewness. However, the variable lnRBEXR has the lowest skewness. Regarding kurtosis, according to table 1, the variable T - bill has the highest value. The variable CPI has the lowest value. The variable lnRBEXR has the lowest value, however, the variable CPI has the maximum value.

Table 1: Descriptive statistics of the variables

Variables	Observations	Mean	Standard Deviation	Skewness	Kurtosis	Min	Max
lnsp500	516	6.671557	0.9980806	-0.3528371	2.130385	4.625855	8.4963
lnM3	516	3.816294	0.7085555	0.1557892	2.02703	2.510377	5.193972
CPI	516	75.30793	23.55012	0.0642275	1.919824	32.82465	125.7
lnRBEXR	516	4.530653	0.0848966	−0.0538219	2.05247	4.362206	4.727211
TB	516	3.994496	3.560401	0.9317747	3.667411	0.01	16.3

Notes: This table shows the summary of the main characteristics of measures of central tendency and variability for the dependent variable and the independent variables for monthly frequency data for the United States of America. The table shows the number of observations, the mean, the standard deviation, the skewness, the kurtosis, the minimum value and the maximum value. The period starts from 1st of January 1980 and ends up to 31st of December 2022

Table 2 shows the pairwise correlation matrix of the variables that will be used in the econometric model. As we can see from table 2, all the correlations between the dependent variable and the independent variables are statistically significant at 0,05 significance level. Furthermore, the variable of the logarithm M_3 (lnM_3) shows positive correlation with the relationship with the dependent variable which is the logarithm of the stock prices (lnsp500). Moreover, the prices (CPI), and the logarithm of the RBEXR (lnRBEXR), present a positive relationship with the logarithm of the S&P 500 Index. However, the T – bill has a negative correlation with the dependent variable. These results may seem valid, since the increase in the money supply decreased the interest rates, which this leads to higher spending. As a result, higher spending leads to higher demand and thus higher inflation. This implies higher prices and higher profits for the businesses. Finally, the t – bill is negatively correlated with the S&P 500 Index, since higher interest rates, leads to higher discounted factor and as a result lower prices based on the stock valuation theory.

Table 2: Pairwise Correlation matrix of the variables

Variables	lnsp500	lnM3	CPI	lnRBEXR	TB
lnsp500	1.0000				
lnM3	0.9524**	1.0000			
CPI	0.9595**	0.9939**	1.0000		
lnRBEXR	0.3551**	0,1321**	0.0915	1.0000	
TB	−0.8245**	−0.8463**	−0.8411**	0,1579**	1.0000

Notes: This table shows the Pearson's correlation matrix between the dependent variable and the independent variables for monthly frequency data for the United States of America. ***, ** and * denote statistically significance at 1%, 5% and 10% level, respectively. The period starts from 1st of January 1980 and ends up to 31st of December 2022

Figure 3 shows the scatterplot between the logarithm of S&P500 and the T-bill. According to figure 3, there is a strong negative relationship between the two variables. Specifically, the high values of the logarithm of the S&P500 correspond to low values of the growth of new deaths due to the Covid 19. The correlation between the logarithm of S&P500 and the T-bill is -0,8245. Regarding the pairwise correlation, the correlation between the two sizes is statistically significant at 5% significance level.

This result is also verified by the theory. More specific, as the yield increases, then the cost of capital increased and this in turn may decrease the business profits. Furthermore, this may decrease the tendency of investors to borrow and invest in the stock market. As a result, the stock prices are negatively affected by the increase of the T-bill. Moreover, regarding the stock valuation, this result verifies. The present value of a stock is:

Equation 1: Present value of a stock

$$PV_t = \left(\frac{Div_t}{(1+r)^t}\right)$$

Where,

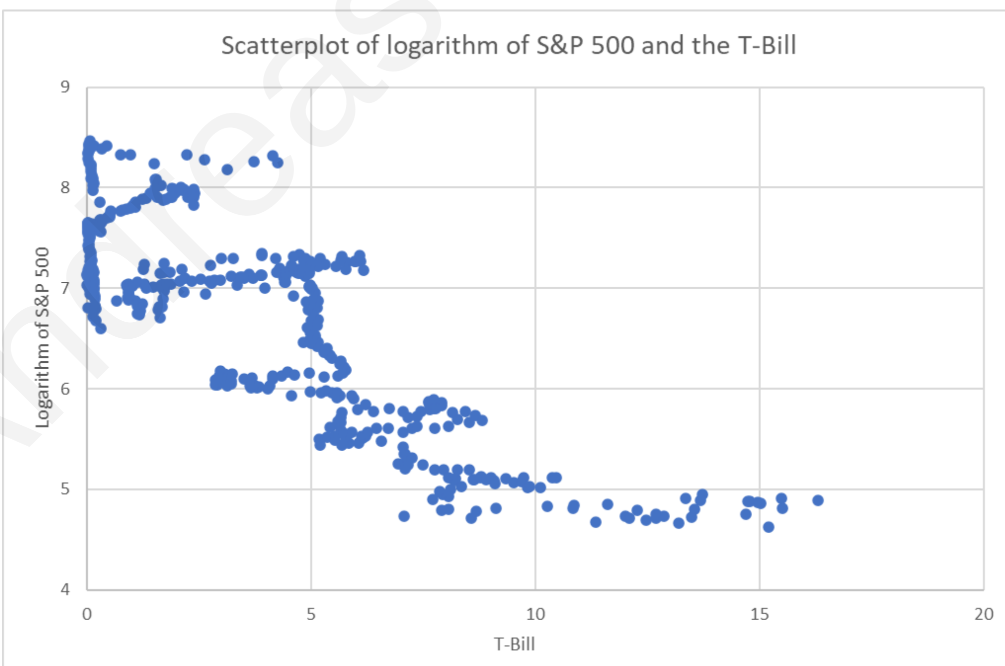
PV = Present value

Div = Dividend

r = yield

As we can see from the above equation, as the yield increases, then the discount factor $\left(\frac{1}{(1+r)^t}\right)$increases and this in turn decreases the stock price. This implies that, since the yield has an upward trend, then the present value of future cash flows declines. This discourages the investors from investing in the stock market.

Figure 3: Scatterplot between the logarithm of S&P 500 Index and the T – bill for the United States of America



Notes: The scatterplot between the logarithm of S&P500 and the T-bill from the 1st of January 1980 and ends up to 31st of December 2022 for the USA

Table 3 shows the summary of the main characteristics of the S&P500 Return before the Covid 19 pandemic. The period starts from the 1st of January 1980 and ends up to 31st of December 2019.

The S&P 500 return is calculated as follows:

Equation 2: The S&P 500 return

$$S\&P\ 500\ return_t = lnsp500_t - lnsp500_{t-1}$$

As we can see from table 3, the total number of observations was 468. Moreover, the average return for this period was 0,67627%. Furthermore, the minimum return was -24,54281%, while the maximum return of the S&P500 Index was 12,37803%

Table 3: Descriptive statistics of the S&P 500 returns before Covid 19pandemic

Variable	Observations	Mean	Standard Deviation	Skewness	Kurtosis	Min	Max
S&P 500 return	468	0,0067627	0,432275	−0,9163757	6,290525	−0,2454281	0,1237803

Notes: This table shows the number of observations, the mean, the standard deviation, the skewness, the kurtosis, the minimum value and the maximum value of the S&P 500 return before the Covid 19 pandemic. The period starts from the 1st of January 1980 and ends up to 31st of December 2019

Table 4 presents the main characteristics of the S&P500 return after the Covid 19 pandemic. Specifically, the period starts from the date that the first Covid 19 case was announced. That is, the period starts from the 1st of January 2020 and ends up to 31st of December 2022. As we can see from table 4, the total number of observations is thirty six (36), the average return is 0,4795%. In addition, the minimum return of the S&P500 was -13,36679% and the maximum return is 11,9421%.

Table 4: Descriptive statistics of the S&P 500 returns after the Covid 19 pandemic

Variable	Observations	Mean	Standard Deviation	Skewness	Kurtosis	Min	Max
S&P 500 return	36	0,004795	0,0037543	−0,344382	2,40965	−0,1336679	0,119421

Notes: This table shows the number of observations, the mean, the standard deviation, the skewness, the kurtosis, the minimum value and the maximum value of the S&P 500 return after the Covid 19 pandemic. from the date that the first Covid 19 case was announced. Specifically, the period starts from the 1st of January 2020 and ends up to 31st of December 2022

According to the descriptive results of both table 3 and table 4, before the Covid 19 pandemic, on average the returns of the S&P500 Index before the Covid 19 pandemic is higher than the average the returns of the S&P500 Index after the Covid 19 pandemic by almost 2 percentage points. This may happen because the USA economy and the world economy have started to recover from the financial crisis of 2008. Furthermore, post-crisis and pre-pandemic expectations of both consumers and investors were optimistic. However, the returns of the S&P500 Index after the Covid 19 pandemic were lower since the pandemic crisis was a very recent event. Moreover, the government, in order to avoid the negative effects of the Covid 19 pandemic, forced us to take some extreme decisions. Such as, the reduction of the mobility on the roads, some businesses were underperforming and they were being bankrupt. These decisions in co-operation with the negative expectations led the economic growth of the economy to decrease and as a result the rate of return of the S&P500 to decline.

Since time series data are being used, then lagged variables and the differences of the variables must be taken, in order to eliminate the possible serial correlations.

3.2 Description of the Econometric Method and Model

3.2.1 Description of the Econometric Method

To examine the effect of the monetary policy on the equity returns in the United States of America, it is necessary to use a model. This model is the Multiple Linear Regression (MLR) model. The method that will be used to analyze the model is VECM. The econometric software that will be used to estimate this impact is the Stata 13.

3.2.2 Model Description

Econometric Model

The following econometric model will be used in order to estimate the effect of monetary policy on stock returns. Below will be presented the estimation of the econometric model in a VECM setting that includes the five (5) variables, that is the S&P 500, the M_3, the CPI, the RBEXR and the T – Bill. The S&P 500, the M_3 and the RBEXR are expressed in logarithm form.

The VECM can be defined as follows:

Equation 3: VECM Model

$$\begin{bmatrix} \Delta lnsp500_t \\ \Delta lnM_{3_t} \\ \Delta CPI_t \\ \Delta lnRBEXR_t \end{bmatrix} = \underline{c} + BX_t + \alpha * \beta' \begin{bmatrix} \Delta lnsp500_{t-1} \\ \Delta lnM_{3_{t-1}} \\ \Delta CPI_{t-1} \\ \Delta lnRBEXR_{t-1} \end{bmatrix} + \sum_{i=1}^{p-1} \Gamma_i * \begin{bmatrix} \Delta lnsp500_{t-i} \\ \Delta lnM_{3_{t-i}} \\ \Delta CPI_{t-i} \\ ln\Delta RBEXR_{t-i} \end{bmatrix} + \underline{u_t}$$

Where,

lnsp500 = Natural logarithm of the S&P 500 Index

lnM_3 = Natural logarithm of the M_3

CPI =Consumer Price Index

lnRBEXR = Natural logarithm of the Real Broad Effective Exchange Rate

$\underline{c}$ = Vector of the intercept

X_t = Exogenous variables

a = (m x r) matrix that determines the speed at which the non-stationary variables respond to deviations from the long run equilibrium.

β' = (m x r) cointegrating vectors

$\underline{u_t}$ = Vector of the error term

Δ = First difference

Unit root test

Time series data must satisfy one assumption, that is, the stationarity. When time series is stationary, this implies that its mechanism does not change significantly over a period. Non stationarity, may be obvious in the data since some variables tend to present some trend over time. Regarding the stock prices, are non stationary since they increased exponentially and changed over time. In the case that some variables in the model are non stationary, then the differences will be taken in order to eliminate the trend.

Figure 4 shows the S&P500 return for the period started from the 1st of January 1980 and ended up to 31st of December 2022. The stock returns are in logarithm form. It is obvious from figure 4 that this variable does not present some trend over time. Most probably this variable may be stationary. Also, the logarithm makes the data more symmetric. This can be seen from figure 4 since the mean return is close to zero. However, the variance seems to be different in the case before Covid 19 pandemic and in the case after the pandemic.

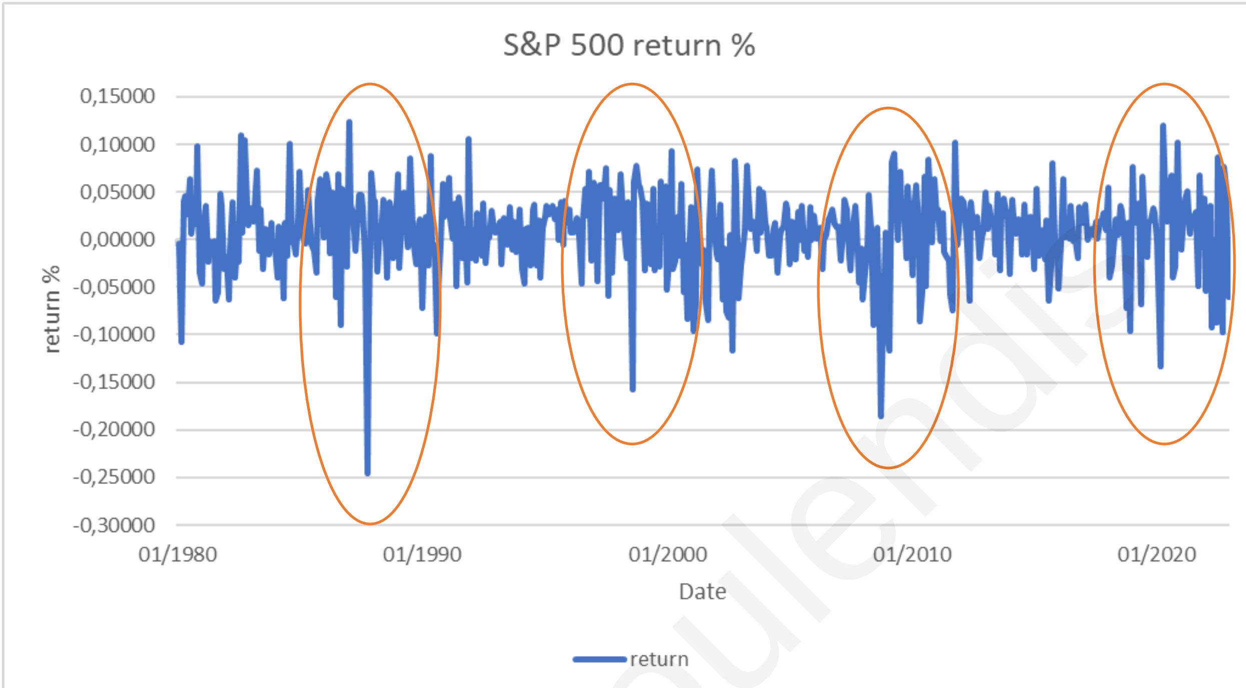
An important thing to refer, is that, according to figure 4, there are four (4) crises, which caused the S&P 500 Index to present a downward trend. The first recession refers to the stock market crash on the 19th of October in 1987. Also, is called *Black Monday*. Regarding this crisis, there were some imminent warning signs for the investors in the trading days prior to the day of stock market crash. Moreover, some days before the 19th of October, the London stock market faced a catastrophic 5% loss. In the day of the crises, that is, on Monday morning, the crash started firstly in Hong Kong and then spreading in Asia and Europe before reaching the USA. When the US stock market opened, the stock prices were in free fall. By the end of the day, the S&P 500 Index dropped more than 55 points. The main contribution factors for this severity of the Black Monday crises were the computerized trading and the portfolio insurance trading. Specifically, they hedged stock market portfolios by selling short the S&P 500 Index future contracts (Corporate Finance Institute, 2022).

The second crisis refers to the Russian financial crisis, which also called *ruble crisis*. According to this crisis, the Russian government on August 17 devalued the ruble as well as the Russian ruble denominated debt was defaulted. Moreover, deferred its payments to foreign creditors of the Russian financial institution. In the case of the US economy, there was evidence for damage in the western economies. This is because the FED acted precisely since it cut the target federal funds rate. As we can see from figure 5, the S&P 500 Index in mid-August of 1998 presents a significant decrease in the stock prices. The biggest decline in the Index happened in October of 1998 (Marshall, 2022).

The third crisis is a more recent event in the US economy as well as in the world economy. It's called *Subprime Mortgage crisis* or *The Great Recession*. Refers to the expansion of the prices in the housing sector, which is associated with an expansion in the housing borrowing of the households. An important factor which contributed to this expansion was the low mortgage rates which was the source of the bubble in the mortgage price. Since, they bought homes not as places, however, as an investment. Furthermore, low interest rates were a disincentive for individuals in the US economy to increase their savings in the Banks. As a result, there was a bubble in the housing sector. After this bubble burst, caused large effects in the US economy which passed in the world economy. Many large financial institutions collapsed since they were exposed to a huge number of non-performing loans. This generated uncertainty in the economy, unemployment increased since some institutions went bankrupt. As we can see from figure 5, this crisis caused a higher decline in the S&P 500 Index than the other aforementioned crises. (Federal Reserve Bank of St. Louis, 2013).

The fourth major crisis is the most recent event. It refers to the *Covid 19 pandemic* which started on the 11th of March 2020. The S&P 500 Index during the Covid 19 pandemic experienced a loss of 34 percent of its value. Possible reasons for this downward trend were the strict policies of the government during this pandemic. Specifically, some of the decisions were workplace closures, restrictions on internal movements and international travel controls. As a result, the stock prices were affected negatively since the expectations of the investors changed and the uncertainty played a decisive role in the stock valuation.

Figure 4: Logarithm of the S&P 500 returns



Notes: This graph shows the logarithm of the S&P 500 return for the period between the 1st of January 1980 and the 31st of December 2022

Heteroskedasticity

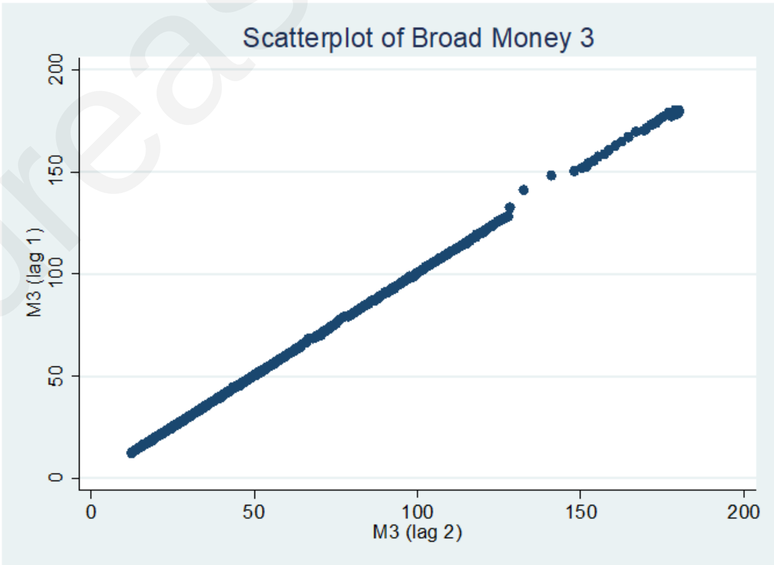
Heteroskedasticity is a problem that may be present in the data. In this case the variance of the error changes over time. Specifically, when there is heteroskedasticity in the model, then the OLS standard errors are not valid. Heteroskedasticity makes the t – statistic and the F – statistic invalid for accepting or rejecting the null hypothesis. In addition, heteroskedasticity causes model misspecification. As a result, the estimator is not efficient.

Serial Correlation

Serial correlation is a violation of condition TS.5, which assumed no serial correlation. Specifically, the error term does not depend on its past values. In addition, serial correlation refers to the relationship between the given variable and the lagged version of that variable over time. This problem may be present in the data since the lagged variable and its lagged version co-exists in the same econometric model.

Figure 5 shows the relationship between the lag 1 of M_3 and the lag 2 of M_3. As we can see from figure 5, the relationship between the two variables is almost perfectly positive correlated. When the lags are included in the model, then the serial correlation is removed from the error.

Figure 5: Relationship between the first lag of the M_3 variable and the second lag of the M_3 variable



Notes: This figure shows the relationship between the lag 1 of M_3 and the lag 2 of M_3. The period is between the 1st of January 1980 and 31st of December 2022

4 Empirical Results

4.1 Estimation of the Econometric Model and Inductive Statistics

This section presents the empirical results of the VECM model that was presented in the model description. Since some of the variables in the model are non-stationary, then a VECM model conducted in order to examine possible short run and long rum relationships of the variables that are integrated of order I(1). In the original model the variables are in levels. However, the results of the regression model are spurious and not valid since there are non stationary variables in the model. Following, an analysis based on the Johansen Cointegration will be presented.

4.1.1 Regression of the original model

Table 5 shows the econometric results of the original model. The period of the analysis starts from the 1st of January 1980 and ends up to 31st of December 2022. The dependent variable is the logarithm of the S&P 500 Index. According to the results of table 5, all the explanatory variables and the constant term are significant at 1% significance level. In the case of the logarithm of M_3 variable, with the other variables constant, if the M_3 increased by 1 dollar, then the stock returns will increase on average by 1,85%. This is statistically significant at all the significant levels. Moreover, the R^2 is 0,9174. This implies that the independent variables explain the 91,74% of the variation of the dependent variables. Moreover, in the regression the robust standard errors are being used in order to obtain unbiased standard errors of OLS coefficients, since the existence of heteroskedasticity in the model leads the variance of the residuals to be unequal, thus invalid results.

Table 5: Econometric results of the original model

Variables	1
M3	1.858124 (0.1792)***
CPI	−0.0229289 (0.0058)***
RBEXR	0.7907794 (0.1269)***
TB	0.0896309 (0.0071)***
Constant	−2.274921 (0.4447)***
Observations	348
R^2	0,9174

*Notes: This table shows the econometric results of the original model. The period of the analysis starts from the 1st of January 1980 and ends up to 31st of December 2022. The dependent variable is the logarithm of the S&P 500. The M_3 variable and the RBEXR variable are in logarithm form. * denotes statistically significance at 10% significance level, ** denotes statistically significance at 5% significance level and *** denotes statistically significance at 1% significance level*

Regarding the significant effects of the independent variable to the dependent variable, sometimes two or more variables may have statistically insignificant impact, however, are jointly significant. Table 6 shows the F – test, which examines whether the variables of the model have jointly significant effect om the S&P 500. The null hypothesis of this test is that the independent variables have not any statistical impact on the S&P 500 Index. As a result, the rejection of the null hypothesis implies that there is a jointly statistically significant impact of the explanatory variables on the dependent variables. The result from table 6 shows that the null hypothesis is rejected at all the significance levels, since the p – value of the test is zero and lower than 1%, 5% and 10% significance level. The explanatory variables have jointly significant effect on the S&P500.

Table 6: Joint significant test

Variables	
M3 = 0	
CPI = 0	
RBEXR = 0	
TB = 0	
F (4 , 343)	952,76
Prob > F	0,0000

Notes: This table shows the joint significant effect of the explanatory variables on the dependent variable. The variable $M_3$and the variable BREXR are in logarithm form.

Although all the estimates of table 5 above are statistically significant, the results are spurious since there are non-stationary variables in the model. That is, the results are not reliable for inference. Below, are presented the unit root test for the stationarity of the variables as well as the Johansen Cointegration Analysis in order to be examined the long run relationship between the on stationary variables with the dependent variable.

4.1.2 Unit Root Test

One of the most important conditions of time series variables is to be stationary. In order to examine whether a variable is characterized with constant variance over time, a constant autocorrelation structure as well as periodic fluctuations a unit root test must be conducted. In this study were used two (2) unit root tests. The first is the Augmented – Dickey Fuller test and the second is the Phillips – Perron test. Table 7 below shows the results of these two unit root tests.

The results show that almost all the variables are non-stationary. More specific, according to the table 7, the non-stationary variables are the S&P 500, the M_3, CPI and RBEXR. That is, these variables contain a unit root. This result is verified in both the Augmented – Dickey Fyller test and the Phillips – Perron test. In contrast, all the variables are stationary at their first differences. Regarding the four (4) aforementioned variables which are non-stationary, then this implies that they are integrated of order 1 or they are I (1). Since of the non-stationary series, then a cointegration analysis must be implemented in order to examine whether these variables have long run relationship.

Table 7: Unit Root test

	Augmented - Dickey Fuller (ADF)		Phillips - Perron (PP)	
Variables	Levels (t - statistic)	First Differences (t - statistic)	Levels (t - statistic)	First Differences (t - statistic)
sp500	−2.092	−16.755***	−2.084	−22.137***
M3	−1.250	−10.437***	−0.839	−10.891***
CPI	−1.808	−12.952***	−0.150	−11.989***
RBEXR	−1.824	−11.933***	−1.377	−12.005***
TB	−3.836**	−17.802***	−2.680**	−15.069***

Notes: The above table shows the unit root test for the variables of the econometric model. The period of the analysis starts from the 1st of January 1980 and ends up to 31st of December 2022. These tests are the Augmented – Dickey Fuller test and the Phillips – Perron test. * indicates rejection of the null at 10% significance level ** indicates rejection of the null at 5% significance level and *** indicates rejection of the null at 1% significance level. The variable sp500, the variable M_3 and the variable RBEXR are in logarithm form

4.1.3 Johansen Cointegration Analysis

Below, the cointegrating analysis by using the Johansen Cointegration Method is presented. One of the steps of this analysis is the lag order selection which will show the optimal lags that will be included in the VECM Model. Next step, is the selection of the optimal cointegrating ranks, will show the optimal number of cointegrating vectors. The last step in the implementation of the VECM Model in order to examine the long run relationships between the cointegrated variables.

4.1.3.1 Optimal Lag Order Selection

One of the important issues in the VAR / VEC Models is the lag order selection. According to the Ivanov and Kilian (2005), suggested six (6) criteria for the lag order selection. The SIC, the HQIC, AIC, LR, SLR, and the LM test. In this study, the AIC standards are being used in order to select the optimal lag numbers. Table 8 below shows the results from the lag order selection. According to the AIC the optimal lags for the VECM are three (3).

Table 8: Lag Order Selection

lag	LL	LR	FPE	AIC	HQIC	SBIC
0	−239.492		0.00005	1.44732	1.48306	1.53702
1	2838.87	6156.7	8.3E-18	−16.4612	−16.354	−16.1921
2	3006.95	336.16	3.4E-13	−17.3506	−17.1719*	−16.9021*
3	3027.03	40.146*	3.3E-13	−17.3744*	−17.1243	−16.7465
4	3034.74	15.415	3.5E-13	−17.3259	−17.0043	−16.5186
5	3047.38	25.288	3.6E-13	−17.3063	−16.9132	−16.3196
6	3057.52	20.277	3.7E-13	−17.272	−16.8075	−16.1059

Notes: This table shows the optimal lag selection for the VECM Model. The period is between 1st of January 1980 and 31st of December 2022. The endogenous variables are the logarithm of the S&P 500, the logarithm of the M_3, the CPI and the logarithm of the RBEXR, while the exogenous variable is the T-bill

4.1.3.2 Cointegrating Rank

Following, the second step of the cointegration analysis in order to identify the cointegration vectors between the logarithm of S&P 500, the logarithm of M_3, CPI and the logarithm of RBEXR. Moreover, in the regression the intercept is included, however, the trend was constant. The results of the cointegrating rank test of trace statistic are presented in table 5 below. According to the results of table 9, it is obvious that the null hypothesis of non-cointegrating variables is rejected. This implies that the four variables are cointegrated in the long run. That is, the logarithm of S&P 500, the logarithm of the M_3, the CPI and the logarithm RBEXR are moving together in the long run. Thus, a VECM Model should be implemented in order to examine these long run relationships. Although, the optimal ranks that must be included in the VECM are three (3), however, the econometric software Stata has selected that the optimal ranks are two (2).

Table 9: Cointegrating Rank for the VECM

Hypothesized No. of CEs	Eigenvalue	Trace Statistic	5% Critical Value
None		76.2444	47.21
At most 1	0.10662	37.5009	29.68
At most 2	0.07906	9.0853*	15.41
At most 3	0.02133	1.6484	3.76
At most 4	0.00477		

Notes: This table shows the estimation of the optimal ranks that must be included in the VECM Model. The optimal ranks based on this test are three, however, the software Stata choose that the optimal ranks are two. The endogenous variables are the logarithm of S&P 500, the logarithm of M_3, the CPI and the logarithm of RBEXR, while the exogenous variable is the T – Bill. The period of the analysis is between 1st of January 1980 and 31st of December 2022. * indicates rejection of non-cointegrating hypothesis at 10% significance level ** indicates rejection of non-cointegrating hypothesis at 5% significance level and *** indicates rejection of non-cointegrating hypothesis at 1% significance level

4.1.3.3 Vector Error Correction Model

Below will be presented the estimation of the original model in a VECM setting that includes the five (5) variables, that is the S&P 500, the M_3, the CPI, the RBEXR and the T – Bill. The S&P 500, the M_3 and the RBEXR are expressed in logarithm form.

As it mentioned before the VECM model that will be used in order to estimate the impact of the monetary policy on the equity prices, is the VECM model as in equation 3.

$$\begin{bmatrix} \Delta lnsp500_t \\ \Delta lnM_{3_t} \\ \Delta CPI_t \\ \Delta lnRBEXR_t \end{bmatrix} = \underline{c} + BX_t + \alpha * \beta' \begin{bmatrix} \Delta lnsp500_{t-1} \\ \Delta lnM_{3_{t-1}} \\ \Delta CPI_{t-1} \\ \Delta lnRBEXR_{t-1} \end{bmatrix} + \sum_{i=1}^{p-1} \Gamma_i * \begin{bmatrix} \Delta lnsp500_{t-i} \\ \Delta lnM_{3_{t-i}} \\ \Delta CPI_{t-i} \\ ln\Delta RBEXR_{t-i} \end{bmatrix} + \underline{u_t}$$

Where Δ, is the first differences, $\underline{c}$ is a vector of the intercept, X_t is a vector that includes the exogenous variables, a is an (m x r) matrix that determines the speed which the non-stationary variables are responds to deviations from the long run equilibrium. In addition, β' an (m x r) cointegrating vectors and $\underline{u_t}$ is a vector of the error term.

Table 10 shows the results of the VECM Model. These results correspond to a short run impact of the explanatory variables to the S&P 500 returns. The dependent variable is the difference of the logarithm of the S&P 500, which is the returns. Table 10 presents the short run effect of the variables on the S&P 500 returns. According to the results, there are two cointegrating equations. The coefficient of the cointegrating equations are the adjustment coefficients. For the first equation, the coefficient has a negative sign. Specifically, the value of the adjustment coefficient is -0,05. This implies that there was a 5% adjust occurs in the previous period to the equilibrium. This is statistically significant at the all the statistically significant levels. Moreover, the sign of the second cointegrating equation is positive and it takes the value 0,3131. This shows that the second cointegrating equation may have invalid coefficients, since the sign must be negative or between 0 and 1.

An important note to be mentioned is that, according to the above VEMC Model, the variables in both the short run and the long run are in t – 1. As mentioned before, there were three lags according to the results of table 8. For this reason, in table 10, the variables are expressed in two lags, since t represents the number of lags which are three (3). Since the lags are three, then when it subtracted with 1, the remaining lags are two (2).

Regarding the short run impact of the variables on the S&P 500 returns, the results from table 10 show that only CPI and T – Bill have some short run relationship with the dependent variables. More specific, the second lag of the CPI has a positive and statistically significant effect on the S&P 500 returns. This is statistically significant only at the 10% significance level. Furthermore, as we can see from table 10, the T – Bill has a positive effect. Specifically, on average a 1% increase in the T – Bill, this leads to a 0,8% increase in the returns in the short run. This is statistically significant at 1%, 5% and 10% significant levels.

Table 10: Short run effects of explanatory variables on the S&P 500 returns

Variable	Coefficient	p -value
CointEq(1)	−0.0502056 (0,0146) ***	0.001
CointEq(2)	0.3131285 (0,0597)***	0.000
(lnsp500(-1))	−0,0315086 (0,0573)	0.583
(lnsp500(-2))	−0.0893563 (0,0587)	0.128
(lnM3(-1))	−0.1892951 (0,5376)	0.725
(lnM3(-2))	0.2668156 (0,5336)	0.617
(CPI(-1))	0.0000479 (0,0083)	0.995
(CPI(-2))	0.0153532 (0,0084)*	0.068
(lnRBEXR(-1))	−0.1457534 (0,2203)	0.508
(lnRBEXR(-2))	0.1833191 (0,2162)	0.397
TB	0.0085654 (0,0018)***	0.000
Constant	−0.000445 (0,0058)	0.940

*Notes: This table presents the short run effects on the explanatory variables on the S&P 500 returns. The CointEq denotes the cointegration equations. The optimal lags are three and the optimal ranks are two. The period of the analysis is between 1st of January 1980 and 31st of December 2022. In the model, trend is not included. *denotes statistically significance at 10% significance level, ** denotes statistically significance at 5% significance level and *** denotes statistically significance at 1% significance level*

Table 11 presents the long run relationship between the non-stationary variables with the S&P 500 returns. According to the results of table 11, the first cointegration equation shows that the CPI has adverse effect on the S&P 500 Index. Since in the short run has a positive effect, while the long run impact is negative. Specifically, a 1% increase in the prices, then the returns will decrease by 2,7% on average in the long run. This is statistically significant at all the significant levels. In contrast the RBEXR affects the S&P 500 returns only in the long run. That is, it has a negative and statistically significant effect at 1%, 5% and 10% significant levels. In addition, the second cointegrating equations shows that both the CPI and the RBEXR have negative and statistically significant effect on the S&P 500 returns in the long run. It is statistically significant at 1%, 5% and 10% significant levels.

Table 11: Long run impact of non stationary variables on the S&P 500 returns

	Coefficient	p - value
CointEq(1)		
lnsp500	1	
lnM3	0	
CPI	−0.0276628 (0.0030)***	0.000
lnRBEXR	−1.783243 (0.4145)***	0.000
Constant	3.597515	
CointEq(2)		
lnsp500	0	
lnM3	1	
CPI	−0.0300805 (0.0006)***	0.000
lnRBEXR	−0.4710229 (0.0876)***	0.000
Constant	0.6104218	

Notes: This table shows the long run effects of the non stationary variables on the S&P 500 returns. The CointEq denotes the cointegration equations. The optimal lags are three and the optimal ranks are two. The period of the analysis is between 1st of January 1980 and 31st of December 2022. *denotes statistically significance at 10% significance level, ** denotes statistically significance at 5% significance level and *** denotes statistically significance at 1% significance level

4.1.3.4 Robustness tests

Following, it will present some robustness tests in order to examine the validity of the results. The first test corresponds to the Lagrange Multiplier test. It examines the case whether there is an autocorrelation in the residuals. The null hypothesis states that there is not any autocorrelation at the lag order while the alternative hypothesis states that in the residuals there is autocorrelation. Table 12 shows the results of the LM test. In the test used six lags in order to examine the possibility of the existence of autocorrelation in the residuals and in which lag. According to the results, there is autocorrelation in the residuals only at the fourth lag. This is statistically significant at the 5% significant level (Stata, 2022b).

Table 12: LM test for autocorrelation in the residuals

Lag	chi2	Prob > chi2
1	17.6189	0.34668
2	16.0466	0.44971
3	20.3384	0.20536
4	27.9645	0.03193**
5	9.2964	0.90071
6	18.4088	0.30051

*Notes: This table shows the Lagrange Multiplier test which examines the case of possible existence autocorrelation in the residuals. In this test 6 lags were examined for possible autocorrelation. *denotes statistically significance at 10% significance level, ** denotes statistically significance at 5% significance level and *** denotes statistically significance at 1% significance level*

Important test of the results of the VECM is the Jarque – Bera test. Specifically, this test examines the normality of the residuals. The null hypothesis of the test is that the disturbances of the VECM are normally distributed. In addition, the Jarque – Bera test provides test statistics for all the equations jointly as well as for each equation against the null hypothesis which is the normality. Specifically, for the individual equation, the null hypothesis states that the disturbances term has a univariate normal distribution, while for all the equation jointly states that N disturbances come from N dimensional normal distribution (Stata, 2022c).

Table 13 shows the results from the Jarque – Bera test. As we can see from table 9, the null hypothesis is strongly rejected for all the statistically significant levels. In the case of the individual equation, only the RBEXR variable shows signs of normality, however, the other variables are not normally distributed. In addition, in the case of all the equations jointly, the null hypothesis was strongly rejected at all the statistically significant levels. This implies that all the equations jointly did not come from N dimensional normal distribution.

Table 13: Test for normally distributed disturbances

Equation	chi2	Prob > chi2
D_lnsp500	46.989	0.0000
D_lnM3	5042.468	0.0000
D_CPI	56.358	0.0000
D_lnRBEXR	1.175	0,55571
ALL	5146.99	0.0000

Notes: This table shows the normality test. It is a goodness of fit test which presents whether the data have skewness and kurtosis matching a normal distribution.

Regarding the last test which is being implemented, is about the stability condition of the vec estimates. Also, the inference of the vec requires that the cointegration equations must be stationary and the number of cointegrating equations must be correctly specified. This test examines whether the cointegration equations are misspecified or in the case of the cointegration equations which assumed to be stationary, are not stationary (Stata, 2022d).

Table 14 shows the results from the stability test. The results show that there are three (3) moduli. Since, in the VECM Model there are four (4) endogenous variables, while there are two (2) cointegration equations. To find the number of moduli, the number of endogenous variables is subtracted from the number of cointegration equations. Furthermore, the results from table 14 show the eigenvalues of the companion matrix and the associated moduli. According to the results of table 14, there are two roots which are equal to one (1). To sum up, the results show that most probably the cointegration equations are not stationary or either there is sone trend and the rank three (3) specified earlier is high. Since, there are some remaining moduli which are higher than one.

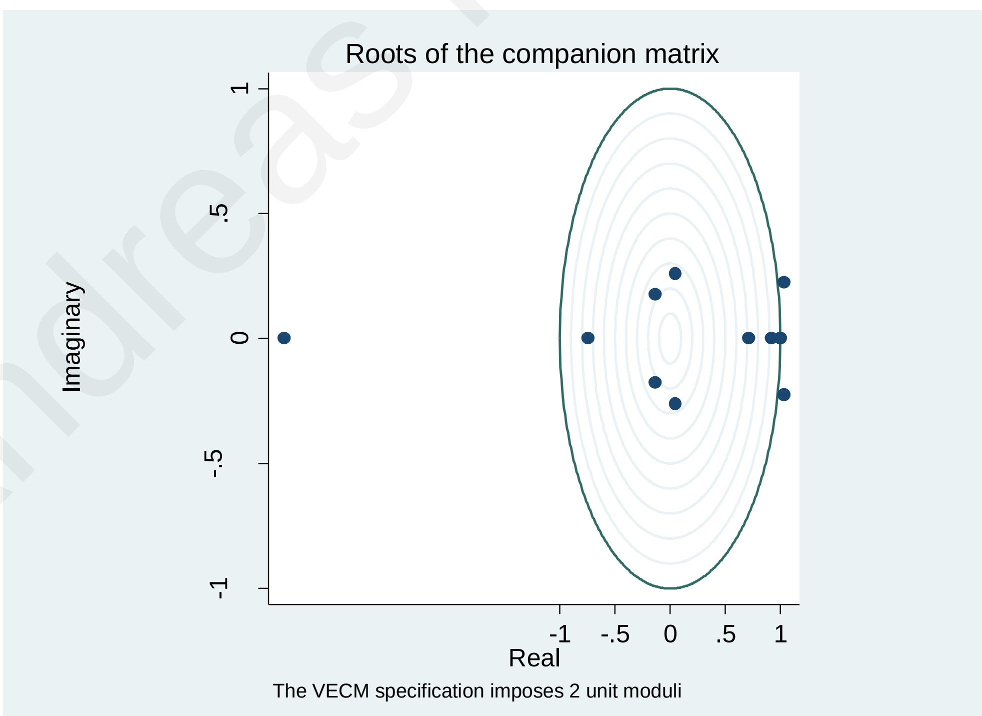
Table 14: Stability test

Eigenvalues			Modulus
−3.500341			3.50034
1.030419	+	0.2242181i	1.05453
1.030419	−	0.2242181i	1.05453
1			1
1			1
0.9198945			0.919895
−0.7427089			0.742709
0.7134351			0.713435
0.04882284	+	0.2597351i	0.264284
0.04882284	−	0.2597351i	0.264284
−0.1343343	+	0 .1765138i	0.221817
−0.1343343	−	1 .1765138i	0.221817

Notes: This table shows the stability test. This test examines whether the cointegrating equations are misspecified

Figure 6 shows the results of table 14 in a visual way. The information is the same as in table 14. In addition, figure 6 plots the eigenvalues of the companion matrix. According to figure 6, shows how close the roots with modulus 0,95 are to the unit circle.

Figure 6: Eigenvalues of the companion matrix



4.2 Estimation of the econometric model for specific periods

This section presents the empirical results of the VECM model for specific periods for the time period between 1st of January 1980 and 31st of December 2022. The analysis is the same as the previous section, that is based on the Johansen Cointegrating analysis. However, there were some limitations of the previous analysis. Specifically, in the previous analysis there were two cointegrating equations, which made it difficult to assess the impact of monetary policy on the equity market returns. Furthermore, the results from the VECM were not valid, since in the period of the analysis, severe financial crises occurred. In this analysis, the cointegrating equation that will be used is one (1) regardless of the number ranks that will be chosen from the cointegrating rank test. Moreover, the analysis period will be divided into subperiods.

4.2.1 Regression of the original model

Table 15 shows the econometric results of the original model. The period of the analysis starts from the 1st of January 1980 and ends up to 31st of December 2000. The dependent variable is the logarithm of the S&P 500 Index. According to the results of table 15, almost all the explanatory variables and the constant term are significant. Specifically, for this period the CPI variable and the T-bill variable are statistically significant at all the significant levels, while the constant term is statistically significant at 5% and 10% significant level. In contrast, the logarithm of M_3 and the logarithm of RBEXR does not have any statistically significant impact on the S&P500 Index. In the case of the logarithm of M_3 variable, with the other variables constant, if the M_3 increased by 1 dollar, then the stock returns will increase on average by 1,85%. Moreover, the R^2 is 0,9686. This implies that the independent variables explain the 96,86% of the variation of the dependent variables. Also, in the regression the robust standard errors are being used to obtain unbiased standard errors of OLS coefficients, since the existence of heteroskedasticity in the model leads the variance of the residuals to be unequal, thus invalid results.

Table 15: Econometric results of the original model

Variables	1
lnM3	0,2619305 (0,4501)
CPI	0,1172341 (0,0127)***
lnRBEXR	0,206658 (0,3755)
TB	−0,1053471 (0,0181)***
Constant	−2,500736 (1,1166)**
No Observations	84
R - squared	0,9686

*Notes: This table shows the econometric results of the original model. The period of the analysis starts from the 1st of January 1980 and ends up to 31st of December 2000. The dependent variable is the logarithm of the S&P 500 Index. The M_3 variable and the RBEXR variable are in logarithm form. In the regression, robust standard errors were used. * denotes statistically significance at 10% significance level, ** denotes statistically significance at 5% significance level and *** denotes statistically significance at 1% significance level*

Regarding the significant effects of the independent variable to the dependent variable, sometimes two or more variables may have statistically insignificant impact, however, are jointly significant. Table 16 shows the F – test, which examines whether the variables included in the model have jointly significant effect on the S&P 500. The null hypothesis of this test states that the independent variables have not any statistical impact on the S&P 500 Index. As a result, the rejection of the null hypothesis implies that there is a jointly statistically significant impact of the explanatory variables on the dependent variables. The results from table 16 show that the null hypothesis is rejected at all the significance levels, since the p – value of the test is zero and lower than 1%, 5% and 10% significance level. The explanatory variables have jointly significant effect on the S&P500.

Table 16: Joint significant test

Variables	
M3 = 0	
CPI = 0	
RBEXR = 0	
TB = 0	
F(4,79)	831,88
Prob > F	0,0000

Notes: This table shows the joint significant effect of the explanatory variables on the dependent variable. The variable M_3 and the variable BREXR are in logarithm form.

Although all the estimates of table 15 above are statistically significant, the results are spurious since there are non-stationary variables in the model. That is, the results are not reliable for inference. Below, are presented the unit root test for the stationarity of the variables as well as the Johansen Cointegration Analysis in order to be examined the long run relationship between the on stationary variables with the dependent variable.

4.2.2 Unit Root Test

One of the most important conditions of time series variables is to be stationary. In order to examine whether a variable is characterized with constant variance over time, a constant autocorrelation structure as well as periodic fluctuations a unit root test must be conducted. In this study were used two (2) unit root tests. The first is the Augmented – Dickey Fuller test and the second is the Phillips – Perron test. Table 17 below shows the results of these two unit root tests.

The results show that almost all the variables are non-stationary. More specific, according to the table 17, the non-stationary variables are the logarithm of S&P 500, the logarithm of M_3, CPI and the logarithm of RBEXR. That is, these variables contain a unit root. This result is verified in both the Augmented – Dickey Fyller test and the Phillips – Perron test. In contrast, as it was expected, all the variables are stationary at their first differences. Regarding the four (4) aforementioned variables which are non-stationary, this implies that they are integrated of order 1 or they are I(1). Since of the non-stationary series, then a cointegration analysis must be implemented in order to examine whether these variables have long run relationship.

Table 17: Unit Root test

	Augmented Dickey - Fuller (ADF)		Phillips - Perron (PP)	
Variables	Levels (t - statistic)	First Differences (t - statistic)	Levels (t - statistic)	First Differences (t - statistic)
sp500	−2,766	−11,631***	−2,757	−16,072***
M3	−2,455	−7,029***	−2,802	−7,431***
CPI	−2,708	−9,872***	−3,050	−10,579***
RBEXR	−3,212	−5,928***	−2,770	−6,007***
TB	−3,769**	−13,174***	−2,719**	−10,676***

Notes: The above table shows the unit root test for the variables of the econometric model. The period of the analysis starts from the 1st of January 1980 and ends up to 31st of December 2000. These tests are the Augmented – Dickey Fuller test and the Phillips – Perron test. * indicates rejection of the null at 10% significance level ** indicates rejection of the null at 5% significance level and *** indicates rejection of the null at 1% significance level. The variable sp500, the variable M_3 and the variable RBEXR are in logarithm form

4.2.3 Johansen Cointegration Analysis for the period between 1st of January 1980 and 31st of December 2000

Below, the cointegrating analysis by using the Johansen Cointegration Method is presented. One of the steps of this analysis is the lag order selection which shows the optimal lags that will be included in the VECM Model. Next step is the selection of the optimal cointegrating ranks. This shows the optimal number of cointegrating vectors. The last step is the implementation of the VECM Model in order to examine the long run relationships between the cointegrated variables.

4.2.3.1 Optimal Lag Order Selection

One of the important issues in the VAR / VEC Models is the lag order selection. According to the Ivanov and Kilian (2005), suggested six (6) criteria for the lag order selection. The SIC, the HQIC, AIC, LR, SLR, and the LM test. In this study, the AIC standards are being used in order to select the optimal lag numbers. Table 18 below shows the results from the lag order selection. According to the AIC the optimal lags for the VECM are two (2).

Table 18: Lag Order Selection

lags	LL	LR	FPE	AIC	HQIC	SBIC
0	284.488		9.8E-09	−7.08943	−6.99267	−6.84772
1	813.325	1057.7	1.9E-14	−20.2391	−19.9488*	−19.514*
2	832.155	37.661	1.8E-14	−20.3117*	−19.8279	−19.1031
3	842.478	20.645	2.1E-14	−20.1661	−19.4888	−18.4741
4	852.922	20.889	2.4E-14	−20.0236	−19.1528	−17.8482
5	870.851	35.857*	2.4E-14	−20.0731	−19.0087	−17.4142
6	879.904	18.107	3.0E-14	−19.895	−18.6371	−16.7527

Notes: This table shows the optimal lag selection for the VECM Model. The period is between 1st of January 1980 and 31st of December 2000. The endogenous variables are the logarithm of the S&P 500 Index, the logarithm of the M_3, the CPI and the RBEXR, while the exogenous variable is the T-bill

4.2.3.2 Cointegrating Rank

Following, the next step of the cointegration analysis is the selection of the cointegrating vectors. An important point to be mentioned is that in the regression the intercept and the trend are included. The null hypothesis indicates that there is no cointegrating rank, that is, there is no long run relationship between the endogenous variables. The results of the cointegrating rank test of trace statistic are presented in table 19 below. According to the results of table 19, it is obvious that the null hypothesis of non-cointegrating variables is rejected. This implies that the four variables are cointegrated in the long run. That is, the logarithm of S&P 500, the logarithm of the M_3, the CPI and the logarithm RBEXR are moving together in the long run. Thus, a VECM Model should be implemented in order to examine these long run relationships. Although, the optimal rank that must be included in the VECM is one (1) since the trace statistic is lower than the 5% critical value.

Table 19: Cointegrating Rank for the VECM

Hypothesized No. of Ces	Eigenvalue	Trace Statistic	5% Critical Value
None		70.3617	54.64
At most 1	0.38922	29.9347*	34.55
At most 2	0.20096	11.5382	18.17
At most 3	0.11059	1.9284	3.74
At most 4	0.02324		

Notes: This table shows the estimation of the optimal ranks that must be included in the VECM Model. The optimal rank based on this test is one. The endogenous variables are the logarithm of S&P 500, the logarithm of M_3, the CPI and the logarithm of RBEXR, while the exogenous variable is the T – Bill. The period of the analysis is between 1st of January 1980 and 31st of December 2000

4.2.3.3 Vector Error Correction Model

Below will be presented an estimation of the original model in VECM setting that includes the five (5) variables, that is the S&P 500, the M_3, the CPI, the RBEXR and the T – Bill. The VECM Model that will be used, corresponds to the VECM Model of the equation 3.

Table 20 shows the results of the VECM Model. These results correspond to a short run impact of the explanatory variables to the S&P 500 returns. The dependent variable is the returns of the S&P 500. Table 20 presents the short run effect of the variables on the S&P 500 returns. According to the results, there is one cointegrating equation since there was one cointegrating rank. The coefficient of the cointegrating equation shows the adjustment coefficient. For the first equation, the coefficient has a negative sign. Specifically, the value of the adjustment coefficient is -0,3290. This implies that there was a 32,90% adjust occurs in the previous period to the equilibrium. This is statistically significant at the 5% significant level and 10% significant level. The negative sign of the adjustment coefficient shows that there is converge towards the long run equilibrium and as a result the VECM model is well specified. Since the optimal lags are two and in the VECM Model the variables are expressed in t – 1, then the t represents the number of lags. For this reason, in table 20, the non stationary variables are expressed only in one lag.

Regarding the short run impact of the variables on the S&P 500 returns, the results from table 20 show that only the T – Bill variable have some short run relationship with the dependent variables. More specific, the T - Bill variable has a negative and statistically significant effect on the S&P 500 returns in the short run. Specifically, on average a 1% increase in the T – Bill, this leads to a 2,06% decrease in the returns in the short run. This is statistically significant at 5% and 10% significant levels. Moreover, in the regression, linear trend is included and according to the results of table 20, there is a negative effect of the linear trend on the S&P 500 returns, however, this impact is not statistically significant at any significant levels.

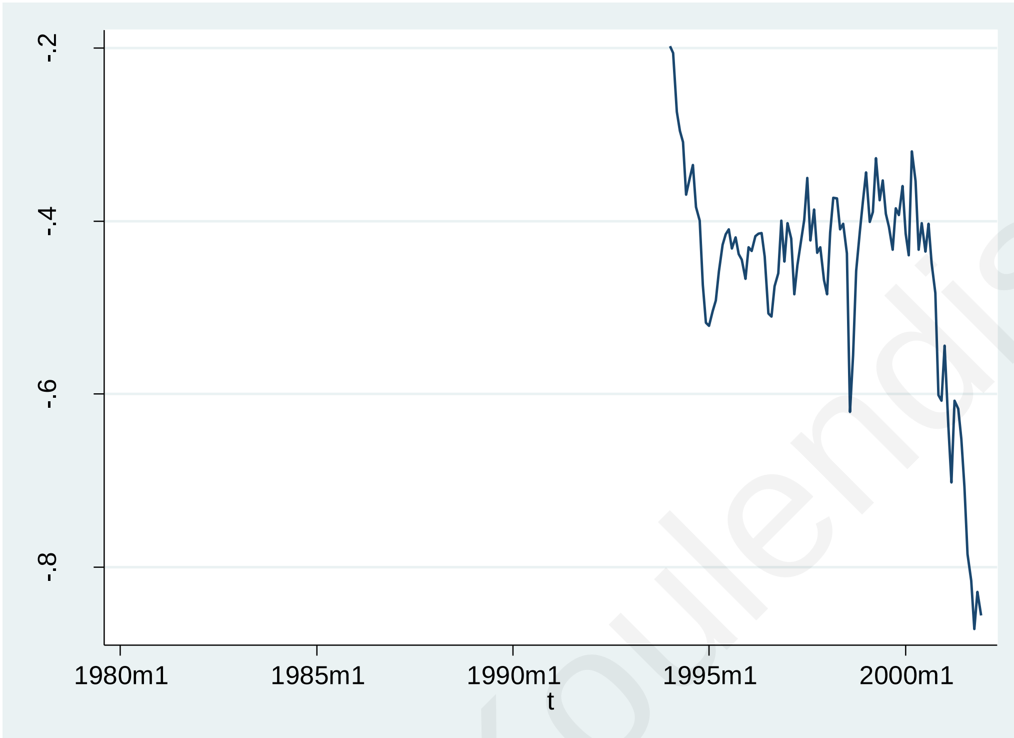
Table 20: Short run effects of explanatory variables on the S&P 500 returns

Variables	Coeffient	p - value
CointEq(1)	−0.3290888 (0.0791)***	0.000
(lnsp500(-1))	−0.0206502 (0.1120)	0.854
(lnM3(-1))	1.496423 (1.886191)	0.428
(CPI(-1))	0.0305769 (0.0358)	0.394
(lnRBEXR(-1))	−0.2617753 (0.3938)	0.506
TB	−0.0206249 (0.0097)**	0.034
trend	−0.0001801 (0.0002)	0.416
Constant	−0.0234853 (0.0444)	0.597

*Notes: This table presents the short run effects of the explanatory variables on the S&P 500 returns. The period of the analysis is between 1st of January 1980 and 31st of December 2000. The CointEq denotes the cointegration equations. The optimal lags are two and the optimal rank is one. In addition, in the VECM model, linear trend is included. The endogenous variables are the logarithm of S&P 500, the logarithm of M_3, the CPI and the logarithm of RBEXR, while the exogenous variable is the T – Bill. *denotes statistically significance at 10% significance level, ** denotes statistically significance at 5% significance level and *** denotes statistically significance at 1% significance level*

Figure 7 shows the results of the first cointegrating equation in a visual way. As we can see from figure 7, the predicting cointegrating equation does look like a stationary process. That is, there is not a clear relationship in the series. Furthermore, according to figure 7, is obvious the negative trend in the predicting cointegrating equation. This shows that the gap is shrinking. However, as mentioned above, the effect of the linear trend is not statistically significant at any significant levels.

Figure 7: Predicted Cointegrated Equation



Notes: This figure shows the predicted cointegrated equation in a visual way. The period started from the 1st of January 1980 and ended up to 31st of December 2000. There is a negative trend, however it is not statistically significant

Table 21 presents the long run relationship between the non-stationary variables with the S&P 500 returns. According to the results of table 21, the first cointegration equation shows that the CPI has a positive effect on the S&P 500 Index. Since in the short run has a positive effect, while in the long run continues to have positive impact on the S&P 500 returns. Specifically, a 1% increase in the prices, then the returns will increase by 8,8% on average in the long run. This is statistically significant at all the significant levels. In addition, the M_3 variable has a positive impact in the returns both in the short run and the long run. Specifically, with the other variables constant, a 1 dollar increase in the money supply, this will increase the S&P 500 returns by 3,33% on average in the long run. According to table 21, this effect is statistically significant at all the significant levels, since the p – value is lower than 1%, 5% and 10% significant levels. In contrast the RBEXR affects the S&P 500 returns only in the long run. That is, it has a negative and statistically significant effect at only 10% significant level. Furthermore, the linear trend seems to have a negative effect on the S&P 500 returns in the long run.

Table 21: Long run impact of non stationary variables on the S&P 500 returns

	Coefficient	**p - value**
CointEq(1)		
lnsp500	1	
lnM3	3.333986 (0.6160)***	0.000
CPI	0.0884873 (0.0323)***	0.006
lnRBEXR	−0.571049 (0.3453)*	0.098
Trend	−0.0430691	
Constant	−20.48138	

Notes: This table shows the long run effects of the non stationary variables on the S&P 500 returns. The period of the analysis is between 1st of January 1980 and 31st of December 2000. The CointEq denotes the cointegration equations. In the regression, a linear trend is included. The endogenous variables are the logarithm of S&P 500, the logarithm of M_3, the CPI and the logarithm of RBEXR, while the exogenous variable is the T – Bill. The optimal lags are two and the optimal ranks is one. *denotes statistically significance at 10% significance level, ** denotes statistically significance at 5% significance level and *** denotes statistically significance at 1% significance level

4.2.3.4 Robustness test

Regarding this test, which is being implemented, is about the stability condition of the vec estimates. Also, the inference of the vec requires that the cointegration equations must be stationary and the number of cointegrating equations must be correctly specified. This test examines whether the cointegration equations are misspecified or in the case of the cointegration equations which assumed to be stationary, are not stationary (Stata, 2022d).

Table 22 shows the results from the stability test. The results show that there are three (3) moduli. Since, in the VECM Model there are four (4) endogenous variables, while there is one cointegration equation. To find the number of moduli, the number of endogenous variables is subtracted from the number of cointegration equations. Furthermore, the results from table 8 show the eigenvalues of the companion matrix and the associated moduli. According to the results of table 22, there are three roots which are equal to one (1). To sum up, the results show that most probably the cointegrating equations are not stationary. Since, there are some remaining moduli which are higher than one.

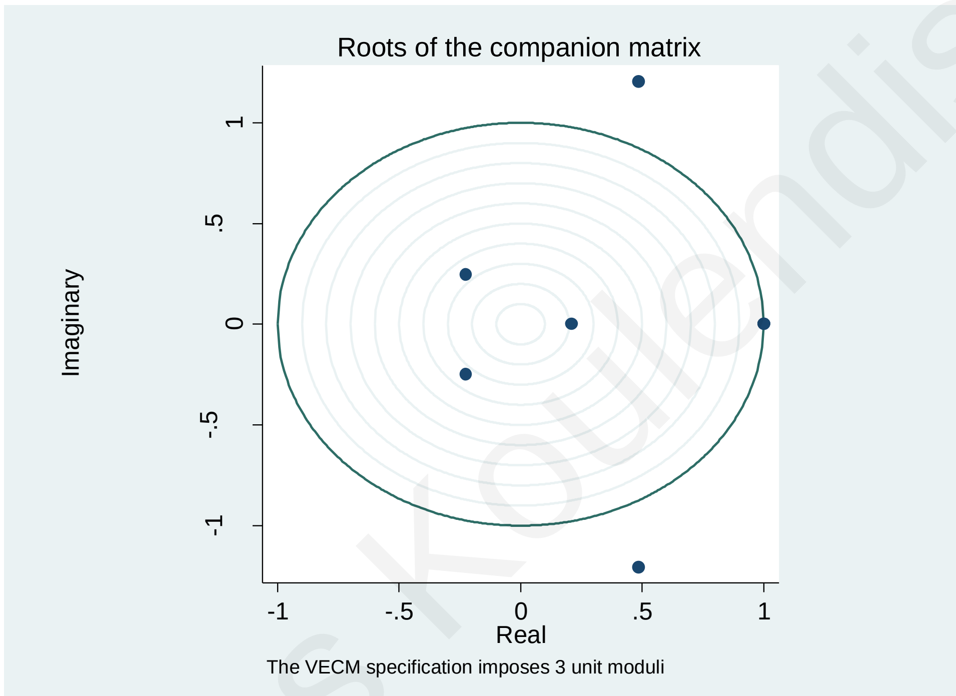
Table 22: Stability test

Eigenvalues	Modulus
0.4857227 + 1.206793i	1.30088
0.4857227 − 1.206793i	1.30088
1	1
1	1
1	1
−0.2242233 + 0.2463827i	0.333137
−0.2242233 − 0.2463827i	0.333137
0.2094317	0.209432

Notes: This table shows the stability test of the VECM model. The period started from the 1st of January 1980 and ended up to 31st of December 2000. There are three modulis since the endogenous variables are four and there is one cointegrating equation.

Figure 8 shows the results of table 22 in a visual way. The information is the same as in table 22. In addition, figure 8 plots the eigenvalues of the companion matrix. According to figure 8, shows how close the roots with modulus 0,95 are to the unit circle.

Figure 8: Eigenvalues of the companion matrix



4.2.4 Johansen Cointegration Analysis for the period between 1st of January 2001 and 31st of December 2006

This analysis examines the relationship between monetary policy and the S&P 500 returns for the period started from 1st of January 2001 and ended up to 31st of December 2006. This period was chosen to be analyzed since no major crisis had occurred. In this way, the existence of the effect of the monetary policy will be better presented.

4.2.4.1 Unit Root Test

The results from table 23 show that almost all the variables are non-stationary. More specific, according to the table 23, the non-stationary variables are the logarithm of S&P 500, the logarithm of M_3, CPI and the logarithm of RBEXR. That is, these variables contain a unit root. This result is verified in both the Augmented – Dickey Fyller test and the Phillips – Perron test. In contrast, as it was expected, all the variables are stationary at their first differences. Following, it will be presented a cointegration analysis, since there are non-stationary variables to examine whether these have long run relationship.

Table 23: Unit Root tests

	Augmented Dickey - Fuller (ADF)		Phillips - Perron (PP)	
Variables	Levels (t - statistic)	First Differences (t - statistic)	Levels (t - statistic)	First Differences (t - statistic)
sp500	−2.097	−8.096***	−2,084	−8.088***
M3	−3.120	−8.049***	−3.078	−8.095***
CPI	−1.958	−5.615***	−2.226	−5.426***
RBEXR	−2.581	−6.273***	−2.784	−6.175***
TB	−5.169***	−4.870***	−4.451***	−4.794***

Notes: The above table shows the unit root test for the variables of the econometric model. The period of the analysis starts from the 1st of January 2001 and ends until 31st of December 2006. These tests are the Augmented – Dickey Fuller test and the Phillips – Perron test. The null hypothesis of these tests is that the variables are non-stationary. * indicates rejection of the null at 10% significance level ** indicates rejection of the null at 5% significance level and *** indicates rejection of the null at 1% significance level. The variable sp500, the variable $M_3$and the variable RBEXR are in logarithm form

4.2.4.2 Optimal Lag selection

For this analysis the SBIC would be used in order to identify the optimal lag selection. Table 24 presents the optimal lag. According to table 24, the optimal lag is one.

Table 24: Optimal Lag Selection

lags	LL	LR	FPE	AIC	HQIC	SBIC
0	288.916		4.8E-09	−7.80322	−7.70251	−7.55025
1	667.631	757.43	2.0E-13	−17.8786	−17.5765	−17.1198*
2	697.580	59.897	1.4E-13	−18.2661*	−17.7626*	−17.0013
3	708.872	22.584	1.6E-13	−18.1353	−17.4304	−16.3646
4	722.381	27.019*	1.7E-13	−18.0661	−17.1598	−15.7895
5	733.309	21.855	2.1E-13	−17.9252	−16.8175	−15.1426
6	744.474	22.330	2.5E-13	−17.7909	−16.4818	−14.5024

Notes: This table shows the optimal lag selection for the VECM Model. The period is between 1st of January 2001 and 31st of December 2006. The endogenous variables are the logarithm of the S&P 500, the logarithm of the M_3, the CPI and the logarithm of the RBEXR, while the exogenous variable is the T-bill. The selection of the optimal lag was based on the Schwarz's Bayesian Information Criterion

4.2.4.3 Cointegrating Rank

Following, the next step of the cointegration analysis is to identify the cointegration vectors between the logarithm of S&P 500, the logarithm of M_3, CPI and the logarithm of RBEXR. In addition, in the regression the intercept and the trend are included. The null hypothesis indicates that there is no cointegrating rank, that is, there is no long run relationship between the endogenous variables. The results of the cointegrating rank test of trace statistic are presented in table 25 below. According to table 25, the optimal rank that must be included in the VECM is one (1)

Table 25: Cointegrating Rank for VECM

Hypothesized No. of Ces	Eigenvalue	Trace Statistic	5% Critical Value
None		45.1173	54.64
At most 1	0.22310	26.9413*	34.55
At most 2	0.18165	12.5075	18.17
At most 3	0.10453	4.5583	3.74
At most 4	0.06135		

Notes: This table shows the estimation of the optimal ranks that must be included in the VECM Model. The optimal rank based on this test is one. The endogenous variables are the logarithm of S&P 500, the logarithm of M_3, the CPI and the logarithm of RBEXR, while the exogenous variable is the T – Bill. The period of the analysis is between 1st of January 2001 and 31st of December 2006

4.2.4.4 Vector Error Correction Model

Table 26 shows the results of the VECM Model. These results present the short run effect of the independent variables to the S&P 500 returns. The period of the analysis started from the 1st of January 2001 and ended up to 31st of December 2006. According to the results, there is one cointegrating equation. For the first equation, the coefficient has a negative sign. Specifically, the value of the adjustment coefficient is -0,0013. This implies that there was a −0,13% adjust occurs in the previous period to the equilibrium. For this period the sign of the e adjustment coefficient is negative, which shows that there is converge towards the long run equilibrium and as a result the VECM model is well specified. However, the adjustment coefficient is not statistically significant at any significant level.

The short run impact of the T – bill and the trend on the S&P 500 returns for this period is presented in table 26. According to table 26 the T – Bill variable does not have any short run relationship with the dependent variable. Specifically, the T - Bill variable has a negative effect on the S&P 500 returns in the short run, however, it is not statistically significant at any significant level. Specifically, with the other variables constant, on average a 1% increase in the T – Bill, this would decrease the returns by 0,44% in the short run. This is not statistically significant at 1%, at 5% and 10% significant levels. Moreover, in the regression, linear trend is included, according to the results of table 12, there is a positive impact of the linear trend on the S&P 500 returns. This effect is statistically significant at 5% and 10% significant level. As mentioned before, according to equation 3 the variables in the VECM are expressed in t – 1. In this analysis, the optimal lag is one, then t represents the number of lags. Since the lag is one, then when it subtracted with 1, the remaining lag is zero (0). For this reason, in the regression are only the T – bill and the trend.

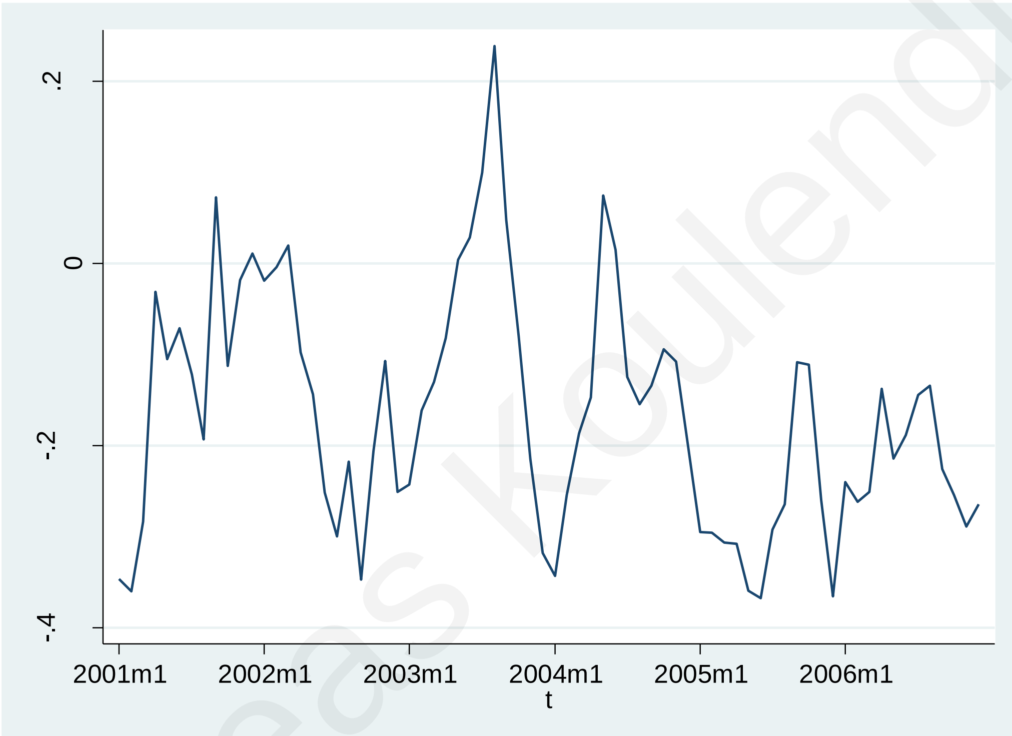
Table 26: Short run effects of explanatory variables on the S&P 500 returns

Variables	Coeffient	p - value
CointEq(1)	−0.0013344 (0.0377)	0.972
TB	−0.0044621 (0.0038)	0.249
Trend	0.0005737 (0.0002)**	0.019
Constant	−0.0088324 (0.0038)	0.429

*Notes: This table presents the short run effects of the explanatory variables on the S&P 500 returns. The CointEq denotes the cointegration equations. The optimal lag is one and the optimal rank is one. In addition, in the VECM model, linear trend is included. *denotes statistical significance at 10% significance level, ** denotes statistical significance at 5% significance level and *** denotes statistical significance at 1% significance level. The endogenous variables are the logarithm of S&P 500, the logarithm of M_3, the CPI and the logarithm of RBEXR, while the exogenous variable is the T – Bill. The period of the analysis is between 1st of January 2001 and 31st of December 2006*

Figure 9 shows the results of the first cointegrating equation in a visual way. As we can see from figure 9, the predicting cointegrating equation shows stationarity. That is, there is no pattern that can help to predict the relationship in the series. The positive trend shows that the gap is increasing. However, as mentioned above, the effect of the linear trend is statistically significant at 5% and 10% significant levels.

Figure 9: Predicted Cointegrated Equation



Notes: This figure shows the predicted cointegrated equation in a visual way. The period started from the 1st of January 2001 and ended up to 31st of December 2006

Table 27 shows the long run relationship between the non-stationary variables with the S&P 500 returns. According to the results of table 27, the first cointegration equation shows that the CPI has a positive effect on the S&P 500 Index. Specifically, a 1% increase in the prices, then the returns will increase by 16,2% on average in the long run. This is statistically significant at 5% and 10% significant levels. In addition, the M_3 variable has a positive impact on the returns both in the short run and the long run. Specifically, with the other variables constant, a 1 dollar increase in the money supply, this will increase the S&P 500 returns by 19,78% on average in the long run. According to table 27, this effect is statistically significant at all the significant levels. In contrast the logarithm of RBEXR does not affect the S&P 500 returns in the long run. The impact of logarithm of RBEXR variable is positive, however it is not statistically significant. Finally, the linear trend seems to have an adverse effect. Specifically, in the short run, the linear trend has a positive impact. In contrast, according to the results of table 27, in the long run, negatively affects the returns.

Table 27: Long run impact of non stationary variables on the S&P 500 returns

	Coefficient	**p - value**
CointEq(1)		
lnsp500	1	
lnM3	19.78656 (6.2247)***	0.001
CPI	0.1626545 (0.0796)**	0.041
lnRBEXR	−0.6394873 (1.4172)	0.652
Trend	−0.1218816	
Constant	−96.05655	

Notes: This table shows the long run effects of the non stationary variables on the S&P 500 returns. The CointEq denotes the cointegration equations. In the regression, a linear trend is included. The endogenous variables are the logarithm of S&P 500, the logarithm of M_3, the CPI and the logarithm of RBEXR, while the exogenous variable is the T – Bill. The period is between 1st of January 2001 and 31st of December 2006. The optimal las is one and the optimal rank is one. *denotes statistically significance at 10% significance level, ** denotes statistically significance at 5% significance level and *** denotes statistically significance at 1% significance level

4.2.4.5 Robustness test

Table 28 shows the results from the stability test. The results show that there are three (3) moduli. Since, in the VECM Model there are four (4) endogenous variables, while there is one cointegration equation. Furthermore, the results from table 28 show the eigenvalues of the companion matrix and the associated moduli. According to the results of table 28, there are three roots which are equal to one (1). The results show that most probably the cointegration equations are stationary since the moduli are lower than one.

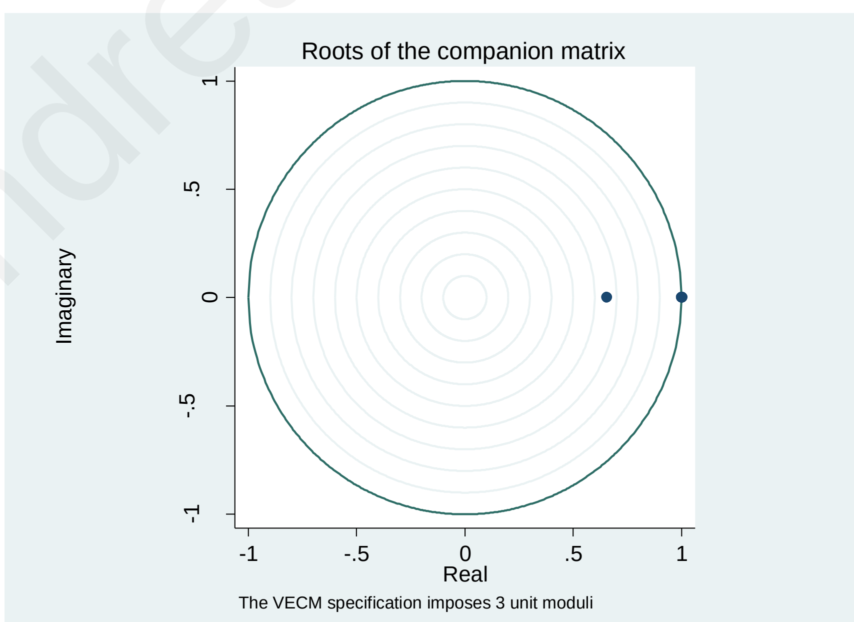
Table 28: Stability test

Eigenvalues	Modulus
1	1
1	1
1	1
0.6562904	0.65629

Notes: This table shows the stability test of the VECM model. The period started from the 1st of January 2001 and ended up to 31st of December 2006. There are three modulis since the endogenous variables are four and there is one cointegrating equation

Figure 10 shows the results of table 28 in a visual way. In addition, figure 10 plots the eigenvalues of the companion matrix. According to figure 10, all the eigenvalues are in the unit circle. That is the cointegrating equation is stationary.

Figure 10: Eigenvalues of the companion matrix



4.2.5 Johansen Cointegration Analysis for the period between 1st of January 2012 and 31st of December 2019

This period has been chosen with the aim of presenting the effect of monetary policy on the prices of the S&P 500 Index, since in this period no important event occurred which would affect the economy. This period begins after the great financial crisis of 2007 and ends the period before the Covid 19 pandemic starts. In this way, this effect can be better presented since there was no other important event in the economy.

4.2.5.1 Unit Root Test

The results from table 29 show that all the variables are non-stationary. More specific, according to the table 29, the non-stationary variables are the logarithm of S&P 500, the logarithm of M_3, the CPI, the logarithm of RBEXR and the T - bill. Compared to the other periods that were being analyzed, for this period the T – bill is non stationary. This result is verified in both the Augmented – Dickey Fyller test and the Phillips – Perron test. In contrast, as it was expected, all the variables are stationary at their first differences. Following, it will be presented a cointegration analysis, since there are non-stationary variables to examine whether these have long run relationship with the S&P 500 returns.

Table 29: Unit root tests

Augmented Dickey - Fuller (ADF)			Phillips - Perron (PP)	
Variables	Levels (t - statistic)	First Differences (t - statistic)	Levels (t - statistic)	First Differences (t - statistic)
sp500	−3.373	−12.031***	−3.229	−12.391***
M3	−1.886	−9.038***	−1.930	−9.108***
CPI	−1.638	−5.795***	−2.161	−5.768***
RBEXR	−1.237	−6.585***	−1.627	−6.489***
TB	−1.077	−5.013***	−1.384	−4.908***

Notes: The above table shows the unit root test for the variables of the econometric model. The period of the analysis starts from the 1st of January 2012 and ends up to 31st of December 2019. These tests are the Augmented – Dickey Fuller test and the Phillips – Perron test. The null hypothesis of these tests is that the variables are non-stationary. For this period all the variables are non stationary. * indicates rejection of the null at 10% significance level ** indicates rejection of the null at 5% significance level and *** indicates rejection of the null at 1% significance level. The variable sp500, the variable M_3 and the variable RBEXR are in logarithm form

4.2.5.2 Optimal lag selection

For the identification of the optimal lag selection in this analysis, the SBIC would be used. Table 30 presents the optimal lag. According to table 30, the optimal lag is one.

Table 30: Optimal Lag Selection

lags	LL	LR	FPE	AIC	HQIC	SBIC
0	285.991		2.0E-09	−5.85398	−5.79999	−5.72042
1	1110.35	1648.7	1.2E-16	−22.5074	−22.1835	−21.706*
2	1165.81	110.91	6.2E-17	−23.1419*	−22.548*	−21.6727
3	1181.09	30.55	7.6E-17	−22.9393	−22.0755	−20.8023
4	1199.91	37.646	8.8E-17	−22.8106	−21.6769	−20.0058
5	1220.65	41.478*	1.0E-16	−22.7218	−21.3182	−19.2493
6	1238.76	36.226	1.2E-16	−22.5783	−20.9047	−18.438

Notes: This table shows the optimal lag selection for the VECM Model. The period is between 1st of January 2012 and 31st of December 2019. The endogenous variables are the logarithm of the S&P 500, the logarithm of the M_3, the CPI, the logarithm of RBEXR and the T - bill. The selection of the optimal lag was based on the Schwarz's Bayesian Information Criterion

4.2.5.3 Cointegrating Rank

The next step of the cointegration analysis is to identify the cointegration vectors between the logarithm of S&P 500, the logarithm of M_3, CPI, the logarithm of RBEXR and the T - bill. In addition, in the regression the intercept and the trend are included. The null hypothesis indicates that there is no cointegrating rank, that is, there is no long run relationship between the endogenous variables. The results of the cointegrating rank test of trace statistic are presented in table 31 below. According to the results of table 31, the null hypothesis of non-cointegrating variables is rejected. The optimal rank that must be included in the VECM is one (1).

Table 31: Cointegrating Rank for VECM

Hypothesized No. of Ces	Eigenvalue	Trace Statistic	5% Critical Value
None		96.1068	77.74
At most 1	0.35261	54.3658*	54.64
At most 2	0.22184	30.2865	34.55
At most 3	0.13640	16.2087	18.17
At most 4	0.11944	3.9976	3.74
At most 5	0.04079		

Notes: This table shows the estimation of the optimal ranks that must be included in the VECM Model. The optimal rank based on this test is one. The endogenous variables are the logarithm of S&P 500, the logarithm of M_3, the CPI, the logarithm of RBEXR and the T – Bill. The period of the analysis is between 1st of January 2012 and 31st of December 2019

4.2.5.4 Vector Error Correction Model

Table 32 shows the results of the VECM Model. That is, it presents the short run effect of the explanatory variables to the S&P 500 returns. The period of the analysis started from the 1st of January 2012 until 31st of December 2019. According to the results, there is one cointegrating equation, since from the results of table 31, the optimal rank was one (1). For the first equation, the coefficient has a negative sign. Specifically, the value of the adjustment coefficient is -0,1111. This implies that there was a −11,11% adjust occurs in the previous period to the equilibrium. The negative sign of the adjustment coefficient shows that there is converge towards the long run equilibrium and as a result the VECM model is well specified. In addition, the adjustment coefficient is statistically significant at 5% and 10% significant level.

The short run impact of the trend on the S&P 500 returns for this period is shown in table 32. In the regression, linear trend is included and according to the results of table 32, there is a positive impact of the linear trend on the S&P 500 returns. This effect is not statistically significant at 1%, 5% and 10% significant level. The constant has negative impact on the returns in the short run. Specifically, with the other variables constant, if all the variables take value of zero, then on average the returns will decrease by 2,7% in the short run. This is statistically significant at all the significant levels. As mentioned before, according to equation 1, the variables in the VECM are expressed in t – 1. In this analysis, the optimal lag is one, then t represents the number of lags. For this reason, in the regression are only the trend since the optimal lag is one.

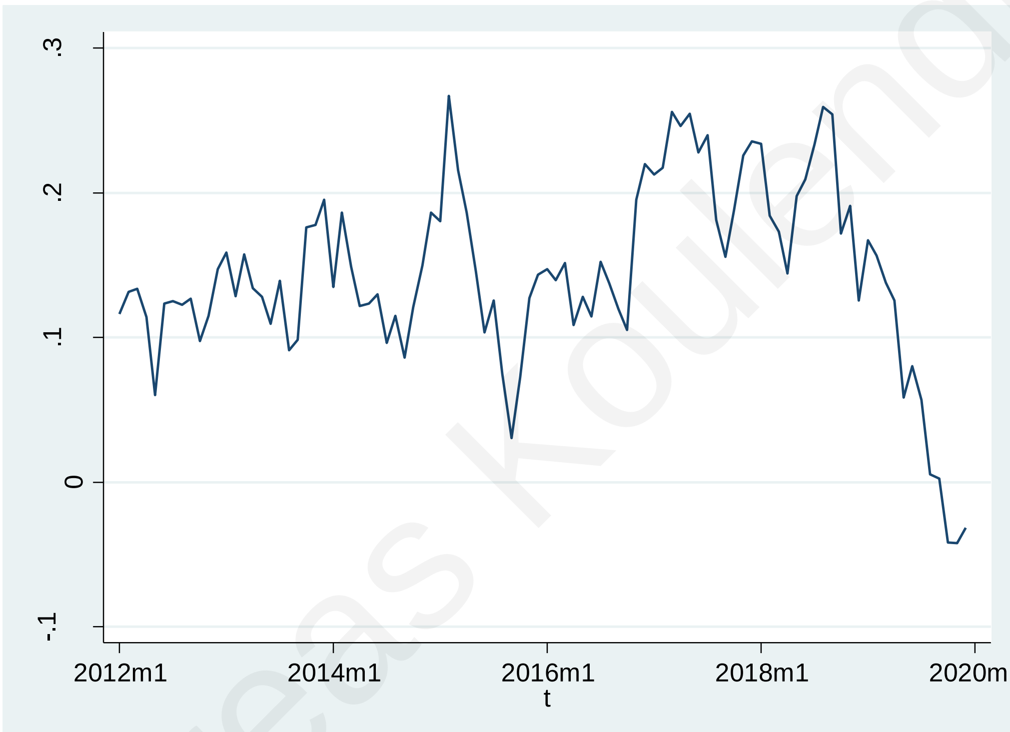
Table 32: Short run effects of trend on the S&P 500 returns

Variables	Coeffient	p - value
CointEq(1)	−0.1111553 (0.0519)**	0.032
Trend	0.0001 (0.0002)	0.839
Constant	−0.0270656 (0.0094)***	0.004

*Notes: This table presents the short run effects of the trend on the S&P 500 returns. The CointEq denotes the cointegration equations. The optimal lag is one and the optimal rank is one. In addition, in the VECM model, linear trend is included. The endogenous variables are the logarithm of S&P 500, the logarithm of M_3, the CPI, the logarithm of RBEXR and the T – Bill. The period of the analysis started from 1st of January 2012 and ended up to 31st of December 2019. *denotes statistically significance at 10% significance level, ** denotes statistically significance at 5% significance level and *** denotes statistically significance at 1% significance level*

Figure 11 shows the results of the first cointegrating equation in a visual way. As we can see from figure 11, the predicting cointegrating equation shows stationarity. That is, there is no pattern that can help to predict the relationship in the series. Furthermore, according to figure 11, the existence of linear trend in the predicting cointegrating equation is not obvious. The sign of the linear trend is positive and this shows that the gap is increasing, however, as mentioned above, the effect of the linear trend is not statistically significant at any significant levels.

Figure 11: Predicted Cointegrated Equation



Notes: This figure shows the predicted cointegrated equation in a visual way. The period started from the 1st of January 2012 and ended up to 31st of December 2019. It is clear that there is no trend

Table 33 shows the long run relationship between the non-stationary variables with the S&P 500 returns. The period of the analysis is between 1st of January 2012 and 31st of December 2019. According to the results of table 33, the first cointegration equation shows that the M_3 variable has a positive effect on the S&P 500 Index in the long run for this period. Specifically, a 1 dollar increase in the prices, then the returns will increase by 7.35% on average in the long run. This is statistically significant at 1%, 5% and 10% significant levels. In addition, the CPI variable in the long run has a negative impact on the returns. That is, with the other variables constant, a 1% increase in the prices, on average this decreased the S&P 500 returns by 2,9% on average in the long run. According to table 33, this effect is statistically significant at 5% and 10% significant levels since the p – value is lower than 5% and 10% significant levels. In contrast the RBEXR has a positive effect on the S&P 500 returns in the long run and it is statistically significant at all the significant levels. Moreover, as mentioned before, the T – bill for this period is non stationary, as a result it has a long run relationship with the S&P 500 returns. According to the results of table 33, the T – bill variable has a positive impact on the return in the long run. More specific, a 1% increase in the T – bill, this increased the returns by 26,9% in the long run and this is statistically significant at all the significant levels. Finally, the linear trend seems to have an adverse effect. According to the results of table 33, the linear trend has a positive impact. In contrast, in the long run, the linear trend negatively affects the returns.

Table 33: Long run impact of non stationary variables on the S&P 500 returns

	Coefficient	**p - value**
CointEq(1)		
lnsp500	1	
lnM3	7.351355 (1.2583)***	0.000
CPI	−0.0293856 (0.0138)**	0.034
lnRBEXR	1.189184 (0.2848)***	0.000
TB	0.2699653 (0.0302)***	0.000
Trend	−0.0487528	
Constant	−41.73783	

Notes: This table shows the long run effects of the non stationary variables on the S&P 500 returns. The CointEq denotes the cointegration equations. In the regression, a linear trend is included. The endogenous variables are the logarithm of S&P 500, the logarithm of M_3, the CPI, the logarithm of RBEXR, and the T – Bill. The period is between 1st of January 2012 and 31st of December 2019. The optimal lag is one and the optimal rank is one. *denotes statistically significance at 10% significance level, ** denotes statistically significance at 5% significance level and *** denotes statistically significance at 1% significance level

4.2.5.5 Robustness test

Table 34 shows the results from the stability test. The results show that there are four (4) moduli. Since, in the VECM Model there are five (5) endogenous variables, while there is one cointegration equation. Furthermore, the results from table 34 show the eigenvalues of the companion matrix and the associated moduli. According to the results of table 34, there are four roots which are equal to one (1). To summarize, the results show that the cointegration equations are stationary, since the moduli are lower than one. As a result, the cointegrating equation is stationary.

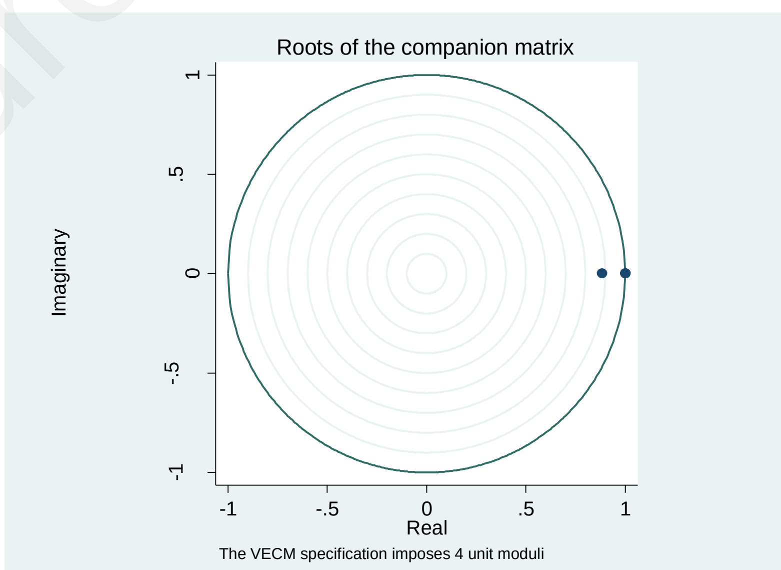
Table 34: Stability test

Eigenvalues	Modulus
1	1
1	1
1	1
1	1
0.8824763	0.882476

Notes: This table shows the stability test of the VECM model. The period started from the 1st of January 2012 and ended up to 31st of December 2019. There are four modulis since the endogenous variables are five and there is one cointegrating equation

Figure 12 shows the results of table 34 in a visual way. The information is the same as in table 34. Moreover, figure 12 plots the eigenvalues of the companion matrix. According to the results of figure 12, all the eigenvalues are in the unit circle. As a result, the cointegrating equation is stationary.

Figure 12: Eigenvalues of the companion matrix



4.2.6 Johansen Cointegrating Analysis for the period between 1st of January 2020 and 31st of December 2022

The last period that is going to be analyzed started from 1st of January 2020 until 31st of December 2022. In this period there was a pandemic. Covid 19 pandemic affected the financial sector as well as the economy as a whole. For this reason, the period was chosen to be analyzed, with the aim of presenting the impact of monetary policy on the equity market returns and the corresponding share of Covid 19 pandemic in this outcome.

4.2.6.1 Unit Root Test

The results from table 35 show that almost all the variables are non-stationary. More specific, the non-stationary variables are the logarithm of S&P 500, the logarithm of M_3, the CPI, the logarithm of RBEXR and the T - bill. That is, these variables contain a unit root. However, the only stationary variable is the PR. This result is verified in both the Augmented – Dickey Fyller test and the Phillips – Perron test. In contrast, for this period, there is a variable that is non stationary in the first differences. Specifically, according to the results of table 35, the only non stationary variable in the first differences is the CPI based on the ADF. In contrast, based on PP, the non stationary variables in the first differences are the CPI and the logarithm of RBEXR. Following, cointegration analysis will be implemented, since there are non-stationary variables to examine whether these have long run relationship with the S&P 500 returns.

Table 35: Unit root tests

Augmented Dickey - Fuller (ADF)			Phillips - Perron (PP)	
Variables	Levels	First Differences	Levels	First Differences
sp500	−1.284	−6.510***	−1.146	−6.616***
M3	−0.933	−3.289*	−0.990	−3.202*
CPI	−2.140	−2.745	−2.129	−2.665
RBEXR	−1.187	−3.172*	−1.482	−3.085
TB	0.020	−5.115***	0.007	−5.069***
PR	−3.837**	−5.757***	−3.691**	−6.230***

Notes: The above table shows the unit root test for the variables of the econometric model. The period of the analysis starts from the 1st of January 2020 and ends up to 31st of December 2022. These tests are the Augmented – Dickey Fuller test and the Phillips – Perron test. The null hypothesis of these tests is that the variables are non-stationary. For this period all the variables are non stationary. * indicates rejection of the null at 10% significance level ** indicates rejection of the null at 5% significance level and *** indicates rejection of the null at 1% significance level. The variable sp500, the variable $M_3$and the variable RBEXR are in logarithm form

4.2.6.2 Optimal lag selection

The selection of the optimal lag in this analysis was based on the SBIC. Table 36 presents the optimal lag. According to table 36, the optimal lag is one.

Table 36: Optimal Lag Selection

lags	LL	LR	FPE	AIC	HQIC	SBIC
0	49.4849		7.7E-08	−2.1936	−2.04008	−1.75374
1	306.172	513.37	2.0E-13	−15.0651	−14.5278	−13.5256*
2	346.116	79.889	9.8E-14	−15.8953	−14.9742	−13.2562
3	381.502	70.771	7.3E-14	−16.4723	−15.1673	−12.7334
4	440.01	117.02*	2.0E-14	−18.3339*	−16.6451*	−13.4954

Notes: This table shows the optimal lag selection for the VECM Model. The period is between 1st of January 2020 and 31st of December 2022. The endogenous variables are the logarithm of the S&P 500, the logarithm of the M_3, the CPI, the logarithm of RBEXR and the T - bill. The exogenous variable is the PR. The selection of the optimal lag was based on the Schwarz's Bayesian Information Criterion

4.2.6.3 Cointegrating Rank

The next step of the cointegration analysis is to identify the cointegration vectors between the logarithm of the S&P 500, the logarithm of M_3, the CPI, the logarithm of the RBEXR, the T – bill and the PR. In addition, in the regression the intercept and the trend are included. The null hypothesis indicates that there is no cointegrating rank. The results of the cointegrating rank test of trace statistic are presented in table 37 below. According to the results of table 37, the null hypothesis of non-cointegrating variables is not rejected. This implies that there is not cointegrating equation, that is, there ιs no long run relationship between the non stationary variables and the S&P 500 returns. However, as mentioned before, in the VECM Model it will be used one cointegrating vector, for better presentation of the impact of monetary policy on the stock market returns.

Table 37: Cointegrating Rank for VECM

Hypothesized No. of Ces	Eigenvalue	Trace Statistic	5% Critical Value
None		131.0801	77.74
At most 1	0.76653	78.7115	54.64
At most 2	0.65573	40.3241	34.55
At most 3	0.42008	20.7091	18.17
At most 4	0.29191	8.2823	3.74
At most 5	0.20552		

Notes: This table shows the estimation of the optimal ranks that must be included in the VECM Model. The optimal rank based on this test is one. The endogenous variables are the logarithm of S&P 500, the logarithm of M_3, the CPI, the logarithm of RBEXR, and the T – Bill. The exogenous variable is the PR. The period of the analysis is between 1st of January 2020 and 31st of December 2022

4.2.6.4 Vector Error Correction Model

Table 38 shows the results of the VECM Model. It presents the short run effect of the explanatory variables to the S&P 500 returns. The period of the analysis started from the 1st of January of 2020 and ended up to 31st of December of 2022. According to the results, there is one cointegrating equation. For the first equation, the coefficient has a negative sign. Specifically, the value of the adjustment coefficient is -0,1725. This implies that there was a −17,25% adjust occurs in the previous period to the equilibrium. The negative sign of the adjustment coefficient shows that there is converge towards the long run equilibrium and as a result the VECM model is well specified. In addition, the adjustment coefficient is statistically significant at 1%, 5% and 10% significant level.

The PR of Covid 19, that is the number of positive diagnostics tests during a day divided by the total number of diagnostics tests which performed in that specific day has a negative impact on the S&P 500 returns in the short run. This result may be expected, since as the positive rate increases, this may cause higher uncertainty in the financial sector. Specifically, as the positive rater presented upward trend, this forced the government to impose stricter policies such as workplace closures, restrictions on the internal movements and other decisions in order to manage and decrease the spread of the Covid 19 pandemic. More specific, with the other variables constant, a 1% increase in the positive rate, on average will decrease the stock market returns by 0,38% in the short run. This is statistically significant only at 10% significant level.

The impact of the linear trend on the S&P 500 returns for this period is shown in table 38. In the regression, linear trend is included, according to the results of table 38, there is a negative impact of the linear trend on the S&P 500 returns. This effect is statistically significant at 1%, 5% and 10% significant level. Finally, the intercept has a positive and statistically significant impact on the returns in the short run. As mentioned before, according to equation 1, the variables in the VECM are expressed in $t - 1$. In this analysis, the optimal lag is one. As mentioned before, the t represents the number of lags in the model. For this reason, in regression there is only the trend since the optimal lag is one.

Table 38: Short run effects of trend on the S&P 500 returns

Variables	Coeffient	p - value
CointEq(1)	−0.1725371 (0.0625)***	0.006
PR	−0.3849144 (0.2167)*	0.076
Trend	−0.0074103 (0.0025)***	0.004
Constant	0.12538 (0.0455)	0.006

*Notes: This table presents the short run effects of the positive rate and the trend on the S&P 500 returns. The CointEq denotes the cointegration equations. The optimal lag is one and the optimal rank is one. In addition, in the VECM model, linear trend is included. The endogenous variables are the logarithm of S&P 500, the logarithm of M_3, the CPI, the logarithm of RBEXR, and the T – Bill. The exogenous variable is the PR. The period of the analysis started from 1st of January 2020 and ended up to 31st of December 2022. *denotes statistically significance at 10% significance level, ** denotes statistically significance at 5% significance level and *** denotes statistically significance at 1% significance level*

Figure 13 shows the results of the first cointegrating equation in a visual way. As we can see, the predicting cointegrating equation shows stationarity. That is, there is no pattern that can help to predict the relationship in the series. Furthermore, is obvious the existence of negative trend in the predicting cointegrating equation. The sign of the linear trend is negative which shows that the gap is shrinking. As mentioned above, the effect of the linear trend is statistically significant at all the significant levels.

Figure 13: Predicted Cointegrated Equation

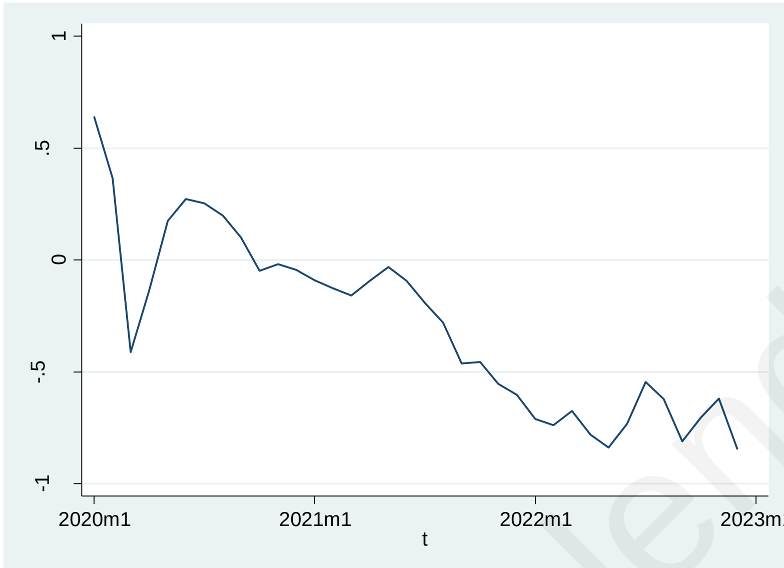


Table 39 shows the long run relationship between the non-stationary variables with the S&P 500 returns. The period of the analysis started from the 1st of January 2020 and ended up to 31st of December 2022. According to the results of table 39, the first cointegration equation shows that the M_3 variable has a positive and statistically significant impact on the S&P 500 Index in the long run. Specifically, a 1 dollar increase in the money supply, then the returns will be increased by 9,76% on average in the long run. This is statistically significant at 1%, 5% and 10% significant levels. In addition, the CPI variable in the long run has a positive effect on the returns. That is, with the other variables constant, a 1% increase in the prices, on average this increased the S&P 500 returns by 12,07% on average in the long run. According to table 39, this effect is statistically significant at all the significant levels since the p – value is lower than 1%, 5% and 10% significant levels.

In contrast the RBEXR has a negative effect on the S&P 500 returns in the long run and it is statistically significant at all the significant levels. Moreover, the T – bill for this period has a long run relationship with the S&P 500 returns. According to the results of table 39, the T – bill variable has a positive impact on the return in the long run and a 1% increase in the T – bill, will increase the returns by 48,8% in the long run. This is statistically significant at all the significant levels. Finally, the linear trend seems to have the same effect as in the short run. According to the results of table 38, in the short run, the linear trend has a positive impact, which seems to pass the short run impact to the long run.

Table 39: Long run impact of non stationary variables on the S&P 500 returns

	Coefficient	**p - value**
CointEq(1)		
lnsp500	1	
lnM3	9.76527 (1.3891)***	0.000
CPI	0.1207939 (0.0243)***	0.000
lnRBEXR	−3.201159 (0.7507)***	0.000
TB	0.4888775 (0.0544)***	0.000
Trend	−0.2243011	
Constant	−53.80395	

Notes: This table shows the long run effects of the non stationary variables on the S&P 500 returns. The CointEq denotes the cointegration equations. In the regression, a linear trend is included. The endogenous variables are the logarithm of S&P 500, the logarithm of M_3, the CPI, the logarithm of RBEXR, and the T – Bill. The exogenous variable is the PR. The period is between 1st of January 2020 and 31st of December 2022. The optimal lag is one and the optimal rank is one. *denotes statistically significance at 10% significance level, ** denotes statistically significance at 5% significance level and *** denotes statistically significance at 1% significance level

4.2.6.5 Robustness test

Table 40 shows the results corresponding to the stability test. The results show that there are four (4) moduli. Since, in the VECM Model there are five (5) endogenous variables and there is one cointegration equation. Furthermore, the results from table 40 show the eigenvalues of the companion matrix and the associated moduli. According to the results of table 40, there are four roots which are equal to one (1). The results show that the cointegration equations are stationary since the moduli are lower than one.

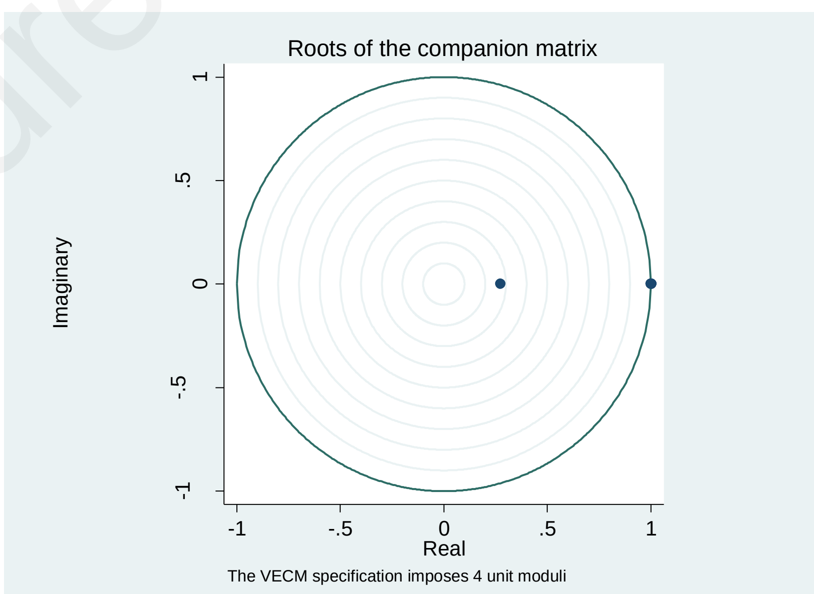
Table 40: Stability test

Eigenvalues	Modulus
1	1
1	1
1	1
1	1
0.2729461	0.272946

Notes: This table shows the stability test of the VECM model. The period started from the 1st of January 2020 and ended up to 31st of December 2022. There are four modulis since the endogenous variables are five and there is one cointegrating equation

Figure 14 shows the results of table 40 in a visual way. The information is the same as in table 40. Moreover, figure 14 plots the eigenvalues of the companion matrix. According to the results of figure 14, all the eigenvalues are in the unit circle. As a result, the cointegrating equation is stationary.

Figure 14: Eigenvalues of the companion matrix



5 Discussion

5.1 Conclusion

This research examined the impact of monetary policy on the stock market returns in the USA for the period starting from 1st of January 1980 and ending up to 31st of December 2022. Combined with the effects of Covid 19 pandemic on the S&P500 Index. The existence of such a relationship has crucial and important implications both for the Central Bank and for the stock market. Specifically, for the Central Bank, this is important in the case of whether the monetary policy actions are transmitted through the financial sector. Moreover, in the case of the stock market, the existence of such a relationship is related to stock price determination and to portfolio management.

To examine the effects of monetary policy and the share of responsibility of changes in the stock market return, monthly time series data were used. The period of the analysis started from the 1st of January 1980 and ended up to 31st of December 2022. The sources of the data were from the Federal Reserve Bank of St. Louis, the Trading Economics. Also, from the OECD and the Our World in Data.

The estimation of the relationship between monetary policy and the stock market returns was based on the VECM Model and was formulated by having four (4) explanatory variables, as well as the dependent variable was the logarithm S&P 500 returns. For the robustness test and the validity of the results, a stability test was performed in order to examine the eigenvalue stability condition of the VECM Model. Furthermore, the stability test shows whether the cointegrating equation is stationary, that is, it tests the cointegration equation misspecification.

The econometric results from the VECM Model showed that the original model was not stationary for the period between the 1st of January 1980 and 31st of December 2022, since in this period major crises and unexpected events happened. For this reason, the aforementioned period was divided into subperiods. Specifically, in these subperiods did not happen any significant crisis or event. In this way the net effect of the monetary policy on the S&P 500 returns were presented.

In each sub-period the effect of monetary policy was presented. The results showed that the T – bill variable in the short run had a negative impact on the S&P 500 Index, however, in the long run had an adverse effect, that is, the T – bill variable positively affected the returns.

Moreover, the M_3 variable in the long run had a positive and statistically significant impact on the S&P 500 returns and this is verified from the theory.

The final subperiod which was analyzed referred to the Covid 19 pandemic. In this way the effect of the Covid 19 pandemic was presented. The PR variable selected to stand for this effect of the pandemic. According to the results, the PR variable showed a negative and statistically significant impact on the S&P 500 returns. Specifically, a 1% increase in the PR during the period between 1st of January 2020 and 31st of December 2022, on average decreased the S&P 500 returns by 0,38%. The stability test showed that most of the subperiods the cointegrating equations were stationary, that is they were well specified.

Finally, prior studies have shown that the Covid 19 pandemic had a negative effect on the financial markets. This forced the governments and the policy makers to take some important policies in order to prevent a financial crisis. In addition, monetary policy is important in determining the stock market price and the stock market are crucial sources of information in conducting the monetary policy by the policy makers. Although the effect of monetary policy on stock prices is statistically significant, the Covid 19 pandemic nevertheless led to a larger decline in the S&P500 Index in the USA.

In this study there are limitations which influence the statistical significance of the results. Specifically, this version of the Stata which used to estimate the impact of the monetary policy on the S&P 500 returns, provided limited commands which could be performed in this way to better present this effect. Such command is the irf which presents impulse response functions, dynamic multiplier functions and forecast error variance decomposition (Stata, 2022a). In addition, the data was monthly, and this may be a disadvantage, since when use prices and returns, the usage of monthly data in such a case decreases the variation of the data. As a result, important information of the variables that would estimate the relationship between the monetary policy and the S&P 500 Index is reduced.

Furthermore, limitation is this thesis was the two cointegrating ranks which were used in the first cointegrating Analysis. Specifically, made it difficult to assess the impact of monetary policy on the equity market returns.

5.2 Future Plans / Perspectives

Further research can be conducted to improve this study by incorporated in the model some key variables like the Oil price which is negatively associated with the stock prices. Specifically, as the oil price decreases, this implies that the transportation cost declines. As the logistic costs decrease the final price of the oil this increases the demand for this good. This in turn increases the stock price. Furthermore, the FOMC plays an important role in determining stock market prices. More specific, the number of the FOMC press conference may play a crucial role in the S&P 500 Index performance. According to recent studies, during six FOMC press conference in the previous years, led to the S&P 500 Index to gain or to lost 1% or $300 billion in value (Narain and Sangani, 2023).

In addition, as mentioned above, the daily data is a good choice for the usage in such research since it includes large amount of the variation of the variables. As a result, it gives enough information. Moreover, for further study can be used quarterly data in order to include in the model important variables such as the GDP. However, this variable is a macroeconomic variable and not a monetary policy variable. In addition, it is suggested that individual analysis for specific countries as well as for a group of countries in future studies. Finally, in such a research, it is better to use one cointegrating rank, that is one cointegration equation, since this impact of monetary policy on the equity market returns is presented more distinctly.

The financial sector is a sensitive area which wants continuous supervision and observation since changes in the factors that affect the financial markets and more generally the financial sector could have a significant impact on the economy. The policymakers must monitor the economy and be able to make quick and effective decisions to prevent negative effects.

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