The effects of Monetary Policy on Stock Market Returns

A study of how the actions of the Federal Reserve affect the returns on the American stock market.

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Abstract
I estimate the interaction between returns on the US stock market (Standard & Poor’s 500 and Dow Jones Industrial Average), US monetary policy and the Investor Sentiment using a structural vector autoregressive (VAR) methodology. The different measures of a monetary policy are the rate change (which has been separated into a expected change and a unexpected change) and the growth rate of money supply (M2). I find that, on average, there is a significant relationship between an expected change in the fed fund target rate and stock market returns. The full sample consists of observations spanning from January 2000 to November 2014.
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1. Introduction

1.1. Background
When thinking about monetary policy one might assume that the main objective for the central bank is to use their tools and instruments to maintain stable prices and a stable inflation. One might also think that they always will focus on the inflation. But for the last 20 years the central banks have successfully been bringing the inflation under control. This can be seen in graph I, it is quite obvious from the shape of the two lines that inflation was more volatile in the period before 1982 (blue line) than in the period from 1982 to today (red line). In fact, the variance of the inflation was 14.32% in that period while it only is 2.26% in the period after. Even though it might be early to suggest that inflation no longer is a great issue, it is realistic to argue that the central banks next battle will lie on financial stability.

Monetary policy news affects the stock market. Regardless of the policy type, investors will react. The type of policy that is implemented and its size should determine the magnitude of the reaction. Macroeconomic variables give important information about the present and future state of the economy and thus, a change in some of these variables should therefore change the expectation about the future. A rational investor takes account for all relevant information when making a decision, and a change in monetary policy would thereby change the behaviour of the investor.

If someone keeps their wealth in public traded stocks and the value of those stocks increase or decrease, it would be logical to suggest that they would change their consumption today (a one-to-one relationship). This topic is therefore important to investigate and especially examine the link between monetary policy and financial stability. However, it is also questionable if inflation
is even worth striving for, but that question will not be addressed in this paper.

The recent increased worldwide volatility on the stock market (due to the financial crises that took place in 2007) has re-energized the interest in understanding the role of central bankers and if they can control, prevent or reduce the disruptive consequence of financial shocks on the economy. The standard deviation of YoY (year-on-year) return on Standard & Poor’s 500 index has increased from 11.30% (in the period 1985 to 1999) to 18.10% (in the period from 2000 to 2014). The stocks tend to be volatile because of changes macroeconomic variables, macroeconomics announcements and variables specific to the company. Bomfim (2001) states that anecdotal press accounts tend to confirm the common observation that daily volatility in asset prices is affected by macroeconomic announcement, such as changes in monetary policy. But the statistical significant link between volatility in stock prices and macroeconomic announcements has been elusive. Companies can be valued in different ways and the most common valuation models use discount rate to take account for future cash flows. The risk free rate is a part of this discount rate and what types of monetary policies that the central bank is implementing determines this rate.

This research is important because stocks can be a part of individuals wealth and thus if the values of stocks increases, so will the wealth of the individuals, resulting in a higher consumption and a greater GDP (Gross Domestic Product). This paper will investigate the link between monetary policy and returns on public traded assets, which is one of the most important financial markets. According to traditional theory changes in monetary policy is transmitted to the stock market via changes in the cost of capital and by other mechanism. In this paper I will use a quantitative method to examine the relationship between monetary policy and returns on public traded stocks in the US (United States). Panel data will be used on monetary policy and returns to estimate a vector auto regression. The results are quite surprising and will not always be consistent with previous studies. And since most of the previous studies have been done prior to the financial crisis in 2007, my results might show that the relationship have changed because of the financial crisis.
1.2. Purpose & research questions
The purpose of this essay is to examine how the actions of the central banks affects the returns on the stock market and if there is a lagged effect. I also want to study if the mind-set of the investors will affect the size of the reaction. The following research questions will be explored in this paper;

1. To what degree does changes in the interest rate affect returns on the stock market?
2. Is there a connection between the money supply and the returns on the stock market?

1.3. Boundaries
This paper will examine the effects on the US stock market, because the monetary policies of the Federal Reserve Bank will affect the entire world. So, if I examine the returns and monetary policy is Sweden it would probably be affected by the actions of the Federal Reserve. I will also narrow the research down to the last fourteen years and use monthly data instead of using all available data and daily returns. There are a lot of indexes in the US, but using all of them would take too much time. I will therefore only use Dow Jones Industrial Average and Standard & Poor’s 500 index for the analysis of the effects that monetary policies has on the stock market.

1.4. Literature
I have collected the necessary data about the monetary policy of the Federal Reserve Bank from their website. The data for the stock market volatility will be collected from Bloomberg. I am going to use books on macroeconomic theory and advanced econometrics. The articles will be obtained from Google’s Scholar where the articles will first be ranked after relevance and second after how many times they’ve been cited. By doing this I will be able to find the best articles suited for the topic. I will also use databases like EconLit to obtain the articles that are not available at Google’s scholar.

1.5 Structure
This paper is structured as follow. In the next chapter I will describe the theoretical background and the theoretical framework I use to examine the effects of monetary policy on the stock market, I will also include previous research in this section. Then I will go through the method used in this paper and descriptive statistics will be presented. In section four I will present the result of my study. Finally, in the last section of this paper I will draw some conclusions.

2. Theoretical approach

2.1 Monetary policy
Central banks are typically viewed as operating monetary policy through adjusting the interest rate in order to keep the economy close to its inflation target at the equilibrium level of output.
The central bank aims to minimize the cost of a shock to the economy in terms of higher inflation caused by the shock and the higher unemployment required to reduce it. They will change the interest rate so as to affect aggregate demand and guide the economy back toward target inflation and equilibrium unemployment (Carlin & Soskice. 2006, s.67). This behaviour of the central bank can be thought about in terms of a reaction function that the bank uses to respond to shocks to the economy and steer it toward an inflation target. There are two tasks of the reaction function, the first one is to provide a nominal anchor in terms of an inflation target, the second task is to provide guidance as to how the central bank’s policy instrument (the interest rate) should adjust in response to shocks to meet targets (Carlin & Soskice. 2006, s.131).

The central bank uses a set of tools and instruments to control the economy and included in this toolset is the interest rate. I will look at the central banks as an agent who sets the interest rate and adjust the money supply in order to maintain equilibrium at the money market. That is where demand for money equals supply of money. Traditional theory suggests that money demand is an inverse function of the interest rate (Carlin & Soskice. 2006, s.35). The higher the interest rate, the lower the demand for money.

When the central bank increases the interest rate they must decrease the money supply in order to maintain equilibrium. The Central Bank can change the supply of money by increasing or decreasing the monetary base, which is defined as the portion of the commercial bank’s reserves that are maintained in accounts with their central bank plus the total currency circulating in the public. They do so by participating in open market operations, such as buying or selling bonds. When increasing the money supply they buy bonds with new printed money, the increased demand for bond will increase the price for bonds thus reducing the interest rate (Carlin & Soskice. 2006, s.320). But ultimately, the money supply is determined by the behaviour of the private sector (households, firms and banks). The Monetary Base multiplier is the link between money supply and monetary base (Carlin & Soskice. 2006, s.270).

The monetary base should not be confused with the supply of money; it is only the base of which the supply of money comes from. The supply of money in an economy is given by the measures M0, M1, M2, and M3. The difference between these measures is what kind of assets that is included. M0 is the most liquid measure of money supply; it only includes cash or assets that quickly could be converted into currency. M3 is the broadest definition of money supply and includes the more illiquid assets and is used by economists to estimate the entire supply of money.
in an economy. In this paper I will use M2 as the money supply. M2 includes cash and assets that are highly liquid but not cash.

2.2 Interest rate as an econometric variable
The interest rate is a central part in economic theory. It is perhaps one of the most important macroeconomic variable when valuating an asset and making an investment decision (since it could be a part of the discount rate). The interest rate has an important role when pricing financial assets. An asset is often valued by discounting future cash flows with a required rate of return. The risk-free rate is a part of the required return (often calculated with the capital asset pricing model, CAPM), and a higher risk-free rate implies a higher required rate of return. The type of monetary policies that the central bank is implementing determines the risk-free rate. When discounting future cash flows we need future interest rates, and since we don’t know the exact interest rates we act on expected interest rates. Monetary policy can only have a significant impact on the incentive to invest in long-lived real asset if it affects expectations about future short-term interest rates. (Sörensen & Whitta-Jacobsen. 2010, s.466).

2.3 The correlation between interest rate and asset prices
The price of an asset, as stated above, is determined in part by the interest rate. The stock price is a function of different economic variables and the interest rate is one of them. The interest rate is exogenous in these functions and affects the price directly by changing the required rate of return and indirectly by its impact on the other macroeconomic variables and expectations. The most volatile component of aggregate demand is often private investment and it is highly correlated with total output. Asset price fluctuations is closely linked to fluctuations in output and movements in stock price tend to lead movements in output. By looking at data for most OECD (Organisation for Economic Co-operation and Development) countries we can see that an increase in economic activity is triggered by an increase in stock prices, whereas a significant drop in stock prices may be a signal of a future economic downturn. (Sörensen & Whitta-Jacobsen. 2010, s.389).

Consider the two following graph where the stock market and the interest rates have a positive correlation in inflationary periods and a negative correlation in deflationary periods.
Graph IIA shows the relationship between YoY (year-on-year) return in percent on the S&P500 index (blue line) and the yearly change on US the-year yields (in reversed scale, red line). In inflationary periods (1966-1978) the correlation between the two is negative (-0.34), so equities and bonds move in the opposite direction. The reverse is true for deflationary periods, as shown in graph IIB. The relationship is this period (1998-2014) displays a positive correlation (0.46) and equities and bonds move in the same direction.

2.4 Asset price
The possibility of going long (buying assets in hope of positive returns) or going short (borrowing assets and selling them in hope of being able to buy them back at a lower price) affects the market price of a share. When many investors trying to buy, going long, there is an increased demand, which bids up the price. When this kind of behaviour dominates there can be a so-called bull market where the rise market price may be unconnected with any fundamentals features of the profitability of companies. Alternately, if investors go short, prices can fall dramatically and a bear market may occur. Such behaviour may give rise to financial bubbles and since households wealth is held in form of shares in assets and that part of individuals consumption is determined by this wealth, these bubbles will have huge macroeconomic consequences if they burst.

2.5 Prior research
Rigobon and Sack (2004) examined the relationship between the interest rate and asset prices. The article is focused on short and long-term interest rate and to which degree they affect the stock market, more precisely how asset prices react to changes in monetary policy. But doing this is complex and I quote; “Estimating the relation between asset prices and monetary policy is complex by the endogeneity of policy decisions and the point that both interest rates and asset prices react to other variables”. Rigobon and Sack focuses on two main problems in estimating
the interaction between monetary policy and asset prices. The first problem lies within the endogeneity of the variables and the second problem is the existence of omitted variables. These two issues can be captured in the following, simplified, system of equations:

\[ \Delta i_t = \beta \Delta s_t + \gamma z_t + \epsilon_t \]
\[ \Delta s_t = \alpha \Delta i_t + z_t + \eta_t \]

where \( \Delta i_t \) is the change in the short-term interest rate, \( \Delta s_t \) is the change in asset price, \( \epsilon_t \) is the monetary policy shock, \( \eta_t \) is a shock to the asset price and \( z_t \) is a single variable for notational simplicity, but the result can easily be generalized to a case where \( z_t \) is a vector of variables. Although this model is a simplification of the relationship it has an advantage as it allows the interaction between the variables to be rather unrestricted. They are, in this paper, interested in the parameter \( (\alpha) \) that measures the impact of a change in the short-term interest rate on the change in asset price.

To estimate the change in asset prices to changes in monetary policy they use a technique called identification through heteroskedasticity. The sample runs from January 3, 1994 to November 26, 2001 and the data on stock indexes include Dow Jones Industrial Average, the S&P 500, the NASDAQ and the Wilshire 5000. Treasury yields with maturities of six month, one, two, five, ten and thirty years are used for the longer-term interest rates. The short-term interest rate used in the analysis is the rate on the nearest eurodollar futures contract to expire, which is based on the three-month eurodollar deposit rate at the time the contract expires. The advantage of using this rate is that it only moves to the extent that there is a surprise. They found out that increases in short-term interest rate have a negative effect on stock prices. The estimated parameter \( (\alpha) \) for the S&P 500 is -6.8, suggesting that an unexpected 25-basis point increase in the short-term interest rate leads to a 1.7% decline in the S&P index. The highest parameter observed is for the Nasdaq index (-9.42), perhaps because the cash flows on those stocks are farther in the future, making them more sensitive to changes in the discount factor and the smallest parameter is that estimated for the Dow Jones Industrial Average (-4.85).

Previous studies have shown that private sector decision-making is influenced by monetary policies. Björnland and Leitemo (2009) states that if prices are not fully flexible in the short run the central bank can temporarily influence the real interest rate and therefore have an effect on real output in addition to nominal prices. It is commonly know, and also stated in the first section
of this chapter that the central banks objective is to keep a low and stable inflation close to the natural rate and to keep a production level (and thus employment level) close to the natural level. In order to fulfil these objectives the central bank controls and adjusts the interest rate appropriately to respond to and influence private sector decision-making. It is quite obvious that that the central bank and the private sector mutually affect each other as described by Rigobon and Sack (2004). Björnland and Leitemo (2009) aims to explore how important the link between monetary policy and financial markets really is.

In this paper they are using monthly data from January 1983 to December 2002 on the annual change in the log of consumer prices, the annual change in the log of the commodity price index in US dollars, the Federal Funds Target Rate, and the log of the S&P 500 stock price index. The stock prices are deflated by CPI (consumer price index) so that they get it in real terms and then differenced to denote monthly changes. The stock prices and the Federal Funds Target Rate are observed daily but averaged monthly to reflect the same information content as the other monthly variables. The econometric analysis is made using a VAR consisting of four lags. They find that there is a considerable synchronised interaction between the interest rate setting and shocks to real stock prices in the US. They also conclude that just as stock prices is affected by monetary policy; the stock market is an important source of information for the central bank when implementing a policy, similar to Rigobon and Sack (2004).

As commonly known from literature a monetary policy shock that increases the interest rate will temporarily result in a fall in output that reaches its minimum after about a year and a half (Björnland & Leitemo, 2009). The negative effect on output is significantly different from zero but essentially dries out. Their results on stock prices indicate that a monetary policy shock has a strong effect on stock returns, the returns immediately falls by about nine percent for each 100 basis-point increase in the Federal Funds Target Rate. The fall in stock prices is consistent with the increase in the discount rate and also with the temporarily reduction in output. A consequence of the increased interest rate is a higher cost of borrowing which are likely to reduce expected future dividend. The increased discount rate, the higher cost of borrowing and smaller output will make the present value of future divided smaller and therefore cause a fall in stock prices. The conclusions are consistent with those given by Rigobon and Sack (2004). However, stock prices are also important indicators for the interest setting. So, they also test the other side of the relationship, where the interest rate is a function of the change in stock prices, which Rigobon and Sack (2004) did not do. They find that a shock, which increases real stock price by 1%, leads to
an increase in the interest rate of close to 4 basis points. Ultimately they find that there is a considerable synchronized interaction between the interest rate setting and shocks to real stock prices in the U.S.

The data that Björnland and Leitemo are using for estimating the model in their paper is monthly data from January 1983 to December 2002. This opens a window for me to use more recent data to find out if the conclusions is true today, after the financial crisis in 2008.

Kurov (2009) explains that the two primary goals of monetary policies are to keep a stable price level and maintain a sustainable economic growth. However, these goals can only be achieved through the effects that monetary policies has on financial markets. He aims to answer if monetary policy decisions have an impact on the sentiment of stock market investors and if the investor psychology influences the stock markets reaction to monetary news. Kurov uses two measures of investor sentiment changes. The first measure is a index consisting of changes in the following six variables NSYE (New York Stock Exchange) turnover, closed-end fund discount, number of IPOs (Initial Public Offering), first-day return on IPOs, the equity share in the new issues and the dividend premium. The second investor sentiment proxy is the change in the Investor Sentiment Index computed using the Investor Intelligence survey, the survey represents the outlook of over 120 independent market newsletters and classifies the newsletters as bullish, bearish or correlation. Kurov compute an investor sentiment index as a ratio of the percentages of bullish advisors to the sum of the percentages of bullish and bearish advisors so the index is bounded between one and zero. High values of the index indicate increased Investor Sentiment and therefore more speculative. He uses an event study approach with a sample that extends from January 1990 to November 2004, which includes 129 observations on decisions made by the FOMC (Federal Open Market Committee) regarding the Federal Funds Target Rate. For the response on the stock market he uses daily returns on the S&P500 index.

The result of his research implies that monetary policy surprises have a strong impact on investor sentiment in bear market periods. The estimated OLS coefficient of a monetary surprise in bull markets is -0,68 (statistically insignificant), so a hypothetical unexpected 100-basis point decrease of the federal fund target leads to a 0,68% increase in S&P. But the estimated coefficient in bear markets implies that stock prices will increase by 11,85% (statistically significant). An explanation of this could be that investors tend to overreact to surprises in bear market periods.
Even though I’m not trying to test how investor sentiment affects the returns, this paper gives me information that the state of the stock market (if it is bearish or bullish) affects how investors will react in terms of returns to monetary news.

Shiu-Sheng Chen (2007) investigates whether monetary policy has asymmetric effects on stock market returns or not. Numerous studies have been done on the topic using money aggregate as a measure of money supply. Some empirical studies suggest that stock returns lag behind changes in monetary policy, but in contrast, some studies have shown that there is no significant forecasting power of past changes in money. Chen uses a Markov-switching model to examine the asymmetric effects that monetary policy has on the stock market. For estimations of the model he uses monthly data from the Standard & Poor’s 500 price index, for data about monetary policy he uses money supply (M2), discount rates and federal fund target rate. The paper focuses on the U.S. stock market and the data is from January 1965 to November 2004. He also subtracts the CPI inflation from nominal returns to obtain real returns.

The empirical result from monthly returns on S&P500 displays that, in both bull and bear markets, when monetary policy is measured by interest rate instrument a contractionary monetary shock strongly decreases the real return. But, a monetary shock in a bear-market regime displays larger effects. The coefficients for money supply show that a contractionary monetary policy (a decrease in money supply) leads to a decrease in stock returns, regardless of the mind-set of the investors. However, the effects of money supply are not statistically significant in either one of the regimes (bull or bear market) and therefore it does not seem good to use monetary supply as a measure for monetary policy.

The results of his empirical work shows that an increase of the discount rate by 1% will lead to a decrease of 2.58% (2.94%) in nominal (real) stock returns during bull markets and a 6.12% (5.39%) decrease during bear markets. Moreover, when the Federal Funds Target Rate is increased by 1%, the nominal (real) stock returns in bear markets will be lowered by 3.54% (2.36%) and 1.13% (1.33%) in bull markets. This results shows an interesting point, namely that the difference between real and nominal returns displays different signs depending on the state of the economy. When the discount rate is increased by 1%, the difference in real and nominal returns is -1.18% in bear markets and 0.2% in bull markets.
Even though money supply might seem like a bad measure for monetary policy, there has been a quite significant change in monetary policy after the financial crisis when the Federal Reserve Bank started using Quantitative Easing as a method for monetary policy. So the effects of money supply on the stock market might have changed after the financial crisis. I will therefore include money supply as a measure for monetary policy in my model.

Bernanke and Kuttner (2005) examine, through an empirical study, the relationship between monetary policy and the market for equities. They use data form June 1989 to December 2002. Conventional knowledge suggests that changes in monetary policy affects the stock market through changes in the wealth effect, changes in the cost of capital and also by other mechanisms. They discover that a market inefficiency driven by investor behaviour may contribute to the strong effect that monetary news has on stock returns. Their study has documented a relatively strong and consistent response of the stock market to unexpected monetary policy actions, by using Federal funds futures data to estimate policy expectations. The industry responses to monetary policy changes seem broadly consistent with the predictions of the standard CAPM. Stocks are claims to real assets, so, if monetary neutrality holds, stock values should be independent of monetary in the very long run, but they may influence stock values in the medium run. The impact of monetary policy surprises on stock prices seems to come either from its effects on expected future excess returns or on expected future dividends. From their conclusions it is seems reasonable that the stock market reaction to monetary policy is primarily driven by the effect of the unexpected changes in the Federal Funds Target Rate on the equity risk premium. They measure the surprise element of policy shocks by deriving it from the change in the future contracts price relative to the day prior to the policy action.

\[
\Delta l^u = \frac{D}{D-d}(f^{0}_{m,d} - f^{0}_{m,d-1})
\]

Where \(\Delta l^u\) is the unexpected target rate change, \(f^0_{m,d}\) is the current-month futures rate, \(m\) is the current month, \(d\) is the day of the month, and \(D\) is the number of days in the month. Estimation with monthly data calls for a slightly different equation,

\[
\bar{\Delta l^u_t} \equiv \frac{1}{D} \sum_{d=1}^{D} i_{t,d} - f^{1}_{t-1,D}
\]
where $i_{t,d}$ is the funds rate target on day $d$ of month $t$, and $f_{t-1,D}^1$ is the rate corresponding to the 1-month futures contract on the last ($D$th) day of month $t$-1. The expected funds rate change is defined as,

$$\bar{\Delta}i_t^e \equiv f_{t-1,D}^1 - i_{t-1,D}$$

They use these two equations for estimating stock market reactions to changes in monetary policy in the following regression, where $H_t$ represent the stock market return, which in this case is the CRSP (the Center for Research in Security Prices) value-weighted equity returns.

$$H_t = a + b^s \bar{\Delta}i_t^u + b^u \bar{\Delta}i_t^e + \epsilon_t$$

Their result from monthly data and the full sample (1989 to 2002) shows that when there is a expected change of 1%, the returns will be lowered by 1.11% (almost a one for one interaction between returns and expected change). But the effect is considerably larger when there is an unexpected increase. If there is an unexpected increase of 1%, the returns will be lowered by 11.43%.

It is interesting to note that the magnitude of this response is about twice what was found in their event-study analysis and the time aggregation issue could explain the difference. The time aggregation issue arises when trying to measure the surprise in terms of the average funds rate, which will tend to weaken the size of the surprise. Without making specific assumptions about the days of possible rate changes, there is no clean way to correct for this problem. So, the magnitude of the response might be explained by the fact that rate changes takes place on different days of the month (time-aggregation issue). The $R^2$ of the estimated model is 0.065, which implies that almost 7% of the variance in the monthly stock returns can be explained by unanticipated policy actions.

2.6 Theoretical framework
In this paper I will combine models from early research and theories to estimate a model that will explain the returns on the U.S. stock market. From the research conducted by Bernanke and Kuttner (2005) we know that it is the unexpected and the expected change in interest rate that...
affects the returns. I will include the unexpected and expected change in the interest rate in my model. The changes will be calculated in the same way as Bernanke and Kuttner.

In previous research, the stock price is assumed to rise as a function of the interest rate, which falls if the money supply increases. It seems that money has become decoupled from the economic activity in western economies, which it is supposed to facilitate. It is not the presence of money that causes economic growth; it is the productive capacity that causes growth. Money should be a reflection of economic activity and not the other way around. Monetary responses to economic problems have centred on easing money supply, to make credit more easily available. The research found in Chen (2007) implies that we should not include the money supply in the model, but, as I stated before, it might have changed after the financial crisis due to Quantitative Easing.

It would also be desirable to include some sort of variable for investor sentiment to see how the effects might differ depending on the state of the economy. I have therefore included the US Investor Sentiment index, which displays the percentage of the investors that bullish.

A simple model for explanation of the value of an asset is through the capital asset pricing model (CAPM). CAPM is a way to calculate the discount rate that will be used to discount future cash flows. It takes account to the riskiness of the asset, the expected excess returns on the market portfolio and the risk-free interest rate. The riskiness of the asset is given by the assets beta-value, which is calculated by dividing the covariance between the asset and the market portfolio with squared standard deviation (variance) of the market portfolio, and it represent the systematic risk of the asset. Expected excess returns on the market portfolio are given by the expected return on the market portfolio minus the risk-free interest rate. The risk-free interest rate is the usually given by the interest rate on the 10-year government bonds, which is assumed to be risk-free. A higher risk-free interest rate will affect the discount rate for every asset directly by increasing the discount rate, but it will also lower the expected excess return since it is given by the expected market return minus the risk-free return. One special part of this model is, when you rearrange it, that a higher risk-free interest rate will lower the discount rate with a beta-value over one (the assets with a higher systematic risk) and increasing the discount rate for assets that are less risky (beta-value less than one).

\[ r_i = r_f + \beta_{i,m}(E[r_M] - r_f) \]
\[ r_i = (1 - \beta_{i,m}) \cdot r_f + \beta_{i,m}E[r_M] \]

As written in the previous chapter, the central bank’s behaviour can be thought of in terms of a reaction function that the bank uses to respond to shocks to the economy and steer it toward an inflation target. It is hard to find a simple model for monetary policy. The simplest way to think of monetary policy is that the central bank adjusts the interest rate depending on the state of the economy. The interaction is complicated because the economy affects the interest rate, and the same is true the other way around.

The objective for the Federal Reserve is to promote maximum employment, stable prices and moderate long-term interest rate. Inflation, employment, and long-term interest rates fluctuate over time in response to economic and financial disturbances. The inflation rate over the longer run is primarily determined by monetary policy. The Committee reaffirms its judgment that inflation at the rate of 2 percent, as measured by the annual change in the price index for personal consumption expenditures. The maximum level of employment is largely determined by nonmonetary factors that affect the structure and dynamics of the labour market. These factors may change over time and may not be directly measurable. (Federal Reserve, 2014)

These objectives can be captured by the Phillips-curve, the Monetary Rule and the IS curve (in output gap form).

Phillips-curve: \[ \pi_t = \pi_{t-1} + \alpha(y_t - y_e) \]
Monetary Rule: \[ (y_t - y_e) = -\alpha \beta (\pi_t - \pi^T) \]
IS, output gap form: \[ y_1 - y_e = -\alpha (i_0 - i_s) \rightarrow i_0 - i_s = -\frac{1}{\alpha} (y_1 - y_e) \]

The Phillips-curve captures the part about the inflation and how today’s inflation (\(\pi_t\)) is affected by previous inflation (\(\pi_{t-1}\)) and deviation from the equilibrium output (\(y_t - y_e\)). It also captures the employment part since each level of output is reflected in a level of employment. The maximum (sustainable) level of employment is given by ERU (Equilibrium Rate of Unemployment), this is the level we want to be on and the equilibrium output level gives ERU. We want \(y_1 = y_e\) and thus \(\pi_t = \pi_{t-1} = \pi^T\). It is therefore clear from the IS-curve in output gap form, that the central bank sets an interest rate to obtain the equilibrium level of output. But the central bank also needs to maintain equilibrium on the money market, so the interest rate is also affected by the money demand and the money supply. Therefore the interest rate is a function of
the state of the economy (inflation, output, money supply and money demand) and the target rate/equilibrium state of the economy (target rate inflation and equilibrium level of output).

\[ i_{t,FFR} = f(\pi_t, \pi^T, y_t, y_e, M^s, M^D) \]

These two models together (and graph VI) show that the discount rate used to value specific assets is affected by the risk-free rate, which is affected by price stability, inflation, output and money supply. These two (CAPM and \( i_{t,FFR} \)) shows how the interaction between monetary policy and stock market works. Changes in any variable in the interest rate function should affect the stock market through the CAPM.

3. Method & data

3.1 Data
I have collected monthly data for money supply (M2), Federal Funds Target Rate, values for Standard & Poor’s 500 index (S&P500) and Dow Jones Industrial Average (DJIA) via Bloomberg. This data has then bee used to calculate monthly returns on both indexes. Monthly data about federal reserves futures rate and the average federal funds effective rate was obtained from Federal Reserves website. The data about investor sentiment was collected in the form of U.S. Investor Sentiment Index, as the percentage of the investors being bulling from ycharts.com. The data is presented each Friday, so I have taken the average of the index per month for it to be in the same format as the rest of my data. The earliest observation in the data is from January 2000 and the last is from November 2014.
Table I
Descriptive statistics
The table reports selected descriptive statistics for returns, Federal Funds Target Rate changes, investor sentiment and growth rate of money supply over the full sample with 172 monthly observations spanning January 2000-November 2014.

<table>
<thead>
<tr>
<th>Notation</th>
<th>Returns S&amp;P500</th>
<th>Returns Dow Jones</th>
<th>Interest rate</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Standard Deviation</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>Returns</td>
<td>0.266</td>
<td>4.432</td>
<td>-16.942</td>
<td>10.772</td>
</tr>
<tr>
<td>Interest rate</td>
<td>2.074</td>
<td>2.066</td>
<td>0.25</td>
<td>6.5</td>
</tr>
<tr>
<td>Expected Change</td>
<td>0.0796</td>
<td>0.206</td>
<td>-0.895</td>
<td>0.735</td>
</tr>
<tr>
<td>Unexpected Change</td>
<td>-0.109</td>
<td>0.163</td>
<td>-0.866</td>
<td>0.077</td>
</tr>
<tr>
<td>Actual Change</td>
<td>-0.0297</td>
<td>0.219</td>
<td>-1.25</td>
<td>0.5</td>
</tr>
<tr>
<td>Expected and Unexpected change</td>
<td>-0.0282</td>
<td>0.184</td>
<td>-0.978</td>
<td>0.297</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investor Sentiment</td>
<td>0.41</td>
<td>0.083</td>
<td>0.23</td>
<td>0.645</td>
</tr>
<tr>
<td>Growth rate of M2</td>
<td>0.515</td>
<td>0.408</td>
<td>-0.8</td>
<td>2.423</td>
</tr>
</tbody>
</table>

Table I present descriptive statistics about the variables that I have included in my model. The monthly returns on Dow Jones (DJIA) varies between -14.06% and 10.61% while the returns on Standard & Poor’s 500 (S&P500) varies a bit more, with -16.94% as the lowest return observed and 10.77% as the highest return observed. The lowest return on both S&P500 and DJIA is, not surprisingly, found in October 2008 during the peak of the financial crisis. The highest returns do not occur on the same date for both indexes, but two month showed the highest returns, October 2011 for S&P500 (the returns on DJIA this month was 9.54%) and October 2002 for DJIA (the returns on S&P500 this month was 8.64%).

The Federal Funds Target Rate in the period January 2000 to November 2014 varies between 0.25% (from December 2008 to today) and 6.5% (from May 2000 to December 2000). It changes mostly by 0.25 percentage points but the most drastic change is a decrease by 1.25% (in January 2008) and an increase by 0.5% (in May 2000). The change in interest rate is part expected and part unexpected, they are calculated in the same way as Bernanke and Kuttner did it. The sum of expected and unexpected change moves similar to the actual change, but it does not capture the extremes. The lowest decrease in the sum of expected and unexpected change is 0.978% compared to -1.25% in the actual change and the highest sum of expected and unexpected change is 0.297%.
compared to 0.5% in the actual change. But, the mean of the actual change (-0.0297%) is almost equal to the mean of the sum of expected and unexpected change (-0.0282%). By looking at graph III it is clear that the sum of expected and unexpected change almost moves in exactly the same way as the actual change. The correlation between the two is 0.68 and the reason why it does not have a correlation of one is because of how it is calculated. This could be fixed by making the unexpected change equal to the actual change minus the expected change, or by making the expected change equal to the actual change minus the unexpected change. But this is not the way it is done by Bernanke and Kuttner and since they are more experienced in this area I will in this paper rely on their way of doing it.

The highest percentage of investors being bullish is observed in January 2004 where there was an average of 64.45% being bullish and the lowest in February 2003, where 23% were being bullish. Since these values are the average of the month it could be interesting to know that the highest single observation using the original data occurs on the sixth of January 2000 where 75% was being bullish, the thirty highest observations is found in the period 2000 to 2004. The majority of the thirty lowest observations occur in the period 2008 to 2012, which is logical due to the financial crisis.

To ensure that the variables are stationary, I use the Augmented Dickey–Fuller (ADF) and the Phillips–Perron (PP) unit root tests. The null hypothesis is that the variable contains a unit root, and the alternative is that a stationary process generated the variable.
Table II

Unit Root Test

The table reports the results from the Unit Root Tests, which is the Augmented Dickey-Fuller unit-root test (ADF) and the Phillip-Perron unit-root test (PP). In both test the null hypothesis is that the series has a unit root. Test critical values for ADF and PP are -3.486 (1%), -2.885 (5%) and 2.575 (10%). Estimated with four lags.

<table>
<thead>
<tr>
<th></th>
<th>ADF test statistic</th>
<th>PP test statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return DJIA</td>
<td>-5.205</td>
<td>-12.516</td>
</tr>
<tr>
<td>Expected Change</td>
<td>-3.967</td>
<td>-5.173</td>
</tr>
<tr>
<td>Unexpected Change</td>
<td>-2.342</td>
<td>-4.59</td>
</tr>
<tr>
<td>Growth Rate of M2</td>
<td>-5.098</td>
<td>-10.792</td>
</tr>
<tr>
<td>Investor Sentiment</td>
<td>-4.09</td>
<td>-7.611</td>
</tr>
</tbody>
</table>

Table VI presents the test statistic for the Augmented Dickey-Fuller test (ADF) and the Phillips-Perron test (PP). The null hypothesis (that it is a unit root) in the ADF test can be rejected for all variables at a significance level of 1% except for the unexpected change, which cannot be rejected even at a significance level of 10%. However, every the null hypothesis for the PP test can be rejected at a significance level of 1%.

3.2 Methodology and econometric model

The econometric research of this paper will be done in a vector auto regressive model (VAR) to capture linear interdependencies among multiple time series. The VAR model does not only take one variables lagged values to account, but also the lagged values of other variables included in the model. It provides a way to describe the evolution of a set of variables over a period. (Patterson. 2000, s.602-603).

The model is useful for describing the dynamic behaviour of economic and financial time series, which suites the purpose of this essay (Zivot & Wang, 2005, pp. 383). It also allows me to capture the simultaneous interaction between the variables and to graph the response of a variable due to the impulse of another.

The final model estimated is:

\[
\begin{pmatrix}
R \\
\Delta t^e \\
\Delta t^u \\
\theta M2 \\
\theta IS
\end{pmatrix}_t = \begin{pmatrix}
\alpha^e \\
\beta^e \\
\gamma^e \\
\delta^e \\
\theta^e
\end{pmatrix} + A_{t-1} \begin{pmatrix}
R \\
\Delta t^e \\
\Delta t^u \\
\theta M2 \\
\theta IS
\end{pmatrix}_{t-1} + A_{t-2} \begin{pmatrix}
R \\
\Delta t^e \\
\Delta t^u \\
\theta M2 \\
\theta IS
\end{pmatrix}_{t-2} + A_{t-3} \begin{pmatrix}
R \\
\Delta t^e \\
\Delta t^u \\
\theta M2 \\
\theta IS
\end{pmatrix}_{t-3} + A_{t-4} \begin{pmatrix}
R \\
\Delta t^e \\
\Delta t^u \\
\theta M2 \\
\theta IS
\end{pmatrix}_{t-4} + \begin{pmatrix}
\varepsilon_R \\
\varepsilon_e \\
\varepsilon_u \\
\varepsilon_M2 \\
\varepsilon_IS
\end{pmatrix}_t
\]
Where \( A \) is a matrix consisting of the coefficients for the variables in each time period.

\[
A = \begin{pmatrix}
\alpha_1^R & \alpha_2^R & \alpha_3^R & \alpha_4^R & \alpha_5^R \\
\beta_1^R & \beta_2^R & \beta_3^R & \beta_4^R & \beta_5^R \\
\gamma_1^R & \gamma_2^R & \gamma_3^R & \gamma_4^R & \gamma_5^R \\
\delta_1^R & \delta_2^R & \delta_3^R & \delta_4^R & \delta_5^R \\
\theta_1^{IS} & \theta_2^{IS} & \theta_3^{IS} & \theta_4^{IS} & \theta_5^{IS}
\end{pmatrix}
\]

\( R \) is the return on the Dow Jones Industrial Average index or Standard & Poor’s 500 index, \( \Delta i^e \) is the expected change in the interest rate and \( \Delta i^u \) is the unexpected change in interest rate calculated in the same way as Bernanke and Kuttner (2005). \( g_{M2} \) is the growth rate of money supply and \( IS \) is the Investor Sentiment Index as the percentage of the investor that are being bullish (believing in a rise in stock prices). In this paper I follow Björnland and Leitemo (2009) by estimate the model with four lags. The null hypothesis for the expected and unexpected change in interest rate is that they don’t have any effects on the returns on the stock market and the same goes for the other variables. To be able to reject the null hypothesis, the coefficients must be significantly different from zero. This means that the test statistic must be larger than the critical value.

### Table III

**The hypothesis for the estimated model**

The table reports the hypothesis that will be tested in the estimated model. In the reference column is refer to the source of the hypothesis.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Null hypothesis</th>
<th>Alternative Hypothesis</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Returns</td>
<td>( H_0[\alpha_1^R] = 0 )</td>
<td>( H_A[\alpha_1^R] \neq 0 )</td>
<td>Bernanke &amp; Kuttner</td>
</tr>
<tr>
<td>Expected change</td>
<td>( H_0[\alpha_2^R] = 0 )</td>
<td>( H_A[\alpha_2^R] \neq 0 )</td>
<td>Bernanke &amp; Kuttner</td>
</tr>
<tr>
<td>Unexpected change</td>
<td>( H_0[\alpha_3^R] = 0 )</td>
<td>( H_A[\alpha_3^R] \neq 0 )</td>
<td>Bernanke &amp; Kuttner</td>
</tr>
<tr>
<td>Growth rate of money</td>
<td>( H_0[\alpha_4^R] = 0 )</td>
<td>( H_A[\alpha_4^R] \neq 0 )</td>
<td>Chen</td>
</tr>
<tr>
<td>Investor Sentiment Index</td>
<td>( H_0[\alpha_5^R] = 0 )</td>
<td>( H_A[\alpha_5^R] \neq 0 )</td>
<td>Kurov</td>
</tr>
</tbody>
</table>

### 4. Results

**4.1 Reproducing Bernanke & Kuttner’s method**

Reproducing their method on my data and using returns on S&P500 displays that an expected increase of 1% will lead to a 3.35% increase in the returns, implying that there is not a one for one interaction between expected change and returns. If there was an unexpected increase by 1%, the returns will be increased by 7.52%. This model explains almost 6% of the variation in returns using expected and unexpected changes as dependent variables (\( R^2 \) of 0.0559) (the results are shown in Table IV). The result is opposite of those found by Bernanke and Kuttner (2005). The
reason why my result is the opposite could be because the time-period and what is shown in graph IIA and IIB, which is that the relationship between the 10-year yields and the YoY (year-on-year) returns on S&P500 and this relationship changes depending on the inflation. Their results are based on a different set of observations, which could take place in a inflationary period.

**Table IV**

**Returns on Dow Jones Industrial Average and S&P500 using the method of Bernanke & Kuttner**

The table reports the estimated intercept and coefficients when using the actual change or the expected and unexpected change in the interest rate to estimate the returns on the DJIA and S&P500 index. Parentheses contain the z-statistics.

<table>
<thead>
<tr>
<th></th>
<th>Returns Dow Jones</th>
<th>Returns S&amp;P500</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Expected and Unexpected</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>0.790</td>
<td>0.846</td>
</tr>
<tr>
<td></td>
<td>(2.08)</td>
<td>(2.16)</td>
</tr>
<tr>
<td>Expected Change</td>
<td>1.930</td>
<td>3.346</td>
</tr>
<tr>
<td></td>
<td>(1.07)</td>
<td>(1.80)</td>
</tr>
<tr>
<td>Unexpected Change</td>
<td>5.539</td>
<td>7.523</td>
</tr>
<tr>
<td></td>
<td>(2.43)</td>
<td>(3.20)</td>
</tr>
<tr>
<td>R²</td>
<td>0.033</td>
<td>0.056</td>
</tr>
</tbody>
</table>

**4.2 Results from the VAR**

The result from the vector auto regression of the five variables on returns is presented in table III. The R² for returns on the DJIA is 0.214 and 0.225 for returns on S&P500. All the eigenvalues lie inside the unit circle and VAR satisfies stability conditions for both models. The critical z-value is 1.96, so all the coefficient are not statistically significant. All hypotheses are tested at a significance level of 5%. Table III is the estimates that were estimated with the equation presented in section 3.3. The VAR estimating the response on the Dow Jones Industrial Average index displays a R² of 0.214 implying that about 21% of the variation in returns could be explained by the lagged values of return, the expected change and unexpected change, the growth rate of money supply (M2) and the Investor Sentiment Index. About 23% (R²=0.225) of the variation on the returns on Standard & Poor’s 500 is explained by the lagged values of return, the expected change and unexpected change, the growth rate of money supply (M2) and the Investor Sentiment Index.
Graph IV shows the impulse response for unexpected and expected changes in the Federal Funds Target Rate. Interesting to note is that an expected increase in the Federal Funds Target Rate is the only thing that decreases the returns on both indexes. The estimated response to an expected change in Target Rate is quite similar on both DJIA and S&P500. But the estimated response of an unexpected increase in the Target Rate is not the same on both markets. S&P500’s returns will increase in the first lag, the decreases in the second lag and then increase in the third and fourth lag. The returns on DJIA will increase in all lags.

These results are surprising and in contradiction with those found by Bernanke and Kuttner in 2005. This may indicate a change in the stock markets response to changes (expected and unexpected) in the Target Rate. The results may seem false, but when running a simple regression of the returns and the actual increase in the Federal Funds Target Rate I get that the returns will
increase if there is an increase in the interest rate. An actual change of 1% will increase the returns on S&P500 with 5.4 percentage points and 1.99 percentage points on DJIA (the results are shown in Table IV). These results are inconsistent with the traditional view. A major difference between the two indexes is the response to unexpected changes in the interest rate. For instance, an unexpected increase of 1% in the interest rate will increase the returns on Dow Jones with 0.92%-points in the first lag and then increase by 8.15% and 1.1%-points in the second and third lag. But, on S&P500, an unexpected increase by 1% in the interest rate will increase the returns in the first lag with 5%-points then 5.66%- and 1.44%-points in the second and third lag respectively. Although, the difference in the sum of the parameters is quite small (about 1.9), so the total effect on both indexes is almost the same.

Table V

The effect of monetary policy on nominal stock returns on Standard & Poor’s 500 Index and Dow Jones Industrial Average

The table reports the results from the vector auto regressions from 1-month returns on S&P500 and DJIA on the expected and unexpected 1-month change in the Federal Funds Target Rate, the growth rate of money supply (M2) and the Investor Sentiment Index. All variables are percentage terms. The full sample includes 172 monthly observations spanning January 2000-November 2014. Parentheses contain z-statistics.

<table>
<thead>
<tr>
<th>Var.</th>
<th>(1) Returns Dow Jones</th>
<th>(2) Returns S&amp;P500</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(a) Lag 1</td>
<td>(b) Lag 2</td>
</tr>
<tr>
<td>Returns</td>
<td>-0.054</td>
<td>-0.227</td>
</tr>
<tr>
<td></td>
<td>(0.66)</td>
<td>(2.76)</td>
</tr>
<tr>
<td>Expected Change</td>
<td>-6.682</td>
<td>-0.021</td>
</tr>
<tr>
<td></td>
<td>(2.22)</td>
<td>(0.01)</td>
</tr>
<tr>
<td>Unexpected Change</td>
<td>0.918</td>
<td>8.145</td>
</tr>
<tr>
<td></td>
<td>(0.27)</td>
<td>(1.91)</td>
</tr>
<tr>
<td>Growth Rate of M2</td>
<td>-2.809</td>
<td>0.279</td>
</tr>
<tr>
<td></td>
<td>(3.33)</td>
<td>(0.33)</td>
</tr>
<tr>
<td>Investor Sentiment Index</td>
<td>1.146</td>
<td>10.748</td>
</tr>
<tr>
<td></td>
<td>(0.24)</td>
<td>(2.02)</td>
</tr>
<tr>
<td>Intercept</td>
<td>1.111</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.47)</td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.214</td>
<td></td>
</tr>
<tr>
<td>LogLik</td>
<td>71,383</td>
<td></td>
</tr>
</tbody>
</table>

4.3 Causality testing

The Granger causality Wald test tests the hypotheses that the other endogenous variables does not Granger-cause the dependent variable, the null hypothesis is that the estimated coefficients of the lagged values of a variable is jointly zero (StataCorp, 2013). The result of this test is presented in
Table VI. We can reject the null hypotheses for all estimated coefficients of the lagged values of an expected change, an unexpected change and the growth rate of M2 for both indexes. This means that each of these coefficients is not jointly zero and does not Granger-cause the dependent variable. But the null hypothesis cannot be rejected for the coefficients of lagged values of the Investor Sentiment Index. However, the null hypothesis on the four lags of all coefficients are jointly zero can be rejected for both indexes.

**Table VI**

<table>
<thead>
<tr>
<th>Equation</th>
<th>Excluded</th>
<th>Chi²</th>
<th>df</th>
<th>Prob &gt; chi²</th>
</tr>
</thead>
<tbody>
<tr>
<td>ReturnsSP500</td>
<td>Expected change</td>
<td>15,533</td>
<td>4</td>
<td>0,004</td>
</tr>
<tr>
<td>ReturnsSP500</td>
<td>Unexpected change</td>
<td>13,279</td>
<td>4</td>
<td>0,01</td>
</tr>
<tr>
<td>ReturnsSP500</td>
<td>GrowthM2</td>
<td>15,662</td>
<td>4</td>
<td>0,004</td>
</tr>
<tr>
<td>ReturnsSP500</td>
<td>Investor Sentiment</td>
<td>7,2326</td>
<td>4</td>
<td>0,124</td>
</tr>
<tr>
<td>ReturnsSP500</td>
<td>ALL</td>
<td>40,873</td>
<td>16</td>
<td>0,001</td>
</tr>
<tr>
<td>ReturnsDJI A</td>
<td>Expected change</td>
<td>18,859</td>
<td>4</td>
<td>0,001</td>
</tr>
<tr>
<td>ReturnsDJI A</td>
<td>Unexpected change</td>
<td>12,564</td>
<td>4</td>
<td>0,014</td>
</tr>
<tr>
<td>ReturnsDJI A</td>
<td>GrowthM2</td>
<td>16,528</td>
<td>4</td>
<td>0,002</td>
</tr>
<tr>
<td>ReturnsDJI A</td>
<td>Investor Sentiment</td>
<td>7,353</td>
<td>4</td>
<td>0,118</td>
</tr>
<tr>
<td>ReturnsDJI A</td>
<td>ALL</td>
<td>39,846</td>
<td>16</td>
<td>0,001</td>
</tr>
</tbody>
</table>

4.4 Results of Returns on Dow Jones Industrial Average Index

The result from the vector auto regression on returns on Dow Jones is presented in Table III (1). It shows that the return today is affected by lagged returns on DJIA, but only lag two and four. The value of the z-statistic indicates that the coefficients are significantly different from zero. The second lag is negative and the fourth lag is positive. The results also suggests that an expected increase of 1% in the interest rate will lead to a 6,68% decrease in returns and a four period lagged increase of 7,67% which indicate that the market overreacts in the first period, but stabilizes after four periods. No one of the coefficients for the unexpected change in the interest rate is significantly different from zero.

An interesting result is the one for the growth rate of money supply (M2). It shows that money supply has in fact a effect on the returns and that an increased growth rate of money with 1% will lead to a 2,81% decrease in the returns in the first period, but just as with expected change in interest rate there is a four period lagged increased by 1,82%, which in the same way indicates that the market overreacts in the first period, but stabilizes in the fourth period.
The results for the Investor Sentiment Index show that it is a lagged effect on the returns on DJIA. The higher the index is in period two, the higher the returns in the current period. These findings indicates, over all, that the stock market overreacts but then stabilizes after a few month.

The result of the regression with Investor Sentiment as the depending variable shows the highest $R^2 (0.109)$, which is not surprising. When the index has a high value the investors are being bullish and they will buy stocks since they are expecting positive returns. This increases the demand and bids up the price. This may indicate that a lot of the variation in the original model (the one presented in section 3.3) is explained by the variation in the Investor Sentiment Index. This was not my intention since I just included the variable to study if the reaction was different depending on the mind-set of the investors.

The critical value for the test statistic in this case is 1.94. This implies that only the unexpected change and investor sentiment index is significant at a significance level of 5%. These models show the simplified relation between the variable and the return on DJIA. Unexpected change and the Investor Sentiment Index displays a positive relationship with the returns while expected change and growth rate of M2 (although the are not significant) shows a negative relationship with the returns.

4.5 Results of Returns on Standard & Poor’s 500 Index
The results from the vector auto regression on S&P500 returns are presented in Table III (2). It shows that the return today is affected by lagged returns on the Standard & Poor’s 500 index, but only lag two, which is negative. The other lags of this variable are not significantly different from zero. The value of the z-statistic indicates that the coefficient of lag two is significantly different from zero. The only coefficient of an expected change in the interest rate that is significant is the fourth. But the first coefficient has a z-value of 1.74, which is not that far from 1.96. These results are quite similar to the results of the VAR on Dow Jones returns. An expected increase of 1% in the interest rate will lead to a 5.44% decrease in returns and a four period lagged increase of 7.17%, which suggests that the market overreacts in the first period, but stabilizes after four periods.

No one of the coefficients for the unexpected change in the interest rate is significantly different from zero at a significance level of 5%, although it is interesting to look at the difference between
DJIA and S&P500 reaction to an unexpected change. The returns on S&P500 will increase in the first and second lag with about 5% (in each lag), but on DJIA the returns will increase by about 1% in the first lag and the dramatically increase by almost 8,15%.

An increased growth rate of money with 1% will lead to a 2,86% decrease in the returns in the first period, but similar to the expected change in interest rate there is a four period lagged increased by 1,83%. Indicating that the market over reacts in the first period, but stabilizes in the fourth period. The effects that growth rate of M2 has on returns on S&P500 is almost the same as the effects it has on DJIA. This could be interpreted in a way that stocks will be affected equally by the growth rate of money supply (M2) while stock may be affected differentially to changes in the interest rate. The returns on S&P500 is not affected by the proportion of investors that are being bullish, at least not a significance level of 5% These findings indicates, over all and similar to those of DJIA, that the stock market overreacts but then stabilizes after a few month.

4.6 Analysis
There is quite a big difference in the intercepts of the two equations. The intercept for Dow Jones Industrial Average is 1,11% and almost 3,11% on Standard & Poor’s 500, the difference is almost 2%. The different companies included in the indexes or perhaps just the limited data could possibly explain this result. The expected reaction to an unexpected increase in the Federal Funds Target Rate is that the returns should be lower, or al least according to Bernanke and Kuttner (2005). But as I have documented in the previous sections, that is not true for my data. For the period from January 2000 to November 2014 it is only the expected increases in the Target Rate that will lower the return. But this is only true in the first period for both indexes, the total change in returns (including all the lags) will be an increase of almost 6,5%-points on DJIA and almost 6,9%-points for S&P500. This strange behaviour could in part be explained by the fact that the Federal Funds Target Rate and the 10- /2- year yield curve slope move in an inverse manor, as noted in the research made by BCA (2014, s.26).
As shown in graph VI, the yield curve slope increases when the target rate decreases. Since it is the 10-year bond that is used in the capital asset pricing model (CAPM) it would seem more logical why the returns are increasing with an expected or unexpected increase in the Target Rate. I.e. an increase in the Target Rate will correspond to a decrease in the 10- /2- year yield curve slope. This graph shows the slope of the yield curve between the 2 year and 10 year bond. When the slope is increasing we expect the risk free interest rate to increase in the future and we will therefore discount future cash flows with a higher discount rate. The same is true the other way around, which is perhaps why I get my results.

An increase in the Federal Funds Target Rate today will decrease the slope of the yield curve, which means that we are expecting a slightly lower risk free return in the future (than we did prior to the increased rate). We are not expecting a lower rate than today, just a slightly lower than the expected. So now we are discounting the future cash flows with a slightly lower discount rate and the value of the stocks will therefore increase and thus we will have positive returns when we are increasing the Target Rate today. The reason why my result is not consistent with Bernanke and Kuttner (2005) could be due to the relationship between the interest rate, inflation and 10-years yield (shown in graph IIA, IIB and IV). They use data stretching from 1989 to 2002 and as shown in graph IIA and IIB the correlation between 10-year yields and returns is positive in deflationary periods and negative in inflationary periods. The data that I am using is in a deflationary period and the data that Bernanke and Kuttner (2005) is mostly in inflationary periods.
4.7 Specification test
Skewness quantifies how symmetrical the distribution is. A symmetrical distribution will have a value on the skewness statistic of zero, an asymmetrical distribution with a long tail to the right has a positive skew and an asymmetrical distribution with a long tail to the left has a negative skew. If the skewness is greater than 1,0 or lower than -1,0 the skewness is substantial and the distribution is far from symmetrical. In this case the skewness of my to VARs is shown in Table X. The skewness for S&P500 is -0.38 which indicates that it has a positive skewed. The skewness for DJIA is -0.32 which also implies that it has a positive skew. Both VARs has an asymmetrical distribution with a long tail to the right. So the mass of the distribution is concentrated to the left in a distribution plot.

Kurtosis quantifies whether the shape of the data distribution matches the Gaussian distribution and a Gaussian distribution has a kurtosis of 3.0. A more flat distribution has a kurtosis lower than 3.0 and a distribution more peaked than a Gaussian distribution has a kurtosis grater than 3.0. The Kurtosis test for my two estimated VARs is also shown in Table X. Kurtosis for S&P500 is 3.83 and 3.63 for DJIA. Both models is therefore more peaked than a Gaussian distribution.

| Table VII |
| Test for normally distributed disturbances |

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5. Conclusion
This paper has focused on the effects that a change in macroeconomic factors has on the returns on the stock market. I have used the returns on two of the most commonly mentioned indexes in the United States, which is the Dow Jones industrial average (DJIA) and Standard & Poor’s 500 (S&P500). As for the macroeconomic factors I have used the Federal Funds Target Rate and the money supply (M2). As I mentioned before, I have focused on the change in these variables. For simplicity I have just included the growth rate of money supply. But for the Federal Funds Target Rate I have used the same approach as Bernanke & Kuttner (2005) and split the change in the
Federal Funds Target Rate in two parts. The first part of the change in the Federal Funds Target Rate is the expected change. The expected change in the rate in period t is calculated using the target rate for period t-1 minus the rate corresponding to the 1-month futures rate at the last day of the previous period. The second part of the change is quite obviously the unexpected change in the target rate. It is calculated by taking the average effective Federal Funds Target Rate in the previous period minus the rate corresponding to the 1-month futures rate at the last day of the previous period. This measure can be calculated in a different way as well, we can calculate the expected change in the interest rate and then subtract that from the actual change to obtain the unexpected change in the interest rate or calculate the unexpected change and subtract it from the actual change.

I have also included a measure for the mind-set of the investors, namely the Investor intelligence Sentiment Index, which shows the percentage of the investors being bullish. That is, the investors who believe that there will be positive returns on the stock market. However, as the topic indicates, I want to examine the effects of macroeconomic factors and this part is not a macroeconomic factor. But more on this later in this chapter.

I have used monthly data stretching from January 2000 to November 2014, with a total of 172 observations for returns on each index. The data about returns, the growth rate of money supply (M2) and the Federal Funds Target Rate was obtained from Bloomberg through a colleague at my previous workplace. I collected the data about forward rates from Federal Reserve website and the Investor Sentiment data from ycharts. This data was then organised in excel and then analysed in Stata13. The econometric analysis has be done by using a vector auto regression with four lags.

Using this data and method I have been able to reject some of the null hypothesis, but not all. The expected and unexpected change in the target rate, growth rate of money supply and the investor sentiment index can explain 21,4% of the variation in the returns on DJIA and 22,5% of the variation on S&P500.

Now, back to the part about the Investor Sentiment Index. As I mentioned before, I used this measure to see if the effects of changes in macroeconomic factors were different depending on the mind-set of the investors. I realise now that this could be done in a better way and that this variable should be excluded from my econometric analysis. This is also indicated by the result of the Granger causality Wald test, which showed that the variable should not be included. However,
this variable could be included, but with a different approach. On way to do it is to assume that we are in a bull market when over 50% are being bullish, and then use a dummy variable that takes the value one when the index is 50% or more and zero when the index is below 50%. By doing this I can see how the stock market is affected by expected and unexpected changes in the interest rate in a bull market. This is something I tried, but the index rarely displays a value lower/higher than 50%. So, doing this on my data resulted that I only had a few observations for returns on the indexes. This would not be a good starting point when running a regression and would probably give less than true results. But, if I had data stretching over a longer period I would possibly get more observations on returns in a bull market. However, this calls for an other problem, it would be hard to analyse lagged effects since it is not sure that a lot the observations that takes a dummy value of one will be in the same period. Another way to do it is to follow the way of Chen (2005) and calculate the smoothed probability of being in a bull market. This method is unfortunately to complex for me, but it is (according to me) a far better way to do it.

The results of my VAR indicated that an expected increase will have a negative effect on the returns in the first lag but it will cancel out by a positive effect in the third lag. The most surprising result was that of the unexpected change in the Target Rate. If my results are accurate and that the unexpected is calculated in a correct way, an unexpected increase will have a positive effect one the returns. This contradicts most previous studies and is surprisingly almost the exact opposite of those results found by Bernanke & Kuttner (2005) who said the only thing that has a negative effect on returns is the unexpected part of the change in the interest rate. But since I most likely have a lack of knowledge compared to Bernanke, who has a team of very smart people working with him, my results may be inaccurate. But there is also a chance that the interaction between Federal Funds Target Rate and returns has changed due to the IT-bubble in 2000 and the financial crises in 2008, or just that the sample period is in deflationary times.

It would be interesting to try the method used in this essay on stock markets in other countries, for example Sweden. Further research could be done on this topic by using more data and daily returns instead of monthly. It is also desirable to do this in a few years when we are fully recovered from the financial crisis that took place in 2007. Another approach that would be good is to use quarterly data to include factors like GDP growth, perhaps the change in the growth rate separated in an expected and an unexpected change or just the expected level of growth and the deviation from this. But these factors are macroeconomic factors and not a monetary policy factors. There
is a lot of room for further research and improvement on this topic. But that requires greater knowledge both in macroeconomic theory and econometrics, which I simply do not possess.
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