FOMC and ECB effect on stock market

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Dissertation submitted in partial fulfilment of requirements for the MSc in International Finance, at Universidade Católica Portuguesa and for the MSc in Finance at BI Norwegian Business School, 19/12/2023.

Abstract

EN

This study explores how unexpected changes in monetary policy influenced the stock market from 2006 to 2022. Using a method inspired by previous research, the analysis looks at various types of stock portfolios, including different market indexes and portfolios of various sizes and sectors. By focusing on the unexpected aspects of Federal Fund Rate changes, the study aims to uncover asymmetries in the market's response during different economic conditions, such as bull and bear markets.

The results show that, while not all industry portfolios exhibited significant effects, there was a strong and statistically significant impact of monetary policy shocks on certain portfolios (CRSP EV and VW portfolios, including their deciles). Interestingly, this impact was more pronounced during bear markets. In simpler terms, the research helps us understand how unexpected changes in monetary policy specifically affect different types of stocks, shedding light on how the market responds under different economic circumstances.

PT

Este estudo explora como mudanças inesperadas na política monetária influenciaram o mercado de ações de 2006 a 2022. Utilizando um método inspirado em pesquisas anteriores, a análise examina diversos tipos de carteiras de ações, incluindo diferentes índices de mercado e carteiras de tamanhos e setores variados. Ao focar nos aspectos inesperados das mudanças na Taxa de Fundos Federais, o estudo busca descobrir assimetrias na resposta do mercado durante diferentes condições econômicas, como mercados em alta e em baixa.

Os resultados mostram que, embora nem todas as carteiras setoriais tenham exibido efeitos significativos, houve um impacto forte e estatisticamente significativo de choques na política monetária em determinadas carteiras (CRSP EV e VW, incluindo seus deciles).
Curiosamente, esse impacto foi mais pronunciado durante mercados em baixa. Em termos mais simples, a pesquisa ajuda a entender como mudanças inesperadas na política monetária afetam especificamente diferentes tipos de ações, oferecendo insights sobre como o mercado responde em diferentes circunstâncias econômicas.

Keywords: FOMC, Monetary policy shocks, Fed Fund Target Rate, S&P500, Industry Portfolios, ECB, STOXX600.

Content

Introduction

My research revolves around examining how changes in monetary policy affect stock returns differently during periods of economic growth (bull markets) and economic downturns (bear markets). While many studies have explored the impact of monetary policy on stock returns, there is a noticeable gap in the literature when it comes to understanding these effects in asymmetric terms, particularly in relation to the market's condition, whether it's in a bullish or bearish state. To conduct this research, I draw inspiration from the study conducted by Jansen and Tsai (2010), who analysed data from February 1994 to December 2005, exclusively focusing on the U.S. market. In contrast, my thesis covers a more recent timeframe, spanning from January 2006 to December 2022. Additionally, I expand the scope of investigation to include the European Union (EU) market.

Background

The Federal Reserve System

The Federal Reserve System has been founded in 1913 under Wilson presidency with the Federal Reserve Act as a response of pasts economic crises: The Great Depression of 1873, the Panic of 1893, and the Knickerbocker Crisis of 1907.

The system is an aggregate of interconnected components:

- Board of Governors: constituted of seven members, has the responsibility to supervise the Reserve Banks, its aims include budget approval, decisions concerning discount rate and reserve requirements, overseeing financial services and lending activities to depository institutions, and, along with their collaboration, regulate specific financial institutions or activities.
- The 12 regional Federal Reserve Banks: serve as operating arm of the system, its key roles include financial services provision (checks clearing, currency distribution, lending to depositary institutions), monitor and inspect state member banks and designated financial establishments.
- The Federal Open Market Committee (FOMC): as the name suggests, the institution is dedicated to open market operations, fundamental to transmit monetary policy; a major FOMC role regards the guidance offered to Federal Reserve manoeuvres in foreign exchange markets.

Fed monetary policies tools

Fed manages the three main monetary policy tools:

- Open market operation consists of buying/selling government bonds with the aim of attaining short-term goals established by the FOMC.
- Discount rates, or in other words, the offered rate to commercial banks and other depository institutions on loans received from Fed Regional Banks. There are three different discount windows: the primary credit (short-term - overnight - credit), secondary credit (for short-term liquidity needs), and seasonal credit (usually designed for smaller institutions with seasonal liquidity needs).
- Mandatory reserve, or the sum of funds that a financial institution is obligated to maintain against its deposits.

In particular, the Board of Governors handles discount rate operations and supervises reserve requirements, while the FOMC is responsible for open market operations. Through these tools, the Central Bank is able to modify the demand and supply of balances that banks hold with it, thereby influencing the federal funds rate. This rate represents the interest rate at which credit institutions lend overnight balances to other institutions. Along with the three aforementioned instruments, the Fed supports monetary stability and economic growth through interest on required reserves and on excess reserve balances. Term deposits (frequently used between 2010 to 2015) are a supplementary instrument the Fed uses to administer the aggregate amount of reserve balances held by financial institutions. Funds placed in these term deposits are taken from the accounts of the participating institution for the entire duration of the deposit, thereby draining balances from the banking system.

FOMC

The Federal Open Market Committee is one of the principal decision-making bodies of the United States central bank, the Federal Reserve. It is constituted by seven members of the Board of Governors, four out of eleven presidents of Federal Reserve Banks and the president of New York Federal Reserve Bank. As Federal Open Market Committee—Rules of Procedure document states, the participant of this authority attend regular meetings, generally eight during the year, to evaluate

> *"information regarding business and credit conditions and domestic and international economic and financial developments, and other pertinent information gathered and submitted by its staff and the staffs of the Board of Governors of the Federal Reserve System (the "Board") and the Federal Reserve Banks. Against the background of such information, the Committee takes actions from time to time to regulate and direct the open market operations of the Federal Reserve Banks. Such policy actions ordinarily are taken through the adoption and transmission to the Federal Reserve Banks of regulations, authorizations, and directives."*.

The long-term goals and strategies are defined by Congress in the form of statutory mandates:

- Maximize occupation: By its nature, the employment level is not straightforwardly quantifiable, and periodic fluctuations predominantly arise from non-monetary determinants that consequently shape the labor market. In light of these characteristics, the target is not set but continuously assessed and open to revision.
- Price stability: Inflation is chiefly influenced by monetary policy. The Committee sets its long-term inflation level objective at 2 percent, and it is evaluated through the

Personal Consumption Expenditures Price Index (PCE). As an example, in the case where inflation runs, for a period of time, above this threshold, a suitable monetary policy would pursue an inflation level slightly above 2 percent.

- Sustainable long-term interest rates.

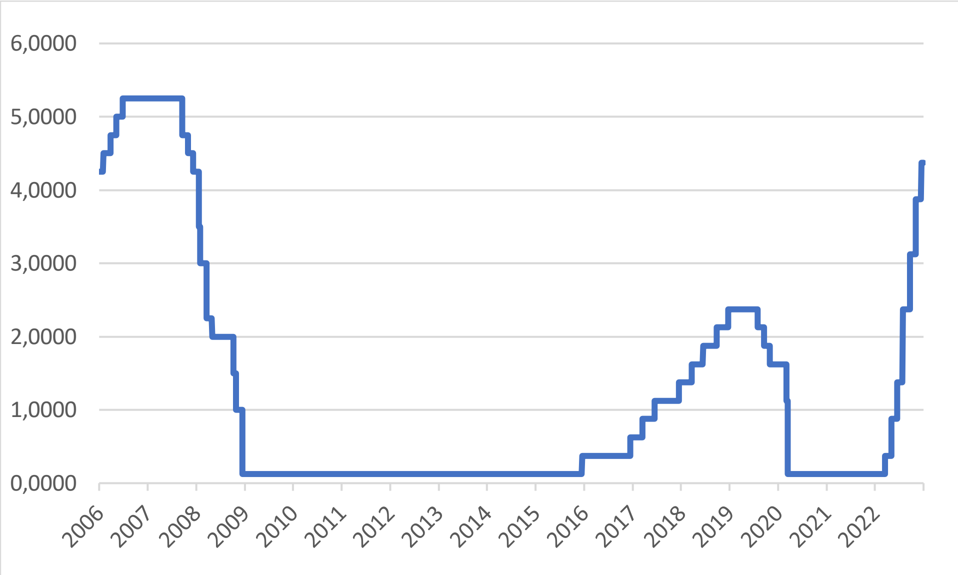
FOMC decisions have a substantial impact not only on the United States economy but also across the world due to the major role of the US dollar and the interconnection of global economies. Laeven and Tong (2012) conducted a study employing stock data from 44 different countries (excluding the U.S.). They obtained statistically significant results demonstrating how foreign stock prices react to unexpected monetary shocks in the U.S.

Fed Funds Target Rate

The Federal Funds Target Rate represents the overnight interest rate at which commercial banks lend funds to each other in federal funds market; the market has, among others, the function of let banks manage their excess or deficit to comply with Federal Reserve requirements. It is considered an important economic indicator, representing Fed intentions on monetary policy matters and reflects evaluations on the current state of the economy and its future perspective. The Federal Open Market Committee controls the rate through open market operation, buying (selling) government bonds with the aim of increase (decrease) the size of available reserves; this indirect form of control allows Fed to sway the cost of money. Fluctuations in Fed Funds Rate have influence on short-term interest rates and, as in a domino effect, on mortgages, credit cards interest or on business loans, likewise companies and consumer decision on expenditures and investments.

In addition, one more control instrument employed is the Overnight Reverse Repurchase Agreement (ON RPP) which consists in a temporary sell government security to financial institutions, with the promise of buying them back the next day, paying them interests.

Image 1; Evolution of Federal Fund Target Rate between 2006 and 2022



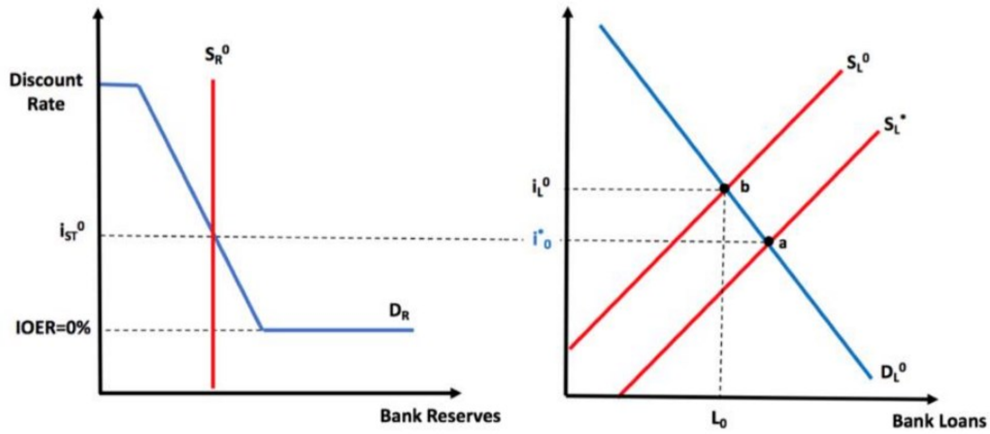
US Monetary Policy: A Macro View

Money related strategy assumes an urgent part in molding a country's monetary scene. In the US, the Central bank is the vital participant liable for carrying out money related approach. Throughout the long term, the Fed has utilized different working structures, with a critical shift from a passage framework to a story framework. This progress has significant ramifications for the working of the monetary framework, especially for banks. In this exposition, we will dive into how US financial strategy functions according to a macroeconomic viewpoint, investigate the distinctions between the passage framework and floor framework, and break down the explanations for the Federal Reserve's shift. In a macroeconomic setting, the essential targets of US money related strategy are to settle costs, expand business, and cultivate monetary development. The Central bank uses various apparatuses to accomplish these objectives, including open market tasks, changes in the rebate rate, and acclimations to save prerequisites. These instruments by and large impact the cash supply and loan fees, forming the general financial scene. One basic part of the Central bank's job is to figure out some kind of harmony between expansion and joblessness. The national bank tries to forestall unnecessary expansion, which dissolves the buying force of the cash, while additionally endeavoring to keep a climate helpful for work creation and monetary extension.

Moving from a corridor to a floor system

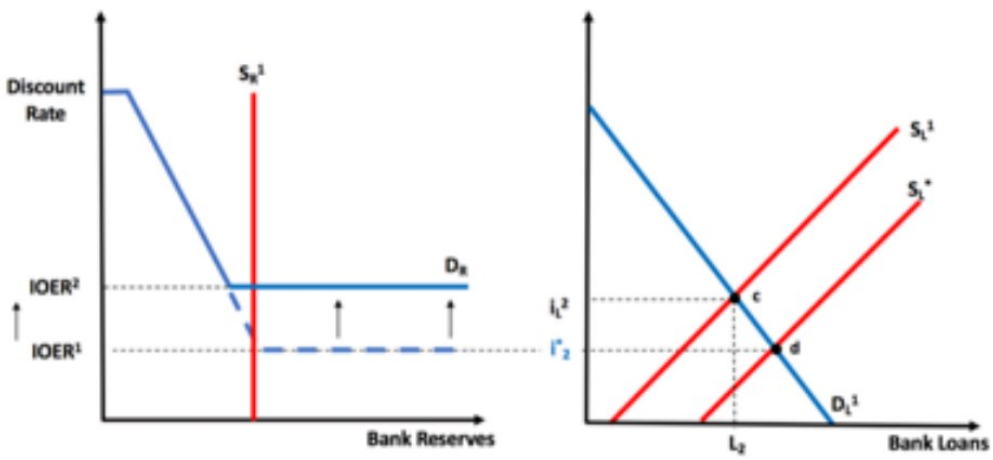
In a corridor system, the central bank establishes a policy rate and sets upper and lower bounds around it, creating a corridor within which the interbank rate, such as the federal funds rate in the US, is expected to fluctuate. The interbank rate is influenced by market forces, and the central bank intervenes when it deviates beyond the established bounds. This system relies on the central bank's ability to fine-tune interest rates within the specified range.

Image 2, Equilibrium in corridor system



Conversely, a floor system involves the central bank setting a policy rate and providing excess reserves to the banking system in amounts sufficient to keep the interbank rate close to the policy rate. The excess reserves act as a floor, preventing the interbank rate from falling below the policy rate. This system aims to ensure stability by providing a solid base for short-term interest rates.

Image 3, Equilibrium in floor system



The Federal Reserve's shift from a corridor system to a floor system was, in part, a response to challenges encountered during the 2008 financial crisis. As the federal funds rate approached the lower bound in the corridor system, the central bank faced limitations in implementing traditional monetary policy tools. The floor system, with its emphasis on maintaining abundant reserves, offers greater flexibility in influencing interest rates, especially during economic downturns.

The move to a floor system also reflects the Fed's efforts to enhance the transmission of monetary policy. By providing a more stable and predictable environment for short-term interest rates, the central bank aims to exert greater control over the broader economic landscape, ensuring that its policy decisions have the desired impact on inflation, employment, and economic growth.

With excess reserves prevalent in the financial system under a floor system, banks may experience a shift in their reliance on short-term funding markets. The abundance of excess reserves reduces the need for interbank borrowing, influencing overall liquidity conditions. This change can have cascading effects on various aspects of banks' operations and their ability to manage liquidity risk effectively. The transition to a floor system prompts banks to reevaluate their portfolio management strategies. With a more stable interest rate environment, banks may adjust their investment and lending practices to adapt to the changing dynamics of the financial system. This shift can impact the composition of banks' assets and liabilities, affecting their profitability and risk profiles.

In conclusion, the Federal Reserve's transition from a corridor system to a floor system represents a strategic response to the challenges posed by economic crises and a commitment to refining monetary policy effectiveness. As the central bank continues to adapt its operating framework, the implications for banks and the broader financial system become increasingly significant. The intricate interplay between monetary policy tools, operating frameworks, and the behavior of financial institutions underscores the complexity of modern central banking and its far-reaching consequences. Understanding these dynamics is crucial for policymakers, financial institutions, and market participants as they navigate the evolving landscape of monetary policy.

Literature review

Several papers suggest that monetary policy exerts an immediate impact on asset prices and stock returns. A set of studies, including works by Basistha and Kurov (2008), Bernanke and Kuttner (2005), Ehrmann and Fratzscher (2004), and Guo (2004), highlights the sensitivity of stock returns to unexpected fluctuations in the federal funds rate. Another set explores how monetary policy exhibits asymmetric effects on stock returns, with these asymmetries linked to business characteristics like firm size, capital intensity, and financial constraints. These nuances are particularly intriguing because theoretical research, especially studies on the credit channel, posits that monetary policy might have varying effects on firms and their values, even within the same industry, depending on their unique financial characteristics. Thorbecke (1997) delves into business size and concludes that monetary policy has a more pronounced impact on smaller enterprises.

A separate set of studies examines the asymmetric reactions of stock returns to unexpected changes in monetary policy across different phases of the business cycle. According to Basistha and Kurov (2008), stock returns display heightened sensitivity to unexpected changes in monetary policy during recessions and tight credit market conditions. Guo (2004) asserts that the stock returns of smaller businesses are more profoundly affected than those of larger enterprises, and this discrepancy is exacerbated during recessions. Another cluster of publications investigates disparities in the impact of monetary policy linked to the overall state of the stock market. Chen (2007) and Perez-Quiros and Timmermann (2000) specifically probe whether monetary policy has asymmetric effects in bull and bear markets.

The theory suggests that agency costs lead to information asymmetry between businesses and financial intermediaries, resulting in a higher external finance premium during bear markets. Chen (2007) and Perez-Quiros and Timmermann (2000) provide evidence supporting the idea that monetary policy has a more pronounced impact on stock returns in declining markets. These researchers use indicators indirectly measuring monetary surprises, such as the M2 growth rate, discount rate changes, and Federal Funds rate changes. In my study, I adopt a more direct approach based on Kuttner's (2001) technique for measuring surprise changes in the Federal Funds Rate target using futures data. This method offers a direct measurement, enabling a more precise estimation of the immediate impact of a surprise change in the Federal Funds Rate on stock returns. Kuttner's method for assessing monetary policy shocks continues to be widely used, as seen in the work of Chulia et al. (2010).

The primary objective is to contribute to our comprehension of the asymmetric effects on stock returns in bull and bear markets. I begin by isolating the unexpected component of Federal Funds Rate changes using Federal Funds futures data. This measure is then used to reevaluate potential asymmetries in the impact of monetary policy surprises on stock returns in bull and bear markets. In imperfect capital markets, information asymmetries are expected to create a difference between the costs of internal and external funds. According to Jaffee and Russell (1976) and Stiglitz and Weiss (1981), agency problems and inefficient capital markets result in an external finance premium. Due to information asymmetry, financial intermediaries assess a company's ability to repay loans. Collateral often backs debts, and businesses with higher collateral values usually have greater debt capacity, facilitating external financing. Some scholars explore potential variations in the influence of monetary policy on the stock returns of financially constrained and unconstrained firms. For example, Ehrmann and Fratzscher (2004) discover that firms with more financial constraints are more significantly affected by sudden shifts in monetary policy. Gertler and Hubbard (1993) note that credit limits fluctuate over business cycles, and Gertler and Gilchrist (1994) as well as Kashyap et al. (1994) imply a link between stock returns and macroeconomic conditions. Recent research by Chulia, Martens, and van Dijk (2010) investigates the potential asymmetric effects of positive and negative surprise federal funds target adjustments on market returns, volatility, and correlations. This article utilizes the Kuttner measure of unexpected policy announcements, focusing on a narrow five-minute window around the announcement. The authors highlight asymmetry in the reaction of stock returns to positive and negative changes in the funds rate, noting a 46 basis point decline in stock returns with a 10-basis point increase in the funds rate. They further emphasize that the occurrence of a surprise increase in the federal funds rate is more impactful than the magnitude, while for a surprise fall in the federal funds rate, the magnitude becomes relevant.

Defining bull and bear markets is crucial for the study. While financial analysts often categorize the stock market based on fixed percentage declines or rises, academic literature lacks a universally recognized systematic definition. Commonly, a bull market is perceived as a period of substantial and sustained stock price increases, while a bear market is seen as a period of significant and continuous stock price declines. Definitions proposed by scholars like Chauvet and Potter (2000), Bry, Boschan, and Eisenpress (1973), and Pagan and Sossounov (2003) align with this general understanding.

Data

The data retrieved for the event study proposed are plenty and from different source. From the Center for Research in Security Prices (CRSP), I retrieved the Value and Equal-weighted returns for S&P500 but also helped me create portfolios containing SIC-sorted securities to verify effects on different industries and portfolios containing each decile of S&P500 sorted by market capitalization. In the Fed webpage I have manually collected the FOMC announcements and their dates while from ECB data portal the EONIA and the €STR rates. Datastream by Eikon has been my major source of information, within Excel I have been able to download S&P500 and STOXX600 price indexes to distinguish bull and bear market, CBOT futures prices with Federal Funds Target Rate as underlying and future prices of EONIA rate as underlying.

Research methodology

Fed policy action expectations are not immediately observable, but Fed funds futures prices provide a logical, market-based proxy for such presumptions. The market was founded at the Chicago Board of Trade in 1989. Currently, contracts based on one- to five-month Fed funds are traded alongside a "spot month" contract based on the funds rate for the current month. Krueger and Kuttner (1996) discovered that funds rate projections based on futures prices are "efficient" in the sense that forecast errors are not significantly linked with other factors known at the time the contract was priced. Using futures data as an indicator of anticipated Fed policy offers several advantages versus using statistical proxies. First, there is no difficulty with model selection; second, there is no problem with the data used to construct the prediction; and third, there are no difficulties with produced regressors. Using futures data has the obvious problem of limiting the research to the post-1989 era. Moreover, the use of futures data is accompanied by two challenges associated. One is that the settlement price of the Fed funds futures contract is based on the average of the relevant month's effective overnight Fed funds rate, as opposed to a given day's rate. Therefore, the time-averaging must be undone in order to obtain an accurate estimate of the predicted funds rate. The second problem is that futures contracts are based on the effective market rate, not the target Fed funds rate. In monthly averages, the two are often within a few basis points of one another. However, on a daily basis, the gap between the market rate and the Fed's objective is frequently too big to be ignored. In light of these challenges, the question is how to effectively extract a measure of the unexpected change in the target rate on date *t+1*, relative to the forecast made on day *t*.

The spot-month futures rate on day *t* of month s; $f_{s,t}^{0}$, can be read as the conditional expectation of the average funds rate in month *s* plus a term indicating the premium accruing to spot-month futures contract long investors:

$$f_{s,t}^{0} = E_t \frac{1}{m} \sum_{i \epsilon s} (r_i + \mu_{s,t}^{0}) \qquad (1)$$

Where r_i is the overnight funds rate on day *i* and *m* represents the number of days in a month. In an efficient market with risk-neutral investors, the term $\mu_{s,t}^{0}$ would be equal to zero. In this study, the premium is not explicitly modelled; rather, it is added to highlight how its presence influences the computation of unexpected policy actions using Fed funds futures rates.

Assume that on day *t*, investors in the futures market anticipated that the Fed would alter the Fed funds target rate on date *t+1*, with no more adjustments anticipated within the month. The futures rate on day *t* would reflect the average of realized funds rates up to that date, as well as estimates of the rates that will prevail after that date:

$$f_{s,t}^{0} = \frac{t}{m} \overline{r_{\iota \le t}} + \frac{m-t}{m} E_t \overline{r_{\iota > t}} + \mu_{s,t}^{0} \qquad (2)$$

The result of expressing the realized funds rate r_i as $\widetilde{r_\iota} + \eta_i$, the sum of the target rate plus an error associated with unforeseen reserve supply or demand fluctuations, yields:

$$f_{s,t}^{0} = \frac{t}{m} [\widetilde{r_t} + \overline{\eta_{\iota \le t}}] + \frac{m-t}{m} [E_t(\widetilde{r_t} + \overline{\eta_{\iota > t}}) + \mu_{s,t}^{0} \qquad (3)$$

Where $\bar{\eta}$ is the average aiming error throughout the relevant month section. An apparent technique to reconstruct the unexpected target rate change on day *t+1* is to examine the difference between the month's average funds rate and the spot month rate on the day before the change, multiplied by the number of days impacted by the change:

$$\frac{m-t}{m} (\overline{r_s} - f_{s,t}^{0}) \qquad (4)$$

where $\bar{r}$ is the average effective funds rate for the full month. Substituting from above yields:

$$(\widetilde{r_{t+1}} - E_t \widetilde{r_{t+1}}) + (\overline{\eta_{\iota > t}} - E_t \overline{\eta_{\iota > t}}) - \frac{m-t}{m} \mu_{s,t}^{0} \qquad (5)$$

Therefore, the computed surprise equals the "actual" surprise plus the average of targeted errors made later in the month minus the scaled-up premium. The first of them may create some noise (particularly if an abnormally turbulent settlement period happens late in the month), but its size will likely not exceed a few basis points. However, the term involving $\mu_{s,t}^{0}$ is a more significant issue due to the fact that scaling accentuates it and increases time variation. The issue is most serious at the conclusion of the month. A one basis point premium would become a 15 basis point mistake with two days remaining in the month, and a 30 basis point error with one day remaining. Subtracting the premium from the futures rate may solve the problem, but only if $\mu_{s,t}^{0}$ was a known constant. The average future targeting error is eliminated when the average realized funds rate is replaced with a weighted average of previous realized funds rates and future target rates, but the scaled-up premium remains. As the month continues, the spot-month future rate tends to converge to the average funds rate. At the end of the month, however, the predicted next-day shift in the Fed Fund goal from the approach outlined above becomes significantly more variable (much, but not all, of the volatility occurs in December, presumably as a result of year-end impacts on the funds market). If $\mu_{s,t}^{0}$ was a constant or deterministic function of the day of the month, there would be a systematic bias in the expected change; instead, the increased volatility of the predictions indicates that it has a random, time-varying component.

The 1-day shift in the spot-month future rate can be used to calculate a policy surprise metric less vulnerable to this issue. The essential insight is that the day-t futures rate reflects the expected change on (or after) date *t+1*; if the projected change occurs, the spot rate will not change. Any divergence from the projected rate will result in a corresponding change to the number of days affected by the deviation in the futures rate. The 1-day surprise for day *t* would be computed as follows:

$$\Delta\widetilde{r_t^u} = \frac{m-t}{m}\left(f_{s,t}^{0} - f_{s,t-1}^{0}\right) \qquad (6)$$

For all but the first day of the month on which the 1-month future rate of the last day of the previous month $f_{s-1,m}^{1}$ would be used instead of $f_{s,t-1}^{0}$. This approach yields a virtually pure measurement of the 1-day surprise target change under the premise that no further changes are anticipated during the month. As it includes solely variations in the futures rate, the premium μ^{0} vanishes if the futures rate does not fluctuate from day to day. The only contamination is the day-t aiming mistake and the reevaluation of future targeting error expectations. Occasionally, these inaccuracies can be significant, thus the change in the 1-month futures rate is utilized when the target rate changes within three days of the end of the month. The expected portion of the change is then determined by subtracting the actual from the unexpected:

$$\Delta\widetilde{r_t^e} = \Delta\widetilde{r}_t - \Delta r_t^u \qquad (7)$$

I employ an event–study technique to examine the asymmetric impact of unexpected changes in the Federal Funds Rate target on stock returns throughout bear and bull markets. First, I estimate Equation 8 to examine the linear relationship between stock returns and expected and unexpected changes in the Federal Funds Rate:

$R_t = \beta_0 + \beta_1 \Delta r_t^u + \varepsilon_t$ (8)

Where R_t represents the return on stocks.

I also investigate the industry-specific effects on stock returns of a monetary policy surprise. For this I estimate Eq. (9) as follows:

$R_{i,t} = \beta_0 + \sum_{i=1}^{N} \beta_1 \Delta r_t^u K_i + \sum_{i=1}^{N-1} \beta_{2,i} K_i + \varepsilon_t$ (9)

where K_i is a dummy variable representing the i^{th} industry group, *N* denotes the total number of groups, and K_N is the reference group. The possibility of a contemporaneous association with other news is a concern for regressions such as those described below. If both our monetary policy surprise and stock market returns respond contemporaneously to other news, then the orthogonality criterion in the regressions would be violated. Bernanke and Kuttner (2005) analyzed this topic at length but concluded that, since February 1994, the FOMC meeting calendar has dictated the timing of policy decisions, making it uncommon for the federal funds rate to respond to economic data on the same day. They tested a number of alternative estimators, such as narrow windows and two 'statistical' solutions and discovered that the outcomes of these alternatives are universally comparable to those of the event–study approach.

Next, I investigate the asymmetric impact over bull and bear markets, and this requires a definition of these terms. As mentioned above, the procedure in order to outline bull and bear markets follows a slightly modified method proposed by Pagan and Sossounov (2003):

1. Determination of initial turning points in raw data.

(a) Determination of initial turning points in raw data by choosing local peaks (troughs) as occurring when they are the highest (lowest) values in a window eight months on either side of the date.

(b) Enforcement of alternation of turns by selecting highest of multiple peaks (or lowest of multiple troughs).

2. Censoring operations (ensure alternation after each).

(a) Elimination of turns within 6 months of beginning and end of series.

(b) Elimination of peaks (or troughs) at both ends of series which are lower or higher.

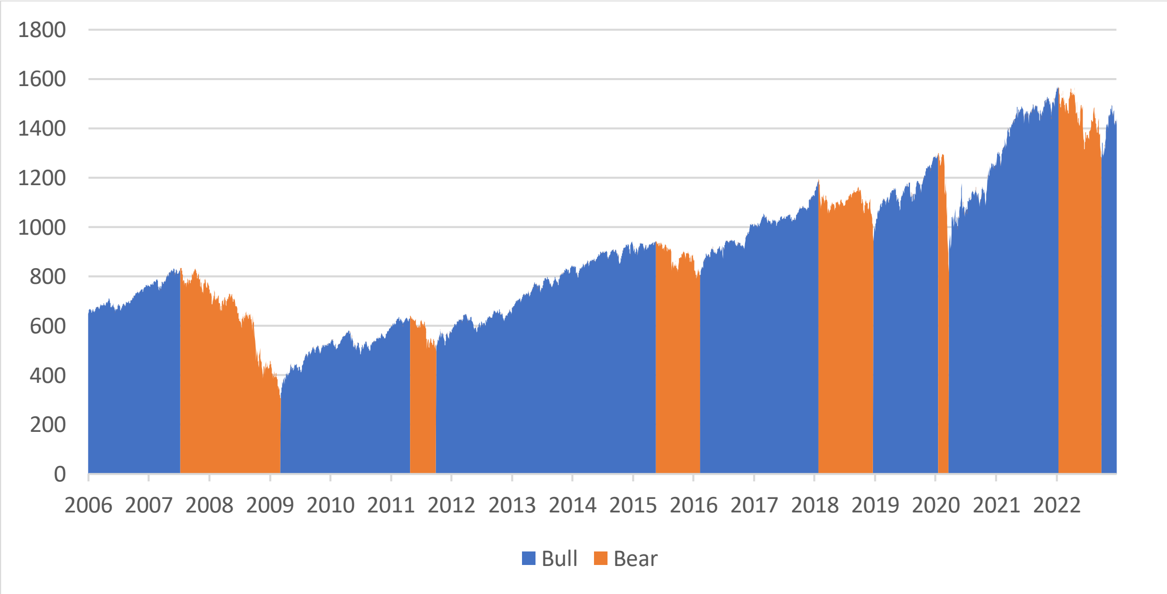
(c) Elimination of cycles whose duration is less than 16 months.

(d) Elimination of phases whose duration is less than 4 months (unless fall/rise exceeds 20%).

3. Statement of final turning points

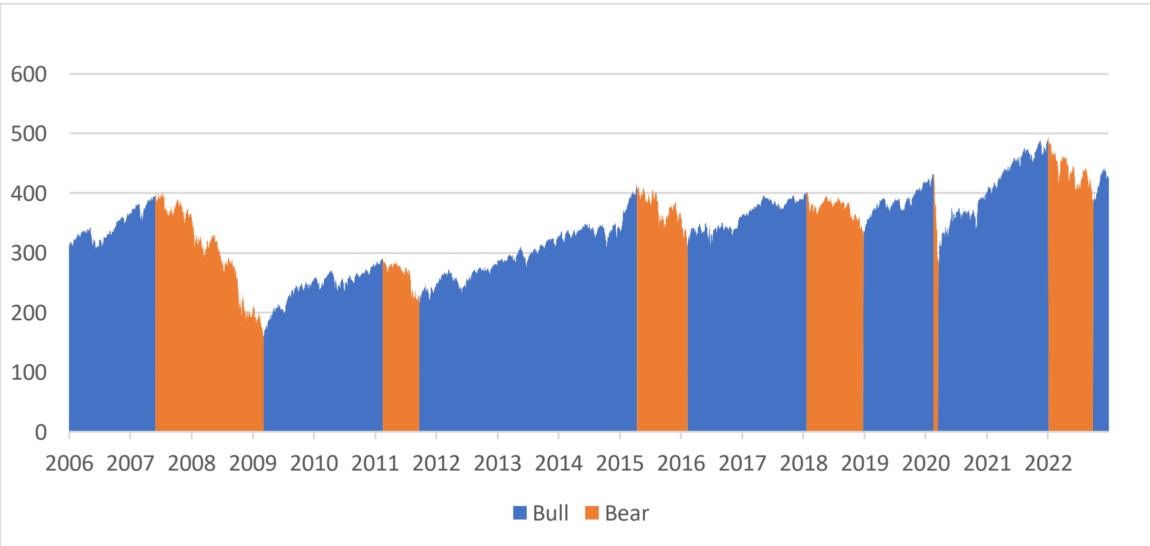
I opted to disregard the stipulation outlined in point 2(a) of our analysis. Instead, I conducted an examination of both the US and EU data series without eliminating the turning points occurring towards the end of each series. It was observed that, in both cases, the market exhibited a persistent bullish trend for a minimum duration of six months subsequent to the conclusion of the specified timeframe (December 2022).

Image 4; S&P500 Price Index, used as a proxy of US market



Both data series demonstrate remarkable similarities in terms of their observed trends, cycles, specific dates, and durations. Notably, both series are characterized by seven distinct bullish phases and six bearish phases.

Image 5; STOXX Europe 600, used as a proxy of EU market



I investigate the possible asymmetries in the effect of surprise monetary policy actions in bull and bear market by estimating equation (10), which includes our indicator variable for a bull market as follows: $R_t = \beta_0 + \beta_1 \Delta r_t^u + \beta_2 \Delta r_t^u Bull_t + \varepsilon_t$

(10)

Note that $\beta_1 + \beta_2$ measures the impacts of monetary policy surprises in a bull market, whereas β_1 measures the effects of monetary policy surprises in a downturn market.

I also examine division-specific and major industry group asymmetries in the impact of unexpected monetary policy moves in bull and bear markets by calculating the following equation:

$R_{i,t} = \beta_0 + \sum_{i=1}^{N} \beta_{1,i} \Delta r_t^u K_i + \sum_{i=1}^{N-1} \beta_{2,i} K_i + \sum_{i=1}^{N} \beta_{3,i} K_i Bull_t + \sum_{i=1}^{N} \beta_{4,i} K_i Bull_t \Delta r_t^u + \varepsilon_{i,t}$

(11)

$\beta_{1,i} + \beta_{4,i}$ measures the effect of unexpected monetary policy in the K_i division during a bull market, whereas $\beta_{1,i}$ measures the effect of unexpected monetary policy during a downturn market. In the absence of an unexpected monetary policy shock, the impact of a bull market on stock returns in the K_i division is $\beta_{2,i} + \beta_{3,i}$, the impact of a bad market is $\beta_{2,i}$.

Empirical Results

Table 1 reports descriptive statistics regarding expected and unexpected variation in monetary policy. Across 140 FOMC meeting dates, the average anticipated adjustments amount to 160 basis points, while unforeseen modifications have an average of -61 basis points. Notably, the standard deviation of expected changes in the Federal Funds Rate is over six times as large as the standard deviation of surprise variations in the Federal Funds Rate.

Table 1, Descriptive statistics

Sample period	*Jan 2006 -Dec 2022*
Number of events: federal funds rate change	33
Number of events: FOMC meeting but no FFR change	107
Mean: anticipated federal funds rate change	1.6%
Mean: surprise federal funds rate change	-0.61%
Standard deviation: anticipated federal funds rate change	0.2252
Standard deviation: surprise federal funds rate change	0.0372
Mean: CRSP value-weighted stock returns	0.05%
Mean: CRSP equally-weighted stock returns	0.05%
Standard deviation: CRSP value-weighted stock returns	0.0125
Standard deviation: CRSP equally weighted stock returns	0.0140

In Table 2, the first column presents the outcomes of estimating Eq. (3). The initial row provides insights into CRSP value-weighted returns, showing that a surprise increase of 1% in the

Federal Funds Rate has a substantial and statistically significant negative effect. Specifically, the estimate suggests that such an increase leads to an immediate daily decline of -9.07% in CRSP value-weighted returns. Moving on to the second row, it highlights results for CRSP equally weighted returns, indicating that a 1% surprise increase in the Federal Funds Rate results in an immediate -9.66% daily change in these returns. The subsequent ten rows in Table 2 delve into the findings for different size deciles of value-weighted returns. In this analysis, stocks are categorized by their market capitalization, and value-weighted returns are computed for each decile. For each of these deciles, a regression analysis is conducted to assess how anticipated and surprise changes in monetary policy impact returns. In the final row of the table, we can observe the impact of monetary policy on the Euro Stoxx 600 index. A 1% surprise increase in this context results in a notable negative variation of 9.68% in the Euro Stoxx 600 index. However, it's worth noting that the number of firms included in the U.S. sample is considerably larger compared to the Euro Stoxx 600 sample, and as a result, the statistical significance of these results does not appear to be as strong.

Table 2, Output results, equation 8 and 10

Portfolio	*Equation(8)*	*Equation (10)*	
	Policy surprise	*Policy surprise, bull market*	*Policy surprise,bear market*
	β_1	$\beta_1 + \beta_2$	β_1
CRSP VW return	-0.0907**(2.3611)	-0.0376 (1.0243)	-0.1285(1.6384)
CRSP EW return	-0.0966**(2.5528)	-0.05497 (1.3332)	-0.1253*(1.7055)
First decile (Largest)	-0.0905***(3.3909)	-0.0956***(2.9098)	-0.0840*(1.7446)
Second decile	-0.0809***(3.3093)	-0.05459**(1.8614)	-0.0959**(2.1418)
Third decile	-0.0962***(3.1863)	-0.0413(1.1669)	-0.1301**(2.3342)
Fourth decile	-0.0938**(2.4854)	-0.0435 (0.9159)	-0.1261*(1,8841)
Fifth decile	-0.0925**(2.4027)	-0.0443 (0.9639)	-0.1363*(1.7204)
Sixth decile	-0.1014**(2.3194)	-0.0501 (1.0449)	-0.1380 (1.6337)
Seventh decile	-0.1032**(2.3135)	-0.0660*(1.3169)	-0.1303 (1.5263)
Eighth decile	-0.1013**(2.2283)	-0.0601 (1.2501)	-0.1325 (1.4820)
Ninth decile	-0.1025**(2.3661)	-0.0530 (1.2163)	-0.13828 (1.5902)
Tenth decile (Smallest)	-0.0884**(2.3480)	-0.0336 (0,9501)	-0.1273 (1.6462)
STOXX600	-0.0968 (1.1062)	-0.1379 (1.1342)	-0.0643 (0.5406)

Our subsequent findings pertain to the estimations of Equation (9), and these results are detailed in Table 3. In the third column of Table 3, we present the outcomes of Equation (9) for 7 portfolios categorized by SIC (Standard Industrial Classification) categories, organized based on the magnitude of surprise target change effects. Our analysis reveals that the influence of monetary policy on stock market returns varies significantly across these SIC categories. Specifically, we observe that firms operating in the Mining, Manufacturing and Construction sectors are the most substantially affected by unanticipated monetary policy actions. For these companies, a surprise 100 basis point increase in the Federal Funds Rate results in an immediate negative change of -18.35%, 11.35% and 11,32% in returns respectively. Following closely, firms in the Services and Transportation & Communication, Retail and Wholesale sectors also exhibit significant impacts, though less pronounced. It's noteworthy that the Mining, Manufacturing and Transportation & Communication industries stand as exceptions, as they are the only displaying statistically significant impact from surprise monetary policy developments.

Table 3, Output results, equation 9 and 11

Major sector	Number of firms	Equation(9)	Equation (11)		Equation (11)	
		Policy surprise $\beta_{1,i}$	Policy surprise, bull market $\beta_{1,i} + \beta_{4,i}$	Policy surprise, bear market β_1	Bull market $\beta_{2,i} + \beta_{3,i}$	Bear market $\beta_{2,i}$
Transportation,communication	467	-0.0674*(1.7681)	-0.0296 (0.7983)	-0.0951 (1.2303)	0.0002 (0.1661)	0.0062 (1.4811)
Services	143	-0.0663 (1.5205)	-0.0192 (-0.4494)	-0.1253 (1.4395)	0.0010 (0.7279)	0.0039 (0.7429)
Manufacturing	1350	-0.1135**(2.5542)	-0.0672 (1.2655)	-0.1446*(1.7716)	0.0022 (1.2399)	0.0039 (0.7109)
Retail Trade	80	-0.0573 (1.5205)	-0.0294 (0.6085)	-0.0787 (1.0439)	0.0012 (0.6837)	0.0035 (0.8279)
Wholesale Trade	30	-0.0520 (1.3582)	-0.0383 (0.8081)	-0.0653 (0.9549)	0.0012 (0.6937)	0.0002 (0.0395)
Construction	8	-0.1132 (1.5864)	-0.06517 (0.6406)	-0.1516 (1.3593)	0.0032 (1.2512)	0.0072 (0.7116)
Mining	25	-0.1835**(2.3888)	-0.1095 (1.0219)	-0.2244*(1.8224)	0.0381 (1.4181)	0.0055 (0.7670)

I also endeavour to estimate models that explore how monetary policy affects financial markets differently during periods of rising/declining market, beginning with Equation (10). Turning our attention back to Table 2, the estimations stemming from Equation (10) are presented in columns three and four, allowing for a comparison with the findings in column two, where we have analysed a common impact that applies to both bull and bear market scenarios. The measure of the effect of an unexpected monetary policy move during a bear market is denoted as β1, while the impact of a similar policy change during a bull market is expressed as β1+β2. The subsequent panel reveals that the effect of an unexpected monetary policy move during a bear market is substantial, displaying a heavy negative effect. This pattern holds true for both the CRSP equal-weighted portfolio, as well as across the first five size-based portfolios we have examined. Conversely, the consequences of a monetary policy surprise during a bull market are of smaller magnitude when compared to those during a bear market. In general, these effects tend to lack statistical significance, except in the case of the first, second and seventh size-based portfolios. Columns 4–7 in Table 3 present the outcomes of Equation (11), examining the effects of unanticipated monetary policy actions on various industries during both bullish and bearish market conditions. In Equation (11), the measure of a surprise monetary policy effect on stock returns within the ith industry during a bull market is represented as β1,i+β4,i.

Conversely, the measure of the impact of a surprise monetary policy shock on stock returns within the ith industry during a bear market is indicated as β1, i.

It is evident that the impact of a surprise monetary policy action tends to be sizable during bear markets. Consider the example of the Manufacturing industry. In a bull market, a surprise 100 basis point increase in the Federal Funds Rate results in an immediate 6.72% decline in stock returns for this industry. However, in a bear market, the same surprise policy change leads to an immediate 14.46% decline in stock returns. This underscores that the impact is considerably stronger and consistently negative during bear markets. These findings are indicative of a broader pattern across industries. During a bear market, seven out of seven industries exhibit larger magnitude, negative, but few significant impacts of surprise monetary policy actions on stock returns. Notably, in a bull market, we still observe a negative impact across the seven industries, but none of these estimates are statistically significant at the ten percent significance level. In Equation (11), the influence of a bull market on stock returns in industry Ki in the absence of a monetary surprise is expressed as β2,i+β3,i; the effect of a bull market alone is given by β2,i. Columns 6–7 of Table 3 provide estimations of these effects for seven industries. The analysis reveals that the effect of a bull market on stock returns (without the presence of a monetary surprise) is consistently positive but again, not statistically significant across all industries; the impact of a bear market is positive but statistically insignificant in all cases. These results suggest that it is not merely the presence of a bear market that drives the observed negative impact of monetary policy surprises during such conditions.

Conclusions

Ultimately, my research aimed to explain the asymmetries of monetary policy shocks and their influence on the security market, particularly across different genres of stock portfolios. This included indexes as proxies for the market, as well as portfolios of varying sizes and sectors. The study period spans 17 years, from January 2006 to December 2022.

I employed a method similar to Jansen and Tsai (2010) by utilizing the approach proposed by Kuttner (2001) to identify the unexpected component of the Federal Fund Rate using futures contracts. Additionally, I enhanced the Pagan and Sossounov (2003) model to identify the alternation of bull and bear markets.

Concerning the results, while I did not find statistical significance in many industry portfolios, my study did reveal a strong statistical significance of the effect of monetary policy shocks on CRSP EV and VW portfolios, including their deciles. Furthermore, there was a general consensus indicating a stronger effect during bear markets.

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