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The Impact of Federal Reserve Monetary Policy on Sector ETF and Market Cap ETF Performance

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The impact of Federal Reserve monetary policy on sector ETF and market cap ETF performance

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ABSTRACT

This study explores the impact of Federal Reserve policy changes on returns and volatility of U.S. equity markets, including large cap, mid cap, and small cap as well as the eleven sectors of the S&P 500. Federal Reserve policy changes in this study are measured by changes in the federal funds target rate. To measure the impact of these rates on U.S. equity markets, I construct a longitudinal dataset inclusive of exchange traded funds (ETFs) that serve as proxies for all eleven sectors, as well as one index and two ETFs that capture the performance of small, mid, and large market capitalization stocks. The monthly performance of these variables are matched against the respective dates of federal funds rate data.

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1. Introduction

Investors across the United States continually aim to identify robust measures of economic climate, indicators of potential future performance, and investment strategies that exhaust the information therein to gain returns greater than that of the market. In order to realize those potential returns in the US stock market, an investor may purchase a stock with optimism that its price in the future is greater than its price at purchase, at which time the investor has realized a capital gain. As an example, if an investor were to invest money into the S&P 500 in January 2000, he would have yielded a total return of about 218% as of the end of January 2022 (Nasdaq, 2022a). The S&P 500 includes holdings from all eleven market sectors. For reference, the eleven sectors of the S&P 500 by size (largest to smallest), are technology, health care, financials, consumer discretionary, telecommunications, industrials, consumer staples, energy, utilities, real estate, and materials. If this same investor were to invest money into the Financial Select Sector SPDR Fund (XLF) in January 2000, he would have yielded a total return of about 130% as of the end of January 2022 (Nasdaq, 2022b). If the investor were to invest money into the Health Care Select Sector SPDR Fund (XLV) in January 2000, he would have yielded a total return of about 361% as of the end of January 2022 (Nasdaq, 2022c). While it is expected that these well-developed markets rise in valuation over time, they also experience significant fluctuations in asset prices (volatility) at certain times and the magnitude of such volatility can differ substantially across markets. For example, on October 19th, 1987, the Dow Jones Industrial Average recorded its greatest single day loss in its history when it fell to 1,738 from 2,246, nearly a 25% deterioration (Bogle, 2008, p. 30). This loss is rivaled by the next largest single day loss which occurred on

October 24th, 1929, well known as “Black Thursday,” where the Dow Jones Industrial Average saw a decline of 13%, which ultimately gave rise to the Great Depression. (Bogle, 2008, p. 30). More recently, over the course of the COVID-19 pandemic, US markets embraced unprecedented levels of long-term volatility. The Federal Reserve responded to the economic impact of the pandemic by implementing near-zero interest rates to promote consumption and investment and help float the economy. Shortly thereafter, US markets realized incredible gains over the remainder of 2020 and over the duration of 2021. Many investors gained during this time of high volatility and expansionary monetary policy implemented by the Federal Reserve. However, 2022 proved to encapsulate the well-known side effect of such an aggressive policy. These incredibly low rates, coupled with considerable quantitative easing and three rounds of stimulus payments to US households over the course of the pandemic, referred to as Economic Impact Payments (Pandemic Response Accountability Committee, 2022), drove inflation to levels unobserved by the US economy in decades. In September of 2022, the core consumer price index rose 6.6 percent from the year-ago period, signaling a 40-year high in one of the most closely observed measures of inflation for US prices (Pickert, 2022). In response to these incredible inflation readings, the Federal Open Market Committee (FOMC) announced seven rate changes to the Federal Funds Target Rate over the course of 2022, four of which were consecutive 75 basis point hikes. Thus, as an inverse response relative to the expansionary policies of 2020 and 2021, markets again became more volatile and tumbled on the news that the Federal Reserve was implementing a contractionary monetary policy to fight inflation.

The aforementioned market occurrences and macroeconomic events as well as the respective responses from the Federal Reserve depict just a few examples that provides an environment in which investors may benefit from an investment strategy that capitalizes on volatility attributable to changes in monetary policy. While higher price volatility is associated with higher risk, which some investors may want to avoid, it also provides opportunities to investors. For example, buying a stock at a bargain when volatility drives its price down in the short-run, while benefiting from potential higher returns in the long-run.

Hence, information regarding the segments of the stock market that are most subject to volatility during specific times (e.g., periods of different monetary policies), as well as information regarding historical performance amidst changing Federal Reserve monetary policy may be useful to investors who want to avoid more volatile and riskier sectors altogether or provide opportunities for investors looking to leverage volatility to outperform the market in the long-run.

With the United States equity markets representing 42%, or $52 trillion, of the global equity market capitalization (Kolchin et al., 2021, p. 4), money moves in and out of these markets at a continuously increasing rate as both commercial and retail investors look to make large capital gains on their investments. Thus, given that the United States economy has proven to be robust, individuals and organizations around the world continue to add to the U.S. stock market's already considerable size. Many of these investors look for financial metrics specific to certain firms in order to identify a stock that has the potential to provide meaningful return on investment. However, the efficacy of firm-specific metrics becomes less absolute in an environment where macroeconomic

conditions are uncertain. Firm-specific metrics may provide guidance relating to potential advantages of a stock relative to its peers, but they do not serve as a comprehensive measure in identifying a firm's standing within the macroeconomy. While it is commonly understood and accepted that rising rates promote and induce economic contraction, and falling rates promote and induce economic expansion, it plays to the advantage of investors to understand which sectors of the stock market are more likely to be susceptible to monetary policy changes based on historical data and trends. In this case, when investors are tuned in to Federal Reserve sentiment and policy, they can best align themselves to transact securities in a manner that is consistent with their respective investment strategies and risk tolerance as it relates to the macroeconomy. Given the levels of volatility observed in recent history, it is more important than ever before for investors to understand the sizeable impact these policies can have on volatility. The amount of research regarding the effect of Federal Reserve policy changes on sector-specific volatility is relatively limited. Chen, Mohan, and Steiner (1999) explore the impact of changes made to the discount rate on equity returns and market volatility. While the findings of this study do suggest causality between discount rate changes and stock market volatility, it is not inclusive of sector-specific implications. Jensen, Johnson, and Bauman (1997) focus on determining the extent to which discount rate changes impact stock market performance across sixteen industries. The study suggested that changes to the discount rate impacts the level of stock market performance and volatility, but the impact of monetary policy changes is not uniform across industries. Moreover, they find that the performance of most sectors is positive when the discount rate decreases, while it is negative when the discount rate increases.

This study follows Jensen, Johnson, and Bauman (1997) by investigating the impact of U.S. monetary policy changes, measured by the movements in the Federal Funds Rate, on the performance and volatility on different sectors, as well as on small-cap, mid-cap, and large-cap, stocks. The paper investigates eleven S&P 500 sector ETFs as well as the S&P 500 ETF (SPY) as a proxy for large-cap stocks, the iShare Core S&P Mid-Cap ETF (IJH) as a proxy for mid-cap stocks as well as the iShare Russell 2000 ETF (IWM) as a proxy for small-cap stocks. This has the advantage that we investigate the impact of monetary policy changes on actual investable securities instead of market indexes. The study covers the period from December 1998 to December 2022, due to data availability.

2. Background

To explore and understand the impacts of monetary policy on US markets, one must first understand the tools with which monetary policy is formulated and by whom these tools are implemented. The Federal Reserve is the central banking system of the United States that is enabled by US Congress to "conduct monetary policy 'so as to promote effectively the goals of maximum employment, stable prices, and moderate long-term interest rates'" (The Board of Governors of the Federal Reserve System, 2022) via the Federal Reserve Act of 1913. In other words, the Federal Reserve is tasked with the responsibility of implementing monetary policy that corresponds with a given macroeconomic objective (i.e., expansionary policy to encourage economic growth and contractionary policy to promote deceleration of the economy). The Federal Reserve can achieve these policies by the use of three tools: reserve requirements, the discount rate,

and open market operations (OMOs). One should also consider some of the basic components comprising the structure of the Federal Reserve System in order to understand how these tools of monetary policy are integrated. While the Federal Reserve System is the overarching central bank of the United States, it can be granulated into three entities: the Federal Reserve Board of Governors, the Federal Open Market Committee (FOMC), and the twelve Federal Reserve Banks (The Board of Governors of the Federal Reserve System, 2022). The Federal Reserve Board of Governors is responsible for reserve requirements and the discount rate. The Federal Open Market Committee is responsible for conducting open market operations. It is by extension of these open market operations that the Effective Federal Funds Rate (EFFR) is achieved. The federal funds rate is defined by the federal reserve as "…the interest rate at which depository institutions lend reserve balances to other depository institutions overnight" (The Board of Governors of the Federal Reserve System, 2022). However, because the FOMC does not have the power to force banks to utilize an exact rate, it sets a target rate instead, known as the Federal Funds Target Rate (Chen, 2023). This is the rate of interest for this study. Given the definitions above, it should be noted that the Federal Reserve often acts as the lender of last resort. That is, all else equal, banks will seek loans among other banks under the conditions of a traditional, stable macroeconomic environment. Such loans would be originated at the federal funds rate. However, a bearish macroeconomic event (perhaps a liquidity crisis) may force banks to go to the Federal Reserve for loans of which would be originated at the discount rate. The purpose of the two rates must not be conflated on account of the material that is to follow, as we are not interested in the discount rate for the purpose of this study.

One can observe the complexity with which the Federal Reserve System employs agents of monetary policy. The federal funds rate is a target rate derived from the process of the Federal Open Market Committee conducting open market operations. The Federal Reserve System defines open market operations as "the purchase and sale of securities in the open market by a central bank" (The Board of Governors of the Federal Reserve System, 2022). The purchase or sale of these securities, however, is contingent on the monetary policy that the Federal Reserve wishes to pursue. If the Federal Reserve were to purchase securities in the open market, this injects money into the money supply, increases reserves, and ultimately leads to a reduction in the federal funds rate. The Federal Reserve would favor this market dynamic in the pursuit of expansionary monetary policy. Conversely, a sale of these securities by the Fed reduces the money supply and reserves, ultimately leading to an increase in the federal funds rate. The Federal Reserve would favor this market dynamic in the pursuit of contractionary monetary policy.

The motivation behind this study is based on the idea that different segments of the stock market are subjected to diverse levels of performance and volatility during different times. For example, a microchip shortage may impact the information technology sector to a much greater extent than the consumer staples sector. Perhaps an ongoing international conflict such as a trade dispute impacts the consumer discretionary sector to a greater extent than the health care sector. Similarly, explicit macroeconomic events can also induce varying degrees of performance and volatility across these sectors. One macroeconomic event that has received much attention over time and especially more recently are monetary policy changes by the Federal Reserve. While it is generally

expected that changes in monetary policy impact equity markets and lead to higher market volatility, the impact might not be uniform across different market segments (large cap versus small cap) as well as different sectors. There may exist a multitude of factors specific to different segments of the market that induce varying degrees of volatility to different sectors. For example, the monetary policy conditions impact revenues and profit of sectors differently. For the financials sector, a contractionary monetary policy from the Federal Reserve would appear favorable, given that the corresponding rate increase results in an increase in interest rate revenue (Garg, 2008, p. 15). Conversely, the information technology sector may realize profit benefits as a result of expansionary monetary policy from the Federal Reserve, as the corresponding rate cuts would cause the cost of borrowing to fall significantly for these debt-intensive firms. The same dynamic would apply in the opposite direction, where rate hikes would cut into profits for sectors such as information technology and communications, due to the intensity of leverage by which those sectors fund their operations. Consideration of debt-to-equity ratios across sectors may also suggest which sectors will feel larger effects of monetary tightening or easing. For example, Garg (2008) finds that financials, consumer goods, telecommunications, utilities, and consumer services are sectors with relatively larger debt-to-equity ratios, meaning that as a proportion of capital structure, firms in those sectors prefer to fund their ventures with debt at a larger rate than with equity (Garg, 2008, p. 14). Further, there is evidence that monetary conditions impact the borrowing capabilities differently depending on the size of the firm. In this context, firm size should be thought of in terms of the size of their market capitalization, which is defined as “the total value of a company's outstanding shares of stock, which include

publicly traded shares plus restricted shares held by company officers and insiders" (Financial Industry Regulatory Authority, 2022). This figure can be calculated simply by multiplying a firm's shares outstanding by the current price of the stock. A stock can be placed into one of three categories: large-cap, mid-cap, or small-cap. While some entities recognize a micro-cap and a mega-cap classification, those delineations are not of relevance for the scope of this study, as the data used accounts for stocks that may align with those classifications. One of the most meaningful factors in differentiating between large-cap, mid-cap, and small-cap stocks in the context of interest rate environments is that the larger firms have access to a larger number of borrowing alternatives relative to smaller firms. Thus, if interest rates at the macro level were to move in either direction, larger firms can benefit from a more stable effective interest rate on the sum of their debt, irrespective of the intensity of fluctuation of rates at the macro level (Garg, 2008, p. 13). The opposite holds true for smaller, growth-oriented firms. The lack of alternatives in borrowing induces a more volatile effective interest rate on their debts and, by extension, promotes volatility in those firms' stock prices. Thus, identifying the reactions of both sectors and market-capitalization-segmented securities may allow investors to formulate a comprehensive investment strategy that seamlessly accounts for forthcoming changes to monetary policy by the Federal Reserve.

3. Literature Review

Chen, Mohan, and Steiner (1999) researched how changes made by the Federal Reserve to the discount rate affected stock market returns and volatility. While the discount rate is not of interest with respect to our study, directional changes in the

discount rate typically follow those of the federal funds rate and are followed by similar reactions from the market. Thus, prior studies that utilize the discount rate as the rate of interest offer findings that provide strong implications in the context of our study. The authors use intraday data in their study in order to also capture changes in trading volume as a result of Federal Reserve policy changes. Their findings suggest that equity markets only experience material volatility when Federal Reserve policy change announcements are unexpected. They conclude:

> Equity returns respond negatively and significantly to the unexpected announcements of discount rate changes, while the expected changes generally have no bearing on the equity returns. On average, stock returns change by 0.5% for every 10 basis point change in the discount rate (p. 921).

These findings are consistent with the idea that changes made to interest rates can have a material impact on stock market volatility. Under the condition of economic uncertainty, surprise rate changes are more likely to occur. Thus, an increase or decrease made to interest rates will likely be followed by negative or positive volatility for U.S. equities, respectively. Identifying the relative differences in volatility among the 11 sectors will provide guidance for investors looking to reduce downside related to potential Federal Reserve policy changes. Another study conducted by Jensen, Johnson, and Bauman (1997) suggests that markets react dramatically to both discount rate increases and decreases. They conclude, "…discount rate decreases were followed by a mean annual return for the CRSP market index of 38.11%, while following discount rate increases the market return averaged only 0.56%, a return difference of 37.55%" (Jensen, Johnson, and Bauman, 1997, p. 641). Given that changes made to the discount rate historically signal

future economic outlook of the Federal Reserve, these returns are likely indicative that investor sentiment is consistent with that of the Federal Reserve. Investors may find that U.S. equities face less downside under the condition of rate decreases, leading to a rise in the overall market. Conversely, rate increases likely serve as a warning signal for investors, driving a decline in the overall market. Moreover, they also conclude that rate increases produced more volatility than rate decreases. Their findings stated, "…for each of the sixteen industries, the variance of returns following rate increases was significantly higher than the variance following rate decreases" (Jensen, Johnson, and Bauman, 1997, p. 641). Such a conclusion provides incentive to study the extent to which monetary policy changes impact the performance and volatility of different U.S. market sectors by studying ETFs over a more updated period It also suggests that specific sectors are relatively more sensitive to rate increases, while no sectors are particularly more sensitive to rate decreases. This adds to the motive to explore the impact of rate changes on stocks segmented by market capitalization, in that the three classifications may reflect differing reactions to those changes.

A study conducted by Chulia, Martens, and van Dijk (2010) explores similar effects on market volatility but uses the federal funds target rate as the parameter, as opposed to the discount rate. Their findings are similar to those of Chen, Mohan, and Steiner (1999), as they conclude, "…an unexpected 10 basis points increase of the target rate leads on average to a 46 basis points negative stock return within 5 min after the announcement" (Chulia et al., 2010, p. 838). Furthermore, Chen, Mohan, and Steiner also find that, in particular, the utilities sector experiences relatively higher volatility as the

discount rate changes. They argue, “Overall, we find utility stocks to have a slightly stronger reaction to changes in the discount rate” (Chen et al., 1999, p. 919).

Garg (2008) conducted a study very similar to this one by analyzing the effect of changes made to the federal funds rate on sector-specific returns. While this study includes both the discount rate and the federal funds effective rate as parameters, the evidence compiled by Garg supports the idea that changes made to Federal Reserve policy (in this case, specifically the federal funds rate) do cause different levels of volatility among the eleven sectors of the U.S. stock market. Garg’s results find that four sectors in particular were largely impacted by changes made to the federal funds rate. Garg concludes that “these sectors are the utilities, financials, telecommunications, and basic materials” (Garg, 2008, p.28).

Bernanke and Kuttner (2004) conducted a study that analyzed the reaction of the stock market to Federal Reserve policy. More specifically, the study examines the impact on the stock market of both expected and unexpected monetary policy actions by using federal funds futures data as a means of examining expectations. The study finds that “an unexpected 25-basis-point rate cut would typically lead to an increase in stock prices on the order of 1%” (Bernanke and Kuttner, 2004, p. 1253). The study also provides some exploration of sector-specific impacts of monetary policy actions. In relation to the effect of policy actions on the broader market, the study found that the technology and telecommunications sectors responded to the policy action at a rate that was “half as large as that of the broad market indices,” while energy and utilities were found to be relatively unaffected by the policy actions (Bernanke and Kuttner, 2004, p.1253).

4. Hypotheses

Based on the above discussion, we propose five hypotheses.

Hypothesis 1:

Depending on the industry, the average daily returns are lower (greater) on announcement days when the Fed Funds Rate is increasing (monetary tightening) versus announcements days when the Fed Funds Rate is decreasing (monetary easing).

We expect the consumer staples, health care, and utilities sectors to realize greater returns on announcement days when the Fed Funds Rate is increasing (monetary tightening) versus announcements days when the Fed Funds Rate is decreasing (monetary easing). We expect the energy, materials, industrials, financials, technology, real estate, consumer discretionary, and communications sectors to realize lower returns on announcement days when the Fed Funds Rate is increasing (monetary tightening) versus announcements days when the Fed Funds Rate is decreasing (monetary easing).

Hypothesis 2:

Depending on the industry, average daily returns are lower (greater) for the two-day announcement window (0, 1) when the Fed Funds Rate is increasing (monetary tightening) versus when the Fed Funds Rate is decreasing (monetary easing).

We expect the consumer staples, health care, and utilities sectors to realize greater returns for the two-day announcement window (0, 1) when the Fed Funds Rate is increasing (monetary tightening) versus when the Fed Funds Rate is decreasing (monetary easing). We expect the energy, materials, industrials, financials, technology, real estate, consumer

discretionary, and communications sectors to realize lower returns for the two-day announcement window (0, 1) when the Fed Funds Rate is increasing (monetary tightening) versus when the Fed Funds Rate is decreasing (monetary easing).

Hypothesis 3:

Depending on the industry, average annual returns are lower (greater) during monetary tightening periods versus monetary easing periods.

We expect the consumer staples, health care, and utilities sectors to realize greater returns for the periods when the Fed Funds Rate is increasing (monetary tightening) versus when the Fed Funds Rate is decreasing (monetary easing).

We expect the energy, materials, industrials, financials, technology, real estate, consumer discretionary, and communications sectors to realize lower returns for the periods when the Fed Funds Rate is increasing (monetary tightening) verses when the Fed Funds Rate is decreasing (monetary easing).

Hypothesis 4:

Average daily returns and average annual returns for the small-cap and mid-cap ETFs will be lower (greater) during monetary tightening periods versus monetary easing periods, relative to the large-cap ETF.

Hypothesis 5:

The variances of the mean annual returns differ between monetary tightening periods and monetary easing periods.

5. Data and Methodology

5.1 Data

Of the eleven sector ETFs that were initially collected, nine were ultimately utilized in the analysis. These nine ETFs included those that correspond to the technology, health care, financials, consumer discretionary, industrials, consumer staples, energy, utilities, and materials sectors. The Communication Services Select Sector SPDR Fund (XLC) and the Real Estate Select Sector SPDR Fund (XLRE) were omitted from the analysis due to the fact that the availability of historical data for these ETFs was not extensive enough to empirically justify inclusion. Thus, the communications and real estate sectors are omitted from the study. The study utilizes prices and returns of iShares Russell 2000 ETF (IWM), iShares Core S&P Mid-Cap ETF (IJH), and SPDR S&P 500 ETF (SPY) to delineate small market capitalization, medium market capitalization, and large market capitalization ETFs, respectively. The aforementioned data was gathered exclusively from Yahoo! Finance. With respect to analysis periods, the nine sector ETFs include daily price and return data beginning on 23 December 1998 and ending on 30 December 2022. Over the course of this period, 67 changes occurred in the federal funds target rate, irrespective of the direction of the change. The data for the three ETFs specific to market capitalization, however, begins on 30 March 2000, and once again ends on 30 December 2022. Over the course of this period, 61 changes occurred in the federal funds rate, irrespective of the direction of the change. The discrepancy in start dates is a result of the market capitalization ETFs' inception dates lagging those of the sector ETFs. The difference in the number of observations is accounted for in the

analysis. Table 1 provides the ticker symbols of the different ETFs, their respective sectors, as well as the summary statistics and geometric annual returns.

To capture changes to the federal funds target rate, the study utilizes daily historical data from the Federal Reserve Bank of St. Louis. Note that two datasets were concatenated to account for a change made by the Federal Reserve to the reporting logic of rate data that went into effect 16 December 2008. The federal funds target rate theretofore was reported as a singular value. Every day thereafter, the target rate is reported as a range, which includes an upper and lower limit. Thus, the first dataset provides the federal funds target rate until 16 December 2008. The second dataset provides the upper limit of the federal funds target rate from 17 December 2008 to 30 December 2022. Note that, for the duration of the analysis period, the quantitative value of the target rate is irrelevant within the context of the analysis, as the study only looks to capture changes to the rate. Hence, the study was provided with the freedom to choose either the upper or lower limit without material impact on the analysis.

5.2 Methodology

To explore the impact of Federal Reserve monetary policy on sector ETFs and market cap ETFs, the analysis examines four categories of sub-periods: 1) announcement day of easing or tightening policy (DaysINDE); 2) announcement day plus the day following the announcement (2DaysINDE); 3) period of an easing or tightening policy, excluding the announcement day, until the policy changes direction (PeriodINDE); 4) period of an easing or tightening policy, including the announcement day, until the policy changes direction (PeriodDayINDE). To account for these delineations, the analysis

employs dummy variables, where “1” represents monetary tightening and “2” represents monetary easing.

Category 1 (DaysINDE) captures only the announcement days of both tightening and easing monetary policy. This captures the effect attributable purely to the announcement of a fed funds rate change on the ETFs. Our return series covers the period from 12/23/1998 to 12/30/2022. For the sector ETFs, there are a total of 39 announcements of monetary tightening and 28 announcements of monetary easing. For the Small Cap and Mid Cap ETFs, data are only available from 5/30/2022 to 12/30/2022. Thus, for the Small cap and Mid cap ETFs, there are a total of 33 announcements of monetary tightening and 28 announcements of monetary easing. Returns are calculated as the arithmetic mean daily return for each ETF, providing the return difference between announcement days when the Fed Funds Rate was increasing versus when it was decreasing. We employ a two-sample t-test in combination with a Levene’s Test of equal variance (Levene, 1960). In the case of the Small Cap, Mid Cap, and Large Cap ETFs as well as the Technology, Health Care, Financials, Consumer Discretionary, Industrial, and Material sector ETFs, we are testing the one tail t-test that returns are lower on increasing Fed Funds Rate announcement days versus decreasing Fed Funds Rate announcement days. In the case of Consumer Staples, Energy, and Utilities sector ETFs, we are testing the one tail t-test that returns are higher on increasing Fed Funds Rate announcement days versus decreasing Fed Funds Rate announcement days.

Category 2 (2DaysINDE) captures both the announcement days of monetary policies and the day following the announcement. While the inclusion of the announcement day helps capture the reaction of the markets to the announcement, the

markets may experience residual shock to the announcement the following day. For the sector ETFs, there are a total of 39 announcements of monetary tightening (N=78) and 28 announcements of monetary easing (N=56). For the Small Cap and Mid Cap ETFs, data are only available from 5/30/2022 to 12/30/2022. Thus, for the Small Cap and Mid Cap ETFs, there are a total of 33 announcements of monetary tightening (N=66) and 28 announcements of monetary easing (N=56). Returns are calculated as the arithmetic mean daily return for each ETF, providing the return difference between two-day announcement windows when the Fed Funds Rate was increasing versus when it was decreasing. We also employ a two-sample t-test in combination with a Levene's Test of equal variance (Levene 1960). In the case of the Small Cap, Mid Cap, and Large Cap ETFs as well as the Technology, Health Care, Financials, Consumer Discretionary, Industrial, and Material sector ETFs, we are testing the one tail t-test that returns are lower during the increasing Fed Funds Rate announcement day window versus decreasing Fed Funds Rate announcement day window. In the case of Consumer Staples, Energy, and Utilities sector ETFs, we are testing the one tail t-test that returns are higher during increasing Fed Funds Rate announcement day window versus decreasing Fed Funds Rate announcement day window

Category 3 (PeriodINDE) captures daily returns of a given policy (easing or tightening) until the Federal Open Market Committee pursues the opposite policy. This category excludes all announcement days in order to minimize the effect of the initial market reaction to the announcement on period returns. For most of our ETFs, the sample includes 2264 daily returns following an increasing Fed Funds Rate and 3714 daily returns following a decreasing Fed Funds Rate. In the case of the Small Cap and Large

Cap ETFs, however, the sample includes 2039 daily returns following an increasing Fed Funds Rate and 3585 daily returns following a decreasing Fed Funds Rate. Since we investigate the long-term effect following a change in monetary policy, we calculate the geometric annual mean returns by employing the following equation:

$$\boldsymbol{G = [(1 + R_1)(1 + R_2)\ldots\ldots\ldots(1 + R_N)]^{251/N} - 1}$$

With respect to the equation above, N represents the total number of daily returns following a directional change of the Fed Funds Rate. The Rs represent the daily returns. We assume an average 251 trading days per year for our period. The method above provides returns as annualized geometric mean returns of the periods following both a Fed Funds Rate decrease and a Fed Funds Rate increase. We also employ a two-sample t-test in combination with a Levene's Test of equal variance (Levene, 1960). In the case of the Small Cap, Mid Cap, and Large Cap ETFs as well as the Technology, Health Care, Financials, Consumer Discretionary, Industrial, and Material sector ETFs, we are testing the one tail t-test that the mean daily returns are lower during the periods following a Fed Funds Rate increase versus the periods following a Fed Funds Rate decrease. In the case of Consumer Staples, Energy, and Utilities sector ETFs, we are testing the one tail t-test that the mean daily returns are higher during the periods following a Fed Funds Rate increase versus the periods following a Fed Funds Rate decrease.

Category 4 (PeriodDayINDE) follows a similar approach as category 3, capturing daily returns of a given policy (easing or tightening) until the Federal Open Market Committee pursues the opposite policy. However, in this category, we include all announcement days. For most of our ETFs, the sample includes 2303 daily returns following an increasing Fed Funds Rate and 3742 daily returns following a decreasing

Fed Funds Rate. In the case of the Small Cap and Large Cap ETFs, however, the sample includes 2072 daily returns following an increasing Fed Funds Rate and 3613 daily returns following a decreasing Fed Funds Rate.

6. Results

Table 2 reports the results of our analysis of the effects of monetary tightening and monetary easing on mean daily returns for only the announcement day. For increasing periods (monetary tightening), the health care, consumer staples, and utilities sector ETFs were the only ETFs with positive mean daily returns. All other ETFs reported negative mean daily returns. The only result of statistical significance is the consumer staples ETF, with statistical significance at the 10% confidence interval. This ETF reports a 0.0693% mean daily return for announcement days of monetary tightening and -0.5367% mean daily return for announcement days of monetary easing. While not statistically significant, the utilities sector ETF reports similar returns, where mean daily return for announcement days of tightening policy was 0.1092% and mean daily return for announcement days of easing policy was -0.4596%. Meanwhile, the technology ETF reported -0.1268% mean daily return for announcement days of monetary tightening and 0.2002% mean daily return for announcement days of monetary easing. Similarly, the materials sector reported -0.2001% mean daily return for announcement days of monetary tightening and 0.6068% mean daily return for announcement days of monetary easing. While we don't find much statistically significant evidence for our hypothesis one, these results support the notion that investors look to capitalize on the counter-cyclical nature of the consumer discretionary and utilities sectors in the event of the announcement of contractionary monetary policy, while they look to invest in more

growth-oriented sectors that have the ability to economize on reduced cost of debt as a result of announcements of monetary easing. Interestingly, the health care ETF is the only ETF to report positive mean daily returns for both announcement days of monetary tightening and monetary easing, with 0.0673% and 0.1681% mean daily returns, respectively. These results may reflect the idea that the constituents of the health care sector embody incredibly inelastic demand irrespective of monetary policy, inducing large-scale confidence in the sector across investor bases on the announcement day. Moreover, with respect to the market cap ETFs, the small-cap ETF was the only ETF of the three to report positive mean daily returns on announcement days of monetary easing, while all three of these ETFs reported negative mean daily returns on announcement days of monetary tightening. For announcement days of monetary easing, the small-cap ETF reported 0.0007% mean daily return, while the mid-cap and large-cap ETFs reported -0.0282% and -0.0523% mean daily returns, respectively. It is also worth noting that, for announcement days of tightening policy, the small-cap ETF reported the largest negative mean daily returns of the three market cap ETFs with a mean daily return of -0.2881%. Meanwhile, the mean daily returns for those days for the mid-cap and large-cap ETFs were -0.2692% and -0.0858%. These results support the paradigm that, as a result of announcements of monetary tightening investors find security investing in stocks with large market capitalization or ETFs whose constituents are considered large-cap stocks. On the other hand, on announcement days of monetary easing, investors look to capitalize on the potential for small-cap ETFs or stocks to perform under an expansionary regime.

Table 3 reports the findings of our analysis of the effects of monetary tightening and monetary easing on mean daily returns for the announcement day as well as the day immediately following the announcement. With a few exceptions, the results are like the findings for the one-day announcement window. For example, for the increasing Fed funds rate windows (monetary tightening), the health care, consumer staples, and utilities sector ETFs were the only ETFs to report positive mean daily returns. All other ETFs reported negative mean daily returns, with the energy sector ETF returning the only statistically significant result. The results for this ETF are statistically significant at the 10% confidence interval. This ETF reported -0.0826% mean daily return for the window of monetary tightening and -0.7449% mean daily return for the window of monetary easing. Interestingly, the latter figure, as compared to the mean daily return for only the announcement day for monetary easing, represents about a half a percentage point lower return (the figure for the single announcement day for monetary easing was -0. 2476%). This would suggest that investors have a higher propensity to rotate out of the energy sector the day following the announcement. Furthermore, the -0.7449% mean daily return following monetary easing is the lowest return of the observed ETFs. This transgresses the nature of the sector, as the energy sector is considered cyclical. Thus, returns for this sector would be expected to be relatively higher as a result of the rate cuts. Again, while not statistically significant, the findings support the general notion of hypothesis two.

Table 4 reports the findings of our analysis of the effects of monetary tightening and monetary easing on mean annual returns following rate changes, including the announcement day of rate changes. The mean annual returns following monetary tightening for this window for the health care, consumer staples, and utilities sector ETFs

are 4.49%, 7.63%, and 14.46%, respectively; while following monetary easing they are 11.58%, 6.32%, and 3.14%, respectively. Although not statistically significant, the results for the consumer staples sector and the utility sector are in line with the notion of hypothesis three. During times of monetary tightening, the only sector ETF to report a higher mean annual return than that of the utilities sector ETF is the energy ETF. As mentioned in the previous paragraph, this contradicts the nature of the sector, as the energy sector is historically cyclical in nature. Thus, the expectation would be for the energy ETF to report relatively lower mean annual returns following monetary tightening for this observation window. Another interesting result is that the financials sector ETF reports a mean annual return of 8.11% for monetary tightening periods. This sector is also historically considered cyclical in nature. However, the rationale for this performance might be based on the fact that financial firms, as a result of rate increases, are provided with the ability to capitalize on higher yields (e.g., loan origination occurs at a higher rate, ultimately generating more revenue). Another result of interest with respect to monetary tightening for this observation window is that the mean annual return for the health care sector ETF is among the lowest of the observed ETFs. Given that health care is considered counter-cyclical, the historical expectation would be for health care to outperform during periods of monetary tightening, relative to cyclical sectors. However, during monetary easing for this observation period, the health care sector ETF reports the second highest mean annual return at 11.58%, trailing only the consumer discretionary sector ETF at 11.88%. As mentioned earlier, this may signal the effect of the inelastic demand of the constituents of the health care sector. Other sectors that demonstrate higher returns during times of monetary easing, compared to monetary tightening, are the

technology sector, the consumer discretionary sector as well as the materials sector. This is in line with our notion of hypothesis three, where we expect that sectors driven by growth are performing better during times of monetary easing.

With respect to the market cap ETFs, the mid-cap ETF reports the highest mean annual return for both monetary tightening and monetary easing periods. Moreover, the mid-cap ETF performed better during periods of monetary tightening, which is rather surprising. Notably, for monetary tightening periods, the small-cap ETF reports a mean annual return of 7.22%, which is 20 basis points higher than the mean annual return of the large-cap ETF at 7.20%. Historical performance would signal that the opposite should hold true, given that small-cap ETFs are comprised of growth-oriented constituents, which are presented with heightened credit risk, relative to large-cap stocks. However, for the small cap, we find slightly higher annualized returns during periods of monetary easing compared to periods of monetary tightening, which is in line with the notion of our hypothesis three, as these stocks are more growth oriented. Finally, there seems to be only a minor difference in the performance of the large-cap ETF between the two monetary periods, with the annualized returns reporting surprisingly higher during the periods of monetary tightening. While we do find some support for our hypothesis three, the findings are not statistically significant.

Table 5 reports the findings of our analysis of the effects of monetary tightening and monetary easing on mean annual returns following rate changes, excluding the announcement day of those rate changes. As compared to the paragraph above, the exclusion of the announcement day of either monetary tightening or monetary easing does not dramatically impact the resulting mean annual returns.

Table 6 reports the findings of our analysis of the effects of monetary tightening and monetary easing on the volatility of returns following rate changes, including the announcement day of the rate change. Table 6 demonstrates that the standard deviation of every observed ETF, includes the market cap ETFs, is higher during periods of monetary easing than during periods of monetary tightening. Moreover, the Levene (1960) test provides statistically significant evidence that the volatility is higher during times of monetary easing compared to times of monetary tightening, supporting hypothesis five. The finding is surprising and contradicts the finding from Jensen, Johnson and Bauman (1997), who found higher volatility during periods of monetary tightening. The findings suggests that investors experienced higher volatility across all sectors during periods of monetary easing, while not all sectors compensated investors with higher returns during these periods.

7. Conclusion

While our analysis provides interesting results with respect to our hypotheses, we are disappointed to find little statistical significance across the categories of analysis. Nevertheless, the results do yield some support for our hypotheses. Hypothesis one is supported by the results of Table 2, which reports the effect of monetary tightening and monetary easing on returns for just the announcement day. We hypothesized that the counter-cyclical nature of the health care, consumer staples, and utilities sectors would allow the corresponding ETFs to realize greater returns during monetary tightening relative to the other sector ETFs. Those results provide support for hypothesis one, suggesting that the relative attractiveness of those three sectors during monetary tightening may be attributable to their defensive characteristics. We hypothesize in

hypothesis two that, in the observation of both the announcement day and the day immediately after the announcement day, the health care, consumer staples, and utilities sectors would realize greater returns during monetary tightening relative to the other, more cyclical sector ETFs. The results for this observation periods are reported in Table 3. The findings suggest that, while there are a few instances of noticeable differentials in returns as a result of including the day following an announcement, the vast majority of the returns hardly differ. This suggests that the inclusion or exclusion of the day following the announcement day may not have a material impact on mean daily returns.

With respect to annualized returns, we hypothesize in hypothesis three that for periods of monetary tightening, the health care, consumer staples, and utilities sector ETFs will realize greater returns, relative to the other sector ETFs. Once again, this is based on the counter-cyclical nature of those three ETFs and their propensity to outperform during economic contraction. In this case, hypothesis three is partially supported, as the health care sector ETF was among the lowest performing sectors during monetary tightening for this observation period. This contradicts the intuition of the previous findings, where the health care sector reported results consistent with its counter-cyclical characteristics. Meanwhile, the consumer staples and utilities sector ETFs do support hypothesis three, reporting some of the highest returns for this observation period. Similar to the findings in Table 2 and Table 3, the inclusion or exclusion of the announcement day for periods of a given policy do not seem to have much of a material effect on returns (i.e., all ETFs follow the same trends in returns, irrespective of the announcement day). With respect to the market cap ETFs, we hypothesized in hypothesis four that during monetary tightening, both average daily

returns and average annual returns would be lower for the small-cap and mid-cap ETFs, relative to large-cap. The results suggest that this hypothesis is partially supported. While, as hypothesized, the small-cap and mid-cap EFFs reported lower mean daily returns in both Table 2 and Table 3 relative to the large-cap ETF during monetary tightening, they report higher returns than the large-cap ETF in Table 4 and Table 5, which report the results of periods of policy. In other words, while daily returns are lower for smaller market capitalization ETFs on announcement days for monetary tightening polices (and announcement days plus the day after the announcement), annual returns for smaller market capitalization ETFs are higher for periods of monetary tightening policies. This is, perhaps, the largest transgression of intuition among all of our results, as it would be expected that steadily rising interest rates over a period of monetary tightening would present small-cap and large-cap constituents with increasingly larger barriers to success, given that credit risk for these constituents rises over those periods.

Lastly, we hypothesized in hypothesis five that variances of the mean annual returns would differ between monetary tightening periods and monetary easing periods, given that markets will react differently to those policies. This hypothesis was supported by the data, which suggested that all of the ETFs were met with higher volatility as a results of monetary easing policy during the observation period.

Our analysis does present some support that some sector ETFs, depending on growth characteristics, do better during monetary easing while health care, consumer staples, and utilities ETFs perform better during monetary tightening, both for mean daily returns and mean annual returns. As a result of these insights, we hope investors can

leverage the findings to develop an investment strategy that comprehensively accounts for the implications of monetary policy on returns.

Table 1: Summary Statistics.

Ticker	Name	N	Daily Mean Return	Geometric Annual Return	Std
XLK	Technology	6045	0.0406%	6.9991%	1.6552%
XLV	Health Care	6045	0.0404%	8.8256%	1.1556%
XLF	Financials	6045	0.0350%	4.5266%	1.8658%
XLY	Consumer Discretionary	6045	0.0419%	8.2171%	1.4431%
XLI	Industrials	6045	0.0403%	8.0687%	1.3659%
XLP	Consumer Staples	6045	0.0311%	6.8113%	0.9822%
XLE	Energy	6045	0.0491%	8.3131%	1.8529%
XLU	Utilities	6045	0.0358%	7.3132%	1.2362%
XLB	Materials	6045	0.0424%	7.9963%	1.5339%
IWM	Small Cap	5685	0.0405%	7.4870%	1.5308%
IJH	Mid Cap	5685	0.0442%	9.0718%	1.3820%
SPY	Large Cap	6045	0.0340%	6.8100%	1.2462%

Table 2: Fed Funds Rate announcement day return differences.

ETF		Mean **Daily** Returns, Announcement Day Returns (Event Window 0)				
Ticker	**Name**	**Increase**	**Decrease**	**Return Difference**	**t-statistics**	**Sign.**
		(1)	**(2)**	**(3)**	**(4)**	**(5)**
XLK	Technology	-0.1268%	0.2002%	-0.3270%	-0.32	
XLV	Health Care	0.0673%	0.1681%	-0.1008%	-0.14	
XLF	Financials	-0.0963%	-0.0353%	-0.0610%	-0.07	
XLY	Consumer Discretionary	-0.1745%	0.1989%	-0.3734%	-0.44	
XLI	Industrials	-0.0329%	0.0583%	-0.0912%	-0.12	
XLP	Consumer Staples	0.0693%	-0.5367%	0.6060%	1.37	*
XLE	Energy	-0.0686%	-0.2476%	0.1790%	0.29	
XLU	Utilities	0.1092%	-0.4596%	0.5688%	0.97	
XLB	Materials	-0.2001%	0.6068%	-0.8069%	-1.13	
IWM	Small Cap	-0.2881%	0.0007%	-0.2888%	-0.39	
IJH	Mid Cap	-0.2692%	-0.0282%	-0.2410%	-0.32	
SPY	Large Cap	-0.0858%	-0.0523%	-0.0335%	-0.05	

Note: Column (1) shows the average returns on the announcement days when the Fed Funds Rate was increasing (monetary tightening). Column (2) shows the average returns on the announcement days when the Fed Funds Rate was decreasing (monetary easing). Our return series covers the period from 12/23/1998 to 12/30/2022 and includes 39 increasing Fed Funds Rate announcement days and 28 decreasing Fed Funds Rate announcement days. The only exceptions are the Small Cap and Mid Cap ETFs, for which data are only available from 5/30/2022 to 12/30/2022 and, hence, includes 33 increasing Fed Funds Rate announcement days and 28 decreasing Fed Funds Rate announcement days. Column (3) provides the return difference between announcement days when the Fed Funds Rate was increasing versus when it was decreasing. Column (4) provides the t-statistics for a two-sample t-test in combination with a Levene's Test of equal variance (Levene 1960). In the case of the Small Cap, Mid Cap, and Large Cap ETFs as well as the Technology, Health Care, Financials, Consumer Discretionary, Industrial, and Material sector ETFs, we are testing the one tail t-test that returns are lower on increasing Fed Funds Rate announcement days (Column (1)) versus decreasing Fed Funds Rate announcement days. In the case of Consumer Staples, Energy, and Utilities sector ETFs, we are testing the one tail t-test that returns are higher on increasing Fed Funds Rate announcement days (Column (1)) versus decreasing Fed Funds Rate announcement days. Columns (5) indicates if the findings are statistically significant. *, **, *** indicate the significance level of 10%, 5% and 1%, respectively.

Table 3: Fed Funds Rate announcement day and post announcement day average returns

ETF		Mean **Daily** Returns, Announcement Day and Post Announcement Day Returns (Event Window 0, 1)				
Ticker	**Name**	**Increase**	**Decrease**	**Return Difference**	**t-Statistics**	**Sign.**
XLK	Technology	-0.1006%	0.5175%	-0.6181%	-1.05	
XLV	Health Care	0.0603%	0.2137%	-0.1534%	-0.36	
XLF	Financials	-0.1827%	-0.0472%	-0.1355%	-0.24	
XLY	Consumer Discretionary	-0.1300%	0.3174%	-0.4474%	-0.91	
XLI	Industrials	-0.0230%	0.0370%	-0.0599%	-1.38	
XLP	Consumer Staples	0.0064%	-0.1938%	0.2002%	0.60	
XLE	Energy	-0.0826%	-0.7449%	0.6623%	1.32	*
XLU	Utilities	0.0456%	-0.1016%	0.1471%	0.34	
XLB	Materials	-0.2150%	0.2811%	-0.4961%	-1.08	
IWM	Small Cap	-0.2070%	0.1157%	-0.3227%	-0.69	
IJH	Mid Cap	-0.1792%	0.0852%	-0.2644%	-0.58	
SPY	Large Cap	-0.0608%	0.0412%	-0.1019%	-0.26	

Note: Column (1) shows the average returns on the announcement days and post announcement day when the Fed Funds Rate was increasing (monetary tightening). Column (2) shows the average returns on the announcement days and post announcement day when the Fed Funds Rate was decreasing (monetary easing). Our return series covers the period from 12/23/1998 to 12/30/2022 and includes 39 increasing Fed Funds Rate announcement days (N = 78) and 28 decreasing Fed Funds Rate announcement days (N = 56). The only exceptions are the Small Cap and Mid Cap ETFs, for which data are only available from 5/30/2022 to 12/30/2022 and, hence, includes 33 increasing Fed Funds Rate announcement days (N = 66) and 28 decreasing Fed Funds Rate announcement days (N = 56). Column (3) provides the return difference between two-day announcement windows when the Fed Funds Rate was increasing versus when it was decreasing. Column (4) provides the t-statistics for a two-sample t-test in combination with a Levene's Test of equal variance (Levene 1960). In the case of the Small Cap, Mid Cap, and Large Cap ETFs as well as the Technology, Health Care, Financials, Consumer Discretionary, Industrial, and Material sector ETFs, we are testing the one tail t-test that returns are lower during the increasing Fed Funds Rate announcement day window (Column (1)) versus decreasing Fed Funds Rate announcement day window. In the case of Consumer Staples, Energy, and Utilities sector ETFs, we are testing the one tail t-test that returns are higher during increasing Fed Funds Rate announcement day window (Column (1)) versus decreasing Fed Funds Rate announcement day window. Columns (5) indicates if the findings are statistically significant. *, **, *** indicate the significance level of 10%, 5% and 1%, respectively.

Table 4: Mean Annual Returns of the Periods Following Fed Funds Rate Changes (Including the Announcement Days)

ETF		Mean **Annual** Returns Following Rate Changes **Including** Announcement Days with Rate Changes			Test for Difference	
Ticker	Name	Increase	Decrease	Return Difference	t-Statistics	Sign.
		(1)	(2)	(3)	(4)	(5)
XLK	Technology	5.17%	8.14%	-2.97%	-0.39	
XLV	Health Care	4.49%	11.58%	-7.09%	-0.99	
XLF	Financials	8.11%	2.38%	5.73%	0.15	
XLY	Consumer Discretionary	2.52%	11.88%	-9.36%	-1.08	
XLI	Industrials	9.77%	7.04%	2.73%	0.12	
XLP	Consumer Staples	7.63%	6.31%	1.32%	0.15	
XLE	Energy	17.17%	3.20%	13.97%	0.91	
XLU	Utilities	14.46%	3.14%	11.32%	1.23	
XLB	Materials	6.81%	8.73%	-1.92%	-0.35	
IWM	Small Cap	7.22%	7.64%	-0.42%	-0.22	
IJH	Mid Cap	10.00%	8.54%	1.46%	-0.04	
SPY	Large Cap	7.02%	6.68%	0.34%	-0.12	

Note: The annual mean returns are calculated as a percentage annualized geometric mean return according to the following equation: $\boldsymbol{G = [(1 + R_1)(1 + R_2)\ldots\ldots(1 + R_N)]^{251/N} - 1,}$ where N represents the total number of daily returns following a directional change of the Fed Funds Rate. The *Rs* represent the daily returns. We assume an average 251 trading days per year for our period. For most of our ETFs, the sample includes 2303 daily returns following an increasing Fed Funds Rate and 3742 daily returns following a decreasing Fed Funds Rate. In the case of the Small Cap and Large Cap ETFs, however, the sample includes 2072 daily returns following an increasing Fed Funds Rate and 3613 daily returns following a decreasing Fed Funds Rate. The sample includes the Fed Funds announcement days with rate changes. Column (1) shows the annualized geometric mean returns of the periods following an increasing Fed Funds Rate. Column (2) shows the annualized geometric mean returns of the periods following a decreasing Fed Funds Rate. Column (3) provides the return difference between the periods following a Fed Funds Rate increase and a Fed Funds Rate decrease. Column (4) provides the t-statistics for a two-sample t-test in combination with a Levene's Test of equal variance (Levene 1960). In the case of the Small Cap, Mid Cap, and Large Cap TEFs as well as the Technology, Health Care, Financials, Consumer Discretionary, Industrial, and Material sector ETFS, we are testing the one tail t-test that the mean daily returns are lower during the periods following a Fed Funds Rate increase versus the periods following a Fed Funds Rate decrease. In the case of Consumer Staples, Energy, and Utilities sector ETFs, we are testing the one tail t-test that the mean daily returns are higher during the periods following a Fed Funds Rate increase versus the periods following a Fed Funds Rate decrease. Columns (5)

indicates if the findings are statistically significant. *, **, *** indicate the significance level of 10%, 5% and 1%, respectively.

Table 5: Mean Annual Returns of the Periods Following Fed Funds Rate Changes (Excluding the Announcement Days)

ETF Ticker	ETF Name	Mean **Annual** Returns Following Rate Changes **Excluding** Announcement Days with Rate Changes: Increase	Decrease	Return Difference	Test for Difference t-Statistics	Sign.
XLK	Technology	5.91%	8.05%	-2.14%	-0.298	
XLV	Health Care	4.30%	11.45%	-7.15%	-0.997	
XLF	Financials	8.76%	2.67%	6.09%	0.191	
XLY	Consumer Discretionary	3.41%	11.74%	-8.33%	-0.970	
XLI	Industrials	10.15%	7.11%	3.04%	1.161	
XLP	Consumer Staples	7.47%	7.49%	-0.02%	-0.045	
XLE	Energy	17.92%	3.82%	14.10%	0.912	
XLU	Utilities	14.22%	4.15%	10.07%	1.081	
XLB	Materials	7.92%	7.69%	0.23%	-0.133	
IWM	Small Cap	8.67%	7.84%	0.83%	-0.098	
IJH	Mid Cap	11.44%	8.82%	2.62%	0.093	
SPY	Large Cap	7.59%	6.94%	0.65%	-0.071	

Note: The annual mean returns are calculated as a percentage annualized geometric mean return according to the following equation: $\boldsymbol{G = [(1 + R_1)(1 + R_2)\ldots\ldots(1 + R_N)]^{251/N} - 1,}$ where N represents the total number of daily returns following a directional change of the Fed Funds Rate. The *Rs* represent the daily returns. We assume an average 251 trading days per year for our period. For most of our ETFs, the sample includes 2264 daily returns following an increasing Fed Funds Rate and 3714 daily returns following a decreasing Fed Funds Rate. In the case of the Small Cap and Large Cap ETFs, however, the sample includes 2039 daily returns following an increasing Fed Funds Rate and 3585 daily returns following a decreasing Fed Funds Rate. The sample excludes the Fed Funds announcement days with rate changes. Column (1) shows the annualized geometric mean returns of the periods following an increasing Fed Funds Rate. Column (2) shows the annualized geometric mean returns of the periods following a decreasing Fed Funds Rate. Column (3) provides the return difference between the periods following a Fed Funds Rate increase and a Fed Funds Rate decrease. Column (4) provides the t-statistics for a two-sample t-test in combination with a Levene's Test of equal variance (Levene 1960). In the case of the Small Cap, Mid Cap, and Large Cap ETFs as well as the Technology, Health Care, Financials, Consumer Discretionary, Industrial, and Material sector ETFs, we are testing the one tail t-test that the mean daily returns are lower during the periods following a Fed Funds Rate increase versus the periods following a Fed Funds Rate decrease. In the case of Consumer Staples, Energy, and Utilities sector ETFs, we are testing the one tail t-test that the mean daily returns are higher during the periods following a Fed Funds Rate increase versus the periods following a Fed Funds Rate decrease. Columns (5) indicates if the findings are statistically significant. *, **, *** indicate the significance level of 10%, 5% and 1%, respectively.

Table 6: Return Volatility for the Periods Following Fed Funds Rate Changes (Including the Announcement Days)

ETF		Standard Deviation of Returns Following Rate Changes **Including** Announcement Days with Rate Changes		Test for Difference in Variance	
Ticker	Name	Increase	Decrease	F-Statistics	Significance
		(1)	(2)	(3)	(4)
XLK	Technology	1.4482%	1.7710%	45.43	***
XLV	Health Care	1.0005%	1.2416%	42.88	***
XLF	Financials	1.2655%	2.1540%	144.42	***
XLY	Consumer Discretionary	1.2394%	1.5554%	68.57	***
XLI	Industrials	1.0494%	1.5287%	124.63	***
XLP	Consumer Staples	0.9059%	1.0265%	16.10	***
XLE	Energy	1.5287%	2.0271%	32.48	***
XLU	Utilities	1.0141%	1.3550%	40.22	***
XLB	Materials	1.2618%	1.6799%	71.00	***
IWM	Small Cap	1.2032%	1.6905%	103.69	***
IJH	Mid Cap	1.0355%	1.5464%	114.41	***
SPY	Large Cap	0.9805%	1.3847%	94.72	***

Note: For most of our ETFs, the sample includes 2303 daily returns following an increasing Fed Funds Rate and 3742 daily returns following a decreasing Fed Funds Rate. In the case of Small Cap and Large Cap ETFs, however, the sample includes 2072 daily returns following an increasing Fed Funds Rate and 3613 daily returns following a decreasing Fed Funds Rate. The sample includes the Fed Funds announcement days with rate changes. Column (1) shows the standard deviations of the daily returns of the periods following an increasing Fed Funds Rate. Column (2) shows the standard deviations of the daily returns of the periods following a decreasing Fed Funds Rate. Column (3) provides F-statistics of Levene's Test of equal variance (Levene 1960) testing if the variance of daily returns between periods following an increasing and decreasing Fed Funds rate change are equal. Columns (5) indicates if the findings are statistically significant. *, **, *** indicate the significance level of 10%, 5% and 1%, respectively.

Table 7: Return Volatility for the Periods Following Fed Funds Rate Changes (Excluding the Announcement Days)

ETF		Standard Deviation of Returns Following Rate Changes **Excluding** Announcement Days		Test for Difference in Variance	
Ticker	Name	Increase	Decrease	F-Statistics	Significance
XLK	Technology	1.4420%	1.7220%	43.48	***
XLV	Health Care	0.9977%	1.2085%	40.22	***
XLF	Financials	1.2616%	2.1253%	139.88	***
XLY	Consumer Discretionary	1.2315%	1.5191%	65.68	***
XLI	Industrials	1.0420%	1.5019%	123.81	***
XLP	Consumer Staples	0.9035%	1.0127%	15.04	***
XLE	Energy	1.5250%	2.0149%	31.41	***
XLU	Utilities	1.0108%	1.3363%	38.03	***
XLB	Materials	1.2572%	1.6581%	68.42	***
IWM	Small Cap	1.1943%	1.6673%	102.54	***
IJH	Mid Cap	1.0253%	1.5194%	114.56	***
SPY	Large Cap	0.9740%	1.3620%	92.94	***

Note: For most of our ETFs, the sample includes 2264 daily returns following an increasing Fed Funds Rate and 3714 daily returns following a decreasing Fed Funds Rate. In the case of the Small Cap and Large Cap ETFs, however, the sample includes 2039 daily returns following an increasing Fed Funds Rate and 3585 daily returns following a decreasing Fed Funds Rate. The sample excludes the Fed Funds announcement days with rate changes. Column (1) shows the standard deviations of the daily returns of the periods following an increasing Fed Funds Rate. Column (2) shows the standard deviations of the daily returns of the periods following a decreasing Fed Funds Rate. Column (3) provides F-statistics of Levene's Test of equal variance (Levene 1960) testing if the variance of daily returns between periods following an increasing and decreasing Fed Funds rate change are equal. Columns (5) indicates if the findings are statistically significant. *, **, *** indicate the significance level of 10%, 5% and 1%, respectively.

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