ETF Ownership and the Transmission of Monetary Policy

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Abstract

We explore whether ETF ownership affects monetary policy transmission to individual equities. Both broad market and sector-specific ETFs appear to moderate return responses to unexpected target rate changes. However, when considering the response to unexpected changes in the path of monetary policy, we find that broad market (sector-specific) ETFs play a moderating (amplifying) role. We also examine the role of ETFs on the balance sheet channel of monetary policy transmission and show that ETFs temper the equity response for firms with greater financial constraints and growth opportunities. Our results suggest that increasing ETF ownership may alter the responses of financial assets in contrast to the outcomes intended by policymakers.

Keywords: Exchange-traded funds, monetary policy, asset prices, monetary policy transmission
JEL Codes: G12, G14, E52

Introduction

Economic theories argue that monetary policy functions via multiple overlapping channels, often referred to as transmission mechanisms, linking central bank actions, financial markets, and the economy (e.g., Bernanke and Gertler, 1995). In this paper, we explore whether exchange-traded funds (ETFs) serve as a potential indirect mechanism for transmitting monetary policy to its underlying financial markets. As ETFs grow in size and popularity,[1] so does the concern about their impact on underlying markets, with studies showing that ETFs transmit fundamental and non-fundamental information to asset prices, directly affecting price informativeness (Israeli et al., 2017; Ben-David et al., 2018; Bhojraj et al., 2020; Glosten et al., 2021; Rhodes and Mason, 2023). Changes in monetary policy aim to influence economic decisions by generating changes in the discount rates used to price financial assets or by altering the cost of capital used to make investment decisions (Durnev et al., 2004; Chen et al., 2007; Bakke and Whited, 2010; Bennett et al., 2020). If ETF ownership alters asset price responses, real investment efficiency and allocation of capital within the economy will also be affected.

Understanding the quantitative links between stock returns and changes in monetary policy in the presence of ETFs is a first-order concern for market participants, regulators, and policymakers. With mixed evidence on precisely how ETFs impact the price informativeness of underlying assets, it is unclear how ETFs may impact the transmission of monetary policy. There is some evidence that ETF ownership brings more fundamental information into stock prices (Glosten et al., 2021; Bhojraj et al., 2020). If so, greater ETF ownership should lead to more informative asset prices, reducing information asymmetries between firms and capital providers and generating a more efficient allocation of capital within the financial markets. Others show that ETF ownership induces nonfundamental volatility and

[1] ETFs play an increasingly important role in US equity markets, exceeding more than 10% of the total market capitalization of US equity and averaging approximately 30-35% of daily trading volumes on US exchanges as of 2022 (Ben-David et al., 2017; Cohen, 2023).

increases nonfundamental information in stock returns (Israeli et al., 2017; Ben-David et al., 2018), which would increase information asymmetries and hinder efficient capital allocation. Without consideration of the potential impact ETFs have on asset price responses, monetary policy implemented by the Federal Reserve (Fed) or other central banks may be less effective or timely and lead to unintended consequences for underlying firms.

We explore the possibility that ETFs play a role in the transmission of monetary policy by conducting a series of analyses that examines the responses of equities held by ETFs to changes in monetary policy. Our analysis suggests that increasing levels of ETF ownership alter the response of individual assets to changes in monetary policy. Of particular concern is that these unintended responses may lead to changes that policy makers are trying to avoid, ultimately reducing the effectiveness of monetary policy.

We follow the literature and use two exogenous measures of monetary policy shocks generated from futures pricing data.[2] Futures contracts are especially important in our context as they reflect market expectations, allowing us to remove anticipated rate or policy changes. As a baseline, we follow prior studies and regress daily returns on the monetary policy variables for the equities in our sample. Doing so allows us to examine the return responses to monetary policy, without taking into account the level of ETF ownership (Bernanke and Kuttner, 2005; Gürkaynak et al., 2005a). We confirm a negative association between target surprise and equity returns and a positive association with path surprise.

Next, we identify the level of ETF ownership for each firm using ETF holdings data from 2012 to 2023 to consider the marginal effect of ETF ownership on equity returns to monetary policy shocks.[3] Each firm is classified as having high or low ETF ownership based on the total percentage of shares outstanding owned by ETFs. After controlling for book-

[2]The first measure captures unexpected changes in the federal funds rate (target surprise) and is the difference between the market expectation, as estimated by the federal funds futures data, and the announced target rate (Kuttner, 2001; Bernanke and Kuttner, 2005). Gürkaynak et al. (2005a) shows that target surprise alone is not sufficient to capture the effects of monetary policy on asset prices. Accordingly, we include a second measure to capture the unexpected change in the rate path of future policy (path surprise) using Eurodollar contracts as proposed by Gürkaynak et al. (2005b).

[3]ETF holding data limits us to the 2012-2023 sample period for ETF ownership analyses.

to-market, firm size, profitability, and leverage, we find that ETFs serve a moderating role in policy transmission. Specifically, we document a positive (negative) association between high ETF ownership and target (path) surprise. The combined effect tempers the overall negative (positive) response to target (path) surprise.

Prior research also indicates that different ETF types may play different roles in the transmission of monetary policy. As such, we consider the implications broad market and sector-specific (or industry) ETF ownership on monetary policy transmission. Studies have shown that sector specific ETFs bring fundamental information into equity prices, while broad market ETFs decrease the sensitivity of individual firms to both of firm- and industry-specific information (Bhojraj et al., 2020; Antoniou et al., 2023). As such, it is possible that market and sector ETFs transmit monetary policy differently with one potentially improving the capital allocation role of asset prices and the other muting this response.

To explore this possibility, we construct separate ETF ownership variables for both types of ETFs and re-estimate our regressions. Both ETF types play a moderating role to target rate surprises, but differences emerge when we consider path surprises. Broad market ETFs continue to serve a moderating role in the equity responses to unexpected changes in future rate policy, but sector ETFs amplify it. Viewing these results in the context of prior studies, our findings suggest that stocks overreact to target surprise, but underreact to path surprise. Further, our results suggest that sector ETFs may bring more fundamental information into stock prices to correct for this underreaction.

One concern may be that our sample period is mostly characterized by low interest rates and rate volatility. To address this, we examine the role of ETFs over three distinct monetary policy regimes that span our sample period: the zero lower bound (ZLB) period from January 2012 to November 2015, the post ZLB period from December 2015 to February 2022, and the post-COVID tightening period from March 2022 to June 2023.[4] ETFs, regardless of type, have no impact on the response of equity to monetary policy shocks in the ZLB period.

[4]The sample period ends June 2023 due to Eurodollar futures data limitations. These contracts stopped trading in mid-2023 after the transition from LIBOR to SOFR.

However, during the post-ZLB and post-COVID tightening regime ETFs appear to serve an important role in the transmission of monetary policy. These results are consistent with our main analysis and also reflect a more normal policy environment given that policy makers have the ability to either raise or lower rates in response to changes in the economy. In this period, which is largely consistent to the average economic environment, broad market ETFs play mostly a moderating role, and sector ETFs moderate target surprise response but amplify equity response to path surprise.

In our last set of tests, we explore the role that ETFs play a role within the balance sheet channel by examining several firm-level characteristics that prior literature has shown are related to equity market response to monetary policy shocks (e.g., Bernanke and Gertler, 1989, 1995; Stein et al., 1998; Ashcraft and Campello, 2007; Jiménez et al., 2012; Ippolito et al., 2018; Ozdagli, 2018). The main prediction of the balance sheet channel is that financially constrained firms are more sensitive to monetary policy than less constrained firms. This is because firms with stronger balance sheets can finance investment internally and/or provide more collateral to reduce conflicts of interest with capital providers (e.g., Gertler and Gilchrist, 1994; Bernanke and Gertler, 1989, 1995; Laeven et al., 2012; Chava and Hsu, 2020).

Consistent with this prediction, financially constrained firms in our sample exhibit greater sensitivity to monetary policy shocks, primarily to changes in the path of monetary policy rather than to target surprises. When we control for ETF ownership, we find that the moderating role of broad market ETFs is stronger for financially constrained firms and when considering path surprises. Interestingly, sector ETFs appear to play a somewhat different role depending on the financial constraints of underlying firms. Sector ETFs play a moderating role to target surprise for unconstrained firms, but an amplifying role to path surprise for constrained firms.

A related prediction of the balance sheet channel is that information asymmetries can prevent investment in positive net present value (NPV) projects during periods of tight credit

conditions. Accordingly, firms with more growth opportunities should be more sensitive to monetary policy (Bernanke and Gertler, 1995). We find evidence in support of this empirical prediction, with high growth firms and young firms exhibiting greater sensitivity to monetary policy shocks. ETFs also alter the equity reponse for these firms. Again, broad market ETFs play a moderating role which is stronger for young firms and those with significant growth opportunities. Sector ETFs, on the other hand, play a moderating role for high growth firms, but an amplifying role for young firms.

Overall, our study provides overwhelming evidence that ETFs alter the price response of equity to monetary policy shocks. This finding contributes to the growing body of literature examining the impact of ETFs on underlying financial markets. Bhojraj et al. (2020), Glosten et al. (2021), and Antoniou et al. (2023) provide evidence that ETF ownership improve price informativeness. Glosten et al. (2021) shows that high levels of ETF ownership improve the incorporation of earnings information into individual equity with weak information environments. However, other studies document negative effects on firm equity prices via arbitrage activity.[5] There is also empirical evidence that nonfundamental information is transmitted from ETFs to their portfolio securities, leading to less informative prices in the underlying markets (Ben-David et al., 2018; Israeli et al., 2017; Rhodes and Mason, 2023).

Another contribution of our study is to an emerging ETF literature that distinguishes among ETF types, specifically between broader market and sector ETFs. Bhojraj et al. (2020) show that sector ETFs improve the transmission of industry-related information to individual stocks. Antoniou et al. (2023) show that more informative equity prices associated with high sector ETF ownership levels translate to higher levels of real investment. We provide evidence that further suggests that there may be informational differences between market and sector ETFs, which has the potential to impact the broader economy via real activity.

[5]These negative effects include increased liquidity shocks (Da and Shive, 2018; Sullivan and Xiong, 2012) and cross-correlations between stocks held by the same ETFs (Da and Shive, 2018; Sullivan and Xiong, 2012), an amplified systematic risk component in returns (Ramaswamy, 2011; Bhattacharya and O'Hara, 2020), and higher intraday return volatility (Krause et al., 2014; Broman, 2016; Ben-David et al., 2018).

We also build on and contribute to the body of work on the impact of monetary policy on asset prices. Our methodology is linked to that developed in Kuttner (2001) and used in Bernanke and Kuttner (2005), which find that unanticipated rate changes impact equity prices via risk premiums. In addition Gürkaynak et al. (2005b) documents the response of the asset price to surprises in the future path of rates. Our paper provides additional evidence of the relationships between equity prices and surprises in both target rates and the future path of rates, but shows that ETF ownership impacts the magnitude of the documented responses in equity prices to monetary policy surprises.

The remainder of the paper is structured as follows: Section 1 discusses the related literature. Section 2 describes the data and variable construction. Section 3 presents the main empirical results. We examine how ETFs impact the balance sheet channel of monetary policy transmission in Section 4. Concluding remarks are provided in Section 5.

1 Related Literature

1.1 Transmission of Monetary Policy

Conventional macroeconomic models predict that monetary policy is transmitted through channels, referred to as transmission mechanisms, that provide a link between central bank actions, financial markets and ultimately the real economy (e.g., Bernanke and Gertler, 1995; Mishkin, 1995). One channel is the interest rate channel, which predicts that an increase in interest rates increases the cost of capital for both firms and households. The increase in cost of capital leads to declines in investment and consumption (Mishkin, 1995). Consistent with this channel, firms in cyclical industries and those more dependent on US sales respond strongly to changes in US monetary policy (Ehrmann and Fratzscher, 2004; Bernanke and Kuttner, 2005; Basistha and Kurov, 2008; Ammer et al., 2010). However, there is a lack of direct empirical support for the interest rate channel as the primary mechanism for monetary policy transmission (Bernanke and Gertler, 1995).

Another transmission mechanism considered in the literature is the balance sheet channel. This channel can be related to either the borrower's (Bernanke and Gertler, 1989, 1995; Ashcraft and Campello, 2007; Ippolito et al., 2018) or the lender's balance sheet (Bernanke and Gertler, 1995; Stein et al., 1998; Jiménez et al., 2012). Higher interest rates associated with tight monetary policy affect the borrower's balance sheet by increasing interest expenses, reducing cash flows, and weakening the firm's financial strength. Higher rates will also cause declines in asset values, which ultimately reduces collateral values. When the transmission shock occurs on the lender's balance sheet, the channel is known as the lending channel. Tight monetary policy affects bank liquidity and lending terms, which ultimately restricts the supply of credit to potential borrowers. The increase in the rates demanded by lenders and depressed collateral values for borrowers leads to a decrease in the net present value of investment opportunities slowing capital investment.

A key prediction of the balance sheet channel is that financially constrained borrowers should be impacted more than their less constrained counterparts. This effect occurs because monetary policy impacts the external finance premium for both borrowers. Laeven et al. (2012) and Chava and Hsu (2020) support this, which is consistent with Gertler and Gilchrist (1994), who use firm size as a proxy for financially constrained. However, Ozdagli (2018) finds that constrained firms earn slightly higher returns than less constrained firms. Chava and Hsu (2020) argue that the results contrasting with Ozdagli (2018) stem from the length of the return window around the FOMC announcement date and suggest that information filtration takes place over a larger number of days. The length has a direct impact on the amount of time it takes for the market to correctly incorporate information related to changes and surprises in monetary policy. Another prediction of this channel is related to the asymmetric information between capital providers and firms. During periods of tight credit conditions, positive net present value (NPV) investment opportunities may go unfunded due to these information asymmetries. Firms with high growth opportunities should be more responsive to changes in monetary policy due to higher opportunity costs (Bernanke and

Gertler, 1995).

The methodological literature used to evaluate the impact of monetary policy of asset prices begins with Cook and Hahn (1989) who found a strong and significant response in Treasury yields to changes in the Federal Funds target rate in the 1970s. Follow-up studies failed to replicate their findings using data from subsequent decades. To address this problem, Kuttner (2001) developed a measure designed to isolate the unexpected or surprise component of monetary policy using widely available fed funds futures data. Numerous studies followed, examining the response of the domestic and foreign equity markets (Ehrmann and Fratzscher, 2004; Bernanke and Kuttner, 2005; Basistha and Kurov, 2008; Ammer et al., 2010; Laeven et al., 2012), Treasury securities market (Gürkaynak et al., 2005b), and corporate credit markets (Zhu, 2013; Gertler and Karadi, 2015; Guo et al., 2020; Palazzo and Yamarthy, 2022) to the monetary policy surprise measure developed by Kuttner (2001).

One criticism of the Kuttner (2001) methodology focuses on the implicit assumption that asset returns respond to surprises in monetary policy only on days when the FOMC announces policy actions. In reality, asset prices respond to the news every day (Rigobon and Sack, 2004). The literature deals with this in two ways. One approach is to use high-frequency data, such as ticks or minute intervals (Gürkaynak et al., 2005b,a; Gertler and Karadi, 2015; Jarociński and Karadi, 2020). Thornton (2014) states that the main problem with this approach is that prices may initially overreact to policy announcements, which provides misleading evidence of the extent to which asset prices respond. He also argues that high-frequency data do not account for the fact that asset prices and interest rates respond to news on non-FOMC days, which amplifies the size of the correlation between target rate surprises and asset prices on FOMC days. He proposes a simple solution that uses all market days, not just FOMC announcement days. Kurov and Gu (2016) shows that the bias is negligible before the financial crisis of 2007-2008 but is significant during the crisis, leading to a positive relationship between monetary policy shocks and stock returns. Brubakk et al. (2021) extends the analysis to consider changes in yields in response to

surprises in target rates and finds a positive association.

More recent work extends the literature to examine the impact of unconventional monetary policy announcements, which followed the financial crisis of 2007-2008. Central banks cut short-term nominal rates to near-zero levels. This so-called zero-lower bound (ZLB) of interest rates forces central banks to increasingly rely on unconventional monetary policy tools. The broad conclusion from the literature focused on these actions is that asset prices respond significantly to unconventional monetary policy (Chava and Hsu, 2020; Swanson, 2021; Palazzo and Yamarthy, 2022). These findings suggest that indirect channels exist that link central bank actions, financial markets, and the broader economy, leading us to consider whether ETFs may serve as one such indirect channel.

1.2 Exchange-Traded Funds

There is growing literature that focuses on the impact of ETFs on underlying markets, with mixed results. Theoretical predictions stemming from the financial innovation literature suggest that the introduction of new securities, such as ETFs, should improve informational efficiency markets by reducing limits to arbitrage while also attracting informed investors (Dow, 1998; Cao, 1999; Massa, 2002). Increased arbitrage activity will also improve the liquidity of the underlying markets (Fremault, 1991; Kumar and Seppi, 1994). Early empirical work provides results largely consistent with these predictions, arguing that ETFs improve price discovery (Hasbrouck, 2003; Yu, 2005; Fang and Sanger, 2011) and increase liquidity in individual stocks held by indexed ETFs (Boehmer and Boehmer, 2003; Hegde and McDermott, 2004).

Recent studies also find that ETFs improve underlying markets. Glosten et al. (2021) shows that ETF ownership facilitates the incorporation of earnings information for firms with weaker information environments. Bhojraj et al. (2020) provide evidence that there are different informational effects for broad market ETFs and those that are sector-specific by showing that sector ETFs facilitate the transfer of industry information across firms. Further

highlighting these differences, Huang et al. (2021) shows that industry ETFs facilitate informed trading and improve market efficiency by serving as a hedging tool for industry risk. Antoniou et al. (2023) examine the impact of ETF ownership on a firm's real investment and find that higher levels of non-market ETF ownership are associated with higher investment sensitivity to stock prices, suggesting that ETFs increase stock price informativeness about cash flow shocks.

A popular argument, however, is that ETFs instead attract uninformed traders because they diversify firm-specific risk and lower adverse selection costs (Subrahmanyam, 1991; Gorton and Pennacchi, 1993). As uninformed traders reallocate their portfolio toward ETFs and away from the underlying securities, illiquidity and transaction costs for the individual securities will increase. Hamm (2014) and Israeli et al. (2017) document effects consistent with these predictions, showing that greater ETF ownership is associated with lower liquidity and higher bid-ask spreads.

Bhattacharya and O'Hara (2020) develop a model where ETF prices serve as a source of information for investors and show that feedback between the ETF and underlying asset markets can lead to non-fundamental shock propagation to the underlying portfolio. Several studies document impacts on underlying markets that are broadly consistent with their model. Greater ETF ownership is associated with lower informational efficiency (Israeli et al., 2017; Rhodes and Mason, 2023), higher volatility (Ben-David et al., 2018), and increases in excess comovement (Israeli et al., 2017; Da and Shive, 2018) of securities held in portfolios. Most of these studies assume that arbitrage is the primary channel through which these non-fundamental shocks are transmitted. However, using intraday and daily data, Box et al. (2021) find no evidence that non-fundamental ETF price shocks are transmitted to the underlying portfolio stocks via arbitrage. Instead, they find that ETF prices follow constituent equity returns.

ETF markets have evolved from mainly indexed ETFs to now including various asset classes. One notable financial innovation in this space is the introduction of sector-specific

ETFs. Early studies did not differentiate across ETF types when calculating ETF ownership and instead considered all ETFs (Israeli et al., 2017; Ben-David et al., 2018; Glosten et al., 2021). More recent literature, however, distinguishes between market and non-market ETF ownership. Informed trading seems to occur mostly in industry-specific ETFs rather than ETFs that track the broader market (Bhojraj et al., 2020; Huang et al., 2021; Antoniou et al., 2023). Bhojraj et al. (2020) show that sector ETF ownership facilitates the transfer of industry and firm-specific components of earning surprises than broader market ETFs. Broadly, both Huang et al. (2021) and Lundholm (2021) show that sector ETFs allow investors to hedge industry risk and exploit information on individual equities, allowing for more efficient transmission of idiosyncratic information.

2 Sample Construction and Variable Measurement

2.1 Sample Construction and Control Variables

2.1.1 ETF Constituents Sample

We identify daily ETF holdings using the ETF Global database. These data are available in 2012, making our sample period 2012 to 2023. We aggregate the total shares held across ETFs for each firm and merge it with the daily CRSP data on CUSIP to obtain the total number of shares outstanding for each firm and their daily equity returns. Then we calculate the percent of the total number of outstanding shares that are held by ETFs, which is defined in Equation 1,

$$ETF\ Own_{i,t} = \left(\frac{\Sigma_{j=1}^{J} Shares\ Owned_{i,j,t}}{Shares\ Outstanding_{i,t}} \right) \times 100, \tag{1}$$

where $Shares\ Owned_{i,j,t}$ is the number of shares of firm i that ETF j owns at time t, and $Shares\ Outstanding_{i,t}$ is the total number of shares outstanding for firm i at time t listed in CRSP. We set ETF ownership equal to zero if there is no ETF Global match after we merge

with CRSP. Then, for ease of interpretation, we construct an indicator variable, $High_{i,t}$, equal to one if firm i's percent of total shares outstanding held by ETFs is higher than the median and zero otherwise. Similar variables are created based on whether an ETF tracks the broader market ($Broad\ High_{i,t}$) or a sector ($Sector\ High_{i,t}$). ETFs are classified as sector ETFs if the investment focus in ETF Global is listed as "sector." All non-sector ETFs are considered broader market ETFs. Financial and utility firms are excluded.

2.1.2 Constituent-Level Control Variables

We include time-varying firm characteristics in all constituent-level analysis that are identified in the prior literature as explaining stock return responses to monetary shocks (Ozdagli, 2018; Ippolito et al., 2018). These are constructed using annual Compustat data and CRSP equity data and include book-to-market (BTM), size, return on assets (ROA), leverage, and CAPM beta. Firms with missing control variables are eliminated from the sample.

In additional tests, we explore the role of ETFs within the balance sheet channel of monetary policy transmission, where firm financial constraints and growth opportunities play an important role as discussed in Section 1.1. We rely on three measures of financing constraints identified in prior literature, which include firm size (Gertler and Gilchrist, 1994), research and development spending (Ozdagli, 2018), and the financial constraint index developed by Hadlock and Pierce (2010).[6] All of these are defined in greater detail in Appendix A. Each proxy is a continuous variable, so we classify firms based on the median value. Firms are considered financially constrained if the HP index is above the median value and not otherwise. Smaller firms are considered financially constrained, so firms are classified as small if the log of their assets is below the median and large otherwise. Firms with greater expenditures devoted toward research and development (R&D) are considered to be more financially constrained (i.e. R&D levels above median) than firms with less spent on R&D.

[6] In unreported results, we use the financial constraint index developed by Whited and Wu (2006) and find similar results.

We use the book-to-market (BTM) ratio as a proxy of growth opportunities, a standard convention in the literature. A lower (higher) BTM ratio suggests that the firm has fewer (more) growth options, so we consider firms with BTM ratio below the median to have low growth opportunities and classify all other firms as having high growth opportunities. We use firm age as an alternative measure of growth opportunities, as younger firms are assumed to have more growth options than older firms (e.g., Mueller, 1972; Anthony and Ramesh, 1992; Fama and French, 2001; DeAngelo et al., 2006). Age is defined as the number of years since the firm was first recorded in Compustat. If firm age is less than the median age, it is classified as young and old otherwise. All variables are winsorized at the 1% level and are defined in greater detail in the Appendix A.

2.2 Monetary Policy Shock Variables

2.2.1 Target Rate Surprises

To examine the impact of monetary policy actions on ETF returns and on equity held by ETFs, we follow the monetary policy event study literature (Kuttner, 2001; Bernanke and Kuttner, 2005; Ehrmann and Fratzscher, 2004; Ammer et al., 2010; Chava and Hsu, 2020; Guo et al., 2020). Kuttner (2001) and Bernanke and Kuttner (2005) propose using Federal funds futures contracts, which should reflect expectations of the effective Federal funds rate, to measure unexpected rate changes in monetary policy. We collect daily data on the active one-month Federal funds future contract from Bloomberg. The surprise element of the target rate of monetary policy actions is calculated as the scaled change in the implied rate of the current-month futures contract as defined in Equation 2,

$$Target\ Surprise_t = \frac{D}{D-d}\left(f^0_{m,d} - f^0_{m,d-1}\right), \tag{2}$$

where $Target\ Surprise_t$ is the unexpected target rate change, $f^0_{m,d}$ is the current-month

futures implied rate,[7] D is the number of days in the month, and d is the day of the month t occurs. The change in implied rates is scaled up by a factor related to the number of days in the month because the contract settlement price is based on the monthly average federal funds rate. We collect Fed target rates from the Federal Reserve Bank of St. Louis.

2.2.2 Path Surprises

Gürkaynak et al. (2005a) and Gürkaynak et al. (2005b) argue that monetary policy surprises contain not only a surprise in the announced target rate but also an unexpected change to the future path of monetary policy, referred to as path surprise. Existing studies provide evidence that the path surprise, which is related to the term structure of interest rates, impacts asset prices (Gürkaynak et al., 2005b; Wongswan, 2009; Hausman and Wongswan, 2011). Path surprise ($Path\ Surprise_t$) is calculated as the change in one-year ahead Eurodollar interest rate futures, which we collect from Bloomberg. This contract stopped trading in mid-2023 after the transition from LIBOR to SOFR, so any analysis using path surprises ends in June 2023.

2.3 Descriptive Statistics

Table 1 reports the descriptive statistics for the variables used throughout our analysis. The macroeconomic variables on FOMC announcement days are reported in Panel A. We report the market return measured by the daily return of the S&P 500 index and the federal funds rate surprise on the 96 FOMC announcement days in our sample period. Interest rate path surprise data is only available for 92 FOMC announcement days because the Eurodollar contracts stopped trading in mid-2023. The average market return on FOMC days is 0.14%, with a standard deviation of 1.06%, which is similar to Bernanke and Kuttner (2005) for the sample period when the Fed switched to announcing the fed funds rate changes.

Target surprise has a smaller mean (0.20 bps) and standard deviation (1.9 bps) than

[7] The implied futures rate is calculated as 100 minus the contract price.

path surprise (0.4 bps and 2.3 bps, respectively). The standard deviation of target surprise is substantially lower than in Bernanke and Kuttner (2005), which is likely driven by the zero-lower bound (ZLB) policy pursued by the Fed after the financial crisis until the end of 2015. As shown in Figure 1, which plots target and path surprises over time, target surprise volatility picked up in the latter part of our sample, especially during the monetary tightening phase that began in early 2022. Also evident in this figure is the inverse relation between the target and path surprises. This is consistent with the economic model predictions in Gürkaynak et al. (2005b), showing that at longer time horizons, the forward rates, which capture the future path of interest rate policy, move opposite to that of the target surprise.

We report the characteristics of the ETFs on FOMC announcement days in Panel B. ETF returns look similar to the market return reported in Panel A. The average return on ETFs is 0.16%, with a standard deviation of 1.36%. The mean (median) assets under management (AUM) is approximately $3.1 billion ($162 million), indicating that there are some larger funds skewing the sample to the right. Sector ETFs comprise 26.8% of the sample. We also report statistics of creation (redemption) activity with indicator variables equal to one if there is an increase (decrease) in the number of shares outstanding for the ETF on an announcement day and zero otherwise. Approximately 3.8% of ETFs have creation activity on FOMC announcement days, and 2.3% have redemption activity. The descriptive statistics for the ETF constituents on the days of FOMC announcements are reported in Panel C. The average return is 0.22%, slightly higher than that of the market with a higher standard deviation. Interestingly, the average CAPM beta for these equities is less than 1. The average ownership of broad ETFs is 5.25%, which is considerably higher than sector-specific ownership (0.75%).

Table 2 reports the descriptive statistics for the firm-level characteristics of equity grouped by the level of ETF ownership. We report the mean and standard deviation of each characteristic separately for high and low ETF ownership and report the difference in the last column along with stars to indicate whether or not the means are statistically different from

each other. Statistics for aggregate ETF ownership are presented in Panel A, broad ETFs in Panel B and sector ETFs in Panel C. Across all panels, ETFs own more shares of older and larger firms with more growth opportunities (lower BTM), higher profitability (higher ROA), slightly more leverage, lower financial constraints (lower HP index) and CAPM betas close to 1. The primary differences between firms with high broad market and sector ETF ownership is related to returns and R&D. Firms with higher broad ETF ownership have lower daily returns on average (0.15%) than firms with high sector ETF ownership (0.25%). They also have substantially lower R&D expenditures than firms with high sector ETF ownership.

[INSERT TABLE 1 HERE]

[INSERT FIGURE 1 HERE]

[INSERT TABLE 2 HERE]

3 Monetary Policy Effects on ETF Constituent Returns

Studies show that price discovery in the stock market impacts firm-level decisions, thereby affecting real investment activity. Managers learn from stock prices when making investment decisions (Bakke and Whited, 2010) and more informative stock prices facilitate investment efficiency (Durnev et al., 2004; Chen et al., 2007). If ETFs decrease price informativeness related to firm cash flows, the prices of stocks with high ETF ownership will not fully incorporate monetary policy shocks, dampening the intended effect of the central bank. However, if ETF ownership increases the informativeness of cash flows, then stock prices will quickly incorporate monetary policy shocks. This suggests that ETFs promote the capital allocation role of asset prices.

Some studies show that aggregate ETF ownership reduces informational efficiency (e.g., Israeli et al., 2017; Ben-David et al., 2018) while others show that rising ETF ownership facilitates price discovery. This is particularly true in sector ETFs where there is evidence

of informed trading (Bhojraj et al., 2020; Huang et al., 2021; Antoniou et al., 2023). Given these findings, we first examine aggregate ETF ownership and its effect on the transmission of monetary policy. We then classify ETFs as either broad market or sector specific to examine how differences in ETF type are related to differences in the transmission of monetary policy.

To generate a baseline for the size and direction of the response to changes in monetary policy, we employ the event study methodology of Bernanke and Kuttner (2005) to examine the response of equities to changes in monetary policy on FOMC announcement dates. Specifically, we use the regression panel regression in Equation 3,

$$R_{j,t} = \alpha + \beta_1 Target\ Surprise_t + \beta_2 Path\ Surprise_t + Controls_{i,t} + \gamma_{industry} + \phi_{year} + \varepsilon_{j,t}, \quad (3)$$

where i indexes the firm and t refers to the day of an FOMC announcement date. $Controls_{i,t}$ are time-varying firm characteristics, which are defined in Appendix A. All regressions include industry- and year-fixed effects, where industries are defined by three-digit SIC codes. Standard errors are clustered at the firm level.

Kuttner (2001) and Bernanke and Kuttner (2005) focus on the target rate surprise and find a negative equity response. To provide a comparison to these earlier studies, we estimate Equation 3 with only target surprise and report the results in Column 1 of Table 3. However, Gürkaynak et al. (2005b) shows that the effect of monetary policy shocks on asset prices is better captured by also including path surprise, so we also estimate Equation 3 with both factors and report the results in Column 2. The coefficients across both specifications are consistent with prior literature, with a negative return response to target surprise and a positive response to path surprise. The R^2 increases from 0.015 to 0.032 when the path surprise is included in Column 2, confirming Gürkaynak et al. (2005b) that two monetary policy factors more adequately cpature the effect on asset prices.

An implicit assumption with the event study methodology in Equation 3 is that returns

respond to surprises in monetary policy only on days when the FOMC announces policy actions. However, the problem is that asset prices respond to news every day. That is, both equity and futures contracts used to estimate monetary policy shocks respond to ambient news, causing the estimated responses of asset prices to monetary policy actions to be biased and inconsistent. Thornton (2014) proposes a simple method to control for this bias by using all days, not only FOMC announcement days as in Equation 4,

$$\begin{aligned} R_{i,t} = \alpha &+ \beta_1 Target\ Surprise_t + \beta_2 FOMC_t + \beta_3 \left(Target\ Surprise_t \times FOMC_t\right) \\ &+ \beta_4 Path\ Surprise_t + \beta_5 \left(Path\ Surprise_t \times FOMC_t\right) \\ &+ Controls_{i,t} + \gamma_{industry} + \phi_{year} + \varepsilon_{j,t}, \end{aligned} \tag{4}$$

where $FOMC_t$ is an indicator variable equal to one on days with an FOMC announcement of monetary policy and zero otherwise. The coefficient on $Target\ Surprise_t$ (β_1) now captures the joint response of returns and the market-based measure for target surprise to ambient news and β_3 denotes the joint response of the equity returns and fed funds futures to unexpected monetary policy. That is, the coefficient on the interaction term between target surprise and the FOMC indicator variable (β_3) captures the marginal change in returns associated with surprises in the target fed funds rate. Similarly, the coefficient on $Path\ Surprise_t$ (β_4) captures the joint response of ETF returns and the market-based measure for path surprise to everyday news and the coefficient on the interaction term between path surprise and the FOMC indicator variable (β_5) captures the joint response of returns and Eurodollar futures contracts to unexpected policy events. We report these results in Columns 3 and 4 of Table 3. Again, the relations between target and path surprises and equity return are consistent with prior studies.

[INSERT TABLE 3 HERE]

We next proceed with our analysis of ETFs as a potential indirect mechanism for the

transmission of monetary policy. We employ the bias-correcting methodology of Thornton (2014) but include interaction variables with ETF ownership to capture the marginal effect in equity returns to policy shocks associated with high ETF ownership. Specifically, we estimate the regression specification defined in Equation 5,

$$
\begin{aligned}
R_{i,t} = \alpha &+ \beta_1 Target\ Surprise_t + \beta_2 Path\ Surprise_t + \beta_3 FOMC_t \\
&+ \beta_4 \left(Target\ Surprise_t \times FOMC_t\right) + \beta_5 \left(Path\ Surprise_t \times FOMC_t\right) \\
&+ \beta_6 \left(High_{i,t} \times FOMC_t \times Target\ Surprise_t\right) \\
&+ \beta_7 \left(High_{i,t} \times FOMC_t \times Path\ Surprise_t\right) + \beta_8 \left(High_{i,t} \times FOMC_t\right) \\
&+ Controls_{i,t} + \gamma_{industry} + \phi_{year} + \varepsilon_{i,t},
\end{aligned}
\tag{5}
$$

where $High_{i,t}$ is an indicator variable equal to one if aggregate ETF ownership for company i at time t is above the median and zero otherwise. We not only include time-varying firm characteristics, but also interact each one with the monetary policy shock variables to allow the covariance to vary based on the size of the shock.

The coefficients on the triple interaction terms with the monetary surprise variables with FOMC and ETF ownership indicator variables (β_6 for target surprise and β_7 for path surprise) capture the marginal change in equity returns associated with high ETF ownership and unexpected policy events. The regression results are reported in Table 4. We estimate high ETF ownership using all ETFs in Column 1. Then we distinguish between broader market ETF ownership (*Broad High*) and sector specific ETF ownership (*Sector High*) in Columns 2 and 3, respectively.

There is a negative association between the target surprise on FOMC announcement days and equity returns regardless of ETF ownership, consistent with prior studies (e.g., Bernanke and Kuttner, 2005; Basistha and Kurov, 2008; Ammer et al., 2010; Laeven et al., 2012). This response ranges from -0.12 bps to -0.09 bps, depending on the regression specification. The triple interaction terms with target surprise consider the marginal impact of ETF ownership

on this negative relation. Across all specifications, the estimated coefficients are positive, indicating that higher levels of ETF ownership of a firm's shares outstanding decrease the stock return sensitivity to monetary policy shocks.

For equities with low (high) aggregate ETF ownership in Column 1, the average response is -0.11 bps (-0.06 bps) or -0.32 bps (-0.17 bps) annualized.[8] For ease of interpretation of these results, we plot the estimated total effects of target surprise on equity returns varied by the size of the surprise for low and high aggregate ETF ownership in Figure 2. The downward slope of both lines illustrates the overall negative response in returns to target surprise. Notable from this figure is the flatter line for high ETF ownership compared to low ETF ownership, showing the moderating role of ETFs in monetary policy transmission. The positive coefficient of the triple interaction with target surprise in Column 1 of Table 4 indicates that high ETF ownership tempers the negative equity return response to target surprise. While this figure plots the estimated effects for aggregate ETF ownership only, we note that the estimated effects broad market and sector ETF ownership are similar but are unreported in the interest of brevity.

Although ETF ownership, regardless of type, seems to decrease the equity return response to target surprises, the same cannot be said for the response to path surprise. Aggregate and broad ETF ownership appear to have a moderating effect on equity returns in response to path surprise, but sector ETFs seem to *increase* equity sensitivity.

Equity with high levels of aggregate or broad market ETF ownership (reported in Columns 1 and 2, respectively) are less sensitive to unexpected changes in fed funds rate than equity with low to no aggregate or broad market ETF ownership as indicated by the negative coefficients on the triple interactions with path surprise. Panel A of Figure 3 plots the estimated total effects of path surprise on equity returns varied by the magnitude of path surprise for high and low aggregate ETF ownership.[9] The overall positive association between

[8]The total effect on policy event dates is the partial derivative with respect to target surprise when $FOMC$ is equal to one. For example, the total effect of the target surprise on the return for high aggregate ETF ownership in Column 1, the total effect is $-0.109 + 0.046 = -0.063$.

[9]The estimated total effect graph for broad ETF ownership is nearly identical to the one for aggregate

equity returns and path surprise is shown by the upward slope on the total effect line. The flatter slope for stocks with high levels of ETF ownership illustrates the moderating effects of aggregate ETFs.

However, sector ETFs play an amplifying role in the transmission of monetary policy. The estimated marginal effect of sector ETF ownership on equity returns is positive (the triple interaction), indicating that returns are more sensitive to unexpected changes in the path of future rate policy when a larger portion of shares are owned by sector ETFs.[10] For ease of interpretation, we plot the estimated total effects of path surprise, but for sector ETFs in Panel B of Figure 3. Again, the total effect lines for high and low ownership are upward-sloping as they are in Panel A, consistent with the positive relationship between equity returns and path surprise. However, the high ETF ownership line has a steeper upward slope, highlighting the *amplifying* effect that seems to occur with increasing levels of sector ETF ownership.

Overall, we find that ETFs, regardless of type, may play a moderating role in the equity response to unexpected changes in the Fed's target rate, but the role that ETFs play in facilitating the transmission of unexpected changes in future rate policy (i.e. path surprise) depends on whether the ETF is broader market or sector focused. Recent studies show that industry or sector specific ETFs increase price informativeness, bringing fundamental information into stock prices, whereas broader market ETFs do not (Bhojraj et al., 2020; Huang et al., 2021; Antoniou et al., 2023). In viewing our results in the context of these studies, it seems that equity may generally overrreact to target surprise but underreact to path surprise. The increased sensitivity to path surprise, perhaps to offset the underreaction, may stem from sector ETFs facilitating the information about the effect of path surprise on firm cash flows or cost of capital quickly, thus improving the allocational role of stock prices.

[INSERT TABLE 4 HERE]

ETF ownership. For brevity and ease of exposition, we only show aggregate ETF ownership.

[10]The total effect of path surprise for high (low) sector ETF ownership is 0.09 bps (0.07 bps). For comparison, the total effect for high (low) aggregate ownership is 0.07 bps (0.10 bps) and broad market ETF ownership is 0.05 bps (0.12 bps).

[INSERT FIGURE 2 HERE]

[INSERT FIGURE 3 HERE]

3.1 Across Different Monetary Policy Regimes

Three distinct monetary policy regimes span our sample period - the zero-lower bound (ZLB) period, the post ZLB period, and the post-COVID tightening period. In this section, we explore whether the quantitative estimates of the links between stock returns and monetary policy in the presence of ETFs vary across these regimes. These are defined as the ZLB period from January 2012 to November 2015, the post-ZLB period from December 2015 to February 2022, and the post-COVID tightening period from March 2022 to June 2023.[11] In unreported results, we estimate the regression defined in Equation 4 without ETF ownership to see if the main effects of target and path surprise are consistent across all three regimes, and they are. Next, we report the results for Equation 5 in Table 5, with broader market ETF ownership presented in the even columns and sector ETFs in the odd columns. We focus on broader market and sector ETFs for conciseness and ease of exposition.

ETFs, regardless of their type, appear to have no impact on the equity response to monetary policy shocks in the ZLB period. In the post-ZLB period, the moderating effects of the broader market ETFs emerge for target and path surprises, but as we move into the post-COVID tightening regime, broader market ETFs appear to no longer have an impact on target surprise. Sector ETF ownership also appears to alter the transmission of monetary policy beginning in the post-ZLB period, but only for the equity response to future path policy. It is not until the post-COVID monetary tightening period that sector ETF ownership seems to impact the equity response to target surprise. An outsized role for ETFs in the transmission of monetary policy during this period would be consistent with the pandemic

[11] We utilize the ZLB regime definitions in Swanson (2021). The Fed's ZLB period began during the great financial crisis of 2007-2008, so our sample period begins in the middle of this period. Also, the sample period ends June 2023 due to Eurodollar data limitations.

having had asymmetric impacts on different industries, leading some benefiting and others suffering. We leave the exact mechanism for future research.

[INSERT TABLE 5 HERE]

4 ETFs and the Balance Sheet Channel

Transmission channels link central bank actions, financial markets, and the economy, so that monetary policy can influence economic decisions, ultimately generating changes in the Fed's targeted macroeconomic variables. One of the primary transmission channels is the balance sheet channel (e.g., Bernanke and Gertler, 1989, 1995; Stein et al., 1998; Ashcraft and Campello, 2007; Jiménez et al., 2012; Ippolito et al., 2018; Ozdagli, 2018). Economic theories argue that monetary policy functions through multiple nonexclusive channels, so in this section, we explore the possibility that the balance sheet channel and ETFs, as an indirect transmission channel, work in an overlapping manner.

4.1 Financing Constraints and ETF Ownership

The main implication of the balance sheet channel is that financially constrained firms are more sensitive to monetary policy than less constrained firms due to the impact on the external finance premium (Gertler and Gilchrist, 1994; Laeven et al., 2012; Chava and Hsu, 2020). Intuitively, firms with stronger financial positions can either fund investment internally or offer more collateral in lending agreements to reduce conflicts of interest with lenders, making external finance premiums less sensitive to monetary policy shocks (e.g., Bernanke and Gertler, 1989, 1995). We estimate Equation 5 on financially constrained and unconstrained firms and report the results using the HP index, firm size, and R&D as the measure of constrained in Tables 6-8, respectively. Across all tables, we present constrained firms in the odd columns and unconstrained firms in the even columns. We also consider the

impact of broad ETF ownership in Columns 1 and 2, and sector ETF ownership in Columns 3 and 4.

Broadly speaking, the results indicate that monetary policy is transmitted through both the balance sheet and the ETF channels. Regardless of the level or type of ETF ownership, constrained firms are more sensitive to monetary policy shocks, which aligns with predictions of the balance sheet channel. When firms are constrained and lack sufficient internal funds, unexpected changes in monetary policy (either target or path surprise) impact their external finance premiums, thereby changing the cost of acquiring external funds for constrained firms more than for unconstrained firms who have adequate internal resources.

When we consider ETFs along with the balance sheet channel, we find some evidence that the moderating role of broad market ETFs is stronger for firms that are financially constrained, but only when measured using the HP index (Table 6) and R&D (Table 8). When using firm size (Table 7), the moderating role of broad ETFs appears to be greater for larger (unconstrained) firms for both target and path surprise.[12] Interestingly, sector ETFs appear to play a moderating role in equity response to target surprise for unconstrained firms, but an amplifying role to path surprise for constrained firms, regardless of how financing constraints are measured. Although sector ETFs moderate (amplify) the effect of target (path) surprise on returns for unconstrained (constrained) firms, they bear no relationship to the return sensitivity of unconstrained (constrained) firms to path (target) surprise.

[INSERT TABLE 6 HERE]

[INSERT TABLE 7 HERE]

[INSERT TABLE 8 HERE]

[12]There are reasons to believe that firm size is not a good proxy for financially constrained, particularly during non-recessionary periods. See Bernanke and Gertler (1995) for a brief discussion.

4.2 Growth Opportunities and ETF Ownership

A related implication of the balance sheet channel is centered on financial frictions, such as imperfect information, which can prevent firms from investing in positive net present value (NPV) projects during periods of tight credit conditions (Bernanke and Gertler, 1995). Firms with more growth opportunities should have higher opportunity costs for missed investments, increasing their sensitivity to monetary policy shocks. To further explore the interaction of the balance sheet channel and ETFs, we consider the impact of monetary policy shocks on firms with high growth options. If ETFs bring additional fundamental information to stock prices, mitigating information asymmetries between firms and capital providers, then ETF ownership could play a larger moderating role for firms with higher growth opportunities.

We estimate Equation 5 on firms with low and high growth opportunities and report the results using BTM and firm age as our proxies in Tables 9 and 10, respectively. Across all tables, we present low growth option firms in the odd columns and high growth in the even columns. We also consider the impact of broad ETF ownership in Columns 1 and 2, and sector ETF ownership in Columns 3 and 4. The main effects of target surprise are the same across low and high growth firms, regardless of how growth opportunities are measured, but high growth firms are more sensitive to path shocks. A possible explanation for this result is that investment decisions are not immediate, so future interest rate expectations can have a more significant impact than spot rate changes, causing investment sensitivity to lag the shock (Bernanke and Gertler, 1995).

The moderating role of broad and sector ETF ownership differs for low and high growth firms. Broad ETFs play a greater moderating role for high growth firms to target surprise and also to path surprise than for low growth firms, which is perhaps unsurprising considering that high growth firms are more sensitive to path surprise. The results of sector ETFs depend on how growth opportunities are measured. When using BTM in Table 9, sector ETF ownership only plays a moderating role to target surprise for high growth firms and

has no other impact. When examining firm age in Table 10, the results are contrary to our expectations. Instead of ETF ownership playing a moderating role, we find some evidence that sector ETFs amplify the response to monetary shocks for high growth firms. While there is a moderating effect to target surprise for old firms (low growth options), the positive coefficient on the triple interaction term in Column 4 suggests that greater sector ETF ownership amplifies the equity response to path surprise for young firms (high growth options).

[INSERT TABLE 9 HERE]

[INSERT TABLE 10 HERE]

5 Conclusion

Informational efficiency in stock markets influences firm-level decisions, such as investments, which impact the broader economy. Changes in price informativeness affect the effectiveness of monetary policy, as less informative prices can hinder proper and efficient capital allocation. Studies have examined the effect of ETF ownership on price discovery, with mixed results. Some show ETFs improves price discovery, while others provide evidence to the contrary. Motivated by these mixed results, we consider whether ETFs alter the equity return response to monetary policy, thereby affecting the monetary policy efficacy. Our paper aims to provide a better understanding of the quantitative link between stock returns and monetary policy in the context of increasing ETF ownership.

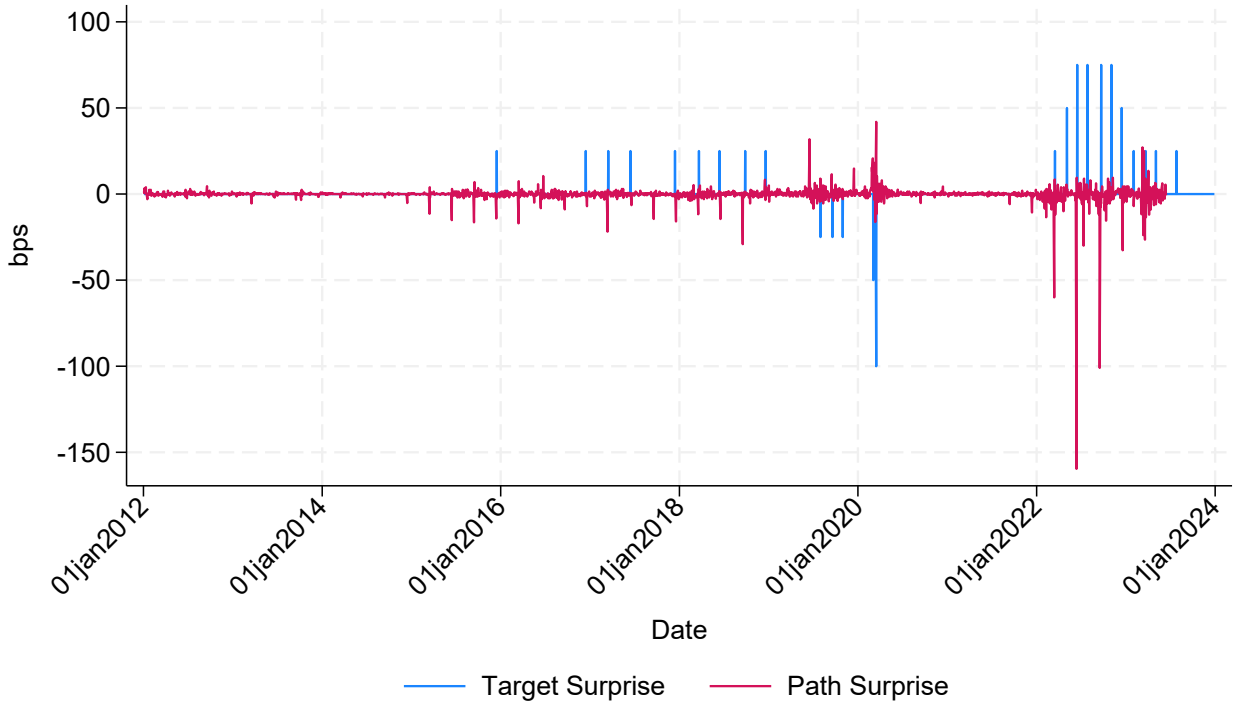
We consider two components of monetary policy shocks, unexpected changes in the Fed's target rate (target surprise) and in the future path of interest rate policy (path surprise). ETFs appear to play a moderating role in the response of equity returns to unexpected changes in the Fed's target rate. That is, returns are less sensitive to target surprises when there are higher levels of ETF ownership. When we consider path surprises, differences between the transmission roles of broad market and sector specific ETFs begin to emerge.

Broad market ETFs continue to moderate equity responses to unexpected changes in future rate policy, but sector ETFs amplify it.

We also consider the possibility that monetary policy functions via multiple overlapping channels (e.g., Bernanke and Gertler, 1995) by exploring the role of ETFs within the balance sheet channel of policy transmission. Two implications of the balance sheet channel is that financially constrained companies and those with higher growth opportunities are more impacted by unexpected changes in monetary policy. While we show that ETFs play a role within the balance sheet channel, we highlight the differentiated roles that broad market and sector ETFs play. In particular, broad market ETFs mostly play a moderating role and sector ETFs amplify shocks, primarily for financially constrained firms and young firms. Given the rise in popularity of ETFs and specifically sector ETFs, understanding these differences is important for regulators and policymakers to avoid anticipated effects in the economy, as ETFs alter the usual asset price response to monetary policy.

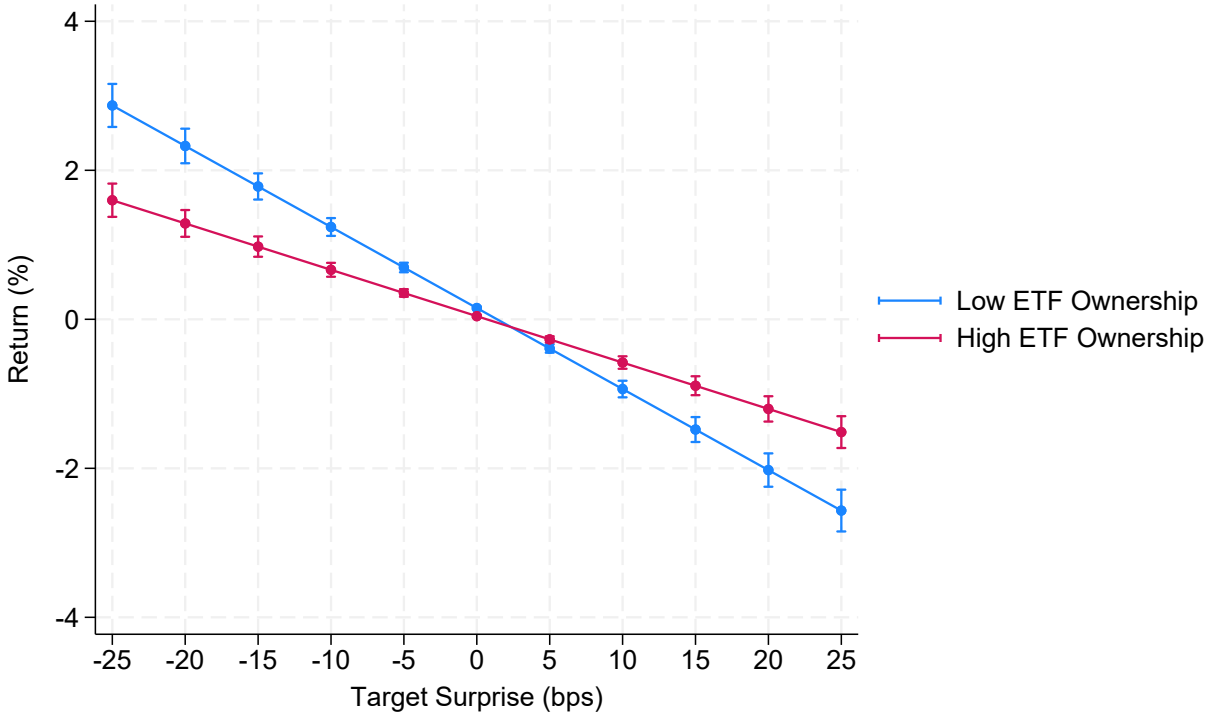
6 Figures and Tables

Figure 1: Time Series of Target and Path Surprises



This figure plots target surprise and path surprise from January 2012 through December 2023. The time series for path surprise ends June 15, 2023, when Eurodollar futures contracts stopped trading.

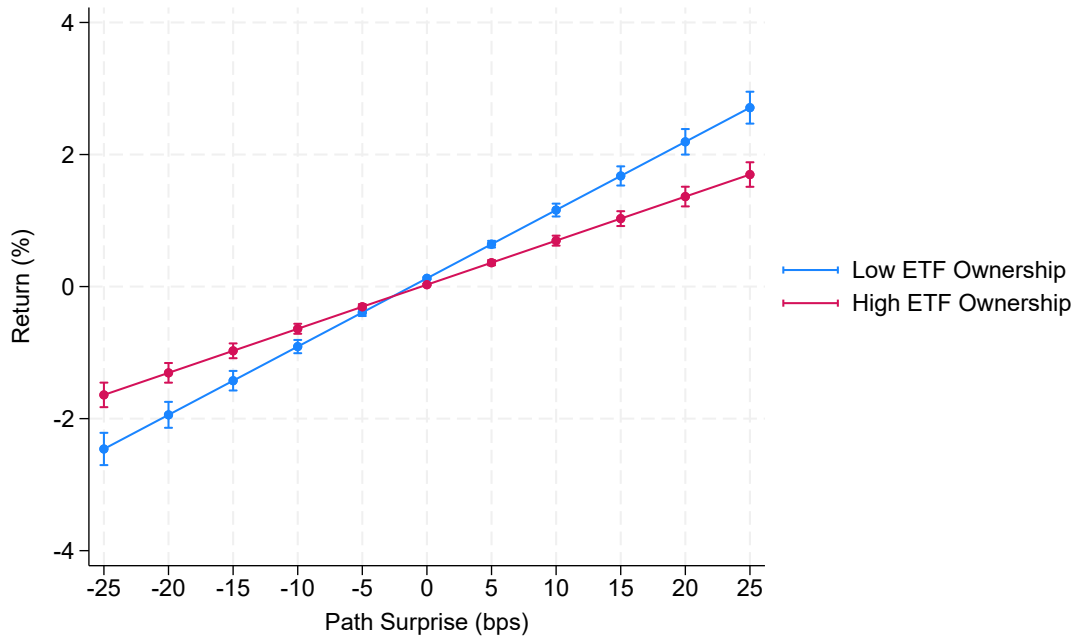
Figure 2: Estimated Total Effect of Target Surprise on Stock Returns on FOMC Announcement Days



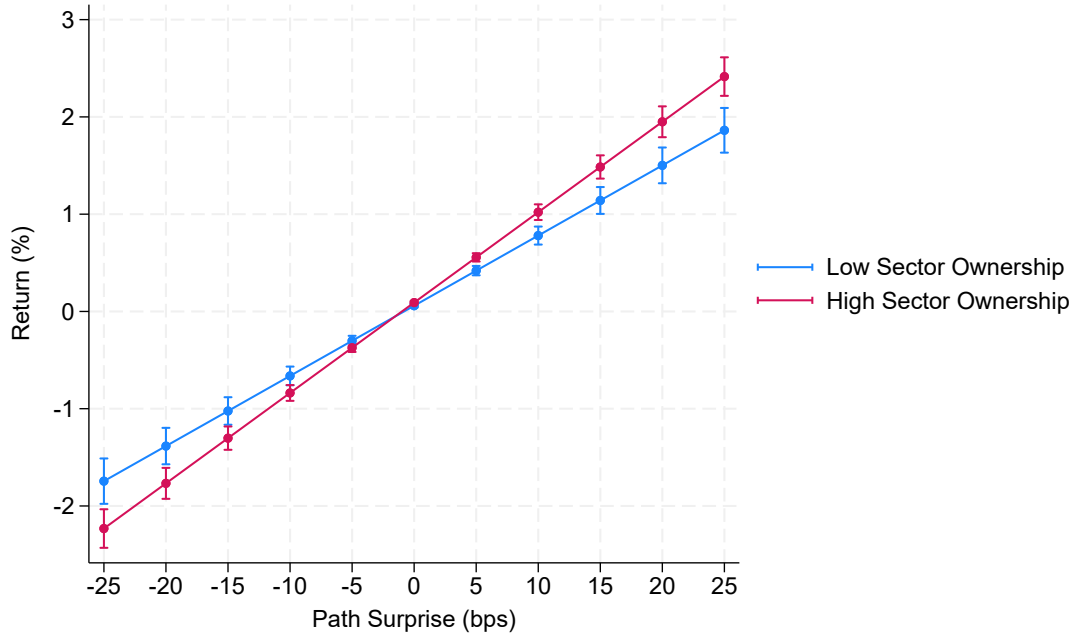
This figure shows the estimated effect of target surprise on stock returns varied by size of the surprise on FOMC announcement dates (*FOMC=1*). The effect is calculated based on the estimates reported in Table 4. Target surprise is calculated based on Bernanke and Kuttner (2005). We plot this effect separately for low and high ETF ownership with the blue and red lines, respectively. Low (High) ETF ownership is based on whether the ownership level is equal to or below (above) the median level for firm *i*. The sample period is January 2012 through June 2023, when the Eurodollar futures contracts stopped trading.

Figure 3: Estimated Total Effect of Path Surprise on Stock Returns on FOMC Announcement Days

(a) Aggregate ETF Ownership



(b) Sector ETF Ownership



This figure shows the estimated effect of path surprise on stock returns varied by size of the surprise on FOMC announcement dates (*FOMC=1*). The effect is calculated based on the estimates reported in Table 4. Path surprise is calculated based on Gürkaynak et al. (2005b). We estimate this effect for high and low ETF ownership, with aggregate ETF ownership in Panel A and sector ETF owenrship in Panel B. Low and high ETF ownership are denoted by blue and red lines, respectively. Low (High) ETF ownership is based on whether the ownership level is equal to or below (above) the median level for firm *i*. The sample period is January 2012 through June 2023, when the Eurodollar futures contracts stopped trading.

Table 1: Descriptive Statistics

Panel A: Macroeconomic Variables	N	Mean	Std	p25	Median	p75
Market Return (%)	96	0.144	1.063	-0.432	-0.004	0.805
Target Surprise (bps)	96	0.202	1.858	-0.259	0.000	0.511
Path Surprise (bps)	92	0.421	2.277	-0.500	0.000	1.000
Panel B: ETF Characteristics	N	Mean	Std	p25	Median	p75
Return (%)	63396	0.156	1.355	-0.575	0.036	0.853
AUM (in millions)	63396	3143.075	16996.197	29.696	162.319	890.841
Creation	63396	0.038	0.191	0.000	0.000	0.000
Redemption	63396	0.023	0.149	0.000	0.000	0.000
Sector ETFs	63396	0.268	0.443	0.000	0.000	1.000
Panel C: ETF Constituent Characteristics	N	Mean	Std	p25	Median	p75
Constituent Return (%)	199935	0.215	2.975	-1.282	0.042	1.581
Broad ETF Ownership (%)	199935	5.256	4.514	1.556	4.201	8.047
Sector ETF Ownership (%)	199935	0.741	1.346	0.000	0.205	0.841
BTM	199935	0.594	0.308	0.350	0.567	0.802
Size	199935	6.961	1.979	5.572	6.945	8.286
ROA	199935	0.038	0.219	0.014	0.096	0.150
Leverage	199935	0.513	0.272	0.314	0.503	0.672
CAPM Beta	199935	0.969	0.410	0.727	0.976	1.222
HP Index	199935	-3.576	0.667	-4.093	-3.532	-3.106
R&D	131568	0.110	0.212	0.007	0.043	0.135
Firm Age	199935	19.180	17.219	5.000	16.000	27.000

This table presents the summary statistics of macroeconomic variables in Panel A, ETF characteristics in Panel B, and ETF constituent (individual equity) level variables in Panel C on FOMC announcement days from 2012 to 2023.

Table 2: Descriptive Statistics of Firm-Level Characteristics by ETF Ownership Levels

	Mean	Std	Mean	Std	Difference
Panel A: Aggregate Ownership	High		Low		
Constituent Return (%)	0.174	2.745	0.259	3.198	0.08***
Broad ETF Ownership (%)	8.568	3.882	1.766	1.491	-6.80***
Sector ETF Ownership (%)	1.204	1.676	0.253	0.541	-0.95***
BTM	0.568	0.277	0.621	0.334	0.05***
Size	7.538	1.532	6.353	2.203	-1.18***
ROA	0.089	0.167	-0.015	0.252	-0.10***
Leverage	0.523	0.249	0.502	0.293	-0.02***
CAPM Beta	1.056	0.348	0.878	0.449	-0.18***
HP Index	-3.836	0.576	-3.303	0.646	0.53***
R&D	0.089	0.162	0.133	0.255	0.04***
Firm Age	23.248	17.731	14.893	15.550	-8.35***
Observations	102577		97358		199935
Panel B: Broad Ownership	High		Low		
Constituent Return (%)	0.146	2.668	0.289	3.266	0.14***
Broad ETF Ownership (%)	8.717	3.656	1.605	1.342	-7.11***
Sector ETF Ownership (%)	0.857	1.193	0.619	1.480	-0.24***
BTM	0.577	0.274	0.613	0.338	0.04***
Size	7.516	1.557	6.376	2.197	-1.14***
ROA	0.103	0.146	-0.030	0.259	-0.13***
Leverage	0.530	0.245	0.494	0.296	-0.04***
CAPM Beta	1.058	0.334	0.876	0.459	-0.18***
HP Index	-3.849	0.572	-3.289	0.638	0.56***
R&D	0.075	0.138	0.151	0.269	0.08***
Firm Age	23.778	17.699	14.331	15.264	-9.45***
Observations	102630		97305		199935
Panel C: Sector Ownership	High		Low		
Constituent Return (%)	0.249	2.857	0.181	3.090	-0.07***
Broad ETF Ownership (%)	6.733	4.368	3.746	4.145	-2.99***
Sector ETF Ownership (%)	1.430	1.619	0.038	0.054	-1.39***
BTM	0.525	0.279	0.665	0.319	0.14***
Size	7.751	1.710	6.155	1.910	-1.60***
ROA	0.059	0.198	0.018	0.237	-0.04***
Leverage	0.519	0.259	0.506	0.284	-0.01***
CAPM Beta	1.051	0.360	0.886	0.440	-0.17***
HP Index	-3.761	0.610	-3.388	0.669	0.37***
R&D	0.114	0.187	0.104	0.237	-0.01***
Firm Age	21.247	18.493	17.069	15.530	-4.18***
Observations	101021		98914		199935

This table presents the summary statistics of firm-level characteristics on FOMC announcement days from 2012 to 2023 by high and low ETF ownership, with aggregate ownership in Panel A, broad market ownership in Panel B, and sector ownership in Panel C. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Return Response of ETF Constituents to Monetary Policy Shocks

VARIABLES	(1)	(2)	(3)	(4)
Target Surprise (bps)	-0.031***	-0.028***	0.002***	0.002***
	(0.004)	(0.004)	(0.001)	(0.001)
Path Surprise (bps)		0.170***		0.013***
		(0.004)		(0.001)
FOMC=1			0.185***	0.112***
			(0.007)	(0.007)
FOMC=1 × Target Surprise (bps)			-0.059***	-0.081***
			(0.003)	(0.004)
FOMC=1 × Path Surprise (bps)				0.084***
				(0.003)
Constant	0.059*	-0.008	-0.036***	-0.028***
	(0.032)	(0.033)	(0.006)	(0.006)
Observations	199935	191068	6115435	5794831
Adjusted R^2	0.015	0.032	0.001	0.003

This table presents results from regressing equity returns on monetary policy action variables on FOMC announcement days using the sample period 2012-2023. Target surprise is computed following Bernanke and Kuttner (2005). Path surprise is calculated based on Gürkaynak et al. (2005b). Columns 1 and 2 follow the event study methodology of Kuttner (2001) and Columns 3 and 4 estimate the regressions of Thornton (2014). *FOMC* is an indicator variable equal to one if the day is an FOMC announcement date and zero otherwise. All regressions include year and industry-fixed effects and time-varying firm controls, which are described in greater detail in Section 2. The interaction variables of the monetary policy shock with firm controls are also included. Standard errors are clustered at the firm level and are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Daily Return Reaction for ETF Constituents to Monetary Policy Shocks

VARIABLES	(1)	(2)	(3)
Target Surprise (bps)	0.002***	0.002***	0.002***
	(0.001)	(0.001)	(0.001)
Path Surprise (bps)	0.013***	0.013***	0.014***
	(0.001)	(0.001)	(0.001)
FOMC=1	0.175***	0.204***	0.095***
	(0.010)	(0.011)	(0.010)
FOMC=1 × Target Surprise (bps)	-0.109***	-0.122***	-0.091***
	(0.006)	(0.006)	(0.005)
FOMC=1 × Path Surprise (bps)	0.103***	0.120***	0.072***
	(0.005)	(0.005)	(0.005)
High=1 × FOMC=1	-0.118***		
	(0.013)		
High=1 × FOMC=1 × Target Surprise (bps)	0.047***		
	(0.007)		
High=1 × FOMC=1 × Path Surprise (bps)	-0.037***		
	(0.006)		
Broad High=1 × FOMC=1		-0.173***	
		(0.013)	
Broad High=1 × FOMC=1 × Target Surprise (bps)		0.067***	
		(0.007)	
Broad High=1 × FOMC=1 × Path Surprise (bps)		-0.069***	
		(0.006)	
Sector High=1 × FOMC=1			0.034**
			(0.014)
Sector High=1 × FOMC=1 × Target Surprise (bps)			0.017**
			(0.007)
Sector High=1 × FOMC=1 × Path Surprise (bps)			0.021***
			(0.006)
Constant	-0.030***	-0.032***	-0.027***
	(0.006)	(0.006)	(0.006)
Observations	5794831	5794831	5794831
Adjusted R^2	0.003	0.003	0.003

This table presents results from regressing equity returns on monetary policy action variables using all trading days from January 2012 to June 2023. Target surprise is computed following Bernanke and Kuttner (2005). Path surprise is calculated based on Gürkaynak et al. (2005b). *FOMC* is an indicator variable equal to one if the day is an FOMC announcement date and zero otherwise. *High* is an indicator variable if the level of total ETF ownership for firm i is above the median and zero otherwise. *Broad High* (*Sector High*) is an indicator variable if the level of broad (sector) ETF ownership is above the median and zero otherwise. All regressions include year and industry-fixed effects and time-varying firm controls, which are described in greater detail in Section 2. Interaction variables of firm controls with target surprise and with path surprise are also included. Standard errors are clustered at the firm level and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Equity Return Response to Monetary Policy Shocks across Various Regimes

	ZLB		Post-ZLB		Tightening	
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Target Surprise (bps)	0.063***	0.067***	0.002**	0.002**	0.001	0.001
	(0.006)	(0.006)	(0.001)	(0.001)	(0.001)	(0.001)
Path Surprise (bps)	-0.018**	-0.022***	0.001	0.001	0.017***	0.017***
	(0.008)	(0.008)	(0.003)	(0.003)	(0.002)	(0.002)
FOMC=1	0.165***	0.037***	0.224***	0.134***	0.190***	0.088***
	(0.018)	(0.014)	(0.014)	(0.014)	(0.031)	(0.032)
FOMC=1 × Target Surprise (bps)	-0.171***	-0.164***	-0.117***	-0.068***	-0.057**	-0.115***
	(0.015)	(0.011)	(0.007)	(0.007)	(0.028)	(0.029)
FOMC=1 × Path Surprise (bps)	-0.029	-0.019	0.076***	0.020***	0.155***	0.119***
	(0.025)	(0.019)	(0.007)	(0.007)	(0.006)	(0.007)
Broad High=1 × FOMC=1	-0.098***		-0.230***		-0.133***	
	(0.022)		(0.018)		(0.041)	
Broad High=1 × FOMC=1 × Target Surprise (bps)	0.010		0.096***		0.005	
	(0.018)		(0.009)		(0.036)	
Broad High=1 × FOMC=1 × Path Surprise (bps)	0.009		-0.063***		-0.051***	
	(0.029)		(0.009)		(0.008)	
Sector High=1 × FOMC=1		0.154***		-0.048**		0.077*
		(0.020)		(0.019)		(0.042)
Sector High=1 × FOMC=1 × Target Surprise (bps)		-0.002		0.014		0.111***
		(0.015)		(0.009)		(0.037)
Sector High=1 × FOMC=1 × Path Surprise (bps)		-0.018		0.031***		0.024***
		(0.027)		(0.009)		(0.009)
Constant	0.013	0.021**	-0.044***	-0.039***	-0.083***	-0.078***
	(0.010)	(0.010)	(0.009)	(0.009)	(0.018)	(0.018)
Observations	1712883	1712883	3242284	3242284	839664	839664
Adjusted R^2	0.002	0.002	0.002	0.001	0.014	0.014

This table presents results from regressing equity returns on monetary policy action variables using all trading days from January 2012 to June 2023. Target surprise is computed following Bernanke and Kuttner (2005). Path surprise is calculated based on Gürkaynak et al. (2005b). *FOMC* is an indicator variable equal to one if the day is an FOMC announcement date and zero otherwise. *High Broad* (*High Sector*) is an indicator variable if the level of broad (sector) ETF ownership for firm i is above the median and zero otherwise. The zero lower bound (ZLB) period in Columns 1 and 2 is from January 2012 to November 2015. The post-ZLB period in Columns 3 and 4 is from December 2015 to February 2022. The remainder of the sample period is defined as the tightening period in Columns 5 and 6. All regressions include year and industry-fixed effects and time-varying firm controls, described in greater detail in Section 2. Interaction variables of firm controls with target surprise and with path surprise are also included. Standard errors are clustered at the firm level and reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Monetary Policy Shocks and ETF Ownership of Financially Constrained Firms

	Broad Ownership		Sector Ownership	
	Constrained	Unconstrained	Constrained	Unconstrained
VARIABLES	(1)	(2)	(3)	(4)
FOMC=1	0.209***	0.201***	0.127***	0.048***
	(0.014)	(0.016)	(0.014)	(0.012)
FOMC=1 × Target Surprise (bps)	-0.124***	-0.117***	-0.095***	-0.083***
	(0.008)	(0.009)	(0.008)	(0.007)
FOMC=1 × Path Surprise (bps)	0.136***	0.075***	0.081***	0.058***
	(0.006)	(0.007)	(0.007)	(0.006)
Broad High=1 × FOMC=1 × Target Surprise (bps)	0.063***	0.066***		
	(0.012)	(0.010)		
Broad High=1 × FOMC=1 × Path Surprise (bps)	-0.069***	-0.033***		
	(0.010)	(0.008)		
Sector High=1 × FOMC=1 × Target Surprise (bps)			-0.007	0.029***
			(0.011)	(0.009)
Sector High=1 × FOMC=1 × Path Surprise (bps)			0.070***	-0.011
			(0.010)	(0.007)
Constant	-0.045***	0.002	-0.044***	0.005
	(0.010)	(0.010)	(0.010)	(0.010)
Observations	2872774	2922057	2872774	2922057
Adjusted R^2	0.003	0.002	0.003	0.002

This table presents results from regressing equity returns on monetary policy action variables using all trading days from January 2012 to June 2023. Target surprise is computed following Bernanke and Kuttner (2005). Path surprise is calculated based on Gürkaynak et al. (2005b). *FOMC* is an indicator variable equal to one if the day is an FOMC announcement date and zero otherwise. *High* is an indicator variable if the level of total ETF ownership for firm i is above the median and zero otherwise. A firm is classified as constrained if its HP Index constructed following Hadlock and Pierce (2010) is above the median value and unconstrained otherwise. All regressions include year and industry-fixed effects and time-varying firm controls, which are described in greater detail in Section 2. Standard errors are clustered at the firm level and are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Monetary Policy Shocks and ETF Ownership of Small and Large Firms

	Broad Ownership		Sector Ownership	
	Small	Large	Small	Large
VARIABLES	(1)	(2)	(3)	(4)
FOMC=1	0.168***	0.269***	0.092***	0.100***
	(0.014)	(0.016)	(0.013)	(0.014)
FOMC=1 × Target Surprise (bps)	-0.113***	-0.140***	-0.094***	-0.085***
	(0.008)	(0.008)	(0.007)	(0.007)
FOMC=1 × Path Surprise (bps)	0.116***	0.127***	0.066***	0.086***
	(0.007)	(0.007)	(0.006)	(0.007)
Broad High=1 × FOMC=1 × Target Surprise (bps)	0.039***	0.096***		
	(0.011)	(0.009)		
Broad High=1 × FOMC=1 × Path Surprise (bps)	-0.054***	-0.083***		
	(0.010)	(0.008)		
Sector High=1 × FOMC=1 × Target Surprise (bps)			0.000	0.023**
			(0.011)	(0.009)
Sector High=1 × FOMC=1 × Path Surprise (bps)			0.083***	-0.021**
			(0.010)	(0.008)
Constant	-0.054***	-0.008	-0.054***	0.000
	(0.012)	(0.014)	(0.012)	(0.013)
Observations	2900029	2894802	2900029	2894802
Adjusted R^2	0.003	0.004	0.003	0.003

This table presents results from regressing equity returns on monetary policy action variables using all trading days from January 2012 to June 2023. Target surprise is computed following Bernanke and Kuttner (2005). Path surprise is calculated based on Gürkaynak et al. (2005b). *FOMC* is an indicator variable equal to one if the day is an FOMC announcement date and zero otherwise. *High* is an indicator variable if the level of total ETF ownership for firm i is above the median and zero otherwise. A firm is classified as small if its log assets are equal to or below the median value and large otherwise. All regressions include year and industry-fixed effects and time-varying firm controls, which are described in greater detail in Section 2. Standard errors are clustered at the firm level and are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Monetary Policy Shocks and ETF Ownership of High and Low R&D Firms

	Broad Ownership		Sector Ownership	
	High	Low	High	Low
VARIABLES	(1)	(2)	(3)	(4)
FOMC=1	0.177***	0.169***	0.093***	0.053***
	(0.018)	(0.018)	(0.021)	(0.015)
FOMC=1 × Target Surprise (bps)	-0.114***	-0.094***	-0.081***	-0.081***
	(0.010)	(0.011)	(0.011)	(0.008)
FOMC=1 × Path Surprise (bps)	0.145***	0.063***	0.074***	0.055***
	(0.009)	(0.009)	(0.010)	(0.007)
Broad High=1 × FOMC=1 × Target Surprise (bps)	0.068***	0.047***		
	(0.013)	(0.012)		
Broad High=1 × FOMC=1 × Path Surprise (bps)	-0.074***	-0.012		
	(0.012)	(0.011)		
Sector High=1 × FOMC=1 × Target Surprise (bps)			0.008	0.039***
			(0.014)	(0.011)
Sector High=1 × FOMC=1 × Path Surprise (bps)			0.062***	-0.000
			(0.013)	(0.010)
Constant	0.018*	-0.065***	0.022**	-0.060***
	(0.011)	(0.014)	(0.011)	(0.014)
Observations	1882835	1918236	1882835	1918236
Adjusted R^2	0.003	0.002	0.003	0.002

This table presents results from regressing equity returns on monetary policy action variables using all trading days from January 2012 to June 2023. Target surprise is computed following Bernanke and Kuttner (2005). Path surprise is calculated based on Gürkaynak et al. (2005b). *FOMC* is an indicator variable equal to one if the day is an FOMC announcement date and zero otherwise. *High* is an indicator variable if the level of total ETF ownership for firm i is above the median and zero otherwise. A firm is classified as a high R&D firm if its annual R&D expense is greater than the median value and low R&D otherwise. All regressions include year and industry-fixed effects and time-varying firm controls, which are described in greater detail in Section 2. Standard errors are clustered at the firm level and are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Monetary Policy Shocks and ETF Ownership of Low and High Growth Firms

	Broad Ownership		Sector Ownership	
	Low Growth	High Growth	Low Growth	High Growth
VARIABLES	(1)	(2)	(3)	(4)
FOMC=1	0.176***	0.237***	0.071***	0.131***
	(0.015)	(0.016)	(0.013)	(0.016)
FOMC=1 × Target Surprise (bps)	-0.117***	-0.128***	-0.094***	-0.082***
	(0.009)	(0.009)	(0.007)	(0.009)
FOMC=1 × Path Surprise (bps)	0.049***	0.194***	0.035***	0.128***
	(0.007)	(0.007)	(0.006)	(0.008)
Broad High=1 × FOMC=1 × Target Surprise (bps)	0.034***	0.100***		
	(0.011)	(0.010)		
Broad High=1 × FOMC=1 × Path Surprise (bps)	-0.029***	-0.116***		
	(0.009)	(0.009)		
Sector High=1 × FOMC=1 × Target Surprise (bps)			-0.006	0.028***
			(0.011)	(0.010)
Sector High=1 × FOMC=1 × Path Surprise (bps)			-0.004	0.006
			(0.009)	(0.010)
Constant	-0.061***	-0.026***	-0.056***	-0.023**
	(0.013)	(0.009)	(0.013)	(0.009)
Observations	2873567	2921263	2873567	2921263
Adjusted R^2	0.002	0.004	0.002	0.004

This table presents results from regressing equity returns on monetary policy action variables using all trading days from January 2012 to June 2023. Target surprise is computed following Bernanke and Kuttner (2005). Path surprise is calculated based on Gürkaynak et al. (2005b). *FOMC* is an indicator variable equal to one if the day is an FOMC announcement date and zero otherwise. *High* is an indicator variable if the level of total ETF ownership for firm i is above the median and zero otherwise. A firm is classified as having low growth opportunities if its book-to-market (BTM) ratio is greater than the median value and as having high growth opportunities otherwise. All regressions include year and industry-fixed effects and time-varying firm controls, which are described in greater detail in Section 2. Standard errors are clustered at the firm level and are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Monetary Policy Shocks and ETF Ownership of Old and Young Firms

	Broad Ownership		Sector Ownership	
	Old	Young	Old	Young
VARIABLES	(1)	(2)	(3)	(4)
FOMC=1	0.168***	0.230***	0.049***	0.136***
	(0.014)	(0.014)	(0.012)	(0.015)
FOMC=1 × Target Surprise (bps)	-0.101***	-0.135***	-0.078***	-0.102***
	(0.009)	(0.008)	(0.007)	(0.008)
FOMC=1 × Path Surprise (bps)	0.060***	0.147***	0.046***	0.092***
	(0.007)	(0.006)	(0.006)	(0.007)
Broad High=1 × FOMC=1 × Target Surprise (bps)	0.052***	0.073***		
	(0.010)	(0.011)		
Broad High=1 × FOMC=1 × Path Surprise (bps)	-0.020**	-0.080***		
	(0.008)	(0.010)		
Sector High=1 × FOMC=1 × Target Surprise (bps)			0.025***	0.003
			(0.009)	(0.011)
Sector High=1 × FOMC=1 × Path Surprise (bps)			0.001	0.048***
			(0.007)	(0.010)
Constant	-0.019**	-0.053***	-0.014	-0.050***
	(0.009)	(0.011)	(0.009)	(0.011)
Observations	2946475	2848356	2946475	2848356
Adjusted R^2	0.002	0.004	0.002	0.004

This table presents results from regressing equity returns on monetary policy action variables using all trading days from January 2012 to June 2023. Target surprise is computed following Bernanke and Kuttner (2005). Path surprise is calculated based on Gürkaynak et al. (2005b). *FOMC* is an indicator variable equal to one if the day is an FOMC announcement date and zero otherwise. *High* is an indicator variable if the level of total ETF ownership for firm i is above the median and zero otherwise. A firm is classified as old if the firm's age is above the median and young otherwise. All regressions include year and industry-fixed effects and time-varying firm controls, which are described in greater detail in Section 2. Standard errors are clustered at the firm level and are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

A Appendix A

In this Appendix, we describe the construction of the variables used in Section 3.

Table A1: Firm Control Variable Definition and Description

Firm Control	Definition
Book-to-market (BTM)	Ratio of $(CEQ + TXDITC)$ to market value of equity $(CSHO \times PRCC\_F)$ as of December of the same year (Ozdagli, 2018).
Firm Size	Natural logarithm of total assets (AT).
ROA	Operating income before depreciation (OIBDP) scaled by total assets (AT).
Leverage	Total liabilities (LT) scaled by total assets (AT).
CAPM Beta	Factor loading on the market return from a Carhart four-factor model of daily returns over the prior 252 trading days.
Financial Constraint Index (HP)	$-0.737 \times Size + 0.043 \times Size^2 - 0.040 \times Age$, where size is defined above, and Age is the number of years the firm is listed in Compustat with a non-missing stock price or asset value. Size is capped at $ln(\$4.5\ billion)$ and Age is capped at 37 years (Hadlock and Pierce, 2010). We follow common practice and sort firms into terciles baed on their index values in the previous period and code those firms in the top tercile as constrained and those in the bottom tercile as unconstrained (Farre-Mensa and Ljungqvist, 2016; Ozdagli, 2018).
R&D spending	R&D spending (XRD) divided by total assets (AT) (Ozdagli, 2018).
Firm Age	Number of years since the firm was first recorded in Compustat.

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