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The Profitability Channel of Monetary Policy Transmission

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Abstract: We provide firm-level evidence that Federal Open Market Committee announcements have real effects by changing expectations of firm profitability. We use an existing decomposition of a monetary policy shock into a central bank information component (CBI) and a conventional monetary component (MP). We find (1) firms with a higher value of capital asset pricing model (CAPM) beta have a higher investment rate sensitivity to the CBI component; no similar heterogeneity in investment response is observed for the MP component. We also find (2) the heterogeneity in investment sensitivity is due to innovations to firm profitability.

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1 Introduction

We present evidence of a new channel through which monetary policy is transmitted, the profitability channel. We show that FOMC announcements change expectations of firm profitability, which, in turn, affects firm investment. The profitability channel complements makes qualitatively distinct predictions compared to the well-studied channels of monetary policy which operate through a discount rate channel (e.g., the conventional monetary channel and the credit channel). To see this, consider an unexpected increase in the nominal policy rate. The discount rate channel predicts that investment must fall in this scenario. However, the profitability channel allows for the possibility of an *increase* in investment following the unexpected rate increase if it is accompanied by a Fed announcement that leads to a large upward revision in firm profitability expectations. We show that this "profitability channel" of monetary policy has a heterogeneous effect on the investment response of firms to FOMC announcements.

Figure 1 shows the average investment rate sensitivities of firms following FOMC announcements estimated over the period 1990-2019. We use the high-frequency monetary policy shocks constructed by Jarociński and Karadi (2020) as our baseline measure of a monetary policy shock. This measure, which incorporates information from both interest rates and the stock market, divides a monetary policy shock into two components: (i) a Central Bank Information shock (henceforth "CBI") identified by a *positive* comovement between interest rates and the S&P500 index and (ii) a conventional monetary shock (henceforth "MP") identified by a *negative* comovement between interest rates and the level of the S&P500 index. Although the exercise in Figure 1 is informal, it nonetheless shows that there is substantial heterogeneity across firms in their average investment response to a CBI shock; there is less heterogeneity in response to a MP shock.[1] In this paper, we focus on the CBI shock because it is more likely to change firm profitability. The MP shock on the other hand,

[1] Note that Figure 1 shows results *without* conditioning on particular firm characteristics. Conditioning on specific characteristics might reveal large differences in investment responses across firms; for example, sorting firms by measures of financial constraints (see our literature review for examples).

is a more conventional monetary shock likely operating through the discount rate channel (e.g., the S&P500 declines following a surprise increase in the nominal policy rate).

To study this heterogeneity in investment sensitivity to monetary policy shocks, we sort firms by their CAPM betas. We do so because CAPM beta is known to capture the heterogeneous response of average excess stock returns on FOMC announcement days (Savor and Wilson, 2014). To the extent that changes in stock prices reflect changes in investment opportunities, we expect CAPM beta to capture the heterogeneous effect of monetary policy shocks on firm-level investment rates.

We establish the profitability channel of monetary policy with two main results. First, we show that high CAPM beta firms have a higher sensitivity to the CBI component than low CAPM beta firms. Quantitatively, following a one standard deviation positive CBI shock (a positive CBI shock is an unexpected increase in the nominal policy rate followed by a stock market rally) firms above the median of the CAPM beta distribution increase their capital stock by 1.73% more than firms below the median over the two years following the shock. In addition to analyzing realized investment rates, we analyze revisions in analysts' forecasts of various firm-level measures of future investment opportunities, including revisions of two-year ahead projections of capital expenditures. We find a positive (negative) CBI shock to be followed by a larger upward (downward) revision in analyst's forecasts of capital expenditures for high CAPM beta firms relative to low CAPM beta firms—in line with our findings using realized firm-level investment patterns. Besides providing additional support for our results based on realized investment rates, revisions in analyst forecasts have the added advantage of being forward-looking and therefore partially address the concern that our investment results reflect firm decisions made prior to the monetary policy shock (as opposed to being a response to the shock).

Our second result is that the higher sensitivity of high CAPM beta firms to a CBI shock is attributable to innovations to firm profitability; we do not find evidence of innovations to firm discount rates driving the heterogeneous investment response. To show the effect of monetary policy shocks on firm profitability, we study revisions in analyst forecasts of return on assets for individual firms. We find such forecasts to be upward (downward) revised more for high CAPM beta firms relative to low CAPM beta firms following a positive (negative) CBI shock. In order to find evidence for the discount rate channel, we carry out a battery of three tests but all these tests deliver null results. First, we decompose firm-level equity return innovations following CBI shocks into an expected profitability component and a discount rate component following Vuolteenaho (2002). We find that the CBI shock affects the profitability component but not the discount rate component of unexpected returns of individual stocks. Second, we test if the change in stock return volatility around an FOMC announcement differs between low and high CAPM beta firms. We do not find evidence in support of this. Finally, we test if market excess returns predict cross-sectional differences in firm investment in response to a CBI shock and find a null result.

We conclude by testing for heterogeneity in investment rate sensitivity to the CBI shock by sorting firms based on their values of Tobin's Q. We find a positive relation between Tobin's Q and investment sensitivity to a CBI shock suggesting that firms richer in growth opportunities are more sensitive to a CBI shock. Indeed, our baseline results which use CAPM beta as a firm characteristic is in line this hypothesis, since firms with more growth opportunities are expected to have higher CAPM betas, for example, due to embedded options such as the option to expand, delay, or abandon projects (see Berk et al. (1999) and Gomes et al. (2003) among others).

Related Literature

Our paper contributes to the literature that analyzes the effect of monetary policy on firm investment. Monetary policy can affect a firm's investment decision either because the policy shock changes the discount rate that the firm uses to value cash flows from the investment, or because the policy shock and accompanying Fed announcements change the firm's expectations of investment profitability. To the best of our knowledge, our paper provides the first evidence of monetary policy affecting firm investment by changing expectations of firm profitability.

Our paper complements existing work in which monetary policy has real effects though the discount rate channel. Two well known channels of monetary policy that operate through the discount rate channel are driven by the presence of frictions such as nominal rigidities and financial frictions. For example, nominal rigidities cause nominal policy rate changes to lead to changes in the real risk-free rate in the conventional monetary channel. Evidence for this channel is provided by the seminal paper Christiano et al. (2005) and the literature following it; see Galí (2008) for a textbook analysis of New-Keynesian models which capture the logic of the conventional monetary channel. Most papers analyzing the traditional channel of monetary policy emphasize monetary policy's effect on aggregate quantities and prices.[2] Financial frictions drive monetary policy's real effects in the credit channel of monetary policy. This channel assumes that a change in the nominal policy rate alters the severity of financial frictions which, in turn, changes the premium a firm pays for external financing (see, Bernanke and Gertler (1995) for a review). Existing analyses of the heterogeneous impact of monetary policy on firm-level investment focus on this financial friction channel. Examples include Ippolito et al. (2018), Jeenas (2019), Ottonello and Winberry (2020), Gürkaynak et al. (2022), and Vats (2022). Financial frictions can also lead to real effects of monetary policy by altering the ability of banks to take risk as highlighted by Drechsler et al. (2018). While the above channels of monetary policy operate through the discount rate channel, Drechsler et al. (2017) show that market power of banks results in monetary policy impacting the quantity of bank lending.

The channel through which monetary policy can change expectations of future economic conditions, such as firm profitability, makes the premise that FOMC announcements and accompanying press releases lead households and firms, henceforth "the public", to update their beliefs about future economic growth. This can be either through the so-called "infor-

[2] Kroen et al. (2021) is an exception. These authors show that the traditional channel of monetary policy can have a heterogeneous effect in the cross-section of firms because changes in the real rate differentially affects competition within an industry.

mation channel" in which the public learns about future economic growth prospects from the Fed because they believe that the Fed has superior information. Alternatively, the public might also update their beliefs about future economic growth indirectly by updating their beliefs about the Fed's policy response function to economic news.

Evidence in support of the public directly learning from the Fed is provided by Romer and Romer (2000), Campbell et al. (2012), Melosi (2017), and Nakamura and Steinsson (2018). These papers show that professional forecasters revise their expectations of macroeconomic aggregate variables such as inflation, output growth, and unemployment following FOMC meetings and press releases. Similarly, Jarociński and Karadi (2020) and Cieslak and Schrimpf (2019) analyze the joint dynamics of interest rates and the aggregate stock market to conclude that central bank announcements contain a news component about future economic growth and also financial risk premia. Ai et al. (2022) use options data to show that monetary policy announcement surprises are priced in the cross-section of equity returns.

A recent literature argues that existing data is also consistent with the indirect channel, namely, the public updating their beliefs about the Fed's response function. Papers in this literature include Bianchi et al. (2022b) and Bauer and Swanson (2023). The profitability channel in this paper is consistent with both direct and indirect learning as long as monetary policy is non-neutral.[3]

There is also a large literature that provides evidence of central bank policy surprises affecting asset prices. These include Bernanke and Kuttner (2005), Savor and Wilson (2014), Gorodnichenko and Weber (2016), Chava and Hsu (2020), Cieslak and Pang (2021), Leombroni et al. (2021), Ai et al. (2022), and Pflueger and Rinaldi (2022). In contrast to these papers, we focus on the real effects of monetary policy surprises.

[3]Specifically, if the public updates their beliefs about how the Fed would respond to a future economic shock, they would rationally update their beliefs about future economic conditions if the Fed's policy affects the real economy.

2 Data

In this section, we describe construction of our firm-level data and provide details on the monetary policy shocks that we use in our analysis. The sample period for the monetary policy shocks is from January 1990—June 2019.

2.1 Firm-level data

We use quarterly financial data from Compustat to measure firm-level variables. We exclude financial firms (sic code from 6000 to 6999) and utility firms (sic code from 4900 to 4999). We merge stock price data from CRSP with Compustat data, and keep firms with a share code of 10 or 11 and an exchange code of 1, 2, or 3.

We measure the investment rate of firms using two measures: (i) the log change in capital stock and (ii) capital expenditure divided by total firm assets atq. We also compute the following firm-level variables: book leverage (current debt $dlcq$ plus long-term debt $dlccq$ divided by total asset), Tobin's Q (total asset minus book equity $ceqq$ plus market equity $cshoq \times prccq$ divided by total asset), and cash flow (income before extraordinary items ibd plus depreciation and amortization dbq divided by lagged total asset).

We estimate the CAPM beta of each firm as the loading of the excess monthly return of this firm on the excess monthly return of the market over our entire sample period. We use the market-value weighted portfolio of all stocks listed in CRSP as our proxy for the market; we use the return on the 1-month Treasury bill as our measure of the risk-free rate. Table 1 reports summary statistics for these variables.

We use analyst forecasts in our analysis based on the monthly summary file from IBES. The data provides us information on the consensus forecasts of projected capital expenditure (CapEx), earnings per share (EPS), sales projections, and return on assets (ROA) for individual firms at different horizons.

2.2 Monetary policy shocks

We use three off-the-shelf monetary policy shock measures. All three are high frequency measures estimated using data over 30-minute windows around FOMC announcements. Since investment rate is observed at a quarterly frequency, while FOMC announcements are made approximately once every six weeks, we follow the literature and sum the monetary policy shocks within a quarter to obtain the quarterly shock.

Our baseline monetary policy shock measure is the Jarociński and Karadi (2020) (henceforth "JK") measure. We use this as our baseline measure because, in addition to using changes in prices of interest rate derivatives, the JK measure uses information based on the reaction of the stock market. The latter is a forward looking measure and it reacts to changes in investment opportunities over longer horizons than is typically captured by measures based on interest rate derivatives. The JK measure has two components: (i) a central bank information shock (henceforth "CBI") and (ii) a conventional monetary policy shock (henceforth "MP"). These two components are identified by analyzing the comovement between changes in the 3 month fed funds futures rate and changes in the level of the S&P 500 index. A CBI (MP) shock is associated with a positive (negative) comovement between changes in the 3 month fed funds futures rate and changes in the level of the S&P 500 index.

Our second monetary policy shock is the Nakamura and Steinsson (2018) (henceforth "NS") measure.[4]. This shock is the first principal component of changes in the following five interest rates over different maturities: the Fed funds rate immediately following the FOMC meeting, the expected Fed funds rate immediately following the next FOMC meeting (using fed funds futures), and expected three-month eurodollar interest rates at maturities of two, three, and four quarters. See the online appendix accompanying Nakamura and Steinsson (2018) for details about the construction of this shock.

Our third monetary policy shock is the orthogonalized monetary policy surprises (henceforth "MPS_ORTH") from Bauer and Swanson (2022). These authors point out that FOMC

[4] We use the time series of the NS shock constructed by Acosta (2022).

meetings are preceded by the release of important macroeconomic and financial data and it is therefore important to remove the effects of the predictable component due to such news releases to construct the monetary surprise. We use their time series of monetary policy surprises which is the residual term from regressing the NS shock on six macroeconomic and financial variables that are available before the FOMC announcement.[5]

3 CAPM beta and investment response to monetary policy shocks

In this section, we provide evidence that firms with a higher value of CAPM beta have a higher investment rate sensitivity to the CBI shock. In contrast, we do not find any heterogeneity in investment response to MP shocks when we look across firms with different CAPM betas.

3.1 Investment response to monetary policy

We establish the relation between a firm's investment rate sensitivity to a monetary policy shock and its CAPM beta in two ways. In our first empirical specification, we sort firms according to their CAPM beta, form CAPM beta deciles, and estimate the investment sensitivity of each decile. In our second specification, we use a panel regression to estimate the difference in investment sensitivity of firms with different CAPM betas.

Average investment response across CAPM beta deciles. We sort firms by their CAPM betas and place each firm into the corresponding CAPM beta decile. We estimate the average investment sensitivity of each CAPM decile over h quarters following the shock

[5]The six predictors used by Bauer and Swanson (2022) are: Nonfarm payrolls surprise, Employment growth, the S&P 500, the slope of the Treasury yield curve, commodity price index, and Treasury skewness.

by using the specification:

$$\Delta logk_{i,t-1\to t-1+h} = \gamma_{1,h} CBI_t + \gamma_{2,h} MP_t + X_{i,t-1} + \eta_i + \theta_{s,t} + \epsilon_{i,t} \tag{1}$$

separately for each decile. In equation (1), we have used our primary measure of the monetary policy shock, namely, the CBI and MP components estimated by Jarociński and Karadi (2020). The dependent variable $\Delta logk_{i,t-1\to t-1+h} \equiv \log k_{i,t-1+h} - \log k_{i,t-1}$ is the log change in firm i's capital stock over h quarters, starting from the end of quarter $t-1$ to the end of quarter $t-1+h$. $X_{i,t-1}$ includes the following lagged firm-level controls at time $t-1$ that may affect firm investment: logged total asset, book leverage, Tobin's Q, and cash flow. We add a firm fixed effect η_i to control for firm-level time-invariant factors that matter for firm investment. We add industry $\times$ time fixed effects $\theta_{s,t}$ to control for common industry-level shocks that affect firm investment. The standard errors are clustered at the firm and year-quarter level.

Our coefficients of interest are the investment rate sensitivity of firms in a given decile to the CBI and the MP components, $\gamma_{1,h}$ and $\gamma_{2,h}$, respectively, for a given horizon h. Figure 2 shows results for $h = 8$ quarters, that is, the two-year ahead log change in capital stock following a monetary policy shock. We have three findings. First, the top panel of this figure shows a positive investment sensitivity across all CAPM beta deciles at the 95% confidence level. In other words, on average, firms increase investment following a positive CBI shock. Second, the bottom panel of this figure shows that the average investment rate sensitivity to the MP component across all CAPM beta deciles is zero at the 95% confidence level. Third, the top panel shows that high beta firms have a higher investment sensitivity to a CBI shock. The difference in the investment response between the top and bottom CAPM deciles to a CBI shock is substantial. For instance, a one standard deviation increase in the CBI shock is associated with 0.93 percentage points (t-stat: 1.68) increase in the two-year investment rate of a firm in the lowest beta decile. The same shock is associated with a 5.20 percentage points (t-stat: 3.02) increase in the two-year investment rate in the highest beta decile, which is slightly more than 50% of the average two-year investment rate.

Relative difference in investment response by CAPM beta. We use the following panel regression specification to estimate how investment rate sensitivity varies across firms that differ in CAPM betas:

$$\Delta logk_{i,t-1\to t-1+h} = \delta_{1,h} CBI_t \times \beta_i + \delta_{2,h} MP_t \times \beta_i + X_{i,t-1} + \eta_i + \theta_{s,t} + \epsilon_{i,t}. \tag{2}$$

The coefficients of interest in equation (2) are the coefficients of the interaction terms $\delta_{1,h}$ and $\delta_{2,h}$ with the two components of the JK shock. In (2), the CAPM β is absorbed by the firm fixed effect η_i, while CBI_t and MP_t are both absorbed by the industry $\times$ time fixed effects $\theta_{s,t}$.

Table 2 reports results for $h = 8$ quarters. We see from Column (1) of this table, that the coefficient of the interaction term of the CBI shock and CAPM beta $\delta_{1,h}$ is positive and significant. This implies that high CAPM beta firms have a higher investment rate sensitivity than low CAPM beta firms to a CBI shock. The difference in the investment response is statistically significant at the 1% level and economically large. For instance, following a positive one standard deviation CBI shock, a firm, whose CAPM beta is one standard deviation higher than the mean, invests with an investment rate that is 1.5 percentage points higher than a firm at the mean of the CAPM beta distribution. In contrast, the coefficient of the interaction term $\delta_{1,h}$ is insignificant, that is, there is no difference in the investment rate response between high and low CAPM beta firms to an MP shock.

In Column (2) of Table 2, we replace the continuous variable β with the dummy variable β_{p50} for the interaction term in equation (2). We set β_{p50} to 1 if a firm's CAPM beta is above the median. Consistent with Column (1), we see that following a one-standard deviation CBI shock, a firm above the median of the CAPM beta distribution increases its investment rate by 1.73 percentage points more than that of a firm below the median. There is no difference in the investment rate response to the MP shock when we compare firms below and above the median.

While the above results are for $h = 8$ quarters, in Figure 3, we report results for estimated sensitivities $\delta_{1,h}$ and $\delta_{2,h}$ in (2) for $h = 1, 2, \cdots, 12$ quarters. The top panel of this figure shows a large and persistent difference in the investment response to a CBI shock between low and high CAPM beta firms. The interaction coefficient $\delta_{1,h}$ increases from $h = 1$ to $h = 8$ quarters and remains flat to $h = 12$ quarters. In contrast, from the bottom panel we see that $\delta_{2,h} = 0$ over this range of h, that is, there is no difference in the investment rate response between high and low CAPM beta firms to an MP shock over 12 quarters following an MP shock.

Because a significant portion of the period in our sample includes the period following the Great Recession which featured zero nominal short rates and unconventional monetary policy, we repeat our analysis over the precrisis sample period 1990-2008. Columns (3) and (4) of Table 2 show that our results remain unchanged. In fact, the pre-2008 period appears to show a greater heterogeneity in investment response to a CBI shock—the point estimate of the coefficient $\delta_{2,h}$ is 0.456 in the pre-2008 period compared to 0.316 in the full sample.

Alternative monetary policy shocks. In this section we show that our headline result, namely, a positive relation between firm investment sensitivity to a monetary policy shock and its CAPM beta holds for alternate measures of monetary policy. Specifically, we use a specification similar to equation (2), but where we use two alternate measures of monetary policy shocks commonly used in the literature: the Nakamura and Steinsson (2018) shock (henceforth "NS") and the Bauer and Swanson (2022) orthogonalized shock (henceforth "MPS_ORTH").

For the NS shock we use a panel regression specification similar to equation (2) adapted for a single monetary policy shock:

$$\Delta log k_{i,t-1\to t-1+h} = \delta_{3,h} NS_t \times \beta_i + X_{i,t-1} + \eta_i + \theta_{s,t} + \epsilon_{i,t}. \tag{3}$$

The coefficient of interest is $\delta_{3,h}$. Panel A of Table A1 shows results. Column (1) shows that this coefficient is positive and significant at the 1% level. This implies that high CAPM beta firms invest more than low CAPM beta firms following a positive NS shock. Column (2) shows a similar result, but with the continuous variable CAPM β replaced by the dummy variable β_{p50} for the interaction term in equation (3). Consistent with Column (1), we see that following a positive (negative) NS shock, a firm whose CAPM beta is above the median invests more (less) than a firm whose CAPM beta is below the median. Specifically, following a one-standard deviation positive NS shock, a firm above the median of the CAPM beta distribution increases its investment rate by 1.58 percentage points more than that of a firm below the median.

For the MPS_ORTH shock, we split the sample into quarters with CBI shocks and quarters without CBI shocks based on Jarociński and Karadi (2020)'s "poorman" shock which classifies each policy shock as either a pure CBI shock or a pure MP shock and run the following regression specification separately for each of the two sub-samples,

$$\Delta logk_{i,t-1\rightarrow t-1+h} = \delta_{4,h} MPS\_ORTH_t \times \beta_i + X_{i,t-1} + \eta_i + \theta_{s,t} + \epsilon_{i,t}. \tag{4}$$

Panel B of Table A1 shows results. Columns (3) and (4) of Table A1 report the results for quarters with CBI shocks. The coefficient $\delta_{4,h}$ for MPS_ORTH is positive and significant, consistent with our baseline results. This result suggests that in quarters with CBI shocks, a one-standard deviation positive MPR_ORTH shock is associated with 1.05 percentage points more in investment rate for high CAPM beta firms relative to low CAPM beta firms. Column (5) and (6) report the results for quarters with MP shock (i.e., non-CBI quarters). The coefficient is negative. This is in line with the interpretation that an MP shock is a conventional monetary policy shock which operates through the discount rate channel. In particular, our results are consistent with the hypothesis that the MP shock changes the market risk premium which leads to a larger change in the risk premium and investment rate of high CAPM beta firms relative to low CAPM beta firms. See Pflueger and Rinaldi (2022), who provide evidence of this risk premium channel using stock returns.[6]

Finally, we repeat our analysis using equation (4), but now using the full sample. That is, we do not condition on the CBI shock. From Columns (1) and (2) of panel B of Table A1, we see that the coefficient estimate $\delta_{4,h}$ is insignificant. This is potentially because $\delta_{4,h}$ appears with opposite signs in sub-samples with CBI and MP shock realizations. Our result highlights the importance of conditioning on CBI shock and MP shock because they likely operate through different channels.

Robustness check. We conclude this section with two robustness checks on our baseline result of a positive relation between firm investment sensitivity to the JK monetary policy shock and CAPM beta.

First, we re-estimate the specification (2), but additionally control for lagged investment. Column (1) of Table A2 shows the result where we control for the cumulative change in log capital over 4 quarters preceding the monetary policy shock. As in our baseline results, we see that the coefficient of the interaction term $CBI \times \beta$ is positive and statistically significant at the 1% level, while the coefficient of the interaction term $MP \times \beta$ is not statistically different from zero. Furthermore, the magnitude of the coefficient of the interaction term with the CBI shock remains unchanged relative to the baseline result when we additionally control for the 4-quarter lagged investment: this coefficient is 0.331 in the baseline specification and 0.324 in our robustness check. Column (2) shows that we get similar results as in our baseline when we replace the continuous variable CAPM β by the dummy β_{p50}. Finally, columns (3) and (4) report results where we control for the cumulative change in log capital over 1 quarter preceding the monetary policy shock using the continuous variable CAPM β and the dummy β_{p50}, respectively. Once again, our results remain unchanged from the baseline specification.

Second, we re-estimate the specification (2), but now use a different measure of firm

[6] When we repeat the same sample splitting exercise for the NS shock and use the specification equation (3), we find that the positive coefficient estimates are mainly driven by quarters with CBI shocks.

investment. Specifically, instead of the log difference in capital stock for the dependent variable used in our baseline analysis, we use CapEx as the dependent variable. Columns (1) through (4) of Table A3 shows the results. Comparing these results with those in our baseline specification reported in Table 2, we see that our results remain unchanged.

3.2 Analyst revisions of CapEx

In Section 3.1 we provided evidence of a positive relation between a firm's investment sensitivity to a CBI shock and its CAPM beta. Our preferred interpretation of this result is that the cross-sectional heterogeneity in firm investment response is due to firms updating the value of investing following a CBI shock. A potential concern with this interpretation is that the results might instead reflect cross-sectional differences in investment plans made *prior* to the CBI shock which are then implemented in stages. Table A2 partially addresses this concern by including lagged investment. In this section, we further address this concern by analyzing revisions in analysts forecasts of two year-ahead CapEx projections.

We use monthly analyst forecasts to construct an event panel where each FOMC meeting is an event. To estimate cross-sectional differences in the effect of a monetary policy shock on analyst forecasts of cash flows, we compute the change in the analyst forecasts from one month before the meeting to one and two months after the meeting. We estimate revisions in analyst forecasts using the following specification:

$$UpRevision\_CapEx_{i,t-1\rightarrow t+h} = \widehat{\delta}_1 CBI_t \times \beta_i + \widehat{\delta}_2 MP_t \times \beta_i + X_{i,t-1} + \eta_i + \theta_{s,t} + \epsilon_{i,t}. \quad (5)$$

The dependent variable in (5) $UpRevision\_CapEx$ is an indicator variable which takes a value of 1 if the forecast of the two-year ahead $CapEx$ of firm i is revised upward from one month before the FOMC meeting to h months after the FOMC meeting, or is 0 otherwise. We use an indicator variable because it is more robust.

Table 3 shows the results where we focus on changes in CapEx forecasts. Columns (1) and

(2) show that the coefficient $\widehat{\delta}_1$ is positive, while $\widehat{\delta}_2$ is close to zero. A positive coefficient $\widehat{\delta}_1$ implies that in the month (or two months corresponding to results in Column (2)) following the monetary policy shock, analysts upward revise their projections for the two-year ahead CapEx more frequently for high CAPM beta firms than for low CAPM beta firms.

Columns (3) and (4) show a similar result using the dummy variable β_{p50} instead of the continuous variable β in equation (5). The coefficient of the interaction term with the CBI shock is positive, large, and statistically significant at the 1% level. The coefficient of the interaction term with the MP shock is small and statistically indistinguishable from zero.

Since CapEx projections are not well populated in the IBES dataset, we estimate the specification (5) using the two-year ahead earnings-per-share (EPS) and two-year ahead sales projections which are better populated in the dataset. While EPS and sales projections do not directly measure a firm's investment rate, it is not unreasonable to assume that they are positively related to investment rates.

Table A4 reports the results. This table highlights two results. First, Panel A shows results for revision in EPS. We see that the coefficient of the $CBI \times \beta$ interaction term is positive and statistically significant at the 1% level. Similarly, Panel B shows results for revision in sales projections. We obtain similar results as EPS in sales projections.

To summarize, we see that a positive CBI shock is associated with a greater upward revision in both EPS and sales projections of high beta firms relative to low beta firms. This result is robust to grouping firms above and below the median of the CAPM beta distribution using the dummy variables β_{p50} (see Columns (3) and (4) of panel A for EPS and panel B for sales projections).

4 The channel: Cash flow versus discount rate

In Section 3 we documented that firms with a higher value of CAPM beta have a higher sensitivity to the CBI shock. Such differences in the investment response can be attributed to either firm-level differences in the response of (i) firm profitability (defined as cash flows generated by a unit of investment) or (ii) firm discount rates to the CBI shock, or a combination of (i) and (ii) above (see, e.g., Kogan and Papanikolaou (2012) for a derivation). We will call channel (i) the "profitability channel" and (ii) the "discount rate channel".

In this section we use analyst forecast revisions and stock returns to better understand the channel through which a CBI shock affects firm investment. Our main result in this section is that the heterogeneous investment response to a CBI shock, documented in Section 3, is driven by cross-sectional differences in innovations to firm profitability rather than cross-sectional differences in innovations to discount rates.

4.1 Shock to firm profitability

We study the profitability channel by analyzing the revision in the analyst forecast of two-year ahead return on assets (ROA) which is our measure of firm profitability. We run a similar regression specification as Equation (5), but change the dependent variable to $UpRevision\_ROA$. $UpRevision\_ROA$ is an indicator variable which takes a value of 1 if the forecast of the two-year ahead ROA is revised upward from one month before the FOMC meeting to one month after the FOMC meeting, or is 0 otherwise. We have a similar measure for an upward revision a month before the FOMC meeting to *two* months after the FOMC meeting. By estimating analyst revisions over a relatively narrow window, we are able to zoom in on the effect of monetary policy shocks on expectations of firm profitability.

Columns (1) and (2) of Table 4 show that analysts upward revise the two-year ahead ROA for high beta firms following positive CBI shocks. In contract, the revision in the ROA is not different between high beta firms and low beta firms following MP shocks. The analysis using the dummy variable β_{p50} in Column (3) and (4) show similar results as Column (1) and (2). Overall, these results indicate that the positive CBI shocks lead to upward revisions of the expectation of future profitability for high beta firms, providing supporting evidence for the profitability channel.

4.2 Shock to firm discount rates

We implement three tests to determine if differences in innovations to firm discount rates between high and low CAPM beta firms drive the heterogeneity in firm investment sensitivity to monetary policy shocks between high and low CAPM beta firms. We do not find such evidence—all these tests deliver null results.

4.2.1 Return decomposition

In our first test, we adopt the approach of Chava and Hsu (2020) and use firm-level stock return innovations following an FOMC announcement to determine the relative contributions of the profitability and discount rate channels. The analysis consists of three steps. First, we compute the innovation in stock returns over a quarter following an FOMC announcement $r_t - \mathbb{E}_{t-1}r_t$ where the policy announcement is at time $t-1$. We use the historical average stock return for the firm under study as our measure of $\mathbb{E}_{t-1}r_t$. Second, we decompose these innovations into innovations in cash flows and expected returns following Vuolteenaho (2002):

$$r_t - \mathbb{E}_{t-1}r_t = \Delta\mathbb{E}_t \sum_{j=0}^{\infty} \rho^j \left(e_{t+j} - f_{t+j}\right) - \Delta\mathbb{E}_t \sum_{j=1}^{\infty} \rho^j r_{t+j} + \kappa_t \tag{6}$$

where $r_t - \mathbb{E}_{t-1}r_t$ is the return innovation, $e_t \equiv \log\left(1 + \frac{Earnings_t}{Book-equity_{t-1}}\right)$ is the return on equity, $f_t \equiv \log\left(1 + rf_t\right)$ is the log gross risk-free rate, and the operator $\Delta\mathbb{E}_t \equiv \mathbb{E}_t - \mathbb{E}_{t-1}$ is the change in expectation between period $t-1$ and t. Next, view the right-hand-side of equation (6) as the difference between a "cash flow news" component defined as:

$$N_{cf,t} \equiv \Delta\mathbb{E}_t \sum_{j=0}^{\infty} \rho^j \left(e_{t+j} - f_{t+j}\right) + \kappa_t, \tag{7}$$

and an "discount rate news" component defined as:

$$N_{r,t} \equiv \Delta\mathbb{E}_t \sum_{j=1}^{\infty} \rho^j r_{t+j}. \tag{8}$$

Finally, following Chava and Hsu (2020), we regress each of these two innovation series $N_{cf,t}$ and $N_{r,t}$ against contemporaneous monetary policy shocks

$$News_{i,t} = \delta_1 CBI_t \times \beta_i + \delta_2 MP_t \times \beta_i + \eta_i + \theta_{s,t} + \epsilon_{i,t}, \tag{9}$$

where $News_{i,t}$ is either cash flows news $N_{cf,t}$ or discount rate news $N_{r,t}$. η_i in equation (9) controls for firm fixed effects and $\theta_{s,t}$ for industry $\times$ time fixed effects (the latter absorbs the quarterly monetary policy shocks). We carry out our analysis at quarterly frequency since firm fundamental data required for in the second step above is only available at quarterly frequency.

Columns (1) and (2) of Table 6 report results where the dependent variable is cash flow news. From column (1), we see that the coefficient on the interaction term $CBI \times \beta$ is positive and statistically significant at the 5% level. This implies that a positive (negative) CBI shock is associated with higher (lower) future cash flow news component. In contrast, while the point estimate for the coefficient of the interaction term $MP \times \beta$ is negative, it is statistically insignificant.

Columns (3) and (4) of Table 6 show results where the dependent variable is discount rate news. We see that the coefficient of both the interaction terms $CBI \times \beta$ and $MP \times \beta$ have much smaller magnitudes compared to corresponding coefficients in Column (1). Moreover, the coefficients for the expected return news are statistically insignificant. These results show that changes in firm value following a CBI shock are driven by changes in news about future cash flows rather than by changes in discount rates. We observe similar results in Column (2) and (4) where we use the dummy variable, β_{p50}.

To summarize, Table 6 highlights two main results: (1) cross-sectional differences in return innovations are driven by the CBI component of the monetary policy shock, rather than the MP component. This result is in line with our investment results from Section 3 where we found the CBI component rather than the MP component to account for cross-sectional differences in investment rate response to monetary policy shocks and (2) return innovations from the CBI shock are driven by the cash flow news component rather than the discount rate news component.

4.2.2 Stock return volatility change

Our results in Section 4.2.1 suggest that the heterogeneity in investment sensitivity (to the CBI shock) between high and low CAPM beta firms is unlikely to be driven by innovations to firm discount rates. A potential shortcoming of the analysis in that section, however, is that balance sheet data necessary for the analysis is obtained at relatively low frequency (quarterly). In this section, we use higher frequency data to test for evidence of a heterogeneous impact of a CBI shock on firm discount rates, by focussing on firm risk as measured by stock return volatility. Specifically, in this section we test if the change in stock return volatility around an FOMC announcement differs between low and high CAPM beta firms. We estimate the volatility of each stock over a 15 day pre-FOMC period; the post-period is also a 15 day period including the FOMC announcement date and the 14 days following it.

Table 5 shows the results of our analysis. Column (1) shows that the coefficients of the $CBI \times \beta$ and also the $MP \times \beta$ interaction terms are not significant at the 10% level. The results of repeating this analysis with the dummy variables β_{p50} are similar, no interaction term is significant at the 10% level.

These results indicate that there is no difference in the change in realized variance between high beta and low beta firms. That is, we do not detect heterogeneity in the change in stock return volatility around an FOMC announcement across the CAPM beta distribution following CBI and MP shocks.

4.2.3 Time-varying market excess returns and firm investment

In our final test to uncover evidence for the discount rate channel, we assume that changes in firm-level discount rates following a monetary policy shock are correlated with changes in the market discount rate. Specifically, following a positive CBI shock in which the market discount rate decreases, the discount rate for high beta firms decrease more than that of low beta firms, which, in turn, results in high beta firms investing more than low beta firms following a positive CBI shock.

Specifically, we re-run our baseline regression specification (2), but, instead of interacting CAPM beta and monetary policy shocks, we interact CAPM beta and S&P 500 excess returns focussing on the 30-minute window around FOMC announcements and sum them up within a quarter as we do for the monetary policy shocks. Table 7 shows that changes in market risk premium do not appear to be an significant driver of the cross-sectional differences in investment rate sensitivities.

To conclude, the four tests we run in Section 4 are all consistent and suggest that the positive relation between CAPM beta and investment sensitivity to monetary policy shocks is likely due to the difference in the future cash flows driven by monetary policy shocks rather than the difference in discount rates.

5 Investment response and growth opportunities

The existing literature has argued that an important difference between high and low CAPM beta firms is their share of growth opportunities (see e.g., Kogan and Papanikolaou 2014). Embedded options, such as options to expand, delay, or abandon projects, imply that the systematic risk of the value of such growth options is levered up relative to the systematic risk of assets in place (see e.g., Berk et al. 1999). In this section, we show that our central result in Section 3, namely, that firms with a higher value of CAPM beta have a higher sensitivity to the CBI shock, is partially driven by differences across firms in the richness of their growth opportunities. We establish this result by repeating our analysis in Section 3 with one difference: instead of sorting firms by the value of their CAPM beta, we now sort them by the value of their Tobin's Q (henceforth simply "Q"). We find that high Q firms mirror the behavior of high CAPM beta firms in their response to monetary policy shocks that we documented in Section 3.

We first show that there is a near-positive relation between firm CAPM beta and Q. To this end, we analyze the ten CAPM beta deciles from Section 3.1 and report the average value of Q for each decile in Table 8. Row 1 of this table shows the average value of the CAPM beta for each decile, while row 2 shows the average Q for each decile. We see that while the lowest CAPM beta decile has Q of 2.53, this value increases to 3.46 for the highest decile. Row 3 of this table shows the fraction of firms in each decile with Q greater than the median Q of all firms in our sample. Similar to row 3, we see this fraction increasing as we move to higher CAPM beta deciles. For instance, while the lowest CAPM beta decile has 40.4% of firms have Q above the median of all firms, this fraction increases to 60.4% for the highest CAPM beta decile.

Next, we analyze the investment response sensitivity of firms to the CBI and MP components of a monetary policy shock. We sort firms by their Q and run a panel regression using the specification equation 2 with the interaction terms now being $CBI_t \times Q_i$ and $MP_t \times Q_i$ instead of $CBI_t \times \beta_i$ and $MP_t \times \beta_i$. Columns (1) and (2) of Table 9 shows the results. We see from the first row of column (1), that high Q firms have a higher sensitivity to the CBI shock. The coefficient, however, is not significant. In contrast, the second row shows that high and low Q firms respond similarly to an MP shock—the coefficient of the interaction term is close to zero in magnitude and insignificant. In Column (2) of the same table, we compare the difference in the average investment response to the CBI and MP shocks between firms above and below the median of the Q distribution. We see from the third row that high Q firms increase their capital stock more by 1% over the two years following a CBI shock. This difference is significant at the 1% level. There is no difference in the response to an MP shock between a high and a low Q firm.

Results documented here with Tobin's q further reinforces the notion that the CBI shocks operate through the profitability channel to affect firm's investment decisions. CBI shocks impact expected future cash flow, thus exerting greater influence over firms with more growth options.

6 Conclusion

Over the past three decades, press releases and announcements have accompanied the Federal Reserves' announcement of their short-term nominal interest rate. We study firm-level investment rate patterns and revisions in analysts forecasts to provide evidence that FOMC announcements change expectations of firm profitability, which, in turn, affects firm investment. This channel, which we call the "profitability channel", has a heterogeneous impact in the cross-section of firms. Specifically, we show that high CAPM beta firms, high Tobin's Q firms, and firms with high average investment rates are more sensitive to the component of a monetary policy shock that the existing literature has identified as a Central Bank Information shock. We futher show that the heterogeneity in investment sensitivity is due to innovations to firm profitability rather than to firm discount rates.

Our results suggests that FOMC announcements appear to have a larger effect on investment by firms which are richer in growth opportunities. To the extent that growth firms have a greater influence on aggregate dynamics over a longer horizon, our findings are in line with the recent study by Bianchi et al. (2022a) who use asset valuation to provide evidence of long-lived effects of monetary policy. It will be interesting to explore the aggregate consequences of this channel.

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Figure 1: Cumulative Distribution of the t-stat of Firm-level Investment Sensitivity to Monetary Policy Shocks

This figure shows the cumulative distribution of the t-stat of firm-level sensitivity to monetary policy shocks. Firm-level investment sensitivity is obtained by running the following firm-level regression, $\Delta logk_{t-1\rightarrow t-1+h} = \gamma_{1,h}CBI_t + \gamma_{2,h}MP_t + X_{t-1} + Z_{t-1} + \epsilon_t$. The dependent variable is the two-year log change in capital stock. CBI and MP are the two components of quarterly monetary policy shocks from Jarociński and Karadi (2020). X_{t-1} includes firm-level controls, and Z_{t-1} includes macro controls. A minimum of 80 firm-level observations are required to better estimate the investment sensitivity.

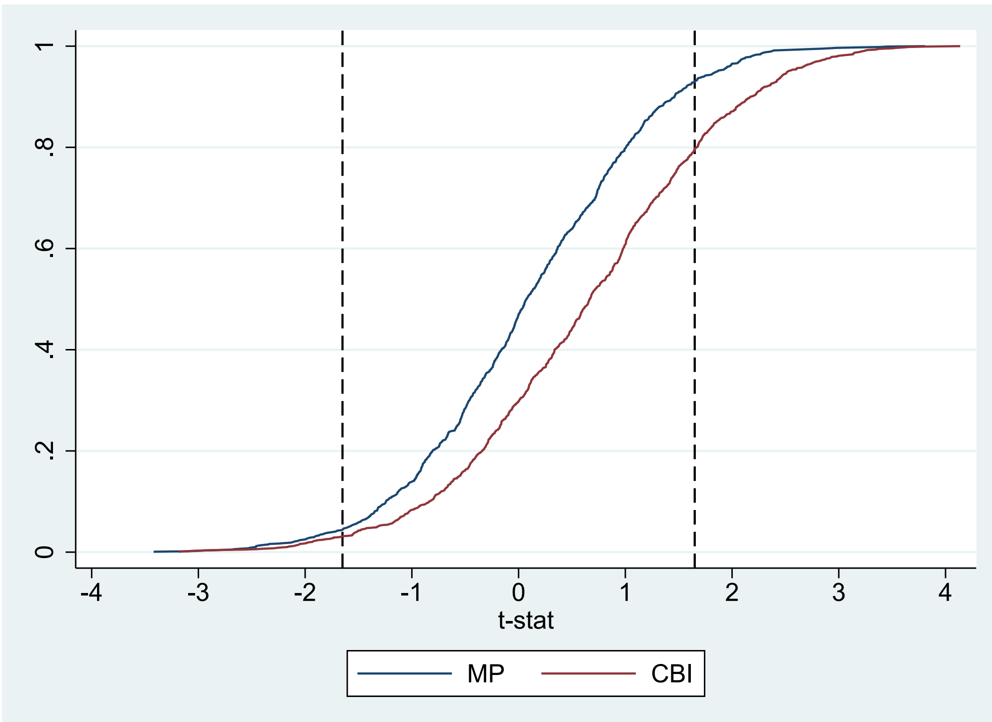
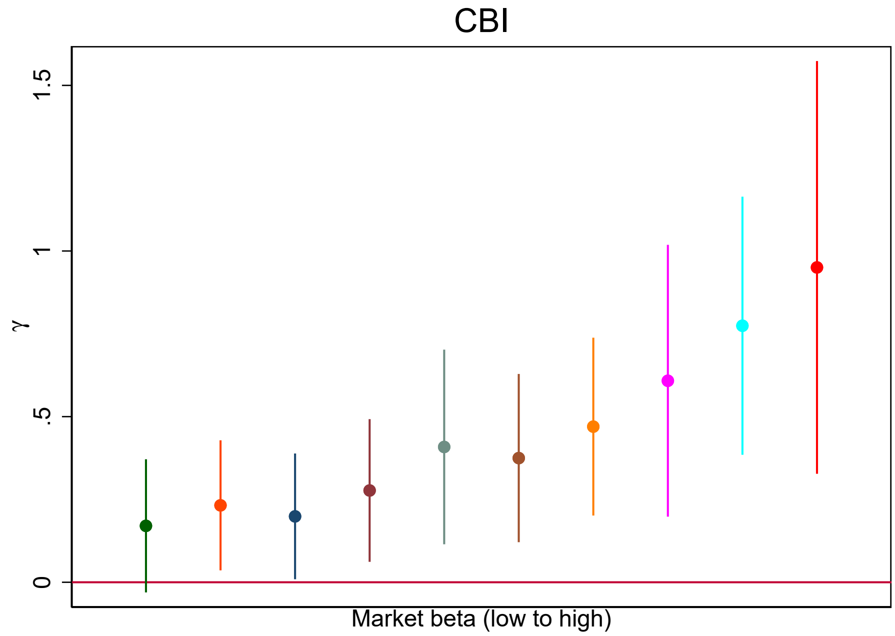


Figure 2: Investment Response to Monetary Policy Shocks by CAPM Beta deciles

These figures show estimates of $\gamma_{1,h}$ and $\gamma_{2,h}$ in the specification equation (1) for $h = 8$ quarters. Firms are sorted by their unconditional CAPM betas and grouped into CAPM beta deciles. The specification (1) is run separately for each decile. Each of the ten points show the point estimates for $\gamma_{1,h}$ (sensitivity to the CBI shock) and $\gamma_{2,h}$ (sensitivity to the MP shock) for each decile; the bars show the 95% confidence interval around each estimate.



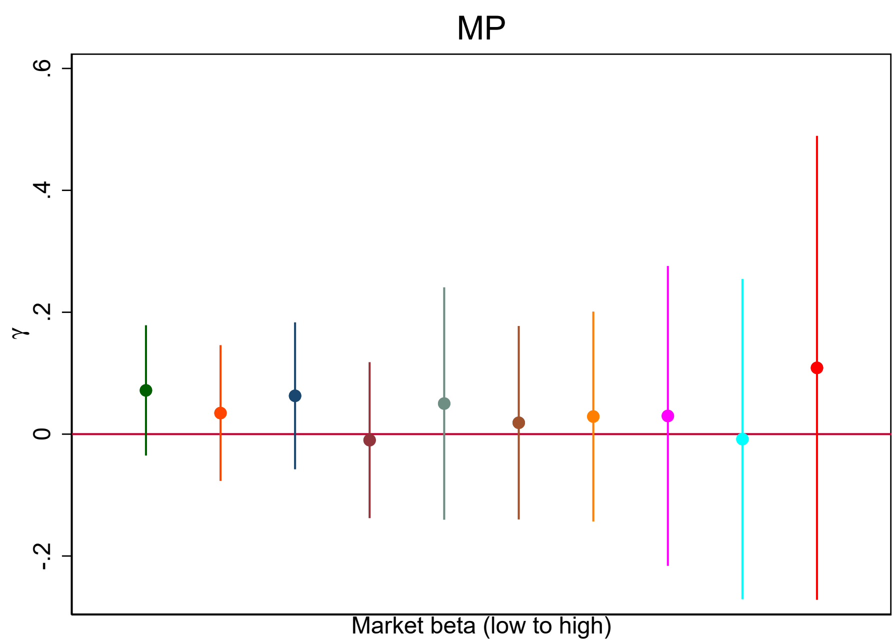


Figure 3: Dynamic Investment Response to Monetary Policy Shocks

These figures show estimates of $\delta_{1,h}$ and $\delta_{2,h}$ in equation (2) for $h = 1, 2, \cdots, 12$ quarters, in the top and bottom panel respectively. The solid line plots the point estimate for δ. The dash lines show the 95% confidence interval around each estimate.

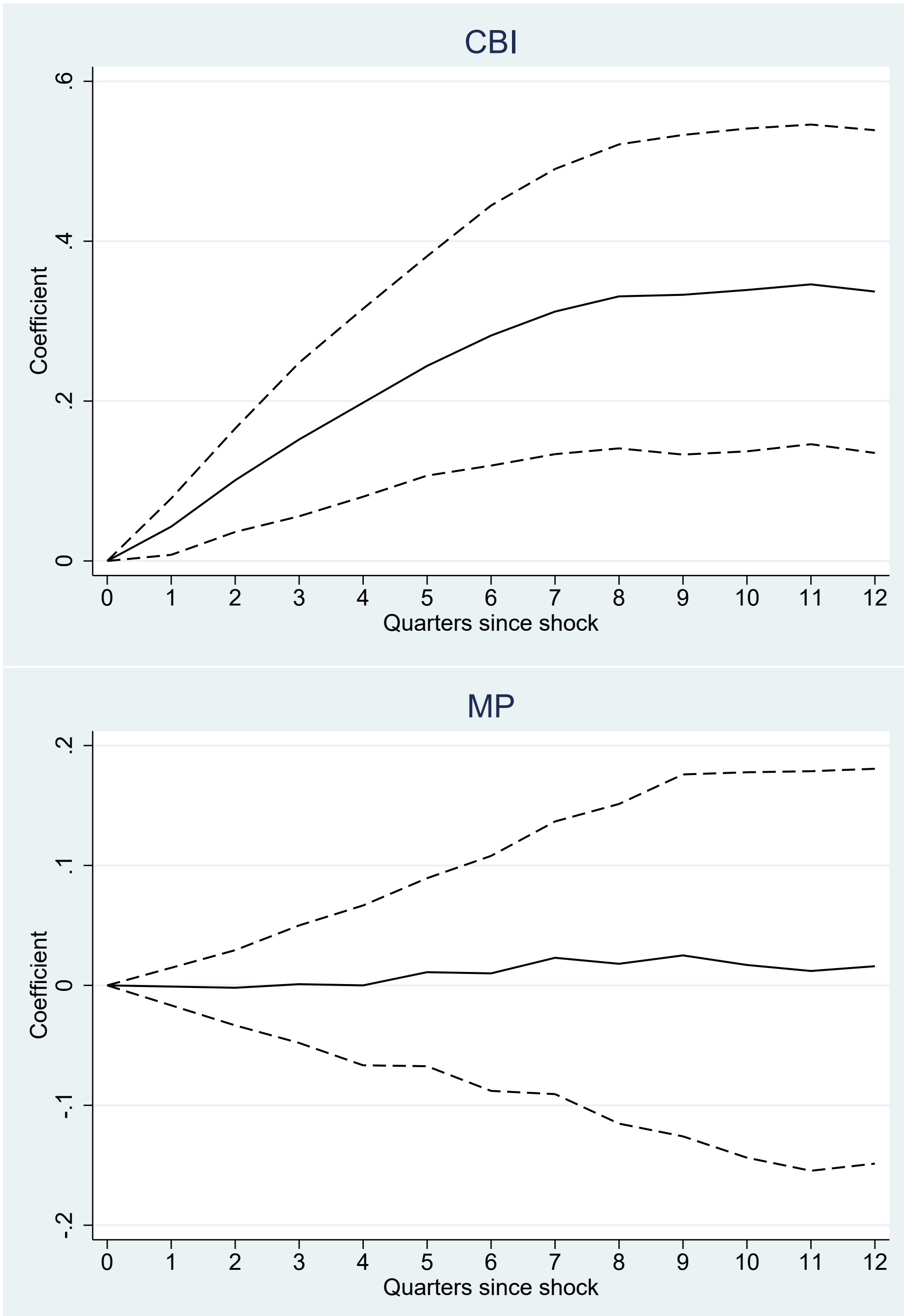


Table 1: Summary Statistics

This table reports summary statistics for variables used in our analysis. The sample period is 1990 - 2019.

	N	Mean	Median	Std Dev
Panel A: Firm-Level Variables				
$\Delta logk_{i,t-1\rightarrow t-1+8}$	331,364	0.1010	0.0223	0.5288
Log(asset)	331,364	5.0475	4.9717	2.2755
Book leverage	331,364	0.2368	0.1702	0.3020
Tobin's Q	331,364	2.5589	1.6150	3.1342
Cash flow	331,364	-0.0134	0.0185	0.1269
β	9,338	1.2199	1.1350	0.8882
Panel B: Monetary Policy Shocks				
CBI	118	-0.0156	-0.0045	0.0547
MP	118	-0.0207	-0.0088	0.0837

Table 2: CAPM Beta and Investment Response to Monetary Policy Shocks

This table shows results of firm-level panel regressions assessing the heterogeneous response of firm investment to monetary policy shocks using Equation 2. The dependent variable is the two-year log change in capital stock. CBI and MP are the two components of the quarterly monetary policy shocks from Jarociński and Karadi (2020). Firm-level controls are described in the main text. Firm fixed effects and industry × time fixed effects are included in the regression. The standard errors are clustered at the firm and year-quarter level are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

	$\Delta log k_{i,t-1\to t-1+8}$			
	Full Sample		Pre 2008	
	(1)	(2)	(3)	(4)
CBI × β	0.331***		0.471***	
	(0.097)		(0.141)	
MP × β	0.018		-0.003	
	(0.068)		(0.071)	
CBI × β_{p50}		0.316***		0.456***
		(0.084)		(0.142)
MP × β_{p50}		0.006		-0.031
		(0.064)		(0.069)
Log(asset)	-0.117***	-0.117***	-0.163***	-0.163***
	(0.006)	(0.006)	(0.009)	(0.009)
Book leverage	-0.290***	-0.290***	-0.326***	-0.326***
	(0.016)	(0.016)	(0.021)	(0.021)
Tobin's Q	0.043***	0.043***	0.044***	0.044***
	(0.002)	(0.002)	(0.002)	(0.002)
Cash flow	0.333***	0.334***	0.355***	0.357***
	(0.034)	(0.034)	(0.043)	(0.043)
Observations	331,364	331,364	223,854	223,854
R^2	0.350	0.349	0.391	0.391
FirmFE	✓	✓	✓	✓
IndustryXTimeFE	✓	✓	✓	✓

Table 3: Analyst Forecast of CapEx

This table shows results of event panel regressions assessing the heterogeneous impact of monetary policy shocks on analyst forecast revisions using Equation (5). The dependent variable is a dummy variable indicating a upward revision in CapEx of fiscal year two from one month before the FOMC meeting to h month after the meeting. CBI and MP are the two components of the contemporaneous monetary policy shock based on Jarociński and Karadi (2020). Firm-level controls are described in the main text. Firm fixed effects and industry × time fixed effects are included in the regression. The standard errors are clustered at the firm and year-month level are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

	$UPRevision\_CapEx_{i,t-1\to t+h}$			
	h=1	h=2	h=1	h=2
	(1)	(2)	(3)	(4)
CBI × β	0.112	0.124		
	(0.099)	(0.085)		
MP × β	0.002	-0.057		
	(0.047)	(0.061)		
CBI × β_{p50}			0.219**	0.243***
			(0.090)	(0.084)
MP × β_{p50}			0.018	-0.003
			(0.050)	(0.055)
Observations	175,907	156,780	175,907	156,780
R^2	0.104	0.113	0.104	0.113
Controls	✓	✓	✓	✓
FirmFE	✓	✓	✓	✓
IndustryXTimeFE	✓	✓	✓	✓

Table 4: Analyst Forecast of ROA

This table shows results of event panel regressions assessing the heterogeneous impact of monetary policy shocks on analyst forecast revisions using Equation (5). The dependent variable is a dummy variable indicating a upward revision in ROA of fiscal year two from one month before the FOMC meeting to h month after the meeting. CBI and MP are the two components of the contemporaneous monetary policy shock based on Jarociński and Karadi (2020). Firm-level controls are described in the main text. Firm fixed effects and industry × time fixed effects are included in the regression. The standard errors are clustered at the firm and year-month level are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

	$UPRevision\_ROA_{i,t-1\to t+h}$			
	h=1	h=2	h=1	h=2
	(1)	(2)	(3)	(4)
CBI × β	0.190	0.374**		
	(0.119)	(0.150)		
MP × β	0.055	-0.039		
	(0.080)	(0.108)		
CBI × β_{p50}			0.187*	0.385***
			(0.106)	(0.127)
MP × β_{p50}			0.049	0.007
			(0.070)	(0.091)
Observations	129,277	114,213	129,277	114,213
R^2	0.102	0.109	0.102	0.109
Controls	✓	✓	✓	✓
FirmFE	✓	✓	✓	✓
IndustryXTimeFE	✓	✓	✓	✓

Table 5: Realized Variance

This table shows results of event panel regressions assessing the heterogeneous impact of monetary policy shocks on realized variance. The dependent variable is the percentage change in realized variance from three weeks before the FOMC meeting to three weeks after the FOMC meeting. CBI and MP are the two components of the contemporaneous monetary policy shock based on Jarociński and Karadi (2020). Firm fixed effects and industry × time fixed effects are include in regressions. The standard errors are clustered at the firm and event level are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

	%ΔRealized Variance	
	(1)	(2)
CBI × β	0.160	
	(0.207)	
MP × β	0.131	
	(0.100)	
CBI × β_{p50}		0.373
		(0.261)
MP × β_{p50}		0.143
		(0.127)
Observations	767,893	767,893
R^2	0.065	0.065
Controls	✓	✓
FirmFE	✓	✓
IndustryXTimeFE	✓	✓

Table 6: Cash Flow News Versus Discount Rate News

This table shows results of firm-level panel regressions assessing the heterogeneous impact of monetary policy shocks on the cash flow news component and discount rate news component of returns using Equation (9). The dependent variables are the two components of quarterly returns: cash flow news component and discount rate news component. CBI and MP are the two components of the contemporaneous quarterly monetary policy shock based on Jarociński and Karadi (2020). Firm fixed effects and industry × time fixed effects are included in the regression. The standard errors are clustered at the firm and year-quarter level are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

	Cash Flow News		Discount Rate News	
	(1)	(2)	(3)	(4)
CBI × β	0.356**		-0.030	
	(0.176)		(0.026)	
MP × β	-0.189		0.032	
	(0.125)		(0.021)	
CBI × β_{p50}		0.356**		-0.035*
		(0.140)		(0.019)
MP × β_{p50}		-0.181*		0.030*
		(0.107)		(0.017)
Observations	242,387	242,387	242,387	242,387
R^2	0.081	0.080	0.122	0.121
FirmFE	✓	✓	✓	✓
IndustryXTimeFE	✓	✓	✓	✓

Table 7: CAPM Beta and Investment Response to Change in Discount Rate

This table shows results of firm-level panel regressions assessing the heterogeneous response of firm investment to the change in discount rate using Equation 2. The dependent variable is the two-year log change in capital stock. SP is the 30-minute S&P500 return around FOMC meetings from Jarociński and Karadi (2020). Firm-level controls are described in the main text. Firm fixed effects and industry × time fixed effects are included in the regression. The standard errors are clustered at the firm and year-quarter level are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

	$\Delta logk_{i,t-1 \to t-1+8}$	
	(1)	(2)
SP × β	0.007	
	(0.008)	
SP × β_{p50}		0.009
		(0.008)
Observations	331,364	331,364
R^2	0.34	0.349
Controls	✓	✓
FirmFE	✓	✓
IndustryXTimeFE	✓	✓

Table 8: CAPM Beta and Tobin's Q

This table reports the average CAPM beta and Tobin's Q for CAPM beta deciles. Firms are sorted by their unconditional CAPM betas and grouped into CAPM beta deciles.

Group	Low	2	3	4	5	6	7	8	9	High
β	-0.040	0.509	0.721	0.889	1.049	1.205	1.386	1.610	1.949	2.729
$Tobin's\ Q$	2.527	2.129	2.204	2.187	2.363	2.413	2.545	2.825	3.255	3.460
$Tobin's\ Q_{p50}$	0.404	0.445	0.480	0.457	0.501	0.489	0.517	0.569	0.604	0.619

Table 9: Tobin's Q and Investment Response to Monetary Policy Shocks

This table shows results of firm-level panel regressions assessing the heterogeneous response of firm investment to monetary policy shocks where firms are sorted by Tobin's Q. The dependent variable is the two-year log change in capital stock. CBI and MP are the two components of the quarterly monetary policy shocks from Jarociński and Karadi (2020). Firm-level controls are described in the main text. Firm fixed effects and industry × time fixed effects are included in the regression. The standard errors are clustered at the firm and year-quarter level are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

	$\Delta log k_{i,t-1\to t-1+8}$	
	(1)	(2)
CBI × $Tobin's\ Q$	0.015	
	(0.014)	
MP × $Tobin's\ Q$	0.001	
	(0.011)	
CBI × $Tobin's\ Q_{p50}$		0.185***
		(0.048)
MP × $Tobin's\ Q_{p50}$		0.006
		(0.035)
Observations	331,364	331,364
R^2	0.349	0.357
Controls	✓	✓
FirmFE	✓	✓
IndustryXTimeFE	✓	✓

Appendix

Table A1: Alternative Monetary Policy Shocks

This table shows a robustness check of the baseline result in Table 2 using alternative monetary policy shocks. The shock based on Jarociński and Karadi (2020) is replaced by the shock based on Nakamura and Steinsson (2018) in Panel A, the shock based on Bauer and Swanson (2022) in Panel B. Column (3) and (4) focus on quarters when there are CBI shocks and Column (5) and (6) focus on quarters when there are no CBI shocks. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

	Panel A: $\Delta logk_{i,t-1\to t-1+8}$					
			CBI Quarters		Non-CBI Quarters	
	(1)	(2)	(3)	(4)	(5)	(6)
NS × β	0.011***		0.014***		0.001	
	(0.003)		(0.003)		(0.006)	
NS × β_{p50}		0.011***		0.015***		0.002
		(0.003)		(0.003)		(0.006)
Observations	279,236	279,236	161,012	161,012	117,273	117,273
R^2	0.361	0.361	0.365	0.364	0.407	0.407
Controls	✓	✓	✓	✓	✓	✓
FirmFE	✓	✓	✓	✓	✓	✓
IndustryXTimeFE	✓	✓	✓	✓	✓	✓

	Panel B: $\Delta logk_{i,t-1\to t-1+8}$					
			CBI Quarters		Non-CBI Quarters	
	(1)	(2)	(3)	(4)	(5)	(6)
MPS_ORTH × β	0.060		0.208*		-0.139*	
	(0.083)		(0.108)		(0.075)	
MPS_ORTH × β_{p50}		0.040		0.183*		-0.129
		(0.086)		(0.105)		(0.099)
Observations	331,364	331,364	192,162	192,162	138,320	138,320
R^2	0.349	0.349	0.354	0.354	0.390	0.390
Controls	✓	✓	✓	✓	✓	✓
FirmFE	✓	✓	✓	✓	✓	✓
IndustryXTimeFE	✓	✓	✓	✓	✓	✓

Table A2: Robustness: Control for Lagged Investment

This table shows a robustness check of the baseline result in Table 2. Lagged investment is includes in the regresison as a control. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

	$\Delta logk_{i,t-1\to t-1+8}$			
	(1)	(2)	(3)	(4)
CBI × β	0.324***		0.321***	
	(0.091)		(0.096)	
MP × β	0.032		0.030	
	(0.064)		(0.069)	
CBI × β_{p50}		0.329***		0.314***
		(0.078)		(0.084)
MP × β_{p50}		0.023		0.019
		(0.059)		(0.065)
$\Delta logk_{i,t-1-4\to t-1}$	0.035***	0.035***		
	(0.012)	(0.012)		
$\Delta logk_{i,t-1-1\to t-1}$			0.366***	0.367***
			(0.038)	(0.039)
Observations	311,585	311,585	330,077	330,077
R^2	0.349	0.348	0.355	0.354
Controls	✓	✓	✓	✓
FirmFE	✓	✓	✓	✓
IndustryXTimeFE	✓	✓	✓	✓

Table A3: Robustness: CapEx

This table shows a robustness check of the baseline result in Table 2. The two-year log change in capital stock is replaced by the one-year (two-year) total capital expenditure scaled by lagged asset. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

	One-Year CapEx		Two-Year CapEx	
	(1)	(2)	(3)	(4)
CBI × β	0.018***		0.045**	
	(0.007)		(0.017)	
MP × β	-0.002		-0.008	
	(0.005)		(0.014)	
CBI × β_{p50}		0.006		0.027
		(0.007)		(0.018)
MP × β_{p50}		-0.000		-0.002
		(0.005)		(0.016)
Observations	353,089	353,089	320,988	320,988
R^2	0.556	0.555	0.605	0.605
Controls	✓	✓	✓	✓
FirmFE	✓	✓	✓	✓
IndustryXTimeFE	✓	✓	✓	✓

Table A4: Other Analyst Forecast

This table shows results of event panel regressions assessing the heterogeneous impact of monetary policy shocks on analyst forecast revisions using Equation (5). The dependent variable is a dummy variable indicating a upward revision in EPS or sales of fiscal year two from one month before the FOMC meeting to h month after the meeting. CBI and MP are the two components of the contemporaneous monetary policy shock based on Jarociński and Karadi (2020). Firm-level controls are described in the main text. Firm fixed effects and industry × time fixed effects are included in the regression. The standard errors are clustered at the firm and year-month level are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

	Panel A: $UPRevision\_EPS_{i,t-1\to t+h}$			
	h=1	h=2	h=1	h=2
	(1)	(2)	(3)	(4)
CBI × β	0.168**	0.177**		
	(0.068)	(0.087)		
MP × β	0.034	0.026		
	(0.029)	(0.038)		
CBI × β_{p50}			0.185***	0.191**
			(0.071)	(0.086)
MP × β_{p50}			0.030	0.008
			(0.031)	(0.043)
Observations	535,789	481,909	535,789	481,909
R^2	0.105	0.122	0.105	0.122
Controls	✓	✓	✓	✓
FirmFE	✓	✓	✓	✓
IndustryXTimeFE	✓	✓	✓	✓
	Panel B: $UPRevision\_Sales_{i,t-1\to t+h}$			
	h=1	h=2	h=1	h=2
	(1)	(2)	(3)	(4)
CBI × β	0.361***	0.388***		
	(0.064)	(0.085)		
MP × β	-0.002	0.019		
	(0.046)	(0.050)		
CBI × β_{p50}			0.395***	0.462***
			(0.079)	(0.110)
MP × β_{p50}			0.003	0.026
			(0.061)	(0.064)
Observations	378,911	340,203	378,911	340,203
R^2	0.135	0.154	0.135	0.154
Controls	✓	✓	✓	✓
FirmFE	✓	✓	✓	✓
IndustryXTimeFE	✓	✓	✓	✓