The Speed of the Fed: How Quick Adjustments in Monetary Policy Affect Stock Returns

Sudheer Chava[*], Alex Hsu[†], Soohun Kim[‡] and Heungju Park[§]

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Abstract

Monetary policy announcements contain guidance on the future interest rate path. In particular, the speed of interest rate adjustment matters for financial market participants. We find that the policy speed shock, which measures the pace of tightening or loosening, generates differential impact on the cross-section of equity returns. Short cashflow duration firms earn lower average returns than long cashflow duration firms following a positive speed shock, which signals a faster pace of tightening. This underperformance does not revert in the month following the FOMC announcement. The return differential is concentrated among firms with short debt maturity. Moreover, policy speed shocks drive the short end of the yield curve more so than long maturity yields, suggesting the debt maturity channel through which monetary policy impacts returns. Short cashflow duration firms have significantly more negative investment rates than long cashflow duration firms 4 to 5 quarters after a positive speed shock is realized.

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[*]Georgia Institute of Technology, sudheer.chava@scheller.gatech.edu.

[†]Georgia Institute of Technology, alex.hsu@scheller.gatech.edu, corresponding author.

[‡]Korea Advanced Institute of Science and Technology, soohun.kimi@gmail.com.

[§]Sungkyunkwan University, hj.park@skku.edu.

1 Introduction

Monetary policy significantly affects the financial market. Numerous studies have documented the impact of monetary policy announcements on the equity market around Federal Open Market Committee (FOMC) meetings. In an effort to curb historically high inflation materializing after the COVID-19 pandemic, the Federal Reserve started to aggressively raise the Fed funds rate (FFR) in 2022. In a six-month span between March and September of 2022, the effective FFR rose from essentially zero to over 3%. The stock market responded violately by falling roughly 20% during the same period. This episode of monetary tightening is not only noted for the stock market reaction but also for the speed at which the U.S. central bank notched up the short-term interest rate. In fact, the 3% rise of the FFR over six months is the quickest rate of increase over the last 35 years. As we enter the last quarter of 2022, market watchers are often speculating about the size of the next interest rate hike. In this paper, we ask how does the change in expected FFR path affect stock returns. Specifically, we examine the cross-sectional response of equity to unanticipated changes in the expected interest rate path.

Monetary policy has heterogeneous impact on firm-level returns. Ozdagli (2018) finds that stock prices of firms with more information friction are less sensitive to monetary policy announcement surprises. Chava and Hsu (2020) document that positive interest rate shocks drive down prices of financially constrained firms more so than nonconstrained firms. Policy announcements not only change the level of the prevailing short-term interest rate, but also update market participants' belief of the expected interest rate path, or the "slope" of monetary policy. Neuhierl and Weber (2019) show that an increase in the policy slope predicts negative aggregate market returns at weekly frequency. As the expected path of policy loosening or tightening fluctuates, driven by "slope shocks," firms with different characterisitics can react differently, leadimg to return dispersion. We conjecture that cashflow duration, as constructed by Dechow, Sloan and Soliman (2004), is a factor in determining the differential response.

Focusing on the sample emcompassing scheduled FOMC annoucements from 1994 to 2018, we find the following three main results. First, short cashflow duration firms underperform long cashflow duration firms following a positive slope shock on the same day of the announcement after controlling for the FFR level shock and other firm characteristics. Second, the slope shock drives short maturity Treasury yields, 5 years or less, but not so much long maturity yields. Because short duration firms employ relatively more short-term debt, this suggests the debt maturity channel of transmission from monetary policy slope shocks to returns. Third, via local projection evidence, short cashflow duration firms, on average, decrease investment to a greater degree compared to the long cashflow duration firms 4 to 5 qauarters after a positive slope shock is realized, consistent with the return implication of policy slope shocks.

Our empirical analysis starts with event studies of firm-level stock returns on slope shocks around FOMC announcements. We examine cumulative returns around the 22-day window: one day prior to the FOMC announcement, the day of the announcement, and six post-announcement periods ranging from 1 day up to 20 days. The reason why we utilize a long post announcement window is for two reasons. One, Chava and Hsu (2020) demonstrate that there is a potential delay in return differential as market participants take time to digest the information content. Two, the longer event windows allow us to capture any return reversals if they occur. In a pooled regression of 191 FOMC annoucements, slope shocks negatively and significantly affect firm-level returns. Furthermore, the presence of the slope shock renders the impact of the Kuttner (2001) (level) shock ineffective. On the day immediately after the announcement, each 10 bps positive slope shock leads to 75.7 bps lower average stock retrun. In the 10-day post-announcement window, the same 10 bps positive slope shock results in 130.6 bps drop in cumulative average return.

Next, we sort firms each quarter based on cashflow duration following Dechow, Sloan and Soliman (2004). We then compare the return differential due to the slope shock between high cashflow duration and low cashflow duration firms around FOMC announcements. On average, firms in the top tercile of the cashflow duration sort earn 25.9 bps higher return than those firms in the bottom tercile when a positive 10 bps slope shock is realized. The return differential materialize on the same day as the announcement. Moreover, we do not find any evidence of the return (difference) reversal in the 20-day post-announcement window. Robustness check shows that the return differential remains if we only focus on the sample prior to the 2008 financial crisis, which eliminates the prolong zero-lower-bound period during which monetary policy shocks tend to be small.

To understand why high cashflow duration firms outperform relative to their low cashflow duration counterparts, we examine the role of debt in the analysis. First, in a reduced sample of non-levered (book leverage) firms, the return differential disappears. High cashflow duration firms no longers outperform low cashflow duration firms following a positive slope shock. Second, focusing on levered firms only, the return differential appears to be much salient among firms with short-term debt. We measure debt maturity using Compustat data and scale long-term debt (6-year to maturity or higher) by total debt. Our baseline finding that long and short cashflow duration firms respond differently to monetary policy slope shocks is concentrated mostly in the bottom tercile of firms based on debt maturity sort. Third, short cashflow duration firms are shown to employ more short-term debt on average compared to long cashflow duration firms after controlling for leverage and other characteristics. Collectively, these results suggest the debt maturity channel of monetary policy transmission. Short cashflow duration firms are more sensitive to short-term interest rate fluctuations because they utilize more short-term debt. To the extent that slope shocks drive the short end of the yield curve but not so much the long end, short duration firms' returns suffer more by positive slope shocks.

To verify that monetary policy slope shocks indeed affect short maturity yields more, we examine the response of Treasury yields to slope shocks around FOMC events. Similar to the return analysis, we focus on yield changes from the day before the announcement up to 40-days after the announcement. The analysis includes Treasury maturities ranging from 1-year all the way through 30-year. As expected, yield changes load positively and significantly on slope shocks in the pooled regression. The impact is persistent: there is an one-for-one increase in average yields in the 30-day period after the slope shock is realized. Next, we separate Treasury yields by maturity into 5-years and less, consistent with our firm-level debt maturity sort, as well as those for bonds 6-years or more. After controlling for the Kuttner (2001) shock and various macroeconomic factors, we conclude that indeed, slope shocks affect short-maturity Treasury yields to a much greater extend than long-maturity yields. Not only statistical signifcance is much higher across all event windows, the magnitude of response is also much greater for the sample including only short-maturity yields.

In the final empirical test, we attempt to understand the real impact of monetary policy shope shocks on firm investment outcomes. Using a vector autoregression (VAR) setup to tease out slope shocks at quarterly frequency, we then project firm investment on lagged policy slope shocks to investigate whether their effect on returns translate into investment decisions. Local projection results confirm that both long and short cashflow duraction firms invest less after the positive slope shock hits, with the largest decline trainling by five to six quarters. The difference in investment rate between the two types of firms is statistical significant four to five quarters after the shock. Long cashflow duration firms disinvest less than short duration firms, consistent with their outperformance in stock returns.

Our paper contributes to several strands of literature in monetary economics and finance. In particular, our paper is related to impact of FOMC announcements on stock returns. Bernanke and Kuttner (2005) find that an unanticipated 25 bps interest rate drop (shock) is associated with roughly a 1% increase of the aggregate market index. Savor and Wilson (2014) show that the equity risk-return relationship is robust around scheduled macroeconomic news releases, including FOMC. They demonstrate that high market beta firms earn higher excess returns only on announcement days. The risk-return relationship breaks down on other trading days. Ippolito, Ozdagli and Perez-Orive (2018) examine the importance of bank debt for the transmission of monetary policy due to the nature of floating rate loans. Firms with high level of bank debt relative to total asset are more sensitive to surprise interest rate changes. Ozdagli (2018) document that the impact of monetary policy shocks in the cross-section of returns depends on the information friction faced by each firm. High information friction firms are shown to have less sensitive returns to monetary policy shock. Chava and Hsu (2020) conclude that financially constrained firms are more affected by monetary policy shocks than unconstrained firms. Furthermore, they show that the return differential between the two groups of firms materialize with a 3 to 4-day delay after the announcement day. Most recently, Ai et al. (2022) investigate the effect of monetary policy announcements on equity risk premium using option-implied variance reduction around FOMC events. They show the risk compensation, or the announcement premium, is significant. In contract to these studies, which focus on the unanticipated change in the Fed funds rate, our paper examine the impact of surprise changes in the expected short rate path.

The rest of the article is structured as follow. Section 2 contains information about the construction of the monetary policy slope shock. Section 3 describes how we construct firm-level cashflow duration. Section 4 documents main results both from the FOMC event study as well as time series tests. Section 5 investigates the mechanism behind the return dispersion shown in Section 4. Section 6 presents the impact of policy slope shocks on firm-leve investment. Section 7 concludes.

2 Data

2.1 Monetary Policy Slope Shock

We follow Piazzesi and Swanson (2008) for identifying monetary policy event days over our sample period 1994-2007. After the monetary policy event days are established, we construct the slope shock by using the price of Fed funds futures contracts as in Neuhierl and Weber (2019). The slope shock is designed to isolate the unexpected target rate changes in prices of the three-month futures contract, in dependent of the level shock, which we capture by the changes in prices of the one-month futures contract. In particular, shocks to the one-month futures contract are

$$FFShock_t^1 = \frac{D^1}{D^1 - d^1}\left(f_{m,t}^1 - f_{m,t-1}^1\right),$$

where $f_{m,t}^1$ is the one-month futures contract price, d^1 is the day of the FOMC meeting and $D^1$is the number of days in the month. The fraction $\frac{D^1}{D^1-d^1}$ adjust the price change to reflect that the Fed funds futures contract settlement price is based on the average monthly Fed funds rate. Similarly, shocks to the three-month futures contract are

$$FFShock_t^3 = \frac{D^3}{D^3 - d^3}\left(f_{m,t}^3 - f_{m,t-1}^3\right),$$

where $f_{m,t}^3$ is the three-month futures contract price, d^3 is the day of the FOMC meeting and $D^3$is the number of days over the three months.

We posit that the one-month futures contract reflect the level of federal funds target rates but that the three-month futures contract reflect the level as well as the path of future short-term rate changes. Hence, it holds that

$$\begin{aligned} FFShock_t^1 &= LevelShock_t, \\ FFShock_t^3 &= \beta LevelShock_t + SlopeShock_t. \end{aligned}$$

We can identify β in the above system by regressing $FFShock_t^3$ on $FFShock_t^1$ and identify $SlopeShock_t$ as the residuals from the regression. However, given that β from the regression is close to 1, consistent with Neuhierl and Weber (2019), we simply construct $SlopeShock_t$ as follows:

$$SlopeShock_t = FFShock_t^3 - FFShock_t^1.$$

2.2 Cashflow Duration

Cashflow duration is defined as the weighted average of the times until each cash flow from stocks, similar in spirit to the traditional Macaulay duration for bonds. Unlike bond duration, however, the estimation of Cashflow duration is not straightforward since the amount and timing of the cash flows from stocks are unknown beforehand. To overcome such complication, we follow the approaches of Dechow, Sloan and Soliman (2004) and Weber (2018). They divide the life of stocks into two parts, a finite forecasting horizon and the remaining infinite period, and then forecast cash flows assuming clean surplus accounting and first-order autoregressive (AR(1)) processes for both returns on stocks and growth in stocks. Specifically, we estimate the cash flow duration of firm i for year t, denoted by $Dur_{i,t}$, as

$$Dur_{i,t} = \frac{\sum_{s=1}^{T} s \times CF_{i,t+s}/(1+r)^s}{P_{i,t}} + \left(T + \frac{1+r}{r}\right) \times \frac{P_{i,t} - \sum_{s=1}^{T} CF_{i,t+s}/(1+r)^s}{P_{i,t}}$$

where $CF_{i,t+s}$ is the cash flow of firm i at time $t{+}s$ and $P_{i,t}$ is price at time t. r is the expected return on stocks. T is the length of a finite forecasting horizon. With the assumption of clean surplus accounting, cash flows can be measured as

$$\begin{aligned} CF_{i,t+s} &= E_{i,t+s} - (BV_{i,t+s} - BV_{i,t+s-1}) \\ &= BV_{i,t+s-1} \times \left[\frac{E_{i,t+s}}{BV_{i,t+s-1}} - \frac{BV_{i,t+s} - BV_{i,t+s-1}}{BV_{i,t+s-1}}\right] \end{aligned}$$

where $E_{i,t+s}$ is net income and $BV_{i,t+s}$ is the book value of stocks. The returns on equity, $(BV_{i,t+s}$-$BV_{i,t+s-1})/BV_{i,t+s-1}$, is assumed to have AR(1) coefficient of 0.24 and a long-run mean of 0.06. We assume that the cost of equity r is 0.12 and the length of a finite forecasting horizon T is 10 years.

3 Return Analysis

In this section, we investigate the effect of the monetary policy slope shock on the cross-section of firm returns. Our analysis centers around the FOMC event study, as in Bernanke and Kuttner (2005), by pooling announcement day observations over the entire 1994 – 2018 period. We focus on panel regressions in which dependent variables are single-day or cumulative returns around the announcement window. Differential impact of the slope shock is examined by utilizing cashflow duration dummies. We further perform robustness checks such as limitiing the sample to stop prior to the 2008 financial crisis. Finally, we conduct a number of standard asset pricing tests at monthly data frequency to verify that return α's are also differentially affected by the policy slope shock across high and low cashflow duration bins.

3.1 FOMC Event Study

Our analysis of the monetary policy slope shock impact on the equity market starts by examining firm-level returns around FOMC announcement. We gather data of returns in the 22-day window around each announcement: 1 day before, the day of, and 20 days post-announcement. We then calculate post-announcement cumulative returns for each firm. Finally, these returns are regressed on the slope shock, the Fed funds rate shock, as well as certain firm characteristics. The panel regression equation is:

$$Return_{i,t} = \alpha + \beta SlopeShock_t + \gamma FFRShock_t + X_{i,t} + \varepsilon_{i,t}, \tag{1}$$

where $SlopeShock_t$ and $FFRShock_t$ denote the slope shock and Fed funds rate shock on announcement date t, respectively. $X_{i,t}$ represents firm i characteristics including log asset, log book-to-market ratio, leverage, and profitability, consistent with Chava and Hsu (2020).

Regression results are shown in Table 1. All regressions contain industry and year fixed effects. We also cluster standard errors at the firm level. Each column employs a different return as the dependent variable. In Column (1), (-1,-1) denotes the return on the day before the FOMC announcement. In Column (2), (0,0) denotes the return on the day of the FOMC announcement. In Columns (3) to (8), (+1,+N) denotes the cumulative return in the post announcement window up to N days.

The estimated β coefficients on $SlopeShock$ are all negative across return windows in Table 1. However, statistical significance only materializes in Columns (3), (4), and (7). On average, positive $SlopeShock$ from the FOMC announcement lowers firm returns with a delay of 1 to 2 days, and the negative drift lasts up to 10 days. Economically, the β estimate of -7.573 in Column (3) implies that a 10 bps positive shock decreases average return by 0.7573% on the day after the announcement. In the presence of the $SlopeShock$, coefficient loading on the $FFRShock$, which Bernanke and Kuttner (2005) found to be negative and significant, is not statistically significant anymore on the event day in Column (2).

Next, we examine the differential impact of the $SlopeShock$ on the cross-section of returns. In particular, we conjecture that a shock to the slope of the term structure affects firms' cashflow differently, thus cashflow duration can be a pivotal determinant of how firm-level returns respond to these shocks. On the one hand, it is possible that high cashflow duration firms underperform due to a positive slope shock because long term cashflows are discounted at a steeper rate. On the other hand, it might be the case that high cashflow duration firms outperform due to a positive slope shock because the long-term economic outlook has strengthened. Relatedly, slope shock can also affect growth and value firms differently based on the cashflow argument as growth firms are typically thought to have high cashflow duration.

We calculate cashflow duration for each firm in each quarter. We then sort firms into terciles based on cashflow duration on each FOMC event day. A dummy variable is used to indicate a given firm belongs in the high cashflow duration group. Firm-level returns are then regressed on the slope shock, the long duration dummy, and the interaction of the two:

$$
\begin{aligned}
Return_{i,t} &= \alpha + \beta SlopeShock_t + \delta \mathbb{I}_{i,t}^{LD} + \theta SlopeShock_t \times \mathbb{I}_{i,t}^{LD} \\
&\quad + \gamma FFRShock_t + \eta FFRShock_t \times \mathbb{I}_{i,t}^{LD/Growth} + X_{i,t} + \varepsilon_{i,t}, \qquad (2)
\end{aligned}
$$

where $\mathbb{I}_{i,t}^{LD}$ denotes the long duration indicator variable. Not shown in Eq. (2) is the dummy variable indicating that a firm belongs in the middle group from the cashflow duration sort. Effectively, the coefficient loading on the interaction term $SlopeShock_t \times \mathbb{I}_{i,t}^{LD}$, or θ, reflects the differential effect of the slope shock between high cashflow duration and low cashflow duration firms.. Similar to the unconditional regression in Eq. (1), we control for the Fed funds rate shock and the interaction of the Fed funds rate shock with the indicator variable.

Table 2 presents the regression results. In each regression specification, the dependent variables are returns on the day before the FOMC event day, on the day of the event day, on the day after the event day, and cumulative returns up to 20 post-event days. Focusing on the β coefficient in the first row, like Table 1, *SlopeShock* is negative and statistically significant in the post-FOMC window in Columns (3), (4), and (7). Furthermore, we see that the δ coefficient in the second row are all positive and significant, signaling long cashflow duration firms earn higher average returns relative to the low duration firms around the FOMC announcement window. Although the economic significance of these estimates are very small. Finally, the θ coefficients of the cashflow duration sorted regressions are shown in the fourth row of Table 2. The only statistically significant estimate is in Column (2), on the announcement date. The coefficient of 2.593 suggests that long cashflow duration firms outperform low cashflow duration firms due to a positive slope shock on the event day. Interestingly, θ coefficients in Columns (3) to (8) are insignificant. This means that, despite the delayed response of returns to the slope shock, there is no return differential in the cross-section within the post-FOMC window.

3.2 Robustness

The Federal Reserve dropped the short-term funds rate to zero in the aftermath of the 2008 financial crisis. The low interest rate environment persisted until the end of 2015. During the zero-lower-bound (ZLB) period, Fed funds rate shocks are notoriously small as financial market participants generally expected the short-rate to stay close to zero. To check if the return differential between long and short cashflow duration firms are solely driven by small slope shocks during the ZLB period, we truncate the sample at the end of 2007. The resulting analysis is summarized in Table 3.

Similar to the full sample analysis, returns around the FOMC announcement window are regressed on the slope shock, the high cashflow duration dummy variable, and the interaction of the two, as in Eq. (2). In the pre-2008 sample, slope shocks induce strongly negative and statistically significant returns across all event windows on and after the announcement day, as shown in Columns (2) to (8) in the first row of Table 3. Furthermore, the θ coefficient on the $SlopeShock$ and the long duration dummy interaction is positive and significant in Column (2), consistent with the fully sample finding in Table 2. Long cashflow duration firms outperform relative to short duration firms on the FOMC event day when a positive slope shock is realized in the pre-2008 sample.

One noticable difference between Tables 2 and 3 is that the Kuttner (2001) shock ($FFRShock$), which is not statistically significant in the full sample, becomes negative and significant in the pre-2008 sample as shown in Column (2) of Table 3. Thus, we are able to recover the original Bernanke and Kuttner (2005) result by dropping the ZLB period observations.

3.3 Monthly Asset Pricing Study

In this section, we move further to examine whether we can observe the empirical patterns around FOMC announcements documented in Section 3.1 even in the monthly data. To this end, we replace the FOMC accouchement day returns and FOMC Slope shocks in Eq (2) with the monthly stock performance and the monthly slope shocks, respectively. For the monthly stock performance, we consider five versions of risk-adjusted returns, alphas from the CAPM, the Fama and French (1993) three-factor model (FF3), the Carhart (1997) four-factor model (Carhart4), the Hou, Xue and Zhang (2015) four-factor model (HXZ4), and the Fama and French (2015) five-factor model (FF5).[1] We already explained the construction of monthly slope shocks in Section 2.2 and use the identical cashflow durations in Section 3.1.

Given that all RHS variables in Eq (1) are included in Eq (2), we focus on confirming the intuitions behind Eq (2). That is, depending on whether a positive slope shock implies a strong long-term economic prospects or a mere higher discounting rate for long-term earnings, a positive slope shock may benefit or hurt a firm with a longer cashflow duration relative to a firm with a shorter duration. We examine which force dominates by regressing the risk-adjusted returns on cashflow duration, slope shock and the interaction of the two as follows:

$$\begin{aligned}\alpha_{i,t} &= a + \beta CFDur_{i,t} \times SlopeShock_t + \delta SlopeShock_t + \theta CFDur_{i,t} \\ &\quad + X_{i,t} + \varepsilon_{i,t},\end{aligned}$$

[1] We compute the beta of individual stocks using past monthly observations over the past five years with the minimum observations of 36.

where $\alpha_{i,t}$ is a risk adjusted return under one of the five models mentioned above and $CFDur_{i,t}$ is a decile rank of cashflow duration measured at time t.

Table 4 reports the estimation results. The main coefficient of our interest, β captures the heterogeneity in the effect of the slope shock on the stock returns. Consistent with the results in Table 4, the estimated β is statistically substantial and strongly positive. Across all five models from column (1) to (5), the results suggest that a positive slope shock is reflected in the value of firms with a high cashflow duration in a much more favorable manner than firms with a low cashflow duration.

4 Mechanism

Why do high cashflow duration firms have higher returns than low cashflow durations firms after a positive policy slope shock hits? A positive slope shock implies the speed of monetary policy tightening is faster than what the market was anticipating. Higher interest rates can affect returns through two channels: the discount rate channel and the cashflow channel. Recently documented by Gürkaynak, Karasoy-Can and Lee (2022), the cashflow channel of monetary policy transmission argues that firms with unhedged floating debt is more sensitive to interest rate shocks. For this mechanism to be relevant, it is not hard to see that the presence of debt and leverage is crucial.

To understand the source of the return dispersion, we focus on two dimensions of the firm: leverage and debt maturity. We first check to see if our finding still holds in unlevered firms. Second, we examine how debt maturity affects the way long and short cashflow duration firms react to policy slope shocks.

4.1 Debt and Leverage

We define leverage as long-term debt plus debt in current liabilities then divided by total assets. As a simple test, we reduced our full sample to only include those observations with zero leverage. We then rerun the baseline regression as specified in Eq. (2). Results are tabulated in Table 5. Coefficient loadings on the *SlopeShock* remain negative and statistically significant in the first row in Columns (3) and (4). Positive slope shocks drive returns of unlevered firms lower in the two-day window immediately after the announcement. However, unlike the full sample results, coefficient loadings on the interaction term between the slope shock and the long duration dummy are all statistically insignificant in Table 5. Our baseline finding that long cashflow duration firms are more sensitive to policy slope shocks is no longer valid in the subsample of unlevered firms. This is a clue that leverage plays a role underlying our finding.

Next, we ask if long and short cashflow duration firms have different debt maturity structures in general. A simple check can be done by regressing long-term debts and debt in current liabilities, both scaled by total assets, on cashflow duration. This is precisly what we do, and the results are shown in Table 6. We also add cash holdings as a dependent variable to see if they differ across firms. Log total asset, Tobin's q, cashflow, and leverage itself are used as lagged control variables. Inudstry and year fixed effect are also included. First row of Table 6 shows that high cashflow duration firms indeed have less short-term (current) debt and lower cash balance relative to low cashflow duration firms. This is not surprising given that firms prefer to match cashflows with liabilities as much as possible.

We have uncovered two pieces of evidence on the mechanism driving the differential return between long and short cashflow duration firms due to the policy slope shock. First, leverage matters as the differential disappears in unlevered firms. Second, long cashflow duration firms tend to have less short-term liabilities. We conjecture that this difference in maturity structure can be the source of return dispersion. To verify this is the case, we construct a debt maturity measure by dividing the amout of debt with 6-years to maturity or greater, by total debt (long-term debt plus debt in current liabilities). Keeping only levered observations, firms are sorted into debt maturity terciles on each FOMC event day. We then examine the return differential between long cashflow and short cashflow duration firms in the top and bottom of the debt maturity terciles.

Regression results are summarized in Table 7. The top panel contains findings for firms in the low debt maturity tercile, while the bottom panel contains findings for those in the high debt maturity tercile. Regression specification is exactly the same as Eq. (2). Consistent with the baseline finding documented in Table 2, positive slope shocks lower average returns in the first row of both top and bottom panels. However, examining the coefficient loadings on the interaction term betweent the slope shock and the long duration dummy, we see that the differential return is mostly concentrated in the top panel of Table 7, among firms sorted in the bottom tercile by debt maturity. The point estimate of 4.383 is statistically significant at the 1% level, and it is also economically large. A 10 bps positive slope shock translates into an average return differential of 43.8 bps between long and short cashflow duration firms. On the other hand, the same return differential is only about 16.7 bps in the bottom panel of Table 7 for firms utilitizing mostly long maturity debt. Furthermore, that coefficeint estimate is only statistically significant at the 10% level.

Analyses done here suggest the presence of short-term debt and current liabilities is important to the transmission of policy slope shocks to the cross-section of firms. To the extent that slope shocks drive the short-end of the yield curve rather than the long-end, it can be argued that higher expected near-term interest rates generate a strong negative cashflow effect for short cashflow duration firms, similar to the mechanism highlighted in Gürkaynak, Karasoy-Can and Lee (2022). The negative cashflow effect is less impactful for long cashflow duration firms because they generally do not rely on as much short-term external financing, see Table 6. In the next section, we verify that, indeed, short maturity interest rates respond more to policy slope shocks relative to long maturity interest rates. Again, event studies are performed around FOMC announcement windows, but yield changes are employed as dependent variables as opposed to returns.

4.2 Treasury Yields

We analyze the responses of US Treasury yields to monetary policy slope shocks around FOMC events to better understand the impact of the slope shocks on short maturity yields. We use daily US Treasury zero-coupon yields data of Gürkaynak, Sack and Wright (2007), which is available at the Federal Reserve web site. Regarding the responses of US Treasury yields, we use the yield changes from the day before the announcement up to 49-days after announcement. Treasury maturities range from 1 to 30 years. Then, we run the pooled regressions of the yield changes with slope shock, Kuttner (2001) shock, and macro variables including industrial production growth, inflation, and unemployment rates. All macro variables are collected from the FRED database at the Federal Reserve Bank of St. Louise and they are lagged by one month. All regressions include maturity and year fixed effects. Robust standard errors with clustering at the FOMC event level are used. We estimate the following regressions:

$$\Delta TreasuryYields_{i,t} = \alpha + \beta SlopeShock_t + \gamma FFRShock_t + X_{j,t-1} + \varepsilon_{i,t},$$

where $TreasuryYields_i$ has 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20, 25, and 30 year maturities and X_j includes industrial production growth, inflation, and unemployment rates.

Table 8 reports results from the regression of the yield changes on the monetary policy slope shock as well as the Kuttner (2001) shock, and the macro variables. The yield changes are positively explained by the slope shocks at traditional significance levels, while the Kuttner (2001) shocks have little explanatory power of the yield changes. The impacts of the slope shocks on the yield changes are persistent and there is an one-for-one increase in yield changes up to the 30 day windows after the slope shock is realized.

Further, we separate Treasury yields by maturity into 5 years and less, consistent with our firm level debt maturity sort, as well as those by 6 years and more. Table 9 presents the regression results with short maturity yields and Table 10 reports the pooled regressions using long maturity yields. Overall, the responses of Treasury yields on slope shock are both economically and statistically significant in a short maturity group, compared to those in a long maturity group. After controlling for macroeconomic variables, the slope shocks still affect short-maturity yields to a much greater extend than long-maturity yields. On the other hand, the Kuttner (2001) shocks are insignificant in explaining the yield changes with both short and long maturities. Overall, our findings of Treasury yield changes support the stronger impact of monetary policy shocks on short-term interest rate fluctuations.

4.3 Analyst Forecast Revisions

Next, we proceed further to find an evidence that the documented results above are not through the cashflow channel. To that end, we exploit the revision in earnings forecast by analyst in IBES database. If the heterogeneity in returns originates from that in expected cashflows, we expect that analysts would have updated the earnings of firms accordingly.

Hence, we fit the following regression:

$$Revision_{i,t} = \alpha + \beta SlopeShock_t + \delta \mathbb{I}^{LD}_{i,t} + \theta SlopeShock_t \times \mathbb{I}^{LD}_{i,t} + X_{i,t} + \varepsilon_{i,t},$$

where $Revision_{i,t}$ is the change in EPS consensus over one or two months after an event date and $\mathbb{I}^{LD}_{i,t}$ denotes the long duration (short duration) indicator variable.

Table 12 reports the estimated coefficients. Columns (1)-(4) differs in $Revision_{i,t}$: (1) 1 year EPS revision over one month after an event date, (2) 1 year EPS revision over two months after an event date, (3) Long-term EPS revision over one month after an event date, (4) Long-term EPS revision over two months after an event date. The coefficient of our interest is θ on $SlopeShock_t \times \mathbb{I}^{LD}_{i,t}$, capturing the heterogenous response to slope shocks. Across various versions of EPS revisions, we do find that analysts update EPS forecasts in response to slope shocks but we do not find such reactions differ across cashflow durations. This finding suggests that the heterogenous response in returns to slope shocks may not be through the cashflow channel.

5 Corporate Investment

In this section, we investigate the effect of the slope shock on corporate outcomes. In particular, given the stock return outperformance of long cashflow duration firms following the realization of a positive slope shock, it is possible that a positive slope shock leads to greater corporate investment among this group. To verify this is indeed the case, we use quarterly data from Compustat and construct a quarterly-frequency version of the slope shock. The slope shock is estimated monthly by a multi-variable VAR with 12 lags for 1-year and 5-year Treasury yields, industrial production, CPI, excess bond risk premium, mortgage spread, and commercial paper spread. The quarterly slope shock is the difference between the estimation residuals of 1-year and 5-year Treasury yields in a quarterly frequency.

Investment is defined two ways: CAPX divided by property, plant, and equipment (CAPX/PPE) and capital expenditure divided by asset (CAPX/Asset). We perform an investment panel regression of the following model:

$$\begin{aligned} Investment^{qtr}_{i,t} &= \alpha + \sum_{s=0}^{12} \beta^s SlopeShock^{qtr}_{t-s} + \delta \mathbb{I}^{LD}_{i,t} + \sum_{s=0}^{12} \theta^s SlopeShock^{qtr}_{t-s} \times \mathbb{I}^{LD}_{i,t} \\ &\quad + X^{inv}_{i,t} + \varepsilon_{i,t}, \end{aligned} \tag{3}$$

where $SlopeShock^{qtr}_t$ is the quarterly slope shock at time t, $\mathbb{I}^{LD}_{i,t}$ is the long cashflow duration dummy variable for firm i at time t, and $X^{inv}_{i,t}$ are the control variables for investment regressions: log asset, Tobin's q, cashflow, and leverage. The model includes year and industry fixed effects. We also cluster standard errors at the firm level. Coefficient estimates θ^s for $s \in \{0, \ldots, 12\}$ capture the differential investment response of long cashflow duration firms in comparison to that of short cashflow duration firms following contemporaneous and lagged quarterly slope shocks. A positive θ^s implies that a positive slope shock results in higher investment for long cashflow duration firms s quarters after the shock realization.

Figure 1 presents the investment regression results. The three subplots in the left column present estimates when CAPX/PPE is employed as the dependent variable, whereas the three subplots in the right column contain the estimation when CAPX/Asset is used. The horizontal-axis of each subplot shows the number of quarters between the slope shock and firm investment, which is the lag, s. 95% confidence bands are shown around the point estimates. We first perform investment regressions for the two subsamples, short and long cashflow duration firms, separately without the use of the interaction term. The first and second rows of Figure 1 display the point estimates of β^s with $\mathbb{I}_{i,t}^{LD}$ and θ^s set to zero in Eq (3). Focusing on the short cashflow duration sample, subplot (a) and subplot (b) in Figure 1, for short cashflow duration firms, a positive slope shock pushes down investment significantly beyond the initial quarter, and the impact loses statistical significance after 10 quarters. For the long cashflow duration firms, subplot (c) and subplot (d) in Figure 1 document that a positive slope shock decreases investment during the trailing 10 quarters after the realization of the shock. However, the statistical significance of the negative impact is very uneven. The β coefficients are statistically significant sporadically.

Figure 1 subplot (e) documents the differential impact of the slope shock on firm investment between long cashflow duration and short cashflow duration firms. Investment regression via Eq (3) is performed. Point estimates of θ^s are shown across lags. Notice there is no differential investment impact between the two cashflow duration type firms immediately following the positive shock. θ^5 turns positive and significant in subplot (e), which means that, on average, the long cashflow duration firms have statistically higher investment 5 quarters after the positive shock. This investment differential stays positive but loses statistical significance 6 and 7 quarters after the positive slope shock. Consistent with return implications documented in Section 3, a positive slope shock is better news for long cashflow duration firms, relatively speaking. As a result, long cashflow duration firms decrease investment by a lesser margin. Similar investment regression results can be found in subplot (f) of Figure 1 when CAPX/Asset is used as the dependent variable.

To further understand how slope shocks cause differential investment between long and short cashflow duration firms, we examine the combined effect of θ^s coefficient estimates in annual windows post shock realization. In other words, we investigate the statistical significance of the sum of θ^1 to θ^4 (one-year window), θ^1 to θ^8 (two-year window), and θ^1 to

θ^{12} (three-year window). Table 11 presents the results. Coefficient sums when CAPX/PPE is the dependent variable is shown in Column (1). p-values of the statistical test is shown below the sum. As evidenced by their small p-values, a positive slope shock generates differential CAPX/PPE between long and short cashflow duration firms in the two- to three-year horizon. Similarly, in Column (2), a positive slope shock leads to relatively greater CAPX/Asset by long cashflow durations firms in year 2 and year 3 following the initial shock. In Column (3), we investigate how slope shocks affect debt issuance in the cross-section. In line with Columns (1) and (2) of Table 11, a positive slope shock causes long duration firms to issue more debt in comparison with the short duration firms 2 or 3 years into the future. Lastly, in Column (4), we document that long cashflow duration firms have higher average net income compared to short cashflow duration firms in the 3 years post-shock, as evidenced by the statistically significant and positive sum of θ^1 to θ^{12}. Overall, findings in Table 11 demonstrate how long cashflow duration firms are better positioned financially in the aftermath of a positive monetary policy slope shock in relation to those with short cashflow duration.

6 Conclusion

The Federal Reserve conducts monetary policy primarily by adjusting short-term interest rates. Through the Fed funds rate, the central bank regulates the economy by increasing or decreasing the cost of borrowing for households and firms. Actions of the Fed Reserve also reverberate through financial assets as market participants form expectations about the future path of interest rates. In this paper, we document that the near-term changing expected path of the Fed funds rate produce differential impact on firms. Short cashflow duration firms are more sensitive to these changing expectations than their long cashflow duration counterparts.

We measure changes in the near-term expected path of the Fed funds rate by taking the difference in innovations of the 3-month and 1-month to maturity Fed fund futures contracts around FOMC announcements. This slope shock reflects market participants' believes about the speed of future rate adjustments. Using event studies around FOMC announcement windows, we document the following. First, positive slope shocks, which imply a faster pace of Fed funds rate increase, drive down average firm-level returns. Secod, short cashflow duration firms underperform when compared to long cashflow duration firms on the event day following a positive slope shock. Furthermore, the return differential is persistent. We do not find evidence of return reversals in the 20-day window after the announcement event.

To understand the mechanism behind the return implication of monetary policy slope shocks, we focus our attention on debt and firm leverage as our baseline finding disappears in the subsample of nonlevered observations. We first note that short cashflow duration firms, on average, have more short-term debt and current liabilities. Furthermore, the return dispersion caused by the slope shock is concentrated among firms utilitzing short-term debt, defined as maturities 5 years or less. We document that slope shocks drive the short-end of the yield curve and not so much the long-end. A positive slope shock is a negative cashflow shock to short cashflow duration firms, thus leading to lower relative returns.

Finally, we examine the real impact of monetary policy slope shocks. In quarterly data, we show that positive slope shocks result in lower investment rate for short cashflow duration firms in comparison to long cashflow duration firms, consistent with the return implication. The difference in investment rates materializes five to six quarters after the initial shock.

Conduct of monetary policy not only drives the level of shor-term interest rates immediately, but it also forms market participants' expectation about the near-term rate path. In time of unprecedented inflation not seen for the last 35 plus years, our paper shows that the speed of interest rate adjustment can produce hetergeneous reaction in the cross-section of firms. Policy makers should be aware of the nonuniform response to ensure the transmission of monetary policy is efficient and on target.

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Tables

Table 1: **Return Response to Monetary Policy Slope Shock around FOMC Meetings**

Table 1 presents event study regression results. The sample period is between 1994 and 2018. The regression equation is:

$$Return_{i,t} = \alpha + \beta SlopeShock_t + \gamma FFRShock_t + X_{i,t} + \varepsilon_{i,t},$$

where . All regressions include industry and year fixed effects as well as controlling for log asset, log book-to-market ratio, leverage, and profitability at the firm level. Robust standard errors with double clustering at the firm and event level are used in reporting the t-statistics in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	(-1,-1)	(0,0)	(+1,+1)	(+1,+2)	(+1,+3)	(+1,+4)	(+1,+10)	(+1,+20)
SlopeShock	-2.071	-0.740	-7.573***	-7.914**	-5.508	-5.829	-13.06**	-7.217
	(-1.00)	(-0.29)	(-2.62)	(-2.13)	(-1.43)	(-1.30)	(-2.04)	(-0.77)
FFRShock	0.276	-0.280	0.0847	0.396	0.0763	-1.267	1.389	-4.335
	(0.19)	(-0.14)	(0.05)	(0.18)	(0.03)	(-0.50)	(0.36)	(-0.68)
Industry FE	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Observations	307915	307915	307915	307915	307915	307915	307915	307915
Adjusted R^2	0.020	0.010	0.021	0.024	0.022	0.027	0.021	0.012

Table 2: **Return Response to Monetary Policy Slope Shock around FOMC Meetings - Cashflow Duration**

Table 2 presents event study regression results. The sample period is between 1994 and 2018. The regression equation is:

$$\begin{aligned} Return_{i,t} &= \alpha + \beta SlopeShock_t + \delta \mathbb{I}_{i,t}^{LD} + \theta SlopeShock_t \times \mathbb{I}_{i,t}^{LD} \\ &\quad + \gamma FFRShock_t + \eta FFRShock_t \times \mathbb{I}_{i,t}^{LD} + X_{i,t} + \varepsilon_{i,t}, \end{aligned}$$

where $\mathbb{I}_{i,t}^{LD}$ is the dummy denoting an observation belongs in the top tercile when firms are sorted by cashflow duration. All regressions include industry and year fixed effects as well as controlling for log asset, log book-to-market ratio, leverage, and profitability at the firm level. Robust standard errors with double clustering at the firm and event level are used in reporting the t-statistics in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	(-1,-1)	(0,0)	(+1,+1)	(+1,+2)	(+1,+3)	(+1,+4)	(+1,+10)	(+1,+20)
SlopeShock	-2.471	-1.914	-8.087***	-8.158**	-5.068	-4.903	-13.99**	-11.62
	(-1.24)	(-0.77)	(-2.91)	(-2.39)	(-1.56)	(-1.28)	(-2.32)	(-1.30)
Long Dur Dummy	0.000868**	0.00111***	0.00166***	0.00252***	0.00278***	0.00308***	0.00643***	0.0125***
	(2.17)	(2.65)	(4.14)	(3.93)	(4.06)	(3.84)	(4.87)	(6.41)
SlopeShock × LD	0.998	2.593***	0.598	0.312	-1.210	-2.245	0.239	7.536
	(1.17)	(2.96)	(0.43)	(0.14)	(-0.50)	(-0.73)	(0.06)	(1.11)
FFRShock	0.349	-0.0630	-0.0261	0.334	-0.267	-1.406	1.120	-5.764
	(0.25)	(-0.03)	(-0.02)	(0.16)	(-0.13)	(-0.66)	(0.29)	(-0.92)
FFRShock × LD	-0.179	-0.502	0.326	-0.284	0.301	-0.277	0.361	2.780
	(-0.38)	(-0.81)	(0.39)	(-0.26)	(0.23)	(-0.15)	(0.16)	(0.76)
Industry FE	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Observations	307915	307915	307915	307915	307915	307915	307915	307915
Adjusted R^2	0.021	0.010	0.021	0.024	0.022	0.028	0.021	0.013

Table 3: **Return Response to Monetary Policy Slope Shock around FOMC Meetings - Pre-2008 Only**

Table 3 presents event study regression results. The sample period is between 1994 and 2007. The regression equation is:

$$\begin{aligned} Return_{i,t} &= \alpha + \beta SlopeShock_t + \delta \mathbb{I}^{LD}_{i,t} + \theta SlopeShock_t \times \mathbb{I}^{LD}_{i,t} \\ &\quad + \gamma FFRShock_t + \eta FFRShock_t \times \mathbb{I}^{LD}_{i,t} + X_{i,t} + \varepsilon_{i,t}, \end{aligned}$$

where $\mathbb{I}^{LD}_{i,t}$ is the dummy denoting an observation belongs in the top tercile when firms are sorted by cashflow duration. We limit the sample to prior of the 2008 financial crisis and the ensuing Zero Lower Bound (ZLB) period. All regressions include industry and year fixed effects as well as controlling for log asset, log book-to-market ratio, and profitability at the firm level. Robust standard errors with double clustering at the firm and event level are used in reporting the t-statistics in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	(-1,-1)	(0,0)	(+1,+1)	(+1,+2)	(+1,+3)	(+1,+4)	(+1,+10)	(+1,+20)
SlopeShock	-0.586	-2.907*	-5.005**	-7.627***	-10.26***	-11.44***	-16.04**	-14.43*
	(-0.36)	(-1.74)	(-2.40)	(-2.64)	(-3.60)	(-3.40)	(-2.57)	(-1.82)
Long Dur Dummy	0.000753	0.00109***	0.00160***	0.00277***	0.00311***	0.00319***	0.00718***	0.0147***
	(1.56)	(2.63)	(3.14)	(3.09)	(3.20)	(2.71)	(4.06)	(5.84)
SlopeShock × LD	1.458	2.555**	-0.492	-1.460	-3.560	-6.358	-4.418	4.939
	(1.42)	(2.40)	(-0.28)	(-0.45)	(-1.10)	(-1.53)	(-0.91)	(0.60)
FFRShock	0.704	-4.070***	0.407	-0.117	-0.824	-2.092	-2.967	-3.800
	(0.53)	(-2.79)	(0.24)	(-0.05)	(-0.31)	(-0.72)	(-0.61)	(-0.46)
FFRShock × LD	0.210	-1.098	-0.978	-2.288	-1.588	-4.319	-4.469	-0.723
	(0.23)	(-1.17)	(-0.69)	(-1.02)	(-0.66)	(-1.51)	(-1.20)	(-0.11)
Industry FE	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Observations	200225	200225	200225	200225	200225	200225	200225	200225
Adjusted R^2	0.015	0.010	0.014	0.018	0.018	0.024	0.026	0.013

Table 4: **Monthly Return Response of Cashflow Duration to Monetary Policy Slope Shock**

Table 4 presents panel regression results, regressing monthly individual stock risk-adjusted returns on the interaction of cashflow duration and monthly slope shock as well as the effect of cashflow duration and monthly slope shock. The sample period is between 1994 and 2018. The regression equation is:

$$\alpha_{i,t} = a + \beta CFDur_{i,t} \times SlopeShock_t + \delta SlopeShock_t + \theta CFDur_{i,t} + X_{i,t} + \varepsilon_{i,t},$$

where . All regressions control for leverage, book-to-market ration, investment and profitability at the firm level. The standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Dependent variable:				
	$\alpha_{\texttt{CAPM}}$	$\alpha_{\texttt{FF3}}$	$\alpha_{\texttt{Carhart4}}$	$\alpha_{\texttt{HXZ4}}$	$\alpha_{\texttt{FF5}}$
	(1)	(2)	(3)	(4)	(5)
CF Dur × SlopeShock	0.004***	0.004***	0.004***	0.003***	0.003***
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
SlopeShock	0.008***	−0.0005	−0.011***	0.004	0.005**
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
CF Dur	−0.001***	−0.0005***	−0.0004***	−0.0001**	−0.0002***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Observations	1,106,278	1,106,278	1,106,278	1,106,278	1,106,278
R^2	0.002	0.001	0.001	0.001	0.001
Adjusted R^2	0.002	0.001	0.001	0.001	0.001

Table 5: **Return Response to Monetary Policy Slope Shock around FOMC Meetings - Non-Levered Firms Only**

Table 5 presents event study regression results. The sample period is between 1994 and 2018. The regression equation is:

$$\begin{aligned} Return_{i,t} &= \alpha + \beta SlopeShock_t + \delta \mathbb{I}^{LD}_{i,t} + \theta SlopeShock_t \times \mathbb{I}^{LD}_{i,t} \\ &\quad + \gamma FFRShock_t + \eta FFRShock_t \times \mathbb{I}^{LD}_{i,t} + X_{i,t} + \varepsilon_{i,t}, \end{aligned}$$

where $\mathbb{I}^{LD}_{i,t}$ is the dummy denoting an observation belongs in the top tercile when firms are sorted by cashflow duration. We limit the sample to firms with zero book leverage. All regressions include industry and year fixed effects as well as controlling for log asset, log book-to-market ratio, and profitability at the firm level. Robust standard errors with double clustering at the firm and event level are used in reporting the t-statistics in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	(-1,-1)	(0,0)	(+1,+1)	(+1,+2)	(+1,+3)	(+1,+4)	(+1,+10)	(+1,+20)
SlopeShock	-2.463	-0.486	-8.107***	-7.819**	-3.700	-2.953	-11.19	-11.08
	(-1.09)	(-0.17)	(-2.69)	(-2.20)	(-0.99)	(-0.64)	(-1.59)	(-1.15)
Long Dur Dummy	0.00129**	0.00142**	0.00267***	0.00273**	0.00360***	0.00474***	0.0112***	0.0184***
	(2.13)	(2.21)	(3.88)	(2.42)	(2.85)	(3.31)	(5.56)	(6.42)
SlopeShock × LD	1.863	1.634	-0.914	-1.476	-5.169	-7.026	-4.902	6.105
	(1.26)	(1.05)	(-0.37)	(-0.46)	(-1.36)	(-1.46)	(-0.76)	(0.59)
FFRShock	0.370	-0.354	0.708	0.726	-0.361	-1.052	3.193	-3.208
	(0.23)	(-0.19)	(0.38)	(0.31)	(-0.15)	(-0.42)	(0.84)	(-0.55)
FFRShock × LD	0.207	0.107	0.489	0.0712	1.292	-0.0820	-1.588	-0.755
	(0.23)	(0.10)	(0.35)	(0.05)	(0.64)	(-0.03)	(-0.43)	(-0.14)
Industry FE	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Observations	52942	52942	52942	52942	52942	52942	52942	52942
Adjusted R^2	0.022	0.008	0.022	0.027	0.025	0.033	0.022	0.012

Table 6: **Firm Characteristics and Cashflow Duration**

Table 6 presents event study regression results. The sample period is between 1994 and 2018. The regression equation is:

$$Return_{i,t} = \alpha + \beta SlopeShock_t + \delta \mathbb{I}_{i,t}^{LD} + \theta SlopeShock_t \times \mathbb{I}_{i,t}^{LD} + \gamma FFRShock_t + \eta FFRShock_t \times \mathbb{I}_{i,t}^{LD} + X_{i,t} + \varepsilon_{i,t},$$

where $\mathbb{I}_{i,t}^{LD}$ is the dummy denoting an observation belongs in the top tercile when firms are sorted by cashflow duration. We limit the sample to firms with zero book leverage. All regressions include industry and year fixed effects as well as controlling for log asset, log book-to-market ratio, and profitability at the firm level. Robust standard errors with double clustering at the firm and event level are used in reporting the t-statistics in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
	STDebt	LTDebt	Cash
CF Duration	-0.000754**	-0.000161	-0.00723***
	(-2.01)	(-0.34)	(-2.92)
LogAsset	-0.00498***	0.00618***	-0.0134***
	(-11.53)	(12.88)	(-13.05)
TobinQ	-0.00137***	0.000872**	0.0331***
	(-3.99)	(2.27)	(23.11)
Cashflow	-0.0555***	0.0195**	-0.814***
	(-6.90)	(2.03)	(-23.26)
Leverage	0.129***	0.821***	-0.315***
	(33.48)	(163.03)	(-36.39)
Observations	112688	112688	112688
Adjusted R^2	0.241	0.827	0.499

Table 7: **Return Response to Monetary Policy Slope Shock around FOMC Meetings - Debt Maturity Test**

Table 7 presents event study regression results. The sample period is between 1994 and 2018. The regression equation is the same as the baseline specification. Only levered observations are kept. Top panel highlight coefficient estimates employing observations belong in the bottom tercile each quarter when firms are sorted by debt maturity, while the bottom panel contains results using observations belong in the top tercile of the quarterly sort. All regressions include industry and year fixed effects as well as controlling for log asset, log book-to-market ratio, leverage, and profitability at the firm level. Robust standard errors with double clustering at the firm and event level are used in reporting the t-statistics in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	(-1,-1)	(0,0)	(+1,+1)	(+1,+2)	(+1,+3)	(+1,+4)	(+1,+10)	(+1,+20)
SlopeShock	-3.167	-3.007	-7.529***	-6.624**	-3.615	-3.675	-12.91**	-9.770
	(-1.60)	(-1.30)	(-2.89)	(-2.19)	(-1.24)	(-1.09)	(-2.16)	(-1.05)
Long Dur Dummy	0.000467	0.000878	0.00144**	0.00183**	0.00160*	0.00175	0.00322	0.0111***
	(0.88)	(1.50)	(2.34)	(2.21)	(1.81)	(1.60)	(1.58)	(3.75)
SlopeShock × LD	1.083	4.383***	-0.551	-3.021	-3.611	-3.801	-2.243	4.910
	(0.89)	(3.69)	(-0.42)	(-1.37)	(-1.41)	(-1.14)	(-0.42)	(0.58)
FFRShock	0.455	0.257	0.0142	-0.596	-1.049	-1.963	0.534	-5.323
	(0.30)	(0.14)	(0.01)	(-0.30)	(-0.58)	(-0.99)	(0.13)	(-0.81)
FFRShock × LD	-0.576	-1.559**	1.235	1.872	2.226	1.786	3.324	6.599
	(-1.01)	(-2.47)	(1.38)	(1.34)	(1.25)	(0.72)	(0.96)	(1.48)
Industry FE	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Observations	60527	60527	60527	60527	60527	60527	60527	60527
Adjusted R^2	0.020	0.010	0.018	0.023	0.022	0.026	0.021	0.014
SlopeShock	-2.113	-1.739	-9.163***	-10.90***	-7.091*	-5.778	-13.69**	-9.417
	(-0.97)	(-0.65)	(-3.24)	(-2.80)	(-1.94)	(-1.39)	(-2.27)	(-1.05)
Long Dur Dummy	0.000901*	0.00111**	0.00120**	0.00185**	0.00288***	0.00283***	0.00584***	0.0111***
	(1.72)	(2.08)	(2.41)	(2.53)	(3.67)	(3.05)	(3.71)	(4.73)
SlopeShock × LD	0.00803	1.672*	1.607	1.290	1.513	-0.716	-0.459	2.160
	(0.01)	(1.85)	(1.27)	(0.62)	(0.66)	(-0.29)	(-0.15)	(0.47)
FFRShock	0.472	-0.241	-0.113	1.519	0.607	-1.274	1.320	-7.292
	(0.31)	(-0.13)	(-0.07)	(0.69)	(0.28)	(-0.55)	(0.31)	(-1.22)
FFRShock × LD	-0.461	-0.0122	-0.234	-0.838	-1.052	-0.885	0.115	3.022
	(-0.91)	(-0.02)	(-0.34)	(-0.79)	(-1.00)	(-0.67)	(0.07)	(1.33)
Industry FE	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Observations	60594	60594	60594	60594	60594	60594	60594	60594
Adjusted R^2	0.024	0.013	0.026	0.029	0.025	0.029	0.021	0.014

Table 8: **Treasury Yields Changes to Monetary Policy Slope Shock around FOMC Meetings**

Table 8 presents event study regression results for Treasury yields changes. The sample period is between 1994 and 2018. The regression equation is:

$$\Delta TreasuryYields_{i,t} = \alpha + \beta SlopeShock_t + \gamma FFRShock_t + X_{j,t-1} + \varepsilon_{i,t},$$

where $TreasuryYields$ has 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20, 25, and 30 year maturities. All regressions include maturity and year fixed effects as well as controlling for industrial production growth, inflation, and unemployment, which are lagged by one month. Robust standard errors with clustering at the event level are used in reporting the t-statistics in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	(-1,+1)	(-1,+3)	(-1,+5)	(-1,+10)	(-1,+20)	(-1,+30)	(-1,+40)
SlopeShock	0.520**	0.488**	0.456**	0.678**	0.744*	0.867*	0.718
	(2.58)	(2.11)	(2.06)	(2.32)	(1.80)	(1.73)	(1.32)
FFRShock	-0.000387	-0.000121	-0.000403	0.000138	-0.00215	0.000687	0.00528
	(-0.42)	(-0.10)	(-0.32)	(0.10)	(-0.85)	(0.23)	(1.47)
Maturity FE	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓
Observations	2688	2688	2688	2688	2688	2688	2688
Adjusted R^2	0.109	0.095	0.082	0.167	0.114	0.135	0.178
SlopeShock	0.455**	0.396*	0.385*	0.646**	0.746*	1.029**	0.946*
	(2.19)	(1.72)	(1.75)	(2.20)	(1.79)	(2.03)	(1.75)
FFRShock	-0.000152	0.000255	-0.0000970	0.000307	-0.00192	0.000344	0.00453
	(-0.16)	(0.21)	(-0.07)	(0.22)	(-0.79)	(0.12)	(1.26)
Industrial Production	-3.234**	-4.203**	-4.831*	-1.169	-1.357	2.552	5.740
	(-2.32)	(-2.27)	(-1.93)	(-0.48)	(-0.31)	(0.58)	(1.14)
Inflation	4.108	7.097*	5.064	3.567	4.993	-7.021	-15.38*
	(1.48)	(1.90)	(1.49)	(0.73)	(0.66)	(-0.84)	(-1.80)
Unemployment	-0.392	-0.461	-0.329	-0.0817	0.493	1.444*	1.478
	(-1.33)	(-1.39)	(-0.86)	(-0.15)	(0.75)	(1.80)	(1.58)
Maturity FE	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓
Observations	2688	2688	2688	2688	2688	2688	2688
Adjusted R^2	0.162	0.167	0.139	0.170	0.119	0.153	0.210

Table 9: **Short Maturity Treasury Yields Changes to Monetary Policy Slope Shock around FOMC Meetings**

Table 9 presents event study regression results for Treasury yields changes. The sample period is between 1994 and 2018. The regression equation is:

$$\Delta TreasuryYields_{i,t} = \alpha + \beta SlopeShock_t + \gamma FFRShock_t + X_{j,t-1} + \varepsilon_{i,t},$$

where $TreasuryYields$ has 1, 2, 3, 4, and 5 year maturities. All regressions include maturity and year fixed effects as well as controlling for industrial production growth, inflation, and unemployment, which are lagged by one month. Robust standard errors with clustering at the event level are used in reporting the t-statistics in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	(-1,+1)	(-1,+3)	(-1,+5)	(-1,+10)	(-1,+20)	(-1,+30)	(-1,+40)
slopeShock	0.635***	0.637**	0.654***	0.888***	0.966**	1.220**	1.000
	(2.75)	(2.28)	(2.76)	(2.78)	(2.18)	(2.17)	(1.62)
FFRshock	0.00117	0.00155	0.000859	0.00120	-0.000363	0.00196	0.00602
	(1.23)	(1.00)	(0.62)	(0.78)	(-0.14)	(0.63)	(1.63)
Maturity FE	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓
Observations	960	960	960	960	960	960	960
Adjusted R^2	0.186	0.164	0.137	0.242	0.200	0.237	0.281
SlopeShock	0.587**	0.557**	0.605**	0.873***	0.987**	1.382**	1.194**
	(2.46)	(2.01)	(2.55)	(2.68)	(2.24)	(2.53)	(2.01)
FFRshock	0.00129	0.00180	0.000970	0.00115	-0.000401	0.00147	0.00523
	(1.28)	(1.13)	(0.65)	(0.74)	(-0.16)	(0.46)	(1.38)
Industrial Production	-2.900**	-3.222	-3.279	0.169	0.460	3.175	4.836
	(-2.28)	(-1.52)	(-1.33)	(0.07)	(0.14)	(0.90)	(1.30)
Inflation	1.352	4.390	1.015	-1.248	-0.665	-10.40	-16.76**
	(0.54)	(1.18)	(0.28)	(-0.25)	(-0.11)	(-1.29)	(-1.98)
Unemployment	-0.409	-0.561	-0.428	-0.317	0.203	1.133	0.944
	(-1.51)	(-1.63)	(-1.10)	(-0.56)	(0.33)	(1.37)	(1.00)
Maturity FE	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓
Observations	960	960	960	960	960	960	960
Adjusted R^2	0.231	0.212	0.168	0.242	0.198	0.254	0.304

Table 10: **Long Maturity Treasury Yields Changes to Monetary Policy Slope Shock around FOMC Meetings**

Table 10 presents event study regression results for Treasury yields changes. The sample period is between 1994 and 2018. The regression equation is:

$$\Delta TreasuryYields_{i,t} = \alpha + \beta SlopeShock_t + \gamma FFRShock_t + X_{j,t-1} + \varepsilon_{i,t},$$

where $TreasuryYields$ has 6, 7, 8, 9, 10, 15, 20, 25, and 30 year maturities. All regressions include maturity and year fixed effects as well as controlling for industrial production growth, inflation, and unemployment, which are lagged by one month. Robust standard errors with clustering at the event level are used in reporting the t-statistics in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	(-1,+1)	(-1,+3)	(-1,+5)	(-1,+10)	(-1,+20)	(-1,+30)	(-1,+40)
SlopeShock	0.456**	0.406*	0.347	0.561*	0.621	0.671	0.561
	(2.29)	(1.74)	(1.44)	(1.85)	(1.44)	(1.32)	(1.02)
FFRShock	-0.00125	-0.00105	-0.00110	-0.000454	-0.00314	-0.0000224	0.00487
	(-1.30)	(-0.88)	(-0.82)	(-0.29)	(-1.14)	(-0.01)	(1.25)
Maturity FE	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓
Observations	1728	1728	1728	1728	1728	1728	1728
Adjusted R^2	0.096	0.080	0.072	0.138	0.092	0.100	0.144
SlopeShock	0.381*	0.306	0.263	0.519*	0.612	0.833	0.808
	(1.86)	(1.32)	(1.11)	(1.73)	(1.40)	(1.59)	(1.45)
FFRShock	-0.000952	-0.000602	-0.000690	-0.000162	-0.00276	-0.000284	0.00414
	(-0.97)	(-0.50)	(-0.50)	(-0.11)	(-1.06)	(-0.09)	(1.08)
Industrial Production	-3.420**	-4.748**	-5.693**	-1.912	-2.367	2.205	6.243
	(-2.27)	(-2.55)	(-2.18)	(-0.73)	(-0.46)	(0.43)	(1.04)
Inflation	5.639*	8.602**	7.314*	6.243	8.136	-5.145	-14.61
	(1.74)	(2.03)	(1.85)	(1.16)	(0.93)	(-0.58)	(-1.63)
Unemployment	-0.383	-0.406	-0.274	0.0490	0.654	1.617*	1.775*
	(-1.19)	(-1.17)	(-0.69)	(0.09)	(0.92)	(1.94)	(1.80)
Maturity FE	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓
Observations	1728	1728	1728	1728	1728	1728	1728
Adjusted R^2	0.158	0.168	0.148	0.149	0.104	0.119	0.181

Table 11: **Investment Response to Monetary Policy Slope Shocks - Sum of Coefficients**

Table 11 presents event study regression results. The sample period is between 1994 and 2018. The regression equation is:

$$\begin{aligned} Investment^{qtr}_{i,t} &= \alpha + \sum_{s=0}^{12} \beta^s SlopeShock^{qtr}_{t-s} + \delta \mathbb{I}^{LD}_{i,t} + \sum_{s=0}^{12} \theta^s SlopeShock^{qtr}_{t-s} \times \mathbb{I}^{LD}_{i,t} \\ &+ X^{inv}_{i,t} + \varepsilon_{i,t}, \end{aligned}$$

where . All regressions include industry and year fixed effects as well as controlling for log asset, log book-to-market ratio, leverage, and profitability at the firm level. Robust standard errors with double clustering at the firm and event level are used in reporting the t-statistics in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
	$\frac{CAPX}{PPE}$	$\frac{CAPX}{Asset}$	$\frac{Debt\ Issue}{Asset}$	$\frac{Net\ Income}{Asset}$
Sum of θ^1 to θ^4	0.000249	0.000337	-0.000466	0.0000629
p-value	0.861	0.331	0.439	0.907
Sum of θ^1 to θ^8	0.00298*	0.000819**	0.00132**	-0.0000373
p-value	0.0519	0.0346	0.0215	0.950
Sum of θ^1 to θ^{12}	0.00527***	0.00103**	0.00266***	0.00146**
p-value	0.00279	0.0166	0.0000611	0.0362
Adjusted R^2	0.141	0.240	0.0129	0.428

Table 12: **EPS forecast revision in response to slope shock**

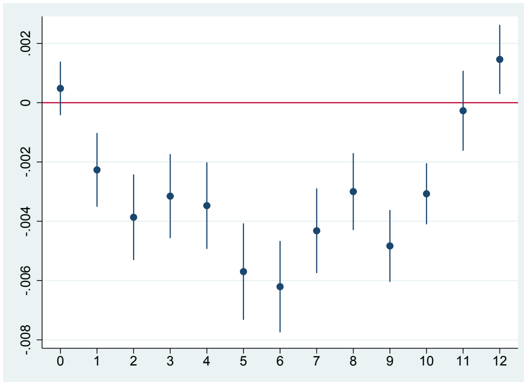
Table 12 presents event study regression results. The sample period is between 1994 and 2018. The regression equation is:

$$Revision_{i,t} = \alpha + \beta SlopeShock_t + \delta \mathbb{I}^{LD}_{i,t} + \theta SlopeShock_t \times \mathbb{I}^{LD}_{i,t} + X_{i,t} + \varepsilon_{i,t},$$

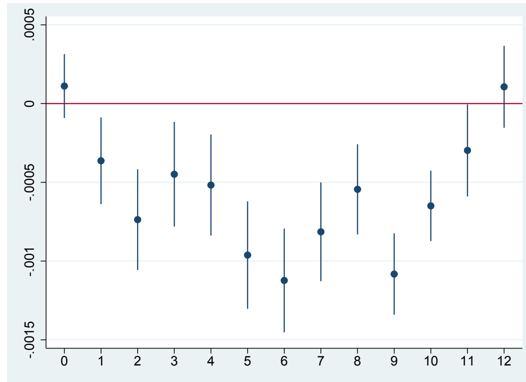
where where $Revision_{i,t}$ is the change in EPS consensus over one or two months after an event date and $\mathbb{I}^{LD}_{i,t}$ denotes the long duration (short duration) indicator variable. Columns (1)-(4) differs in $Revision_{i,t}$ as follows: (1) 1 year EPS revision over one month after an event date, (2) 1 year EPS revision over two months after an event date, (3) Long-term EPS revision over one month after an event date, (4) Long-term EPS revision over two months after an event date. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Dependent variable:			
	(1)	(2)	(3)	(4)
SlopeShock	4.148***	5.276***	2.755**	4.933***
	(1.288)	(1.756)	(1.086)	(1.432)
$\mathbb{I}^{LD}$	0.013***	0.023***	0.010***	0.017***
	(0.001)	(0.002)	(0.001)	(0.001)
$SlopeShock \times \mathbb{I}^{LD}$	−2.386	−0.072	2.608	2.949
	(2.351)	(3.204)	(1.982)	(2.613)
Constant	−0.002*	−0.001	−0.003***	−0.006***
	(0.001)	(0.001)	(0.001)	(0.001)
Observations	157,233	157,233	157,233	157,233
R^2	0.001	0.002	0.001	0.001
Adjusted R^2	0.001	0.002	0.001	0.001
Residual Std. Error (df = 157225)	0.196	0.267	0.165	0.218
F Statistic (df = 7; 157225)	26.696***	43.070***	18.613***	30.734***

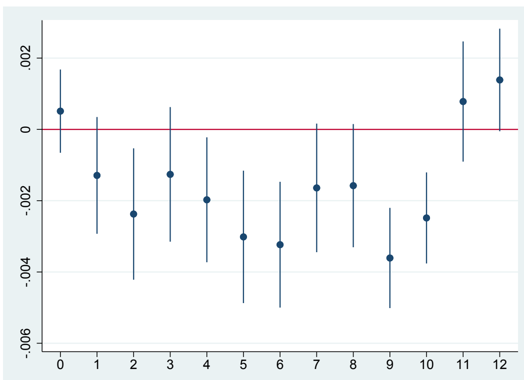
Figures



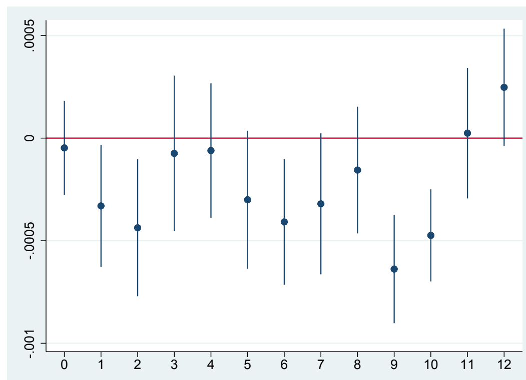
(a) Short Cashflow Duration



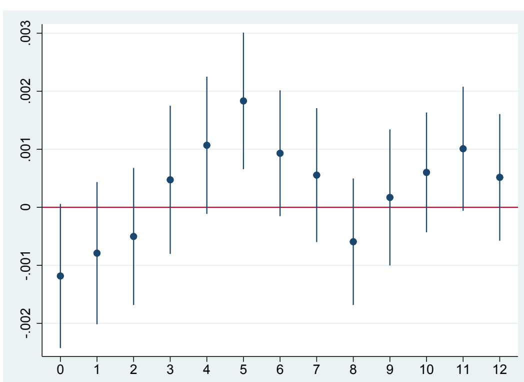
(b) Short Cashflow Duration



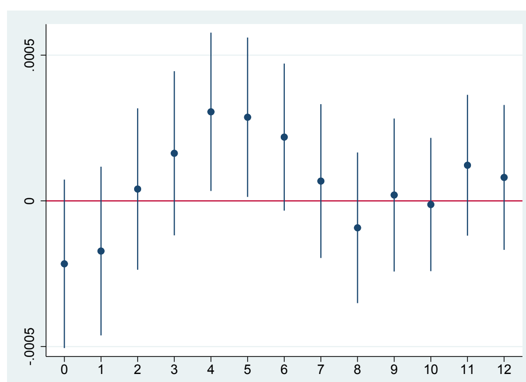
(c) Long Cashflow Duration



(d) Long Cashflow Duration



(e) Long over Short



(f) Long over Short

Figure 1: **Investment response to slope shocks according to cashflow duration**: Panel regression coefficient estimates of investment (left column - CAPX/PPE; right column - CAPX/Asset) on contemporaneous and lagged, up to 12 quarters, slope shocks. 95% confidence intervals are shown. Firms are sorted into cashflow duration terciles each quarter. Log asset, Tobin's q, cashflow, and leverage are employed as controls. Year and industry fixed effects are included. Robust standard errors are used. Clustering done at the firm level.