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Uncertainty and Corporate Investments in Response to the Fed's Dual Shocks

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Abstract

The Federal Reserve's impact on corporate investments varies with the type of monetary shock. From a conventional standpoint, contractionary monetary shocks trigger a rise in financing costs that significantly reduce investment. Such effects are predicted by the widely investigated monetary policy channels. However, we highlight informational circumstances under which monetary contraction reduces uncertainty and incentivizes a rise in investment. These effects arise when monetary tightening conveys a positive assessment of the macroeconomic outlook by the Fed. We further show that the positive effect of contractionary Fed information shocks on investment is largely driven by these shocks' ability to reduce uncertainty.

Keywords: Federal Reserve; Information Shocks; Uncertainty; Capital Investments.
JEL Codes: D25; D80; E22; E23; E52; E58.

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1 INTRODUCTION

The influence of macroeconomic uncertainty on corporate investments is subject to considerable investigation (Bloom et al. 2018; Gulen and Ion 2016; Morikawa 2016). Still, further analysis is required to determine the relevant factors that influence uncertainty, investment, and their joint dynamics. Our main focus in this paper is on the dimensions through which a recognized macroeconomic force – the Federal Reserve (hereafter "the Fed") – contributes to the variation in macroeconomic uncertainty and shapes corporate investments. At times of rising fiscal paralysis, the Fed has become the most influential player on the economic scene. Indeed, the Fed with its growing influence alongside that of the other main central banks, led to it becoming labeled as "the only game in town" (El-Erian 2016) (p.1). In light of the growing relevance of monetary policy (Romero et al., 2023), how does investment respond to monetary shocks? And to what extent does this response vary with the Fed's influence on macroeconomic uncertainty?

We start our analysis by building on the well-established literature on monetary policy channels to assess the conventional impact of monetary policy on investment (Delis, Hasan, and Mylonidis 2017; Bernanke and Gertler 1995; Ottonello and Winberry 2020). This literature presents various channels via which monetary shocks affect investments without the necessary mediating effect of uncertainty. In the context of our analysis, the most relevant channel is the investment channel suggesting that the monetary-policy-driven tightening of credit conditions leads to a subsequent decrease in investment. Via this channel, the increasing financing costs due to unanticipated monetary contraction steepen the marginal cost curve and lead firms to reduce investment expenditures (Ottonello and Winberry 2020; Caraiani 2022; Cloyne et al. 2021).

The posited relations described above, while direct and fully grounded in an established body of literature, do not capture the full scope of the Fed's influence on investment. In this paper, we emphasize the relevance of an additional and influential class of Fed shocks where monetary contraction can contribute to a rise in investment. We further argue that these shocks' influence on corporate investment is largely attributed to their ability to influence macroeconomic uncertainty.

The starting point in this argument is the recognition that the Fed's actions include a significant informational component. When making key monetary policy decisions, the Fed also reveals private information about its assessment of the future economic outlook (Jarociński and Karadi 2020; Romer and Romer 2000; Andrade and Ferroni 2021). The Fed's increased communication with the public gives its informational role more relevance by helping investors navigate volatile economic conditions through credible and comprehensive forecasts (Shiller 2017; Yellen 2015; Cieslak and Schrimpf 2019; Jubinski and Tomljanovich 2017). Such forecasts are shown to outperform those provided by professional forecasters (Romer and Romer 2000).

In this context, monetary contraction, when reflecting the Fed's confidence in a growing economy, can be treated by observers as a new and credible signal of a positive economic outlook (Nakamura and Steinsson 2018; Breitenlechner, Gründler, and Scharler 2021). A direct empirical implication is that contractionary monetary shocks can lead to counterintuitive reactions in key economic variables. For instance, there is evidence that rising interest rates can increase, rather than decrease, economic growth forecasts (Nakamura and Steinsson 2018), housing investments (Adra and Menassa 2022), and initial public offerings (Adra 2021). The Fed's growing informational role has direct methodological implications on monetary policy research. In particular, the failure to disentangle the Fed's conventional shocks from the informational component embedded in the Fed's announcement might bias the empirical insights about the economic effects of monetary policy (Jarociński and Karadi 2020; Breitenlechner, Gründler, and Scharler 2021; Adra and Menassa 2022; Miranda-Agrippino and Ricco 2021).

Along these lines, we expect contractionary monetary shocks, when treated as a positive assessment of the macroeconomic outlook by the Fed, to reduce economic uncertainty. In line with the real options view of investment (Dixit and Pindyck 1994), we predict that this reduction in uncertainty is the key contributor to a subsequent increase in investment. We further expect the influence of the Fed's information shocks on uncertainty and investments to be more pronounced in periods of high economic uncertainty when the Fed's decisions and assessments of the economic outlook are highly awaited.

To separate conventional shocks from those conveying new forecasts, we follow the Jarociński and Karadi (2020) approach where the conventional and information shocks are imputed from a rich VAR model with high-frequency variables and sign restrictions. Based on this approach, the co-movement between the rates on Fed funds futures and the stock market at the time of the Federal Open Markets Committee (FOMC) announcements allows the empiricist to track the separate effects of conventional and Fed information shocks for a long horizon.

Conventional monetary shocks are identified as those arising when a negative correlation between stock and bond returns emerges around FOMC announcements. This negative association suggests that rising interest rates are interpreted by equity investors as drivers of tighter future financing conditions, as suggested by the monetary literature

(Bernanke and Gertler 1995; Bernanke and Kuttner 2005). The Fed information shocks, in turn, are identified by the positive high-frequency correlation between stock and bond returns around FOMC announcements.[1] In this latter context, rising (declining) interest rates are interpreted by equity investors as reflectors of a positive (negative) assessment of the economic outlook by the highly credible Fed.

Our time series evidence based on the Jordà (2005) local projection analysis of the variation in macroeconomic uncertainty between 1990 and 2019 supports our prediction of separate, distinctive, and economically consequential effects of conventional and Fed information shocks. We find that monetary contraction that conveys a positive assessment of economic fundamentals by the Fed leads to a noticeable decrease in macroeconomic uncertainty. These effects are largely driven by monetary shocks occurring during periods of high market uncertainty. A standard deviation positive Fed information, on average, leads to a subsequent decrease in the Jurado et al. (2015) 12-month-ahead macroeconomic uncertainty index by up to 10% in the subsequent quarter.

The evidence from the time series analysis of the growth in both (a) the investment rates of U.S. firms, and (b) the aggregate capital investment levels of such firms, is also aligned with our predictions. A standard deviation contractionary shock conveying positive economic signals triggers a rise in the average investment rate by up to 1.5% during the subsequent four quarters. This rise is roughly equivalent to 0.75 deviation. In turn, a standard deviation conventional contractionary shock on average leads to a 0.7% decline in this rate over the same period. The analysis of the growth in

[1] It is worth noting that a quarter of the Federal Open Market Committee (FOMC) announcements about key policy rates is characterized by a "wrongly-signed" positive association between short-term interest rates and stock returns. That is, a rise in interest rates (i.e. monetary contraction) is associated with a rise in stock returns and an improvement in the economic outlook, which contradicts the view that monetary shocks reduce investment prospects.

aggregate investment levels presents similar patterns. A standard deviation contractionary shock conveying positive economic signals triggers a rise in aggregate capital investment levels by up to 10% during the subsequent four quarters. In turn, a standard deviation conventional contractionary shock on average leads to a 5% decline in aggregate capital investments over the same period. When limiting the analysis to public firms, we show that under high uncertainty, a standard deviation contractionary Fed information shock increases public firms' investment by up to 70% over the three subsequent quarters. Conventional contractionary shocks decrease these investments by up to 20%.

We validate our main inferences by applying our analysis to a comprehensive panel dataset covering 17,795 firms with a rich set of control variables. Our panel-level local projection analysis suggests that contraction conveying positive economic forecasts increases both the firm-specific investment rates and investment levels. Conventional contraction, in turn, reduces these outcomes. Furthermore, we show that these effects, especially the informational ones, are noticeably large when monetary shocks occur during periods of high uncertainty. In periods of high uncertainty, the firm-level quarterly investment rate increases by roughly 0.7% over the subsequent three quarters in response to a standard deviation positive Fed information shock. This increase in investment rate is equivalent to roughly 40% of the baseline firm-specific investment rate and 20% of the baseline standard deviation. In contrast, the conventional contractionary shocks lead to subsequent declines in investment rates by roughly 0.34%.

We further show that the leading effects of the Fed information shocks on investment are fully explained by the post-shock changes in macroeconomic uncertainty. These results support our initial conjecture that the investment impact of Fed information shocks is largely dependent on the extent to which macroeconomic uncertainty changes in response to such shocks. The investment impact of conventional monetary shocks, however, remains statistically significant after controlling for the effect of post-shock uncertainty levels. As posited by the investment channel of monetary policy (Ottonello and Winberry 2020; Cloyne et al. 2021), we show that the capital investment's response to conventional monetary shocks is largely dependent on the level of the firm's degree financial flexibility.

Our findings contribute to various strands of literature. The first direct contribution is to provide new insights into the determinants of macroeconomic uncertainty (Bloom 2014) by emphasizing the contributing role of the Fed, both as an executor of monetary policy as well as a producer of market-moving insights. The key takeaway from our results is that policy decisions are not only influenced by general uncertainty (Baker, Bloom, and Davis 2016) but can also significantly contribute to it.

Our findings also enhance the literature focusing on the Fed's growing informational role in the economy (Nakamura and Steinsson 2018; Jarociński and Karadi 2020; Campbell et al. 2012). In particular, our results focusing on the role of market uncertainty in mediating the effects of Fed information shocks on uncertainty and investment, respectively, help explain the dispersed empirical evidence indicating a lack of consistency in the Fed's informational impact (Lunsford 2020; Faust, Swanson, and Wright 2004). That is, such impact is considerably large in periods of widespread uncertainty when the markets look for the Fed to provide a comprehensive narrative that reconciles the conflicting economic signals (Shiller 2017).

Finally, we expand the literature on the effect of monetary shocks on corporate investment (Ottonello and Winberry 2020; Cloyne et al. 2021; Detzel 2017). A key insight from our results is that the failure to separate the effects of conventional monetary shocks from the effects of Fed information shocks significantly biases the inferences regarding the monetary policy's effects on investment. As discussed earlier, Jarociński and Karadi (2020) warn that ignoring the Fed's information shocks leads the empiricist to make wrong inferences about monetary policy non-neutrality in influencing output growth and inflation.

To the best of our knowledge, our paper is the first to extend the insights on the Fed's information role to the realms of investment, at both the aggregate and firm levels. By showing that the effects of Fed information shocks on investment are stronger in the short run than the effects of conventional monetary shocks, a direct implication of our results for empiricists is that controlling for Fed information shocks is critical to yield unbiased assessments of the interest-investment relationship. Such disentanglement allows for a robust assessment of the Fed's non-neutrality both through conventional monetary channels and the alteration of investors' expectations.

This paper proceeds as follows: Section 2 provides a brief background on the origin of Fed information shocks and predicts their implications on investments; Section 3 discusses the identification of monetary shocks and presents the time series analysis of variation in aggregate capital investments; Section 4 presents our firm-level results; and finally, Section 5 concludes.

2 THE FED INFORMATION SHOCKS: ORIGINS AND IMPLICATIONS ON INVESTMENT

The influence of monetary shocks on financial markets and economic activity has been widely investigated (Bernanke and Gertler 1995; Thorbecke 1997; Barakchian and Crowe 2013; Gertler and Karadi 2015). From a conventional perspective, monetary contraction limits the availability of credit (Jiménez et al. 2012; Bernanke and Gertler

1995), which reduces economic output (Gertler and Karadi 2015). In addition to their conventional roles as executors of monetary policy, central banks have also become highly influential information producers. The share of non-monetary news in Fed announcements has increased substantially over the last decades (Cieslak and Schrimpf 2019).

A key insight from Romer and Romer's (2000) results is that investors with access to both Fed-produced and commercial forecasts should primarily focus on the first group of forecasts while mostly ignoring the latter. This is largely due to the superiority of the signals embedded in the Fed's decisions and communications in predicting future economic activity. The growing informational relevance of the Fed has been presented as an explanation of why unemployment forecasts are revised downward, not upward, in response to monetary tightening (Campbell et al. 2012). This is because, in many circumstances, monetary tightening is interpreted as a signal of growing confidence in the economic outlook, which makes inflation considerations more relevant than unemployment (Nakamura and Steinsson 2018).

Where does the Fed's informational influence come from? Romer and Romer (2000) attribute the Fed's informational advantage to its commitment of significant resources to economy-wide forecasting compared to commercial forecasters. Building on the view that markets are in constant pursuit of narratives (Shiller 2017), the Fed – as the most influential macroeconomic player – provides narratives that help investors make sense of the widely dispersed macroeconomic figures. In justifying each decision, the FOMC provides a detailed, wide-reaching, and comprehensive description of the present economic outlook, future economic challenges, and potential policy reactions to such challenges.

The increased verbosity of the Fed over time is much needed especially by investors who struggle to reconcile the conflicting economic signals (Hansen and McMahon 2016). The Fed's strong economic role, combined with the clear objectives of its staff and perceived lack of conflict of interest, makes it a strong focal point and a center of attention for investors trying to make sense of the prevailing economic challenges. Terms such as "Irrational Exuberance" and "Great Moderation" have been popularized by Fed chairs and have become part of the common lingo used to describe significant periods of economic and financial behavior (Shiller 2001; 2017).

Accordingly, the well-researched, consistent, and coherent overview of the economic outlook by the Fed can be treated as a public good that provides much-needed guidance for investors. By providing comprehensive assessments and forecasts that reduce uncertainty about fundamental economic factors, the Fed neutralizes key sources of the uncertainty that investors face. In line with theoretical models that focus on complementarity in information production, the reduction in uncertainty in one key dimension incentivizes further information search that lowers uncertainty about other fundamentals (Goldstein and Yang 2015; Hirshleifer and Sheng 2021).

Thus, while monetary contraction in the conventional sense reduces investment primarily due to credit tightening (Ottonello and Winberry 2020), there are informational conditions whereby rising interest rates can have a positive effect on investment. If the Fed offers credible and new signals about the future of economic activity, then rising interest rates – when conveying a positive assessment of the economic outlook – are expected to be followed by a rise in investment. Within the real options framework (Dixit and Pindyck 1994; Aizenman and Marion 1993; Kang, Lee, and Ratti 2014), by reducing uncertainty, the Fed reduces the value of the "option to wait and see" (Dixit and Pindyck 1994) and incentivizes firms to execute their investment plans. Stressing the relevance of the uncertainty-reducing role of the Fed's insights, the rise in investment in response to positive Fed information shocks is expected to be largely driven by the reduction in economic uncertainty.

3 IDENTIFICATION AND TIME SERIES ANALYSIS

3.1 Identifying conventional and informational shocks

Identifying exogenous monetary shocks is critical to yield an unbiased evaluation of the monetary policy's non-neutral impact on key economic outcomes. Such a requirement led to the growth of a rich body of literature focused on the high-frequency identification of monetary shocks (Ramey 2016; Gertler and Karadi 2015; Gerko and Rey 2017). In this approach, the changes in short-term interest rates in the narrow window surrounding the FOMC announcements are treated as strong proxies of the market's reaction to unanticipated monetary policy action (Gerko and Rey 2017). This identification strategy offers more robust insights into the Fed's role in influencing economic outcomes through conventional monetary policy. Yet, it does not successfully identify the role of the non-monetary and economy-wide signals sent by the Fed in shaping market expectations.

Jarociński and Karadi (2020) offer a refinement of the previously discussed approach to disentangle conventional shocks from informational ones (Breitenlechner, Gründler, and Scharler 2021; Adra 2021). The Jarociński and Karadi (2020) approach capitalizes on the use of high-frequency variables by including in the VAR models the 30-minute changes in the S&P 500 and the three-month Fed funds futures around FOMC announcement. Then, it imposes sign restrictions to disentangle conventional shocks from information ones.

As shown in Table 1, conventional shocks are identified as the changes in interest rates when the high-frequency correlation between the S&P 500 and the Fed funds futures is negative. This indicates that equity investors treat monetary tightening as an indicator of future economic challenges, as suggested by the widely cited monetary literature (Bernanke and Kuttner 2005; Thorbecke 1997). Fed information shocks, in contrast, are identified as the changes in interest rates when the high-frequency correlation between the S&P 500 and the Fed funds futures is positive. This indicates that rising interest rates are treated as a signal of a strong macroeconomic outlook, leading to more favorable valuations in the stock market. These sign restrictions are imposed on a VAR model that includes the natural logarithm of the S&P 500, the monthly Real GDP and GDP deflator (interpolated at the monthly level), the one-year government bond returns, and the excess bond premium.[2]

(Insert Table 1 about here)

Figure 1 reproduces the impulse responses of Jarociński and Karadi (2020) to standard deviation shocks from conventional and informational perspectives. The results highlight distinct patterns between the effects of these shocks. In line with the conventional view, conventional shocks reduce growth, stock market returns, and inflationary pressures. They also increase the excess bond premium. The Fed information shocks signaling a positive economic outlook are associated with subsequent rises in growth and stock returns, higher inflationary expectations, and lower excess bond premia.

(Insert Figure 1 about here)

[2] The reader is advised to check Jarociński and Karadi (2020) for the details of their econometric methodology.

In their online appendix, Jarociński and Karadi (2020) derive the conventional and information shocks from the VAR model from the period between 1990 and 2019. As our analysis in this paper focuses on quarterly data that is more widely available for firm-level and macroeconomic variables, we use the quarterly aggregates of these shocks. The Fed information shocks' distribution in Figure 2 suggests that the contractionary shocks that covey positive economic news usually occur outside recessionary periods, signaling the fed's confidence in the economic outlook. In contrast, the expansionary shocks that convey the Fed's concern about the economic outlook largely occur around and within the periods of economic slack, reflecting the Fed's concerns about the depth of economic contraction or a sluggish economic recovery. This is evident, for instance, in the aftermath of the early 1990s recession which was a period characterized by a sluggish recovery (Graetz and Michaels 2017). The conventional monetary shocks depicted in Figure 3 are aligned with the view that the largest conventional expansionary shocks occur during periods of economic slack, as the Fed tries to restabilize economic conditions (El-Erian 2016). This pattern is aligned with the explicit descriptions provided by policymakers, such as Bernanke's (2015) account of the unprecedented monetary easing measures in response to the 2008 financial crisis.

(Insert Figures 2 and 3 about here)

3.2 Time series variables

Our uncertainty proxy is the macro uncertainty index developed by Jurado et al. (2015) and used in various recent empirical studies (Barbopoulos, Adra, and Saunders 2020; Chan and Marsh 2021; Altig et al. 2020). This approach consists of using a dataset covering 279 economic and financial time series in a system of forecasting equations based on the Stock and Watson (2002) diffusion index method[3]. The forecasting errors from this approach are retrieved over one-, three-, and twelve-month horizons after filtering the effects of autocorrelation and stochastic components.

Our analysis in this paper focuses on the twelve-month horizon to emphasize the ability of conventional and information shocks to influence business expectations for an extended period. In this paper, this index covers the period between the first quarter of 1990 and the second quarter of 2019, for which identified conventional and Fed information shocks are available from the Jarociński and Karadi (2020) online appendix. Figure 4 emphasizes the cyclical nature of uncertainty which increases during periods of negative economic performance (Bloom et al. 2018; Alfaro, Bloom, and Lin 2018) and decreases during periods of economic expansion.

(Insert Figure 4 about here)

In turn, we employ three proxies for capital investment. Our first proxy, inspired by the Gulen and Ion (2016) analysis at the firm level, is the investment rate, consisting of the aggregate quarterly level of capital investments of U.S. firms as a percentage of the one-quarter lags of total assets held by these firms. We label this variable as $InvestmentRate$. Our second proxy, covered in Appendix 1, is the series of quarterly capital expenditures of all U.S. firms, as reported in the FRED Database. Our third proxy, later covered in Appendix 2, focuses on the quarterly sums of capital investment expenditures made by public U.S. companies with available data in the COMPUSTAT database (Series CAPXY).

[3] The dataset covers variables such as real output and income, real retail, manufacturing and trade sales, the dividend-price ratio and earnings-price ratio, employment, growth rates of total dividends and aggregate prices, default spreads, term spreads, etc.

We employ a rich set of macroeconomic controls, as in Gulen and Ion (2016). As a proxy for the pre-shock expectations of economic growth, we include the four-quarter-ahead average GDP growth forecasts based on the Survey of Professional Forecasters. As a proxy for the potential level of disagreement among forecasters, we control for the difference between the 75th and 25th percentiles of reported forecasts. To represent the general expectations about the future economic situation, we control for the level of the Leading Index. Given that consumption represents the largest share of Gross Domestic Product (GDP), we control for the level of the University of Michigan Consumer Confidence index at the end of each quarter. As a proxy for the uncertainty associated with political changes, and in the spirit of Gulen and Ion (2016), we include a dummy variable representing quarters in which a presidential election is taking place. All the time series variables are defined in Table 2 and their descriptive statistics are presented in Table 3.

(Insert Tables 2 and 3 about here)

3.3 Local projection analysis

To test how the effect of conventional and information shocks on macroeconomic uncertainty unfolds over time, we estimate a Jordà (2005)-style local projection where we track the effects of conventional and Fed information shocks on uncertainty and investment over pre-specified horizons. In assessing the impact of these shocks, it is reasonable to assume that these effects are time-varying and considerably more pronounced at times when the market is highly anxious for the Fed's next move. The emphasis on the Fed's time-varying informational influence has been discussed in prior studies, without explicitly quantifying the magnitude of uncertainty. For instance, Lunsford (2020) shows that Fed information shocks are more pronounced in the period surrounding the 2001 recession (between 2000 and 2003), rather than the period that followed (between 2003 to 2006).

Our local projection specification of the variation in uncertainty is presented as follows:

$$\begin{aligned} \ln(Unc_{t+h}) = \gamma^h + \beta^h_{Info}.Info_t + \beta^h_{Info,unc}.Info_t \times HighUnc_{t-1} + \beta^h_{Conv}.Conv_t \\ + \beta^h_{Conv,Unc}.Conv_t \times HighUnc_{t-1} + +\beta^h_{Unc}.HighUnc_{t-1} \\ + f(Control\,Variables_{t-1}) + \epsilon_{t+h} \end{aligned} \quad (1)$$

where Unc_t refers to the value of the Jurado et al. (2015) uncertainty index at the end of each quarter. $Conv_t$ and $Info_t$ represent the quarterly levels of conventional and informational shocks, divided by their respective sample standard deviations, at time t. This approach allows us to assess the impact of standard deviation respective shocks in both the conventional and informational sense. β^h_{Info} represents the effect of the Fed information shocks in periods not characterized by considerable high uncertainty. $\beta^h_{Info} + \beta^h_{Info,Unc}$ represent this effect when the shocks take place during periods of considerably high uncertainty, the dummy variable $HighUncetainty$ being assigned the value of 1 if Unc is larger than its 90th percentile in our sample, and 0 otherwise. An equivalent interpretation applies to β^h_{Conv} and $\beta^h_{Conv} + \beta^h_{Conv,Unc}$ in the case of conventional shocks.

The models covered in Table 4 cover a three-quarter horizon starting with the level of the uncertainty index at the end of the quarter in which the shock takes place ($h = 0, 1, 2, 3$). These results depict two opposing effects of conventional and Fed information shocks on macroeconomic uncertainty. Conventional information shocks significantly contribute to a subsequent reduction in market uncertainty. Such effects are exclusively driven by the information effects occurring during quarters starting with considerably high levels of market uncertainty.

As shown in Table 4, a standard deviation contractionary shock conveying a positive assessment of the economic outlook by the Fed leads, on average, to a decrease in the Jurado et al. (2015) uncertainty index by up to 13% at the end of the quarter. This decline persists to the second quarter after the information shock.[4] Conventional shocks, however, have an opposing effect on market uncertainty. The predicted negative effects of conventional shocks are focused on periods of high uncertainty where a standard deviation contractionary shock leads to a decline in uncertainty by up to 5% by the end of the subsequent quarter. This cumulative effect persists until the end of the second quarter and fades by the end of the third one.[5]

As both the Fed's informational and conventional effects start declining from their peaks by the end of $h = 1$, the last model in Table 4 reassesses the variation in uncertainty over this horizon after controlling for the changes in credit conditions after Fed shocks. Our proxy for the changes in these conditions is Moody's seasoned Baa corporate bond yield relative to yield on 10-Year treasury constant maturity, made available on the website of the Federal Reserve Bank of St Louis. This proxy is used in prior studies emphasizing the Fed's influence on monetary conditions (Bordo and Haubrich 2010; Cenesizoglu and Essid 2012).

Accordingly, we expand the local projection specification by including as additional controls the dummy variable $CorporateBondPremiumRise_{t+1}$ which is

[4] As both the conventional and Fed information shocks are standardized through division by their respective sample standard deviations, the reported coefficients represent the response of the dependent variable to a one unit (i.e. one standard deviation) increase in the corresponding shock variable.
[5] In additional analysis, we expand our estimations to up to eight horizons after the monetary shocks. We do not find consistent effects of either conventional or information shocks on macroeconomic uncertainty in these longer horizons.

assigned the value of 1 if corporate bond premia rise by more than half a standard deviation in the aftermath of monetary shocks, and 0 otherwise. We also add the interaction of this variable with the presence of high uncertainty before the monetary shock. Similarly, we add the variable $CorporateBondPremiumDecline_{t+1}$ which is assigned the value of 1 if corporate bond premia decrease by more than half a standard deviation in the aftermath of monetary shocks, and 0 otherwise. This variable's interaction with the dummy variable referring to high uncertainty periods is also introduced.

The key insight from this specification is that the effect of conventional monetary contraction on macroeconomic uncertainty becomes statistically and economically insignificant after controlling for the effect of large post-shock changes in external financing costs. This result suggests that the rise in uncertainty in response to conventional contraction is a direct by-product of sizeable variation in credit conditions triggered by such shocks. However, the negative cumulative effect of positive Fed information shocks on macroeconomic uncertainty is robust to controlling for changes in credit conditions. This finding supports the view that the effects of the Fed information shocks on macroeconomic uncertainty extend beyond the monetary policy's direct influence on credit conditions.[6]

(Insert Table 4 about here)

We present our local projection analysis in Table 5 where we estimate the following specification:

[6] The effects of control variables are aligned with the view that deteriorating economic conditions contribute to the rise in uncertainty (see Bekaert, Hoerova, and Duca (2013)). Specifically, uncertainty increases in response to declining consumer confidence, deflationary pressures, and reduced growth forecasts.

$$
\begin{aligned}
&(InvestmentRate_{t+h} - InvestmentRate_t) \\
&\quad = \gamma^h + \beta^h_{Info}.Info_t + \beta^h_{Info,unc}.Info_t \times HighUnc_{t-1} + \beta^h_{Conv}.Conv_t \\
&\quad + \beta^h_{Conv,Unc}.Conv_t \times HighUnc_{t-1} + +\beta^h_{Unc}.HighUnc_{t-1} + f(Control\,Variables_{t-1}) + \epsilon_{t+h}
\end{aligned}
\tag{2}
$$

The results from Table 5 are strongly supportive of our prediction in Section 1. A standard deviation contractionary shock that conveys a positive assessment of the economic outlook leads the aggregate capital investment rate to increase by roughly 1.5% over the subsequent two quarters relative to its level at the time of the shock. Over the same horizon, a standard deviation contractionary shock leads to a decrease in this rate by roughly 0.7%. In Appendices 1 and 2, we show that similar patterns hold when the local projection analyses are applied to the growth in the levels of aggregate capital investment and the investments by public firms, respectively.

(Insert Table 5 about here)

An interesting observation that emerges from the analyses of the growth in investment levels and investment rates is that the effects of standardized Fed information shocks are economically larger than the effects of conventional monetary shocks. These findings provide further support for the emphasis by Jarociński and Karadi (2020), among others, on the importance of disentangling conventional shocks from informational ones to accurately assess the non-neutral economic impacts of monetary policy.

4. FIRM-LEVEL ANALYSIS

4.1 Panel-level data

In this section, we resort to panel regression analysis to determine if our main inferences from the time series analysis hold at the firm level after controlling for a rich set of firm-specific and macroeconomic control factors. We test our predictions on a comprehensive sample covering firms for which quarterly data is available from COMPUSTAT and a large set of control variables are available from the multiple resources discussed below.

In addition to the macroeconomic control factors covered in Section 3, our panel regression analysis covers various firm-related factors. We treat the growth in the firm-specific investment rate as a proxy for firm-level investment, which we label as *Firm_InvestmentRate*. This rate is used as a primary proxy for firm-level investment in prior studies (See Gulen and Ion (2016), Kahle and Stulz (2013), and Cloyne et al. (2021)). We calculate this variable by taking the quarterly level of CAPX as a percentage of the one-quarter-lagged level of firm-level assets. In Appendix 3, we follow the approach used by Ottonello and Winberry (2020) and which focuses on the growth in firm-level CAPX in logarithmic form. As in Gulen and Ion (2016), we cover various firm-related factors such as the quarterly RoA, cash flows from operations, revenue growth, leverage, and total assets. These variables are described in detail in Table 6. Overall, most of the empirical variables discussed above are available for 17,795 firms and 519,781 firm-quarter observations for the period between 1990 and 2019. The descriptive statistics of all the firm-level variables are reported in Table 7.

(Insert Tables 6 and 7 about here)

4.2 Panel local projection

Our panel local projection analysis of the growth in firm-level investment rates for each horizon h in Table 8 is based on the following specification:

$$
\begin{aligned}
&(Firm\_InvestmentRate_{i,t+h} - Firm\_InvestmentRate_{i,t}) \\
&\quad = \alpha_{i,h} + \alpha_{sy,h} + \beta^h_{Info}.Info_t + \beta^h_{Info,unc}.Info_t \times HighUnc_{t-1} + \beta^h_{Conv}.Conv_t \\
&\quad + \beta^h_{Conv,Unc}.Conv_t \times HighUnc_{t-1} + +\beta^h_{Unc}.HighUnc_{t-1} + f(Firm\ Control\ Variables_{i,t-1}) \\
&\quad + f(Economic\ Control\ Variables_{t-1}) + \epsilon_{t+h}
\end{aligned} \tag{3}
$$

$\alpha_{i,h}$ presents the firm fixed effect at each h quarter after the quarter of the monetary shock. Moreover, building on the recognition of the heterogeneous exposure of broad sectors to shocks (Ottonello and Winberry 2020), $\alpha_{sy,h}$ represents the sector-calendar-year fixed effect to control for the differences in sectoral exposure to shocks over time. Clustering-wise, the reported results are based on two-way clustering by firm and quarter, as in Gulen and Ion (2016) and Ottonello and Winberry (2020). This approach is recommended by Petersen (2009) to correct cross-sectional and serial correlation in the error term ϵ_{t+h}.

The general insights from the changes in the investment rate analysis at the firm level in Table 8 are aligned with those of our analysis of the investment rate at the aggregate level in Section 4. In particular, a standard deviation contractionary shock that conveys positive economic news in response to high uncertainty increases the quarterly capital investment rate by roughly 0.7% (equivalent to roughly 40% of the mean investment rate in the sample) over the subsequent two quarters. A conventional contraction by the same magnitude, however, reduces this rate by roughly 0.34% over the same horizon. The evidence from Appendix 3, which focuses on the growth in firm-level CAPX, provides similar patterns.

(Insert Table 8 about here)

The last column in Table 8 offers additional insights into the mechanisms via which conventional and information shocks influence firm-level investment. Our main prediction is that the investment impact of the Fed information shocks on investment is largely driven by the extent to which macroeconomic uncertainty changes in the aftermath of such shocks. To test this prediction, we expand the local projection model at $h = 4$, which is the last horizon at which the cumulative investment effects of conventional and Fed information shocks are jointly significant. In this expanded specification, we add as an additional regressor the sum of the Jurado et al. (2015) uncertainty index over the three quarters that follow the shock. As predicted, we find that the leading effects of Fed information shocks on corporate investment become insignificant when the post-shock uncertainty levels are controlled for. Moreover, in line with the predictions of the real options theory, we find that such uncertainty levels have a significant negative influence on investment.[7]

When it comes to the conventional impact of monetary shocks on investments, the results from the expanded specification at $h = 4$ are strongly aligned with the predictions of the investment channel. A key prediction of the New Keynesian model of Ottonello and Winberry (2020) is that the extent to which monetary shocks – as traditionally perceived – affect investment strongly depends on the level of the firm's financial riskiness. In particular, low leverage is predicted to make the firm more flexible in adjusting its investments in response to conventional monetary shocks. This effect is largely attributed to the relatively flat marginal cost of financing that characterize low-risk firms. Our results support this view by showing that investments by firms with low pre-shock leverage are more responsive to conventional monetary shocks than investments by firms with high pre-shock leverage.[8]

[7] In alternative estimations over a smaller subsample, we expand our analysis by controlling for the effects of executive compensation deltas and vegas on capital investment. These additional variables areretrieved from Professor Lalitha Naveen's webpage. Our main insights regarding the effects of conventional and Fed information shocks on investment are robust to the inclusion of these additional controls.

[8] When it comes to the control factors covered in Table 8, the results are generally aligned with those covered in prior studies. In line with Caraiani (2022), we show that size and prior performance have positive influence on investments.

It is also worth noting that, with post-shock uncertainty levels included in the model, the effects of Fed information shocks on investment remain insignificant across different levels of firm leverage. Therefore, a key takeaway from our results is that, while the firm's financial flexibility plays a key role in shaping the effects of the conventional monetary shocks on investment, the effects of Fed information shocks on investments are largely explained by the magnitude of post-shock uncertainty.[9]

5. CONCLUSION

Put together, our results add new emphasis from the realms of uncertainty and corporate investments on the importance of separating conventional monetary shocks from the shocks conveying new assessments of the economic outlook by the Fed. In the first part of the paper, we use the conventional and information shocks from the Jarociński and Karadi (2020) model to explain the time series variation in Jurado, Ludvigson, and Ng's (2015) macroeconomic uncertainty index. We find that conventional monetary contraction triggers a subsequent rise in uncertainty. This rise is explained by the large changes in credit conditions. However, monetary contraction that conveys a positive economic assessment by the Fed leads to a significant decrease in uncertainty. These effects are pronounced in the high-uncertainty periods when markets await Fed decisions and communications with high anticipation. We also document the significant negative (positive) effect of conventional (informational) shocks on various proxies of investments.

Also, as in Caraiani (2022), we show that high leverage is a significant contributor to the decrease in investment. However, it is worth noting that Caraiani (2022) focus on the contemporaneous effects of monetary policy rather than a local projection over a horizon

[9] In alternative estimations, we follow a reviewer's suggestion by specifying models that include four-quarter lags of conventional and information shocks, in addition to the lags of the capital investment rate growth. The results from these specifications are aligned with our empirical conclusions in the paper, and available upon request.

The second part of the paper applies a panel data analysis to examine how monetary shocks influence the investment dynamics of a comprehensive sample of U.S. public firms. We find that the main inferences from our time series analysis are valid at the firm level, after controlling for a wide range of firm-specific and macroeconomic variables. Moreover, we find the positive influence of Fed information shocks on investment is largely dependent on the extent to which such shocks manage to reduce macroeconomic uncertainty. The investment effects of conventional monetary shocks, in turn, primarily depend on the firm's financial flexibility.

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Table 1: Identification restrictions in the Jarociński and Karadi (2020) VAR model

	Class of Shocks		
Variable	Conventional	Informational	Other
Interest Rate	+	+	0
Stock Returns	-	+	0
Other Variables	No Restr	No Restr	No Restr

Note: This table presents the sign restrictions used by Jarociński and Karadi (2020) to identify conventional and Fed information shocks in their VAR model. +, – refer to sign restrictions, while 0 and "No Restr" refer to zero restrictions and unrestricted responses, respectively.

Table 2: Time series variables

Variable	Description	Source
Unc	The level of the Jurado et al. (2015) macroeconomic uncertainty index at the end of each quarter.	Sydney Ludvigson's website
$Conv$	The quarterly aggregated VAR-imputed conventional monetary shocks, scaled by the standard deviation in the sample.	The Online Appendix of Jarociński and Karadi (2020)
$Info$	The quarterly aggregated VAR-imputed Fed information shocks, scaled by the standard deviation in the sample .	The Online Appendix of Jarociński and Karadi (2020)
$Unemp$	The U.S. civilian unemployment rate at the end of each quarter.	U.S. Bureau of Labor Statistics, Unemployment Rate [UNRATE], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/UNRATE
CPI	The U.S. Consumer Price Index at the end of each quarter.	U.S. Bureau of Labor Statistics, Consumer Price Index for All Urban Consumers: All Items in U.S. City Average [CPIAUCSL], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/CPIAUCSL
$StockReturn$	The excess return on the market, value-weight return of all CRSP firms incorporated in the US and listed on the NYSE, AMEX, or NASDAQ that have a CRSP share code of 10 or 11 over the one-month T-bill rate.	Kenneth French's Data Library (Fama and French 1996)
$CAPX$	Total quarterly capital expenditures of all U.S. firms, in millions of dollars.	Board of Governors of the Federal Reserve System (US), All Sectors; Total Capital Expenditures, Transactions [BOGZ1FA895050005Q], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/BOGZ1FA895050005Q
$PubCAPX$	Total quarterly capital expenditures (series: CAPXY) for all U.S. public firms covered in COMPUSTAT, in millions of dollars.	COMPUSTAT
$CorporateBondPremium$	Moody's seasoned Baa corporate bond yield relative to yield on 10-Year treasury constant maturity.	Federal Reserve Bank of St. Louis, Moody's Seasoned Baa Corporate Bond Yield Relative to Yield on 10-Year Treasury Constant Maturity [BAA10YM], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/BAA10YM
$CorporateBondPremiumRise_{t+k}$	Dummy=1 if the bond yield premium in quarter $t+k$ increases by more than half a standard deviation (0.20%) relative to the quarter k of the monetary shock, and 0 otherwise.	Federal Reserve Bank of St. Louis, Moody's Seasoned Baa Corporate Bond Yield Relative to Yield on 10-Year Treasury Constant Maturity [BAA10YM], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/BAA10YM
$CorporateBondPremiumDecline_{t+k}$	Dummy=1 if the bond yield premium in quarter $t+k$ decreases by more than half a standard deviation (0.20%) relative to the	Federal Reserve Bank of St. Louis, Moody's Seasoned Baa Corporate Bond Yield Relative to Yield on 10-Year Treasury Constant Maturity [BAA10YM], retrieved from

	quarter k of the monetary shock, and 0 otherwise.	FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/BAA10YM
$ElectionIndicator$	Dummy=1 if a presidential election is held during the quarter, and 0 otherwise.	Federal Elections Commission
$GDPForecasts$	For each quarter t, this variable represents the mean level of GDP growth forecasts provided in the Survey of Professional Forecasters for quarter *t+4*.	Survey of Professional Forecasters
$GDPForecastsDispersion$	For each quarter t, this variable represents the difference between the 75th percentile and the 25th percentile of the individual forecasts reported in the Survey of Professional forecasters for quarter *t+4*.	Survey of Professional Forecasters
$LeadingIndex$	A prediction of the six-month ahead coincident index of the aggregate U.S. economy. In addition to the coincident index, the models include other variables that lead the economy: housing permits (1 to 4 units), initial unemployment insurance claims, delivery times from the Institute for Supply Management (ISM) manufacturing survey, and the interest rate spread between the 10-year Treasury bond and the 3-month Treasury bill.	Federal Reserve Bank of Philadelphia, Leading Index for the United States [USSLIND], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/USSLIND
$TotalAssets$	The value of the aggregate assets held by non-financial U.S. corporations, in millions of dollars.	Board of Governors of the Federal Reserve System (US), Nonfinancial Corporate Business; Total Assets, Level [TABSNNCB], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/TABSNNCB
$InvestmentRate$	The total capital expenditure (*CAPX*) for each quarter, as a percentage of the prior quarter's level of total assets (*TotalAssets*).	Board of Governors of the Federal Reserve System (US), Nonfinancial Corporate Business; Total Assets, Level [TABSNNCB], retrieved from FRED, Federal Reserve Bank of St. Louis

Note: This table presents the name, description, and source of each time-series variable used in our analysis.

Table 3: Descriptive statistics of time series variables

Variable	# of Obs.	Mean	25th Pct	Median	75th Pct	SD
Unc	118	0.90	0.87	0.89	0.91	0.05
$Conv$	118	0.00	-0.22	0.13	0.56	1.00
$Info$	118	0.00	0.00	0.00	0.37	1.00
$Unemp(\%)$	118	5.87	4.70	5.50	6.78	1.59
CPI	118	192.83	160.45	190.75	228.20	37.31
$StockReturn(\%)$	118	1.97	-1.42	3.12	6.59	8.05
$CAPX(\$m)$	118	3,573,015.03	2,571,859.50	3,600,990.00	4,344,832.50	1,177,913.86
$TotalAssets(\$m)$	118	23,532,591.03	13,680,996.00	23,729,649.50	30,113,551.50	9,844,278.01
$InvestmentRate(\%)$	118	16.08	14.32	15.85	18.01	2.02
$PubCAPX(\$m)$	118	306,793.43	168,897.05	300,826.30	403,834.63	166,624.91
$CorporateBondPremium(\%)$	118	2.37	1.78	2.27	2.83	0.75
$ElectionIndicator$	118	0.06	0.00	0.00	0.00	0.24
$ConsumerConfidence$	118	87.61	78.38	90.65	95.78	11.91
$GDPForecasts(\%)$	118	4.90	4.41	4.89	5.47	0.77
$GDPForecastsDispersion(\%)$	118	0.81	0.64	0.77	0.97	0.25
$LeadingIndex$	118	1.24	0.99	1.49	1.70	0.79

Note: This table presents the key descriptive statistics of the time series variables used in this paper. For each variable, the available number of observations, mean, median, 25th, and 75th percentiles, in addition to the standard deviation, are reported.

Table 4: Local projection analysis of monetary shocks' effects on macroeconomic uncertainty

Variables\Quarter	$h=0$	$h=1$	$h=2$	$h=3$	$h=1$
Intercept	-1.610***	-1.922***	-2.352***	-2.526***	-1.930***
	(0.281)	(0.304)	(0.311)	(0.384)	(0.244)
$Info_t$	0.002	0.002	0.003	0.001	0.001
	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)
$Info_t \times HighUnc_{t-1}$	-0.131***	-0.099***	-0.094***	-0.017	-0.050**
	(0.027)	(0.030)	(0.021)	(0.037)	(0.025)
$Conv_t$	0.001	-0.001	-0.001	0.002	-0.0003
	(0.002)	(0.003)	(0.003)	(0.004)	(0.002)
$Conv_t \times HighUnc_{t-1}$	0.051***	0.051***	0.040***	0.016	0.010
	(0.013)	(0.014)	(0.009)	(0.016)	(0.013)
$HighUnc_{t-1}$	0.086***	0.116***	0.127***	0.088***	0.020
	(0.013)	(0.015)	(0.015)	(0.018)	(0.021)
$\ln(CAPX_{t-1})$	0.073	0.092	0.116	0.170*	0.090
	(0.067)	(0.073)	(0.074)	(0.090)	(0.058)
$\ln(TotalAssets_{t-1})$	0.249***	0.287***	0.337***	0.317***	0.270***
	(0.071)	(0.077)	(0.079)	(0.097)	(0.062)
$Unemp_{t-1}$	0.001	-0.0002	0.002	0.002	0.004
	(0.003)	(0.004)	(0.004)	(0.004)	(0.003)
$\ln(CPI_{t-1})$	-0.708***	-0.825***	-0.983***	-1.030***	-0.775***
	(0.120)	(0.131)	(0.137)	(0.172)	(0.105)
$StockReturn_{t-1}$	-0.0001	-0.0002	-0.0002	0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$ElectionIndicator_{t-1}$	0.001	-0.007	-0.005	-0.011	-0.006
	(0.009)	(0.010)	(0.010)	(0.012)	(0.008)
$ConsumerConfidence_{t-1}$	-0.0007*	-0.001***	-0.0009**	-0.0009*	-0.0004
	(0.0004)	(0.0004)	(0.0005)	(0.0005)	(0.0004)
$GDPForecasts_{t-1}$	-0.008**	-0.003	-0.001	-0.005	-0.005
	(0.004)	(0.005)	(0.005)	(0.006)	(0.004)
$GDPForecastsDispersion_{t-1}$	0.000	-0.008	-0.025**	-0.034**	-0.003
	(0.001)	(0.012)	(0.012)	(0.015)	(0.010)
$LeadingIndex_{t-1}$	-0.009	0.006	0.012*	0.011	0.001
	(0.007)	(0.007)	(0.007)	(0.009)	(0.006)
$CorporateBondPremiumRise_{t+1}$					0.023***
					(0.005)
$CorporateBondPremiumRise_{t+1} \times HighUnc_{t-1}$					0.152***
					(0.028)
$CorporateBondPremiumDecline_{t+1}$					0.003
					(0.005)
$CorporateBondPremiumDecline_{t+1} \times HighUnc_{t-1}$					0.073***
					(0.020)
N	117	116	115	114	116
Adjusted R-Squared	0.77	0.73	0.73	0.60	0.81

Note: This table presents the estimation of the local projection specification of the effects of conventional and Fed information shocks on macroeconomic uncertainty. The first four models are specified by Equation (1) for a horizon of three quarters. The last column reassesses the impacts of these shocks on macroeconomic uncertainty at $h = 1$ after controlling the effect of post-shock changes in the corporate bond yield premia. ***, **, and * represent significance at the 1%, 5%, and 10% levels, respectively. Standard errors are reported within parentheses. All variables are defined in Table 2.

Table 5: Local projection analysis of monetary shocks' effects on the growth in the capital investment rate

Variables\Quarter	$h = 1$	$h = 2$	$h = 3$	$h = 4$	$h = 5$	$h = 6$	$h = 7$	$h = 8$
Intercept	4.007	12.751***	20.927***	28.878***	35.477***	43.417***	52.960***	61.827***
	(2.529)	(3.878)	(4.770)	(5.474)	(6.435)	(6.752)	(7.174)	(6.971)
$Info_t$	-0.004	-0.009	-0.014	-0.060	-0.089*	-0.103	-0.060	-0.103
	(0.017)	(0.027)	(0.034)	(0.040)	(0.054)	(0.066)	(0.079)	(0.080)
$Info_t \times HighUnc_{t-1}$	1.290***	1.457***	1.027*	0.173	-0.420	0.062	-0.619	-0.449
	(0.214)	(0.577)	(0.306)	(0.599)	(0.406)	(0.188)	(0.508)	(0.581)
$Conv_t$	-0.002	0.047	0.010	-0.027	-0.058	-0.086	-0.035	-0.001
	(0.031)	(0.034)	(0.043)	(0.051)	(0.067)	(0.073)	(0.076)	(0.062)
$Conv_t \times HighUnc_{t-1}$	-0.588***	-0.707***	-0.659**	0.173	0.120	0.063	0.129	0.064
	(0.097)	(0.260)	(0.279)	(0.599)	(0.200)	(0.187)	(0.289)	(0.279)
$HighUnc_{t-1}$	-0.119	-0.548**	-0.994***	-1.177***	-0.801***	-0.674**	-0.590	-0.401
	(0.138)	(0.251)	(0.247)	(0.281)	(0.308)	(0.323)	(0.378)	(0.312)
$\ln(CAPX_{t-1})$	-1.194*	-2.960**	-3.950***	-5.184***	-7.494***	-9.601***	-11.626***	-14.053***
	(0.637)	(1.212)	(1.343)	(1.401)	(1.488)	(1.598)	(1.643)	(1.682)
$\ln(TotalAssets_{t-1})$	0.348	0.968	0.227	0.137	1.393	2.244	2.789*	3.577**
	(0.843)	(1.633)	(1.762)	(1.653)	(1.842)	(1.644)	(1.668)	(1.583)
$Unemp_{t-1}$	0.060*	0.091*	0.133**	0.155**	0.148**	0.153**	0.120	0.038
	(0.032)	(0.053)	(0.058)	(0.065)	(0.074)	(0.078)	(0.080)	(0.081)
$\ln(CPI_{t-1})$	1.348	2.793	6.288**	8.551***	9.738***	11.403***	13.614***	16.294***
	(1.336)	(3.377)	(2.732)	(2.714)	(3.542)	(3.324)	(3.420)	(3.069)
$StockReturn_{t-1}$	0.004***	0.003*	0.004**	0.004*	0.003	-0.001	-0.001	-0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)	(0.004)
$ElectionIndicator_{t-1}$	-0.026	0.053	0.150	0.185	0.349*	0.310**	0.362**	0.310*
	(0.075)	(0.081)	(0.146)	(0.201)	(0.198)	(0.140)	(0.167)	(0.162)
$ConsumerConfidence_{t-1}$	0.005	0.007	0.015*	0.019**	0.021**	0.025***	0.027***	0.028***
	(0.004)	(0.008)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)	(0.010)
$GDPForecasts_{t-1}$	0.023	-0.045	-0.016	-0.005	0.058	0.107	0.206*	0.288***
	(0.048)	(0.078)	(0.091)	(0.097)	(0.136)	(0.114)	(0.107)	(0.103)
$GDPForecastsDispersion_{t-1}$	0.042	-0.061	0.010	-0.016	0.187	0.172	-0.020	0.290
	(0.141)	(0.234)	(0.243)	(0.303)	(0.330)	(0.315)	(0.358)	(0.307)
$LeadingIndex_{t-1}$	-0.002	-0.137	-0.397**	-0.564***	-0.519***	-0.576***	-0.767***	-0.812***
	(0.080)	(0.146)	(0.171)	(0.180)	(0.183)	(0.156)	(0.158)	(0.153)
N	116	115	114	113	112	111	110	109
Adjusted R-Squared	0.27	0.35	0.47	0.57	0.62	0.69	0.74	0.77

Note: This table presents the estimation of the local projection specification of the effects of conventional and Fed information shocks on growth in the capital investment rate. The estimations follow Equation (2) for up to 8 quarters ahead. ***, **, and * represent significance at the 1%, 5%, and 10% levels, respectively. Heteroscedasticity-robust standard errors are reported within parentheses. All variables are defined in Table 2.

Table 6: Firm-level variables

Variable	Description	Source
Firm_CAPX	The quarterly value of capital expenditures for each firm, in millions of dollars.	COMPUSTAT
Firm_InvestmentRate	*Firm_CAPX* as a percentage of the one-quarter lagged level of *Firm_Assets*.	COMPUSTAT
Firm_Assets	The quarterly value of recorded assets for each firm, in millions of dollars.	COMPUSTAT
Firm_RoA	The firm's quarterly Return on Assets (%).	COMPUSTAT
Firm_RevenuesGrowth	The growth in the firm's revenues relative to the previous quarter.	COMPUSTAT
Firm_CashFlows	The firm's quarterly operating cash flows as a percentage of the prior quarter's asset level.	COMPUSTAT
Firm_Debt	The total debt as a percentage of the total assets.	COMPUSTAT

Note: This table presents the name, description, and source of each firm-level variable used in our analysis.

Table 7: Descriptive statistics of the firm-level variables

Variable	# of Obs.	Period	Mean	25th Pct	Median	75th Pct	SD
Firm_CAPX	519,781	1990-2019	50.89	0.18	1.71	12.005	349.61
Firm_InvestmentRate	519,781	1990-2019	1.78	0.32	0.82	1.88	3.62
Firm_Assets	519,781	1990-2019	3,185.06	33.52	181.21	997.43	18,183.49
Firm_RevenuesGrowth	519,781	1990-2019	40.26	0.00	44.22	83.69	171.87
Firm_CashFlows	519,781	1990-2019	-2.08	-3.51	2.17	7.28	32.07
Firm_RoA	519,781	1990-2019	-3.63	-2.84	0.45	1.86	32.70
Firm_Debt	519,781	1990-2019	57.77	30.06	50.28	70.45	48.44

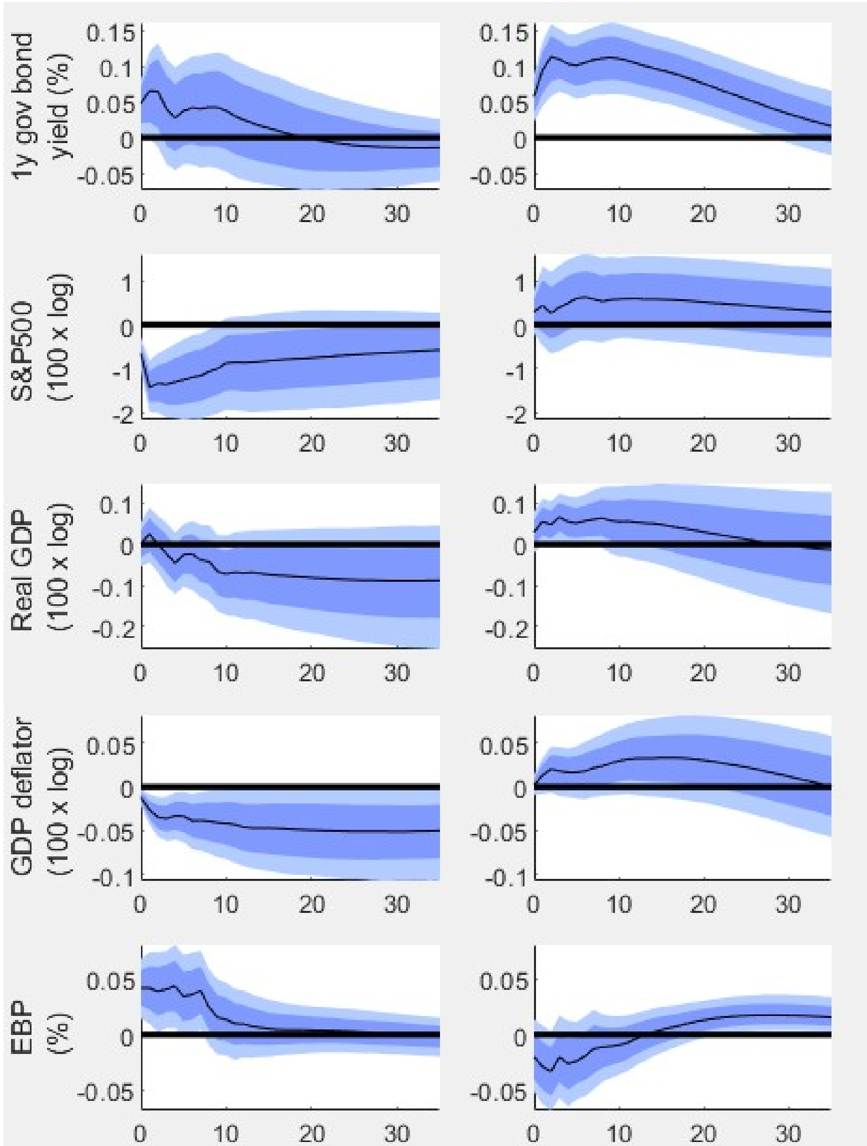
Note: This table presents the key descriptive statistics of the firm-level variables used in this paper. For each variable, the available number of observations, the period covered, mean, median, 25th, and 75th percentiles, in addition to the standard deviation, are reported.

Table 8: Local projection analysis of the growth in firm-level investment rates

Variables\Quarter	$h = 1$	$h = 2$	$h = 3$	$h = 4$	$h = 5$	$h = 6$	$h = 7$	$h = 8$	$h = 4$
$Info_t$	-0.006	0.002	-0.038	0.004	-0.002	0.254	0.515	2.359	0.070
	(0.019)	(0.028)	(0.032)	(0.034)	(0.032)	(1.922)	(2.000)	(2.095)	(0.051)
$Info_t \times HighUnc_{t-1}$	0.477***	0.686***	0.422**	0.367**	0.102	-0.192	-0.364	-0.316	0.192
	(0.124)	(0.183)	(0.208)	(0.184)	(0.205)	(12.060)	(12.354)	(12.695)	(0.240)
$Conv_t$	-0.009	0.005	0.005	0.024	-0.024	-0.758	0.656	-0.386	0.509***
	(0.011)	(0.017)	(0.019)	(0.020)	(0.019)	(1.107)	(1.138)	(1.171)	(0.039)
$Conv_t \times HighUnc_{t-1}$	-0.183***	-0.339***	-0.265***	-0.254***	-0.082	-0.357	-0.020	0.067	-0.000
	(0.057)	(0.084)	(0.096)	(0.101)	(0.094)	(5.535)	(5.675)	(5.822)	(0.000)
$HighUnc_{t-1}$	-0.034	-0.217**	-0.360***	-0.384***	-0.323***	2.235	1.571	3.064	-0.452***
	(0.065)	(0.096)	(0.109)	(0.116)	(0.108)	(6.348)	(6.523)	(6.698)	(0.020)
$ln(Firm\_Assets_{t-1})$	0.248***	0.415***	0.445***	0.504***	0.585***	5.135**	4.214*	5.626**	0.509***
	(0.021)	(0.032)	(0.037)	(0.039)	(0.037)	(2.169)	(2.245)	(2.322)	(0.039)
$Firm\_CashFlows_{t-1}$	0.000	0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.002)	(0.002)	(0.000)
$ln(Firm\_CAPX_{t-1})$	-0.245***	-0.355***	-0.344***	-0.453***	-0.540***	-5.789***	-4.668***	-5.906***	-0.452***
	(0.011)	(0.016)	(0.019)	(0.020)	(0.018)	(1.096)	(1.135)	(1.175)	(0.020)
$Firm\_RevenuesGrowth_{t-1}$	-0.000	-0.000	-0.001	-0.000	-0.001	0.001	0.000	-0.001	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)
$Firm\_Debt_{t-1}$	-0.009***	-0.012***	-0.000	-0.001	-0.002***	-0.052	-0.056*	-0.053	-0.001
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.033)	(0.035)	(0.036)	(0.001)
$Firm\_RoA_{t-1}$	0.002***	-0.003***	0.005***	0.006***	0.007***	-0.025	-0.036	-0.022	0.006***
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.053)	(0.056)	(0.054)	(0.001)
$ln(CPI_{t-1})$	-0.404	-0.743	-1.324**	-0.389	-0.355	16.108	28.303	-7.017	-0.222
	(0.331)	(0.489)	(0.566)	(0.607)	(0.576)	(34.463)	(35.969)	(37.495)	(0.623)
$Unemp_{t-1}$	0.002	0.006	0.018	0.028	0.074***	0.308	0.104	0.470	-0.027
	(0.012)	(0.018)	(0.021)	(0.022)	(0.021)	(1.238)	(1.277)	(1.319)	(0.025)
$ConsumerConfidence_{t-1}$	0.001	0.000	0.000	-0.003	0.006*	0.015	0.100	0.108	-0.004
	(0.002)	(0.003)	(0.004)	(0.004)	(0.004)	(0.210)	(0.219)	(0.226)	(0.004)
$GDPForecasts_{t-1}$	-0.059**	-0.149***	-0.141***	-0.090*	-0.099**	1.634	2.959	-0.398	-0.106**
	(0.027)	(0.040)	(0.046)	(0.049)	(0.047)	(2.791)	(2.898)	(2.984)	(0.052)
$GDPForecastsDispersion_{t-1}$	0.037	-0.035	-0.001	0.081	0.104	-5.853	5.605	-1.083	0.056
	(0.057)	(0.084)	(0.096)	(0.102)	(0.096)	(5.738)	(5.901)	(6.089)	(0.105)
$LeadingIndex_{t-1}$	0.030	0.054	0.004	0.016	-0.107**	1.030	-0.038	2.455	0.041
	(0.029)	(0.043)	(0.050)	(0.054)	(0.051)	(3.049)	(3.160)	(3.263)	(0.057)
$StockReturn_{t-1}$	0.007***	0.008***	0.011***	0.005**	0.009***	-0.028	-0.048	-0.040	0.004*
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.136)	(0.144)	(0.149)	(0.003)
$Election_{t-1}$	-0.372***	-0.308***	-0.361***	-0.194***	-0.389***	16.370***	-2.059	-2.100	-0.180**
	(0.044)	(0.065)	(0.074)	(0.078)	(0.073)	(4.283)	(4.402)	(4.551)	(0.080)
$Conv_t \times Firm\_Debt_{t-1}$									0.002***
									(0.000)
$Info_t \times Firm\_Debt_{t-1}$									-0.001
									(0.001)
$Unc_{t+1} + Unc_{t+2} + Unc_{t+3}$									-1.198***
									(0.237)
Firm Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year-Sector Effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
N	469,718	458,067	444,349	430,601	416,862	403,213	389,998	377,368	430,601
Adjusted R-Squared	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

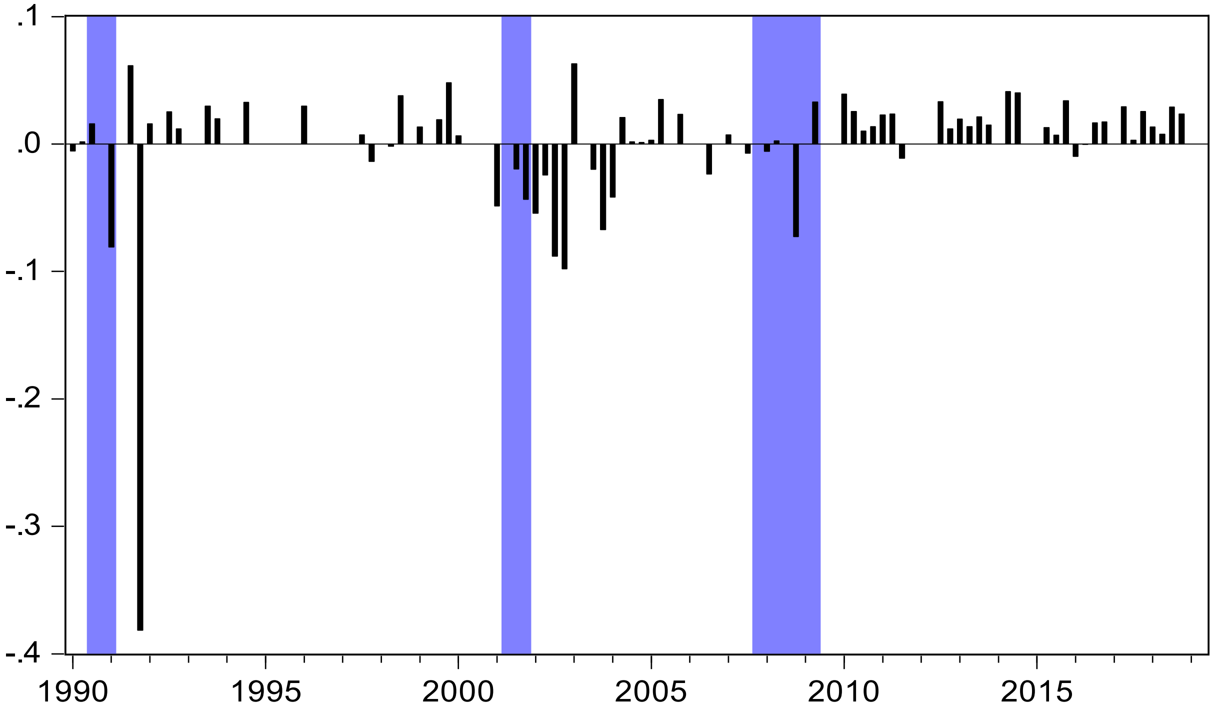
Note: This table presents the estimation of the local projection specification of the effects of conventional and Fed information shocks on the growth in firm-level investment rates. The first eight columns follow Equation (3) for up to 8 quarters ahead. In the last column, we expand the local projection specification at $h = 4$ by including both the sum of the post-shock levels in macroeconomic uncertainty and the interactions between conventional (information) shocks and pre-shock firm-level debt. ***, **, and * represent significance at the 1%, 5%, and 10% levels, respectively. Heteroscedasticity-robust standard errors are reported within parentheses. All variables are defined in Tables 2 and 6.

Figure 1: Impulse response effects from the Jarociński and Karadi (2020) model



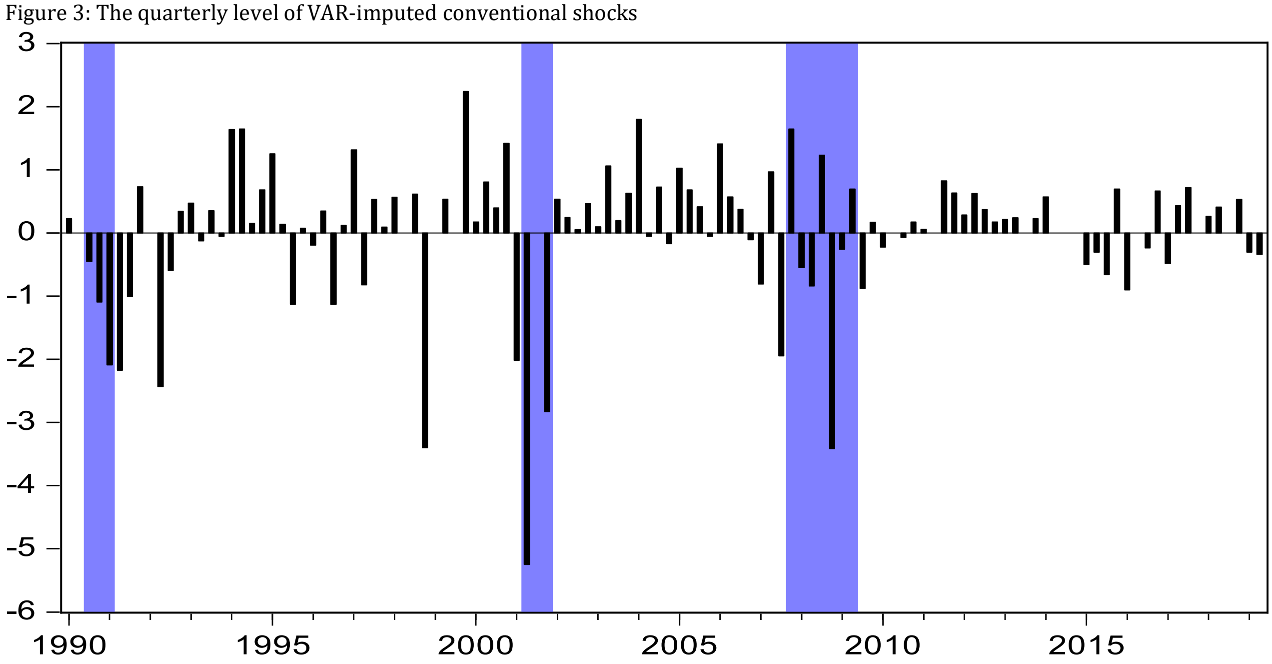
Note: This figure replicates the impulse response analysis of Jarociński and Karadi (2020), specifically their Figure 2. The left panel depicts the effect of a standard deviation conventional contraction, while the right panel depicts the effects of a standard deviation Fed information shock. Black represents the median effects; the darker band of blue represents effects between percentiles16 to 84 , and the lighter band represents effects between percentiles 5 to 95.

Figure 2: The quarterly level of VAR-imputed Fed information shocks



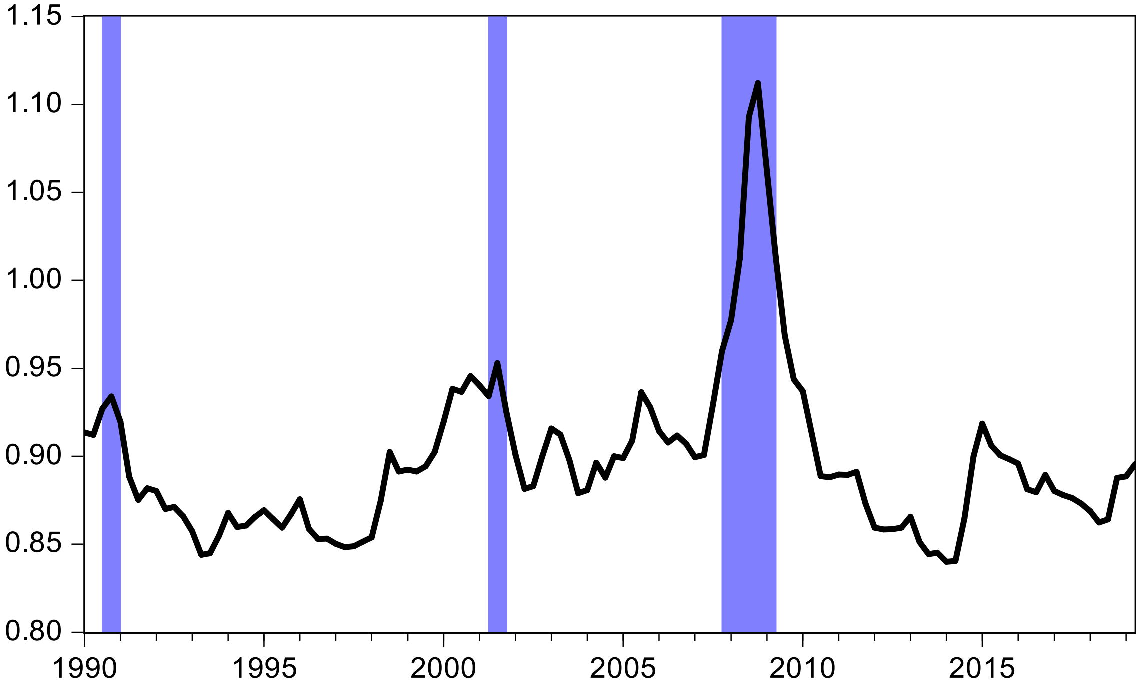
Note: This figure presents the levels of the VAR-imputed Fed information shocks derived from the Jarociński and Karadi (2020) model and aggregated at the quarterly level. Shaded areas represent periods of economic recession, as identified by the National Bureau of Economic Research.

Figure 3: The quarterly level of VAR-imputed conventional shocks



Note: This figure presents the levels of the VAR-imputed conventional shocks derived from the Jarociński and Karadi (2020) model and aggregated at the quarterly level. Shaded areas represent periods of economic recession, as identified by the National Bureau of Economic Research.

Figure 4: The 12-month-ahead macroeconomic uncertainty



Note: This figure presents the monthly level of the Jurado, Ludvigson, and Ng (2015) 12-month-ahead macroeconomic uncertainty index at the end of each quarter between 1990 and the second quarter of 2019. Shaded areas represent periods of economic recession, as identified by the National Bureau of Economic Research.