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THE FED'S FINE-TUNE: COARSE STATEMENTS AND PREDICTIVE PRESSERS*

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Abstract

Central bank communications, particularly FOMC statements and press conferences, play a crucial role in shaping financial market expectations. Using large language models to quantify central bank content, this paper demonstrates how sentiment aligns with traditional market-based monetary policy measures. We show that press conferences correlate with future policy to a greater extent than other communications. While FOMC statements coarsely signal the current stance of policy, press conferences fine-tune the message, which helps market participants revise their expectations about future policy.

Keywords: central bank communication; large language models; monetary policy transmission; empirical monetary economics.
JEL Codes: E52, E58, E31, E32.

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1 Introduction

Communication from central banks to the public presents a wealth of potential identified monetary policy events to estimate the transmission of monetary policy. Because asset prices observed minutes before these events contain all available information, asset prices observed immediately after are thus the market reaction to monetary news, and their difference can identify exogenous variation in monetary policy. While previous work focused exclusively on the market reaction to FOMC statements, subsequent work—like Swanson and Jayawickrema (2024), Narain and Sangani (2026), Gordon and Lunsford (2024), and Jarocinski and Karadi (2025)—has studied speeches, press conferences, and official testimonies as types of monetary events.

Unsurprisingly, market reactions can differ by type of communications, especially the press conference.[1] For example, during the 2022 tightening cycle the market reaction to the press conference is sometimes opposite of the preceding FOMC statement. These reversals in the market reaction are puzzling because Gómez-Cram and Grotteria (2022) find that the content of the press conference is similar to that of the statement, on average.

We explain reversals in the market reaction to the press conference via content that is absent from the statement and correlates more strongly with the future policy rate—a finding we are the first to document, to our knowledge. While Narain and Sangani (2026) document reversals in the market reaction and attribute them to variation in the content of the press conference, we take their analysis a step further and show that this variation correlates with the stance of future policy. Our finding on the predictive correlations of the press conference's content complements the predictive content of FOMC transcripts and speeches found by Cieslak et al. (2025b, 2024b) and Cieslak et al. (2025a, 2024a).

To understand why the press conference has predictive correlations above and beyond that of FOMC statements and speeches by the Chair, we compare sentiment scores from a BERT large language model fine-tuned to Fed communication. While the overall signals of press conferences match those of FOMC statements, signals from statements tend to be relatively coarser. Over three-fourths of sentiment scores from FOMC statements are either entirely hawkish, dovish, or neutral while only one-quarter of press conference scores are so stark. The variation in content of the press conference—some dovish content even though it is hawkish on net, and vice versa—is the source of predictive correlations with the future federal funds rate and helps account for market reversals. For example, in the summer of 2023, record increases in the federal funds rate were accompanied by entirely hawkish FOMC statements and positive market reactions. However, the market reaction to the press conference was often negative—opposite of the FOMC statements—with content that was hawkish on net, but contained some dovish content.

Because the current stance of policy is now largely anticipated by markets and the relationship between the federal funds rate and sentiment is highly endogenous, we also study how high-frequency market reactions about expected future policy relate to the sentiment of federal reserve communications. Among all types of communication studied, we find that press conferences stand out as having the strongest relationship between content and market reactions. While overall hawkish content is of-

[1] Furthermore, many studies have documented the importance of speeches and press conference for the European Union (Altavilla et al., 2025) and the U.K. (Mumtaz et al., 2024).

ten associated with dovish surprises, we can explain these seemingly opposite-signed responses via the press conference's predictive correlations with the future federal funds rate. Essentially markets revise their expectations about future policy in response to dovish content in press conferences that is absent from FOMC statements.

Press conferences do not announce changes in fundamentals (like the federal funds rate) and instead communicate narrative information, whereas FOMC statements announce fundamentals and narratives. Consequently, we also assess market reactions to speeches by the Federal Reserve Chair to understand if other events that communicate narratives but not changes in fundamentals have similar relationships between content and market reactions. As shown by regression analysis, speeches do not, on average, have a strong relationship with market reactions. We interpret this as speeches having a noisier signal relative to what we observe from press conferences.

We formalize the distinct role of press conferences in refining the statement's message via an announcement variance ratio of trading volume and find that markets indeed perceive additional signal from press conferences after they were introduced in 2011. The perception of additional signal from press conferences was not immediate and occurred in 2015, a few years after their introduction, as the Fed prepared to raise interest rates from the effective lower bound (ELB). However, by the time Chair Powell implemented press conferences after every meeting in 2019, we detect that press conferences contain more signal than FOMC statements. Taken together, this evidence suggests that new communication tools evolve and it may take time for them to be understood.

Given the central role of press conferences, we conclude by assessing how to best include them in the construction of high-frequency monetary policy shocks. Because Brennan et al. (2025) and Bundick and Smith (2020) note that different high-frequency shocks can lead to different estimates of monetary policy transmission, it is important to understand how differences arising from the inclusion of press conferences affect estimates of monetary policy transmission. While Acosta et al. (2025) and Grotteria and van Binsbergen (2025) expand the time window around FOMC statements to include press conferences, we find that this construction can sometimes benefit from including longer-term rates to capture the longer-term forward guidance signaled via the press conference.

We estimate monetary policy transmission via the vector autoregression (VAR) of Gertler and Karadi (2015) from 1973 to present (instead of ending in 2019 like in other work) and find that point estimates are largely aligned with existing empirical and theoretical evidence. In fact, the point estimates from the Nakamura and Steinsson (2018) monetary policy shock are most stable when the press conference is included in shock construction, otherwise responses to the excess bond premium are opposite-signed or ambiguous. However, in the case of the Gürkaynak et al. (2005) monetary policy shocks where current policy and forward guidance are distinct dimensions, we find that augmenting the instrument set with longer-term rates helps assure the correctly-signed response in forward guidance when the press conference is included in shock construction.

2 LITERATURE REVIEW

Federal Reserve press conferences are now perceived to be the single most useful channel of Fed communication, as noted in Wessel and Boocker's (2024) survey.[2] Lamla and Vinogradov (2019) find that more consumers receive news about the Fed via the press conference, which could help account for its growing importance. Market reactions to central bank press conferences have been studied since inception by Rosa (2016), Ehrmann and Fratzscher (2009a), Gómez-Cram and Grotteria (2022), Narain and Sangani (2026), Gorodnichenko et al. (2023), Curti and Kazinnik (2023), Parle (2022), Altavilla et al. (2025).

To understand why market reactions to Fed press conferences are sometimes opposite those of the FOMC statements, we turn to a BERT large language model to understand if content explains these differences. Advances in large language modeling have ensured that natural language processing can capture the nuance and soft information of central bank policy communication. Hansen and Kazinnik (2024) and Dunn et al. (2024), show heightened efficiency of more sophisticated methods like BERT compared to dictionary-based predecessors such as Gati and Handlan (2023), Kypraios et al. (2024), Czudaj and Nguyen (2025), Calomiris et al. (2022), Lucca and Trebbi (2011), Apel et al. (2022), Gardner et al. (2022), and Picault and Renault (2017), Munday and Brookes (2021), Parle (2022), Cherry and Tong (2023), Tobback et al. (2017), Banerjee et al. (2025). Because dictionary-based methods often rely on keyword matching or bag-of-words models, their ability to capture the nuanced meaning and context within complex text can be limited. More specifically, these methods treat words as isolated units, ignoring crucial orderings, which can fundamentally alter meaning.

By contrast, our BERT model (DeBERTa V3; He et al. (2020); Devlin et al. (2019); He et al. (2023) can consider all words in a sentence simultaneously when encoding the meaning of word and thus accommodate long-range dependencies. Similar to transformer-based AI chatbots like GPT, BERT models are pretrained on a massive corpus of text data and then fine-tuned to a specific task like sentiment analysis of Federal Reserve communications. With an enhanced ability to analyze Federal Reserve communications at the paragraph or sentence level, we can quantify the stance on monetary policy conveyed in the text. BERT models are used to study Federal Reserve Communications by Alexopoulos et al. (2024), Osowska and Wojcik (2024), Shah et al. (2023), Pfeifer and Marohl (2023), Gorodnichenko et al. (2023), Gambacorta et al. (2024).[3]

Assessing how quantified content of central bank communication correlates with current and or future policy is studied by Doh et al. (2021, 2025), Aruoba and Drechsel (2026), Fischer et al. (2023), Cieslak et al. (2025b, 2024b), Cieslak et al. (2025a, 2024a), and others. Our study of the predictive correlations of the press conference complements these findings that span Fed communications such as transcripts, speeches, the Beige Book, Tealbooks, and the minutes. Because press conferences are available immedi-

[2] See https://www.brookings.edu/articles/grading-fed-communications-a-2024-survey-of-fed-watchers/

[3] Other applications of large language models include those by Aruoba and Drechsel (2026), Deng et al. (2024), Gnan et al. (2025), Silva et al. (2025), Schmanski et al. (2023), Fischer et al. (2023), Ahrens et al. (2025), Granziera et al. (2025). More specific approaches include Latent Dirichlet Allocation topic modeling by De Pooter (2021) and Hansen and McMahon (2016); Hansen et al. (2017); semantic similarity by Ehrmann and Talmi (2020), Handlan (2022a), and Acosta and Meade (2015)); topic modeling by Fraccaroli et al. (2020); universal sentence encoding by Doh et al. (2021, 2025); ChatGPT by Hansen and Kazinnik (2024); and neural networks by Handlan (2022b) and Curti and Kazinnik (2023); and multi-agent LLM simulation by Kazinnik and Sinclair (2026).

ately while transcripts are released with a five-year lag, we view our contribution as providing a real-time window into the deliberative content that transcripts eventually disclose.

Given the improved ability of large language models to accurately capture the content of central bank communication, we next ask if our model can account for market reactions, specifically reversals observed in the 2020s tightening cycle. Market reactions and natural language processing are featured in Handlan (2022b), Fischer et al. (2023), Parle (2022), Gnan et al. (2025), Kypraios et al. (2024), Shah et al. (2023), Osowska and Wojcik (2024). More specifically, Fischer et al. (2023) and Gnan et al. (2025) demonstrate that text-based sentiment indicators can help explain errors in market policy expectations that traditional Taylor-rule variables miss. We compare the market reaction across types of communication (statements, press conferences, and speeches) and find that the press conference stands out for having the strongest sentiment score and market reactions, particularly in the 2022-2024 tightening episode.

Finally, we assess how including the press conference in the construction of high-frequency monetary policy shocks affects estimates of monetary policy transmission. Augmenting monetary policy shocks with additional forms of communication to estimate monetary policy transmission has been studied by Swanson and Jayawickrema (2024), Altavilla et al. (2025), Mumtaz et al. (2024), and others. Like An et al. (2025) we find that estimates of monetary policy transmission are largely stable as time windows expand, but show that including long-term rates in shock construction can add additional information when the press conference is included.

3 MARKET REACTIONS

We define market reactions as changes in asset prices around Federal Reserve communications. Specifically, we construct market reactions using high-frequency intraday changes in futures prices immediately surrounding communication events to capture market participants immediately updating their beliefs about monetary policy. Futures prices correspond to basis point changes in implied interest rates such that positive market reactions indicate upward surprises in the expected future policy rate and negative reactions indicate downward surprises.

We collect intraday futures data used in the construction of monetary policy shocks for scheduled and unscheduled fed communications: FOMC statements, post-FOMC press conferences, Federal Reserve Chair speeches, and Congressional testimonies, from 1995 through April 2025. Timing details are confirmed using Swanson and Jayawickrema (2024), Gürkaynak et al. (2005), and Gordon and Lunsford (2024), supplemented by Factiva searches.

Mathematically, the market reaction for an asset A at event time t is defined as:

$$\text{Market reaction}_{A,t} = P_{A,t+\Delta t} - P_{A,t-\Delta t}, \tag{1}$$

where $P_{A,t}$ is the price of asset A at time t, and Market reaction$_{A,t}$ captures the market reaction within a narrow window around the release of the FOMC statement $\{+\Delta t, -\Delta t\}$, which is typically 10 minutes before and 20 minutes after the event. The market reaction for each type of communication is computed separately, enabling us to assess their distinct impacts.

3.1 INTRADAY FUTURES We use the dataset of Brennan et al. (2025) which relies on intraday data from the CME Group Inc. DataMine (https://datamine.cmegroup.com/) at the Federal Reserve Board. Although the intraday tick data is available starting in January 1995, we sometimes restrict our sample to one that starts in June 1999 when Federal Reserve communications are available in formats more readily usable for natural language processing. Our full sample ends in April 2025 and contains 259 statements after FOMC meetings (7 of which are unscheduled) 85 post-FOMC meeting press conferences, 121 Congressional testimonies, and 707 speeches by the Federal Reserve Chair.[4] See Appendix B for more details, especially those on dates, times, and window sizes.

Intraday futures used to assess market reactions to FOMC communications are federal funds futures and Eurodollar/Secured Overnight Financing Rate (SOFR) futures. These futures represent the first year of the term structure of interest rates and are commonly used to construct high-frequency monetary policy shocks as detailed in Brennan et al. (2025).[5] Federal fund futures are monthly contracts such that the first expiring contract, $FF1$, expires at the end of the month of a given FOMC communication. For example, for the March 19, 2014 FOMC statement $FF1$ expires at the end of March. The second, third, and fourth expiring federal funds futures expire one, two, and three months after a given FOMC statement, respectively. For example, $FF4$ expires at the end of June 2014 for the March 19, 2014 FOMC statement. Eurodollar/SOFR futures are quarterly contracts where the first expiring contract expires at the end of the quarter for a particular FOMC communication in the case of the latter, but in the quarter following in the case of the former.

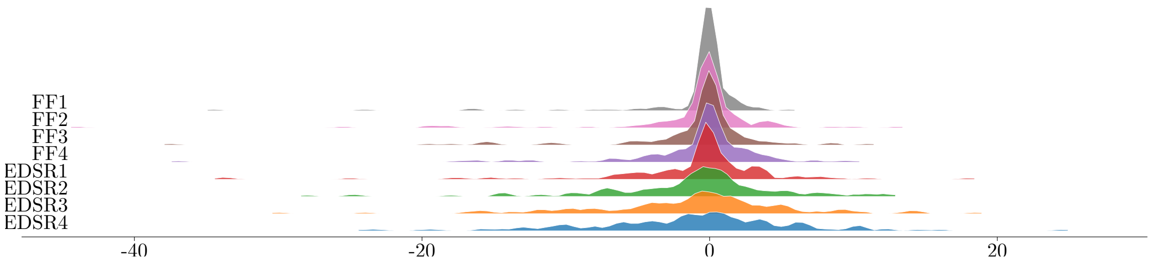
Figure 1 shows the distribution of intraday changes 10 minutes before and 20 minutes after an FOMC communication for FOMC statements, press conferences, chair speeches, and Congressional testimonies. The tightness of the distributions decreases as the maturity increases, i.e. the shortest maturity futures—$FF1$—are the least volatile and the longest maturity futures shown—$EDSR4$—are the most volatile. Changes in the former represent surprises to actual changes in the federal funds rate while changes in the latter represent surprises to forward guidance or communication about the future path of policy.

There are two main reasons for the positive correlation between maturity and volatility. First, FOMC statements are much less likely to be surprising to markets than in previous eras. As a result, changes in $FF1$, the immediately expiring future and hence the closest market expectation to the federal funds rate, are small in magnitude. Second, communications other than FOMC statements are unlikely to have surprises in $FF1$ or shorter maturities because the federal funds rate cannot possibly change on these other events. Therefore, these events can only be forward guidance.

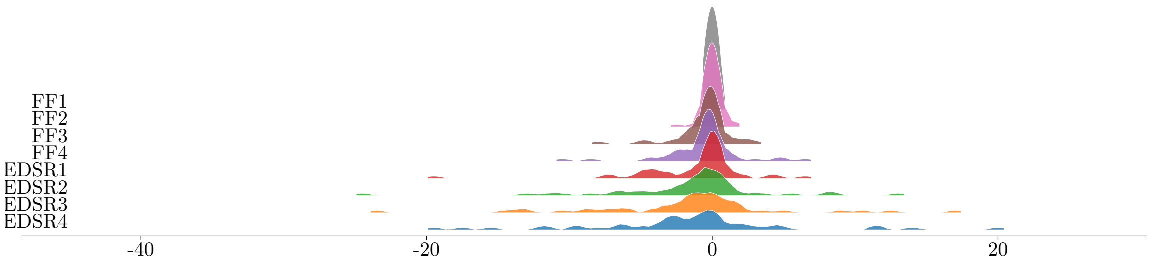
We also note that market reactions to speeches, as shown in panel 1c are much more muted—and

[4] Although there are 707 speeches by a Federal Reserve Chair available in our sample, we restrict our sample to the 226 Chair speeches since 2008 that are obtainable in a format accessible to our model. Swanson and Jayawickrema (2024) show that the chair speeches are more likely to move intraday futures than those of other officials. In contrast to Swanson and Jayawickrema (2024) and Sekkel and Zhan (2024) who filter their sample of chair speeches to those that relate to monetary policy, we keep all chair speeches in our sample for two reasons. First, the text of Chair Speeches is typically unreleased beforehand leaving few ways besides the topic and location for markets to know the contents of a speech. Second, texts with no monetary policy content should simply have a sentiment score of zero and no market reaction.

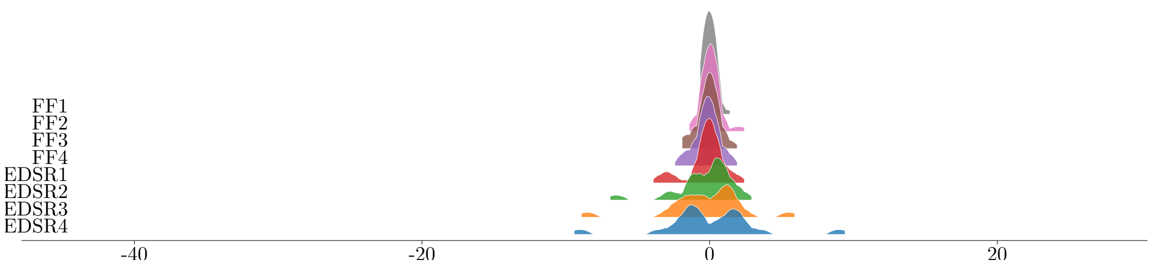
[5] Because Eurodollars were discontinued in 2023 and SOFR futures introduced in 2018, we switch to SOFR futures in January 2022, as advocated by Acosta et al. (2024). We note that the switch date has little material effect on the series of intraday changes in asset prices.



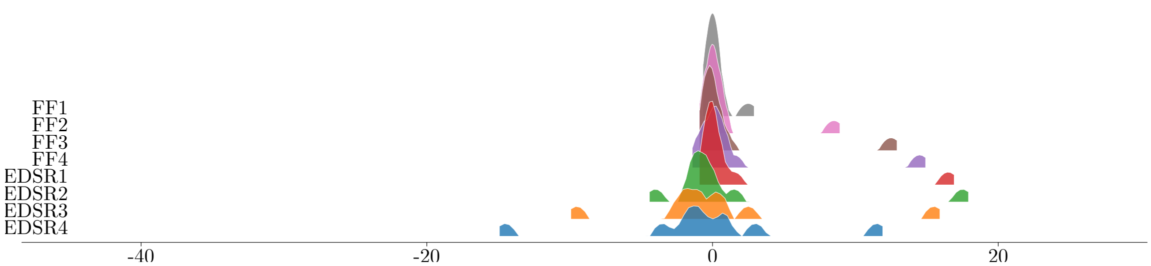
(a) FOMC statements, basis points



(b) Press conferences, basis points



(c) Chair Speeches, basis points



(d) Congressional Testimonies, basis points

Figure 1: Distributions of intraday changes in futures prices around Federal Reserve communications, January 1995 to April 2025.

Intraday changes are calculated 10 minutes before and 20 minutes after an FOMC communication. See Appendix B for more details on time window sizes. FFi for $i = 1, \ldots, 4$ is the ith federal funds rate future where i corresponds to the month ahead, $i = 0$ is the current month. The ith Eurodollar/$(i+1)$th SOFR future (ESRi), which corresponds to the expected policy rate i quarters ahead for $i = 1, \ldots, 4$.

clustered closer to zero—than those for FOMC statements or press conferences. This arises because 76 percent of speeches have a market reaction that is less than 3 basis points, or quite close to zero. While some speeches can move markets just as much as press conferences or FOMC statements, market movements are on average quite small.

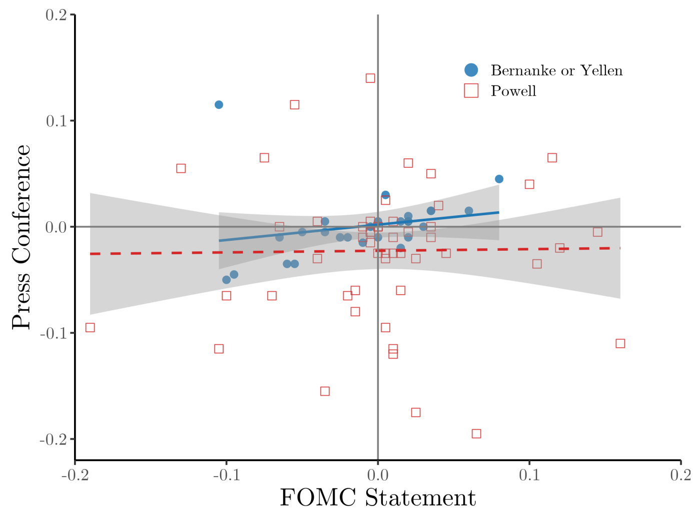


Figure 2: Market reactions to the press conference vs. FOMC statements, basis points.

The figure shows the slope coefficient $\hat{\beta}$ from the regression $\text{Market Reaction}_{t,\text{Press}} = \alpha + \beta \text{Market Reaction}_{t,\text{FOMC}} + \epsilon_t$ by Fed chairs for the 4th Eurodollar/5th SOFR future (EDSR4), which represents the expected policy rate four-quarters ahead. Bernanke or Yellen is April 2011 to January 2018 and Powell is from February 2018 to April 2025. Shaded bands are 90% error bands.

The small market reaction to speeches highlights how speeches may be distinct from other events. While FOMC statements and press conferences occur alongside policy actions, like changes in the federal funds rate, speeches do not. Even though all these communications can contain information about the future stance of policy, speeches may not undergo the same degree of market re-pricing given that they do not occur alongside changes in fundamentals. Relatedly, the market may react more to statements and press conferences because they are the first communication to follow a 10-day blackout preceding the FOMC meeting as studied by Ehrmann and Fratzscher (2009b).

Given that market reactions to press conferences and the FOMC statements are roughly the same size, are they often in the same direction? Figure 2 shows the market reaction of the press conference regressed on that of the preceding FOMC statement for the fourth Eurodollar/fifth SOFR future, which represents the expected policy rate four quarters ahead.[6] While the slope is positive under Chairs Bernanke and Yellen (2011-2018), the slope is insignificant from zero under Chair Powell (2018-2025). In fact, there are many observations where the press conference has the opposite sign to that of the FOMC statements under Chair Powell.

Message 1. *The market reaction to the press conference sometimes reverses FOMC statements, especially during the 2022-2024 tightening cycle (under Chair Powell).*

Figure 3 shows an example of a market reversal on June 15, 2022 where the market reaction to the FOMC statement is positive, but is negative to the press conference. This suggests that market participants revised up their expectations for the federal funds rate a year ahead in reaction to the FOMC state-

[6] Appendix figure B.1 shows a similar relationship between the market reaction to the press conference and the FOMC statements by Fed chair for other interest rate futures used in construction of high-frequency monetary policy shocks.

ment, but revised them down in reaction to the subsequent press conference. Appendix figure B.2 confirms that these reversals are not one-off events. Relatedly, Appendix figure B.3 shows that the speeches in the week after an FOMC statement did not have the same wide-spread opposite-signed market reactions prior to the introduction of the press conference in 2011.

Given that press conferences have reversed market reactions to FOMC statements under Chair Powell, but not his predecessors, we next explore why. While Narain and Sangani (2026) attribute these reversals in market reactions to different content conveyed by the Q&A of the press conference relative to that of the FOMC statement, Gómez-Cram and Grotteria (2022) detect a similarity between FOMC and press conference pairs, albeit on a sample that ends in 2019. We use a large language model to clarify these somewhat contrasting findings by showing that the content of press conferences refines the coarse signal of FOMC statements. This refined signal, in turn, contains predictive correlations for the future stance of policy to a greater extent than FOMC statements. Understanding the source of these reversals is important for estimating monetary transmission as reversals could alter the sign of monetary policy shocks if the FOMC statement and press conference are treated as a single event.

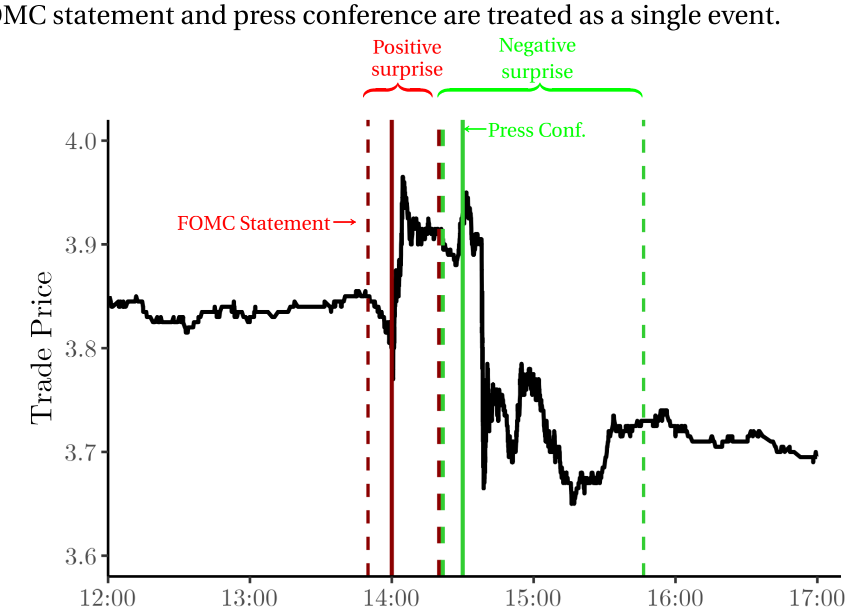


Figure 3: Trading prices of the 5th SOFR future on the afternoon of June 15, 2022, percent

The figure shows intra-day trade prices for the 5th SOFR future (4-quarter-ahead interest rate exposure) when the Federal Reserve raised interest rates 75 basis points on June 15, 2022. The solid red line represents the FOMC statement release with the dashed red lines indicating the trade price pulled 10 minutes before and 20 minutes after the FOMC statement release. The solid green line represents the start of the press conference and the dashed green lines indicate the trade price pulled 10 minutes before and 20 minutes after the conference ends.

4 Sentiment and Monetary Policy

4.1 Large Language Modeling To quantify the content of Federal Reserve communications, we employ DeBERTa V3 (He et al., 2021, 2023), an iteration of the Bidirectional Encoder Representations from Transformers (BERT) architecture Devlin et al. (2019) optimized for natural language understanding. Unlike generative models (e.g., GPT) designed for text synthesis, BERT-based architectures excel at producing contextualized word embeddings, dynamic numerical vectors that capture the meaning of a word based on its specific usage within a sentence. While standard self-attention (Vaswani et al., 2017) collapses content and position into a single query-key product, DeBERTa separates content and relative position.[7] By isolating relative positioning from semantic content, the model achieves finer distinctions in meaning.

Using this advanced natural language processing technique, we analyze the text of Federal Reserve communications at the paragraph or sentence level. By training text classification models based on BERT to recognize pre-defined categories, we quantify the monetary policy stance and content related to macroeconomic conditions via sentiment scores. We use two distinct classification approaches based on BERT, which are subsequently passed through a classification header—a fully connected neural network layer—to compute the probability of text belonging to a predefined category.

$$P(s \in \mathbb{C}) = \sigma(\text{BERT}(s)), \tag{2}$$

where s is a text sequence (sentence or paragraph), $\mathbb{C}$ represents the class category, and $\sigma(\cdot)$ is the classification header.

We fine-tune these models using training data specific to two classification tasks:

- **Sentiment classification (BERT-Sentiment)**: Paragraph-level classification into monetary policy stances: *Dovish*, *Hawkish*, or *Neutral*. These labels pertain to the stance of policy: dovish indicates loosening, hawkish indicates tightening, and neutral indicates no change. Each paragraph s_i is assigned to the category with the highest predicted probability:

  $$s_i \in \mathbb{C}^L, \quad \text{where} \quad L = \arg \max_{\ell \in \{Dove, Hawk, Neut\}} P(s_i \in \mathbb{C}^\ell). \tag{3}$$

  The sentiment scores are aggregated as

  $$\text{FedStance}_{c,t}^{\text{Dove/Hawk}} = \frac{1}{N_{c,t}} \sum_{i=1}^{N_{c,t}} 1(s_i \in \mathbb{C}^{\text{Dove/Hawk}}), \tag{4}$$

  where $N_{c,t}$ is the number of paragraphs in communication c at time t. Paragraphs without explicit policy stance or with ambiguous statements are classified as *Neutral*.

- **Topic-based classification (BERT-Topic)**: Sentence-level binary classification identifying macroeconomic aspects influencing policy decisions: employment, inflation, financial conditions, economic growth, global economic conditions, and “others" (including fiscal policy, oil prices, etc.).

[7] Mathematically, the attention weight $A_{i,j}$ between word i and word j is decomposed into a sum of components representing content-to-content, content-to-position, and position-to-content interactions

$$A_{i,j} = Q_c K_c^T + Q_c K_r^T + P_r K_c^T + P_r K_r^T$$

where Q_c and K_c are content-based query and key matrices, and Q_r and K_r are their relative position counterparts.

Each sentence can be classified into multiple overlapping categories, subject to a 70% probability threshold

$$\text{TopicWeight}_{c,t}^{\mathcal{T}} = \frac{1}{N_{c,t}} \sum_{i=1}^{N_{c,t}} 1(s_i \in \mathcal{T}), \tag{5}$$

where $\mathcal{T}$ is the topic category. Sentences discussing monetary policy without explicit reference to economic contexts are classified separately.

Topic-specific sentiment scores are computed as

$$\text{TopicStance}_{c,t}^{\mathcal{T},\text{Dove/Hawk}} = \frac{1}{N_{c,t}} \sum_{i=1}^{N_{c,t}} \left[1(s_i \in \mathcal{T}) \times 1(s_i \in \mathbb{C}^{\text{Dove/Hawk}})\right] \tag{6}$$

To determine which communication channel has the most significant impact, we analyze texts of 223 FOMC statements, 85 post-FOMC press conferences, 226 Federal Reserve Chair speeches, and 34 congressional testimonies by the Fed Chair from 1999 to 2025. Our sample of Chair speeches and Congressional testimonies begins in 2008 due to availability and our sample of press conferences in April 2011 which is when they were first held. Footnotes, appendices, supplementary information, and administrative addenda were excluded from the analysis.

Appendix C shows that raw sentiment scores across topics and types of communications. The values of our sentiment scores are in line with those of Dunn et al. (2024) and Fischer et al. (2023). Following Silva et al. (2025), we compute net policy sentiment scores that quantifies the directional stance of monetary policy—essentially where it is and where it going. For each communication type $j \in$ {Press conference, Speech, FOMC Statement}, we aggregate paragraph-level classifications from equation (4) to obtain $\text{Hawkish}_{j,t} = \text{FedStance}_{j,t}^{\text{Hawk}}$ and $\text{Dovish}_{j,t} = \text{FedStance}_{j,t}^{\text{Dove}}$.

$$\text{Net Sentiment}_{j,t} = \frac{\text{Hawkish}_{j,t} - \text{Dovish}_{j,t}}{\text{Hawkish}_{j,t} + \text{Dovish}_{j,t}} \tag{7}$$

When $\text{Hawkish}_{j,t} + \text{Dovish}_{j,t} = 0$ (all neutral), we set $\text{Net Sentiment}_{j,t} = 0$. $\text{Net Sentiment}_{j,t} \in [-1, 1]$ such that a value of -1 indicates entirely dovish sentiment, 0 is neutral, and 1 entirely hawkish. A value of 0.75, for example, indicates predominantly hawkish sentiment, but with some dovish sentiment.

As shown in figure 4, net sentiment at the paragraph-level is generally consistent with the stance of monetary policy: Hawkish (dovish) net sentiment, is consistent with tightening (loosening) cycles of monetary policy. The correlation between the net sentiment of the press conference and the target federal funds rate is the most striking.[8] The contemporaneous correlation of the net sentiment of the press conference and the federal funds rate is only 0.37—much lower than that of the net sentiment of the FOMC statement and the federal funds rate of 0.53. However, the correlation between contemporaneous net sentiment and the future federal funds rate peaks at about 0.87 nine meetings ahead for the press conference. By contrast, the peak correlation between net sentiment of FOMC statements and the federal funds rate comes in lower at 0.79 seven meetings ahead. The higher correlation between net sen-

[8] See Appendix G for the construction of the target federal funds rate. We use the mid-point of the target range after each FOMC meeting.

timent of the press conference and the future federal funds rate likely arises because net sentiment at the paragraph level is finer and more varied for press conferences than FOMC statements. While over three-fourths of all net sentiment scores for the FOMC statement are 1,0, or -1—entirely hawkish, neutral, or dovish—only one-fourth of net sentiment scores for the press conference are that coarse. Appendix figure C.3 is the same as figure 4, but shows sentence level instead of paragraph level net sentiment for the FOMC statement in the top panel. At this finer frequency, there is more variation than the coarse paragraph level analysis of the statement, but peak correlation is still only 0.8 five meetings ahead, which is still below that of the press conference.

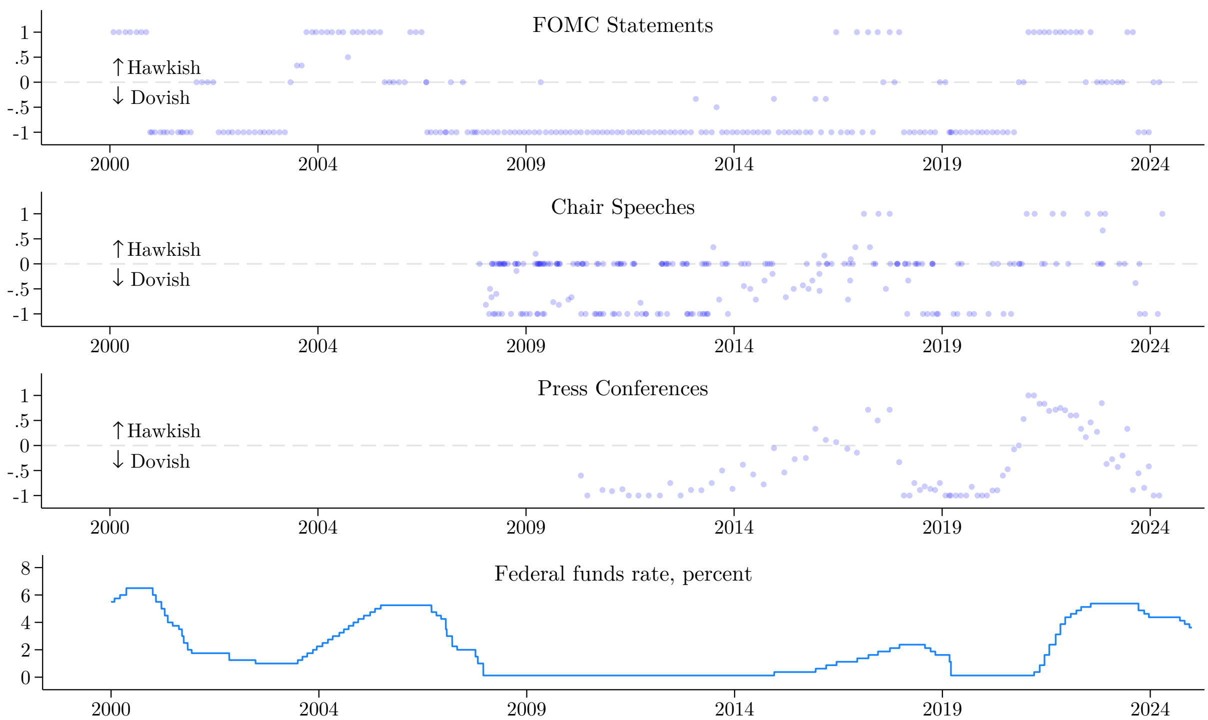


Figure 4: Net sentiment scores at the paragraph level and the target federal funds rate.

Hawkish sentiment pertains policy tightening and dovish to loosening. For communication type $j \in$ {Press conference, Chair speech, FOMC Statement}, Net Sentiment$_{j,t}$ = (Hawkish$_{j,t}$ − Dovish$_{j,t}$)/(Hawkish$_{j,t}$ + Dovish$_{j,t}$). The federal funds rate is the target after each FOMC meeting, see Appendix G for details on its construction. Appendix A details the availability and sources of each type of communication.

Message 2. *The press conference correlates with the future policy rate to a greater extent than other communications. This is because the FOMC statement coarsely signals the current stance of policy and the press conference fine-tunes the message to signal future policy.*

4.2 LOCAL PROJECTIONS To formalize the predictive correlations of sentiment and the federal funds rate, we estimate local projections. We choose to study the actual federal funds rate in these estimations, in light of its endogeneity to sentiment, because the communications underlying our sentiment scores are often aimed at communicating the current and future path of the federal funds rate.[9] To that end, if the federal funds rate is constrained at its effective lower bound, then the communications will also necessarily reflect this constraint. Hypothetical rates such as the shadow federal funds rate of Wu and Xia (2016) that proxy for what the federal funds rate would be if it could go negative, necessarily reflect policy choices that are not reflected in communications.

We first estimate impulse responses separately for the statement and the press conference:

$$\text{Federal Funds Rate}_{t+h} = \beta_0^h + \beta_1^h \text{Net Sentiment}_{j,t} + \epsilon_{j,t} \tag{8}$$

Where t is the FOMC meeting frequency, $h = 0, .., 24$, and $j \in$ {FOMC statement, Press}.[10] Standard errors are those of Newey and West (1987) with two lags (findings are robust for two to eight lags) and robust to heteroskedasticity. The sample starts in April 2011 and only includes meetings where there is a press conference (every other meeting until 2019 and every meeting thereafter). Appendix figures C.4 and C.5 most importantly show that the point estimates for the net sentiment of FOMC statements are almost identical when the sample is either all FOMC meetings from January 2011 to April 2025 or restricted to meetings followed by press conferences, as shown in this section. The $t + h$ federal funds rate includes all meetings such that the 8-meeting-ahead point estimates corresponds to a one-year-ahead horizon. Appendix figure C.6 controls for the lagged value of the federal funds rate.

Figure 5 shows that an increase in net sentiment (hawkish content) is correlated with a higher federal funds rate for both the net sentiment of FOMC statements and press conferences. The response to press conferences (dashed red line) has a more distinct hump-shape and peaks about 8 meetings (one year) ahead. While this suggests that an increase in net sentiment in press conferences is associated with a relatively higher federal funds rate than the same increase in FOMC statements, these sentiment scores are highly correlated at 0.8 and their impulse response coefficient not statistically significant from each other.

Consequently, we expand the specification in equation (8) to include both net sentiment scores. We also include a specification with the lagged federal funds rate to control for (1) observed persistence in the federal funds rate and (2) the fact that current net sentiment likely depends on the recent policy stance.[11]

$$\text{Federal Funds Rate}_{t+h} = \beta_0^h + \beta_1^h \text{Net Sentiment}_{FOMC,t} + \beta_2^h \text{Net Sentiment}_{Press,t} + \epsilon_t \tag{9}$$

$$\begin{aligned}\text{Federal Funds Rate}_{t+h} =& \beta_0^h + \beta_1^h \text{Net Sentiment}_{FOMC,t} + \beta_2^h \text{Net Sentiment}_{Press,t} + \ldots \\ & \alpha^h \text{Federal Funds Rate}_{t-1} + \epsilon_t\end{aligned} \tag{10}$$

Figure 6 shows the impulse response to specifications (9) and (10) in panels 6a and 6b, respectively.[12]

[9] The "FOMC Policy on External Communications of Committee Participants" states, "The Federal Open Market Committee is committed to provide clear and timely information to the public about the Committee's monetary policy actions and rationale for those decisions." https://www.federalreserve.gov/monetarypolicy/files/FOMC_ExtCommunicationParticipants.pdf.

[10] Appendix figure C.8 shows that the impulse response coefficients of the net sentiment of speeches is lower than that of either press conferences or FOMC statements. Moreover, speeches are necessarily a different sample.

[11] See Crawley et al. (2026) for a discussion of gradualism and inertia in monetary policy rules.

[12] Appendix figure C.7 shows point estimates of equations (9) and (10) that include an interaction term

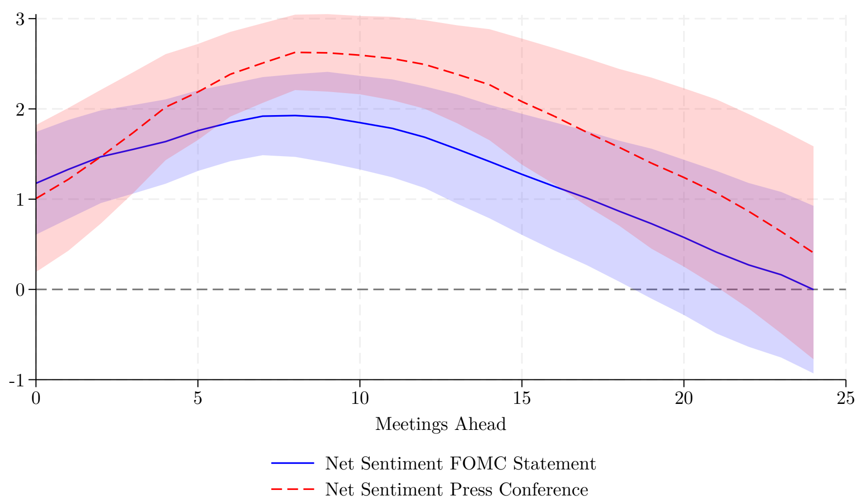


Figure 5: Impulse response of the federal funds rate to net sentiment, 90% error bands with two Newey-West lags.

The figure plots $\hat{\beta}_1^h$ from the local projection, $\text{Federal Funds Rate}_{t+h} = \beta_0^h + \beta_1^h \text{Net Sentiment}_{j,t} + \epsilon_{j,t}$ in equation (8). Where t is the FOMC meeting frequency, $h = 0, \ldots, 24$, and $j \in$ {FOMC statement, Press}. $\text{Net Sentiment}_{j,t} = (\text{Hawkish}_{j,t} - \text{Dovish}_{j,t})/(\text{Hawkish}_{j,t} + \text{Dovish}_{j,t})$. The sample is from April 2011 to April 2025 and is for FOMC meetings followed by press conferences (every other FOMC meeting from 2011 to 2019 and every meeting thereafter). Appendix figure C.4 compares point estimates of net sentiment for FOMC meetings on the sample of all meetings. The $t+h$ federal funds rate includes all meetings such that the 8-meeting-ahead point estimates corresponds to a one-year-ahead horizon.

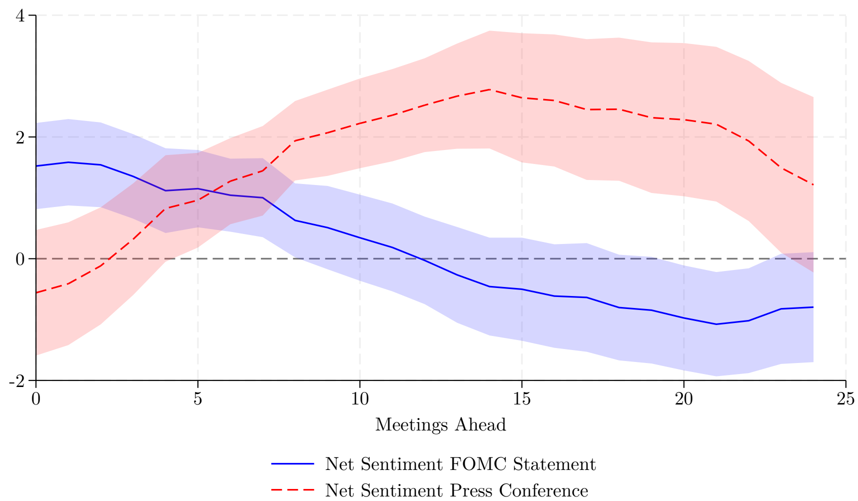
Panel 6a shows that net sentiment of FOMC statements and press conferences have distinct and complementary correlations with the federal funds rate when estimated jointly. The point estimates of net sentiment of FOMC statements (solid blue line) are mostly positive such that an increase in net sentiment represents more hawkish content in FOMC statements and correlates with a higher federal funds rate up to roughly eight meetings ahead. Thereafter, the point estimates are insignificant from zero. By contrast, the point estimates of net sentiment of press conferences (dashed red line) have the opposite pattern. That is, point estimates are initially insignificant from zero for about four meetings ahead and then turn positive and significant with a peak effect about 12 meetings ahead. Because net sentiment of press conferences leads the federal funds rate, these point estimates can be interpreted as hawkish sentiment today coinciding with a higher federal funds rate at least 6 months ahead.

Panel 6b shows that controlling for the pre-meeting value of the federal funds diminishes the predictive correlations of net sentiment of FOMC statements with the federal funds rate such that point estimates are insignificant from zero more than four meetings ahead. This suggests that that much of the variation previously attributed to net sentiment of FOMC statements may instead reflect the recent policy stance. However, the predictive correlations of net sentiment of press conferences with the federal funds rate are similar to their counterparts shown in panel 6a. Taken together, this evidence suggest that net sentiment of press conferences has a distinct relationship with the future federal funds rate beyond that of FOMC statements and the recent policy stance. The positive and significant predictive correla-

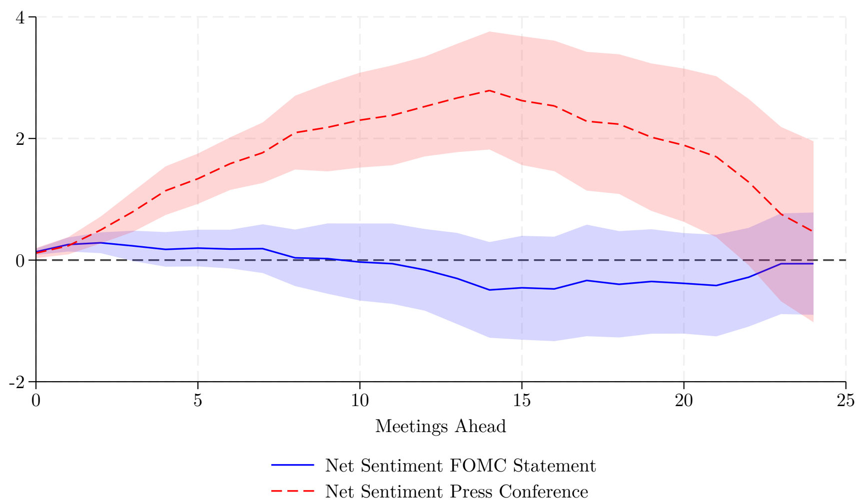
$(\text{Net Sentiment}_{FOMC,t} \times \text{Net Sentiment}_{Press,t})$.

tions of the press conference about 22 meetings ahead (just under three years) suggests that press conferences signal the future stance of policy well in advance of actual changes in the federal funds rate.[13]

[13] Appendix figure C.9 follows Crawley et al. (2026), Carlstrom and Fuerst (2014), and Coibion and Gorodnichenko (2012) by adding in a second lag of the federal funds rate, which shortens the positive and significant horizon of the press conference to about 19 meetings ahead. Appendix figure C.10 shows that local projections with the sentence-level FOMC statements instead of the paragraph-level FOMC statements are similar to those described in this section. Figure C.11 shows that results are robust to standard macroeconomic controls.



(a) Joint estimation



(b) Joint estimation with lagged federal funds rate

Figure 6: Impulse response of the federal funds rate to net sentiment, 90% error bands with two Newey-West lags.

Panel 6a plots $\hat{\beta}_1^h$ and $\hat{\beta}_2^h$ from the local projection, $\text{Federal Funds Rate}_{t+h} = \beta_0^h + \beta_1^h \text{Net Sentiment}_{FOMC,t} + \beta_2^h \text{Net Sentiment}_{Press,t} + \epsilon_t$ in equation (9). Panel 6b plots $\hat{\beta}_1^h$ and $\hat{\beta}_2^h$ from the local projection, $\text{Federal Funds Rate}_{t+h} = \beta_0^h + \beta_1^h \text{Net Sentiment}_{FOMC,t} + \beta_2^h \text{Net Sentiment}_{Press,t} + \alpha^h \text{Federal Funds Rate}_{t-1} + \epsilon_t$ in equation (10). $\text{Net Sentiment}_{j,t} = (\text{Hawkish}_{j,t} - \text{Dovish}_{j,t})/(\text{Hawkish}_{j,t} + \text{Dovish}_{j,t})$. The sample is from April 2011 to April 2025 and is for FOMC meetings followed by press conferences (every other FOMC meeting from 2011 to 2019 and every meeting thereafter). The $t+h$ federal funds rate includes all meetings such that the 8-meeting-ahead point estimates corresponds to a one-year-ahead horizon.

4.3 OUT OF SAMPLE The predictive correlations of net sentiment with the federal funds rate shown in the local projections in figures 5 and 6 are necessarily an in sample exercise. We next ask if net sentiment can correlate with the federal funds rate out sample and how these forecasts compare with prescriptions from the well-known Taylor (1999) rule and other simple benchmarks for predicting the federal funds rate.[14]

The predictions shown in figure 7 are the following:

$$\text{Federal}\,\widehat{\text{Funds}}\,\text{Rate}_{t+h} = \hat{\beta}_0^{t+h} + \hat{\beta}_1^{t+h}\text{Net Sentiment}_{FOMC,t} + \hat{\alpha}^{t+h}\text{Federal Funds Rate}_{t-1} \tag{11}$$

$$\text{Federal}\,\widehat{\text{Funds}}\,\text{Rate}_{t+h} = \hat{\alpha}_0^{t+h} + \hat{\alpha}_1^{t+h}\text{Federal Funds Rate}_{t-1} \tag{12}$$

$$\text{Federal}\,\widehat{\text{Funds}}\,\text{Rate}_{t+h} = 2.5 + 1.5(\pi_{t+h} - 2) + 2(u^*_{t+h} - u_{t+h}) \tag{13}$$

$$\text{Federal}\,\widehat{\text{Funds}}\,\text{Rate}_{t+h} = 0.85\text{Federal Funds Rate}_{t+h-1} + 0.15\Big(2.5 + 1.5(\pi_{t+h} - 2) + 2(u^*_{t+h} - u_{t+h})\Big) \tag{14}$$

Each horizon is $h = 1,..,8$ meetings ahead, which corresponds to one year ahead. We use all FOMC meetings from January 1999 to April 2025.[15] The net sentiment and lagged federal funds rate forecasts shown in equations (11) and (12), respectively, are initially estimated for $t = \{1999,...,2001\}$ and then re-estimated for each meeting through April 2025. The coefficients for the non-inertial and inertial Taylor (1999) rules shown in equations (13) and (14), respectively, are the well-known values of Taylor (1999). The inflation rate π_{t+h} is the realized $t+h$ monthly personal consumption expenditures index less food and energy detailed in Appendix G. The unemployment rate u_{t+h} is the realized $t+h$ monthly unemployment rate and the natural rate u^*_{t+h} is the realized $t+h$ non-cyclical rate of unemployment, also detailed in Appendix G. The 0.85 weight on the lagged federal funds rate is from the Federal Reserve Bank of Atlanta's Taylor Rule Utility Tool (https://www.atlantafed.org/research-and-data/data/taylor-rule.)

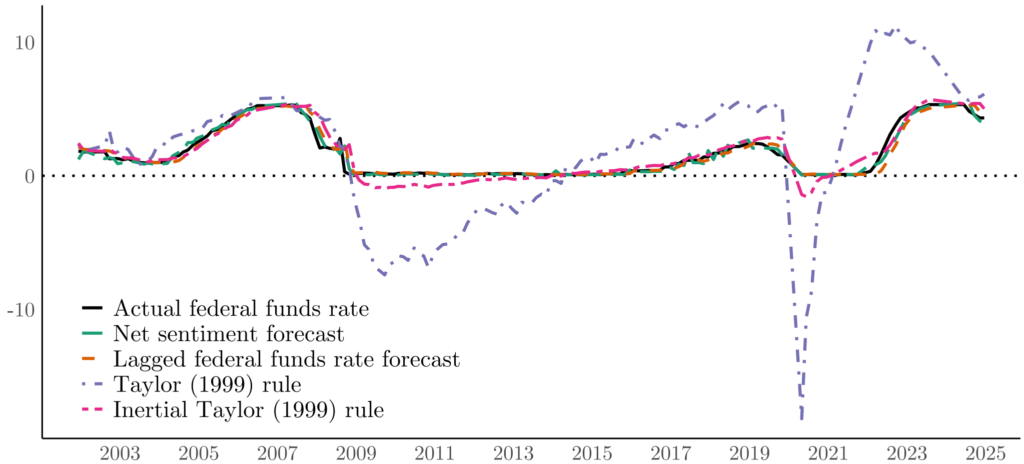
Panel 7a shows that the $t+1$ forecast of the federal funds rate using just the net sentiment FOMC statements, as detailed in equation (11), performs remarkably well in forecasting the federal funds rate out sample. In fact, it performs better than the prediction of the Taylor (1999) rule detailed in equation (13). However, the forecast with net sentiment is also quite close to the prescriptions of the inertial Taylor (1999) rule and a forecast based on the lagged federal funds rate as, detailed in equations (14) and (12), respectively.[16] For this reason, we calculate root mean squared errors 8 FOMC meetings ahead to better understand forecast performance. In equation (15), the federal funds rate is the target as detailed in Appendix G and the predicted Federal $\widehat{\text{Funds}}$ Rate_{t+h} is shown for equations (11), (12), and (14).

$$\text{RMSE}_h = \sqrt{\frac{1}{h}\sum_{t=1}^{h}(\text{Federal Funds Rate}_{t+h} - \text{Federal}\,\widehat{\text{Funds}}\,\text{Rate}_{t+h})^2} \tag{15}$$

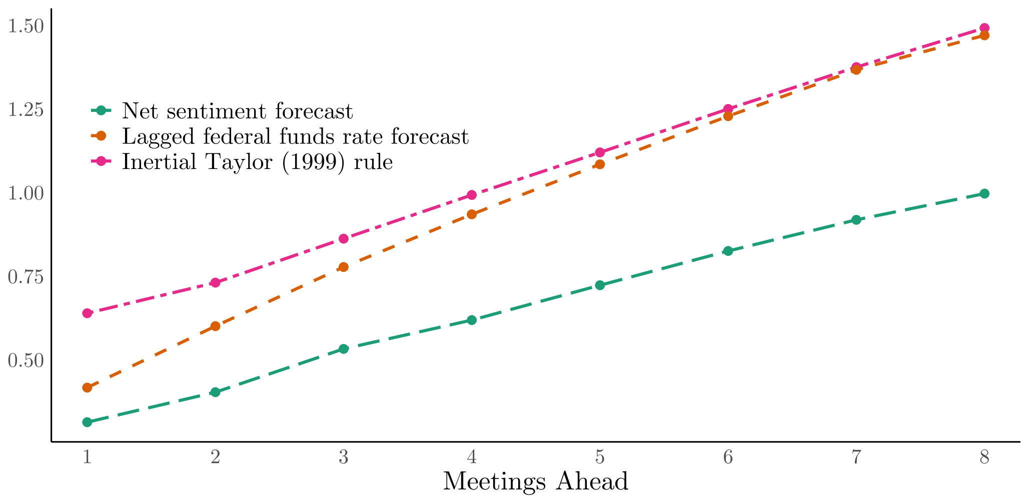
[14] See pages 43-45 of the Federal Reserve's June 2025 Monetary Policy Report to Congress for a version of the Taylor (1999) rule we use, https://www.federalreserve.gov/monetarypolicy/files/20250620_mprfullreport.pdf.

[15] We do not include net sentiment of press conferences in equation (11) to avoid estimating a different specification for every other meeting from 2011 to 2019.

[16] Crawley et al. (2026) show that double inertial rules are sometimes necessary to improve upon the predictive fit of Taylor-type rules.



(a) Federal funds rate with select one-period ahead predictions, percent



(b) Root mean squared errors for the predicted federal funds rate

Figure 7: Out of sample predictions of the federal funds rate.

All data series are detailed in G, including the target federal funds rate. Panel 7a shows $t+1$ predictions. The net sentiment forecast is that of equation (11), $\widehat{\text{Federal Funds Rate}}_{t+h} = \hat{\beta}_0^{t+h} + \hat{\beta}_1^{t+h}\text{Net Sentiment}_{FOMC,t} + \hat{\alpha}^{t+h}\text{Federal Funds Rate}_{t-1}$ and the lagged federal funds rate forecast is that of equation (12) $\widehat{\text{Federal Funds Rate}}_{t+h} = \hat{\alpha}_0^{t+h}\hat{\alpha}_1^{t+h}\text{Federal Funds Rate}_{t-1}$. These forecasts are initially estimated for $t = \{1994, ..., 1997\}$ and then re-estimated for each meeting through April 2025 for $h = 1, ..., 8$. The Taylor (1999) rule is equation (13), $\widehat{\text{Federal Funds Rate}}_{t+h} = 2.5 + 1.5(\pi_{t+h} - 2) + 2(u^*_{t+h} - u_{t+h})$ where inflation is the $t+h$ realized core PCE index and unemployment rate gap series is the realized $t+h$ unemployment rate less its natural rate, and the inertial Taylor (1999) rule is that of equation (14), $\widehat{\text{Federal Funds Rate}}_{t+h} = 0.85\text{Federal Funds Rate}_{t-1+h} + 0.15\left(2.5 + 1.5(\pi_{t+h} - 2) + 2(u^*_{t+h} - u_{t+h})\right)$ which uses the same inflation and unemployment rate series as its non-inertial counterpart. The 0.85 weight on the lagged federal funds rate is from the Federal Reserve Bank of Atlanta's Taylor Rule Utility Tool, (`https://www.atlantafed.org/research-and-data/data/taylor-rule`). The root mean squared errors shown in panel 7b is from equation (15) $\text{RMSE}_h = \sqrt{\frac{1}{h}\sum_{t=1}^{h}(\text{Federal Funds Rate}_{t+h} - \widehat{\text{Federal Funds Rate}}_{t+h})^2}$ for $h = 1, ..., 8$.

Panel 7b shows that the root mean squared error of the net sentiment forecast is the lowest for all horizons shown. While the RMSE of the lagged federal funds rate specification is lower than that of the inertial Taylor (1999) rule at short horizons, as shown by Crawley et al. (2026), the net sentiment forecast is the lowest shown at all horizons and significantly so as confirmed by Diebold and Mariano (1995) tests of forecast accuracy shown in appendix table 1. These findings are robust to excluding the periods when the federal funds rate is at its effective lower bound (December 16, 2008 to December 16, 2015 as well as March 15, 2020 to March 16, 2022). Taken together, this evidence suggests that net sentiment communicated by the Federal Reserve is at least as good of a predictor of future policy as well-studied reaction functions based on macroeconomic aggregates.

While this section shows that the net sentiment of the FOMC statements and press conferences contain predictive correlations with the future federal funds rate, these specifications are highly endogenous. To better understand the effect of sentiment on future policy, we next turn to high-frequency market reactions that allow for the construction of monetary policy shocks.

5 SENTIMENT AND MARKET REACTIONS

We regress market reactions discussed in section 3 on sentiment as constructed in section 4 for each type of communication to partially control for the endogeneity of the federal funds rate. We focus on the 4th Eurodollar/5th SOFR future, $EDSR4$, which corresponds to the expected policy rate four quarters ahead, for ease of discussion. Appendix D.1 confirms that all results for $EDSR4$ hold with all other interest rate futures of lower maturities.

$$\text{Market Reaction}_{t,i,j} = \alpha + \beta \text{Sentiment}_{t,i,j} + \epsilon_{t,j,i} \tag{16}$$

For communication type $j \in \{\text{Press conference}, \text{Chair speech}, \text{FOMC Statement}\}$ and raw sentiment $i \in \{\text{Hawkish}, \text{Dovish}, \text{Neutral}\}$ for each monetary event t.

Message 3. *When regressing market reactions on LLM sentiment, the press conference stands out for the strongest relationship between sentiment and market reaction.*

Figure 8 shows the estimates of the slope coefficient $\hat{\beta}$ from equation (16) estimated via OLS with Huber-White robust standard errors and 95 percent error bands. The x-axis shown is hawkish sentiment and the y-axis is the 4th Eurodollar/5th SOFR future representing the expected policy rate four quarters ahead. Appendix D.1 shows the results for dovish and neutral sentiment along with other market indicators. The market reaction can vary, with some communication events having almost no market reaction and others having one that is almost 20 basis points. As in section 4, communication events can contain dovish, hawkish, and neutral sentiment.

Press conferences stands out as having the strongest relationship between hawkish sentiment and market reaction, consistent with its predictive correlations with the federal funds rate shown in the previous section. The slope coefficient $\hat{\beta}$ is statistically significant from zero meaning that the stronger the hawkish content, the stronger the market reaction. By contrast, speeches by the chair and FOMC statements have a slope coefficient that is statistically insignificant from zero suggesting no discernible relationship between content and the size of the market reaction. If speeches also had a statistically significant slope coefficient like press conferences, one could conclude that markets react more to FOMC communications than actions. However, the results in figure 8 suggest that communications following actions elicit the largest market reactions, which suggests the importance of communications related to changes in fundamentals and special role for the press conference that is distinct from speeches.

Figure 8 presents a puzzle: the most negative market reactions of the press conference are those in the 2022-2024 tightening cycle. Why was the market surprised to the downside during a rapid tightening cycle characterized by hawkish sentiment? We first note that Appendix figure D.4 confirms that the strongest market reactions are indeed those that reverse the reactions to the preceding FOMC statement. We argue that these reversals are the result of dovish sentiment in press conferences refining the coarse hawkish signal of FOMC statements about the future stance of policy. That is, because the press conference has a higher correlation with the future federal funds rate, the market is reacting to refined signals.

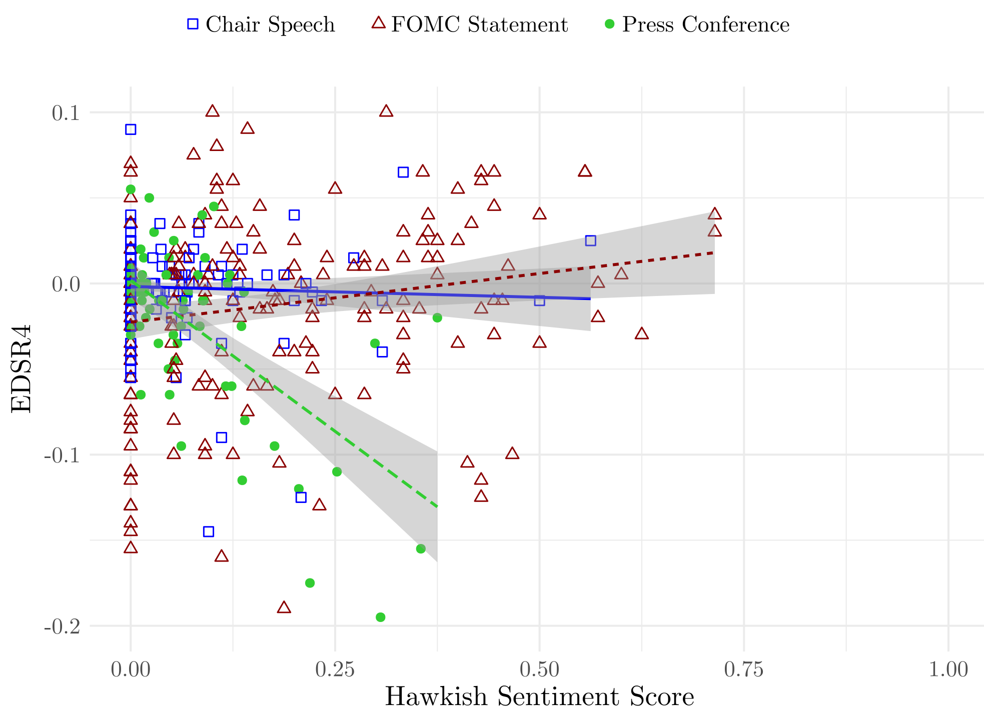


Figure 8: Regression of market surprises on hawkish sentiment.

The figures shows equation (16) $\Delta \text{Market Reaction}_{t,j} = \alpha + \beta \text{Sentiment}_j + \epsilon_{t,j}$ for hawkish sentiment for each type of communication $j \in \{\text{Press conference, Speech, FOMC statement}\}$. Shaded bands are 95 percent confidence intervals. The figure plots all market reactions with paired sentiment scores. Market reactions are intraday changes of trade prices 20 minutes after a communication event relative to trade prices 10 minutes before for the ith Eurodollar/$(i+1)$th SOFR future (ESRi), which corresponds to the expected policy rate i quarters ahead for $i = 1, \ldots, 4$. The estimation sample starts in 1999 for FOMC statements, in 2008 for Chair speeches, and in 2011 for press conferences, which is based on the availability of texts of these communications.

While FOMC statements used to be the primary form of communication, our findings highlight a key role for the sentiment of the press conference in explaining market reactions that sometimes reverse those of the statement, especially in interest rate futures four quarters ahead. We next test if the market does indeed perceive the press conference as clarifying information that shapes expectations about the future path of policy. After all, Narain and Sangani (2026) document heightened market volatility under Chair Powell's press conferences, particularly when addressing forward guidance, which aligns with our finding that press conferences refine the statement's message.

6 Announcement Variance Ratio

Although elevated trading volume around FOMC statements is well known, less is understood about how long the announcement-related impulse remains informative. To measure the incremental signal associated with the press conference, we estimate an Announcement Variance Ratio (AVR) using an approach similar in spirit to the local-projections difference-in-differences framework in Dube et al. (2025).[17] The AVR captures, in the OLS sense, the share of variation in minute-level trading activity attributable to the FOMC-announcement treatment interaction relative to the variation left unexplained by the fitted model. It is therefore a partial/incremental measure of explained variance and inherits a standard variance-decomposition interpretation. This is because OLS partitions the total sum of squares into a component explained by the regressors and a residual component, and the AVR reports how much the announcement interaction contributes to the former per unit of the latter. Specifically, we measure the marginal variation in trading activity around an FOMC statement relative to the same day and time one week before and one week after the release.We focus on scheduled meetings only in this section, but results are similar if unscheduled meetings are included. Pre-trend assumptions necessary for the differences-in-differences analysis are less likely to hold for unscheduled meetings as they could be proceeded by atypical trading activity.[18]

For each futures contract i and each horizon h, we estimate

$$Y^i_{\tau,d} = \beta_0^{i,h} + \beta_1^{i,h}\mathbb{1}(d = \text{FOMC}) + \beta_2^{i,h}\mathbb{1}(-10 \le \tau \le h) + \beta_3^{i,h}\left[\mathbb{1}(d = \text{FOMC}) \times \mathbb{1}(-10 \le \tau \le h)\right] + \lambda_{m\times y} + \varepsilon^{i,h}_{\tau,d}, \tag{17}$$

where $Y^i_{\tau d}$ is minute-τ trading volume for contract i, scaled by that day's (d) total trading volume, and $\tau = 0$ denotes the scheduled FOMC statement release time. The futures studied i are the ith Eurodollar/$(i+1)$th SOFR futures for $i = 1,..,4$ corresponding to the first year of the term structure of interest rates. The indicator $\mathbb{1}(d = \text{FOMC})$ equals one on FOMC statement days and zero on control days, defined as the same weekday one week before and one week after the FOMC meeting. Scaling by daily trading volume accounts for differences in overall trading intensity across days, while month×year fixed effects absorb additional variation.

[17] Annette Vissing-Jorgensen's discussion of Swanson and Jayawickrema (2024) conducts a related variance decomposition exercise of stock market returns around FOMC events. She finds that speeches are noisier (less attributable variation) than statements and press conferences https://drive.google.com/file/d/1GD8FK7QwA1VqSu1g1LdCtLeOqYQ1cujT/view.

[18] Appendix figure E.1 shows trading volumes around FOMC announcements as a share of daily volume for FOMC statement releases studied.

The estimation sample is fixed over $\tau \in [-70, 170]$. For a given horizon h, the treated window is defined as the interval from ten minutes before the statement release through minute h, that is, $\tau \in [-10, h]$. We begin with $h = -9$, so the initial treated window contains only the two minutes immediately preceding the statement release, and then expand the window one minute at a time up to $h = 170$. This design preserves comparability with standard identification of high-frequency monetary policy events, which measures price changes relative to the trade price ten minutes before the statement release.

We focus on the incremental explanatory power of the interaction term as the treated window expands. At each horizon h, we define the AVR as

$$\text{AVR}_h = \frac{SS(\mathbb{1}(d = \text{FOMC}) \times \mathbb{1}(-10 \leq \tau \leq h))}{RSS_h}, \tag{18}$$

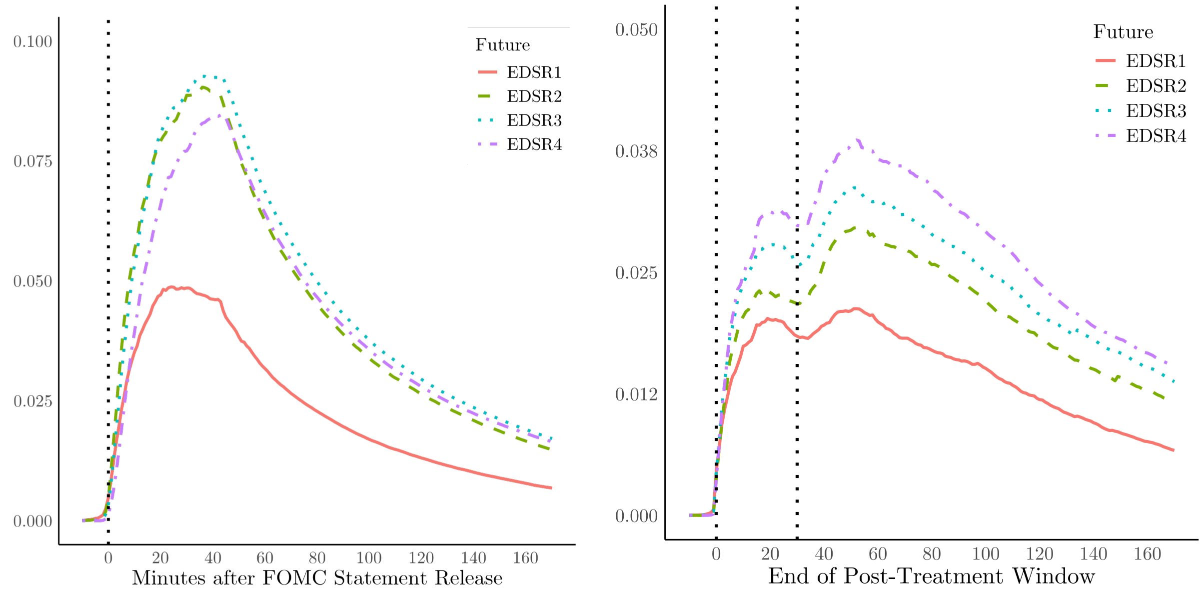
where $SS(\cdot)$ denotes the ANOVA sum of squares attributable to the interaction term and RSS_h is the residual sum of squares from the full model estimated at horizon h. A higher value of the statistic indicates that including minute h in the event window adds more FOMC-related signal than residual noise.

This minute-by-minute analysis provides a direct way to assess how quickly statement-related trading activity becomes informative and how long that informativeness persists. In particular, a value of zero when $h < 0$ indicates little differential trading activity before the scheduled release, as shown in figure 9. An increase in the statistic at $\tau = 0$ and continuing afterward suggests that statement-related information arrives at the scheduled release and continues to unfold during the subsequent press conference period which begins at $\tau = 30$.

Message 4. *The statement alone is less influential compared to a few years ago. Market participants increasingly wait for the press conference to fine-tune their expectations, as indicated by relatively higher announcement variance detected from the press conference relative to the statement.*

Figure 9 compares the AVR around releases of FOMC statements in the period prior to the press conference in panel 9a (1995 to March 2011) to that after the introduction of the press conference in panel 9b (April 2011-2025) and shows that the market perceives additional signal from press conferences. While panel 9a shows that signal detected from trading volumes peaked about 40 minutes after FOMC statements in all four interest rate futures shown, panel 9b shows a different pattern after the introduction of the press conference. In panel 9b, signal peaks about 20 minutes after the FOMC statement release, flattens and then begins to climb again after the start of the press conference, which is 30 minutes after the statement release (denoted by the second dashed vertical line). The signal continues to climb during press conferences and peaks about 30 minutes after the start, which is about an hour after the release of the FOMC statement. The announcement variance ratios are relatively lower in the post-press conference sample in 9b (2011-2025) because of, in part, relatively low values during the ELB in 2020 and 2021, as shown in figure 10. By averaging over each year instead of pre- and post-press conference periods, figure 10 shows that announcement variance ratios lend to relatively more signal from the press conference than the statement by 2019 when Chair Powell institutes a press conference after every meeting.

Given that the press conference contains additional information above and beyond the statement, how should researchers incorporate the press conference into the construction of high-frequency mon-



(a) Pre-press conference, 1995 to March 2011

(b) Post-press conference, April 2011 to 2025

Figure 9: Announcement variance ratio by pre- and post-press conference samples

The figure plots the Announcement Variance Ratio, which is the sum of squares of the coefficient $Y^i_{\tau,d} = \beta_0^{i,h} + \beta_1^{i,h}\mathbb{1}(d = \text{FOMC}) + \beta_2^{i,h}\mathbb{1}(-10 \le \tau \le h) + \beta_3^{i,h}\left[\mathbb{1}(d = \text{FOMC}) \times \mathbb{1}(-10 \le \tau \le h)\right] + \lambda_{m\times y} + \varepsilon^{i,h}_{\tau,d}$. Zero indicates the minute of the FOMC statement (typically 2:00 PM EST), and the x-axis is minutes since the statement release. The press conference typically starts 30 minutes after the statement release, as indicated by the second vertical dashed line in panel 9b. The sample includes all scheduled FOMC Statements from January 1995 to April 2025. The ith Eurodollar/$(i+1)$th SOFR future (ESRi) corresponds to the expected policy rate i quarters ahead for $i = 1, ..., 4$.

etary policy shocks? After all, focusing solely on statements may miss the full scope of monetary news contained in the press conference.

7 MONETARY TRANSMISSION

We construct commonly used monetary policy shocks from the previously discussed intraday changes in federal funds futures and Eurodollar/SOFR futures. The Nakamura and Steinsson (2018) shock series is the scaled first principal component of the instrument set $\{MP1, MP2, EDSR2, EDSR3, EDSR4\}$ using 30-minute windows around FOMC statements.[19] We construct a second version of this series using the same instrument set, but 90-minute windows around FOMC statements when there is a post-meeting press conference as in Acosta et al. (2025) and Grotteria and van Binsbergen (2025). Using this same instrument set, Gürkaynak et al. (2005) extract and rotate two factors—the target and path—which correspond to the level and slope of the yield curve for one-year-ahead interest rates. Given that the net sentiment of press conferences contains predictive correlations with the future federal funds rate beyond one year, we augment the instrument set to include

[19] $MP1$ and $MP2$ are calculations performed on $FF1$ through $FF4$ to correct for time averaging in settlement prices. See Brennan et al. (2025) and Appendix F for detailed descriptions.

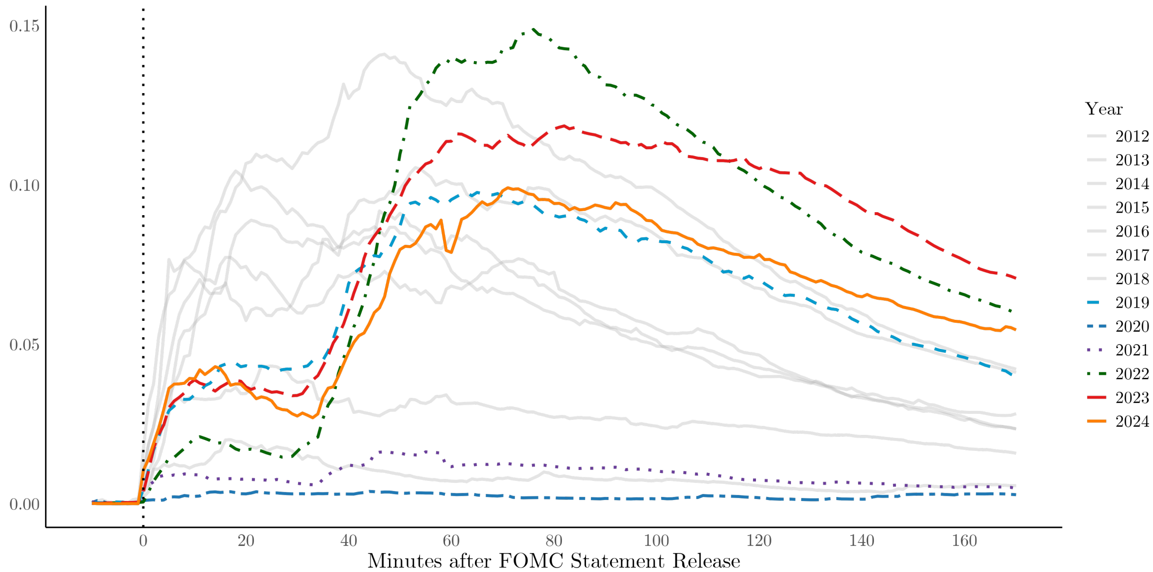


Figure 10: Announcement variance ratio by year, 2011-2025.

The figure plots the Announcement Variance Ratio, which is the sum of squares of the coefficient $Y^i_{\tau,d} = \beta^{i,h}_0 + \beta^{i,h}_1 \mathbb{1}(d = \text{FOMC}) + \beta^{i,h}_2 \mathbb{1}(-10 \leq \tau \leq h) + \beta^{i,h}_3 \left[\mathbb{1}(d = \text{FOMC}) \times \mathbb{1}(-10 \leq \tau \leq h)\right] + \lambda_{m\times y} + \varepsilon^{i,h}_{\tau,d}$. Zero indicates the minute of the FOMC statement (typically 2:00 PM EST), and the x-axis is minutes since the statement release. The press conference typically starts 30 minutes after the statement release. The sample includes all scheduled FOMC Statements from January 1995 to April 2025. The volume shown is for EDSR4 which is the 4th Eurodollar/5th SOFR future corresponding to the expected policy rate four quarters ahead.

high-frequency changes in 2-, 5-, 10-, and 30-year Treasury yields as in Brennan et al. (2025). Appendix F contains details on shock construction.

The effect of monetary policy on the macroeconomy is frequently estimated via a structural vector autoregression framework at a monthly frequency by using high-frequency monetary policy shock series as external instruments.[20] We use the VAR specification of Bauer and Swanson (2022) which is a variant of Gertler and Karadi (2015) and extend it to April 2025 instead of stopping in 2019 as in previous studies. The external instrument imposes a second moment restriction to identify shocks, more specifically it replaces one column of the rotation matrix with predicted values from a regression of a reduced form VAR innovation on the external instrument.

Identification via an external instrument hinges on a high-frequency monetary policy shock series ε^i_t satisfying relevance and exogeneity conditions to be an adequate external instrument for ε^{mp}_t the unobservable true monetary shocks.

$$E[\varepsilon^{mp}_t \varepsilon^i_t] \neq 0 \qquad \text{and} \qquad E[\varepsilon^i_t \varepsilon^{\not{mp}}_t] = 0$$

Where ε_t is any serially uncorrelated structural shocks driving the economy and $\varepsilon^{\not{mp}}$ is a subset of these

[20] See Stock and Watson (2018) for additional documentation of VARs with external instruments and Miranda-Agrippino and Ricco (2023) for a discussion of why it is the dominant specification in empirical macroeconomics.

shocks unrelated to monetary policy.

Since the true value of ε_t^{mp} is unobserved, instrument validity must ultimately be justified logically. Any high-frequency monetary shock series should satisfy the relevance condition as they capture monetary news conveyed by Fed communication by construction. The exclusion condition should also be satisfied because the tight windows around FOMC statement releases should prevent non-monetary news from moving markets. While Bauer and Swanson (2023) show that the exclusion condition is violated for the Nakamura and Steinsson (2018) monetary policy shock series, Brennan et al. (2025) find that that other shock series like those of Bu et al. (2021) and Kuttner (2001) are unpredictable, which suggests that predictability is a feature of certain shocks, not high-frequency monetary shocks per se. Relatedly, these shock series exhibit conventionally-signed responses which can alleviate concerns about contamination from the so-called Fed information effect.

The specification for a VAR with external instruments is given as:

$$Y_T = \alpha + B(L)Y_{T-1} + s_1 Y_T^{2Y} + \tilde{u}_T \tag{19}$$

Where Y_T is a vector containing four monthly economic variables from January 1973 to April 2025: the log of the consumer price index (CPI), the log of industrial production (IP), the Gilchrist and Zakrajšek (2012) excess bond premium (as advocated by Caldara and Herbst (2019), and the two-year zero-coupon Treasury yield at a monthly frequency. Appendix G details the sources of these series. We also note that the two-year Treasury yield is the daily change observed at the end of the month as in the excel spreadsheet used by Bauer and Swanson (2022).[21] The excess bond premium controls for financial factors and the two-year Treasury is a measure of the stance of monetary policy. Although the original Gertler and Karadi (2015) specification uses the one-year Treasury, the two-year has the advantage of being less constrained at the ELB and is used by Bauer and Swanson (2022).

Next, $B(L)$ is the matrix polynomial in the lag operator. Although Bauer and Swanson (2022) follow Gertler and Karadi (2015) and Ramey (2016) in using 12 lags, we follow Brennan et al. (2025) and use 8 lags.[22] While Bauer and Swanson (2022) construct a version of the NS shock series from 1988 to 2019, our monetary policy shock series begins in 1995 which is as close to the 1994 introduction of explicit policy statements as our intraday data allows without resorting to sources we cannot replicate from intraday data on actual trades. We extend these shock series to present and estimate the VAR to present as well with Appendix figures F.4-F.6 showing that results are similar if we instead stop in 2019.

Finally, ϵ_t^i is the instrument for $s_1 Y_T^{2y}$ estimated via two-stage least squares and $\tilde{u}_T$ is the residual. The sample of the external instrument ϵ_t^i does not have to be the same as that of the economic data. In fact, the sample used for our shock series is from January 1995 to April 2025 and the sample for the economic data is from January 1973 to April 2025. Furthermore, following the literature, ϵ_t^i is aggregated to a monthly frequency by summation, $\epsilon_T^i = \sum_t \epsilon_t^i$. We do not make any further adjustments for the timing of shocks within the month as Ramey (2016) and Miranda-Agrippino and Ricco (2021) find that the adjustments proposed by Gertler and Karadi (2015) can induce serial correlation.

[21] See https://www.frbsf.org/wp-content/uploads/monetary-policy-surprises-data.xlsx?2026-03-24.

[22] Appendix figures F.1-F.3 show that the results are quite similar with 12 lags, albeit with wider error bands in some instances.

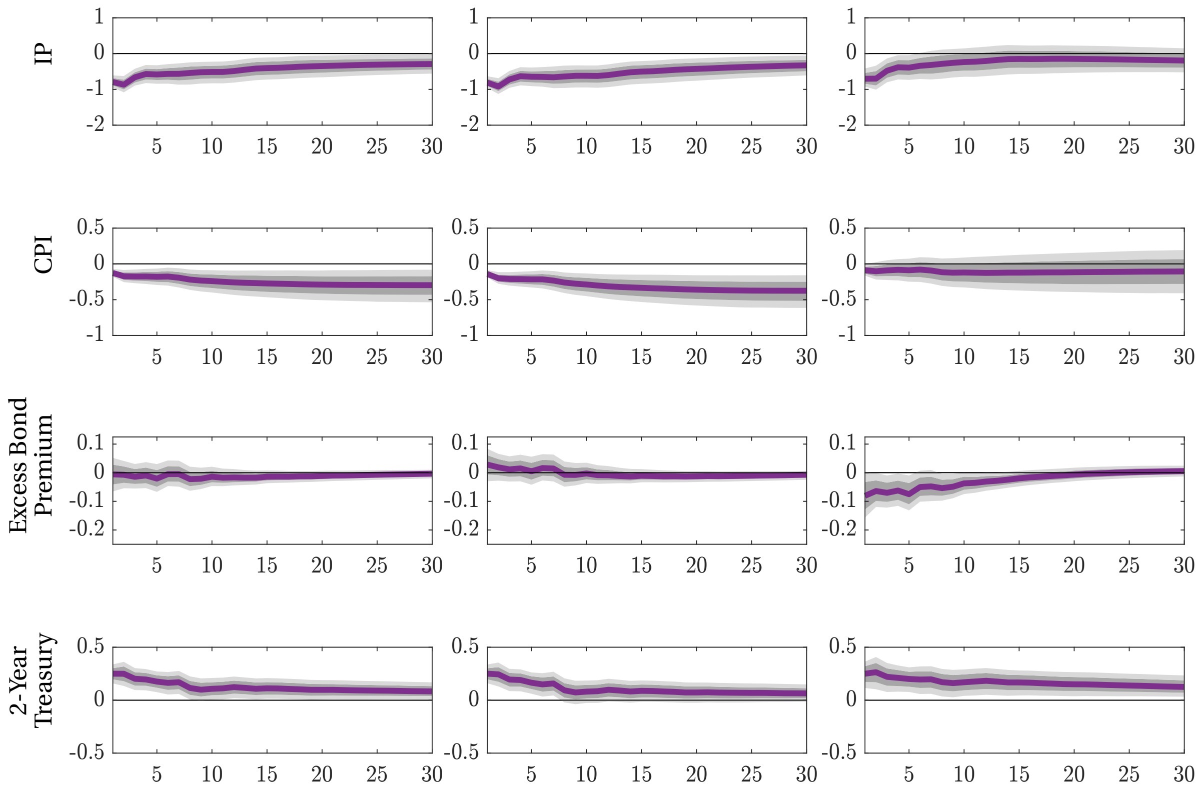
Figure 11 plots impulse responses from equation (19) obtained via the Canova and Ferroni (2022) toolbox with 68 and 90 percent error bands and 20,000 draws. The impulse responses to a 25 basis point monetary shock are qualitatively in line with macroeconomic theory and similar in sign and shape, even though the shock series used in panel 11a is constructed without the press conference, its counterpart in panel 11b includes the press conference, and panel 11c contains the press conference and longer-term Treasuries in the instrument set. The response of the two-year Treasury, shown in the bottom row of each panel, rises on impact to a normalized initial response of 25 basis points and then returns to zero about 10 months after the initial impulse.

The impulse responses of both industrial production and CPI to a contractionary monetary policy shown in the first and second rows of figure 11, respectively, are significantly negative—as standard New Keynesian theory predicts. Differences in point estimates among the shock series are only in magnitude rather than in sign. A 25 basis point contractionary monetary policy shocks results in about a 1 and 0.25 p.p. reduction in industrial production (IP) and the consumer price index (CPI), respectively.

The excess bond premium shown in row three is the only variable that displays qualitative differences in point estimates. While the coefficients are ambiguously zero for the original 30-minute time window shown in panel 11a, they are positive and statistically significant from zero on impact, as shown in panel 11b, and statistically negative in panel 11c. In Gertler and Karadi (2015), the excess bond premium is positive and significant, which is only the case in panel 11b where the Nakamura and Steinsson (2018) monetary policy shock is constructed to include the press conference, but not long-term Treasuries.

Figure 12 plots the impulse responses from equation (19) using the target shock of Gürkaynak et al. (2005) constructed from the rotated first principal component of the instrument set $\{MP1, MP2, EDSR2, EDSR3, EDSR4\}$ and the version augmented with intraday changes in 2-, 5-, 10-, and 30-year Treasuries. The target shock represent unexpected changes in actual interest rate decisions by the FOMC. Figure 12 shows point estimates that are aligned with theoretical predictions and have little difference across monetary policy shock constructions. In fact, unlike the impulse responses to the Nakamura and Steinsson (2018) shock shown in figure 11, those for the target shock of Gürkaynak et al. (2005) in figure 12 are all positive and significant for the excess bond premium shown in row three. Taken together, these results suggest that expanding time windows to include the forward guidance contained in the press conference and its effects on long-term rates has little effect on unexpected changes in the federal funds rate, as one would expect.

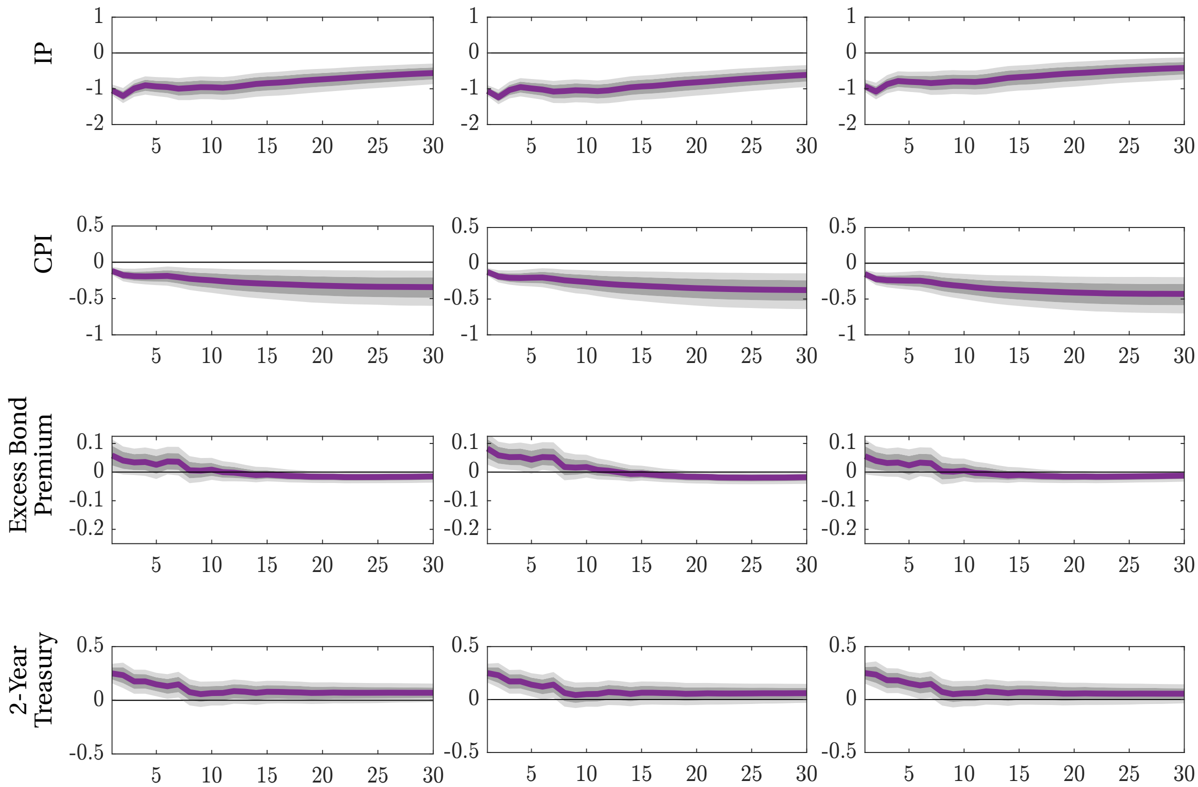
Figure 13 plots the impulse responses from equation (19) using the path shock of Gürkaynak et al. (2005) constructed from the rotated second principal component of the instrument set $\{MP1, MP2, EDSR2, EDSR3, EDSR4\}$ and the version augmented with intraday change in 2-, 5-, 10-, and 30-year Treasuries. The figure shows point estimates that are either opposite-signed or insignificant from zero for the original shock construction and the version that includes information from the press conference (panels 13a and 13b, respectively). While authors like Bundick and Smith (2020) account for these point estimates as information shocks about the state of the economy, Swanson and Jayawickrema (2024) show that including market reactions to speeches in monetary policy shock construction can lead to signs of point estimates that are conventionally-signed and look like those in panel 13c. Additionally, Adams and Barrett (2026) find point estimates similar to ours with long-term rates in panel 13c from synthetic monetary policy shocks constructed from long-horizon forward guidance.



(a) Original time window (b) Includes press conference (c) Includes press conference and long-term rates

Figure 11: Impulse response to a 25 basis point Nakamura and Steinsson (2018) monetary policy shock, x-axis is months and y-axis is percentage points.

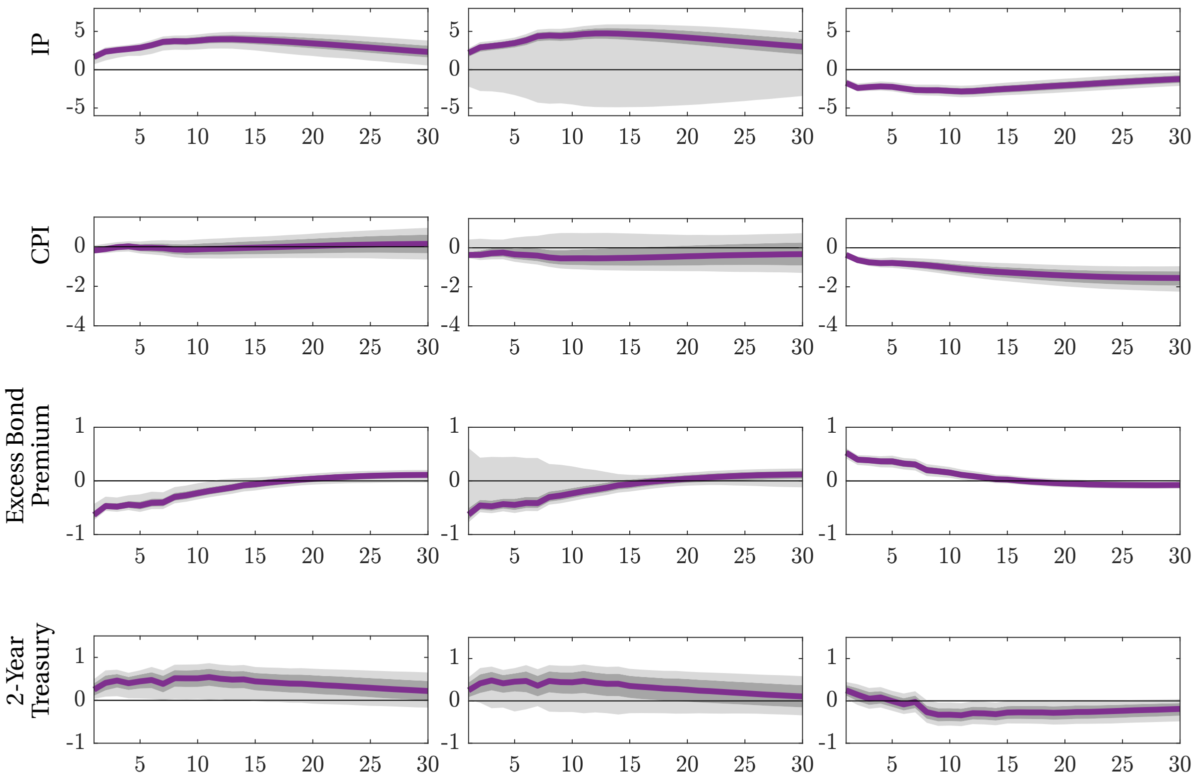
Impulse responses are estimates from equation (19) $Y_T = \alpha + B(L)Y_{T-1} + s_1 Y_T^{2Y} + \tilde{u}_T$ obtained via the Canova and Ferroni (2022) Bayesian VAR toolbox with 68 and 90 percent error bands (darker and lighter bands, respectively), 20,000 draws, and 8 lags. The sample of monetary shock series is from January 1995 to April 2025 while the sample of economic data starts in January 1973. The shock series are the first principal component of the instrument set $\{MP1, MP2, EDSR2, EDSR3, EDSR4\}$. The shock series in panel a is constructed from the 30-minute change in these futures around FOMC statements. The shock series in panel b is constructed from the 90-minute change in these futures around FOMC statements when there is a post-meeting press conference so that the time window includes the press conference. Panel c augments the instrument set in panel b with intraday changes in 2-, 5-, 10-, and 30-year Treasury yields. IP is the industrial production index, CPI is the consumer price index, excess bond premium is from Gilchrist and Zakrajšek (2012), and the two-year Treasury is the end of the month daily change in the zero-coupon yield. All sources of series are detailed in Appendix G. Appendix Table 2 displays the first-stage F-statistics.



(a) Original time window (b) Includes press conference (c) Includes press conference and long-term rates

Figure 12: Impulse response to a 25 basis point Gürkaynak et al. (2005) target monetary policy shock, x-axis is months and y-axis is percentage points.

Impulse responses are estimates from equation (19) $Y_T = \alpha + B(L)Y_{T-1} + s_1 Y_T^{2Y} + \tilde{u}_T$ obtained via the Canova and Ferroni (2022) Bayesian VAR toolbox with 68 and 90 percent error bands (darker and lighter bands, respectively), 20,000 draws, and 8 lags. The sample of monetary shock series is from January 1995 to April 2025 while the sample of economic data starts in January 1973. The shock series is the rotated first principal component of the instrument set $\{MP1, MP2, EDSR2, EDSR3, EDSR4\}$. The shock series in panel a is constructed from the 30-minute change in these futures around FOMC statements. The shock series in panel b is constructed from the 90-minute change in these futures around FOMC statements when there is a post-meeting press conference so that the time window includes the press conference. Panel c augments the instrument set in panel b with intraday changes in 2-, 5-, 10-, and 30-year Treasury yields. IP is the industrial production index, CPI is the consumer price index, excess bond premium is from Gilchrist and Zakrajšek (2012), and the two-year Treasury is the end of the month daily change in the zero-coupon yield. All sources of series are detailed in Appendix G. Appendix Table 2 displays the first-stage F-statistics.



(a) Original time window

(b) Includes press conference

(c) Includes press conference and long-term rates

Figure 13: Impulse response to a 25 basis point Gürkaynak et al. (2005) path monetary policy shock, x-axis is months and y-axis is percentage points.

Impulse responses are estimates from equation (19) $Y_T = \alpha + B(L)Y_{T-1} + s_1 Y_T^{2Y} + \tilde{u}_T$ obtained via the Canova and Ferroni (2022) Bayesian VAR toolbox with 68 and 90 percent error bands (darker and lighter bands, respectively), 20,000 draws, and 8 lags. The sample of monetary shock series is from January 1995 to April 2025 while the sample of economic data starts in January 1973. The shock series are the rotated second principal component of the instrument set $\{MP1, MP2, EDSR2, EDSR3, EDSR4\}$. The shock series in panel a is constructed from the 30-minute change in these futures around FOMC statements. The shock series in panel b is constructed from the 90-minute change in these futures around FOMC statements when there is a post-meeting press conference so that the time window includes the press conference. Panel c augments the instrument set in panel b with intraday changes in 2-, 5-, 10-, and 30-year Treasury yields. IP is the industrial production index, CPI is the consumer price index, excess bond premium is from Gilchrist and Zakrajšek (2012), and the two-year Treasury is the end of the month daily change in the zero-coupon yield. All sources of series are detailed in Appendix G. Appendix Table 2 displays the first-stage F-statistics.

8 CONCLUSION

This study explains patterns in market reactions to Federal Reserve communications with insights from large language modeling. We document empirical relationships showing that Federal Reserve press conferences refine coarse signals of FOMC statements and contain content that accounts for the future federal funds rate and intraday changes in asset prices that are opposite of those in response to FOMC statements. By integrating large language models with high-frequency asset price data, we find that press conferences stand out for their intensity of sentiment and market reactions. We confirm the distinct role of press conferences in refining the statement's message by showing that market participants indeed perceive additional signal. Finally, we show that including press conferences in the construction of high-frequency monetary policy shocks can affect estimates of monetary policy transmission.

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A Appendix: Dates and Times

We determine the dates and times of the monetary policy announcements following Swanson and Jayawickrema (2024). In particular, we collected the dates, times, and high-frequency, intraday asset price changes from June 1995 to April 2025 for: i) unscheduled and scheduled FOMC statements, ii) speeches by the Federal Reserve chair, iii) Congressional testimony by the Federal Reserve Chair, and iv) post-FOMC-meeting press conferences from January 2011 to April 2025. The start and end times of Congressional testimony start times were confirmed and end times obtained from Gordon and Lunsford (2024). Transcribed text is readily available starting in 1999 for FOMC statements and 2008 for Congressional testimonies and speeches by the Fed Chair.

FOMC Statements and Minutes Releases

We collected the schedules of FOMC announcements and meeting minutes releases from January 1995 to April 2025 through the Federal Reserve Board's public website. The Federal Reserve announces decisions on monetary policy or regulations to the press, and all such statements can be found in the press release section of the official website. The dates and times when FOMC statements were released and when the minutes of each meeting are available from 2006 onward on the Federal Reserve's public website.

For events from 1995 to 2005, we obtained the dates through the website and supplemented the timing information from Gürkaynak et al. (2005) and Swanson and Jayawickrema (2024). Any remaining missing information was verified through Factiva searches of news archives.

FOMC statements are issued on the last day of the meeting. From 1999 to 2010, with a few exceptions, these statements were announced at 2:15 PM Eastern Time. In 2011, the introduction of post-FOMC press conferences led to changes in this timing. For the two years from 2011 to 2012, if a post-meeting press conference occurred, the FOMC issued a press release at 12:30 PM Eastern Time; for meetings without press conferences, the Fed maintained the 2:15 PM release time. From 2013 onwards, the schedule was adjusted, and the FOMC generally announced its monetary policy decisions at 2:00 PM Eastern Time. We drop all notational meetings including August 27, 2000, October 4, 2019, March 11, 2008, and August 10, 2007. Following much of the literature, we drop the meetings after 9/11. We drop the March 15, 2020 unscheduled meeting as it occurred on a Sunday and it is difficult to source trades.

Post-FOMC press conferences

All materials related to post-FOMC-meeting press conferences are available on the Federal Reserve's publicw website. These press conferences began in April 2011, so unlike other events, the data exists only from 2011 onwards. Currently, press conferences are held after almost every FOMC meeting, resulting in eight scheduled press conferences per year. However, in the early years (2011 to 2012), press conferences were held every other meeting, occurring four times annually.

From 2011 to 2012, the press conferences started at 2:15 PM, and from 2013, they began at 2:30 PM. The Federal Reserve's website posts videos of press conferences along with transcripts. The duration of each conference can be verified through these videos. The press conferences last between 14 minutes at the shortest and 76 minutes at the longest, with an average duration of 53 minutes.

Speeches by the Federal Reserve Chair

The schedules for speeches and Congressional testimonies of the Fed Chair are available on the Federal Reserve Board's public website from 2006 onward. The website posts transcripts of the speeches, which include the time each document was released to the public. We extract the timing information from these transcripts. However, transcripts were not posted for speeches and Congressional testimony from 2006 to 2009, making it impossible to confirm precise timing. Therefore, for speeches and testimonies prior to 2009, we verified the timing data using the FRASER library of the Federal Reserve Bank of St. Louis. Additionally, speech materials from before 2006 that are not available on the Federal Reserve's website can also be found in FRASER.

FRASER contains transcripts of all speeches and testimonies by the Federal Reserve Chair and include the start time of the speech, from which we were able to extract the timing information. Occasionally, for Congressional testimonies rather than regular speeches, the time may not be included. In these cases, we verified the testimony time through news sources using Factiva searches.

B APPENDIX: HIGH-FREQUENCY MARKET REACTIONS

B.1 MARKET REACTIONS: PRESS CONFERENCE VS. FOMC STATEMENT Figure B.1 plots the market reactions for the first year of interest rate futures, $EDSR1$ to $EDSR4$, which correspond to the ith Eurodollar/$(i+1)$th SOFR futures for $i = 1, \ldots, 4$ quarters ahead.

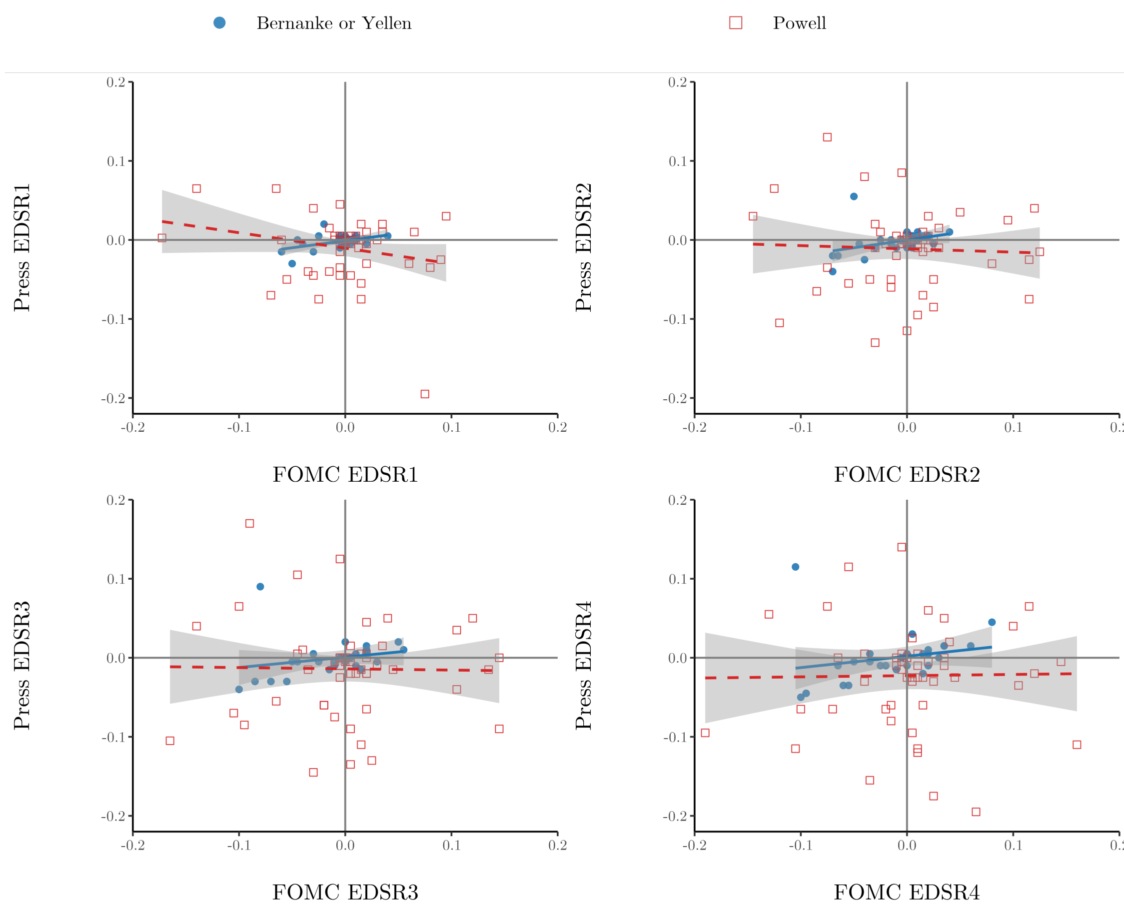
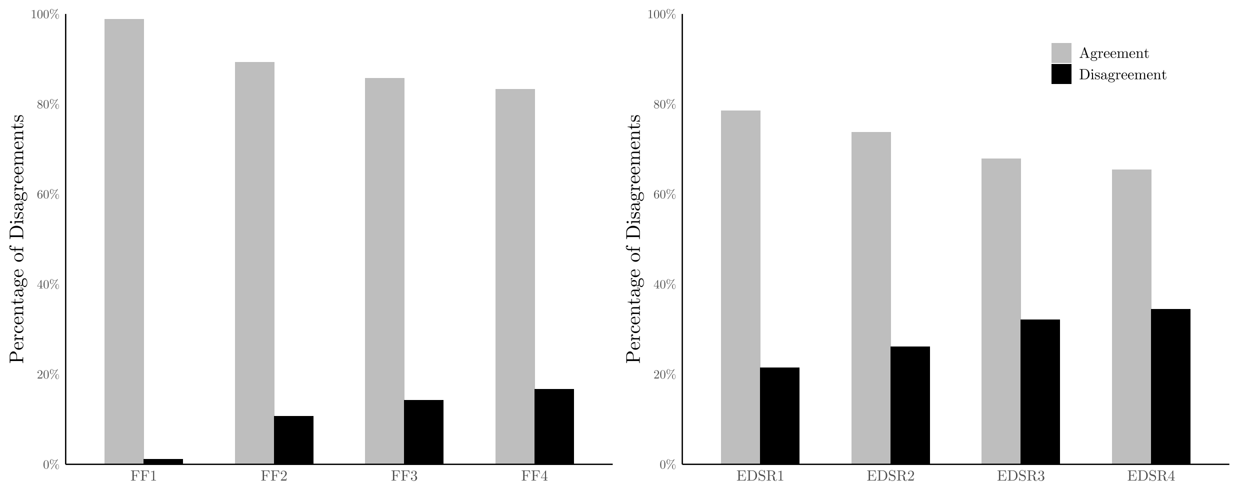


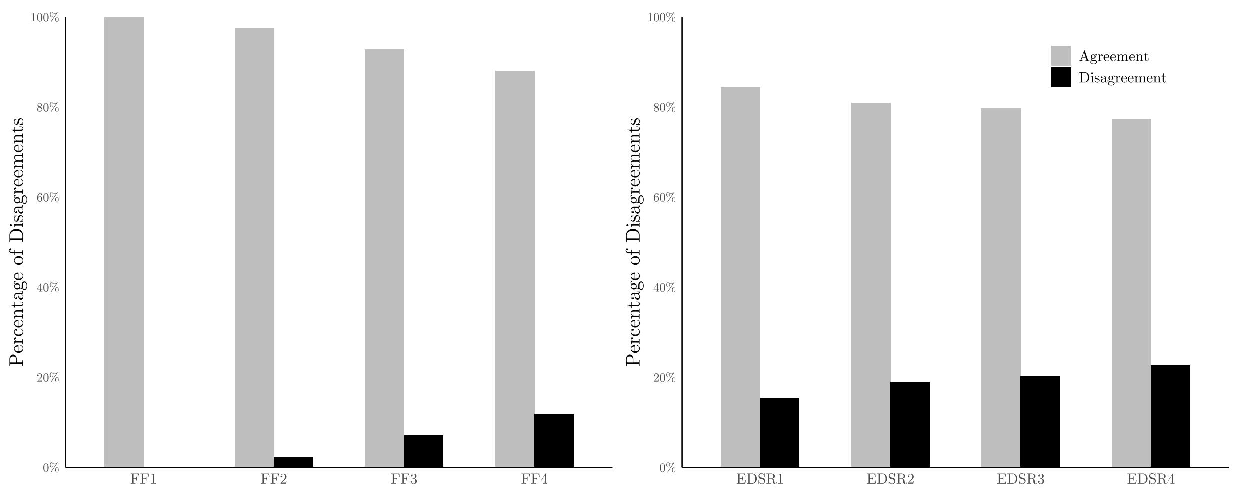
Figure B.1: Market reactions to the press conference vs. FOMC statement, basis points.

The figure shows the regression Market Reaction$_{t,\text{Press}} = \alpha +$Market Reaction$_{t,\text{FOMC}} + \epsilon_t$ by Fed chairs for the 1st Eurodollar/2nd SOFR future through the 4th Eurodollar/5th SOFR future. Market reactions are intraday changes of trade prices 20 minutes after a communication event relative to trade prices 10 minutes before for the ith Eurodollar/$(i+1)$th SOFR future (ESRi), which corresponds to the expected policy rate i quarters ahead for $i = 1, \ldots, 4$. Bernanke or Yellen is April 2011 to January 2018 and Powell is from February 2018 to April 2025. Shaded bands are 90% error bands.

B.2 MARKET DISAGREEMENTS Figure B.2 shows that the rate of disagreement is increasing in the maturity of interest rate futures. The first expiring federal funds future $FF1$ has no disagreements, as changes in this future are directly linked to the federal funds rate and it is therefore not affected by the press conference. By contrast, $EDSR4$ has about one-fifth to one-third of all FOMC statement/press conference pairs in disagreeing in the sign of the market surprise.



(a) Three basis point threshold for disagreements



(b) Five basis point threshold for disagreements

Figure B.2: Disagreement in market reactions to FOMC statements and press conferences

A disagreement is an intraday change that is more than three or five basis points with different signs for an FOMC statement and a press conference. An agreement is all other observations. Market reactions are the trade prices 20 minutes after the FOMC statement release or start of the press conference less the trade prices 10 minutes prior, respectively. The sample is from April 2011 to April 2025. FFi for $i = 1, ..., 4$ is the ith federal funds rate future where i corresponds to the month ahead, $i = 0$ is the current month. The ith Eurodollar/$(i+1)$th SOFR future (ESRi), which corresponds to the expected policy rate i quarters ahead for $i = 1, ..., 4$.

Market reactions are intraday changes of trade prices 20 minutes after a communication event relative to trade prices 10 minutes before for the ith Eurodollar/$(i+1)$th SOFR future (ESRi), which corresponds to the expected policy rate i quarters ahead for $i = 1, ..., 4$.

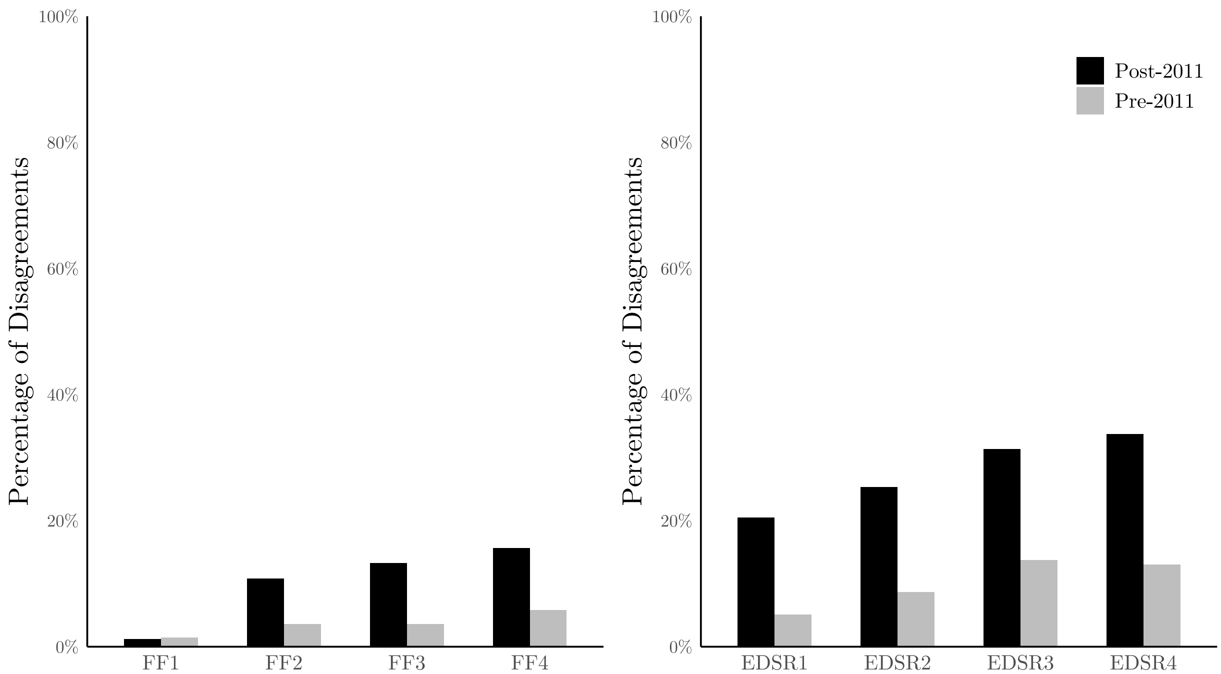


Figure B.3: Comparing disagreements in market reactions for speeches and the press conferences

Pre-2011 is the period before the introduction of the press conference in April 2011. A pre-2011 disagreement is a more than three basis point intraday change surrounding a speech by the Chair in the week following an FOMC statement that is different in sign from the intraday change around the preceding FOMC statement. A post-2011 disagreement is an intraday change that is more than three or five basis points with different signs for an FOMC statement and a press conference. An agreement is all other observations. The pre-2011 sample has 32 observations and the post-2011 sample has 76 observations. The sample is from January 1995 to April 2025. FFi for $i = 1, ..., 4$ is the ith federal funds rate future where i corresponds to the month ahead, $i = 0$ is the current month. The ith Eurodollar/$(i+1)$th SOFR future (ESRi), which corresponds to the expected policy rate i quarters ahead for $i = 1, ..., 4$.

C APPENDIX: SENTIMENT SCORES

C.1 RAW SENTIMENT SCORES This appendix shows the sentiment scores of FOMC statements, press conferences, Congressional testimonies, and Fed Chair speeches. Figures C.1 and C.2 show the Fed's statutory goals—inflation and unemployment—along with its main instrument in the form of monetary policy. The figure shows that the share of text devoted to these topics and the hawkish or dovish sentiment—that is, sentiment pertaining to tightening or loosening, respectively—varies across time. The prevalence of both hawkish and dovish sentiment varies across type of communication and is discussed in the main text.

To assure that the LLM captures the Fed's monetary policy stance we note a few episodes. First, the Fed's 2022-2024 tightening cycle aimed to bring inflation back to its 2 percent policy objective and figures C.1 and C.2 show that hawkish sentiment about inflation consisted of about 40 percent of the FOMC statement communication, the highest hawkish inflation sentiment recorded in our sample. Second, from 2008 to about 2015 about 30 percent of the FOMC statement focused on dovish unemployment sentiment, which is consistent with the Fed's objective of returning the economy to full employment. Finally, monetary policy is detected as hawkish during the 2015-2018 and 2022-2024 tightening cycles.

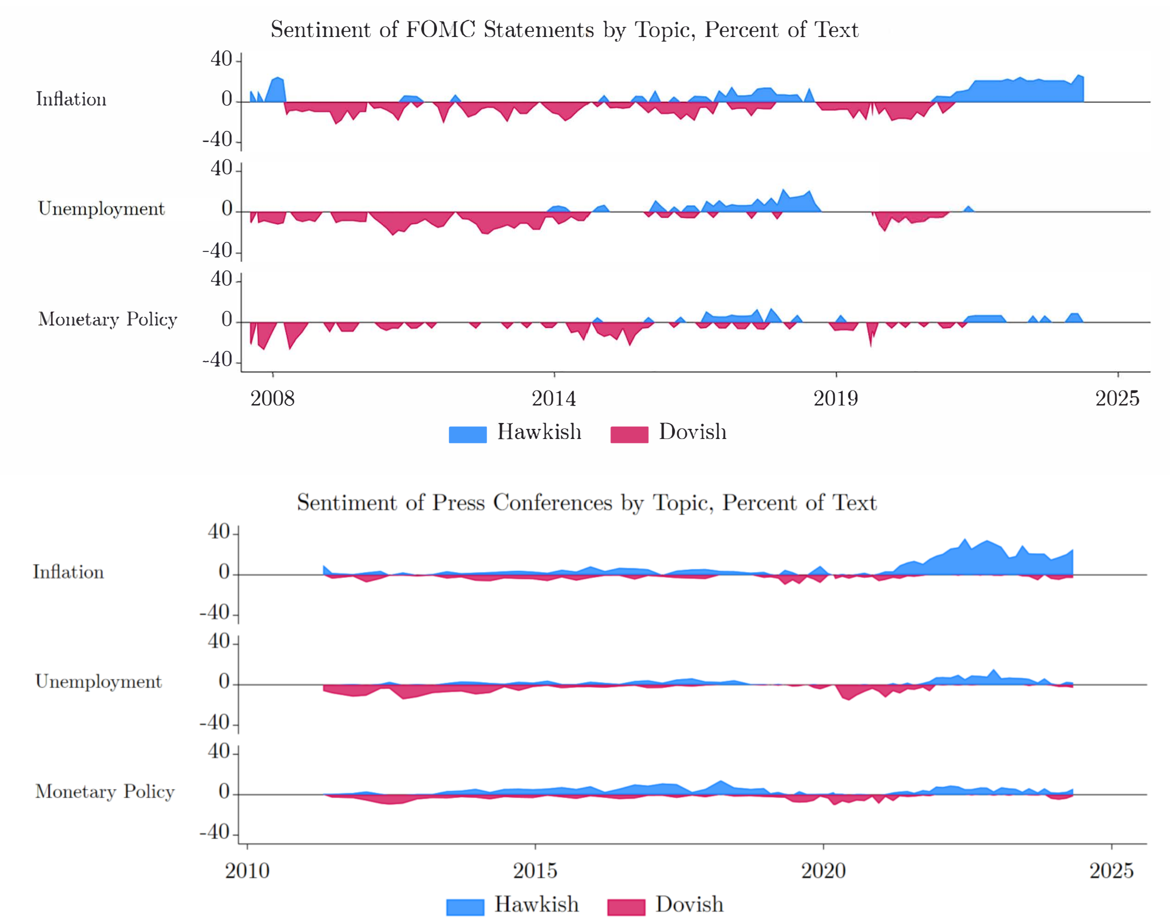
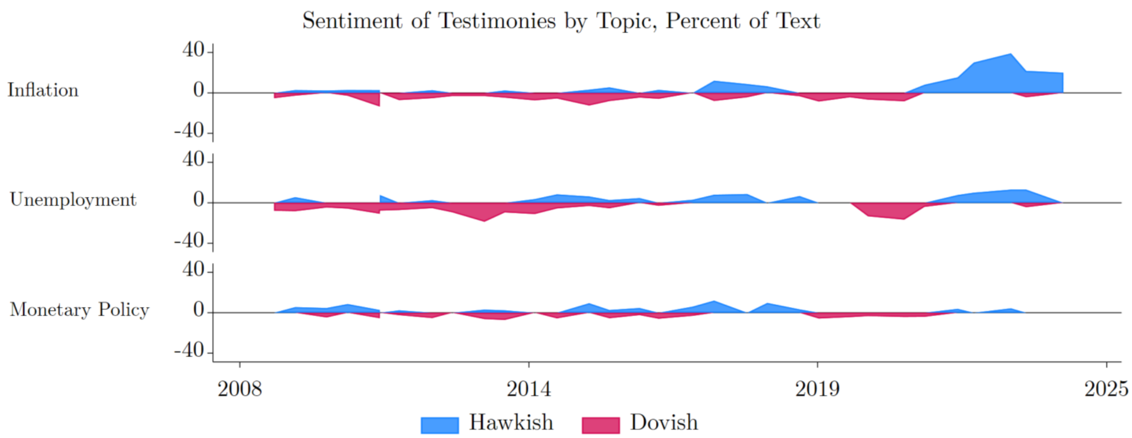


Figure C.1: Sentiment by topic, percent of text.

Hawkish sentiment pertains policy tightening and dovish to loosening. The y-axis is the percentage of the text that is devoted to that topic.



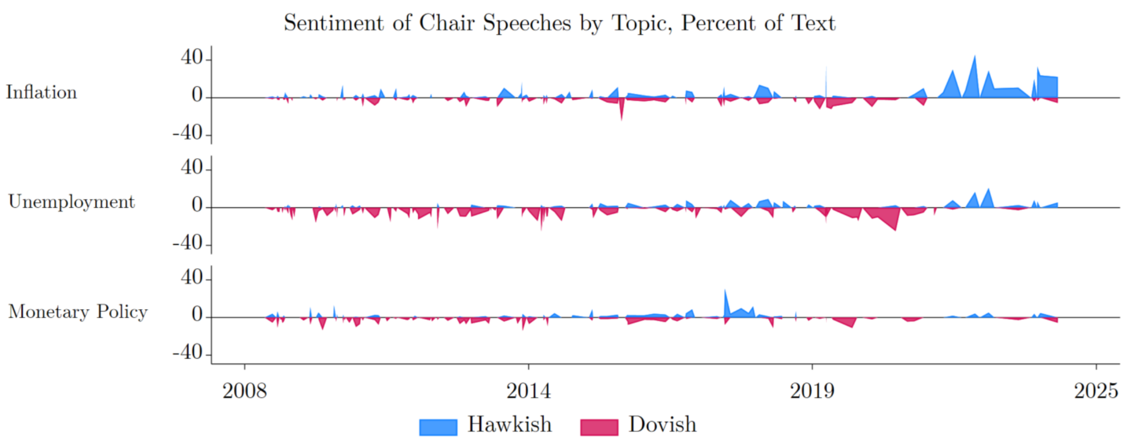


Figure C.2: Sentiment by topic, percent of text.

Hawkish sentiment pertains policy tightening and dovish to loosening. The y-axis is the percentage of the text that is devoted to that topic.

C.2 NET SENTIMENT AND MONETARY POLICY, SENTENCE-LEVEL The figure below is the same as figure 4 in the main text except for the top panel that plots sentence-level net sentiment for the FOMC statement instead of paragraph-level net sentiment.

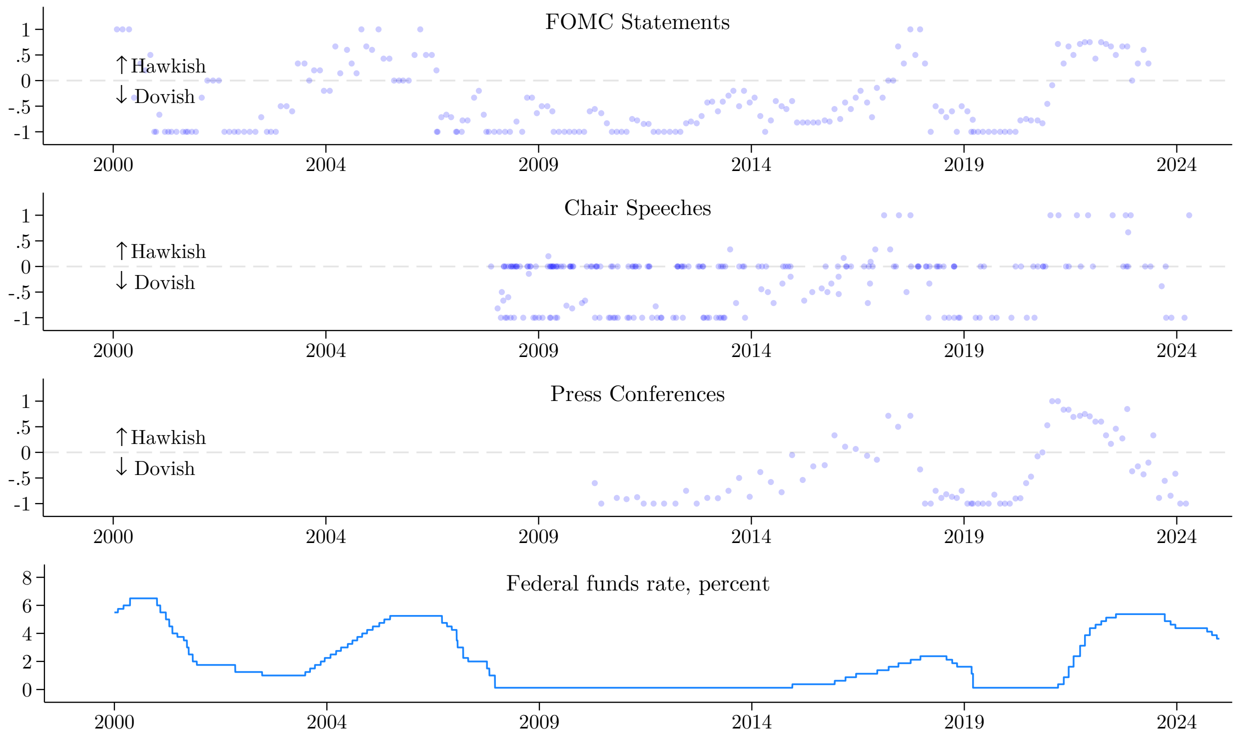
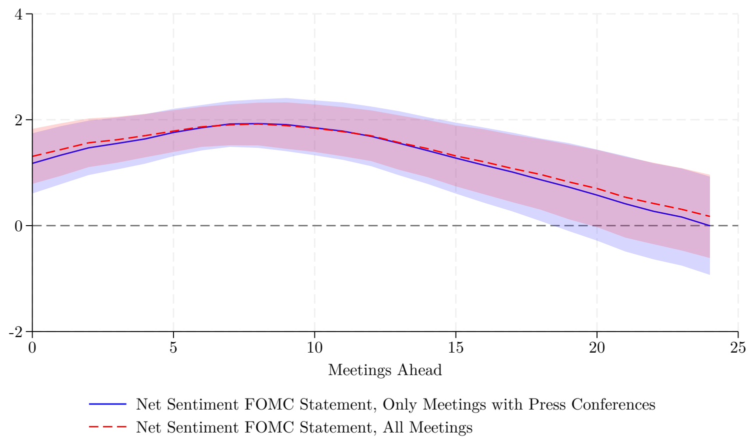


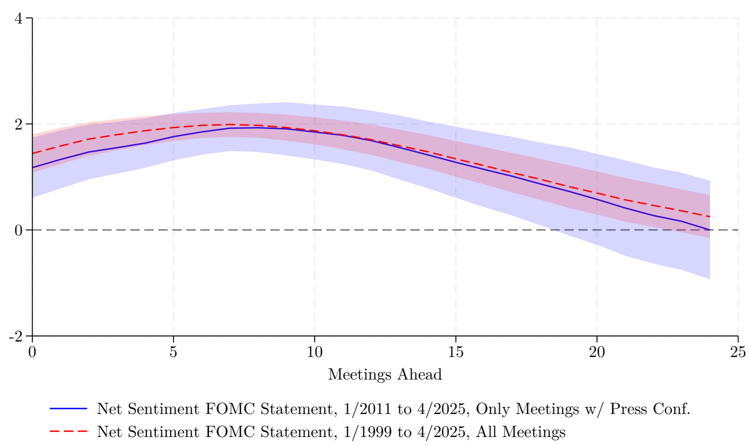
Figure C.3: Net sentiment scores at the sentence level for the FOMC statement and the paragraph level for the press conference and speeches along with the target federal funds rate.

Hawkish sentiment pertains policy tightening and dovish to loosening. For communication type $j \in$ {Press conference, Speech, FOMC statements}, Net Sentiment$_{j,t}$ = (Hawkish$_{j,t}$ − Dovish$_{j,t}$)/(Hawkish$_{j,t}$ + Dovish$_{j,t}$). The federal funds rate is the target after each FOMC meeting, see Appendix G for details on its construction. Appendix A details the availability and sources of each type of communication.

C.3 ROBUSTNESS OF LOCAL PROJECTION SAMPLES While press conferences now occur after every meeting, they only occurred after every other meeting from 2011 to 2019. Panel C.4a compares impulse responses from net sentiment of FOMC statements to the federal funds rate for the sample of all meetings from January 2011 to April 2025 to that shown in the main text in figure 5 based on the sample of meetings followed by press conferences. The full sample in panel C.4a has 121 meetings, while the sample in the main text in figures 5-6 has 83. The impulse responses are nearly identical, which suggests that joint estimation conditioned on meetings with only press conference are robust to estimation on the full sample of meetings. Panel C.4b extends the start of the sample from 2011 to 1999 (when we have sentiment for the FOMC statements) and likewise shows point estimates that are quite similar to those shown in the main text.



(a) Comparing samples



(b) Comparing Time Period Samples

Figure C.4: Impulse response of the federal funds rate to net sentiment, 90% error bands with two Newey-West lags.

The figure plots $\hat{\beta}_1^h$ from the local projection, Federal Funds Rate$_{t+h} = \beta_0^h + \beta_1^h$Net Sentiment$_{FOMC,t} + \epsilon_{FOMC,t}$ in equation (8). Where t is the FOMC meeting frequency, $h = 0, ..., 24$. Net Sentiment$_{j,t}$ = (Hawkish$_{j,t}$−Dovish$_{j,t}$)/(Hawkish$_{j,t}$+Dovish$_{j,t}$). The sample is from April 2011 to April 2025 in panel C.4a. The $t+h$ federal funds rate includes all meetings such that the 8-meeting-ahead point estimates corresponds to a one-year-ahead horizon.

To check whether or not predictive correlations of net sentiment with the federal funds rate depend on occurrence of press conferences, we extend the start date of the sample from 2011 back to 1999 (when we have sentiment for the FOMC statements). The indicator $\mathbb{1}\text{Press}_t$ is equal to one when there was a post meeting press conference.

$$\text{Federal Funds Rate}_{t+h} = \beta_0^h + \beta_1^h \text{Net Sentiment}_{\text{FOMC},t} + \beta_2^h \mathbb{1}\text{Press}_t + \ldots \quad (20)$$
$$\beta_3^h \left(\text{Net Sentiment}_{\text{FOMC},t} \times \mathbb{1}\text{Press}_t\right) + \varepsilon_{t+h}$$

Figure C.5 shows that the coefficient on net sentiment of the FOMC statement $\hat{\beta}_1^h$ is positive and significant and slightly higher in magnitude then its estimates shown in figures 5 and C.4. The coefficients on the press conference and its interaction with net sentiment—$\hat{\beta}_2^h$ and $\hat{\beta}_3^h$, respectively—are insignificant or only on the margin of significance from 0. Taken together, these estimates suggests that the availability of press conferences as an additional communication tool does not significantly alter the predictive correlations of the FOMC statement with the federal funds rate.

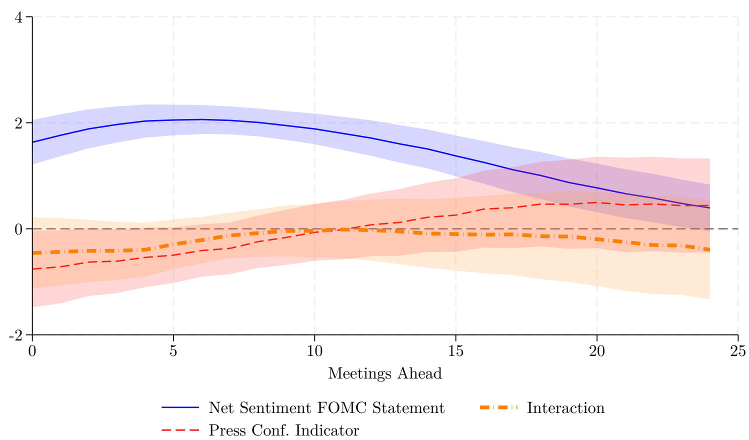


Figure C.5: Impulse response of the federal funds rate to net sentiment, 90% error bands with two Newey-West lags.

The figure plots $\hat{\beta}_j^h$ for $j = 1, \ldots, 3$ from the local projection, $\text{Federal Funds Rate}_{t+h} = \beta_0^h + \beta_1^h \text{Net Sentiment}_{\text{FOMC},t} + \beta_2^h \mathbb{1}\text{Press}_t + \beta_3^h \left(\text{Net Sentiment}_{\text{FOMC},t} \times \mathbb{1}\text{Press}_t\right) + \varepsilon_{t+h}$ in equation (8). Where t is the FOMC meeting frequency, $h = 0, \ldots, 24$ and $\text{Net Sentiment}_{j,t} = (\text{Hawkish}_{j,t} - \text{Dovish}_{j,t})/(\text{Hawkish}_{j,t} + \text{Dovish}_{j,t})$. The sample is from January 1999 to April 2025 and $\mathbb{1}\text{Press}_t$ indicates if there was a post-meeting press conference or not. The $t+h$ federal funds rate includes all meetings such that the 8-meeting-ahead point estimates corresponds to a one-year-ahead horizon.

C.4 ROBUSTNESS OF LOCAL PROJECTIONS WITH THE LAGGED FEDERAL FUNDS RATE Figure C.6 shows that the point estimates in figures 5 are robust to controlling for the lagged federal funds rate.

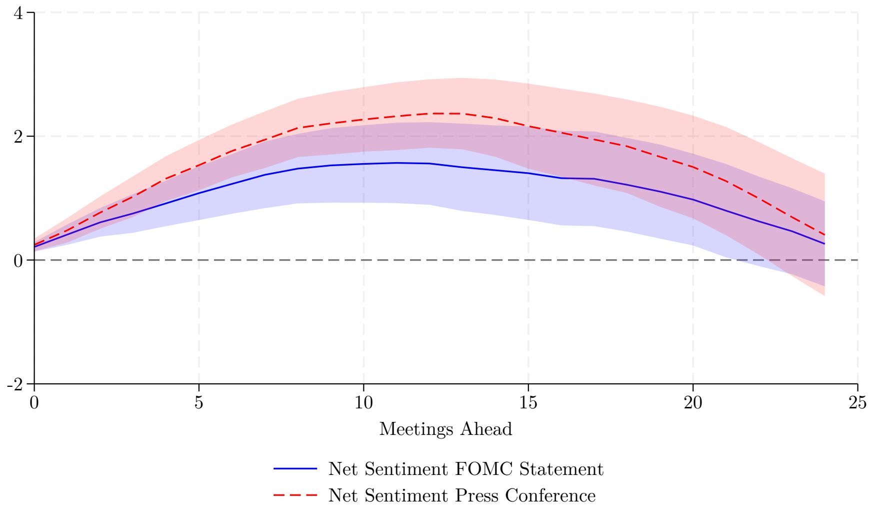
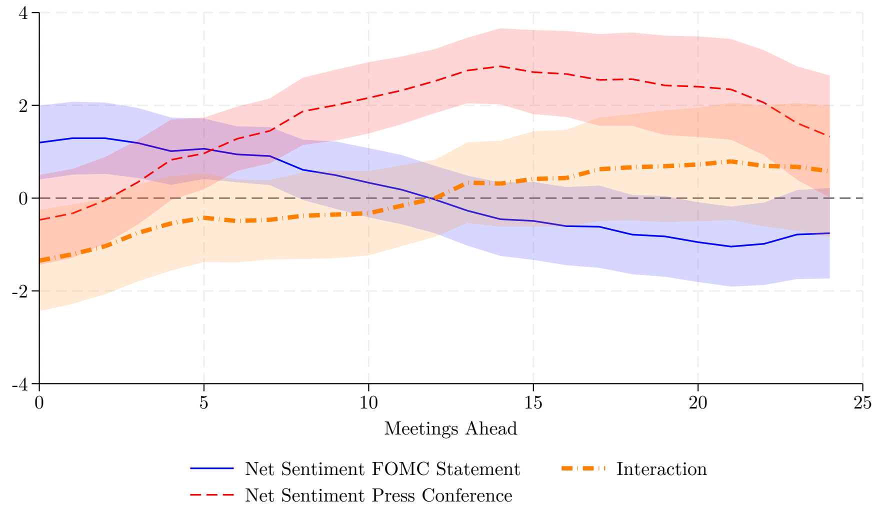


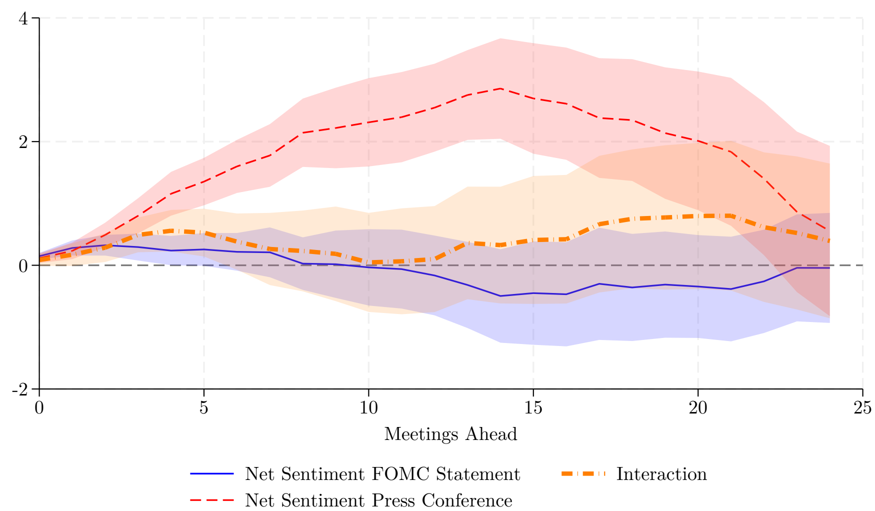
Figure C.6: Impulse response of the federal funds rate to net sentiment with inertia, 90% error bands with two Newey-West lags.

The figure plots $\hat{\beta}_1^h$ from the local projection, Federal Funds Rate$_{t+h} = \beta_0^h + \alpha^h$Federal Funds Rate$_{t-1} + \beta_1^h$Net Sentiment$_{j,t}$ + $\epsilon_{j,t}$ for $j \in$ {FOMC statement, Press}. Where t is the FOMC meeting frequency and $h = 0, \ldots, 24$. Net Sentiment$_{j,t}$ = (Hawkish$_{j,t}$ − Dovish$_{j,t}$)/(Hawkish$_{j,t}$ + Dovish$_{j,t}$). The sample is from April 2011 to April 2025 and is for FOMC meetings followed by press conferences (every other FOMC meeting from 2011 to 2019 and every meeting thereafter). The $t+h$ federal funds rate includes all meetings such that the 8-meeting-ahead point estimates corresponds to a one-year-ahead horizon.

C.5 ROBUSTNESS OF LOCAL PROJECTIONS WITH INTERACTION TERMS Figure C.7 shows the point estimates of equations 9 and 10 with an interaction term (Net Sentiment$_{FOMC,t}$ × Net Sentiment$_{Press,t}$) included in each specification.



(a) Joint estimation with interaction



(b) Joint estimation with interaction and inertia

Figure C.7: Impulse response of the federal funds rate to net sentiment with interaction terms, 90% error bands with two Newey-West lags.

Panel C.7a plots $\{\hat{\beta}_1^h, \hat{\beta}_2^h, \hat{\beta}_3^h\}$ from Federal Funds Rate$_{t+h}$ = $\beta_0^h + \beta_1^h$Net Sentiment$_{FOMC,t}$ + β_2^hNet Sentiment$_{Press,t}$ + β_3^h(Net Sentiment$_{FOMC,t}$ × Net Sentiment$_{Press,t}$) + ϵ_t. Panel C.7b plots $\{\hat{\beta}_1^h, \hat{\beta}_2^h, \hat{\beta}_3^h\}$ from Federal Funds Rate$_{t+h}$ = $\beta_0^h + \alpha^h$Federal Funds Rate$_{t-1}$ + β_1^hNet Sentiment$_{FOMC,t}$ + β_2^hNet Sentiment$_{Press,t}$ + β_3^h(Net Sentiment$_{FOMC,t}$ × Net Sentiment$_{Press,t}$) + ϵ_t. Where t is the FOMC meeting frequency and $h = 0,...,24$. Net Sentiment$_{j,t}$ = (Hawkish$_{j,t}$ − Dovish$_{j,t}$)/(Hawkish$_{j,t}$ + Dovish$_{j,t}$). The sample is from April 2011 to April 2025 and is for FOMC meetings followed by press conferences (every other FOMC meeting from 2011 to 2019 and every meeting thereafter). The $t+h$ federal funds rate includes all meetings such that the 8-meeting-ahead point estimates corresponds to a one-year-ahead horizon.

C.6 ROBUSTNESS OF LOCAL PROJECTIONS WITH NET SENTIMENT OF SPEECHES Figure C.8 shows the point estimates in figure 5 along with point estimates for speeches in the local projection in equation (8):

$$\text{Federal Funds Rate}_{t+h} = \beta_0^h + \beta_1^h \text{Net Sentiment}_{j,t} + \epsilon_{j,t} \tag{8}$$

Where t is the FOMC meeting frequency, $h = 0,..,20$, and $j \in$ {FOMC statement, Press, Chair speech}.

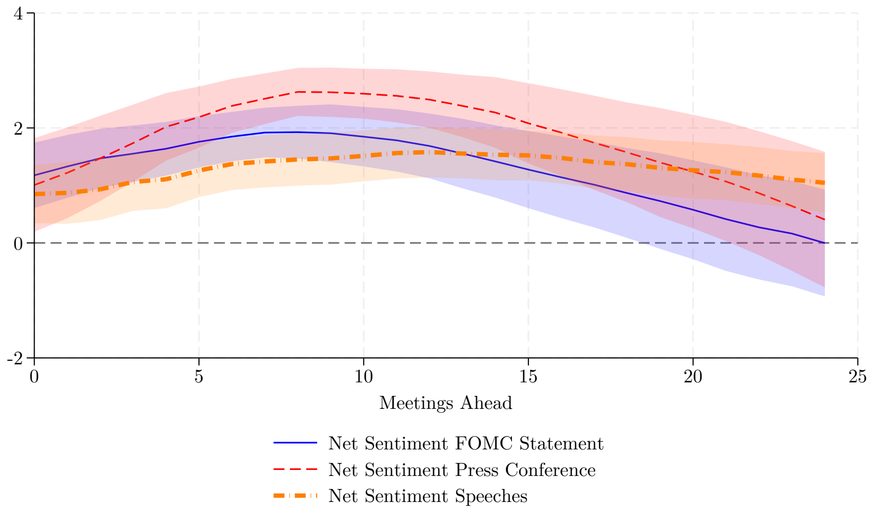


Figure C.8: Impulse response of the federal funds rate to net sentiment with speeches, 90% error bands with two Newey-West lags.

The figure plots $\hat{\beta}_1^h$ from the local projection, Federal Funds Rate$_{t+h} = \beta_0^h + \beta_1^h$Net Sentiment$_{j,t} + \epsilon_{j,t}$ in equation (8). Where t is the FOMC meeting frequency, $h = 0,...,24$, and $j \in$ {FOMC statement, Press, Chair speech}. Net Sentiment$_{j,t}$ = (Hawkish$_{j,t}$ − Dovish$_{j,t}$)/(Hawkish$_{j,t}$ + Dovish$_{j,t}$). The sample is from April 2011 to April 2025 and is for FOMC meetings followed by press conferences (every other FOMC meeting from 2011 to 2019 and every meeting thereafter). The $t+h$ federal funds rate includes all meetings such that the 8-meeting-ahead point estimates corresponds to a one-year-ahead horizon.

C.7 DOUBLE INERTIA LOCAL PROJECTIONS Figure C.9 includes two lags of the federal funds rate into equation, as advocated by Crawley et al. (2026), Carlstrom and Fuerst (2014), and Coibion and Gorodnichenko (2012). The result are little changed from those shown in panel 6b, albeit with the positive and significant point estimates of net sentiment of the press conference shortening from about 22 meetings ahead to 19 meetings ahead. The results are similar if Federal Funds Rate$_{t-1}$ − Federal Funds Rate$_{t-2}$ is included instead of Federal Funds Rate$_{t-2}$.

$$\begin{aligned}\text{Federal Funds Rate}_{t+h} =& \beta_0^h + \beta_1^h \text{Net Sentiment}_{FOMC,t} + \beta_2^h \text{Net Sentiment}_{Press,t} + \ldots \\ & \ldots \alpha_1^h \text{Federal Funds Rate}_{t-1} + \alpha_2^h \text{Federal Funds Rate}_{t-2} + \epsilon_t \end{aligned} \tag{21}$$

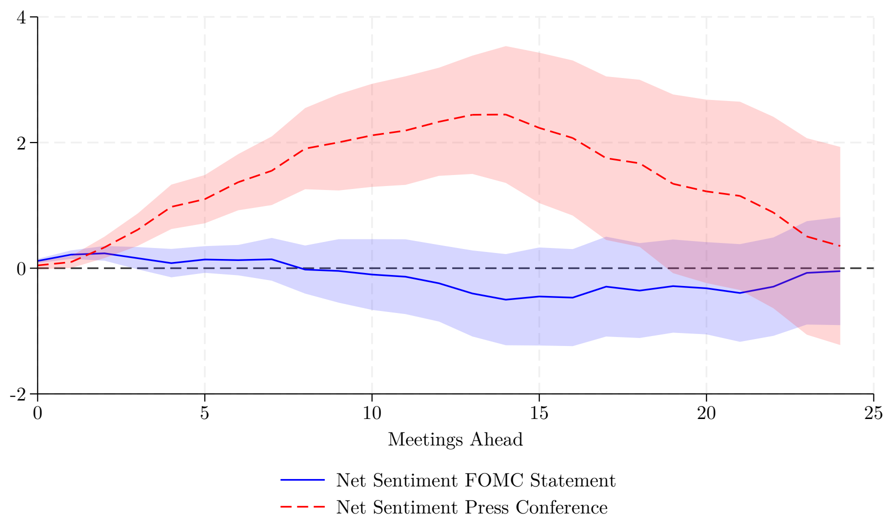
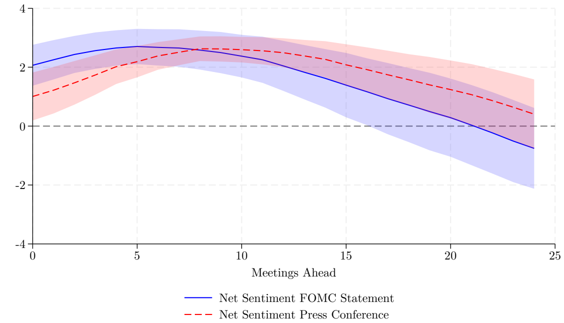


Figure C.9: Impulse response of the federal funds rate to net sentiment with double inertia, 90% error bands with two Newey-West lags.

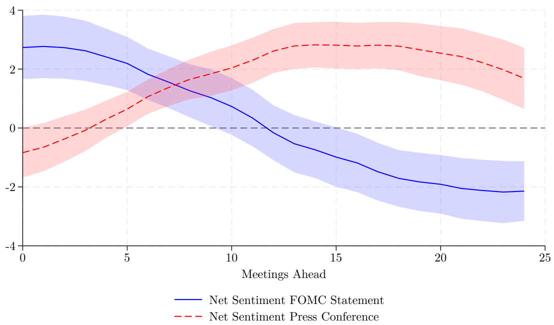
The figure plots $\hat{\beta}_1^h$ and $\hat{\beta}_2^h$ from the local projection, Federal Funds Rate$_{t+h}$ = β_0^h + β_1^hNet Sentiment$_{FOMC,t}$ + β_2^hNet Sentiment$_{Press,t}$ + α_1^hFederal Funds Rate$_{t-1}$ + α_2^hFederal Funds Rate$_{t-2}$ + ϵ_t in equation (10). Where t is the FOMC meeting frequency and $h = 0, \ldots, 24$. Net Sentiment$_{j,t}$ = (Hawkish$_{j,t}$ − Dovish$_{j,t}$)/(Hawkish$_{j,t}$ + Dovish$_{j,t}$). The sample is from April 2011 to April 2025 and is for FOMC meetings followed by press conferences (every other FOMC meeting from 2011 to 2019 and every meeting thereafter). The $t+h$ federal funds rate includes all meetings such that the 8-meeting-ahead point estimates corresponds to a one-year-ahead horizon.

C.8 Robustness of Local Projections with Sentence-level FOMC Statement Sentiment

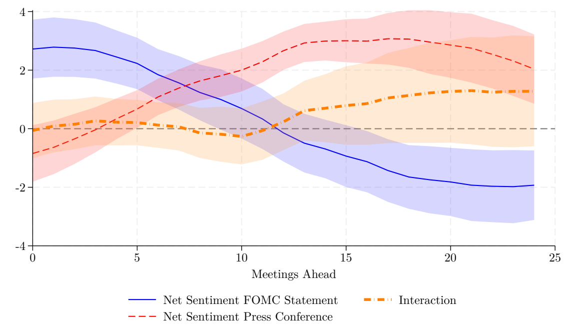
Figure C.10 shows estimates in section 4.2 and appendix C with sentence-level FOMC statement sentiment.



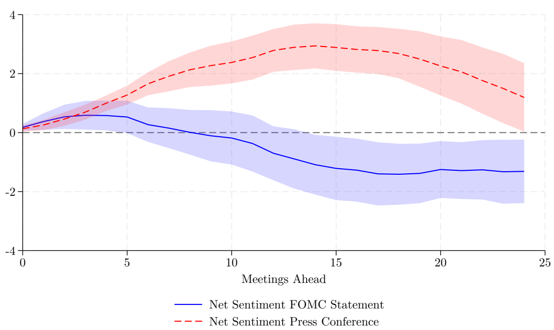
(a) Separate estimation



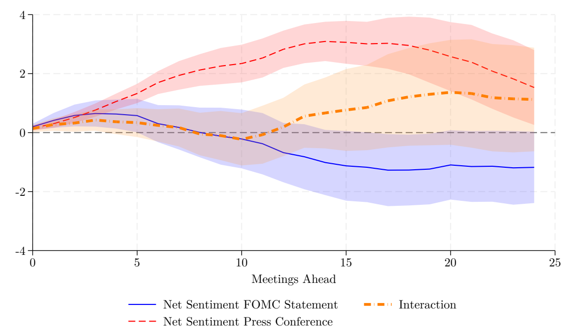
(b) Joint estimation



(c) Joint estimation with interaction



(d) Joint estimation with inertia

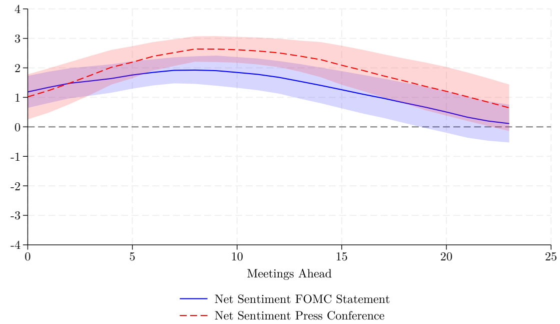


(e) Joint estimation with interaction and inertia

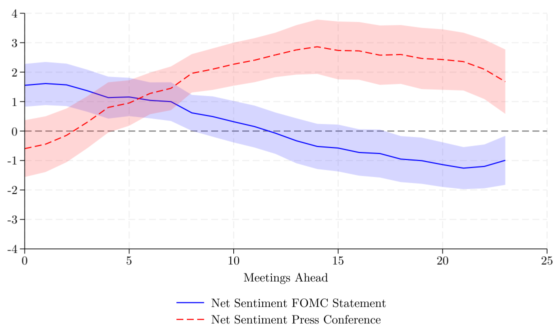
Figure C.10: Impulse response of the federal funds rate to net sentiment with sentence-level sentiment for the statement, 90% error bands with two Newey-West lags.

Panel C.10a plots $\hat{\beta}_1^h$ from the local projection, $\text{Federal Funds Rate}_{t+h} = \beta_0^h + \beta_1^h \text{Net Sentiment}_{j,t} + \epsilon_{j,t}$ for $j \in \{\text{FOMC statement sentence-level, Press}\}$. Where t is the FOMC meeting frequency and $h = 0, \dots, 24$. Panel C.10b plots $\hat{\beta}_1^h$ and $\hat{\beta}_2^h$ from the local projection, $\text{Federal Funds Rate}_{t+h} = \beta_0^h + \beta_1^h \text{Net Sentiment Sentence-level}_{FOMC,t} + \beta_2^h \text{Net Sentiment}_{Press,t} + \epsilon_t$. Panel C.10c plots $\{\hat{\beta}_1^h, \hat{\beta}_2^h, \hat{\beta}_3^h\}$ from $\text{Federal Funds Rate}_{t+h} = \beta_0^h + \beta_1^h \text{Net Sentiment Sentence-level}_{FOMC,t} + \beta_2^h \text{Net Sentiment}_{Press,t} + (\text{Net Sentiment}_{FOMC,t} \times \text{Net Sentiment}_{Press,t}) + \epsilon_t$. Panel C.10d plots $\hat{\beta}_1^h$ and $\hat{\beta}_2^h$ from the local projection, $\text{Federal Funds Rate}_{t+h} = \beta_0^h + \alpha^h \text{Federal Funds Rate}_{t-1} + \beta_1^h \text{Net Sentiment Sentence-level}_{FOMC,t} + \beta_2^h \text{Net Sentiment}_{Press,t} + \epsilon_t$. Panel C.10e plots $\{\hat{\beta}_1^h, \hat{\beta}_2^h, \hat{\beta}_3^h\}$ from $\text{Federal Funds Rate}_{t+h} = \beta_0^h + \alpha^h \text{Federal Funds Rate}_{t-1} + \beta_1^h \text{Net Sentiment Sentence-level}_{FOMC,t} + \beta_2^h \text{Net Sentiment}_{Press,t} + (\text{Net Sentiment}_{FOMC,t} \times \text{Net Sentiment}_{Press,t}) + \epsilon_t$. Where t is the FOMC meeting frequency and $h = 0, \dots, 20$. $\text{Net Sentiment}_{j,t} = (\text{Hawkish}_{j,t} - \text{Dovish}_{j,t}) / (\text{Hawkish}_{j,t} + \text{Dovish}_{j,t})$. The sample is from April 2011 to April 2025 and is for FOMC meetings followed by press conferences (every other FOMC meeting from 2011 to 2019 and every meeting thereafter). The $t + h$ federal funds rate includes all meetings such that the 8-meeting-ahead point estimates corresponds to a one-year-ahead horizon.

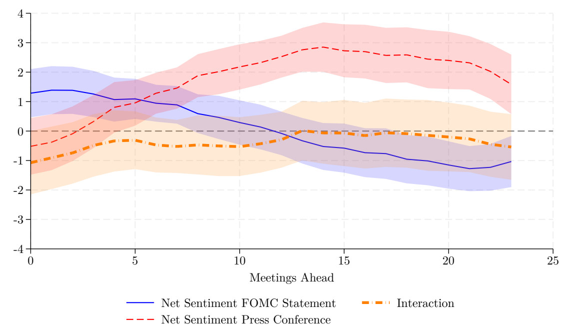
C.9 ROBUSTNESS OF LOCAL PROJECTIONS WITH LAGGED VIX AS A CONTROL While Lee (2026) uses lagged real GDP growth and the VIX volatility index as controls for macroeconomic conditions, we are unable to use the former because the timing of quarterly GDP is difficult to line up at the FOMC meeting frequency. Instead we use lagged monthly growth in industrial production to control for output. Even with these macroeconomic controls, figure C.11 shows impulse responses that are similar to those in section 4.2 and appendix C. Results in figure C.11 are robust to using the average of the VIX five days before an FOMC announcement instead of the value the day before an FOMC announcement.



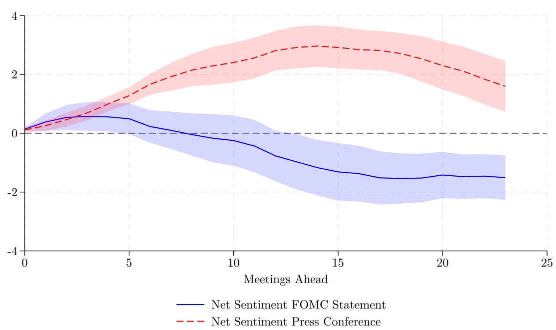
(a) Separate estimation



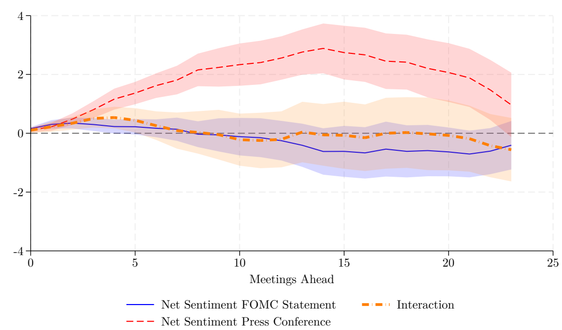
(b) Joint estimation



(c) Joint estimation with interaction



(d) Joint estimation with inertia



(e) Joint estimation with interaction and inertia

Figure C.11: Impulse response of the federal funds rate to net sentiment with macro controls, 90% error bands with two Newey-West lags.

Panel C.11a plots $\hat{\beta}_1^h$ from the local projection, $\text{Federal Funds Rate}_{t+h} = \beta_0^h + \beta_1^h \text{Net Sentiment}_{j,t} + \gamma_1^h \text{VIX}_{\tau-1} + \gamma_2^h \Delta \log \text{IP}_{T-1} + \epsilon_{j,t}$ for $j \in \{\text{FOMC}, \text{Press}\}$. Where t is the FOMC meeting frequency, $\tau - 1$ is the day before FOMC meeting t, $T-1$ is the month prior to FOMC meeting t, and $h = 0, \ldots, 24$. Panel C.11b plots $\hat{\beta}_1^h$ and $\hat{\beta}_2^h$ from the local projection, $\text{Federal Funds Rate}_{t+h} = \beta_0^h + \beta_1^h \text{Net Sentiment}_{FOMC,t} + \beta_2^h \text{Net Sentiment}_{Press,t} + \gamma_1^h \text{VIX}_{\tau-1} + \gamma_2^h \Delta \log \text{IP}_{T-1} + \epsilon_t$. Panel C.11c plots $\{\hat{\beta}_1^h, \hat{\beta}_2^h, \hat{\beta}_3^h\}$ from $\text{Federal Funds Rate}_{t+h} = \beta_0^h + \beta_1^h \text{Net Sentiment}_{FOMC,t} + \beta_2^h \text{Net Sentiment}_{Press,t} + (\text{Net Sentiment}_{FOMC,t} \times \text{Net Sentiment}_{Press,t}) + \gamma_1^h \text{VIX}_{\tau-1} + \gamma_2^h \Delta \log \text{IP}_{T-1} + \epsilon_t$. Panel C.11d plots $\hat{\beta}_1^h$ and $\hat{\beta}_2^h$ from the local projection, $\text{Federal Funds Rate}_{t+h} = \beta_0^h + \alpha^h \text{Federal Funds Rate}_{t-1} + \beta_1^h \text{Net Sentiment}_{FOMC,t} + \beta_2^h \text{Net Sentiment}_{Press,t} + \gamma_1^h \text{VIX}_{\tau-1} + \gamma_2^h \Delta \log \text{IP}_{T-1} + \epsilon_t$. Panel C.11e plots $\{\hat{\beta}_1^h, \hat{\beta}_2^h, \hat{\beta}_3^h\}$ from $\text{Federal Funds Rate}_{t+h} = \beta_0^h + \alpha^h \text{Federal Funds Rate}_{t-1} + \beta_1^h \text{Net Sentiment Sentence-level}_{FOMC,t} + \beta_2^h \text{Net Sentiment}_{Press,t} + (\text{Net Sentiment}_{FOMC,t} \times \text{Net Sentiment}_{Press,t}) + \gamma_1^h \text{VIX}_{\tau-1} + \gamma_2^h \Delta \log \text{IP}_{T-1} + \epsilon_t$. $\text{Net Sentiment}_{j,t} = (\text{Hawkish}_{j,t} - \text{Dovish}_{j,t}) / (\text{Hawkish}_{j,t} + \text{Dovish}_{j,t})$.

C.10 DIEBOLD AND MARIANO (1995) TESTS OF FORECAST ACCURACY Table 1 shows that the out of sample net sentiment federal funds rate forecast shown in equation (11) is statistically significant from predictions given by equations (12)-(14).

Horizon, h	Taylor (1999)	Inertial Taylor (1999)	Lagged federal funds rate
1	-5.90^{***}	-5.54^{***}	-3.06^{***}
2	-4.09^{***}	-3.54^{***}	-2.20^{**}
3	-3.45^{****}	-2.52^{***}	-1.74^{**}
4	-3.2^{***}	-2.29^{**}	-1.65^{**}
5	-3.01^{***}	-2.03^{**}	-1.62^{*}
6	-2.86^{***}	-1.87^{**}	-1.65^{*}
7	-2.74^{***}	-1.81^{**}	-1.75^{**}
8	-2.65^{***}	-1.77^{**}	-1.77^{**}

Table 1: Diebold and Mariano (1995) Statistics comparing the forecast of the federal funds rate using net sentiment to other specifications.

*** p<0.01, ** p<0.05, * p<0.1. Horizon $h = 1,...,8$ is for FOMC meetings ahead. The net sentiment forecast is that of equation (11), $\widehat{\text{Federal Funds Rate}}_{t+h} = \hat{\beta}_0^{t+h} + \hat{\beta}_1^{t+h}\text{Net Sentiment}_{FOMC,t} + \hat{\alpha}^{t+h}\text{Federal Funds Rate}_{t-1}$ and the lagged federal funds rate forecast is that of equation (12) $\widehat{\text{Federal Funds Rate}}_{t+h} = \hat{\alpha}_0^{t+h}\hat{\alpha}_1^{t+h}\text{Federal Funds Rate}_{t-1}$. These forecasts are initially estimated for $t = \{1994,...,1997\}$ and then re-estimated for each meeting through April 2025 for $h = 1,...,8$. The Taylor (1999) rule is equation (13), $\widehat{\text{Federal Funds Rate}}_{t+h} = 2.5 + 1.5(\pi_{t+h} - 2) + 2(u^*_{t+h} - u_{t+h})$ where inflation is the $t + h$ realized core PCE index and unemployment rate gap series is the realized $t + h$ unemployment rate less its natural rate, and the inertial Taylor (1999) rule is that of equation (14), $\widehat{\text{Federal Funds Rate}}_{t+h} = 0.85\text{Federal Funds Rate}_{t-1+h} + 0.15\Big(2.5 + 1.5(\pi_{t+h} - 2) + 2(u^*_{t+h} - u_{t+h})\Big)$ which uses the same inflation and unemployment rate series as its non-inertial counterpart. The 0.85 weight on the lagged federal funds rate is from the Federal Reserve Bank of Atlanta's Taylor Rule Utility Tool, (https://www.atlantafed.org/research-and-data/data/taylor-rule). Data series used are detailed in appendix G.

D Appendix: Market Reactions and Sentiment Scores

D.1 Market Reaction vs. Sentiment Scores Figure D.1 shows that press conferences stands out for their relationship between hawkish sentiment and market reactions for estimates of equation (16).

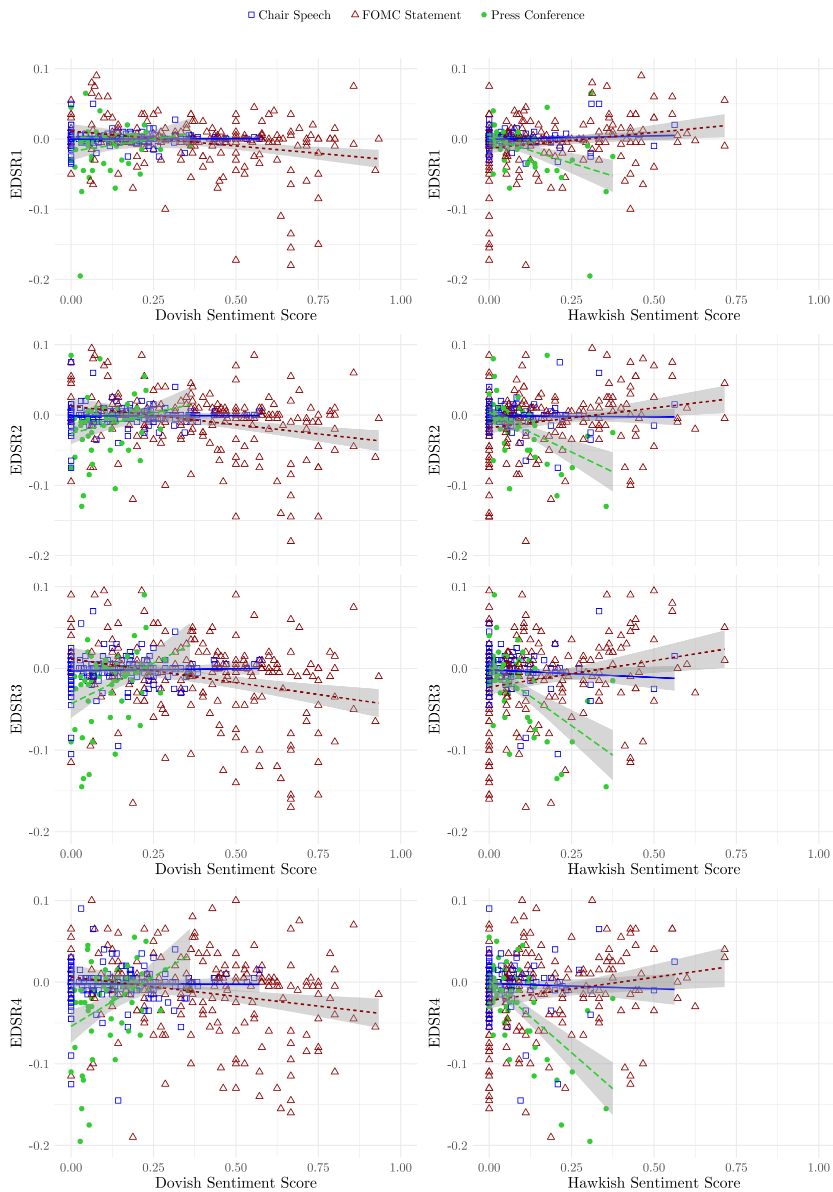


Figure D.1: Market reactions vs. Sentiment

The figures shows equation (16) ΔMarket Reaction$_{t,j} = \alpha + \beta$Sentiment$_j + \epsilon_{t,j}$ for hawkish sentiment for each type of communication $j \in$ {Press conference, Chair speech, FOMC statement}. Shaded bands are 95 percent confidence intervals. The figure plots all market reactions with paired sentiment scores. Market reactions are intraday changes of trade prices 20 minutes after a communication event relative to trade prices 10 minutes before for the ith Eurodollar/$(i+1)$th SOFR future (ESRi), which corresponds to the expected policy rate i quarters ahead for $i = 1, ..., 4$. The estimation sample starts in 1999 for FOMC statements, in 2008 for Chair speeches, and in 2011 for press conferences, which is based on the availability of texts of these communications.

Figure D.2: Market Reaction vs. Sentiment, filled observations correspond to market reactions that differ by at least 3 basis points for each FOMC statment/press conference pair.

The figures shows equation (16) $\Delta\text{Market Reaction}_{t,j} = \alpha + \beta\text{Sentiment}_j + \epsilon_{t,j}$ for hawkish and dovish sentiment for each type of communication $j \in \{\text{Press conference, FOMC statement}\}$. Shaded bands are 95 percent confidence intervals. The figure plots all market reactions with paired sentiment scores. Market reactions are intraday changes of trade prices 20 minutes after a communication event relative to trade prices 10 minutes before for the ith Eurodollar/$(i+1)$th SOFR future (ESRi), which corresponds to the expected policy rate i quarters ahead for $i = 1, \ldots, 4$. The estimation sample starts in 1999 for FOMC statements and in 2011 for press conferences, which is based on the availability of texts of these communications.

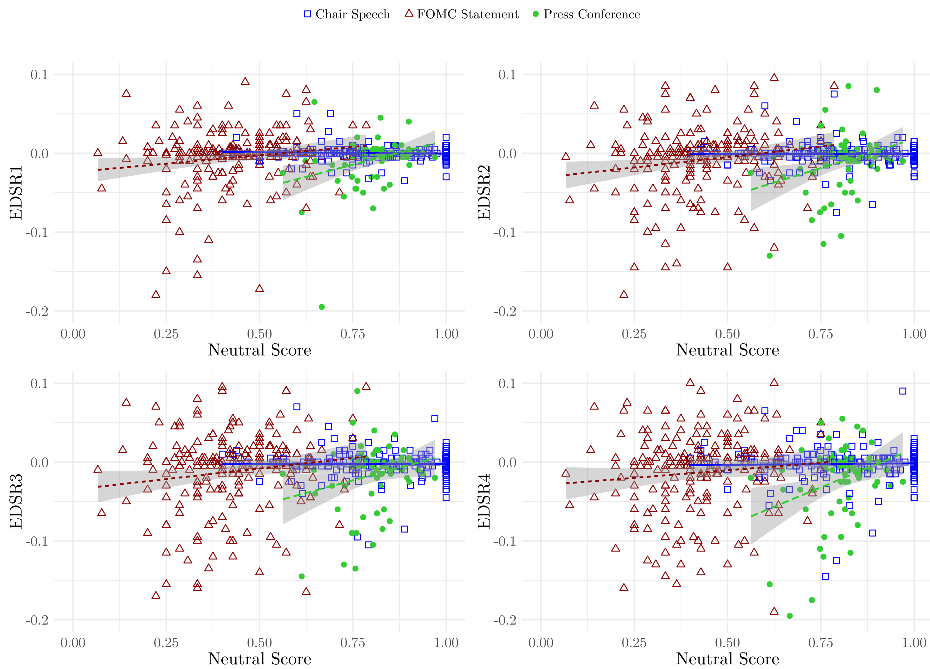


Figure D.3: Market Reaction vs. Neutral Sentiment

The figures shows equation (16) ΔMarket Reaction$_{t,j} = \alpha + \beta$Sentiment$_j + \epsilon_{t,j}$ for neutral sentiment for each type of communication $j \in$ {Press conference, Chair speech, FOMC statement}. Shaded bands are 95 percent confidence intervals. The figure plots all market reactions with paired sentiment scores. Market reactions are intraday changes of trade prices 20 minutes after a communication event relative to trade prices 10 minutes before for the ith Eurodollar/$(i+1)$th SOFR future (ESRi), which corresponds to the expected policy rate i quarters ahead for $i = 1, \ldots, 4$. The estimation sample starts in 1999 for FOMC statements, in 2008 for Chair speeches, and in 2011 for press conferences, which is based on the availability of texts of these communications. The figure shows the same regression as figure D.1 but for the neutral sentiment score only.

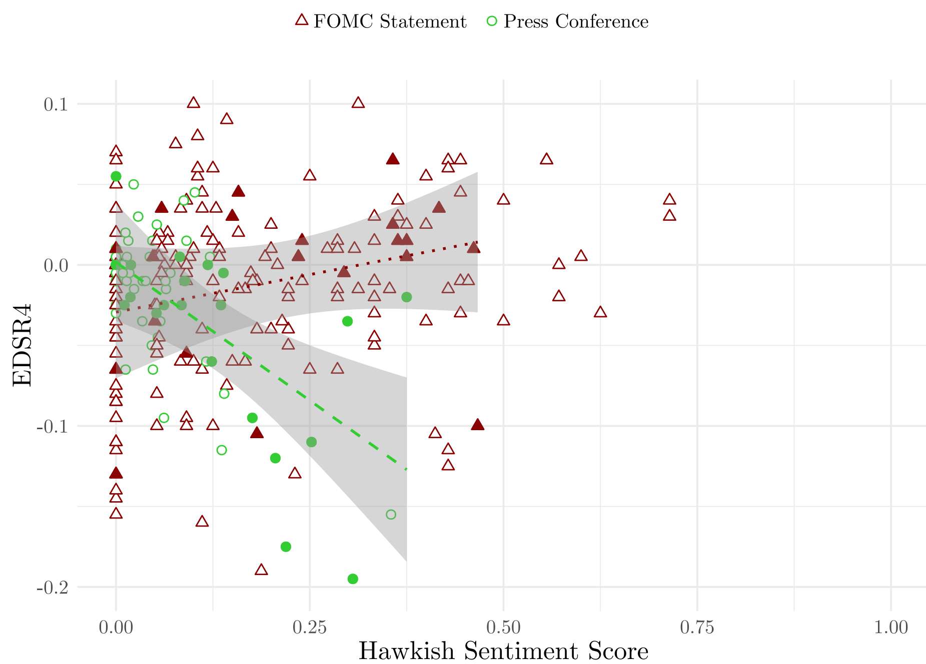


Figure D.4: Market Reaction vs. Hawkish Sentiment

The figures shows equation (16) ΔMarket Reaction$_{t,j} = \alpha + \beta$Sentiment$_j + \epsilon_{t,j}$ for hawkish sentiment for each type of communication $j \in$ {Press conferenceFOMC statement}. Shaded bands are 95 percent confidence intervals. The figure plots all market reactions with paired sentiment scores. Market reactions are intraday changes of trade prices 20 minutes after a communication event relative to trade prices 10 minutes before for the 4th Eurodollar/5th SOFR future (ESR4), which corresponds to the expected policy rate four quarters ahead. The estimation sample starts in 1999 for FOMC statements and in 2011 for press conferences, which is based on the availability of texts of these communications. Filled observation indicate a respective opposite sign shock of at least 3 basis points.

E Appendix: Announcement Variance Ratio

This appendix presents the average minute-level share of daily trades around FOMC statements with and without a press conference.

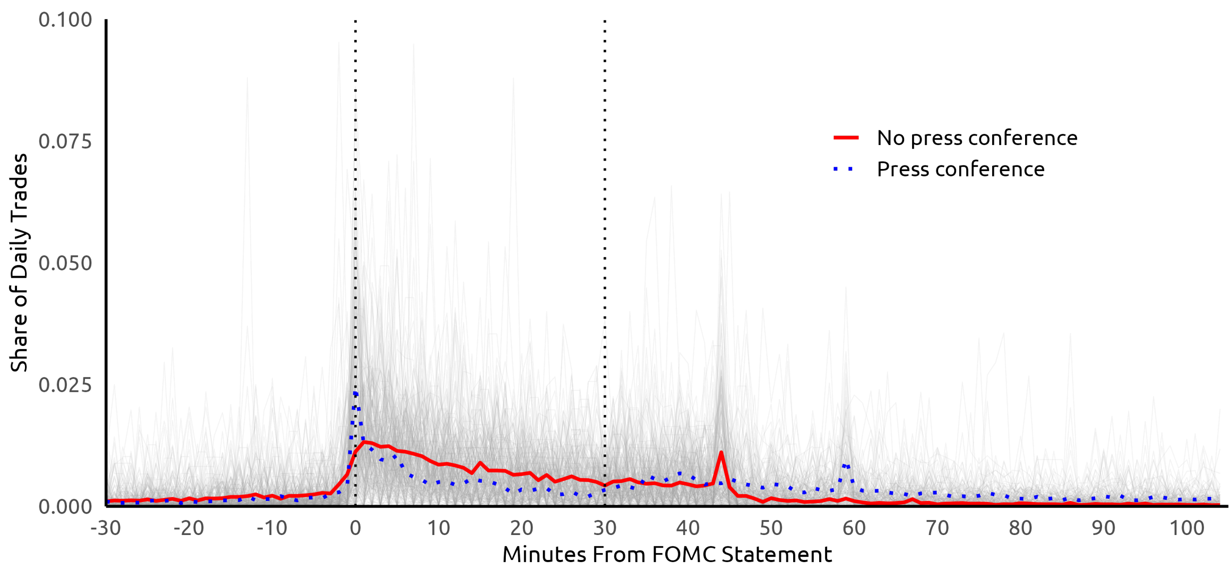


Figure E.1: Intraday Trade Shares Around FOMC Statements for the 4th Eurdollar/5th SOFR Future
The figure plots, for each minute relative to the FOMC statement, the share of that day's total trades that occur in that minute. Gray lines show individual FOMC meeting days; colored lines show the average across meeting-day groups.

F APPENDIX: VAR

F.1 MONETARY POLICY SHOCK CONSTRUCTION

The details are drawn from Brennan et al. (2025).

NAKAMURA AND STEINSSON (2018) MONETARY POLICY SHOCK uses futures tick data accessed via CME Group Inc. DataMine (https://datamine.cmegroup.com/) at the Federal Reserve Board. The construction of the shock series follows that of Gürkaynak et al. (2005) as described in Nakamura and Steinsson (2018) and Brennan et al. (2025). The shocks are the first principal component of changes in high-frequency federal funds rate futures and Eurodollar/SOFR futures:

$$MP1_s = \begin{cases} \frac{D^s}{D^s - d^s}(ff^1_{s,t+\Delta t} - ff^1_{s,t-\Delta t}) & \text{if} \quad D^s - d^s > 7 \\ ff^2_{s,t+\Delta t} - ff^2_{s,t-\Delta t} & \text{otherwise} \end{cases} \tag{22}$$

$$MP2_s = \begin{cases} \frac{D^{s'}}{D^{s'} - d^{s'}}\left[(ff^j_{s',t+\Delta t} - ff^j_{s',t-\Delta t}) - \frac{d^{s'}}{D^{s'}}MP1_s\right] & \text{if} \quad D^{s'} - d^{s'} > 7 \\ ff^{j+1}_{s',t+\Delta t} - ff^{j+1}_{s',t-\Delta t} & \text{otherwise} \end{cases} \tag{23}$$

$$\Delta EDSR2_q = \begin{cases} ED^2_{q,t+\Delta t} - ED^2_{q,t-\Delta t} & \text{if} \quad q < 2022:Q1 \\ SF^3_{q,t+\Delta t} - SF^3_{q,t-\Delta t} & \text{otherwise} \end{cases} \tag{24}$$

$$\Delta EDSR3_q = \begin{cases} ED^3_{q,t+\Delta t} - ED^3_{q,t-\Delta t} & \text{if} \quad q < 2022:Q1 \\ SF^4_{q,t+\Delta t} - SF^4_{q,t-\Delta t} & \text{otherwise} \end{cases} \tag{25}$$

$$\Delta EDSR4_q = \begin{cases} ED^4_{q,t+\Delta t} - ED^4_{q,t-\Delta t} & \text{if} \quad q < 2022:Q1 \\ SF^5_{q,t+\Delta t} - SF^5_{q,t-\Delta t} & \text{otherwise} \end{cases} \tag{26}$$

Let s index the month of the current FOMC meeting and s' index the month of the next meeting. For example, s = March 2014 and s' = April 2014 for the March 19, 2014 FOMC meeting where s and s' need not be consecutive months. We define t as the time of the FOMC statement release, typically 14:00 EST and $t + \Delta t$ more precisely as 20 or 80 minutes *after* the FOMC statement release while $t - \Delta t$ is defined as 10 minutes *before* the FOMC statement release. For the March 19, 2014 FOMC statement, which occurred at t = March 19, 14:00, $t + \Delta$ = March 19, 2014 14:20 or t = March 19, 2014 15:20 and $t - \Delta t$ = March 19, 2014 13:50.

Let ff^j denote the duration j of the federal funds futures contract ff. For example, $j = 1$ denotes the contract expiring in the current month, $j = 2$ the contract expiring next month, etc. For month s, D^s and d^s are the number of total days in the month and the day of the FOMC meeting, respectively. If a monetary policy announcement occurs in the first 23 days of the month, then that month's federal funds future $j = 1$ is used to calculate $MP1_s$. Because the settlement prices are based on the average of the effective overnight federal funds rate in month s rather than the federal funds rate on a specific day, one must correct for time averaging and scale by the inverse of the share of days remaining in the month, $\frac{D^s}{D^s - d^s}$. Otherwise, if the FOMC announcement occurs in the last seven days of the month, next month's future $j = 2$ is used to calculate $MP1_s$.

$MP2_s$ captures the unexpected change in the federal funds futures contracts that expire at the end of month s' which is the month of the next scheduled FOMC meeting. Brennan et al. (2025) show that in practice the next or following month's federal funds future $j = 2,3$ is used to calculate $MP2_s$.

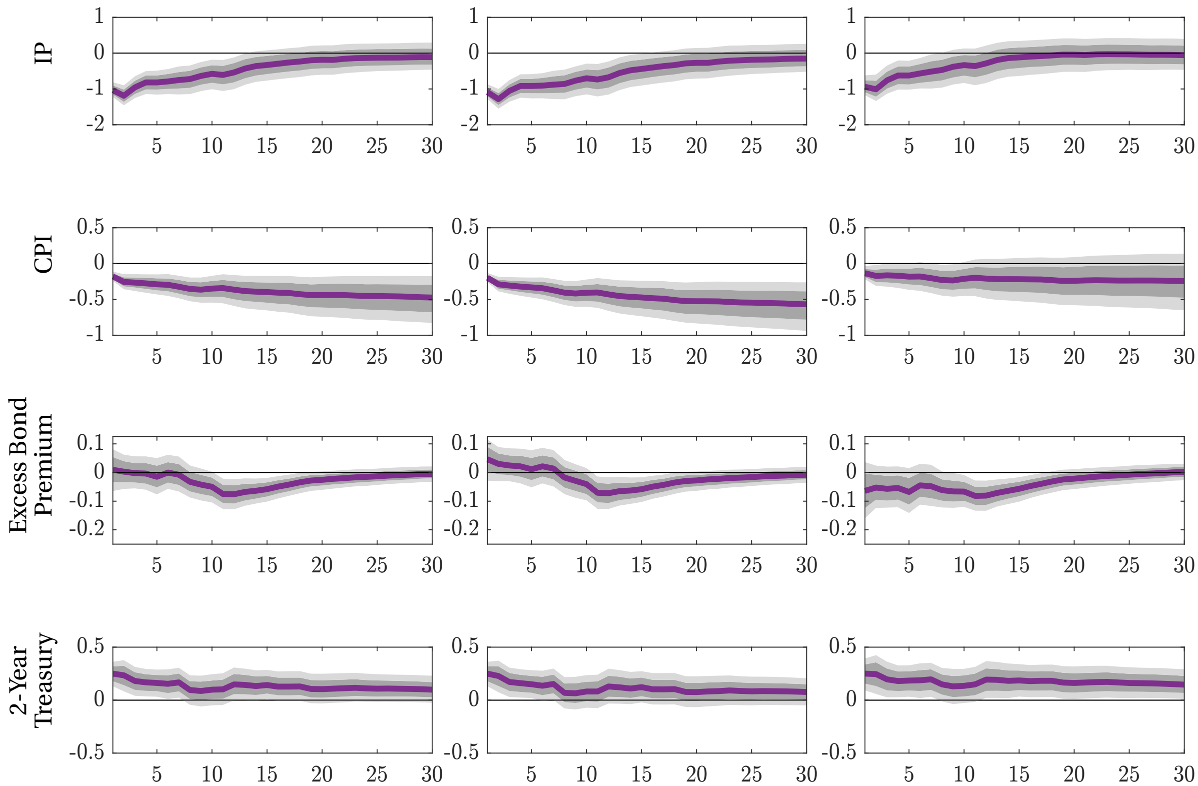
Because federal funds futures are highly liquid for contracts expiring in the next three months but less liquid for contracts thereafter, researchers use Eurodollar and SOFR futures to cover the remaining first year of the term structure. Eurodollar futures were listed quarterly and mature in March, June, September, and December. They were an agreement to exchange, on the second London business day before the third Wednesday of the last month of the quarter, the price of the contract minus the three-month US dollar BBA LIBOR interest rate. Because the BBA LIBOR interest rate is discontinued, Eurodollar futures ceased trading in April 2023. SOFR futures have successfully replaced Eurodollar futures on the Chicago Mercantile Exchange. The SOFR rate is based on the cost to borrow USD overnight using Treasury securities as collateral. Because SOFR futures are designed to replace Eurodollar futures, they can be spliced into shock construction when they are available. We follow Acosta et al. (2024) and use January 2022 as a start date for SOFR futures.

Let q index the quarter of the current FOMC meeting and $q+1$ index the of the next FOMC meeting. For example, $q = 2014{:}Q1$, $q+1 = 2014{:}Q2$, and $q+2 = 2014{:}Q3$ for the March 19, 2014 FOMC meeting.

The monetary policy shock is then the first principal component of expressions (22)-(26) scaled so that its effect on one-year nominal Treasury yields is equal to one.

GÜRKAYNAK ET AL. (2005) MONETARY POLICY SHOCKS The target and path shocks of Gürkaynak et al. (2005) are constructed using principal component analysis over the same instrument set of Nakamura and Steinsson (2018)—expressions (22)-(26). Rather than extracting just the first principal component, Gürkaynak et al. (2005) extract the first two principal components and then rotate these principal components so that the second has no effect on the federal funds rate. The first rotated principal component is called the target shock and is normalized so that it is one-for-one with the federal funds rate. The second is the called path shock which is normalized to be one-for-one with $EDSR4_q$ in expression (26) and captures all forward guidance surprises.

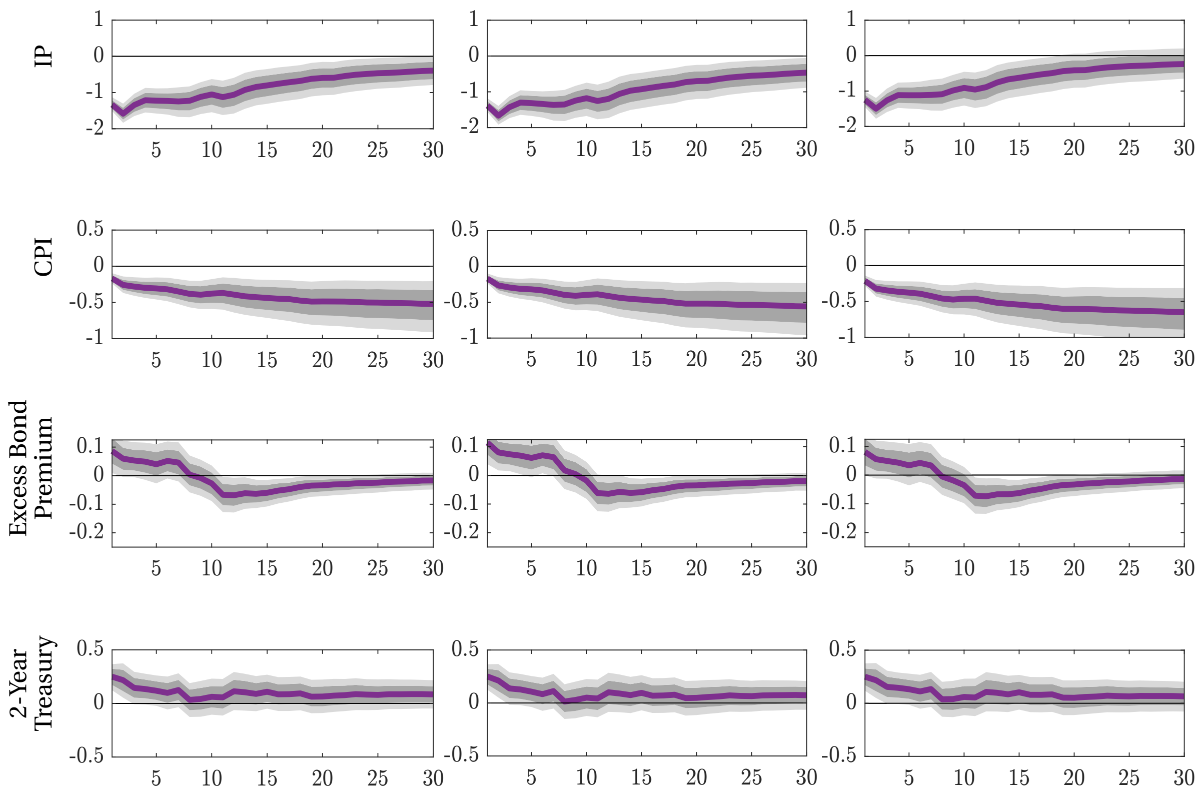
F.2 VAR ESTIMATES The figure below show alternative lags and samples to those shown in the main text.



(a) Original time window (b) Includes press conference (c) Includes press conference and long-term rates

Figure F.1: Impulse response to a 25 basis point Nakamura and Steinsson (2018) monetary policy shock, x-axis is months and y-axis is percentage points. 12 lags instead of eight.

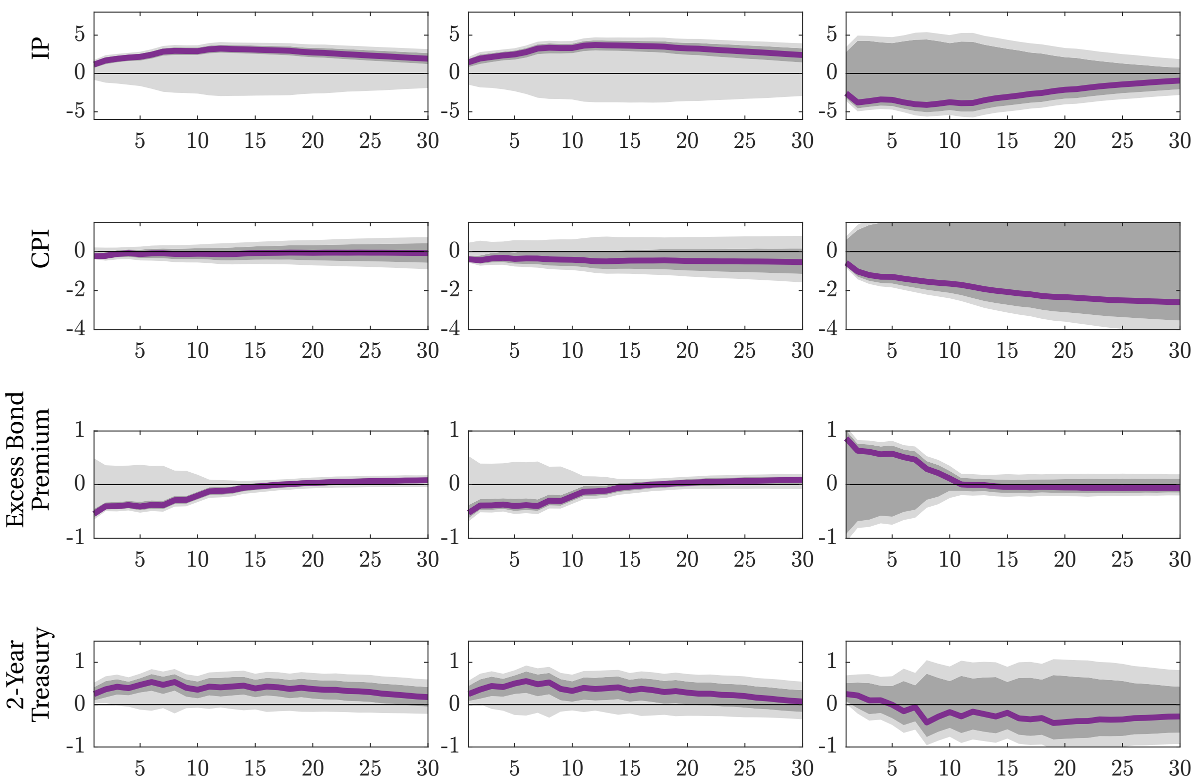
Impulse responses are estimates from equation (19) $Y_T = \alpha + B(L)Y_{T-1} + s_1 Y_T^{2Y} + \tilde{u}_T$ obtained via the Canova and Ferroni (2022) Bayesian VAR toolbox with 68 and 90 percent error bands (darker and lighter bands, respectively), 20,000 draws, and 12 lags. The sample of monetary shock series is from January 1995 to April 2025 while the sample of economic data starts in January 1973. The shock series are the first principal component of the instrument set $\{MP1, MP2, EDSR2, EDSR3, EDSR4\}$. The shock series in panel a is constructed from the 30-minute change in these futures around FOMC statements. The shock series in panel b is constructed from the 90-minute change in these futures around FOMC statements when there is a post-meeting press conference so that the time window includes the press conference. Panel c augments the instrument set in panel b with 2-, 5-, 10-, and 30-year Treasury yields. IP is the industrial production index, CPI is the consumer price index, excess bond premium is from Gilchrist and Zakrajšek (2012), and the two-year Treasury is the end of the month daily change in the zero-coupon yield. All sources of series are detailed in Appendix G. Appendix Table 2 displays the first-stage F-statistics.



(a) Original time window (b) Includes press conference (c) Includes press conference and long-term rates

Figure F.2: Impulse response to a 25 basis point Gürkaynak et al. (2005) target monetary policy shock, x-axis is months and y-axis is percentage points. 12 lags instead of eight.

Impulse responses are estimates from equation (19) $Y_T = \alpha + B(L)Y_{T-1} + s_1 Y_T^{2Y} + \tilde{u}_T$ obtained via the Canova and Ferroni (2022) Bayesian VAR toolbox with 68 and 90 percent error bands (darker and lighter bands, respectively), 20,000 draws, and 12 lags. The sample of monetary shock series is from January 1995 to April 2025 while the sample of economic data starts in January 1973. The shock series are the rotated first principal component of the instrument set $\{MP1, MP2, EDSR2, EDSR3, EDSR4\}$. The shock series in panel a is constructed from the 30-minute change in these futures around FOMC statements. The shock series in panel b is constructed from the 90-minute change in these futures around FOMC statements when there is a post-meeting press conference so that the time window includes the press conference. Panel c augments the instrument set in panel b with 2-, 5-, 10-, and 30-year Treasury yields. IP is the industrial production index, CPI is the consumer price index, excess bond premium is from Gilchrist and Zakrajšek (2012), and the two-year Treasury is the end of the month daily change in the zero-coupon yield. All sources of series are detailed in Appendix G. Appendix Table 2 displays the first-stage F-statistics.



(a) Original time window (b) Includes press conference (c) Includes press conference and long-term rates

Figure F.3: Impulse response to a 25 basis point Gürkaynak et al. (2005) path monetary policy shock, x-axis is months and y-axis is percentage points. 12 lags instead of eight.

Impulse responses are estimates from equation (19) $Y_T = \alpha + B(L)Y_{T-1} + s_1 Y_T^{2Y} + \tilde{u}_T$ obtained via the Canova and Ferroni (2022) Bayesian VAR toolbox with 68 and 90 percent error bands (darker and lighter bands, respectively), 20,000 draws, and 12 lags. The sample of monetary shock series is from January 1995 to April 2025 while the sample of economic data starts in January 1973. The shock series are the rotated second principal component of the instrument set $\{MP1, MP2, EDSR2, EDSR3, EDSR4\}$. The shock series in panel a is constructed from the 30-minute change in these futures around FOMC statements. The shock series in panel b is constructed from the 90-minute change in these futures around FOMC statements when there is a post-meeting press conference so that the time window includes the press conference. Panel c augments the instrument set in panel b with 2-, 5-, 10-, and 30-year Treasury yields. IP is the industrial production index, CPI is the consumer price index, excess bond premium is from Gilchrist and Zakrajšek (2012), and the two-year Treasury is the end of the month daily change in the zero-coupon yield. All sources of series are detailed in Appendix G. Appendix Table 2 displays the first-stage F-statistics.

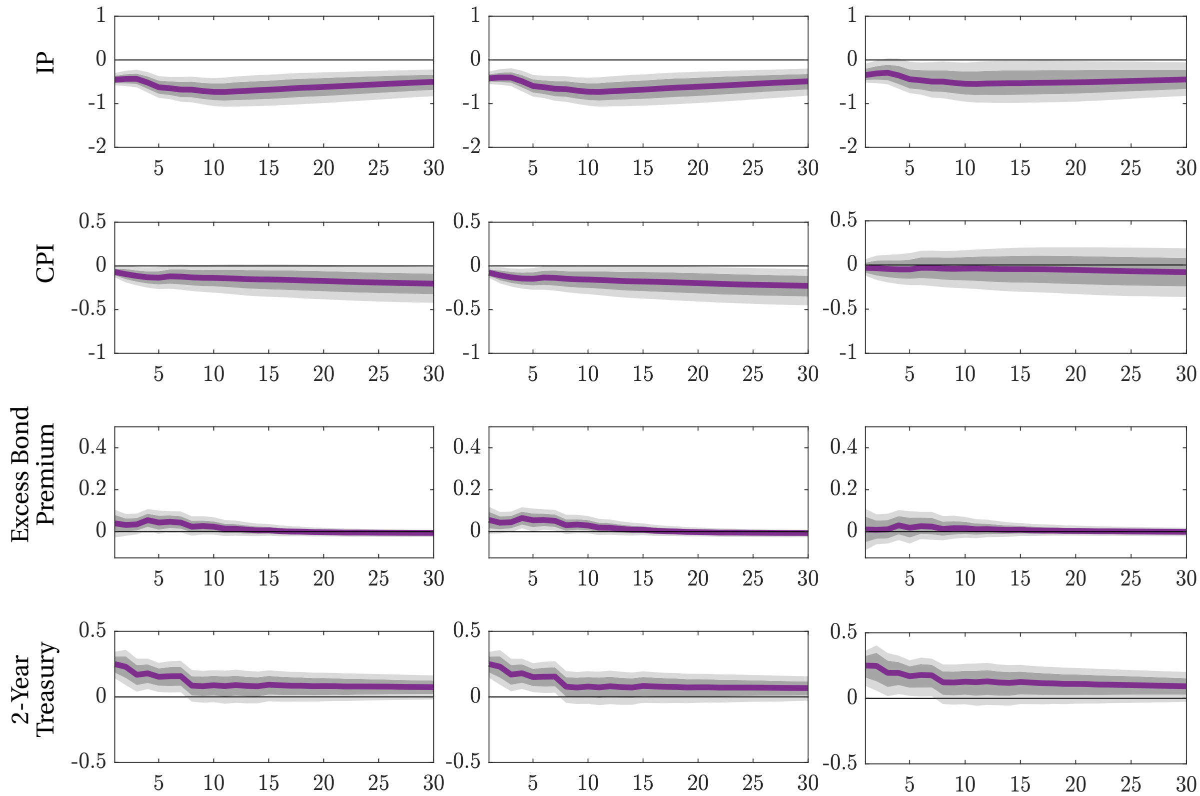
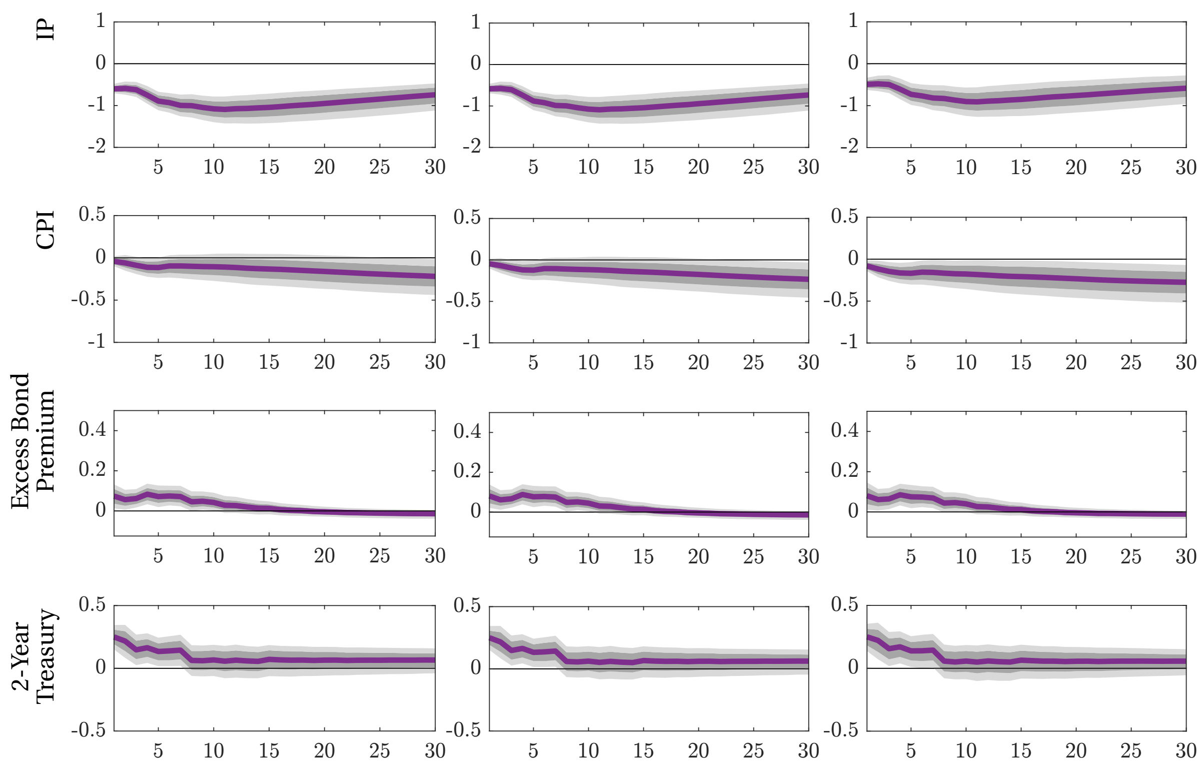


Figure F.4: Impulse response to a 25 basis point Nakamura and Steinsson (2018) monetary policy shock, x-axis is months and y-axis is percentage points stopping in 2019.

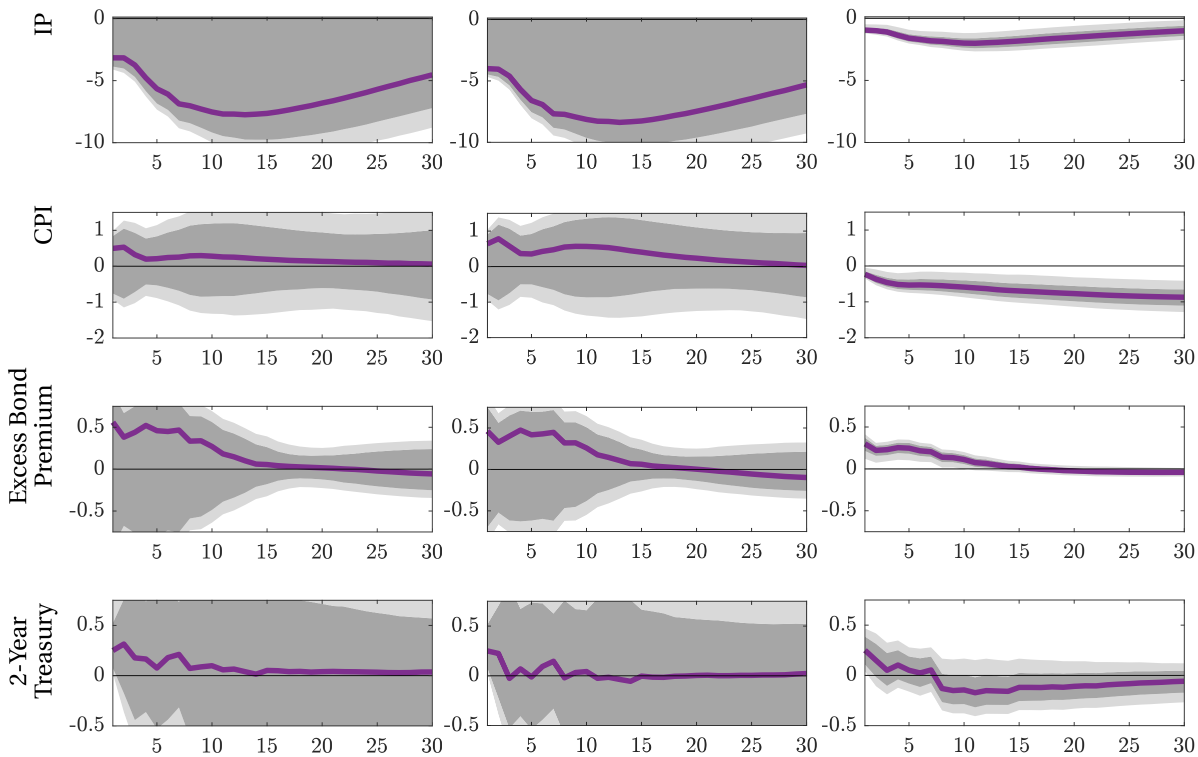
Impulse responses are estimates from equation (19) $Y_T = \alpha + B(L)Y_{T-1} + s_1 Y_T^{2Y} + \tilde{u}_T$ obtained via the Canova and Ferroni (2022) Bayesian VAR toolbox with 68 and 90 percent error bands (darker and lighter bands, respectively), 20,000 draws, and 8 lags. The sample of monetary shock series is from January 1995 to April 2025 while the sample of economic data starts in January 1973. The shock series are the first principal component of the instrument set $\{MP1, MP2, EDSR2, EDSR3, EDSR4\}$. The shock series in panel a is constructed from the 30-minute change in these futures around FOMC statements. The shock series in panel b is constructed from the 90-minute change in these futures around FOMC statements when there is a post-meeting press conference so that the time window includes the press conference. Panel c augments the instrument set in panel b with 2-, 5-, 10-, and 30-year Treasury yields. IP is the industrial production index, CPI is the consumer price index, excess bond premium is from Gilchrist and Zakrajšek (2012), and the two-year Treasury is the end of the month daily change in the zero-coupon yield. All sources of series are detailed in Appendix G. Appendix Table 2 displays the first-stage F-statistics.



(a) Original time window (b) Includes press conference (c) Includes press conference and long-term rates

Figure F.5: Impulse response to a 25 basis point Gürkaynak et al. (2005) target monetary policy shock, x-axis is months and y-axis is percentage points stopping in 2019.

Impulse responses are estimates from equation (19) $Y_T = \alpha + B(L)Y_{T-1} + s_1 Y_T^{2Y} + \tilde{u}_T$ obtained via the Canova and Ferroni (2022) Bayesian VAR toolbox with 68 and 90 percent error bands (darker and lighter bands, respectively), 20,000 draws, and 8 lags. The sample of monetary shock series is from January 1995 to December 2019 while the sample of economic data starts in January 1973. The shock series are the rotated first principal component of the instrument set $\{MP1, MP2, EDSR2, EDSR3, EDSR4\}$. The shock series in panel a is constructed from the 30-minute change in these futures around FOMC statements. The shock series in panel b is constructed from the 90-minute change in these futures around FOMC statements when there is a post-meeting press conference so that the time window includes the press conference. Panel c augments the instrument set in panel b with 2-, 5-, 10-, and 30-year Treasury yields. IP is the industrial production index, CPI is the consumer price index, excess bond premium is from Gilchrist and Zakrajšek (2012), and the two-year Treasury is the end of the month daily change in the zero-coupon yield. All sources of series are detailed in Appendix G. Appendix Table 2 displays the first-stage F-statistics.



(a) Original time window

(b) Includes press conference

(c) Includes press conference and long-term rates

Figure F.6: Impulse response to a 25 basis point Gürkaynak et al. (2005) path monetary policy shock, x-axis is months and y-axis is percentage points stopping in 2019.

Impulse responses are estimates from equation (19) $Y_T = \alpha + B(L)Y_{T-1} + s_1 Y_T^{2Y} + \tilde{u}_T$ obtained via the Canova and Ferroni (2022) Bayesian VAR toolbox with 68 and 90 percent error bands (darker and lighter bands, respectively), 20,000 draws, and 8 lags. The sample of monetary shock series is from January 1995 to December 2019 while the sample of economic data starts in January 1973. The shock series are the rotated second principal component of the instrument set $\{MP1, MP2, EDSR2, EDSR3, EDSR4\}$. The shock series in panel a is constructed from the 30-minute change in these futures around FOMC statements. The shock series in panel b is constructed from the 90-minute change in these futures around FOMC statements when there is a post-meeting press conference so that the time window includes the press conference. Panel c augments the instrument set in panel b with 2-, 5-, 10-, and 30-year Treasury yields. IP is the industrial production index, CPI is the consumer price index, excess bond premium is from Gilchrist and Zakrajšek (2012), and the two-year Treasury is the end of the month daily change in the zero-coupon yield. All sources of series are detailed in Appendix G. Appendix Table 2 displays the first-stage F-statistics.

Series name	F-stat	Robust F-stat
8 lags, April 2025 end date		
Original time window, NS	4.08	1.73
Press conference included, NS	4.16	1.83
Press conference + long-rates, NS	1.77	1.49
Original time window, target	3.71	1.30
Press conference included, target	3.96	1.41
Press conference + long-rates, target	3.42	1.50
Original time window, path	0.34	0.14
Press conference included, path	0.21	0.09
Press conference + long-rates, path	0.69	0.24
12 lags, April 2025 end date		
Original time window, NS	2.94	1.35
Press conference included, NS	2.90	1.41
Press conference + long-rates, NS	1.53	1.29
Original time window, target	2.51	0.97
Press conference included, target	2.60	1.02
Press conference + long-rates, target	2.33	1.11
Original time window, path	0.41	0.17
Press conference included, path	0.27	0.13
Press conference + long-rates, path	0.15	0.05
8 lags, 2019 end date		
Original time window, NS	4.14	1.60
Press conference included, NS	4.22	1.64
Press conference + long-rates, NS	1.80	1.63
Original time window, target	4.33	1.32
Press conference included, target	4.42	1.35
Press conference + long-rates, target	3.58	1.38
Original time window, path	0.00	0.00
Press conference included, path	0.02	0.01
Press conference + long-rates, path	0.75	0.23

Table 2: First-stage F-statistics.

Estimates from equation (19) $Y_T = \alpha + B(L)Y_{T-1} + s_1 Y_T^{2Y} + \tilde{u}_T$ obtained via the Canova and Ferroni (2022) Bayesian VAR toolbox with 68 percent error bands, 20,000 draws. The sample of monetary shock series is from January 1995 to April 2025, unless otherwise noted, while the sample of economic data starts in January 1973. The shock series of each panel are principal components of the instrument set $\{MP1, MP2, EDSR2, EDSR3, EDSR4\}$ with the series constructed from long rates augmented with intraday changes in 2-, 5-, 10-, and 30-year Treasuries. The "NS" shock is the first principal component and the "target" and "path" shocks are the rotated first and second principal component, respectively. The "original time window" shock series is constructed from the 30-minute change in these futures around FOMC statements. The "press conference included" shock series is constructed from the 90-minute change in these futures around FOMC statements when there is a post-meeting press conference so that the time window includes the press conference. The "Press conference + long rates" includes intraday changes in 2-, 5-, 10-, and 30-year Treasury yields in the instrument set. All sources of series are detailed in Appendix G.

G APPENDIX: DATA

CONSTANT MATURITY TREASURY YIELDS are daily market yields on U.S. Treasuries obtain via the H.15 Selected Interest Rate Release from the Federal Reserve Board.

CONSUMER PRICE INDEX is the seasonally adjusted monthly Consumer Price Index from the Bureau of Labor Statistics (`FRED: CPIAUCSL`).

EURODOLLAR FUTURES are available at an intraday tick frequency from 1995 to March 2023 via the CME Group Inc. DataMine (https://datamine.cmegroup.com/) at the Federal Reserve Board.

EXCESS BOND PREMIUM is a monthly credit spread index from Gilchrist and Zakrajšek (2012) and is available from the Federal Reserve Board
(https://www.federalreserve.gov/econres/notes/feds-notes/ebp_csv.csv.)

FEDERAL FUNDS FUTURES are available at an intraday tick frequency from 1995 to present via the CME Group Inc. DataMine at the Federal Reserve Board (https://datamine.cmegroup.com/).

FEDERAL FUNDS RATE is the target federal funds rate after each FOMC meeting. Because a change in the federal funds rate is executed the day after an FOMC meeting, this series is constructed by taking the value for the day after an FOMC meeting. The FRED series `DFEDTAR` is used from 1994 to December 15, 2008 and then the average of `DFEDTARU` and `DFEDTARL` is used thereafter.

INDUSTRIAL PRODUCTION is the seasonally adjusted monthly Industrial Production Index from the Federal Reserve Board (`FRED: INDPRO`).

CORE PERSONAL CONSUMPTION EXPENDITURES INDEX is the seasonally adjusted monthly personal consumption expenditures index excluding food and energy, seasonally adjusted from the Bureau of Economic Analysis (`FRED: PCEPILFE`).

SOFR FUTURES are used at an intraday tick frequency from January 2022 to September 2024 via the CME Group Inc. DataMine (https://datamine.cmegroup.com/) at the Federal Reserve Board.

UNEMPLOYMENT RATE is the seasonally adjusted monthly unemployment rate from the Bureau of Labor Statistics (`FRED: UNRATE`).

NON-CYCLICAL RATE OF UNEMPLOYMENT is the monthly not seasonally adjusted series from the U.S. Congressional Budget Office (`FRED: NROU`).

VIX is the daily not seasonally CBOE Volatility Index of adjusted market expectation of volatility conveyed by stock index options from the Chicago Board of Options Exchange (`FRED: VIXCLS`).

ZERO-COUPON TREASURY YIELDS are continuously compounded zero-coupon daily yields (mnemonic: SVENYXX) obtained from the Federal Reserve Board (https://www.federalreserve.gov/data/yield-curve-tables/feds200628_1.html or as a csv file).