Words Speak As Loudly As Actions: The Response of Equity Prices to Macroeconomic Announcements*

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Abstract

We study the impact that macroeconomic news has on equity prices. While the literature has already widely documented the effects of macroeconomic announcements on asset prices, as well as their asymmetric impact during good and bad times, we focus on the reaction to news when the description of the state of the economy—as painted by the Federal Open Market Committee (FOMC) statements—deteriorates. We develop a novel FOMC sentiment index using textual analysis techniques, and find that news has a bigger impact on equity prices during bad times as described by our FOMC sentiment index. This finding is consistent with previous literature, which finds that the stock market's reaction depends on the state of the economy, except that the FOMC's description of the state of the economy is the variable that best explains the variation in the response—more so than the state of the economy itself as measured by real-time indices. Our interpretation is that the reaction of equity prices to news depends on the probability of an increase in interest rates, and the FOMC's description of the state of the economy is one of the best predictors of this probability.

Keywords: Monetary policy, public information, probability of a recession, price discovery.

JEL Classifications: C53, D83, E27, E37, E44, E47, E5, G1.

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1 Introduction

There is an extensive literature on the response of equity prices to macroeconomic news announcements, and how this response depends on the state of the economy. In particular, good news has a lower or even negative effect on equity prices during good times compared to bad times. The explanation put forth by McQueen and Roley (1993), Boyd et al. (2005), Andersen et al. (2007), and Law et al. (2019), among others, is that the Federal Open Market Committee (FOMC) is more likely to raise interest rates during economic expansions than during recessions, dampening the effect of good news. This is because good news during good times is associated with higher cash flows for a firm—implying a *positive* equity price change following the macroeconomic announcement—as well as with a higher risk-free rate and a higher risk premium—implying a *negative* equity price change following the macroeconomic announcement. The former effect can potentially be offset by the latter resulting in a lower, or even negative, overall response of equity prices to good news during good times. In this pape, we further explore this question by introducing a novel FOMC sentiment index summarizing the view that the FOMC has on the future outlook for output, labor markets, inflation, financial conditions, and monetary policy. To better understand the role the *text* of FOMC statements has on the sensitivity of equity prices to macroeconomic news, we also test the ability of our index to forecast monetary policy decisions and macroeconomic outcomes.

We use textual analysis techniques to extract our novel FOMC sentiment index. Specifically, we develop a dictionary based on the most common words that appear in 162 FOMC statements over the January 2000 to April 2019 period to describe five topics: the state of the economy, financial conditions and future monetary policy. The dictionary contains two separate list of words, a list of topic keywords (e.g., GDP) and a list of modifiers (e.g., increasing). The algorithm pairs each keyword with the closest modifier and determines whether the combination of topic-modifier communicates good(tightening), neutral, or bad(easing) news about five topics: labor market conditions, output, inflation, financial conditions, and future monetary policy actions. Throughout the

paper we focus on the overall FOMC sentiment index (a combination of all five topics), and discuss the predictive power of the five indices separately in the robustness section.[1]

Figure 1 displays the FOMC sentiment index along with the coefficient describing the stock market response to macroeconomic news announcements. The FOMC sentiment index is a mirror image of the coefficient, when the FOMC sentiment index is high, the response of equity prices to macroeconomic news is low. In particular, we can observe that months after the recession is over, the FOMC is still hesitant to talk about positive economic conditions that would warrant an increase in interest rates (i.e. the FOMC sentiment index is below zero), implying a positive effect of good news on equity prices well after the recession is over. Our empirical analysis corroborates this hypothesis: we find that a positive FOMC sentiment index dampens the effect that better-than-expected macroeconomic releases—namely nonfarm payroll, initial jobless claims, ISM manufacturing and the Conference Board consumer confidence index—have on equity prices. We also find that the FOMC sentiment is one of the best predictors of the sensitivity of equity prices to macroeconomic news, performing better than a number of other variables. In particular, the FOMC sentiment index performs better than the unemployment rate gap analyzed by Law et al. (2019), possibly because monetary policy decisions weigh in more factors than just the unemployment rate gap. Importantly, the FOMC sentiment index is able to predict the response of equity prices to macroeconomic news after controlling for other macro and financial variables, including expectations of future interest rates and yield curve measures, consistent with the view that words complement number estimates.

To understand the properties of the FOMC sentiment index and its role in affecting the response of macroeconomic news on equity prices, we test its ability to forecast monetary policy decisions and macroeconomic outcomes. In the former exercise, we estimate a probit model where we allow the FOMC sentiment index to compete with a number of explanatory variables to forecast the future policy stance. We find that indeed the FOMC sentiment index is an important predictor of FOMC decisions along with rate change expectations estimated using federal funds futures, the VIX index, and the Aruoba et al. (2009) index. As expected, an increase in the FOMC sentiment index

[1]During our sample period, the FOMC sentiment index is mainly an FOMC output sentiment index because statements over the 2000-2019 period consistently provide information about output, while they do not always provide information about inflation, labor, financial market conditions or future monetary policy actions, particularly at the beginning of our sample. However, in the future, other components of the FOMC sentiment index may convey more information than the FOMC output sentiment index.

increases the marginal probability of a rate hike, even after controlling for other variables. In the second exercise, we forecast some macroeconomic variables, like GDP and the unemployment rate, using our sentiment index and a number of other explanatory variables. We find a more limited role for our FOMC sentiment index, which tends not to be significant when controlling for all of the other explanatory variables. These results help us understand further the two opposite forces behind the effect of macro news on stock prices: a higher discount rate versus higher cash flows. Our finding suggests that good macro news when the Federal Reserve (Fed) is more likely to increase interest rates has a smaller impact on equity prices because the discount rate effect offsets the cash flow effect. An alternative view, which would be corroborated by a positive relationship between the FOMC sentiment index and the equity response to macroeconomic news, would suggest that good news when the Fed thinks the economy is growing makes the cash flow component dominate the discount rate component. Since we do not find a positive relationship, even though the FOMC sentiment index is positively correlated with future GDP growth, we validate the first explanation.

Our paper contributes to different strands of the literature. First, it contributes to the literature that studies time-variation in the response of equity prices to macroeconomic news (McQueen and Roley, 1993; Boyd et al., 2005; Andersen et al., 2007; Law et al., 2019). Our study provides further support to the explanation put forth by previous studies that equity prices are less sensitive to good news during good times because the FOMC is more likely to increase interest rates during good times. Second, it contributes to the literature that uses textual analysis techniques to extract useful variables that have predictive power. Textual analysis has gained significant ground in recent years, particularly in the study of uncertainty and of central bank and political deliberations. These analyses use a combination of methods including news search (Baker et al., 2016; Demiralp et al., 2019; Caldara and Iacoviello, 2017), Latent Dirichlet Allocation (Hansen and McMahon, 2016; Hansen et al., 2017) and dictionary methods (Loughran and McDonald, 2011; Sharpe et al., 2017; Banerjee et al., 2019). We contribute to this literature by developing a Federal Reserve specific dictionary to sign FOMC statements and demonstrating that it works better than using the general dictionary of financial market positive and negative words of Loughran and McDonald (2011), consistent with the findings of Picault and Renault (2019). Our study also shows that textual analysis variables contain valuable information that is not subsumed by asset price information such as market-based expectations of future interest rates.

The paper proceeds as follows. Section 2 introduces the data used in this study, including the derivation of the FOMC sentiment indices. In Section 3, we dive into our three main questions: Section 3.1 studies the impact of macroeconomic news announcements on equity prices and the role of the FOMC sentiment index, Section 3.2 investigates whether the FOMC sentiment is a good predictor of future monetary policy, and Section 3.3 explores the question of whether the sentiment index predicts future macroeconomic outcomes . In Section 4, we investigate the robustness of our results. Finally, we conclude in Section 5.

2 Data

In this section, we describe the variables that we use in the analysis. We consider a set of variables that may predict the time-varying response of equity prices to macroeconomic news announcements, with a particular emphasis on our novel FOMC sentiment index. We also include in the analysis additional variables describing monetary policy and the state of the economy. The sample period we study starts in January 2000 and ends in April 2019.[2]

2.1 FOMC Sentiment Index

We construct the FOMC sentiment index using a user-defined dictionary of *topic-keywords*, *modifier-keywords* and phrases. We separate topic-keywords and phrases into five topics: labor, output, inflation, financial conditions and future monetary policy (e.g. labor market, business conditions, inflationary, etc.) based on our reading of the 162 FOMC statements over the 2000-2019 period. Words or phrases are added to each topic-keyword dictionary based on their relative frequency in a list of most frequently used words that appear in FOMC statements after dropping common stop words such as "a," "the," etc. Due to the predictable pattern of FOMC communication, we were able to generate a representative set of topic-keywords (seven for labor, eighteen for output, three for inflation, and three for financial conditions) and phrases (twenty four for future monetary policy).

Figure 2 shows the frequency of output, labor, inflation, financial conditions and future monetary policy topic-keywords or phrases over our sample period. The figure shows that from 2000 to 2010,

[2]Our sample period starts in January 2000. We could possibly start the analysis in September 1998, when the Federal Reserve started to release a statement, albeit not consistently, along with the decision. However, the statements in the early part of the period were not very informative and therefore we decided to start in 2000. Nevertheless, we note that our results are robust to including statements from November 1998 to December 1999.

the FOMC rarely mentioned labor and financial market conditions. Using a similar methodology, we create a dictionary for *modifier-keywords* (e.g. high, deteriorated, strengthened, etc.). That is, we create a list of most frequently used modifiers that are associated with our *topic-keywords*.

For the first four topics—labor, output, inflation, and financial conditions—we pair a topic-keyword (listed in Table A1) with the closest modifier-keyword (listed in Table A2 and Table A3) within a sentence to get the *topic-modifier* pair. Distance is measured by the number of words from the beginning of a topic-keyword to the beginning of a modifier-keyword. We then use this topic-modifier pair to sign FOMC communication depending on whether the statement indicates that the economy (output, employment, financial conditions) is expanding, neutral or contracting, or inflation is increasing, neutral or decreasing. A simple mention of the word "unemployment" does not provide much information about what the FOMC believes regarding the state of the economy; similarly, using modifiers independently of the keyword might be misleading because they can have positive or negative connotations according to the keyword they refer to. Importantly, including the context of "unemployment is low" allows us to assign a signed score. By separating words into topic and modifier categories, our algorithm is more flexible at recognizing both "unemployment is low" and "low unemployment" without having to identify and score every possible permutation of those two words. Topics and modifiers take on values of 1, 0, and -1 based on our assessment of whether they communicate good, neutral, or bad news about economic conditions. In the Appendix we have separated modifiers depending on the topic, because certain modifiers are more likely to be used with certain topics, but our results are robust to using a "global" modifier dictionary.

We calculate the *topic-modifier pair sentiment* by multiplying the topic-score with the modifier-score. For example, in the aforementioned phrase "unemployment is low", "unemployment" and "low" both receive a score of -1 for an overall score of 1. In contrast, the phrase "labor market conditions have deteriorated" from the December 16, 2008 press release receives an overall score of -1, because the topic "labor market" is scored as 1 and the modifier "deteriorated" is scored as -1. Tables A1 and A2 in the Appendix list the keywords, modifiers and their respective scores.

To generate the future monetary policy index we use a combination of phrases, instead of topic-modifier matches. This is in line with the narrative approach used by Hansen and McMahon (2016) who identify in each statement the relevant paragraphs where there are mentions of future decisions. In our case, however, we look at future decisions regarding both rates and purchases. Because the

FOMC committee is predictable in its speech pattern, we use different rules (found in Table A5) to uniquely identify and score actions throughout the entire period. The rules are formatted as lists of words common to the FOMC's explanations of future monetary policy decisions, but allow for different ordering and word tenses as necessary. For example, the rule "complete, purchase, improvement" signals the end of asset purchases and is scored with a 1 to indicate the end of an accommodative period; whereas the rule "below levels, longer run" (scored as -1) indicates that the current, weak economic state justifies keeping the target rate low for an extended period.

The sentiment index for each topic is the sum of each topic sentiment divided by the square root of the number of words in the statement after having deleted uninformative sentences (see the Appendix for a description of how we identify uninformative sentences). Our overall FOMC sentiment index is the sum of each topic sentiment and takes on values between -1 and 1.[3]

Figure 3 displays FOMC sentiment indices for our five topics and the overall sentiment. The output (black solid line), labor (green dotted line), and inflation (red dashed line) sentiment indices are shown in the left panel. The financial markets (orange solid line), monetary policy (blue dotted line), and the overall (red dashed line, secondary axis) sentiment indices are shown in the right panel. As shown in Figure 2 there is a distinct shift in the FOMC communication content around 2010 with the introduction of comments about the state of the labor market. Before 2010 the FOMC rarely mentioned labor markets, thus our labor sentiment score prior to 2010 is close to zero and it misses the 2001 recession. In contrast, the output sentiment score goes down prior to the 2001 recession. After 2010 all five sentiment scores are positively correlated. The correlation across all five topics ranges from 0.16 to 0.5 (not shown), and the correlation of the FOMC sentiment index (the sum of all five sentiments) with respect to each topic ranges from 0.16 to 0.7, with the highest correlation being that of the FOMC sentiment index and the FOMC output sentiment (0.7 is the correlation between the two from 2010 to the present, the correlation is 0.45 when we estimate it over the full sample).

2.2 Equity Prices

Following prior literature that uses high-frequency (minute-by-minute) data to estimate the response of asset prices to macroeconomic news announcements to better identify the effect, we use intraday

[3]The textual analysis program is written in R and is available upon request.

data on the E-mini S&P 500 futures contract bid and ask quotes from Thomson Reuters Tick History. There is a new futures contract issued every three-months—in March, June, September, and December. The most recently issued or "front-month" contract, is the most heavily traded contract and is a close substitute for the underlying spot instrument. Thus, in our tests, we use the front-month futures contract, so that our results carry over to the spot S&P 500 index. When a new contract is issued there are a few days when the recently issued contract is slightly less liquid than the previously issued contract. We switch contracts when the trading volume of the recently issued contract is bigger than that of the previously issued contract. Once we switch contracts we do not switch back. We consider futures contracts for the asset prices in our analysis because futures contracts allow us to capture the effect of announcements that take place at 8:30 am Eastern time before the equity market opens.

2.3 Macroeconomic News Announcements

There are many macroeconomic news announcements, but not all of these announcements have a significant impact on asset prices.[4] For example, out of 36 announcements, Gilbert et al. (2017) find that only three—namely nonfarm payroll, ISM Manufacturing PMI, and retail sales, listed in order of importance—explain more than 10 percent of the variation in daily two-year U.S. Treasury yield changes.[5] Law et al. (2019) focus on four macroeconomic news announcements: nonfarm payroll, initial claims, ISM manufacturing and the Conference Board consumer confidence index. For ease of comparison, we focus on these four announcements as well, but our results are robust to focusing on the three announcements Gilbert et al. (2017) consider to be important.[6]

We use Bloomberg real-time data on the expectations and realizations of these four U.S. macroeconomic announcements to estimate surprises. Table 1 provides a brief description of the most salient characteristics of the news announcements in our sample: the total number of observations in our sample, the agency reporting each announcement, and the time of the announcement release.

We define announcement surprises as the difference between announcement realizations and their corresponding expectations. More specifically, since units of measurement vary across macroeco-

[4] See Gilbert et al. (2017) for an explanation of why this is the case.

[5] ISM stands for Institute for Supply Management, formerly National Association of Purchasing Management (NAPM). PMI stands for Purchasing Manager Index.

[6] An alternative could be to use a macro surprise index as the one developed by Scotti (2016).

nomic variables, we standardize the resulting surprises by dividing each of them by their sample standard deviation. The standardized news associated with the macroeconomic indicator i at time t is therefore computed as

$$Surprise_{it} = \frac{A_{it} - E_{it}}{\widehat{\sigma}_i}, \tag{1}$$

where A_{it} is the announced value of indicator i, E_{it} is its Bloomberg median forecast, as a proxy for its market expected value, and $\widehat{\sigma}_i$ is the sample standard deviation of $A_{it} - E_{it}$. Equation (1) facilitates meaningful interpretation of the response of equity prices to news and allows us to pool all four announcements to have more observations per year when estimating time-varying coefficients.[7]

2.4 Different Measures of the State of the Economy

Previous literature documents that the response of equity markets to macroeconomic news is time-varying. Therefore, in our exercise, we will test whether a variety of measures of the state of the economy can explain the variation in the response.

The first set of proxies we consider are measures that indicate the current state of the economy. Even though the NBER does not announce expansions and recessions on a real-time basis, we consider an indicator variable equal to 1 when the economy is in recession, zero otherwise.[8] As a real-time proxy of the current state of the economy, we use the ADS business conditions index, Aruoba et al. (2009). This index is updated in real-time as new macroeconomic data become available and may be used to compare business conditions at different times. Progressively bigger positive values indicate progressively better-than-average conditions, whereas progressively more negative values indicate progressively worse-than-average conditions.[9]

A second set of proxies that we consider are those that have been shown to be able to predict the future state of the economy. In particular, we include in our analysis the excess bond premium (EBP) suggested by Gilchrist and Zakrajšek (2012), an indicator of the effective "risk-bearing capacity" of

[7] While we have 232 announcements for the monthly variables and over $1,000$ for initial jobless claims, when we run regressions on a yearly basis, we would only have 12 observations without the pooling.

[8] The NBER defines a recession as a significant decline in economic activity spread across the economy, lasting more than a few months, normally visible in real GDP, real income, employment, industrial production, and wholesale-retail sales.

[9] The Aruoba et al. (2009) index is maintained by the Federal Reserve Bank of Philadelphia at https://www.philadelphiafed.org/research-and-data/real-time-center/business-conditions-index.

the financial intermediary sector.[10] Lopez-Salido et al. (2017), using U.S. data from 1929 to 2015, show that elevated credit-market sentiment is associated with a decline in economic activity in future years. In addition, we use the near-term forward spread as suggested by Engstrom and Sharpe (2018) and an indicator variable equal to 1 if the near-term forward spread is negative (zero otherwise). The near-term forward spread can be interpreted as a measure of the market expectations for the near-term trajectory of conventional monetary policy rates and has been shown to statistically dominate the more traditional long-term spread—spread between the yield on a 10-year Treasury bond and the yield on a shorter maturity bond, such as a 2-year Treasury— in recession prediction models.

2.5 Monetary Policy and Other Variables

In addition to the FOMC sentiment, we consider a number of other variables in our analysis, as they could affect the response of equity prices to macroeconomic news announcements. One such variable is the level of the federal funds target rate (FFTR). Indeed, Goldberg and Grisse (2013) argue that the Federal Open Market Committee (FOMC) is less likely to raise interest rates in response to positive nonfarm payroll surprises when the FFTR is already high. Thus, in this situation, positive nonfarm payroll surprises should have a bigger impact on equity prices.

Because our sample contains the effective lower bound (ELB) period, in addition to the change in the FFTR, we also consider a policy stance indicator that takes the value $s = -1,\ 0$, or 1 according to whether the FOMC decreases, leaves unchanged or increases the Federal Funds Target Rate and to whether it announces other unconventional policies that are tightening, neutral or accommodative.[11]

In the paper, we also evaluate which variables best predict FOMC decisions. Indeed, Law et al. (2019) show that the equity price response to macroeconomic news not only depends on the current level of the federal funds target rate but it also depends on variables that predict future FOMC decisions. The variables we use are those considered by Law et al. (2019): output gap, inflation level, 5-year bond yield level and changes, the price-to-dividend ratio, the VIX index as a proxy for

[10] The EBP is updated regularly, following Favara et al. (2016) at https://www.federalreserve.gov/econresdata/notes/feds-notes/2016/updating-the-recession-risk-and-the-excess-bond-premium-20161006.html.

[11] The dates follow Rogers et al. (2014) and Rogers et al. (2018).

uncertainty.[12] In a robustness exercise (not shown), we replaced the VIX index with the economic uncertainty (EPU) index of Baker et al. (2016) and the monetary policy uncertainty index of Husted et al. (2019) and the results for our FOMC sentiment index are similar. In addition, we control for monetary policy expectations derived by federal funds futures, since Kuttner (2001), among others, show that federal funds futures are one of the best predictors of the federal funds target rate.[13]

3 Understanding the Reaction of Equity Prices

Having described the FOMC sentiment index and the data used in the analysis, in this section we focus on understanding whether the FOMC index can explain the reaction of equity prices to macroeconomic announcements. We also investigate whether such an index can predict future FOMC decisions and macroeconomic outcomes.

3.1 What Can Explain the Time-Varying Response of Equity Prices to Macroeconomic Announcements?

We estimate the time-varying effect of news by allowing the response to vary year-by-year, similar to the framework of Swanson and Williams (2014) and Law et al. (2019), but forcing the coefficient to be the same across the four real-activity surprises that we consider. That is, we pool the announcement of nonfarm payroll, initial claims, ISM manufacturing and the Conference Board consumer confidence index into one vector. Specifically, we run the following regression:

$$r_t = \alpha_j + \sum_{j=2000}^{2019} \beta_{Sj} Surprise_t \times Year_j + \epsilon_t, \tag{2}$$

where r_t is the 30-minute percent change in the E-mini S&P500 futures contract, $Surprise_t$ are the pooled standardized surprises of the four macroeconomic news announcements described above, and $Year_j$ is an indicator variable equal to one during year $j = 2000, 2001, ..., 2019$.[14] In Figure 1, we plot the estimates of β_{Sj} for each year, along with the FOMC sentiment index and

[12] In our regressions, we use the value of the VIX index at the close of the day preceding the macroeconomic announcement because options used to construct the index trade from 9:15 am to 4:15 pm ET.

[13] More details on the computation of monetary policy expectations are in the appendix.

[14] In more details, r_t is the 30-minute percent change in the E-mini S&P500 futures contract using bid and offer quotes 1-minute before the release of the announcement, and bid and offer quotes 29 minutes after the announcement, that is $100 \times [ln(mq_{t+29}) - ln(mq_{t-1})]$.

shaded areas indicating NBER recessions. The figure shows that equity prices are more sensitive to macroeconomic news announcements (red line) when the FOMC sentiment index (blue line) is low. The effect on equity prices of a one-standard deviation surprise in macroeconomic announcements can be as low as zero (or even negative) in the midst of expansionary periods and as high as 0.15/0.25 following recessions.[15] Conversely, the FOMC sentiment index ranges from 3/4 during expansions to -3 following recessions.

To formally test whether the effect news has on equity prices depends on the state of the economy or the FOMC's description of the state of the economy we introduce an interaction term in Equation 3. In particular, we estimate the following equation:

$$r_t = \alpha + \beta_S Surprise_t + \beta_{BX} Surprise_t \times X_t + \beta_X X_t + \epsilon_t, \tag{3}$$

where r_t is the 30-minute percent change in E-mini S&P500 futures contract, $Surprise_t$ are the pooled standardized surprises of the four macroeconomic news announcements described above, and X_t will be different proxies for the state of the economy, monetary policy, and uncertainty measures we described in Section 2. A significant β_{BX} will tell us that the effect of macroeconomic surprises on equity prices changes depending on the values of the other X_t independent variables. For continuous variables, we divide the X_t by its standard deviation so that the coefficients are easily interpreted.

Table 2 shows the estimation results of equation (3) when we consider each X_t at a time. The first column of Panel A shows the estimation results when macroeconomic surprises are interacted with the FOMC sentiment index. As expected, a positive macro surprise lifts equity prices: a one-standard deviation increase in the macroeconomic surprise increases equity prices by 0.1 percentage points. Importantly, this effect is lower when the FOMC sentiment index is high, as shown by the negative coefficient on the interaction term. Specifically, a one-standard deviation increase in the FOMC sentiment index (corresponding to approximately a 0.35 increase in the index) lowers the effect of the surprise by 0.04 percentage points. This is consistent with Figure 1 and supports the

[15] Of note, these coefficients are not comparable to Law et al. (2019) because they standardize surprises by the standard deviation across professional forecasters, rather than the standard deviation of the surprise. However, the coefficients are comparable to those reported in Andersen et al. (2007). The range of the variation in the magnitude of the response of equity prices to macroeconomic news shown in Figure 1 is somewhat smaller than that documented in Andersen et al. (2007), who find that a one-standard deviation surprise in nonfarm payroll during recessions increases stock prices by 0.3 percentage points, and during expansions it decreases stock prices by -0.2 percentage points.

view that the discount rate effect dominates the cash flow effect: when the FOMC is more likely to increase rates, the impact of macro news on equity prices is lower.

The remainder of the columns in Panels A and B of Table 2 show the results of a similar analysis when different variables are interacted, one by one, with macroeconomic surprises. For example, column 2 in Panel A shows that when the federal funds futures market expects an increase in the federal funds target rate of 25 basis points at the next meeting (corresponding approximately to a one standard deviation increase), the equity price response to a one standard deviation macroeconomic surprise is 0.07 percentage points (0.1-0.03). Columns 3-7 in Panel A show that the response of equity markets to macroeconomic news is lower when the unemployment gap is lower, when inflation is higher, and when Gilchrist and Zakrajšek (2012)'s excess bond premium (EBP) is lower. Columns 1-7 in Panel B show that the equity price response to macroeconomic announcements is lower when the economy is expanding, when the Federal Funds Target Rate is higher, when there was an increase in the federal funds target rate in the last meeting, etc. Interestingly, variables that forecast the future state of the economy or future monetary policy decisions can explain better the response than variables that describe the current state of the economy, such as the ADS index and an indicator variable equal to one during NBER recessions, as indicated by the Adjusted R^2.

Table 3 shows the results of the horse race when we include all of the interaction terms from Table 2 in the same regression. Column (2) includes the FOMC sentiment and a subset of other explanatory variables and column (3) includes all the variables. Even in the latter case, the FOMC sentiment remains significant and is one of the seven variables that affect the response of macro announcements on equity prices, proving that it contains information above and beyond what is contained in the other variables.

3.2 Can the FOMC sentiment help explain FOMC Decisions?

To understand better the information carried by our FOMC sentiment score, we test the ability of our index to forecast future monetary policy decisions. FFTR changes (as shown in Table A6) are naturally ordered in 0.25 percent increments over the range ± 0.75 percent, prompting the use of an ordered probit model to forecast the size of the FFTR change, consistent with Hamilton and Jordá (2002), Scotti (2011), and Angrist et al. (2018). However, because the period we analyze is characterized by both conventional and unconventional policies, we develop a policy stance indicator

that takes the value $s = -1,\ 0,\ or\ 1$ according to whether the FOMC decreased, left unchanged or increased the Federal Funds Target Rate and whether it announced other unconventional policies that were tightening, neutral or accommodative, respectively.[16] During our sample period, February 2000 to April 2019, there were, as shown in Tables A6, 162 FOMC meeting press releases, some of which were inter-meeting press releases.[17]

In terms of explanatory variables, our specification is similar to that used by Angrist et al. (2018), who, consistent with Kuttner (2001), find that federal funds futures are one of the best predictors of the federal funds target rate. In addition to the federal funds futures, we also consider different measures of the state of the economy and variables that Law et al. (2019) find to be good predictors of future monetary policy, such as output gap, inflation, 5-year bond yield level and changes, the price-to-dividend ratio, and the VIX index. And, of course, we include our FOMC sentiment index.

Specifically, we estimate the following probit specification at the daily frequency:

$$Pr(MPD_t = s|X_{t-1}) = \Phi(X_{t-1}\mathrm{B} + \epsilon_t), \tag{4}$$

where MPD_t is the monetary policy decision on day t, measured as the policy stance variable just described, and X_{t-1} is the matrix of predictors of monetary policy decisions available as of the day before the FOMC meeting. For most variables this means that we use their value as of $t-1$, but for the FOMC sentiment the latest value is that corresponding to the previous FOMC meeting. Φ is the normal probability distribution.

We first consider each variable's predictive power in isolation in a univariate specification. In Table 4, we show that the expected rate change implied by federal funds futures—computed as described in section 2.5 and in the Appendix— is the best predictor of future monetary policy with a pseudo R^2 of 0.45, followed by our FOMC sentiment index with a pseudo R^2 of 0.26 and the previous change in the federal funds target rate with a pseudo R^2 of 0.25. These results are consistent with the intuitive notion that interest rate derivatives provide an optimal policy forecast (Piazzesi,

[16]Results are qualitatively similar when we estimate equation (4) with MPD_t being the actual federal funds target rate change $s = -0.75,\ -0.5,\ -0.25,\ 0,\ 0.25,\ 0.50$ or 0.75 or when we exclude the ELB period—see Table 5, Columns (3)- (4) and Section 4.3

[17]The FOMC press-release dates shown in Tables A6 are taken from www.federalreserve.gov. We confirmed the release dates using Bloomberg, the Internet Appendix Table IA.I in Boguth et al. (2018) and the dates from Rogers et al. (2014) and Rogers et al. (2018).

2005), and the text of FOMC statements, as well as past FOMC actions, are good predictors of future monetary policy decisions. The VIX index, Gilchrist and Zakrajšek (2012)'s EBP, the ADS index, and a recession indicator variable also turn out to be good predictors of future monetary policy stance. For ease of interpretation, we standardized all continuous variables and the table reports the marginal effects on the probability of the FOMC making a tightening announcement for a one-standard deviation increase in continuous variables, or for a change from 0 to 1 in discrete variables.[18] In column (1), we observe that a one-standard deviation increase in the FOMC sentiment (corresponding to a 0.35 increase in the index) increases the probability of a tightening announcement by 0.22, which is a sizeable number. For comparison, a one-standard deviation increase in the expected FFTR change implied by fed funds futures (corresponding to about 25 basis points) would increase the probability of a tightening announcement by 0.32. Conversely, the probability of tightening decreases by 0.25 when the economy moves into recession.

In Table 5 Column (1), we show results from a horse race exercise where we include in the probit regression all the variables at once. Not all variables are statistically significant in this specification: the fact that the FOMC sentiment maintains its significance in this regression is indicative of the fact that its information is not subsumed by other market variables. Importantly, the marginal effect of the FOMC sentiment index is still sizeable. A one-standard deviation increase in the FOMC sentiment, increases the probability of tightening announcement by 0.12. Variables like the VIX or the EBP, instead, lose significance in this exercise. In columns (2)-(4) we show that our conclusion is robust to excluding the ELB period and to forecasting federal funds target rate changes rather than using the monetary policy stance variable (more details in Section 4.3).[19]

Perhaps it is surprising that the information in the FOMC sentiment index is not subsumed by the information in the federal funds futures expectation. Our interpretation is that the narrative that accompanies FOMC decisions complements point forecasts that are provided by asset prices such as federal funds futures expectations. This interpretation is consistent with the findings in Sharpe et al. (2017) who find that the narrative that accompanies the Fed's GDP point forecasts contains information above and beyond that contained in the point forecast.

[18] To be clearer, the table does not show the marginal effect in terms of slope, but in terms of impact on the probability.

[19] An alternative to a probit specification would be to use the shadow rate of Wu and Xia (2016) and follow the approach used by Hansen and McMahon (2016).

3.3 Can the FOMC Sentiment Help Predict Future Economic Activity?

An additional way to understand the properties of the FOMC sentiment index is to formally test whether it has any forecasting powers for macroeconomic outcomes. To do so, we forecast in real time one-quarter or one-month ahead real activity variables and CPI inflation through the following simple regression:

$$Y_t = \alpha + \beta X_{t-1} + \epsilon_t, \tag{5}$$

where Y_t are the measures of the state of the economy—namely GDP Advanced, the unemployment rate, and nonfarm payroll employment—or core CPI inflation, and X_{t-1} represents different explanatory variables, including the FOMC sentiment index and the other variables considered so far in the analysis. Time t is that of the release of the macroeconomic announcement Y that we are forecasting. The values of the independent variables are those available as of the day before the release of the macroeconomic announcement that is forecast. The FOMC sentiment index is that of the latest FOMC meeting prior to the macroeconomic release.

Table 6 presents such results. Overall, the FOMC sentiment is able to predict future activity when included in a regression in addition to the lag of the forecast variable, as shown in the odd-numbered columns. However, the FOMC sentiment index loses significance when it competes with all the other variables at once.

These results corroborate the importance of the discount rate channel versus the cash flow channel. Our findings from Table 2 suggest that good macro news when the Fed is more likely to increase interest rates has a smaller impact on equity prices because the discount rate effect offsets the cash flow effect. The alternative view would suggest that good news when the Fed thinks the economy is growing makes the cash flow component dominate the discount rate component. Results in Tables 5 and 6 confirm that our explanation of a dominant discount rate effect is a more plausible one.

4 Robustness

This section presents some alternative specifications ranging from using the sub-components of our FOMC sentiment index, to using a different dictionary—namely the Loughran and McDonald (2011) dictionary—or using a different measure of policy stance, like the more traditional FFTR.

4.1 Results with Sub-Components of the FOMC Sentiment Index

As discussed in section 2.1, we construct the overall FOMC sentiment index as an aggregation of its sub-components: the output, labor, inflation, financial and monetary policy FOMC sentiment indices. Each one of these individual indices is constructed based on the subset of information related to output, labor, inflation, financial market and monetary policy, respectively. There are advantages and drawbacks from using these components separately. For example, information about labor conditions, as shown in Figure 2, is primarily contained in FOMC statements in the second part of our sample and, as such, the corresponding FOMC labor sentiment index might be inferior to its output counterpart in the first part of the sample. To shed light on where most of the information content of the overall FOMC sentiment index comes from, we present results similar those shown for the overall FOMC sentiment for each of its sub-components in Tables 7-9.

Table 7 shows results for the equity response, where equation (3) is estimated using each of the individual components of the FOMC sentiment index as an explanatory variable. As before, a positive macro surprise lifts equity prices and the effect is dampened when the sub-component of the FOMC sentiment index increases. When the FOMC sentiment indices compete only against a subset of explanatory variables, all the coefficients related to the FOMC sentiment sub-components are significant (not shown). The sub-components of the FOMC sentiment index lose some of their significance when they compete against all the other explanatory variables, potentially highlighting the importance of aggregating the information from the sub-components into an overall index, as the one that we use in the first part of the paper.

Table 8 shows results similar to those of Table 5, and Table 9 shows results similar to those of Table 6. To save space, each of the components of the FOMC sentiment index is used as explanatory variable to help predict only the macroeconomic variables it is most related to. That is, for example, the output FOMC sentiment index is used to forecast GDP Advanced. Figure 4

displays the components of the FOMC sentiment index and the macroeconomic outcome that they forecast in this exercise. Results in Table 9 show that, generally, each sub-components of the FOMC sentiment index help forecast the macroeconomic announcement that it relates to. However, there is some decrease in significance once they compete with the full set of alternative variables, and only the output FOMC sentiment index survives the horse race.

As suggested from the results just shown, our monetary policy sentiment index is not particularly robust and a more accurate investigation of the causes might be warranted. One reason behind this result could be that only a subset of FOMC statements contains information about forward guidance and future monetary policy actions (136 out of 162). Consistent with this explanation, the FOMC participants reportedly use other venues to firm market expectations related to future policy, such as the press conference following the rate announcement or speeches. An alternative explanation could be that these sentences might need to be evaluated together with the other information related to the state of the economy in order to be able to formulate an accurate view of future policies, as it is indeed the case with conditional forward guidance. Of note, our FOMC monetary policy sentiment index is different from the direction of guidance presented in Hansen and McMahon (2016). While we use a narrative approach similar to theirs, we look at guidance regarding both rates and asset purchases and this gives rise to significant differences in the second part of the sample.

4.2 Alternative Dictionaries

Table 10 shows the results of our sentiment index competing against an alternative index generated using the Loughran and McDonald (2011) dictionary.[20] Consistent with prior research, we find that using a keyword list specific to the text in question is better than using a dictionary specific to broader texts such as company's financial disclosures. The sentiment produced using the Loughran and McDonald (2011) dictionary tracks our FOMC sentiment index for the majority of the sample; however, there is one key divergence. In the period of 2009 to 2010, the FOMC committee makes frequent references to policies that are stabilizing and strengthening for the economy. The alternative sentiment heavily emphasizes these positive words without capturing the nuance communicated in these statements, "although economic activity is likely to remain weak for a time, the committee

[20]The Loughran and McDonald (2011) dictionary is used as an input to a readily-available polarity function found in the R package, qdap.

continues to anticipate that policy actions to stabilize financial markets and institutions, fiscal and monetary stimulus, and market forces will contribute to a gradual resumption of sustainable economic growth." It appears that this alternative scoring method takes the FOMC committee at face value when it attempts to reassure investors.

4.3 Predicting Monetary Policy Decisions: Alternative Specification

As explained in Section 3.2, in our tests regarding the ability of FOMC sentiment to predict future monetary policy, we use as our dependent variable a monetary policy stance dummy variable equal to $1, -1$ or 0 depending on whether the FOMC announced a target rate decision or an asset purchase decision. This dummy variable takes into account easing monetary policy decisions during the ELB period and is shown in column (3) of Table A6. Alternatively, we can evaluate whether the FOMC sentiment index predicts the *target rate change* decisions shown in column (2) of the same Table. In Table 5, we show in Column (3) the estimates of the ordered probit in equation 4 where MPD_t is the change in the FFTR, using the full sample period. In column (4) we show the estimates when we exclude the ELB period from December 2008 to December 2015. For completeness, column (2) shows the estimate using the monetary policy stance dummy excluding the ELB period.[21]

Results are robust to the different specifications. If anything, the impact of the FOMC statement on the probability of a change in the stance or in the FFTR is bigger when excluding the ELB period.

5 Conclusion

In this paper, we study the impact macroeconomic news have on equity prices with a particular attention to the role played by the description of the state of the economy as painted by the FOMC statements. To this purpose, we construct an overall FOMC sentiment index over the 2000-2019 period, as aggregation of its five components: the labor, output, inflation, financial, and future monetary policy FOMC sentiment indices.

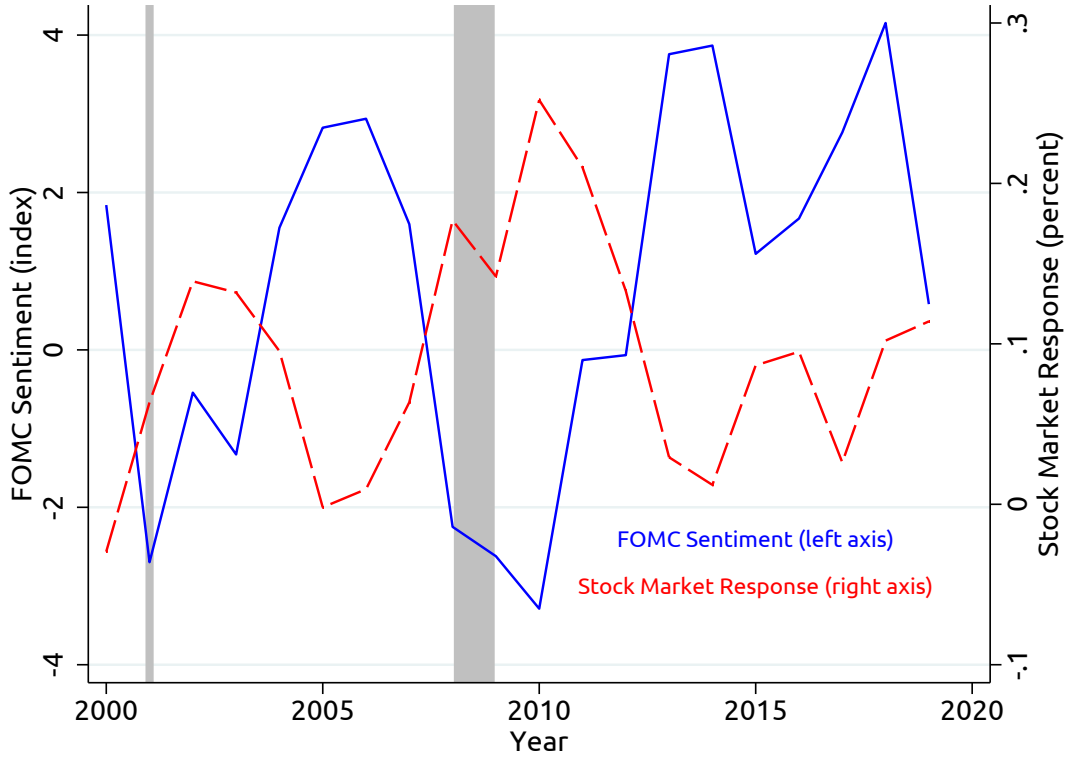
[21] The federal funds target rate was essentially zero from August 2011 to December 2012. However, we use the same ELB period definition as in Benamar et al. (2020), which starts in August 2011 and ends in December 2012. The ELB starts in August 2011, when Swanson and Williams (2014) find that 2-year U.S. Treasury yields started being constrained. We end the effective lower bound period on December 2012 because this is when the FOMC committee ends the "qualitative" and "calendar-based" forward guidance period and starts a data-dependent or "threshold based" forward guidance period based on particular unemployment and inflation thresholds (Femia et al., 2013).

We find that news has a bigger impact on equity prices during bad times as described by the FOMC. This finding is consistent with previous literature which finds that the stock market's reaction depends on the state of the economy, except that the FOMC's description of the state of the economy, more so than the state of the economy itself, as measured by real-time indices, is the variable that better explains the variation in the response. We also find that the FOMC sentiment index is an important predictor of FOMC decisions, while we find a more limited role in forecasting GDP and other macroeconomic variables, once we introduce other controls.

These results shed further light on the two opposite forces behind the effect of macro news on stock prices: a higher discount rate versus higher cash flows. Our finding suggests that good macro news when the Fed is more likely to increase interest rates has a smaller impact on equity prices because the discount rate effect offsets the cash flow effect.

An open issue remains to be further investigated: why is the FOMC statement communication predictive of the equity response to macroeconomic news once we control for federal funds futures expectations? In other words, why doesn't the federal funds futures fully incorporate the information in FOMC statement communications? Our conjecture is that narrative information can complement point forecasts such as the one implied by federal funds futures.

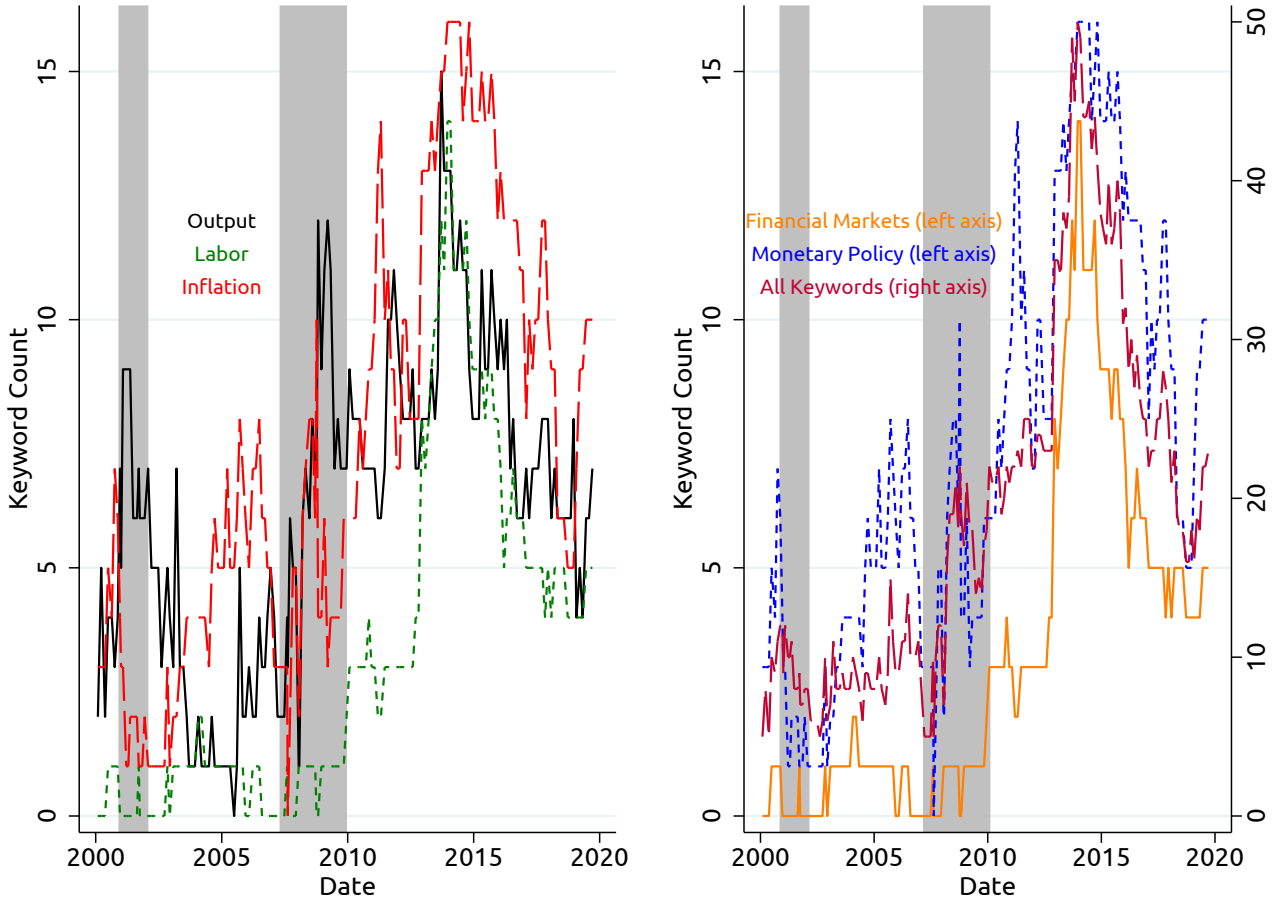
Figure 1: FOMC Sentiment index and Time-Variation in the Response of the Stock Market to Macroeconomic News



Notes: The figure shows the response of the equity market to macroeconomic news announcements (blue solid line) and the overall FOMC sentiment index (red dashed line) over time. The response is the coefficient on macroeconomic news surprises when regressing 30-minute equity return on macroeconomic news surprises from 2000 to 2019. We allow the coefficient to vary over time by estimating the regression each year separately. The FOMC sentiment index is extracted using the textual analysis technique described in the paper and it takes values that range from -1 to 1 each meeting. We graph the sum of the FOMC sentiment index over the year. The shaded areas denote the NBER recession periods. The first recession period is the year 2001 and the second recession starts in 2008 and ends in 2009.

SOURCE: Authors' calculations based on Bloomberg, Thomson Reuters Tick History and FOMC statements from www.federalreserve.gov.

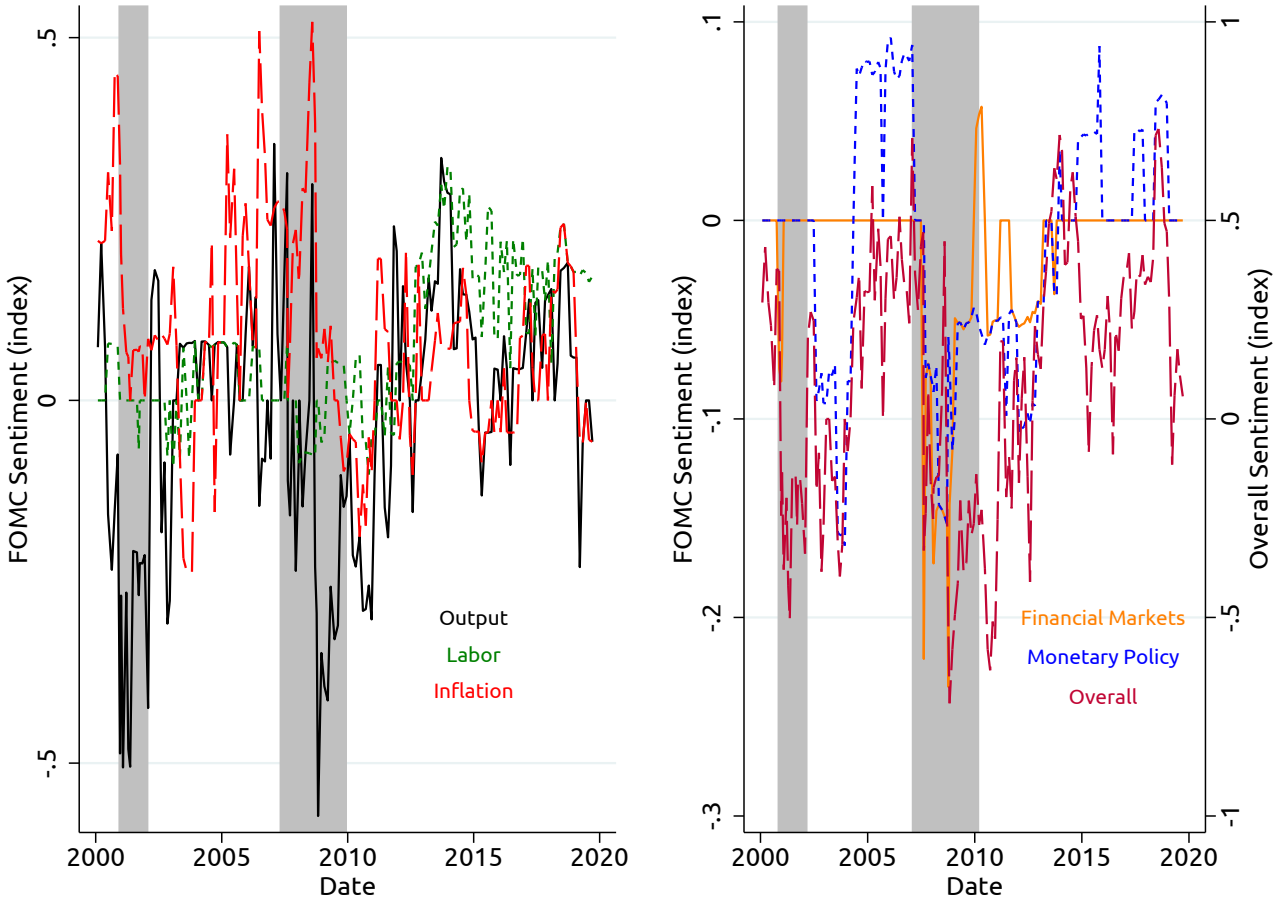
Figure 2: Keyword Count



Notes: The left panel of the figure shows the count of keywords related to output (black solid line), labor (green dotted line), and inflation (red dashed line). The right panel shows the count of keywords related to financial markets (orange solid line) and monetary policy (blue dotted line) as well as the overall keyword count (red dashed line, secondary axis). The sample covers the FOMC statements over the 2000-2019 period. The shaded areas denote the NBER recession periods.

SOURCE: Authors' calculations based on FOMC statements from www.federalreserve.gov.

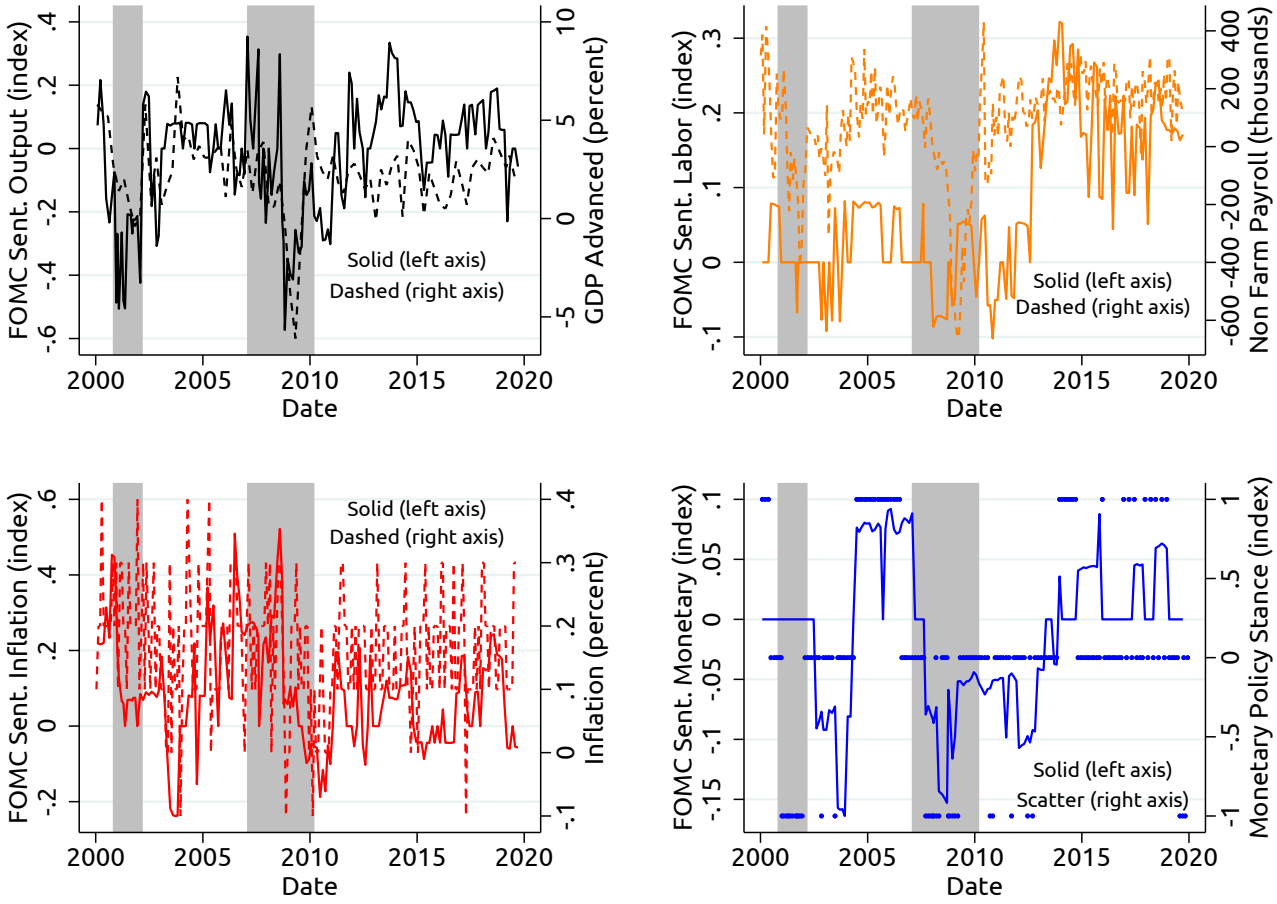
Figure 3: FOMC Sentiment Index Sub-Components



Notes: The figure shows the meeting-by-meeting FOMC sentiment index and its sub-components, computed as described in Section 2.1 of the paper. The output (black solid line), labor (green dotted line), and inflation (red dashed line) sentiment indices are shown in the left panel. The financial markets (orange solid line), monetary policy (blue dotted line), and the overall (red dashed line, secondary axis) sentiment indices are shown in the right panel. The shaded areas denote the NBER recession periods.

SOURCE: Authors' calculations based on FOMC statements from www.federalreserve.gov.

Figure 4: FOMC Sentiment Index Sub-Components and Selected Macroeconomic Variables



Notes: The figure shows in each panel one of the FOMC sentiment index sub-components (solid line) and the macroeconomic announcement most related. The top-left panel shows the output FOMC sentiment (letf axis) and GDP Advanced (right axis). The top-right panel shows the labor FOMC sentiment (letf axis) and nonfarm payroll employment (right axis). The bottom-left panel shows the inflation FOMC sentiment (letf axis) and CPI inflation (right axis). The bottom-right panel shows the monetary policy FOMC sentiment (letf axis) and our monetary policy stance dummy (right axis). The shaded areas denote the NBER recession periods.

SOURCE: Authors' calculations based on Bloomberg and FOMC statements from www.federalreserve.gov.

Table 1: Macroeconomic News Announcements

Name	(1) Observations	(2) Release Time	(3) Agency
Initial Jobless Claims	1,008	8:30 am	ETA
ISM PMI	232	10:00 am	ISM
Consumer Confidence Index	232	10:00 am	CB
Nonfarm Payroll Employment	232	8:30 am	BLS

Notes: The table reports the name of the macroeconomic announcement, the number of observations (releases) in our sample period (from January 2000 to April 2019), and the agency that produces the data. The agencies are: Bureau of Labor Statistics (BLS), Conference Board (CB), Employment and Training Administration (ETA) and Institute for Supply Management (ISM).

SOURCE: Authors' calculations based on Bloomberg.

Table 2: Response of Equity Markets to Macroeconomic News

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Monetary Policy and the State of the Economy							
Surprise	0.103***	0.0975***	0.0704***	0.142***	0.0983***	0.100***	0.0943***
	(0.00789)	(0.00794)	(0.00946)	(0.0176)	(0.00934)	(0.00832)	(0.00850)
Surprise × FOMC Sentiment	-0.0443***						
	(0.00745)						
Surprise × FFF Expectation		-0.0288***					
		(0.00678)					
Surprise × UR Gap			0.0456***				
			(0.00790)				
Surprise × Inflation				-0.0200***			
				(0.00753)			
Surprise × ADS Index					-0.00474		
					(0.00656)		
Surprise × Inv. Yield Curve						0.00315	
						(0.0289)	
Surprise × EBP							0.0110**
							(0.00480)
Constant	-0.00452	-0.00485	-0.00455	-0.0144	-0.0125	-0.00616	-0.00506
	(0.00839)	(0.00802)	(0.00931)	(0.0187)	(0.00882)	(0.00847)	(0.00810)
Observations	1,685	1,685	1,685	1,685	1,685	1,685	1,685
Adjusted R^2	0.105	0.098	0.104	0.090	0.089	0.087	0.090
Panel B: Monetary Policy, the State of the Economy, and Uncertainty							
Surprise	0.0924***	0.133***	0.0944***	0.176***	0.0993***	0.145***	-0.000386
	(0.00905)	(0.0113)	(0.00822)	(0.0183)	(0.00797)	(0.0245)	(0.0188)
Surprise × Recession	0.0369*						
	(0.0191)						
Surprise × FFTR		-0.0332***					
		(0.00820)					
Surprise × Δ FFTR			-0.0169***				
			(0.00599)				
Surprise × 5-Year Yield				-0.0805***			
				(0.0176)			
Surprise × Δ 5-Year Yield					-0.0177***		
					(0.00618)		
Surprise × PD Ratio						-0.0154*	
						(0.00795)	
Surprise × VIX							0.0379***
							(0.00633)
Constant	-0.00607	-0.00843	-0.00473	-0.00464	-0.00459	0.00784	-0.0476**
	(0.00856)	(0.0111)	(0.00802)	(0.0174)	(0.00802)	(0.0249)	(0.0202)
Observations	1,685	1,685	1,685	1,685	1,685	1,685	1,685
Adjusted R^2	0.089	0.096	0.092	0.098	0.091	0.089	0.107

Notes: We estimate the response of E-mini S&P 500 futures to macroeconomic news announcements using data from January 2000 to April 2019. The dependent variable is the 30-minute E-mini S&P500 futures returns using the prevailing futures price as of one minutes before the announcement to twenty nine minutes after the announcement. The estimation also includes main effects, but we do not report these coefficients. The independent variables are divided by their standard deviation, so that the magnitude of the coefficients can be interpreted more easily. FFTR is the Federal Funds Target Rate, FFF expectation is the expected change in the FFTR implied by Fed Funds Futures, unemployment rate (UR) gap is the difference between the actual unemployment rate and the natural rate of unemployment rate, inflation is CPI inflation, ADS index is the Aruoba et al. (2009) index, EBP is the Gilchrist and Zakrajšek (2012) excess bond premium, PD ratio is the price to dividend ratio, and VIX is CBOE volatility index. Standard errors are in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

SOURCE: Authors' calculations based on Bloomberg, Thomson Reuters Tick History, Center for Research in Security Prices (CRSP), the Federal Reserve Bank of Philadelphia, Aruoba-Diebold-Scotti Business Conditions Index, the Favara et al. (2016) EBP update, and FOMC statements from www.federalreserve.gov.

Table 3: Response of Equity Markets to Macroeconomic News: Horse Race

	(1)	(2)	(3)
Surprise	0.101***	0.138***	0.00601
	(0.00796)	(0.0117)	(0.0515)
Surprise × FOMC Sentiment		-0.0428***	-0.0319**
		(0.00931)	(0.0126)
Surprise × FFF Expectation		-0.0402***	-0.0338**
		(0.0103)	(0.0136)
Surprise × UR Gap			0.00826
			(0.0138)
Surprise × Inflation			0.0118
			(0.00981)
Surprise × ADS Index			0.0589***
			(0.0161)
Surprise × Inv. Yield Curve			0.0697*
			(0.0396)
Surprise × EBP			-0.00774
			(0.0118)
Surprise × Recession			0.0625*
			(0.0362)
Surprise × FFTR		-0.0290***	-0.0229
		(0.00834)	(0.0236)
Surprise × Δ FFTR		0.0304***	0.0340**
		(0.0101)	(0.0132)
Surprise × 5-Year Yield			-0.0311
			(0.0443)
Surprise × Δ 5-Year Yield			-0.0215***
			(0.00759)
Surprise × PD Ratio			-0.00630
			(0.0102)
Surprise × VIX			0.0651***
			(0.0119)
Constant	-0.00516	-0.00702	-0.0767
	(0.00803)	(0.0113)	(0.0477)
Observations	1,685	1,685	1,685
Adjusted R^2	0.087	0.121	0.162

Notes: We estimate the response of E-mini S&P 500 futures to macroeconomic news announcements using data from January 2000 to April 2019. The dependent variable is the 30-minute E-mini S&P500 futures returns using the prevailing futures price as of one minutes before the announcement to twenty nine minutes after the announcement. The estimation also includes main effects, but we do not report these coefficients. The independent variables are divided by their standard deviation, so that the magnitude of the coefficients can be interpreted more easily. FFTR is the Federal Funds Target Rate, FFF expectation is the expected change in the FFTR implied by Fed Funds Futures, unemployment rate (UR) gap is the difference between the actual unemployment rate and the natural rate of unemployment rate, inflation is CPI inflation, ADS index is the Aruoba et al. (2009) index, EBP is the Gilchrist and Zakrajšek (2012) excess bond premium, PD ratio is the price to dividend ratio, and VIX is CBOE volatility index. Standard errors are in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

SOURCE: Authors' calculations based on Bloomberg, Thomson Reuters Tick History, Center for Research in Security Prices (CRSP), the Federal Reserve Bank of Philadelphia, Aruoba-Diebold-Scotti Business Conditions Index, the Favara et al. (2016) EBP update, and FOMC statements from www.federalreserve.gov.

Table 4: Forecast of FOMC Monetary Policy Stance

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Monetary Policy and the State of the Economy							
FOMC Sentiment	0.220***						
	(0.023)						
FFF Expectation		0.317***					
		(0.035)					
UR Gap			-0.040				
			(0.026)				
Inflation				0.101***			
				(0.026)			
ADS Index					0.201***		
					(0.035)		
Inv. Yield-Curve						-0.167***	
						(0.045)	
EBP							-0.186***
							(0.030)
Observations	161	161	161	161	161	161	161
Pseudo R^2	0.2638	0.4472	0.0075	0.0509	0.1598	0.0258	0.1527
Panel B: Monetary Policy, the State of the Economy, and Uncertainty							
Recession	-0.251***						
	(0.036)						
FFTR		-0.028					
		(0.026)					
Δ FFTR			0.238***				
			(0.029)				
5-Year Yield				0.020			
				(0.026)			
Δ 5-Year Yield					0.113***		
					(0.024)		
PR Ratio						-0.025	
						(0.026)	
VIX							-0.210***
							(0.032)
Observations	161	161	161	161	161	161	161
Pseudo R^2	0.1634	0.0038	0.253	0.0019	0.0641	0.003	0.176

Notes: We estimate an ordered probit to forecast monetary policy decisions from 2000 to 2019. The dependent variable is an indicator variable equal to -1, 0, 1 according to whether the FOMC decreased, left unchanged or increased the Federal Funds Target Rate or announced other unconventional policies that were tightening, neutral or easing. The table reports marginal effects on the probability of tightening for a one standard deviation increase in the independent variable, if the variable is continuous, and for an increase from 0 to 1, if the variable is an indicator variable. All of the independent variables are lagged as as of the day before the FOMC meeting, except for the FOMC sentiment index which is based on the most recent FOMC statement. FFTR is the Federal Funds Target Rate, FFF expectation is the expected change in the FFTR implied by Fed Funds Futures, unemployment rate (UR) gap is the difference between the actual unemployment rate and the natural rate of unemployment rate, inflation is CPI inflation, ADS index is the Aruoba et al. (2009) index, EBP is the Gilchrist and Zakrajšek (2012) excess bond premium, PD ratio is the price to dividend ratio, and VIX is CBOE volatility index. Standard errors are in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

SOURCE: Authors' calculations based on Bloomberg, Center for Research in Security Prices (CRSP), the Federal Reserve Bank of Philadelphia, Aruoba-Diebold-Scotti Business Conditions Index, the Favara et al. (2016) EBP update, and FOMC statements from www.federalreserve.gov.

Table 5: Forecast of FOMC Monetary Policy Stance: Horse Race

	(1)	(2)	(3)	(4)
	Monetary Policy Stance		Target Rate Change	
	Full Sample	No ELB period	Full Sample	No ELB period
FOMC Sentiment	0.123***	0.140***	0.048**	0.052**
	(0.024)	(0.026)	(0.025)	(0.027)
FFF Expectation	0.222***	0.254***	0.159***	0.171***
	(0.036)	(0.039)	(0.029)	(0.031)
UR Gap	-0.036	-0.032	-0.021	-0.031
	(0.028)	(0.029)	(0.027)	(0.029)
Inflation	0.011	0.013	-0.005	-0.009
	(0.02)	(0.021)	(0.018)	(0.02)
ADS Index	0.071**	0.074**	0.028	0.024
	(0.032)	(0.035)	(0.026)	(0.03)
Inv. Yield Curve	0.134	0.102	0.058	0.067
	(0.098)	(0.094)	(0.066)	(0.069)
EBP	0.006	-0.003	-0.017	-0.009
	(0.032)	(0.037)	(0.025)	(0.028)
Recession	0.03	0.014	-0.021	-0.025
	(0.092)	(0.092)	(0.052)	(0.056)
FFTR	-0.165***	-0.131*	-0.074	-0.099*
	(0.062)	(0.071)	(0.046)	(0.052)
Δ FFTR	-0.01	-0.01	0.008	0.012
	(0.029)	(0.03)	(0.019)	(0.021)
5-Year Yield	0.13***	0.093*	0.084**	0.108**
	(0.045)	(0.053)	(0.041)	(0.045)
Δ 5-Year Yield	0.035*	0.031	-0.001	0.0004
	(0.02)	(0.023)	(0.015)	(0.016)
PD Ratio	-0.057***	-0.08***	-0.039**	-0.049**
	(0.021)	(0.023)	(0.018)	(0.02)
VIX	0.014	0.007	-0.033	-0.049*
	(0.028)	(0.038)	(0.024)	(0.029)
Observations	161	149	161	149
Pseudo R^2	0.690	0.738	0.603	0.601

Notes: We estimate an ordered probit to forecast monetary policy decisions from 2000 to 2019. The dependent variable in columns (1) and (2) is an indicator variable equal to -1, 0, 1 according to whether the FOMC decreased, left unchanged or increased the Federal Funds Target Rate or announced other unconventional policies that were tightening, neutral or easing. The dependent variable in columns (3) and (4) is the federal funds target rate change. The table reports marginal effects on the probability of tightening (columns 1-2) or of 25 basis point increase (columns 3-4) for a one standard deviation increase in the independent variable, if it is continuous, and for a change from 0 to 1, if it is an indicator variable. All of the independent variables are lagged as of the day before the FOMC meeting, except for the FOMC sentiment index which is based on the most recent FOMC statement. FFTR is the Federal Funds Target Rate, FFF expectation is the expected change in the FFTR implied by Fed Funds Futures, unemployment rate (UR) gap is the difference between the actual unemployment rate and the natural rate of unemployment rate, inflation is CPI inflation, ADS index is the Aruoba et al. (2009) index, EBP is the Gilchrist and Zakrajšek (2012) excess bond premium, PD ratio is the price to dividend ratio, and VIX is CBOE volatility index. ELB denotes the effective lower bound period. Standard errors are in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

SOURCE: Authors' calculations based on Bloomberg, Center for Research in Security Prices (CRSP), the Federal Reserve Bank of Philadelphia, Aruoba-Diebold-Scotti Business Conditions Index, the Favara et al. (2016) EBP update, and FOMC statements from www.federalreserve.gov.

Table 6: Forecast of Real Activity, Inflation, and Labor Market Conditions

	(1) GDP	(2) GDP	(3) Core CPI	(4) Core CPI	(5) NFP	(6) NFP	(7) UR	(8) UR
Lag Dependent	0.398***	0.00907	0.210***	0.147**	0.687***	0.389***	0.978***	0.994***
	(0.104)	(0.104)	(0.0653)	(0.0675)	(0.0492)	(0.0566)	(0.00686)	(0.00864)
FOMC Sentiment	0.201*	-0.112	0.134**	0.0965	0.169***	0.0674	-0.0368***	-0.00270
	(0.107)	(0.133)	(0.0654)	(0.0995)	(0.0496)	(0.0570)	(0.00692)	(0.00965)
FFTR		-0.0356		0.0799		0.134		0.00682
		(0.243)		(0.185)		(0.106)		(0.0171)
FFF Expectation		0.0163		-0.0462		0.0246		0.00187
		(0.207)		(0.209)		(0.0993)		(0.0156)
Δ FFTR		-0.257		0.0966		-0.0371		-0.000160
		(0.237)		(0.204)		(0.100)		(0.0159)
VIX		0.0797		-0.219*		-0.150**		0.00121
		(0.142)		(0.119)		(0.0620)		(0.01000)
PD Ratio		0.0585		0.106		0.0920**		-0.00282
		(0.162)		(0.0838)		(0.0454)		(0.00717)
5-Year Bond		0.376		0.0832		-0.220**		0.00442
		(0.237)		(0.171)		(0.0976)		(0.0151)
Δ 5-Year Bond		0.204		-0.0763		0.0274		-0.00714
		(0.155)		(0.112)		(0.0640)		(0.0101)
EBP		-0.303*		0.116		0.0115		0.0108
		(0.162)		(0.119)		(0.0685)		(0.0108)
ADS Index		0.318*		0.0125		0.236***		-0.0268**
		(0.167)		(0.128)		(0.0754)		(0.0117)
Inv. Yield Curve		-0.559		-0.166		-0.0132		-0.0240
		(0.363)		(0.286)		(0.163)		(0.0261)
Recession		-0.775*		0.397		-0.360*		0.0387
		(0.444)		(0.340)		(0.189)		(0.0298)
Constant	0.606***	0.552	1.366***	1.419***	0.0803*	0.784***	0.0811***	-0.00950
	(0.150)	(0.471)	(0.131)	(0.324)	(0.0439)	(0.193)	(0.0249)	(0.0441)
Observations	77	77	231	231	231	231	231	231
Adjusted R^2	0.249	0.603	0.073	0.145	0.637	0.731	0.992	0.993

Notes: We estimate a regression to forecast real-time GDP Advanced, consumer price inflation (CPI), nonfarm payroll (NFP), and the unemployment rate (UR) from 2000 to 2019. The values of the independent variables are those available as of the day before the release of the macroeconomic announcement that is forecast. The FOMC sentiment index is that of the latest FOMC meeting prior to the macroeconomic release. FFTR is the Federal Funds Target Rate, FFF expectation is the expected change in the FFTR implied by Fed Funds Futures, unemployment rate (UR) gap is the difference between the actual unemployment rate and the natural rate of unemployment rate, inflation is CPI inflation, ADS index is the Aruoba et al. (2009) index, EBP is the Gilchrist and Zakrajšek (2012) excess bond premium, PD ratio is the price to dividend ratio, and VIX is CBOE volatility index. Standard errors are in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

SOURCE: Authors' calculations based on Bloomberg, Center for Research in Security Prices (CRSP), the Federal Reserve Bank of Philadelphia, Aruoba-Diebold-Scotti Business Conditions Index, the Favara et al. (2016) EBP update, and FOMC statements from www.federalreserve.gov.

Table 7: Response of Equity Markets to Macroeconomic News — Sub-Components

	(1) Output	(2) Labor	(3) Inflation	(4) Financial	(5) Monetary
Surprise	-0.0299	0.0229	-0.00233	-0.0591	-0.0507
	(0.0471)	(0.0604)	(0.0504)	(0.0459)	(0.0467)
Surprise × FOMC Sentiment	-0.0228**	-0.0230*	-0.0228**	-0.0195*	-0.00281
	(0.0108)	(0.0120)	(0.00947)	(0.0103)	(0.0110)
Surprise × FFF Expectation	-0.0412***	-0.0362***	-0.0367***	-0.0384***	-0.0418***
	(0.0132)	(0.0136)	(0.0134)	(0.0134)	(0.0141)
Surprise × UR Gap	0.0152	0.0142	0.0278**	0.0204	0.0241*
	(0.0130)	(0.0134)	(0.0122)	(0.0124)	(0.0128)
Surprise × Inflation	0.0142	0.00831	0.0118	0.00873	0.0123
	(0.00980)	(0.0101)	(0.00980)	(0.0101)	(0.0104)
Surprise × ADS Index	0.0527***	0.0569***	0.0455***	0.0569***	0.0500***
	(0.0157)	(0.0161)	(0.0157)	(0.0162)	(0.0160)
Surprise × Inv. Yield-Curve	0.0611	0.0565	0.0378	0.0605	0.0583
	(0.0394)	(0.0394)	(0.0402)	(0.0394)	(0.0394)
Surprise × EBP	-0.0114	-0.00526	-0.00472	-0.00716	-0.00683
	(0.0120)	(0.0118)	(0.0118)	(0.0118)	(0.0120)
× Surprise × Recession	0.0527	0.0492	0.0614*	0.0395	0.0486
	(0.0358)	(0.0357)	(0.0361)	(0.0360)	(0.0359)
Surprise × FFTR	-0.0317	-0.0219	-0.00232	-0.0384	-0.0247
	(0.0237)	(0.0237)	(0.0255)	(0.0244)	(0.0241)
Surprise × Δ FFTR	0.0354***	0.0280**	0.0263**	0.0300**	0.0304**
	(0.0133)	(0.0132)	(0.0132)	(0.0131)	(0.0134)
Surprise × 5-Year Yield	-0.0105	-0.0366	-0.0183	0.0285	0.00356
	(0.0426)	(0.0476)	(0.0431)	(0.0438)	(0.0423)
Surprise × Δ 5-Year Yield	-0.0243***	-0.0207***	-0.0201***	-0.0251***	-0.0230***
	(0.00756)	(0.00767)	(0.00766)	(0.00761)	(0.00767)
Surprise × PD Ratio	-0.00758	-0.00879	-0.0144	-0.00559	-0.00954
	(0.0101)	(0.0101)	(0.0103)	(0.0103)	(0.0101)
Surprise × VIX	0.0686***	0.0671***	0.0717***	0.0686***	0.0710***
	(0.0118)	(0.0119)	(0.0117)	(0.0118)	(0.0117)
Constant	-0.0790*	-0.0534	-0.0923**	-0.0843**	-0.0776*
	(0.0438)	(0.0570)	(0.0461)	(0.0430)	(0.0441)
Observations	1,685	1,685	1,685	1,685	1,685
Adjusted R^2	0.162	0.161	0.162	0.161	0.159

Notes: We estimate the response of E-mini S&P 500 futures to macroeconomic news announcements using data from January 2000 to April 2019. The dependent variable is the 30-minute E-mini S&P500 futures returns using the prevailing futures price as of one minutes before the announcement to twenty nine minutes after the announcement. The estimation also includes main effects, but we do not report these coefficients. The independent variables are divided by their standard deviation, so that the magnitude of the coefficients can be interpreted more easily. FFTR is the Federal Funds Target Rate, FFF expectation is the expected change in the FFTR implied by Fed Funds Futures, unemployment rate (UR) gap is the difference between the actual unemployment rate and the natural rate of unemployment rate, inflation is CPI inflation, ADS index is the Aruoba et al. (2009) index, EBP is the Gilchrist and Zakrajšek (2012) excess bond premium, PD ratio is the price to dividend ratio, and VIX is CBOE volatility index. Standard errors are in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

SOURCE: Authors' calculations based on Bloomberg, Thomson Reuters Tick History, Center for Research in Security Prices (CRSP), the Federal Reserve Bank of Philadelphia, Aruoba-Diebold-Scotti Business Conditions Index, the Favara et al. (2016) EBP update, and FOMC statements from www.federalreserve.gov.

Table 8: Forecast of FOMC Monetary Policy Stance: Horse Race — Sub-Components

	(1) Output	(2) Labor	(3) Inflation	(4) Financial	(5) Monetary
FOMC Sentiment	0.122***	0.086***	0.053**	-0.006	0.041
	(0.027)	(0.024)	(0.022)	(0.026)	(0.024)
FFF Expectation	0.285***	0.218***	0.219***	0.233***	0.200***
	(0.039)	(0.034)	(0.037)	(0.036)	(0.037)
UR Gap	-0.053*	-0.062**	-0.083***	-0.09***	-0.076***
	(0.027)	(0.028)	(0.026)	(0.027)	(0.027)
Inflation	0.002	0.028	0.009	0.018	0.029
	(0.02)	(0.021)	(0.021)	(0.021)	(0.021)
ADS Index	0.082**	0.073**	0.087**	0.085**	0.078**
	(0.034)	(0.032)	(0.035)	(0.036)	(0.034)
Inv. Yield-Curve	0.168	0.179*	0.136	0.173	0.157
	(0.106)	(0.094)	(0.108)	(0.106)	(0.100)
EBP	0.036	-0.015	-0.004	0.007	0.008
	(0.033)	(0.033)	(0.034)	(0.035)	(0.033)
Recession	0.002	0.068	-0.014	0.019	0.042
	(0.091)	(0.103)	(0.091)	(0.103)	(0.101)
FFTR	-0.143**	-0.157***	-0.168***	-0.148**	-0.16***
	(0.06)	(0.061)	(0.063)	(0.063)	(0.062)
Δ FFTR	-0.022	0.028	0.019	0.027	0.03
	(0.029)	(0.029)	(0.03)	(0.03)	(0.029)
5-Year Yield	0.12***	0.15***	0.095**	0.089*	0.091**
	(0.042)	(0.049)	(0.045)	(0.046)	(0.045)
Δ 5-Year Yield	0.031	0.038*	0.039*	0.035	0.037*
	(0.019)	(0.022)	(0.022)	(0.022)	(0.021)
PD Ratio	-0.058***	-0.07***	-0.057**	-0.057**	-0.054**
	(0.022)	(0.022)	(0.023)	(0.023)	(0.022)
VIX	-0.002	0.017	-0.004	-0.012	-0.005
	(0.028)	(0.028)	(0.031)	(0.031)	(0.029)
Observations	161	161	161	161	161
Pseudo R^2	0.676	0.642	0.616	0.598	0.607

Notes: We estimate an ordered probit to forecast monetary policy decisions from 2000 to 2019. The dependent variable is an indicator variable equal to -1, 0, 1 according to whether the FOMC decreased, left unchanged or increased the Federal Funds Target Rate or announced other unconventional policies that were tightening, neutral or easing. The table reports marginal effects on the probability of tightening for a one standard deviation increase in the independent variable, if it is continuous, and for a change from 0 to 1, if it is an indicator variable. All of the independent variables are lagged as of the day before the FOMC meeting, except for the FOMC sentiment index which is based on the most recent FOMC statement. FFTR is the Federal Funds Target Rate, FFF expectation is the expected change in the FFTR implied by Fed Funds Futures, unemployment rate (UR) gap is the difference between the actual unemployment rate and the natural rate of unemployment rate, inflation is CPI inflation, ADS index is the Aruoba et al. (2009) index, EBP is the Gilchrist and Zakrajšek (2012) excess bond premium, PD ratio is the price to dividend ratio, and VIX is CBOE volatility index. Standard errors are in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

SOURCE: Authors' calculations based on Bloomberg, Center for Research in Security Prices (CRSP), the Federal Reserve Bank of Philadelphia, Aruoba-Diebold-Scotti Business Conditions Index, the Favara et al. (2016) EBP update, and FOMC statements from www.federalreserve.gov.

Table 9: Forecast of Real Activity, Inflation, and Labor Market Conditions — Sub-Components

	(1) GDP	(2) GDP	(3) Core CPI	(4) Core CPI	(5) NFP	(6) NFP	(7) UR	(8) UR
Lag Dependent	0.372***	0.008	0.176***	0.149**	0.751***	0.408***	0.991***	0.991***
	(0.0972)	(0.102)	(0.0658)	(0.0666)	(0.0451)	(0.0562)	(0.00633)	(0.00864)
FOMC Output Sent.	0.345***	0.200*						
	(0.0993)	(0.115)						
FOMC Inflation Sent.			0.212***	0.109				
			(0.0651)	(0.0870)				
FOMC Labor Sent.					0.0794*	-0.0137	-0.0260***	-0.00897
					(0.0454)	(0.0537)	(0.00637)	(0.00915)
FFTR		-0.0962		0.0522		0.157		0.00614
		(0.232)		(0.188)		(0.105)		(0.0170)
FFF Expectation		0.114		-0.0362		0.0232		0.00346
		(0.209)		(0.209)		(0.0998)		(0.0157)
Δ FFTR		-0.385		0.0816		-0.0307		-0.00325
		(0.240)		(0.205)		(0.102)		(0.0160)
VIX		0.135		-0.250**		-0.175***		-0.000117
		(0.134)		(0.114)		(0.0623)		(0.00998)
PD Ratio		0.0740		0.105		0.0920**		-0.00307
		(0.159)		(0.0834)		(0.0455)		(0.00716)
5-Year Bond		0.454*		0.0647		-0.247**		-0.000562
		(0.229)		(0.166)		(0.102)		(0.0159)
Δ 5-Year Bond		0.0940		-0.0588		0.0656		-0.00363
		(0.143)		(0.105)		(0.0659)		(0.0104)
EBP		-0.320**		0.120		0.0305		0.0136
		(0.156)		(0.119)		(0.0714)		(0.0112)
ADS Index		0.232		0.0278		0.242***		-0.0254**
		(0.166)		(0.128)		(0.0757)		(0.0116)
Inv. Yield Curve		-0.609*		-0.206		-0.0129		-0.0256
		(0.358)		(0.288)		(0.165)		(0.0260)
Recession		-0.847*		0.348		-0.328*		0.0380
		(0.438)		(0.344)		(0.187)		(0.0294)
Constant	0.730***	0.234	1.338***	1.534***	0.0552	0.897***	0.0446*	0.0193
	(0.147)	(0.435)	(0.129)	(0.307)	(0.0499)	(0.226)	(0.0232)	(0.0512)
Observations	77	77	231	231	231	231	231	231
Adjusted R^2	0.324	0.617	0.098	0.147	0.623	0.729	0.991	0.993

Notes: We estimate a regression to forecast real-time GDP Advanced, consumer price inflation (CPI), nonfarm payroll (NFP), and the unemployment rate (UR) from 2000 to 2019. The values of the independent variables are those available as of the day before the release of the macroeconomic announcement that is forecast. The FOMC sentiment index is that of the latest FOMC meeting prior to the macroeconomic release. FFTR is the Federal Funds Target Rate, FFF expectation is the expected change in the FFTR implied by Fed Funds Futures, unemployment rate (UR) gap is the difference between the actual unemployment rate and the natural rate of unemployment rate, inflation is CPI inflation, ADS index is the Aruoba et al. (2009) index, EBP is the Gilchrist and Zakrajšek (2012) excess bond premium, PD ratio is the price to dividend ratio, and VIX is CBOE volatility index. Standard errors are in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

SOURCE: Authors' calculations based on Bloomberg, Center for Research in Security Prices (CRSP), the Federal Reserve Bank of Philadelphia, Aruoba-Diebold-Scotti Business Conditions Index, the Favara et al. (2016) EBP update, and FOMC statements from www.federalreserve.gov.

Table 10: Response of Equity Markets to Macroeconomic News – Horse Race with Loughran and McDonald (2011) Dictionary

	(1)
Surprise	0.104***
	(0.00795)
Surprise × FOMC Sentiment LM	-0.00680
	(0.00876)
Surprise × FOMC Sentiment	-0.0406***
	(0.00893)
Constant	-0.00270
	(0.00852)
Observations	1,685
Adjusted R^2	0.106

Notes: We estimate the response of E-mini S&P 500 futures to macroeconomic news announcements using data from January 2000 to April 2019. The dependent variable is the 30-minute E-mini S&P500 futures returns using the prevailing futures price as of one minutes before the announcement to twenty nine minutes after the announcement. LM sentiment is constructed using the Loughran and McDonald (2011) dictionary. The estimation also includes main effects, but we do not report these coefficients. The independent variables are divided by their standard deviation, so that the magnitude of the coefficients can be interpreted more easily. Standard errors are in parentheses. ***, **, * denote statistical significance at the 1%, 5%, and 10% level, respectively.

SOURCE: Authors' calculations based on Bloomberg, Thomson Reuters Tick History, Center for Research in Security Prices (CRSP), the Federal Reserve Bank of Philadelphia, Aruoba-Diebold-Scotti Business Conditions Index, the Favara et al. (2016) EBP update, and FOMC statements from www.federalreserve.gov.

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APPENDIX

A Using Federal Funds Futures to Forecast Future Monetary Policy Decisions

Following Kuttner (2001), we use federal funds futures to estimate the market's expectation of the federal funds target rate at the next FOMC meeting. While there are some survey measures of expected Fed policy in the most recent sample, the use of Feds funds futures allows us to compute these expectations on particular days of interest (rather than having to use stale expectations). The use of Fed funds futures has some disadvantages, including the fact that the contract's settlement price is based on the average of the relevant month's effective overnight Fed funds rate as well as the fact that contracts are based on the effective Fed funds rate rather than the target, possibly causing discrepancies between the two rates on a daily basis.

Following Kuttner (2001) and Faust et al. (2004) we extract a measure of the unexpected change in the target rate on date $t+1$, relative to the forecast made on date t, using the the 1-day change in the spot-month future rate. In particular, the unexpected change in the policy rate is

$$\Delta FFTR_t^u = \frac{m}{m-t}(f_{s,t}^0 - f_{s,t-1}^0), \tag{6}$$

where $f_{s,t}^0$ is the spot-moth futures rate on day t of month s. The idea behind this is that $day - t$ futures prices embody the expected change on (or after) date $t+1$. If the change occurs as expected, the spot rate should not change and, under the assumption of no-change in the risk premium, the change in the futures market would equal the change in the market's expectation. When using daily futures prices, an additional assumption to make is that the change on FOMC announcement days is due to an exogenous monetary policy shock, which would fail if macro releases occur on the same day as FOMC announcements—rarely the case in our sample. In addition, it is still possible that this measure contains not only exogenous monetary policy shocks but also the FOMC information advantage through earlier access to data, as discussed in Faust et al. (2004).

B Identifying Uninformative Sentences

In an attempt to best capture the FOMC's current description of the economy, we eliminated sentences from the sample that we deemed uninformative, such as those that expressed views on how the economy might react to future policy actions. Frequently in its statements the FOMC makes comments about changes to monetary policy, and then explains how these actions may affect key areas such as employment or economic expansion. However, if we were to score these phrases the same way as remarks about direct expectations of future macroeconomic outcomes, they would produce scores that are opposite of what we want to measure. For example, in October 2008 the FOMC stated, "recent policy actions, including today's rate reduction, coordinated interest rate cuts by central banks, extraordinary liquidity measures, and official steps to strengthen financial systems, should help over time to improve credit conditions and promote a return to moderate economic growth." Our algorithm would pick up on the mention of "moderate economic growth" and score it positively; however, the actual conditions for output were highly negative. Removing these types of phrases is most important during the early part of our sample in which the statements are shorter, and a mismatch has a larger impact on the overall score.

To systematically identify and remove uninformative sentences, we used combinations of words and phrases that are commonly found within these types of sentences. The first type of pattern is evident in the example above. The FOMC states they will take action and explains how they hope the economy will react. A few other common patterns involve the restatement of the Fed's "dual mandate" or references to its policy toolbox. A full list of rules, created through the authors' own reading, can be found in Table A4. Note that some of these patterns overlap with those in Table A5. The uninformative label was used to remove a sentence from the scoring algorithm for the output, labor, inflation, and financial markets sub-components.

Table A1: List of Keywords and Their Scores

keyword	score	category
inflation	1	inflation
price	1	inflation
cost	1	inflation
employers	1	labor
employment	1	labor
job gains	1	labor
job losses	-1	labor
labor	1	labor
hiring	1	labor
underutilization of labor resources	-1	labor
unemployment	-1	labor
utilization of the pool of available workers	1	labor
business conditions	1	output
business outlook	1	output
confidence	1	output
consumption	1	output
strengthening in final demand	1	output
demand	1	output
econom	1	output
expenditures	1	output
export	1	output
income	1	output
indicators	1	output
investment	1	output
investment spending	1	output
output	1	output
production	1	output
sales	1	output
sentiment	1	output
spending	1	output
bank lending	1	financial
credit	1	financial
financial	1	financial

Notes: The table reports the most common keywords characterizing output, labor, inflation and financial conditions in the FOMC statements released between January 2000 and April 2019. The associated score takes on values of 1 and -1 based on our assessment of whether they communicate positive or negative association with the topic (e.g., unemployment takes a -1 for labor conditions, so that an increase in unemployment conveys worse labor conditions, while employment takes a 1).

SOURCE: Authors' calculations.

Table A2: List of Modifiers and Their Scores

modifier	score	category	modifier	score	category
declin	-1	labor	below	-1	inflation
deteriorat	-1	labor	damp	-1	inflation
diminish	-1	labor	ease (space)	-1	inflation
disappoint	-1	labor	easing	-1	inflation
inhibit	-1	labor	declin	-1	inflation
losses	-1	labor	diminish	-1	inflation
low	-1	labor	down	-1	inflation
modest	-1	labor	low	-1	inflation
moderated	-1	labor	modest	-1	inflation
reluctant to add	-1	labor	moderated	-1	inflation
restrain	-1	labor	muted	-1	inflation
set back	-1	labor	reduction	-1	inflation
slow	-1	labor	restrain	-1	inflation
soft (exclude software)	-1	labor	set back	-1	inflation
subdued	-1	labor	slow	-1	inflation
underutilization	-1	labor	soft (exclude software)	-1	inflation
weak	-1	labor	subdued	-1	inflation
elevat	1	labor	weak	-1	inflation
expand	1	labor	elevat	1	inflation
gains	1	labor	expand	1	inflation
high	1	labor	foster	1	inflation
improv	1	labor	height	1	inflation
increas	1	labor	high	1	inflation
pick up	1	labor	improv	1	inflation
picking up	1	labor	increas	1	inflation
picked up	1	labor	persist	1	inflation
record expansion	1	labor	pressure	1	inflation
rebound	1	labor	pick up	1	inflation
rise	1	labor	picking up	1	inflation
rising	1	labor	picked up	1	inflation
rose	1	labor	moderate (space)	1	inflation
risen	1	labor	rise	1	inflation
solid	1	labor	risk remain	1	inflation
strong	1	labor	rising	1	inflation
strength	1	labor	rose	1	inflation
upward	1	labor	risen	1	inflation
up (space)	1	labor	solid	1	inflation
balance	0	labor	sustain	1	inflation
mix	0	labor	strong	1	inflation
little change	0	labor	strength	1	inflation
stable	0	labor	upward	1	inflation
stabilizing	0	labor	up (space)	1	inflation
steady	0	labor	upside risk	1	inflation
unchanged	0	labor	contain	0	inflation

Notes: The table reports the modifiers related to the most common keywords characterizing output and labor in the FOMC statements released between 2000 and 2019. Modifiers take on values of 1, 0, and -1 based on our assessment of whether they communicate good, neutral, or bad news about economic conditions.

SOURCE: Authors' calculations.

Table A3: List of Modifiers and Their Scores

modifier	score	category	modifier	score	category
balance	0	inflation	subdued	-1	output
equal probability	0	inflation	uncertain	-1	output
little change	0	inflation	weak	-1	output
stable	0	inflation	yet to exhibit sustainable growth	-1	output
stabilizing	0	inflation	weigh	-1	output
steady	0	inflation	weigh on	-1	output
unchanged	0	inflation	weighing on	-1	output
volatility	0	inflation	growing at a moderate pace	1	output
uncertain	0	inflation	moderating	-1	output
tight	-1	financial	moderation	-1	output
volatile	-1	financial	moderated	-1	output
strain	-1	financial	remain moderate	-1	output
stress	-1	financial	more moderate	-1	output
turmoil	-1	financial	advanc	1	output
supportive	1	financial	bolster	1	output
unchanged	0	financial	expand	1	output
below	-1	output	remains firm	1	output
contract	-1	output	firm	1	output
cooling	-1	output	firmer	1	output
cut	-1	output	gains	1	output
damp	-1	output	grow at a solid pace	1	output
decelerat	-1	output	high	1	output
depress	-1	output	improv	1	output
declin	-1	output	increas	1	output
deteriorat	-1	output	moderate (space)	1	output
diminish	-1	output	pick up	1	output
dislocation	-1	output	picking up	1	output
disappoint	-1	output	picked up	1	output
disruption	-1	output	record expansion	1	output
down	-1	output	rebound	1	output
drag	-1	output	rise	1	output
erod	-1	output	rising	1	output
(space) flat	-1	output	rose	1	output
gap	-1	output	risen	1	output
inhibit	-1	output	solid	1	output
increasing less rapidly	-1	output	strength	1	output
hesitancy	-1	output	strong	1	output
(space) low	-1	output	upward	1	output
modest	-1	output	abating	0	output
might not be strong enough	-1	output	balance	0	output
pause	-1	output	evolve	0	output
reduction	-1	output	leveling out	0	output
restrain	-1	output	mix	0	output
slump	-1	output	same	0	output
sluggish	-1	output	temporarily depressed	0	output
set back	-1	output	stable	0	output
shortfall	-1	output	stabilizing	0	output
slow	-1	output	sustain	0	output
soft (exclude software)	-1	output	tentative	0	output

Notes: The table reports the modifiers related to the most common keywords characterizing output and labor in the FOMC statements released between 2000 and 2019. Modifiers take on values of 1, 0, and -1 based on our assessment of whether they communicate good, neutral, or bad news about economic conditions.

SOURCE: Authors' calculations.

Table A4: Rules for Identifying Uninformative Sentences

pattern
(will)|(assess)|(as needed)
(will)|(monitor)|(as needed)
(promote a stronger)|(as announced)
(review)|(size)|(composition)
(promote a stronger)|(dual mandate)
(sizable)|(still increasing holdings)
(recognize)|(below its 2 percent objective)
(expect)|(gradual adjustments)|(will .*? strengthen|remain strong)
(appropriate policy accommodation)|(dual mandate)
(dual mandate)|(purchasing additional)|(agency mortgage backed securities)
(long term prospects)|(unusual forces)|(demand abate)
(sustain.*? expansion)|(symmetric 2 percent objective)
(federal reserve)|(employ all available tools|using its balance sheet)
(today's .*? action)|(help)

Notes: The table reports the regex patterns that were used to identify the most common uninformative sentences. After the matches were extracted, a sentence was labeled as uninformative only if it contained each of the patterns in parentheses.

SOURCE: Authors' reading of the FOMC statements from www.federalreserve.gov.

Table A5: Rules for Scoring Futute Monetary Policy Actions

pattern	score
(policy accommodation)|(maintained)	-1
(low levels)|(warrant)	-1
(maintain)|(highly accommodative stance)	-1
(below levels)|(longer run)	-1
(accommodative stance)|(monetary policy)	-1
(substantial easing)|(monetary policy)	-1
continue its purchases	-1
(ready to expand)|(purchase)	-1
(await more evidence)|(pace of its purchases)	-1
(will act)|(as needed)	-1
be patient	0
appropriate	0
(anticipate)|(rais.* the target)	1
(believe)|(policy accommodation)|(removed)	1
(firming)|(need)	1
(expects)|(increases in the target range)	1
(judges)|(increases in the target range)	1
(appropriate)|(raise the target range)	1
(warrant)|(gradual increases)	1
balance sheet normalization	1
(purchase)|(improvement)	1
(reduce)|(purchase)	1
(complete|moderate)|(purchase)|(improvement)	1
(decides to)|(remove policy accommodation)	1

Notes: The table reports the regex patterns that were used to identify and score future monetary policy actions. After the matches were extracted, a sentence was scored only if it contained each of the patterns in parentheses.

SOURCE: authors' reading of the FOMC statements from www.federalreserve.gov.

Table A6: Federal Open Market Committee Meetings

date	(1)	(2)	(3)	date	(1)	(2)	(3)	date	(1)	(2)	(3)	date	(1)	(2)	(3)
2/2/2000	5.75	0.25	1	11/10/2004	2	0.25	1	4/29/2009	0.25	0	0	6/18/2014	0.25	0	1
3/21/2000	6	0.25	1	12/14/2004	2.25	0.25	1	6/24/2009	0.25	0	0	7/30/2014	0.25	0	1
5/16/2000	6.5	0.5	1	2/2/2005	2.5	0.25	1	8/12/2009	0.25	0	0	9/17/2014	0.25	0	1
6/28/2000	6.5	0	0	3/22/2005	2.75	0.25	1	9/23/2009	0.25	0	0	10/29/2014	0.25	0	0
8/22/2000	6.5	0	0	5/3/2005	3	0.25	1	11/4/2009	0.25	0	0	12/17/2014	0.25	0	0
10/3/2000	6.5	0	0	6/30/2005	3.25	0.25	1	12/16/2009	0.25	0	0	1/28/2015	0.25	0	0
11/15/2000	6.5	0	0	8/9/2005	3.5	0.25	1	1/27/2010	0.25	0	0	3/18/2015	0.25	0	0
12/19/2000	6.5	0	0	9/20/2005	3.75	0.25	1	3/16/2010	0.25	0	0	4/29/2015	0.25	0	0
1/3/2001 *	6	-0.5	-1	11/1/2005	4	0.25	1	4/28/2010	0.25	0	0	6/17/2015	0.25	0	0
1/31/2001	5.5	-0.5	-1	12/13/2005	4.25	0.25	1	6/23/2010	0.25	0	0	7/29/2015	0.25	0	0
3/20/2001	5	-0.5	-1	1/31/2006	4.5	0.25	1	8/10/2010	0.25	0	0	9/17/2015	0.25	0	0
4/18/2001 *	4.5	-0.5	-1	3/28/2006	4.75	0.25	1	9/21/2010	0.25	0	-1	10/28/2015	0.25	0	0
5/15/2001	4	-0.5	-1	5/10/2006	5	0.25	1	11/3/2010	0.25	0	-1	12/16/2015	0.5	0.25	1
6/27/2001	3.75	-0.25	-1	6/29/2006	5.25	0.25	1	12/14/2010	0.25	0	0	1/27/2016	0.5	0	0
8/21/2001	3.5	-0.25	-1	8/8/2006	5.25	0	0	1/26/2011	0.25	0	0	3/16/2016	0.5	0	0
9/17/2001 *	3	-0.5	-1	9/20/2006	5.25	0	0	3/15/2011	0.25	0	0	4/27/2016	0.5	0	0
10/2/2001	2.5	-0.5	-1	10/25/2006	5.25	0	0	4/27/2011	0.25	0	0	6/15/2016	0.5	0	0
11/6/2001	2	-0.5	-1	12/12/2006	5.25	0	0	6/22/2011	0.25	0	0	7/27/2016	0.5	0	0
12/11/2001	1.75	-0.25	-1	1/31/2007	5.25	0	0	8/9/2011	0.25	0	0	9/21/2016	0.5	0	0
1/30/2002	1.75	0	0	3/21/2007	5.25	0	0	9/21/2011	0.25	0	-1	11/2/2016	0.5	0	0
3/19/2002	1.75	0	0	5/9/2007	5.25	0	0	11/2/2011	0.25	0	0	12/14/2016	0.75	0.25	1
5/7/2002	1.75	0	0	6/28/2007	5.25	0	0	12/13/2011	0.25	0	0	2/1/2017	0.75	0	0
6/26/2002	1.75	0	0	8/7/2007	5.25	0	0	1/25/2012	0.25	0	0	3/15/2017	1	0.25	1
8/13/2002	1.75	0	0	8/10/2007 *	5.25	0	0	3/13/2012	0.25	0	0	5/3/2017	1	0	0
9/24/2002	1.75	0	0	8/17/2007 *	5.25	0	0	4/25/2012	0.25	0	0	6/14/2017	1.25	0.25	1
11/6/2002	1.25	-0.5	-1	9/18/2007	4.75	-0.5	-1	6/20/2012	0.25	0	-1	7/26/2017	1.25	0	0
12/10/2002	1.25	0	0	10/31/2007	4.5	-0.25	-1	8/1/2012	0.25	0	0	9/20/2017	1.25	0	0
1/29/2003	1.25	0	0	12/11/2007	4.25	-0.25	-1	9/13/2012	0.25	0	-1	11/1/2017	1.25	0	0
3/18/2003	1.25	0	0	1/22/2008 *	3.5	-0.75	-1	10/24/2012	0.25	0	0	12/13/2017	1.5	0.25	1
5/6/2003	1.25	0	0	1/30/2008	3	-0.5	-1	12/12/2012	0.25	0	0	1/31/2018	1.5	0	0
6/25/2003	1	-0.25	-1	3/11/2008 *	3	0	0	1/30/2013	0.25	0	0	3/21/2018	1.75	0.25	1
8/12/2003	1	0	0	3/18/2008	2.25	-0.75	-1	3/20/2013	0.25	0	0	5/2/2018	1.75	0	0
9/16/2003	1	0	0	4/30/2008	2	-0.25	-1	5/1/2013	0.25	0	0	6/13/2018	2	0.25	1
10/28/2003	1	0	0	6/25/2008	2	0	0	6/19/2013	0.25	0	0	8/1/2018	2	0	0
12/9/2003	1	0	0	8/5/2008	2	0	0	7/31/2013	0.25	0	0	9/26/2018	2.25	0.25	1
1/28/2004	1	0	0	9/16/2008	2	0	0	9/18/2013	0.25	0	0	11/8/2018	2.25	0	0
3/16/2004	1	0	0	10/8/2008*	1.5	-0.5	-1	10/30/2013	0.25	0	0	12/19/2018	2.5	0.25	1
5/4/2004	1	0	0	10/29/2008	1	-0.5	-1	12/18/2013	0.25	0	1	1/30/2019	2.5	0	0
6/30/2004	1.25	0.25	1	12/16/2008	0.25	-0.75	-1	1/29/2014	0.25	0	1	3/20/2019	2.5	0	0
8/10/2004	1.5	0.25	1	1/28/2009	0.25	0	-1	3/19/2014	0.25	0	1				
9/21/2004	1.75	0.25	1	3/18/2009	0.25	0	-1	4/30/2014	0.25	0	1				

Notes: The table reports FOMC dates, the Federal Funds Target Rate level (1) and change (2) from January 2000 to April 2019. Beginning December 16, 2008, the FOMC moved from a single target rate to a target range, including an upper and lower limit. In the table we report the upper limit. Column (3) reports a dummy that takes the value -1, 0, 1 according to whether the FOMC decreased, left unchanged or increased the Federal Funds Target Rate or announced other unconventional policies that were tightening, neutral or accommodative. * denote inter-meeting dates.

SOURCE: Authors' calculations and www.federalreserve.gov.