The Economics of the Fed Put

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We study the impact of the stock market on the Federal Reserve's monetary policy. We analyze the economics behind the "Fed put," i.e., the tendency for low stock returns to predict accommodating monetary policy. We show that stock returns are a statistically more powerful predictor of Federal funds target changes than standard macroeconomic news releases. Using textual analysis of FOMC minutes and transcripts, we then argue that stock returns *cause* Fed policy. FOMC participants are more likely to be concerned about the stock market after market declines and the frequency of negative stock market mentions in FOMC documents predicts target rate cuts. The focus on the stock market reflects Fed's concern about the consumption-wealth effect and about the impact of the stock market on investment, with less role for the stock market simply predicting (as opposed to driving) the economy. We assess whether the Fed may be reacting too much to the stock market by (a) comparing the sensitivity to the stock market of the Fed's growth, unemployment and inflation forecasts with the stock-market sensitivity of private sector forecasts, and (b) estimating whether the stock market impacts target changes even after controlling for Fed expectations of economic activity and inflation.

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I. Introduction

The interplay between the stock market and monetary policy is complex. Monetary policy may both affect the stock market and react to it. In this paper, we analyze the impact of the stock market on monetary policy, focusing on the U.S. Federal Reserve. In particular, we study the economics behind the "Fed put" documented by Cieslak, Morse, and Vissing-Jorgensen (2016, CMVJ). In that paper, we showed that over the 1994–2016 period, the excess return on stocks over Treasury bills follows an alternating weekly pattern measured in FOMC cycle time, i.e. time since the last FOMC meeting. The (realized) equity premium is earned in weeks 0, 2, 4 and 6 (even weeks) in FOMC cycle time. We argued that over half of the high equity premium earned in even weeks can be explained by what we refer to as the "Fed put", i.e., larger than expected monetary policy accommodation following stock market declines. Put-shaped patterns appear both in excess stock returns and in Federal fund target changes. Low excess returns on stocks are followed by high excess stock returns (but only on even-week days), and by large target rate easings. We review this work in Section II below, summarizing the evidence for why news about monetary policy comes out disproportionately in even weeks, and thus linking the put patterns in returns and target changes. The Fed put is the combined effect of the Fed reacting to the stock market and the Fed affecting the stock market. Here, we seek to understand why the stock market appears to be an important driver of Fed policy.

Unrelated to our work, the Federal Reserve has recently come under criticism for being excessively driven by asset prices, the stock market in particular, rather than by economic data. For example, former governor Kevin Warsh has stated: *"It is not obvious what their strategy is. I know they say they're data dependent. I don't know exactly what that means. [...] They look to me asset price dependent, more than they look [economic] data dependent. When the stock market falls like it did in the beginning of this year, they say: 'Oh, we'd better not do anything.' Stock markets are now at career highs. I suspect when they meet*

over the course of the next 10 days, they will suggest now they look like they can be somewhat more responsible." (CNBC's "Squawk Box" interview, July 14, 2016)[1]

However, to our knowledge, no systematic work exists on whether Fed policy is in fact more responsive to the stock market than to news about macroeconomic variables. In addition, even if that was the case, the relation could be purely coincidental. The stock market may simply be correlated with macro variables that determine Fed decision making, rather than being a causal factor in Fed's thinking. Furthermore, if the Fed does in fact react strongly to the stock market, this could be optimal if the market is a key factor affecting Fed expectations for growth or inflation.

We thus seek to understand the framework underlying the impact of the stock market on Fed policy focusing on four questions. First, how does the stock market compare to macroeconomic indicators as a predictor of Fed policy? Second, is the Fed reacting to the stock market or to variables correlated with the stock market? Third, if the Fed does in fact react to the stock market, why is it doing that? Fourth, if the Fed reacts to the stock market, is the reaction appropriate or too strong?

To compare the explanatory power of the stock market for Fed policy to that of macroeconomic news, we use macro news releases from Bloomberg going back to 1996. We regress changes in the Fed funds target from one FOMC meeting to the next on own lags and either the intermeeting excess stock returns or intermeeting news about a given macro variable (including lags of the explanatory variable). We find that the explanatory power of the stock market for changes in the Federal funds target is stronger than that of any of the 38 macro variables covered by Bloomberg.

To assess whether the strong relation between the stock market and Fed policy is causal or coincidental, we conduct an extensive textual analysis of FOMC minutes and transcripts.

[1]The interview is available here.

A necessary condition for the stock market being a key causal factor for Fed policy is that the Fed pays close attention to its developments. We construct a list of phrases related to the stock market (e.g., "stock market", "equity prices", "S&P 500"). In our baseline approach, we search for these words in FOMC minutes. We find 983 mentions of the stock market in the 184 FOMC minutes covering the 1994–2016 period. We read the paragraphs that contain stock market mentions and classify them into whether FOMC meeting attendees discuss the market going up or down. The number of negative (down) stock market mentions and the number of positive (up) stock market mentions relate to actual stock returns with expected signs, with low stock returns leading to more negative stock market mentions and high stock returns to more positive stock market mentions. This relation is present both before and during the zero-lower bound period. Consistent with the Fed put, the number of negative stock market mentions—but not the number of positive stock market mentions—has significant explanatory power for target changes over the 1994–2008 period, i.e., low stock returns cause the Fed to provide monetary stimulus. To assess robustness of this result to using FOMC transcripts, we develop an algorithm to find and classify stock market mentions. The algorithm is based on a set of stock market phrases interacted with a list of direction words describing the market going down (negative words) or up (positive words). We train the algorithm on the minutes and then use it to show that our results are robust to studying the transcripts.

In addition to arguing causality by textual analysis, we use textual analysis to study the mechanism for why the Fed pays attention to the stock market. We classify the 983 paragraphs in the minutes with stock market mentions based on what is said about the market. 551 cases are purely descriptive. These are mainly from the part of the FOMC meeting where staff summarizes financial conditions. More interesting, of the other 432 paragraphs, 265 (61%) discuss the impact of the stock market on consumption. Many of these specifically refer to the consumption-wealth effect, i.e. the notion that higher stock market

wealth leads to higher consumption. The impact of the stock market on investment is another repeated theme in FOMC discussions, appearing 34 times. Many of these refer to the impact of the stock market on firms' cost of capital. While not mentioned explicitly this relation is consistent with models of the financial accelerator in which firms' cost of external finance depends on how much collateral they can offer, with equity values being the key determinant of collateral values (Bernanke and Gertler, 1999, 2001). In another 44 cases, the stock market is discussed as part of a larger set of variables describing financial conditions, with financial conditions seen as influencing investment and, less frequently mentioned, consumption. Of the 432 paragraphs with stock market mentions that are not purely descriptive, over 90% are cases in which the Fed views the stock market as causal for the economy, as opposed to just predicting the economy. We find a surprisingly small number of cases in which the stock market is discussed as a predictor of the economy. Overall, the Fed's attention to the stock market is consistent with a view that the stock market is an important driver of consumption and investment, as opposed simply being a predictive indicator of the economy.

We extend our analysis of the mechanism to account for the fact that FOMC minutes may discuss financial conditions without explicitly stating that the stock market is one of the indicators. While in the early part of the sample references to financial conditions are relatively rare, their frequency rises during the financial crisis. In line with our results using stock market phrases, the number of references to negative financial conditions increases following poor stock returns and helps predict target changes.

To quantify whether the Fed reacts with appropriate strength to the stock market we take two approaches. Our first approach is to estimate whether the Fed's growth and inflation expectations (formerly collected in Greenbooks, now in Tealbooks) update too much in response to stock market shocks. We benchmark the impact of the stock market on Fed economic forecasts to that on the corresponding private sector forecasts from the Survey of Professional Forecasters, as well as to the predictive power of the stock market for realized

economic variables (output, unemployment and inflation). While the stock market is a clear predictor of the Fed forecast updates, we find little evidence that Fed expectations overreact to the stock market relative to these two benchmarks. Our second approach is to estimate, within a standard Taylor rule framework, whether the Federal funds target responds more to the stock market than can be explained by updates to Fed growth and inflation expectations. Bernanke and Gertler (1999, 2001) argue that the Fed should respond to the stock market only via its effects on expectations for output gap and inflation. Whether we measure Fed expectations from the Greenbooks or construct textual analysis proxies for FOMC attendees' concerns about growth and inflation, we find that only about 20% of the impact of the stock market on the Federal funds target (in terms of the cumulative impact of a shock) remains after controlling for macro expectations. A residual reaction could be optimal if the Fed cares separately about financial stability due large fiscal cost of bailouts (as argued recently by Peek, Rosengren, and Tootell (2016)), or if the stock market affects the natural Federal funds rate (r^*).

Related literature

While a substantial literature studies the impact of monetary policy on the stock market, less work focuses on how the stock market affects monetary policy. A popular approach to identify the impact of monetary policy on the stock market is to estimate monetary policy shocks on announcement dates by comparing actual target changes to expected changes inferred from Federal funds futures prices (Kuttner (2001), Gürkaynak, Sack, and Swanson (2005), Bernanke and Kuttner (2005)). The impact of those shocks on the stock market can then be assessed. Bernanke and Kuttner (2005) estimate that a surprise 25 bps reduction in the Federal funds target causes the stock market to rise between 75 and 150 bps. Using a VAR approach, they argue that the effect arises mostly through monetary policy impacting the equity risk premium (rather than expected real rates and dividends). Importantly, the estimated effect is for announcement dates only, and so it does speak to

the overall impact of the Fed on the equity premium across all days. Lucca and Moench (2015) provide evidence that the stock market does well ahead of FOMC announcements, regardless of the policy outcome. Focusing on the 24 hours from 2pm to 2pm prior to scheduled FOMC announcements and the time period from September 1994 to March 2011, they document that stocks outperform Treasury bills by an average of 49 bps. With eight scheduled FOMC meetings per year that implies that the pre-FOMC equity performance accounts for a substantial part of the overall realized equity premium since 1994. Lucca and Moench (2015) consider several explanations for their finding but conclude it is a puzzle and may not in fact be driven by the Fed. CMVJ (2016) study stock returns over the full cycle between scheduled FOMC meetings and argue that high even-week returns account for the entire equity premium and are driven by the Fed, to a large extent via the above-mentioned Fed put.

Less work has been done on the impact of the stock market on Fed decision making. An early paper in this line of research is Rigobon and Sack (2003) who measure the reaction of monetary policy to the stock market using identification via heteroscedasticity. Comparing the covariance of stock returns and the T-bill rate across regimes of low or high variance of each variable and using data from 1985 to 1999, they estimate that an unexpected 5% rise in the stock market index leads to an expected tightening at the next meeting of 14 bps. This effect which is much smaller than the Fed put pattern from CMVJ that we review below, likely due to a difference in sample periods.

In terms of methodology, our work is related to Peek, Rosengren, and Tootell (2016) in that they also use textual analysis to assess the Fed's thinking. Using counts of words related to financial stability in the transcripts for the 1987–2008 sample, they find that those counts affect the Federal funds target above and beyond their effect on the Fed's unemployment and inflation forecasts. Their objective is to assess whether the Fed acts as if it has a tertiary mandate (financial stability). Our objective differs in that we aim to

understand the economic mechanism behind the Fed put. Furthermore, they do not address the other questions we focus on here: the relative explanatory power of the stock market and macroeconomic variables for target changes, the causal impact of the stock market on Fed's decision making and the role of considerations about consumption and investment in this decision making. From a methodological perspective, while Peek et al. (2016) focus on a set of 32 noun phrases which they classify as positive or negative,[2] our textual analysis goes beyond simple word counts and allows to identify positive/negative context of a particular stock market mention. As an additional innovation, we also construct textual measures of the Fed's concerns about growth and inflation and include these in Taylor rule estimations. This increases confidence that any effect of the stock market even in the presence of controls for Fed growth and inflation expectations are robust.

The rest of the paper proceeds as follows. Section II reviews the evidence on stock returns over the FOMC cycle and the Fed put in CMVJ (2016). Section III compares the stock market to macroeconomic indicators as predictor of Fed's policy. Section IV contains the textual analysis evidence that the stock market causes Fed's policy while Section V provides textual analysis evidence on the mechanisms through which the stock market drives Fed's thinking. Section VI focuses on whether the Fed reacts too strongly to the stock market and Section VII concludes.

II. Review of the Fed put

This section reviews the results of CMVJ (2016) to lay out the nature of the Fed put and explain why the Fed put suggests that the stock market may be a central driver of Fed policy.

CMVJ document systematic variation of average excess stock returns over Treasury bills (i.e., the realized equity premium) over the full FOMC cycle, and causally relate it to the

[2]For example, Peek et al. (2016) classify "stock market," "stock prices," "equity values" as positive financial stability words although, as we show, many of these appear within a negative context.

Fed. Over the 1994–2016 period, the equity premium follows an alternating weekly pattern measured in FOMC cycle time, i.e. time since the last FOMC meeting, with the entire equity premium earned in weeks 0, 2, 4 and 6 ("even weeks") in FOMC cycle time. We review this evidence in Figure 1 Panel A. Day 0 on the x-axis is the day of a scheduled FOMC announcement. There are 8 of these per year, thus the figure captures a total of 184 FOMC cycles. We omit weekend days, so day 10 on the x-axis is 2 calendar weeks after the FOMC announcement date and so on. We define week 0 in FOMC cycle time to be the week right around the announcement, going from day -1 to day 3 (both included). Weeks 2, 4, and 6 starts on days 9, 19, and 29, respectively. The figure graphs the average 5-day buy and hold returns on the US stock market over the 5-day buy and hold return on one month Treasury bills in event time relative to the FOMC announcement date. A surprisingly regular pattern appears, with high average 5-day excess stock returns in each of the even weeks: 57 bps for week 0, 33 bps for week 2, 46 bps for week 4, and 60 bps for week 6. The figure includes bootstrapped 90% confidence intervals. The average 5-day excess stock return is statistically significantly positive in each of the even weeks while they are insignificantly negative in the odd weeks. Table I Panel A column 1 provides a regression to test whether even-week returns are significantly higher than odd-week returns. We regress daily excess returns on even-week dummies. Each of the even-week dummies is significant at the 5% significance level or better.

CMVJ argue that the high realized equity premium in even weeks in FOMC cycle time is driven by news coming from the Fed. We show that the FOMC calendar does not systematically line up with calendars for reserve maintenance periods, macroeconomic data releases, or corporate earnings releases. In addition, decision making/information processing within the Federal Reserve System tends to take place bi-weekly in FOMC cycle time. Specifically, we document that intermeeting changes in the Fed funds target tend to happen in even weeks, and high average even-week excess returns are driven by even weeks with Board

of Governors board meetings (discount rate meetings). We explain how the importance of even-week board meetings is likely due to the fact that the Board of Governors will have a full set of updated policy recommendations from the 12 regional Federal Reserve banks just before the FOMC meeting in week zero and every two weeks in FOMC cycle time following that. Board meetings in even weeks thus take on particular importance. Furthermore, while even weeks do not line up with official releases or speeches, there is substantial evidence of systematic informal communication between the Fed and the private financial sector and the media. The use of informal communication channels by the Fed can be explained by several motives including flexibility (informal communication does not bind policy makers' hands), learning (informal communication with the private sector facilitates Fed's learning about the economy or the market reaction to a potential policy move), and disagreement (informal communication is an equilibrium outcome of disagreement among policy makers all trying to impact market expectations). We refer the reader to CMVJ (2016) for details on these arguments.

Perhaps the strongest argument for the high even-week average excess stock returns being driven by news from the Fed is that a large fraction of the high even-week average excess stock returns is earned in even weeks that follow poor excess stock returns in the recent past. This is consistent with the popular notion that the Fed has provided unexpectedly strong accommodation following poor stock returns, i.e., a Fed put, with the market-moving news from the Fed coming out in even weeks. Importantly for arguing causality, no such mean-reversion following low stock returns is seen in odd weeks. Figure 1 Panel B shows this "Fed put" pattern in returns. We sort all days t in the 1994–2016 period into five quintiles based on the realized excess return on stocks over T-bills over the prior 5 days ($t-1$ back to $t-5$). We calculate averages of these 5-day excess returns for each quintile. These averages are shown on the x-axis in both the left and right figures. We then calculate average one-day realized excess returns on day t for days t that fall in even weeks (left graph) and for days t

that fall in odd weeks (right graph). Vertical bars indicate 95% confidence intervals. Of the 10 day-t averages graphed, the only one that is significantly positive is the average one-day excess return on even-week days that follow past 5-day excess returns in the lowest quintile. In other words, the stock market mean-reverts, but only in even weeks. The left graph in Figure 1 Panel B resembles the payoff from writing a put option, with the underlying being the past performance of the stock market. CMVJ quantify that 60% of the even-week excess returns are accounted for by the 1/5th of even-week days that follow past 5-day excess returns in the lowest quintile. Table I Panel A column 2 re-estimates the regression from column 1 on the subset of days that follow a past 5-day excess return in the lowest quintile. The coefficients on the even-week dummies are now about three times larger implying that the difference between returns on even and odd-week days is particularly strong following poor stock returns over the past week. Column 3 shows that for days that do not follow a past 5-day excess return in the lowest quintile, the even-week dummies are much smaller and much less significant.

The Fed put explanation for a large part of the high even-week returns is consistent with the fact that no one seems to have known about the FOMC cycle pattern in excess stock returns before CMVJ, and the fact that monetary policy news is not generally associated with high stock returns as should be the case under a risk-premium explanation. Brusa, Savor, and Wilson (2016) find no evidence of abnormally high average stock returns around monetary policy announcements made by the European Central Bank, the Bank of England, or the Bank of Japan.

The relation between the stock market and subsequent target rate changes supports the return-based evidence that the Fed reacts strongly to poor stock returns. We define an intermeeting excess stock return, denoted rx_m, as the excess return from day 1 of cycle $m-1$ to day -2 of cycle m, i.e. excluding returns earned one day before and on the day of scheduled FOMC meetings. The left graph in Figure 1 Panel C displays changes in

the Federal funds target as a function of past excess stock returns. Using data for 1994–2016, we graph the average cumulative change in the Fed funds target from meeting $m-1$ to meeting $m+X$ (for different values of X) against average intermeeting excess stock returns, with both averages calculated by quintile of the intermeeting excess stock return. Intermeeting excess stock returns in the lowest quintile (averaging around -7 percent) are associated with an average reduction in the target of as much as 119 basis points over 8 FOMC cycles from $m-1$ to $m+7$. No such pattern of Fed accommodation following low stock returns is seen pre-1994 (right graph in Figure 1 Panel C). Columns 1–4 of Table I Panel B show regressions of target changes on a dummy for an intermeeting excess return in the lowest quintile. Over horizons ranging from one FOMC cycle ($X=0$) to a year ($X=7$), target changes are significantly lower following intermeeting excess return in the lowest quintile. In order to exploit the continuous variation in the intermeeting excess return we also define a stock market put variable capturing negative realizations of intermeeting returns, i.e. $rx_m^- = \min(0, rx_m)$. In columns 5–8, we report analogous regressions using rx_m^- as the explanatory variable. The R^2 for explaining target changes are substantially higher relative to the quintile dummy regressions, indicating that the Fed accommodates more strongly the more negative an intermeeting excess return is observed. Table I Panel C avoids the use of overlapping data for the dependent variable and instead regresses the change in the Fed funds target (from $m-1$ to m) on two lags and either a dummy for an intermeeting excess stock return in the lowest quintile (in column 2) or the stock market put variable (in column 3). Compared to column 1 which includes only the lags of the dependent variable, the stock market put variable increases the R^2 from 0.35 to 0.51 suggesting a strong statistical relation between the stock market and target changes.

III. How does the stock market compare to macroeconomic indicators as predictor of Fed's policy?

To put the explanatory power of the stock market for target changes into perspective, we compare it to the explanatory power of macroeconomic variables. We obtain data on macro announcements from Bloomberg. We start from the universe of variables included in Bloomberg's calendar of US economic releases. The Bloomberg data go back to October 1996. We use data up to the last FOMC meeting of 2008 where the Fed lowered the target to 0–25 basis points, resulting in a sample of 98 FOMC meetings for this part of our analysis.[3] We consider macroeconomic variables for which at least 10 years of announcement data are available in Bloomberg over the October 1996–December 2008 sample. There are 38 such variables, 32 of which have monthly announcements. Of the rest, one variable has weekly announcements (Initial Jobless Claims), one has 24 announcements per year (University of Michigan Confidence), two variables have 4 announcements per year (Current Account Balance, Employment Cost Index), and two variables have 8 announcements per year (Nonfarm Productivity, Unit Labor Costs).

For each explanatory variable x, we estimate the following two regressions:

$$\Delta\text{FFR}_m = \beta_0 + \beta_1 \Delta\text{FFR}_{m-1} + \beta_2 \Delta\text{FFR}_{m-2} + \delta_1 x_m + \delta_2 x_{m-1} + \gamma_1 \mathbf{1}_{x_m} + \gamma_1 \mathbf{1}_{x_{m-1}} + \varepsilon_m \quad (1)$$

$$\Delta\text{FFR}_m = \beta_0 + \beta_1 \Delta\text{FFR}_{m-1} + \beta_2 \Delta\text{FFR}_{m-2} + \gamma_1 \mathbf{1}_{x_m} + \gamma_1 \mathbf{1}_{x_{m-1}} + \varepsilon_m \quad (2)$$

The regressions are estimated with one observation per scheduled FOMC meeting; therefore, m denotes a scheduled FOMC announcement date. $\Delta\text{FFR}_m = \text{FFR}_m - \text{FFR}_{m-1}$ is the change in the Fed funds target between meetings $m-1$ and m. x_m denotes the latest realized value of the explanatory variable that is available as of date of the m-th meeting. $\mathbf{1}_{x_m}$ is a dummy variable equal to one if x_m is missing and similarly for $\mathbf{1}_{x_{m-1}}$. Missing values occur mainly

[3] The target remained at the zero lower bound until the increase at the last meeting in 2015. We exclude the post-2008 period from this part of our analysis given the lack of variation in the target.

because some series start later than October 1996. We also code a variable as missing if there has been no announcement for this variable since the last FOMC announcement date. We use the actual values of the macro variables as regressors rather than the surprises relative to consensus. We want our x_m-variables to capture news that has arrived since the $(m-1)$-th meeting. Consensus forecasts for a given variable are generally dated just before the release of the variable and thus reflect information about the likely value of the release that arrives between $(m-1)$-th meeting and (just before) the release. Surprises relative to consensus forecasts would therefore focus only on a subset of the news contained in x_m. We include x_{m-1} as a regressor to allow for a delayed Fed response to the news contained in the particular macro announcement. We calculate the R^2 values from each of the regressions and use the difference as a measure of the incremental R^2 generated by the particular variable. By using incremental R^2, rather than simply the R^2 from equation (1), we disregard any explanatory power due to the lags of the target changes and the dummy variables for missing data. To assess whether a given x_m-variable has statistically significant explanatory power for Fed's policy, we report the p-values from an F-test of $H_0 : \delta_1 = \delta_2 = 0$.

The results are reported in Table II. Variables are listed in order of declining incremental R^2. For the stock market put variable, the incremental R^2 is 0.182 and the p-value for the test of $H_0 : \delta_1 = \delta_2 = 0$ is less than 0.1%. Only the Philadelphia Fed Business Outlook Survey comes close in its incremental R^2 with a value of 0.159. If we include the stock market put and its lagged value in regression (1) jointly with each macro variable, only two macro variables have significant additional explanatory power at the 5% level based on the test of $H_0 : \delta_1 = \delta_2 = 0$. These are the Philadelphia Fed Business Outlook Survey and the Change in Manufacturing Payrolls.

IV. Establishing causality by textual analysis: Does the stock market *cause* Fed policy or is the relation coincidental?

There are two possible interpretations of the above evidence regarding the high explanatory power of the stock market for the Fed funds target changes. One possibility is that the relation is *causal* in that the stock market drives or predicts economic variables the Fed cares about, thus causing the Fed to rationally pay attention to the stock market. Alternatively, the relation between the target and the stock market may be *coincidental*. The stock market may be correlated with variables that drive or predict Fed's decision making. In the latter case, the Fed may not actually pay attention to the stock market, and yet an econometrician will find that the stock market has explanatory power for target changes.

To distinguish between these two possibilities, we rely on textual analysis of FOMC minutes and transcripts. A necessary condition for the explanatory power of the stock market for the target to be causal is that the Fed pays significant attention to the stock market. Thus, we perform extensive textual analysis of FOMC meeting minutes and transcripts to document: (a) the frequency of stock market mentions in these documents, (b) the direction of how the stock market is discussed (going up or down), (c) whether the direction of the stock market mentions moves with realized stock returns as one would expect (e.g., more negative mentions following stock market declines), and (d) whether the count of negative (down) stock market mentions in the FOMC documents predicts target changes, consistent with the Fed put being causal (i.e., low stock returns causing Fed policy accommodation). We document the results of this analysis in the current section and then turn to using textual analysis to understand the mechanism behind these results in the next section.

FOMC meetings are highly structured events which always include:

1. Staff Review of the Economic Situation
2. Staff Review of the Financial Situation

3. Staff Economic Outlook
4. Participants' Views on Current Conditions and the Economic Outlook
5. Committee Policy Action

FOMC minutes "record all decisions taken by the Committee with respect to these policy issues and explain the reasoning behind these decisions."[4] From 1993 through today, the minutes have followed a standardized format with sections corresponding to the five parts of the FOMC meetings.[5] We refer to sections 1–3 as representing the views of the staff, and sections 4 and 5 as concerning the views of the participants. Minutes also contain lists of who attended the meeting, authorizations for Fed's operations, and summaries of any discussions of special topics. We drop those parts for our analysis. The sections of the minutes corresponding to the above five parts of the FOMC meeting are typically 7–10 pages long. Since 2005 minutes have been published three weeks after the FOMC meeting. Before 2005 they were published three days after the next FOMC meeting. Minutes are available up to the end of our sample period in 2016.

FOMC transcripts contain verbatim comments made by individual staff members and meeting participants. They are released with a 5-year lag with transcripts currently available up to 2011. Each meeting transcript is around 200–300 pages long. For that reason, we manually code the stock market mentions focusing on the FOMC minutes. We then develop an algorithm to find and classify such mentions in an automated way. We use this algorithm on the transcripts to show that our results are robust to studying the transcripts.

[4]The quote is from https://www.federalreserve.gov/monetarypolicy/fomc_historical.htm.

[5]These sections headings appear explicitly in the minutes from April 2009 onward. However, given that the structure of the documents has remained essentially unchanged since the early 1990s, for the period between 1994 and March 2009, we manually assign text to sections.

IV.A. Results based on manual coding of stock market mentions in FOMC minutes

We extract all paragraphs in the 1994–2016 FOMC minutes that mention the stock market. The search phrases we use and the counts for each phrase are shown below:

Phrase	Count
stock market	153
stock pri*	137
stock ind*	5
S&P 500 index	51
equities	22
equity and home price*	3
equity and house price*	6
equity and housing price*	2
equity ind*	58
equity market*	125
equity price*	385
equity value*	23
equity wealth	6
home and equity price*	4
house and equity price*	2
housing and equity price*	1
Total	**983**

Over the 1994–2016 period, there are 983 references to stock market conditions in FOMC minutes. This number represents 14% of times that minutes mention inflation, and 31% of times they mention (un)employment. Figure 2 Panel A reports the counts of stock-market phrases by section of the minutes.

We read the 983 paragraphs with stock market mentions and classify them based on the direction of the market's evolution: positive (discussion of the stock market going up), negative (discussion of the stock market going down), neutral (stock market flat), and hypothetical (discussion of would happen if the stock market were to move in a particular way). If the direction is unclear or cannot be determined, we mark the phrase as "n/a" and these stock market mentions are not counted in the 983 mentions described above.

Figure 2 Panel B (left bar chart) displays the positive, negative, neutral and hypothetical counts by staff and participants, respectively. Consistent with the stock market on average

having increased over the 1994–2016 period, there are more positive than negative stock market mentions in both the sections summarizing participant comments and the sections summarizing staff presentations. Figure 3 graphs the time series of negative (Panel A) and positive (Panel B) stock market mentions. Peaks in the number of negative mentions often correspond to periods of market stress. The time series properties of positive stock market mentions in Panel B are less apparent.

To systematically relate stock market mentions to stock returns, Figure 4 Panel A and B plots negative and positive stock market mentions in a given FOMC minute document against intermeeting excess stock returns. In Panel C and D, we display the average number of mentions against average intermeeting excess stock returns, with averages calculated by intermeeting excess stock return quintiles. From Panel A and C, it is clear that lower intermeeting excess stock returns lead to more negative stock market mentions, especially in the lowest quintile of returns. Similarly, Panel B and D show that higher stock returns lead to more positive stock market mentions, although the pattern is more linear than for negative mentions.

To assess whether these relations are statistically significant, in Table III we regress stock market mentions on intermeeting excess stock returns. In columns 1 and 5, the explanatory variable is the intermeeting excess stock return and its two lags. In columns 2–4 and 6–8, we include separate variables for negative and positive intermeeting returns. The coefficients on $rx_m^- = \min(rx_m, 0)$ and $rx_m^+ = \max(rx_m, 0)$ (and their lags) capture, respectively, the impact of negative and positive intermeeting excess stock returns. From column 1, the intermeeting excess stock return and its lags have strong explanatory power for negative stock market mentions with an R^2 of 0.49. The explanatory power strengthens further when we consider the negative return realizations in columns 2–4. In column 2, the sum of the coefficients on the stock market put rx_m^- and its lags is 0.64. This implies that in the region of negative excess returns, a 10% lower excess stock return leads to 6.4 more negative stock market

mentions, a substantial impact relative to the mean (1.8) and standard deviation (2.6) of the number of negative stock market mentions. Columns 3 and 4 indicate that the relation between low stock returns and a high number of negative stock market mentions is present both before and during the zero lower bound period. For positive stock market mentions, columns 6–8 also suggest a strong relation in both statistical and economic terms, with more positive stock returns leading to more positive stock market mentions as one would expect.

Table IV panel A presents results on whether counts of stock market mentions in the FOMC minutes predict target changes over the 1994–2008 period. This should be the case if the Fed's concern about the impact of the stock market on the economy is causing them to change the target. Consistent with the Fed put argument, negative stock market mentions in the minutes of the current and past FOMC meeting have statistically significant explanatory power for target changes. Both the current and lagged number of negative stock market mentions are significant as are the first two lags of the dependent variable. The estimates in column 1 imply that a one standard deviation increase in the number of negative stock market mentions (2.6 more mentions) leads to a cumulative reduction in the Fed funds target of 32 bps (6 bps at the current meeting, 12 additional bps at the next meeting etc.). Importantly for arguing causality, negative stock market mentions predict target changes even if we focus only on mentions by FOMC participants (column 3) rather than staff (column 2). As we discuss below, some of the stock market mentions by the staff are purely descriptive summarizing recent financial developments. If all explanatory power of stock market mentions came from such staff mentions one would be concerned that the stock market was not causally affecting FOMC decision makers. This is not the case given the strong result in column 3. Accordingly, when we split the stock market mentions into those that are purely descriptive versus others (column 4 and 5), we find significant results even for those mentions that do not simply summarize recent developments (column 5).

IV.B. Robustness: Results based on algorithmic coding of stock market mentions in FOMC minutes and transcripts

To assess whether the above results are robust to using FOMC transcripts we develop a computer algorithm to identify negative and positive stock market mentions in the transcripts. The algorithm looks for a set of 47 stock market related phrases. It then searches for a direction word (negative/positive) near the stock market phrase based on a list of 52 negative and 41 positive words. Negative words correspond to the market going down and positive words to it going up. The word lists are shown in Appendix Table A-I. We train our algorithm on the minutes in order to identify and correctly classify as many of the 983 stock market mentions as possible. The algorithm captures 589 stock market mentions in the minutes without inducing a substantial number of misclassified phrases. A central parameter in the algorithm determines within how many words around the stock market phrase a direction word should occur (search is bounded within a sentence). The lower this distance is, the more accurately a given stock market mention is classified but the more likely it is that no positive or negative word is found. We currently use a distance of zero words, i.e., the match is found if a direction word directly precedes or follows a stock market phrase. This rule is applied after dropping stop words as well as certain descriptive phrases, and defining sentences as laid out in the Appendix. Such a setup allows us to err on the side of obtaining an accurate classification of stock market mentions rather than to capture a maximum number of phrases. We do not seek to code neutral or hypothetical phrases in the algorithmic approach. Figure 2 Panel B compares algorithm-based and manual searches of the FOMC minutes in terms of the distribution of positive and negative stock market mentions, both for participants and the staff.

Turning to the FOMC transcripts, we find 2,680 stock market mentions over the 1994–2011 period, using the stock market search words listed in Section IV.A. Of these, our algorithm

picks up 1,197 mentions, i.e. 45% of the overall count, of which 618 are negative matches and 579 are positive matches.

For robustness, we replicate our earlier results obtained using manual searches by applying the algorithm to both minutes and transcripts. Appendix Figure A-1 shows the relation between intermeeting returns and negative and positive stock market mentions in the minutes and transcripts, respectively. The results indicate that our algorithmic approach is able to capture the same key features of this relationship that we have established using the manual search approach. In particular, the asymmetry in the dependence of stock market mentions on intermeeting returns—i.e., the Fed paying disproportionately more attention to the stock market after extreme negative returns—shows up with equal strength in the FOMC transcripts as it does in the minutes. Appendix Table A-V shows that the predictability of negative and positive stock market mentions by intermeeting excess stock returns is robust to using our algorithmic approach. Likewise, Table IV Panel B predicts target changes using counts from the algorithmic approach and documents similar patterns as for the manual coding: While there is no relationship between positive stock market counts and target changes, negative stock market counts predict target reductions.

In summary, the Fed pays attention directly to the stock market rather than merely to variables correlated with the stock market. Our textual analysis has documented lots of discussion of the stock market at the FOMC meetings by both the staff and by the FOMC participants. Positive and negative stock market mentions move with intermeeting excess stock returns in the expected direction and the Fed put is present in the textual analysis results in that counts of negative stock market mentions predict target reductions. Taken together, these facts are consistent with the view that the stock market is a causal factor influencing Fed policy making.

V. Establishing mechanism by textual analysis: Why does the stock market cause Fed's policy?

To shed light on the Fed's economic reasoning about the stock market as a determinant of policy, we analyze the content of the 983 paragraphs in the FOMC minutes that contain stock market mentions. Our goal is to uncover whether the Fed thinks of the stock market as a *driver* of the economy or as a *predictor* of the economic outlook. If the first possibility dominates, we would like to understand the economic channels though which the Fed believes the stock market impacts the economy. We again take both a manual and an algorithmic approach. Currently, we focus this part of the analysis on the FOMC minutes. We plan to extend the algorithmic analysis to the FOMC transcripts.

V.A. Results based on manual coding of discussion in paragraphs with stock market mentions

Our main results are based on reading the 983 paragraphs in the FOMC minutes with stock market mentions. We classify the discussion of the stock market into the eight categories, listed below. For each category, we include an example extracted from one of the paragraphs with a stock market mention.

Descriptive: "Broad U.S. equity price indexes were highly correlated with foreign equity indexes over the intermeeting period and posted net declines." (Staff Review of the Financial Situation, 9/17/2015)

The different ways in which the stock market *drives* the economy are as follows:

Consumption: "With regard to the outlook for key sectors of the economy, a number of members commented that consumer spending had held up reasonably well in recent months despite a variety of adverse developments including the negative wealth effects of stock market declines, widely publicized job cutbacks, heavy consumer debt loads, and previous overspending by many consumers." (Participants' Views on Current Conditions and the Economic Outlook, 5/15/2001)

Investment: "Many businesses also were inhibited in their investment activities by less accommodative financial conditions associated with weaker equity markets and tighter credit terms and conditions imposed by banking institutions. As a consequence, a

substantial volume of planned investment was being postponed, if not cancelled." (Participants' Views on Current Cond. and the Economic Outlook, 3/20/2001)

Demand (no detail on which component of demand): "Financial market conditions continued to improve, providing support to aggregate demand and suggesting that market participants saw some reduction in downside risks to the outlook: Equity prices rose further, credit spreads declined somewhat, and the dollar depreciated over the intermeeting period." (Participants' Views on Current Conditions and the Economic Outlook, 4/27/2016)

Financial conditions (stock market as part of financial conditions driving the economy): "Participants noted that financial conditions had worsened significantly over the intermeeting period. The failure or near failure of a number of major financial institutions had deepened market concerns about counterparty credit risk and liquidity risk. As a result, financial intermediaries had cut back on lending to some counterparties, particularly for terms beyond overnight, and in general were conserving liquidity and capital. Moreover, risk aversion of investors increased, driving credit spreads sharply higher. Survey results and anecdotal information also suggested that credit conditions had tightened significantly further for businesses and households. Equity prices had varied widely and were substantially lower, on net." (Participants' Views on Current Conditions and the Economic Outlook, 10/29/2008)

Stock market as driver of the economy, no mechanism stated: "In the discussion of monetary policy for the intermeeting period, most members believed that a further significant easing in policy was warranted at this meeting to address the considerable worsening of the economic outlook since December as well as increased downside risks. As had been the case in some previous cyclical episodes, a relatively low real federal funds rate now appeared appropriate for a time to counter the factors that were restraining economic growth, including the slide in housing activity and prices, the tightening of credit availability, and the drop in equity prices." (Participants' Views on Current Conditions and the Economic Outlook, 1/30/2008)

Economic outlook (stock market as predictor of the economy): "Participants noted that financial markets were volatile over the intermeeting period, as investors responded to news on the European fiscal situation and the negotiations regarding the debt ceiling in the United States. However, the broad declines in stock prices and interest rates over the intermeeting period were seen as mostly reflecting the incoming data pointing to a weaker outlook for growth both in the United States and globally as well as a reduced willingness of investors to bear risk in light of the greater uncertainty about the outlook." (Participants' Views on Current Conditions and the Economic Outlook, 8/9/2011)

Financial stability: "However, during the discussion, several participants commented on a few developments, including potential overvaluation in the market for CRE, the elevated level of equity values relative to expected earnings, and the incentives for investors to reach for yield in an environment of continued low interest rates."(Participants' Views on Current Conditions and the Economic Outlook, 7/27/2016)

Table V summarizes our findings on how the Fed thinks about the stock market based on the above classification. About half (551) of the 983 stock market mentions are descriptive in nature. Most of these mentions are in the Staff Review of the Financial Situation. Of the other 432 stock market mentions, the stock market is most frequently discussed in the context of it affecting consumption, with 265 such cases (61% of the non-descriptive mentions). When more detail is provided, discussions of the stock market wealth effect—higher household wealth leading to increased consumption—is common. The word "wealth" appears 192 times. A second quite frequent theme is the impact of the stock market on investment, with 34 such cases. In many of these cases, the discussion refers to the effect of the stock market on firms' cost of capital or ability to raise equity financing on favorable terms. In 44 cases the discussion of the stock market is in the context of financial conditions more broadly. Other stock market mentions discuss the stock market's impact on demand without specifying which component of demand (15 cases) or discusses the stock market as a driver of the economy without specifying the mechanism (37 cases). We find only a small number of cases (13) where stock market is viewed simply as a predictor of the economy.

The substantial focus on consumption in paragraphs mentioning the stock market is consistent with recent comments by the former Dallas Fed President Richard Fisher made in the context of increased volatility and declines in the equity market: *"Basically, we had a tremendous rally and I think a great digestive period is likely to take place now and it may continue because, again, we front-loaded at the Federal Reserve an enormous rally in order to accomplish a wealth effect."* (CNBC interview, January 5, 2016)[6]

[6] Available at:
http://www.cnbc.com/2016/01/06/dont-blame-china-for-the-market-sell-off-commentary.html

V.B. Robustness: Discussion of broader financial conditions

Our above analysis may understate the FOMC's concern with the stock market and the role of investment in FOMC's thinking about the stock market. The FOMC minutes often talk about "financial conditions" without explicitly mentioning the stock market. When clarified, financial conditions typically refer to the stock market, credit spreads, bank lending standards, and the dollar. Financial conditions are frequently mentioned in the context of investment. To assess the frequency of references to financial conditions that do not explicitly mention the stock market (and thus may not be accounted for above), we create a list of words that relate to financial conditions along with lists of positive and negative direction words used to describe them. We then algorithmically code the number of negative and positive financial conditions phrases that do not explicitly mention the stock market. The word lists are shown in the Appendix.

We find 350 negative and 232 positive financial conditions mentions. To the extent that the stock market is one of the indicators of financial conditions, this suggests even more attention paid to the stock market (and other financial markets) than our prior analysis would suggest. We graph the count of negative financial conditions phrases over time in Appendix Figure A-2 with our series for manually coded negative stock market mentions included for comparison. Not surprisingly, the negative financial conditions series spikes during the financial crisis in 2008 and 2009. In Appendix Table A-VI Panel A, we show that counts of financial conditions mentions are predictable by the intermeeting stock returns in the same way as are the counts of stock market mentions (reported in Table III above). Additionally, in Appendix Table A-VII, we find that financial conditions predict Fed fund target changes (column 1–2) over and above the stock market. However, this result is driven by year 2008. Dropping 2008 from the analysis, the stock market mentions subsume the explanatory power of financial conditions for target changes (columns 3 and 5 versus 4 and 6).

V.C. Robustness: Results based on algorithmic coding of economic content of paragraphs with stock market mentions

In addition to the manual coding of the mechanisms that describe Fed's thinking about the causal effect of the stock market on the economy (Table V), we also study algorithmically which economic phrases are most frequently discussed in conjunction with the stock market. We conduct the analysis at the level of the paragraph in FOMC minutes in which we have identified a stock market phrase with our manual searches ("stock-market paragraph" below). We first create a dictionary of economic phrases that appear in the stock-market paragraphs. Then, we count the number of times that each economic phrase is mentioned both within the stock-market paragraphs as well as within the full sections of the minutes that contained the stock-market paragraphs.

Table VI lists economic phrases that are most frequently discussed within the stock-market paragraphs, by section of the minutes, displaying only phrases that occur 20 times or more. The table provides the counts of each economic phrase in the stock-market paragraph (column 1), in the minutes' section (column 2), and their ratio (column 3). It also reports the odds ratio (column 4), i.e. the odds of finding a given economic phrase in the stock-market paragraph relative to the odds of finding it in the overall section.

As we point out above in Table V, the two sections containing the largest share of non-descriptive stock market mentions are Staff Review of Economic Situation and Participants' Views.[7] Focusing on these two sections, Table VI makes clear that the economic variables that are most frequently discussed together with the stock market are related to consumption. For example, the participants mention "consumer spending" 187 times within the stock-market paragraph, which corresponds to 43% of their total references to consumer spending.

[7]Staff Economic Outlook section also contains a significant number of non-descriptive statements. However, given that in early years it is frequently comprised of just a single paragraph, the interpretation of co-occurrences of stock market and economic phrases is less tight than for the Staff Review of Economic Situation and Participants' Views, both of which contain multiple paragraphs focusing on distinct topics.

This implies that it is 3.22 times more likely that consumer spending will be mentioned in a stock-market paragraph within this section of the minutes than that it will be mentioned in this section in general.

Similarly, 50% or more of participants' mentions of "consumer confidence," "consumer expenditures" and "consumer sentiment" occur within the stock market paragraph. In Staff Review of Economic Situation, "disposable income," "consumer sentiment," and "personal consumption expenditure*" are most tightly linked to the stock market occurrences as measured by the ratios is column (3) and (4). Consistent with our manual coding of the mechanism, mentions of business investment are relatively less common, with participants referring to it only 16% of the time within the context of the stock market paragraph.

VI. Does the Fed react too strongly to the stock market?

VI.A. Comparing the sensitivity of Fed economic forecasts to the stock market with that of the private sector forecasts and of the realized data

To assess whether the Fed's reaction to the stock market is appropriate, we compare how much the Fed's Greenbook expectations for growth, unemployment and inflation update in response to the stock market relative to the corresponding updates of the private sector expectations in the Survey of Professional Forecasters (SPF). We also benchmark the Fed's expectations sensitivity to the stock market to how much predictive power the stock market has for realized values of growth, unemployment and inflation.

Table VII documents how much Fed expectations update in response to the stock market. Greenbook data are available up to 2010. Regressions are estimated at the FOMC meeting frequency, resulting in 136 observations for the 1994–2010 period. Greenbooks report Fed expectations for various calendar quarters. We consider how expectations for a given calendar quarter are updated from one FOMC meeting to the next based on the intermeeting excess

stock return. We allow for one lag of the stock return variable to account for gradual expectations updating (additional lags are generally not significant). Panel A focuses on updating of the Fed's real GDP growth forecasts. Columns 1–4 refer to updating of forecasts for the current quarter (quarter zero) out to the third quarter from the date of the meeting. Column 5 refers to updating over the next year calculated by summing the updates for quarters zero through three (thus comparing GDP in the prior quarter to the same quarter four quarters later). The growth rates used in columns 1–4 are not annualized, while the growth rate in column 5 by construction will be an annual growth rate.

Fed expectations update asymmetrically to stock returns, reacting significantly to the current and lagged negative intermeeting excess stock returns, with a smaller and in most cases insignificant reaction to positive return realizations. Summing the coefficients of 5.06 and 4.61 on the current and lagged intermeeting excess stock returns in column 5, a 10 percent lower intermeeting excess stock return implies a reduction of the total expected growth rate over the next four quarters of 1.0 percentage point. Before 1994, going back to September 1982 for comparison with Table I Panel B, there is no significant relationship between the stock market and updates to Fed growth expectations. Table VII Panel B shows the same analysis for changes in Fed expectations about the unemployment rate. Based on column 5, a 10 percent lower intermeeting excess stock return implies a reduction of the unemployment rate of 1.3 percentage points over the one-year period from last quarter to three quarters out. Comparing column 1 to column 4, the coefficients are increasing with horizon (despite these columns referring to non-overlapping periods). This indicates that the peak effect of the stock market on Fed expectations for unemployment may occur later than three quarters out and may be larger than the 1.3 percentage points. In the positive region, the excess stock return has little explanatory power for Fed unemployment updates and none of the stock market variables are significant in the pre-1994 period. Table VII Panel C refers to updating of Fed inflation expectations. The impact of the stock market on these appears sensitive to

the measure of inflation used. Overall, estimates in Table VII thus suggests that there is a robust and quite large impact of negative stock market returns on Fed expectations for real output growth and the unemployment rate, with no clear pattern for inflation.

Table VIII presents analogous results for how much private sector expectations for the same three dependent variables update in response to stock market news. The SPF conducts four surveys per year, resulting in 92 observations over the 1994-2016 period. The deadline for respondents supplying their expectations to the survey are only available from the third survey of 1990 so we do not present pre-1994 results.[8] We calculate cumulative inter-survey excess stock returns over the period from the date of the prior survey deadline to the day before the deadline for the current survey. Based on column 1, summing the coefficients of 4.55 and 4.67 on the current and lagged inter-survey excess stock returns, a 10 percent lower inter-survey excess stock return implies a reduction of the total expected growth rate over the next four quarters of about 0.9 percentage point, similar to the 1.0 percentage point found for Fed Greenbook expectations. The impact of the stock market on private sector unemployment rate expectations in column 2 is about half as strong as that seen for Fed expectations. Importantly, the explanatory power of the stock market for private sector expectations of both real output growth and the unemployment rate is again coming from the range of negative excess stock returns. Furthermore, similar to the Fed expectations, the SPF data show no clear relation between the stock market and updates to inflation expectations.

In Table IX, we document the strength of the relationship between excess stock returns and realized macro variables. Quarterly NIPA data on real GDP growth and the GDP deflator are available from 1947 to 2016 as are data on the unemployment rate from the BLS. We show results both for the 1994–2016 period, the pre-1994 period and the full 1947–2016 period. We

[8]Related, we focus on private sector expectations from the SPF rather than from the Blue Chip survey because we do not have the exact respondent deadlines for the latter.

regress the realized sum of growth rates, unemployment rate changes, or inflation rates over a four-quarter period (the current and the subsequent three quarters) on quarterly excess stock returns for the current quarter. We do not include lags here since the lags in Table VII and VIII were motivated by gradual expectations updating and the current table is for realized values as opposed to expectations.

For real GDP growth, the coefficient on the stock market put of 10.11 for the 1994–2016 period translates to a 1.0 percentage point lower growth rate for a 10 percent drop in the stock market, the same effect (within rounding error) as for Fed growth expectations in Table VII. For the unemployment rate changes, the coefficient of −7.21 post-1994 implies a relation between excess stock returns and actual 4-quarter unemployment rate changes a bit more than half as strong as found for Fed unemployment expectations and more similar to the result from the private sector data. The relation between excess stock returns and realized unemployment rate changes is asymmetric and driven by the range of negative excess return values whereas less asymmetry is seen for realized output growth. The main difference between the results for the realized variables and for Fed expectations is that the realized data show similar relations to the stock market pre- and post-1994. Realized inflation for the GDP deflator is only weakly related to the stock market, consistent with the results for the Fed or SPF expectations.

Our textual analysis suggests that the Fed's focus on the stock market is driven a lot by its concern about the effect of stock market declines have on consumption, with a relatively smaller weight put on other GDP components. Accordingly, Table X studies the predictive power of the stock market for the components of real GDP growth, both expected and realized. Panel A compares Fed and SPF expectations. For reference, columns 1 and 5 repeats the results for overall real GDP growth in either data set. Columns 2 and 6 document similar responsiveness of Fed and SPF expectations for real consumption growth to the stock market and columns 3 and 7 show similar reactions of Fed and SPF expectations for real

business fixed investment growth to the stock market. While business fixed investment is more sensitive to the stock market than consumption, consumption is about four times as large in dollars terms, implying that consumption contributes almost as much as business fixed investment to the overall sensitivity of output growth to the stock market. Results for the smaller category of residential investments are more erratic.

Table X Panel B shows the relation between stock returns and components of realized real GDP growth. Realized growth of business fixed investment is about as sensitive to the negative stock market returns as are the Fed or SPF expected growth rate for this variable.[9] For consumption, realized growth rates in Panel B column 2 have a stock market sensitivity of 7.33 over the 1947–2016 period, quite similar to the sensitivity of Fed or SPF expectations.[10] In the 1994–2016 period, the sensitivity of realized consumption growth to the negative stock market outcomes is small. This is driven by consumption growth holding up well in the early 2000s following the bursting of the tech boom in the stock market. Expectations data for consumption thus appear more consistent with realized data for the full 1947–2016 period than realized data for the post-1994 period.

Overall, relative to either benchmark—private sector expectations or realized macroeconomic variables—there is little evidence that Fed expectations overreact to the stock market news. The exception is that Fed unemployment rate expectations appear to react somewhat more strongly to the stock market than do SPF unemployment rate expectations or realized unemployment rate changes.

[9]Compare the coefficient 42.09 in Panel B column 4 to the sum of 23.77 and 12.97 in Panel A column 3 for the Fed or the sum of 21.18 and 7.45 in Panel A column 7 for the SPF.

[10]To see this, we sum the coefficients of 2.72 and 2.55 in Panel A column 2 for the Fed and the coefficients of 2.53 and 3.31 in Panel A column 6 for the SPF.

VI.B. Estimating whether the stock market impacts target changes even controlling for Fed economic forecasts

Our second approach to evaluate whether the Fed reacts too strongly to the stock market is to use the benchmark of Bernanke and Gertler (1999, 2001) who argue that the Fed should not respond to the stock market beyond the effect of the stock market on Fed expectations for the real economy and inflation.

In Table XI, we estimate Taylor rules augmented with stock market variables using data for the 1994–2008 period. All columns regress the change in the Fed funds target (from meeting $m-1$ to m) on its two lags plus a set of additional variables. In column 1, the additional variables are the stock market put and its lag, in column 2 it is Greenbook variables and in column 3 is it both stock market put and Greenbook variables.[11] Comparing column 1 and 3, the coefficient on the stock market put drops from 0.019 to 0.0077 and the coefficient on the lagged stock market put drops from 0.027 to 0.013. The latter remains statistically significant at the 5 percent level.[12]

Greenbook variables prepared by the Fed staff may not fully reflect the concerns of FOMC decision makers. In column 4 to 6, we therefore introduce measures of Fed concerns about growth and inflation based on textual analysis of the FOMC minutes (see the Appendix for details on their construction). Column 4 shows that when the textual analysis variables are included on their own (without Greenbook or stock return variables), more negative economic growth mentions are associated with target rate reductions, and conversely for more positive economic growth mentions. Textual analysis variables for inflation mentions

[11] We determine the horizon of Greenbook forecasts using the AIC criteria, resulting in the inclusion of the expectations for current quarter real GDP growth, next quarter inflation (in the GDP deflator) and next quarter's unemployment rate, along with the expectations update for real GDP summed over the current and subsequent three quarters.

[12] In Table XI, the coefficient on unemployment forecast is incorrectly signed. This arises when we include as regressors lagged changes in the Federal funds target rather than its lagged levels. In the specification which includes lagged target levels as regressors, the unemployment forecast is insignificant. Stock market put coefficients are unaffected if we drop unemployment forecast or if we estimate the regression including the lagged levels of the target.

(with negative mentions corresponding to higher inflation) are not significant. In column 6, we include both Greenbook, textual analysis and stock market put variables. The lagged stock market put variable retains a coefficient of 0.012, significant at the 10 percent level. Using the coefficients on the two lags of the Fed funds target change and the coefficient on the stock market put variable and the lagged stock market put variable, a 10% drop in the stock market leads to a cumulative drop in the target of 102 bps in column 1, 29 bps in column 3 and 23 bps in column 6. About 80% of the explanatory power of the stock market put for target changes thus work via Fed expectations for growth, unemployment and inflation (especially the growth expectations update).[13]

A residual predictive power of the stock market could be optimal if the Fed is concerned with the fiscal costs of financial instability as argued by Peek et al. (2016). Alternatively, the Fed may view the equilibrium real rate (the natural Federal funds rate) as being dependent on the stock market, as argued by Taylor (2008), Meyer and Sack (2008), and Curdia and Woodford (2010).

VII. Conclusion

Motivated by the findings in Cieslak, Morse and Vissing-Jorgensen (2016), we study the economic underpinnings of the "Fed put," i.e. the tendency of the US Federal Reserve to respond to negative stock market outcomes with monetary policy accommodation. From the mid-1990s, negative intermeeting stock market returns are a stronger predictor of subsequent target changes than any of the commonly followed macroeconomic variables. We argue in

[13]Fuhrer and Tootell (2008) also study the impact of the stock market on the Federal funds rate. They do not find significant explanatory power of the stock market for the average realized effective Federal funds rate in the week after the FOMC meeting. We focus on the target rather than the effective rate in order to characterize Fed policy (the effective rate also reflects shocks to the demand for Federal funds). Over the period since 2000 the Fed has accommodated demand shocks and kept the effective rate close to the target, the stock market has a significant effect on both the target and the effective rate. In the earlier period, deviations between the effective rate and the target add noise making it statistically more difficult to detect the effect of the stock market on the target if one uses data for the effective rate.

favor of a causal (rather than coincidental) interpretation of this result. Using textual analysis of FOMC minutes and transcripts, we document that the Fed pays significant attention to stock market developments. Intermeeting stock market returns predict the tone of the Fed's discussions about the stock market during subsequent FOMC meetings with the expected sign. The Fed's attention to the stock market increases disproportionately following extreme negative stock market realizations during the intermeeting period. Accordingly, a negative tone of the stock market mentions during FOMC meetings (i.e. the Fed discussing negative stock market developments) predicts significant cuts to the Fed funds target rate; no analogous relationship exists for positive stock market mentions.

We use textual analysis to establish whether the Fed thinks about the stock market as merely a predictor of future economic outcomes or as a driver of the economy. We find overwhelming evidence in favor of the latter. Discussions of stock market conditions by the FOMC attendees are most frequently cast in the context of consumption, with the consumption-wealth effect highlighted as one of the main channels through which the stock market affects the economy. Some attention is also paid to the stock market working through investment and, relatedly, through the cost of capital.

We show that the Fed updates its macroeconomic expectations (about growth and unemployment) in a way that is highly sensitive to stock market outcomes during the intermeeting period. This relationship is pervasive starting from the mid-1990s, but is largely absent before that. To understand whether the Fed's reaction to the stock market is appropriate or excessive, we benchmark it to the stock market sensitivity of private sector macro forecasts and to the predictive power of the stock market for realized macro variables. Relative to both of these benchmarks, we find little evidence for the Fed overreacting to the stock market. We also ask whether the Federal funds target responds more to the stock market than what would be warranted by the updates to the Fed's macroeconomic expectations. Using a Taylor rule, we find that updates of Fed growth expectations subsume about 80%

the stock market effect on the target. This result confirms the Fed thinking causally about the stock market as a driver of the economy and updating its expectations of future economic conditions accordingly. At a time when it has come under criticism for focusing too much on asset prices it would be useful for the Fed to lay out whether it believes the stock market should have an independent impact on the target beyond its effects on growth and inflation expectations.

Table I. Review of the Fed put in stock returns and target changes

This table reviews the results of CMVJ (2016). In Panel A, the excess stock return is in percent, e.g., 0.1 means 10 basis points per day. Robust t-statistics are in parentheses. Panel B regresses FFR target changes on a dummy for intermeeting excess return being in quintile 1 (lowest), and on the stock return put $rx_m^- = \min(0, rx_m)$. Excess return quintiles are defined over the full 1994–2016 period in the 1994–2008 regressions and over the 1982:9–1993 period in the regressions for that period. T-statistics are robust to heteroscedasticity and autocorrelation up to order X. In all panels *** denotes significance at the 1% level, ** at the 5% level, and * at the 10% level.

Panel A. The Fed put in stock returns, 1994-2016

	Dependent variable: Excess return on stocks over T-bills		
	(1) All days	(2) Last 5-day ex. return in lowest quintile	(3) Last 5-day ex. return not in lowest quintile
Dummy=1 in Week 0	0.14***	0.36**	0.091**
	(3.17)	(2.44)	(2.12)
Dummy=1 in Week 2	0.090**	0.35**	0.026
	(2.10)	(2.35)	(0.67)
Dummy=1 in Week 4	0.12**	0.28*	0.077*
	(2.52)	(1.96)	(1.66)
Dummy=1 in Week 6	0.19**	0.65***	0.014
	(2.07)	(3.46)	(0.15)
Constant	-0.025	-0.054	-0.017
	(-1.25)	(-0.84)	(-0.92)
N (days)	5,997	1,199	4,798

Panel B. The Fed put in target changes: Multi-period target changes following low excess stock returns

	Dependent variable: (FFR target on day 0 of cycle $m+X$)−(FFR target on day 0 of cycle $m-1$)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Sample: 1994-2008							
	$X=0$	$X=1$	$X=4$	$X=7$	$X=0$	$X=1$	$X=4$	$X=7$
Dummy (rx_m in qtile 1)	-0.15*	-0.42***	-0.93***	-1.20***				
	(-1.67)	(-2.92)	(-3.79)	(-3.13)				
rx_m^-					0.026***	0.064***	0.103***	0.127***
					(3.28)	(5.69)	(4.12)	(3.26)
Constant	0.011	0.049	0.069	0.011	0.029	0.078*	0.059	-0.015
	(0.41)	(1.05)	(0.40)	(0.03)	(1.07)	(1.81)	(0.33)	(-0.04)
N (meetings)	120	120	120	120	120	120	120	120
R^2	0.04	0.10	0.11	0.09	0.11	0.21	0.13	0.09
	Sample: 1982:9-1993							
	$X=0$	$X=1$	$X=4$	$X=7$	$X=0$	$X=1$	$X=4$	$X=7$
Dummy (rx_m in qtile 1)	0.076	0.076	-0.054	-0.13				
	(0.62)	(0.43)	(-0.20)	(-0.34)				
rx_m^-					-0.010	-0.007	0.014	-0.008
					(-1.05)	(-0.39)	(0.41)	(-0.15)
Constant	-0.093**	-0.16**	-0.29	-0.41	-0.091**	-0.16**	-0.28	-0.44
	(-2.19)	(-2.07)	(-1.18)	(-0.99)	(-2.26)	(-2.12)	(-1.18)	(-1.13)
N (meetings)	90	90	90	90	90	90	90	90
R^2	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00

Table I. Review of the Fed put in stock returns and target changes (continued)

Panel C reports regressions of FFR target changes between meeting $m-1$ and m on quintiles of the intermeeting excess stock return (column 2) and on the stock return put rx_m^- (column 3). The sample period is 1994–2008.

Panel C. The Fed put in target changes, one-period changes			
	(1)	(2)	(3)
	Dependent variable: $\Delta\text{FFR}_m = \text{FFR}_m - \text{FFR}_{m-1}$		
ΔFFR_{m-1}	0.41***	0.36***	0.25***
	(4.63)	(5.06)	(3.15)
ΔFFR_{m-2}	0.30***	0.29***	0.33***
	(2.72)	(2.75)	(3.02)
Dummy (rx_m in qtile 1)		-0.027	
		(-0.32)	
Dummy (rx_{m-1} in qtile 1)		-0.21***	
		(-2.86)	
rx_m^-			0.019**
			(2.17)
rx_{m-1}^-			0.027***
			(4.60)
Constant	-0.015	0.039**	0.074***
	(-0.62)	(2.10)	(3.34)
N (meetings)	120	120	120
R^2	0.35	0.43	0.51

Table II. Ability of the stock market put and macroeconomic indicators to predict FFR target changes

The table reports estimates of regressions (1) and (2). The incremental R^2 is the difference between the R^2 from regression (1) and (2). The p-values are for the F-test of the null hypothesis H_0: $\delta_1 = \delta_2 = 0$. The sample period is 1996:10–2008:12.

Indicator	Bloomberg ticker	Incremental R^2	p-value
Stock market put, rx^-		0.182	<0.0001
Philadelphia Fed.	OUTFGAF Index	0.159	<0.0001
ISM Manufacturing	NAPMPMI Index	0.110	0.0001
ISM Non-Manufacturing	NAPMNMI Index	0.096	0.0005
Housing Starts	NHSPSTOT Index	0.091	0.001
Industrial Production	IP CHNG Index	0.087	0.001
Consumer Confidence	CONCCONF Index	0.075	0.003
Change in Manufact. Payrolls	USMMMNCH Index	0.061	0.010
Import Price Index (MoM)	IMP1CHNG Index	0.060	0.010
New Home Sales	NHSLTOT Index	0.054	0.016
Change in Nonfarm Payrolls	NFP TCH Index	0.053	0.018
Chicago Purchasing Manager	CHPMINDX Index	0.052	0.019
U. of Michigan Confidence	CONSSENT Index	0.050	0.023
Capacity Utilization	CPTICHNG Index	0.049	0.024
Consumer Price Index NSA	CPURNSA Index	0.049	0.025
Leading Indicators	LEI CHNG Index	0.047	0.030
Avg Hourly Earning MOM Prod	USHETOT% Index	0.045	0.034
Producer Price Index (MoM)	PPI CHNG Index	0.041	0.047
Avg Weekly Hours Production	USWHTOT Index	0.032	0.088
Unemployment Rate	USURTOT Index	0.031	0.099
Domestic Vehicle Sales	SAARDTOT Index	0.027	0.115
GDP QoQ (Annualized)	GDP CQOQ Index	0.027	0.130
Initial Jobless Claims	INJCJC Index	0.027	0.137
Consumer Price Index (MoM)	CPI CHNG Index	0.022	0.195
Personal Income	PITLCHNG Index	0.020	0.229
Business Inventories	MTIBCHNG Index	0.015	0.331
CPI Ex Food & Energy (MoM)	CPUPXCHG Index	0.014	0.345
Personal Spending	PCE CRCH Index	0.012	0.398
Current Account Balance	USCABAL Index	0.012	0.417
Factory Orders	TMNOCHNG Index	0.008	0.560
Nonfarm Productivity	PRODNFR% Index	0.007	0.600
Employment Cost Index	ECI SA% Index	0.006	0.660
Trade Balance	USTBTOT Index	0.005	0.675
Consumer Credit	CICRTOT Index	0.005	0.697
Unit Labor Costs	COSTNFR% Index	0.005	0.694
Monthly Budget Statement	FDDSSD Index	0.005	0.719
Durable Goods Orders	DGNOCHNG Index	0.004	0.752
Wholesale Inventories	MWINCHNG Index	0.002	0.850

Table III. Predicting negative and positive stock market phrases in the FOMC minutes by intermeeting stock market excess returns (manual coding)

The table presents regressions of counts of positive and negative stock market phrases on intermeeting stock market returns. The regressions are estimated at the frequency of FOMC meetings, i.e. counts of the m-th meeting are regressed on the latest intermeeting stock market excess return, rx_m. rx_m is the excess return realized between one day after the previous FOMC meeting ($m-1$-st meeting) to two days before the current meeting (m-th meeting); thus rx_m excludes returns realized from day -2 and $+1$ around FOMC meetings. rx^-_{m-1} denotes the negative portion of the intermeeting return, $rx^-_m = \min(rx_m, 0)$, and rx^+_m denotes the positive portion of the intermeeting return, $rx^-_m = \max(rx_m, 0)$. The results are based on manual coding of the positive and negative stock market phrases.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Negative stock market phrases				Positive stock market phrases			
Sample:	1994-2016	1994-2016	1994-2008	2009-2016	1994-2016	1994-2016	1994-2008	2009-2016
rx_m	-0.30***				0.22***			
	(-6.10)				(5.87)			
rx_{m-1}	-0.12***				0.082***			
	(-5.59)				(3.52)			
rx_{m-2}	-0.060**				0.021			
	(-2.56)				(0.89)			
rx^-_m		-0.37***	-0.32**	-0.72***		0.086**	0.059**	0.27***
		(-3.00)	(-2.51)	(-4.70)		(2.31)	(2.20)	(3.37)
rx^-_{m-1}		-0.20***	-0.24***	-0.011		0.011	0.0056	-0.00025
		(-7.68)	(-7.27)	(-0.23)		(0.37)	(0.28)	(-0.00)
rx^-_{m-2}		-0.068*	-0.15**	0.021		0.050	0.077*	0.0066
		(-1.81)	(-2.29)	(0.47)		(1.36)	(1.91)	(0.24)
rx^+_m		-0.19***	-0.22***	-0.10**		0.41***	0.30***	0.46***
		(-2.91)	(-3.05)	(-2.37)		(7.40)	(7.42)	(5.31)
rx^+_{m-1}		0.032	0.033	-0.050		0.25***	0.20***	0.24***
		(0.65)	(0.59)	(-0.83)		(4.55)	(2.90)	(3.26)
rx^+_{m-2}		0.023	0.022	-0.048		0.066*	0.038	0.040
		(0.46)	(0.31)	(-0.96)		(1.74)	(1.14)	(0.75)
Constant	2.01***	0.93**	0.60	1.68***	2.06***	0.84**	0.80***	1.73***
	(10.00)	(2.12)	(1.23)	(5.46)	(11.24)	(2.41)	(3.53)	(4.10)
N (meetings)	184	184	120	64	184	184	120	64
R^2	0.49	0.52	0.57	0.65	0.38	0.47	0.43	0.56

Table IV. Predicting target changes with positive and negative stock market phrases

The table presents regressions of FFR target changes between meetings $m-1$ and m, ΔFFR_m, on counts of positive and negative stock-market phrases appearing in FOMC documents of meeting m and $m-1$. The sample period is 1994–2008. One observation is lost due the use of lagged stock-market counts in minutes documents, which are available from 1994.

Panel A. Minutes, manual coding

	(1) All	(2) Staff	(3) Partic.	(4) Desc	(5) Nondesc
ΔFFR_{m-1}	0.26**	0.31***	0.30**	0.33***	0.28**
	(2.31)	(2.98)	(2.48)	(3.21)	(2.49)
ΔFFR_{m-2}	0.26*	0.28*	0.23	0.31**	0.22
	(1.90)	(1.93)	(1.64)	(2.22)	(1.62)
$\#\text{Stocks}^-_m$	-0.024**	-0.039	-0.030**	-0.059**	-0.031**
	(-2.11)	(-1.61)	(-2.08)	(-2.22)	(-2.15)
$\#\text{Stocks}^-_{m-1}$	-0.038***	-0.075***	-0.050***	-0.076***	-0.042**
	(-2.95)	(-2.85)	(-2.58)	(-2.85)	(-2.16)
$\#\text{Stocks}^+_m$	-0.016	-0.028	0.011	-0.046**	0.010
	(-1.47)	(-1.27)	(0.50)	(-2.10)	(0.55)
$\#\text{Stocks}^+_{m-1}$	0.0035	0.0086	0.0038	0.028	-0.011
	(0.23)	(0.44)	(0.14)	(1.30)	(-0.47)
Constant	0.099*	0.093*	0.027	0.086	0.048
	(1.88)	(1.91)	(0.68)	(1.62)	(1.09)
N (meetings)	119	119	119	119	119
R^2	0.47	0.46	0.42	0.48	0.43

Panel B. Minutes and transcripts, algorithm-based coding

	(1)	(2) Minutes	(3)	(4)	(5) Transcripts	(6)
	All	Staff	Partic.	All	Staff	Partic.
ΔFFR_{m-1}	0.22**	0.32***	0.22**	0.26**	0.34***	0.30**
	(2.38)	(3.57)	(2.25)	(2.27)	(2.90)	(2.25)
ΔFFR_{m-2}	0.20	0.23	0.21	0.24*	0.28**	0.21
	(1.44)	(1.52)	(1.59)	(1.94)	(1.96)	(1.48)
$\#\text{Stocks}^-_m$	-0.031	-0.049	-0.050**	-0.0094	-0.061**	-0.0064
	(-1.59)	(-1.20)	(-2.25)	(-1.44)	(-2.24)	(-1.58)
$\#\text{Stocks}^-_{m-1}$	-0.048**	-0.065	-0.071***	-0.019***	-0.0080	-0.025***
	(-2.57)	(-1.61)	(-3.37)	(-3.18)	(-0.74)	(-4.27)
$\#\text{Stocks}^+_m$	-0.021	-0.037	0.0033	-0.00040	0.018	-0.0045
	(-1.15)	(-1.17)	(0.24)	(-0.09)	(1.59)	(-0.63)
$\#\text{Stocks}^+_{m-1}$	0.0067	0.025	-0.0014	0.0068	0.020	-0.00036
	(0.49)	(0.90)	(-0.12)	(1.12)	(1.14)	(-0.04)
Constant	0.11**	0.070	0.057*	0.063	0.013	0.077
	(2.23)	(1.60)	(1.76)	(1.50)	(0.43)	(1.62)
N (meetings)	119	119	119	119	119	119
R^2	0.48	0.43	0.46	0.47	0.46	0.46

Table V. Economic content of stock market mentions in FOMC minutes

The table describes the economic content of the stock market related mentions in FOMC minutes. Stock market mentions that are not purely descriptive are assigned into categories for the mechanism through which the stock market affects the economy. We report the number of stock market mentions by category and FOMC minutes sections. The sample period is 1994–2016.

	Staff Review of Economic Situation	Staff Review of Financial Situation	Staff Economic Outlook	Particip. Views	Committee Policy Action	Other	**Total**
Descriptive	4	491	10	11	1	34	**551**
Consumption	72	0	43	150	0	0	**265**
Investment	2	2	1	29	0	0	**34**
Financial conditions	0	0	0	40	4	0	**44**
Causal, no mechanism	3	3	11	12	6	2	**37**
Demand	0	1	5	9	0	0	**15**
Economic outlook	0	1	0	12	0	0	**13**
Financial stability	0	2	0	5	0	0	**7**
Other	0	3	0	4	1	9	**17**
Total	**81**	**503**	**70**	**272**	**12**	**45**	**983**

Table VI. Algorithmic coding of economic content of stock-market mentions in FOMC minutes

The table shows counts of phrases related to economic conditions that occur within the same paragraph (# in par.) and within the same section (# in sec.) in which a stock market phrase is mentioned. Stock market phrases and paragraphs are obtained by manual searches within FOMC minutes over the 1994–2016 sample period. The odds ratio is defined as (# phrase i in paragraph mentioning stocks / # all phrases in paragraph mentioning stocks) / (# phrase i in section / # all phrases in section). We display only phrases that occur 20 times or more in the same paragraph as a stock market phrase.

Phrase	(1) # in par.	(2) # in sec.	(3) Ratio (1)/(2)	(4) Odds ratio
Staff Review of Economic Situation				
disposable income	39	69	0.57	6.82
consumer sentiment	50	111	0.45	5.44
personal consumption expenditure*	34	112	0.30	3.66
retail sales	34	141	0.24	2.91
pce	44	206	0.21	2.58
consumer spending	50	235	0.21	2.57
motor vehicle*	70	591	0.12	1.43
Staff Review of Financial Situation				
un(employment)	30	56	0.54	1.81
oil prices	20	43	0.47	1.57
economic activity	32	70	0.46	1.55
economic outlook	22	60	0.37	1.24
inflation	114	495	0.23	0.78
economic growth	29	129	0.22	0.76
Staff Economic Outlook				
wealth effect*	21	22	0.95	3.76
final demand	24	27	0.89	3.50
exports	31	67	0.46	1.82
labor market*	21	53	0.40	1.56
business investment	26	69	0.38	1.49
potential output	28	78	0.36	1.42
economic activity	62	178	0.35	1.37
consumer spending	24	85	0.28	1.11
real gdp	66	291	0.23	0.89
gdp growth	32	167	0.19	0.76
un(employment)	32	180	0.18	0.70
inflation	71	547	0.13	0.51
Participants' Views				
wealth effect*	23	30	0.77	5.68
consumer expenditures	32	58	0.55	4.09
consumer confidence	63	126	0.50	3.70
consumer sentiment	31	62	0.50	3.70
retail sales	39	82	0.48	3.52
consumer spending	187	430	0.43	3.22
motor vehicle*	47	114	0.41	3.05
consumption	22	63	0.35	2.59
house prices	20	83	0.24	1.79
economic expansion	26	129	0.20	1.49
household* spending	20	100	0.20	1.48
housing activity	20	106	0.19	1.40
aggregate demand	22	121	0.18	1.35
business investment	38	243	0.16	1.16
productivity	54	356	0.15	1.12
economic activity	62	505	0.12	0.91
energy prices	28	276	0.10	0.75
economic growth	33	372	0.09	0.66
exports	22	256	0.09	0.64
economic outlook	29	365	0.08	0.59
labor market*	51	674	0.08	0.56
un(employment)	73	993	0.07	0.54
inflation	128	2404	0.05	0.39

Table VII. Impact of stock market on Federal Reserve growth, unemployment and inflation expectations (Greenbook forecasts)

The table reports regressions of updates to Greenbook expectations of macroeconomic variables on intermeeting stock market returns. Updates are relative to expectations in prior Greenbook for same calendar quarter, i.e., for a variable Z an update is defined as $E_m^{GB}(Z_{qi}) - E_{m-1}^{GB}(Z_{qi})$, where qi is a particular calendar quarter (q0 is the current quarter, q1 is the next quarter relative to meeting m, etc.); $E_m^{GB}(\cdot)$ denotes a Greenbook forecast at meeting m. Core CPI expectations data start in 1986. All specifications include one lag of the dependent variable and a constant (not reported). Intermeeting returns are in decimals.

	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A. Real GDP growth forecast update					
	1994–2010					1982:9-1993
	q0	q1	q2	q3	q0+q1+q2+q3	q0+q1+q2+q3
rx_m^-	0.86	1.41**	1.61***	1.10***	5.06***	2.33
	(1.24)	(2.30)	(3.96)	(3.77)	(2.98)	(1.40)
rx_{m-1}^-	1.99***	1.71***	0.71**	0.06	4.61***	-0.39
	(3.54)	(3.19)	(2.53)	(0.15)	(3.94)	(-0.19)
rx_m^+	-0.17	0.85	0.42	0.83***	1.95	2.18
	(-0.26)	(1.47)	(1.19)	(2.84)	(1.28)	(1.39)
rx_{m-1}^+	0.57	0.42	0.30	0.83**	2.01	2.2
	(0.77)	(0.78)	(0.95)	(2.60)	(1.50)	(1.26)
Lag of dept. var.	Y	Y	Y	Y	Y	Y
N (meetings)	136	136	136	136	136	90
R^2	0.19	0.37	0.33	0.31	0.38	0.11
	Panel B. Unemployment rate forecast update					
	1994–2010					1982:9-1993
	q0	q1	q2	q3	q0+q1+q2+q3	q0+q1+q2+q3
rx_m^-	-0.87**	-1.41***	-2.09***	-2.67***	-7.00***	-2.90
	(-2.35)	(-3.15)	(-4.04)	(-4.91)	(-4.09)	(-1.01)
rx_{m-1}^-	-0.90**	-1.75***	-1.78***	-1.89***	-6.16***	-3.61
	(-2.49)	(-2.83)	(-2.82)	(-2.91)	(-2.87)	(-0.97)
rx_m^+	-0.05	-0.24	-0.20	-0.49	-1.02	2.48
	(-0.10)	(-0.48)	(-0.39)	(-0.80)	(-0.57)	(0.61)
rx_{m-1}^+	0.50	0.78	0.54	0.56	2.37	-0.36
	(0.89)	(1.16)	(0.69)	(0.67)	(0.89)	(-0.09)
Lag of dept. var.	Y	Y	Y	Y	Y	Y
N (meetings)	136	136	136	136	136	90
R^2	0.11	0.29	0.34	0.37	0.32	0.06
	Panel C. Update to inflation forecast					
	1994–2010, q0+q1+q2+q3			1982:9–1993, q0+q1+q2+q3		
	GDP defl.	CPI	Core CPI	GDP defl.	CPI	Core CPI
rx_m^-	0.52	3.84***	1.08**	-0.25	0.11	0.47
	(1.62)	(3.23)	(2.10)	(-0.40)	(0.06)	(0.27)
rx_{m-1}^-	0.43	0.43	0.38	1.19**	-0.81	-0.64
	(0.57)	(0.26)	(0.57)	(2.53)	(-0.89)	(-0.77)
rx_m^+	-0.93	-2.72**	-1.01	-0.65	-3.26**	-0.87
	(-1.47)	(-2.31)	(-1.59)	(-0.77)	(-2.51)	(-0.85)
rx_{m-1}^+	-1.166**	-0.333	-0.537	-0.622	0.832	1.165
	(-2.11)	(-0.27)	(-0.92)	(-0.87)	(0.53)	(0.99)
Lag of dept. var.	Y	Y	Y	Y	Y	Y
N (meetings)	136	136	136	90	90	62
R^2	0.05	0.25	0.13	0.12	0.17	0.12

Table VIII. Impact of stock market on Federal Reserve growth, unemployment and inflation expectations (SPF forecasts)

The excess stock return is defined using the period from (including) the last SPF survey deadline date and up (including) to the day before the current SPF survey deadline. Thus, rx_t denotes an inter-survey stock excess return. There are four SPF surveys per year, corresponding to every other FOMC meeting, with SPF deadlines on average 11 days after the FOMC meeting over the 1994–2016 period but with quite wide variation from −19 to +27 days. T-statistics (in parentheses) are robust to heteroscedasticity. Intermeeting excess returns are expressed in decimals.

	(1)	(2)	(3)
	Forecast update, q0+q1+q2+q3		
	Real GDP growth	Unemployment rate	Inflation (GDP deflator)
rx_t^-	4.55***	-3.23***	0.36
	(3.11)	(-5.10)	(1.08)
rx_{t-1}^-	4.67***	-2.02***	1.57
	(5.12)	(-3.43)	(1.58)
rx_t^+	1.62	0.69	-0.74
	(1.60)	(1.27)	(-1.52)
rx_{t-1}^+	0.17	0.79	-0.48
	(0.21)	(1.58)	(-0.85)
Lag of dept. var.	0.08	-0.18**	0.16
	(0.71)	(-2.11)	(1.55)
Constant	-0.004	-0.19***	0.037
	(-0.05)	(-4.42)	(0.86)
N (quarters)	92	92	92
R^2	0.54	0.54	0.16

Table IX. Predictive power of stock market for realized macro variables

The table presents predictive regressions of realized macro variables (four-quarter growth rates or changes) on lagged positive and negative stock market realizations. Real GDP data are from NIPA Table 1.1.1. The unemployment rate is the seasonally adjusted series for individuals 16 years and over from the Bureau of Labor Statistics. The GDP deflator is from NIPA Table 1.1.4. The regressions are estimated at the quarterly frequency. HAC t-statistics are in parentheses.

	Real GDP growth q0+q1+q2+q3			Unemployment rate change q0+q1+q2+q3		
	1994-2016	1947-1993	1947-2016	1994-2016	1948-1993	1948-2016
rx_t^-	10.11**	13.84***	13.00***	-7.21***	-7.39***	-7.92***
	(2.54)	(2.91)	(3.66)	(-2.69)	(-2.68)	(-3.70)
rx_t^+	5.55**	9.44**	8.06***	-1.79	-1.22	-1.12
	(1.97)	(2.18)	(2.60)	(-1.06)	(-0.47)	(-0.65)
Lag of q0-value	1.04***	0.41**	0.54***	1.50***	0.45*	0.64***
of dept. var.	(3.62)	(1.98)	(2.84)	(4.67)	(1.82)	(2.73)
Constant	1.79***	3.17***	2.76***	-0.14	-0.07	-0.13
	(4.67)	(7.02)	(8.17)	(-0.86)	(-0.36)	(-0.91)
N (quarters)	89	186	275	89	182	271
R^2	0.32	0.13	0.15	0.42	0.10	0.16

	Inflation (GDP deflator) q0+q1+q2+q3		
	1994-2016	1947-1993	1947-2016
rx_t^-	0.039*	-0.048	-0.012
	(1.92)	(-1.49)	(-0.48)
rx_t^+	-0.02	-0.004	-0.007
	(-1.35)	(-0.14)	(-0.36)
Lag of q0-value	1.61***	2.59***	2.76***
of dept. var.	(4.56)	(7.18)	(8.48)
Constant	0.013***	0.01***	0.01***
	(7.58)	(3.54)	(3.88)
N (quarters)	89	186	275
R^2	0.34	0.56	0.59

Table X. Components of GDP: Comparing impact of stock market on Greenbook, SPF, and realized values

Panel A reports regressions of Greenbook and SPF forecasts updates for the GDP growth components on stock market returns. Greenbook regressions are estimated at the frequency of scheduled FOMC meetings, while SPF regressions are estimated at the quarterly frequency. Panel B presents predictive power of the stock market for the realized growth rates of GDP components. Y refers to GDP, C to consumption, $I_{bus.fixed}$ is business fixed investment; I_{res} is residential investment and I_{tot} is total investment. HAC t-statistics are in parentheses.

Panel A. Growth rate forecast update, q0+q1+q2+q3

	Federal Reserve, Greenbook 1994-2010				Private sector, SPF 1994-2016			
	(1) Y	(2) C	(3) $I_{bus.fixed}$	(4) I_{res}	(5) Y	(6) C	(7) $I_{bus.fixed}$	(8) I_{res}
rx_t^-	5.06***	2.72***	23.77***	16.26	4.56***	2.53***	21.18***	6.67
	(2.98)	(3.20)	(3.24)	(1.46)	(3.13)	(2.73)	(4.60)	(0.79)
rx_{t-1}^-	4.61***	2.55**	12.97***	-6.33	4.68***	3.31***	7.45*	11.53***
	(3.94)	(2.22)	(2.70)	(-0.87)	(5.15)	(4.15)	(1.80)	(3.34)
rx_t^+	1.95	1.53	0.95	7.31	1.63	1.57*	-1.74	8.47
	(1.28)	(1.26)	(0.14)	(0.66)	(1.61)	(1.88)	(-0.49)	(1.66)
rx_{t-1}^+	2.01	2.301**	0.71	16.18	0.14	-0.37	3.01	-6.33
	(1.50)	(2.41)	(0.11)	(1.27)	(0.17)	(-0.47)	(0.91)	(-1.36)
Lag of dept. var.	-0.105	-0.098	0.043	0.013	0.08	0.11	0.29*	0.51***
	(-1.12)	(-0.73)	(0.42)	(0.11)	(0.72)	(0.94)	(1.97)	(5.73)
Constant	0.03	0.02	0.52	-0.76	0.00	0.03	0.44	-0.05
	(0.38)	(0.51)	(1.48)	(-1.29)	(-0.02)	(0.45)	(1.40)	(-0.10)
N (meetings)	136	136	136	136	93	93	93	93
R^2	0.38	0.21	0.31	0.07	0.54	0.40	0.54	0.46

Panel B: Realized growth rates (NIPA data), q0+q1+q2+q3

	(1) Y	(2) C	(3) I_{total}	(4) $I_{bus.fixed}$	(5) I_{res}
			1994-2016		
rx_t^-	10.11**	1.324	52.73**	42.09***	-5.32
	(2.54)	(0.53)	(2.32)	(2.87)	(-0.27)
rx_t^+	5.55**	7.96***	27.66*	10.98	46.07**
	(1.97)	(3.02)	(1.86)	(1.10)	(2.27)
Lag of q0-value	1.04***	2.08***	0.53*	1.56***	1.79***
of dept. var.	(3.78)	(7.33)	(1.74)	(6.04)	(5.34)
Constant	1.79***	1.01***	3.28**	3.08***	-1.39
	(5.20)	(2.97)	(2.04)	(2.88)	(-0.85)
N (quarters)	89	89	89	89	89
R^2	0.32	0.47	0.24	0.42	0.37
			1947-2016		
rx_t^-	13.00***	7.33***	58.06***	49.17***	15.03
	(3.66)	(2.68)	(3.17)	(5.10)	(0.80)
rx_t^+	8.06***	6.62**	35.14**	-5.22	88.20***
	(2.60)	(2.10)	(2.24)	(-0.63)	(3.76)
Lag of q0-value	0.54***	0.48*	0.02	0.70***	0.76***
	(2.84)	(1.77)	(0.12)	(3.30)	(3.59)
Constant	2.76***	2.85***	5.45***	5.19***	-0.20
	(8.17)	(7.81)	(3.94)	(6.09)	(-0.12)
N (quarters)	275	275	275	275	275
R^2	0.15	0.11	0.10	0.18	0.17

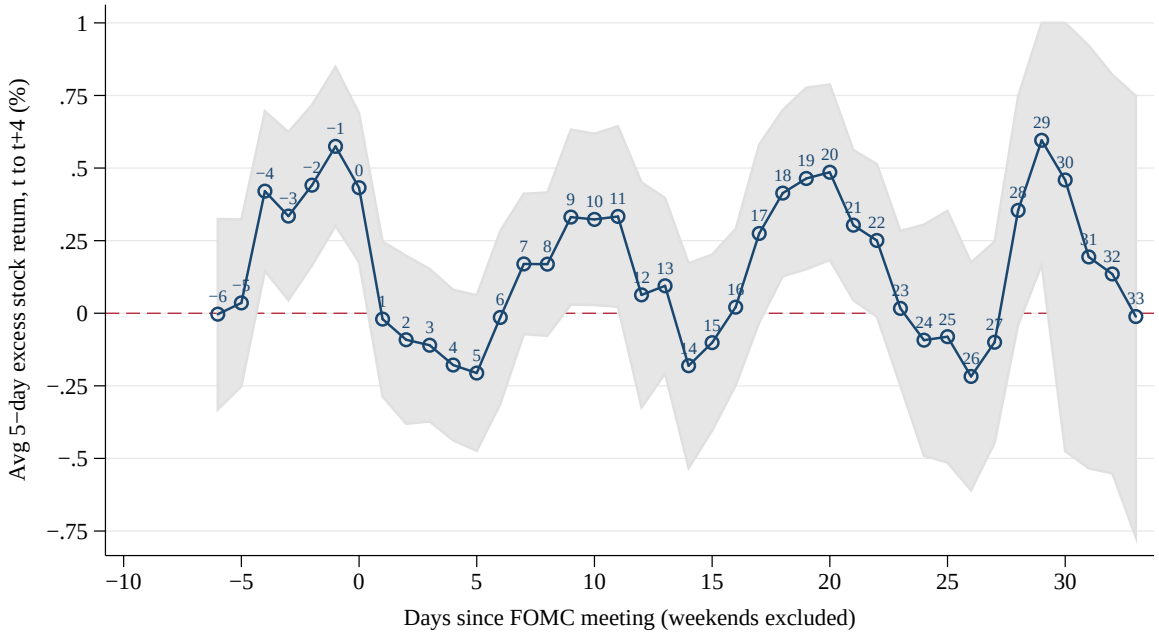
Table XI. Taylor rules

The table presents estimates of different specifications of Taylor rules. $E_m^{GB}(\cdot)$ denotes Greenbook expectations for real GDP growth (current quarter $g_{m,q0}$), inflation (GDP deflator, next quarter, $\pi_{m,q1}$) and unemployment rate (next quarter, $u_{m,q1}$). The horizons for Greenbook expectations are chosen by AIC. $\overline{\Delta E_m^{GB}}(g_{m,q0,3})$ is the average expectations update of real GDP growth rate between previous and current meeting, $\overline{\Delta E_m^{GB}}(g_{m,q0,3}) = \sum_{i=0}^{3}[E_m^{GB}(g_{m,qi}) - E_{m-1}^{GB}(g_{m-1,qi})]/4$. $\#\text{Econ.cond.}_m^{-(+)}$ and $\#\text{Infl.cond.}_m^{-(+)}$ denote the number of negative (positive) phrases related to economic growth and inflation, respectively, and are obtained from FOMC minutes. The sample period is 1994–2008. HAC t-statistics are in parentheses.

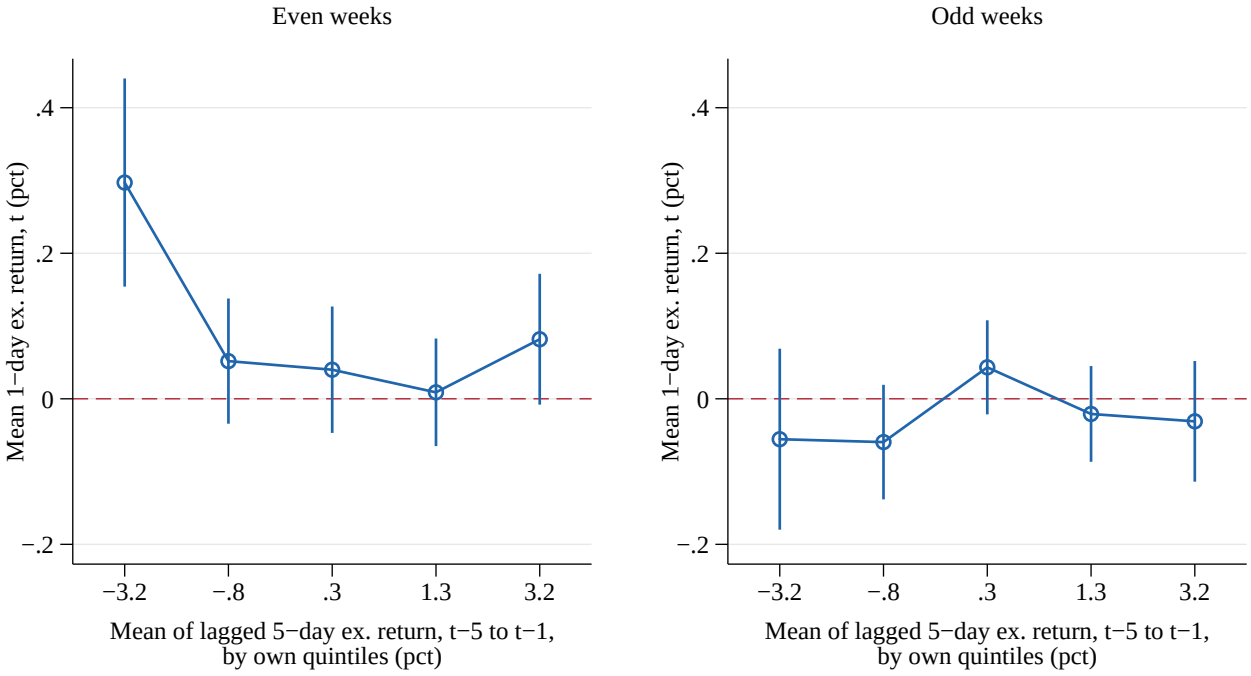
	(1)	(2)	(3)	(4)	(5)	(6)
ΔFFR_{m-1}	0.25***	0.055	0.034	0.17**	0.14*	0.0064
	(3.15)	(0.53)	(0.33)	(2.13)	(1.76)	(0.07)
ΔFFR_{m-2}	0.33***	0.24**	0.25**	0.28**	0.31***	0.26***
	(3.02)	(2.33)	(2.57)	(2.39)	(2.95)	(2.82)
$E_m^{GB}(g_{m,q0})$		0.093***	0.084***			0.067***
		(4.46)	(3.91)			(2.95)
$E_m^{GB}(\pi_{m,q1})$		0.078***	0.065**			0.059*
		(2.88)	(2.20)			(1.93)
$E_m^{GB}(u_{m,q1})$		0.058**	0.059**			0.085***
		(2.49)	(2.32)			(3.21)
$\overline{\Delta E_m^{GB}}(g_{m,q0,3})$		0.16***	0.11*			0.11*
		(3.24)	(1.68)			(1.76)
$\#\text{Econ.cond.}_m^-$				-0.026***	-0.019**	-0.011
				(-3.70)	(-2.43)	(-1.25)
$\#\text{Econ.cond.}_m^+$				0.011**	0.005	0.0020
				(2.42)	(1.02)	(0.47)
$\#\text{Infl.cond.}_m^-$				0.0065	0.006*	0.010***
				(1.58)	(1.79)	(2.92)
$\#\text{Infl.cond.}_m^+$				0.000	0.003	0.0096
				(-0.03)	(0.48)	(1.63)
rx_m^-	0.019**		0.0077		0.014*	0.0047
	(2.17)		(1.01)		(1.74)	(0.69)
rx_{m-1}^-	0.027***		0.013**		0.018**	0.012*
	(4.60)		(2.11)		(2.32)	(1.83)
Constant	0.074***	-0.69***	-0.62***	-0.030	0.040	-0.79***
	(3.34)	(-3.60)	(-3.24)	(-0.38)	(0.51)	(-3.84)
N (meetings)	120	120	120	120	120	120
R^2	0.51	0.61	0.63	0.52	0.58	0.67

Figure 1. Review of the Fed put

Panel A. Stock excess returns over the FOMC cycle (1994–2016)



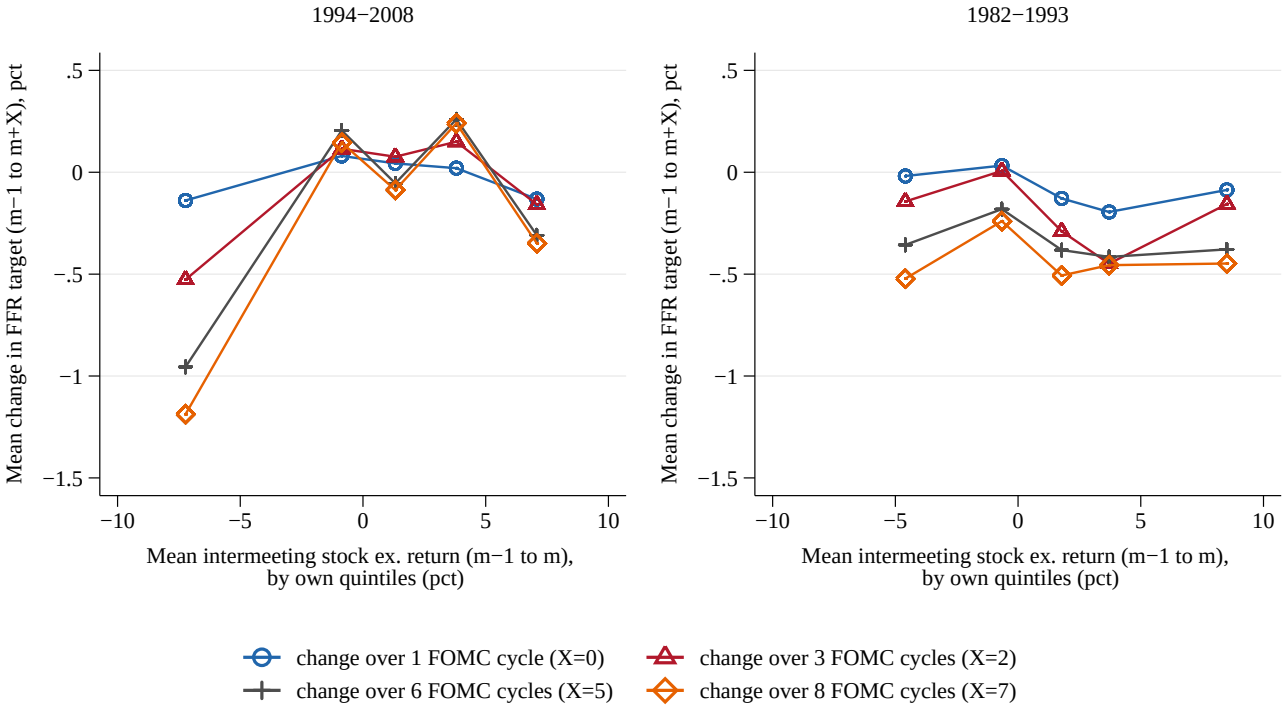
Panel B. The even-week put pattern in stock excess returns (1994–2016)



Panel A plots an average 5-day excess return (from day t to day $t+4$) against day t of the FOMC cycle. The shaded area represents a 90% bootstrapped confidence interval. Panel B displays average excess stock return on day t as a function of average 5-day excess return from day $t-5$ to $t-1$ for even versus odd weeks in FOMC cycle time. Daily returns are sorted into five buckets based on quintiles of past returns (quintiles are defined without conditioning on the FOMC cycle time). Within each bucket, we calculate the average of the day t return (y axis) and the average of the lagged 5-day return (x axis).

Figure 1. Review of the Fed put (continued)

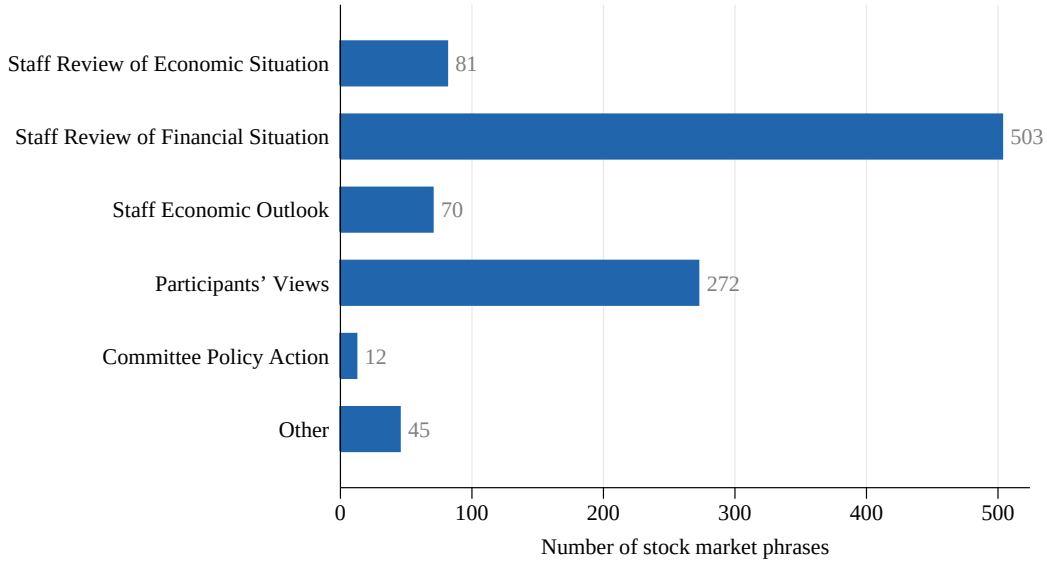
Panel C. Changes in FFR target conditional on intermeeting stock excess returns



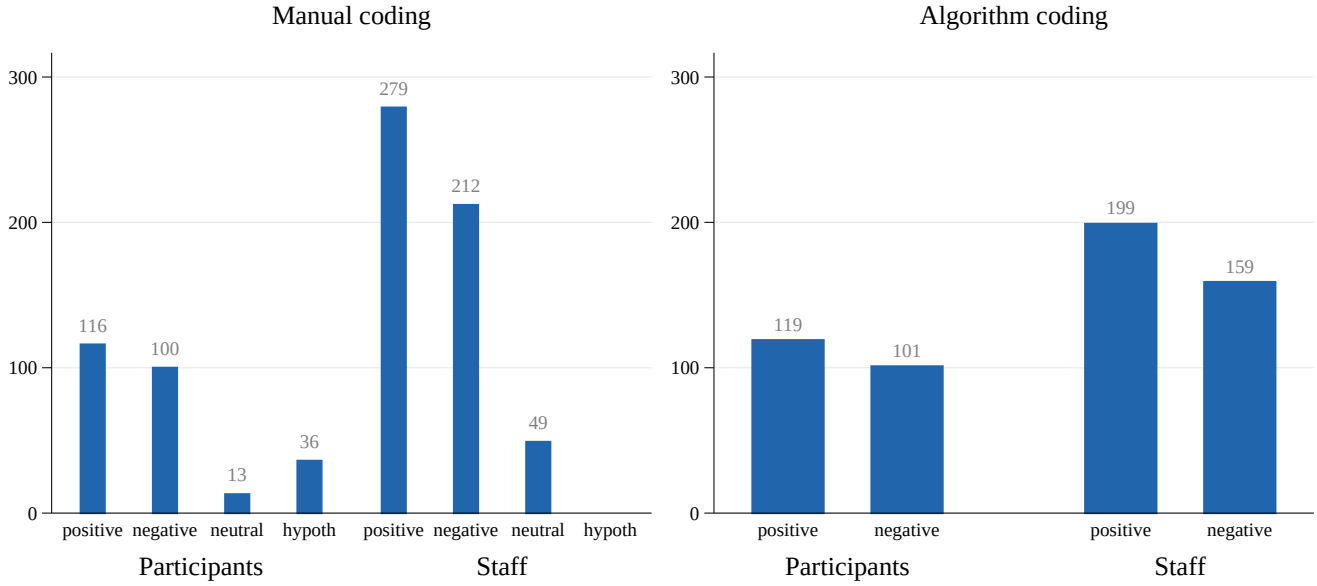
Panel C plots the change in FFR target against quintiles of intermeeting stock excess returns. The intermeeting excess return is defined as the excess return from day 1 of cycle $m-1$ to day -2 of cycle m. We define 5 quintiles based on this variable. The average cumulative FFR target change from day 0 of cycle $m-1$ to day 0 of cycle $m+7$ (approximately a one-year period) is plotted as a function of the intermeeting excess return.

Figure 2. Summary statistics for stock market counts in FOMC minutes (1994–2016)

Panel A. Counts by section of the minutes



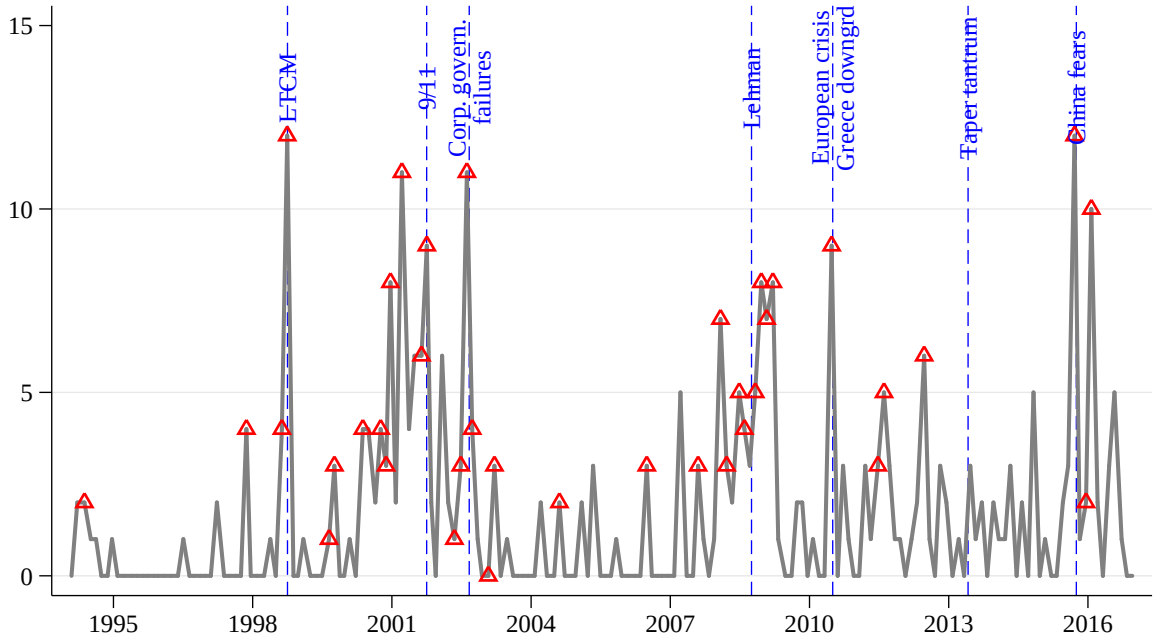
Panel B. Positive/negative counts by staff and participants



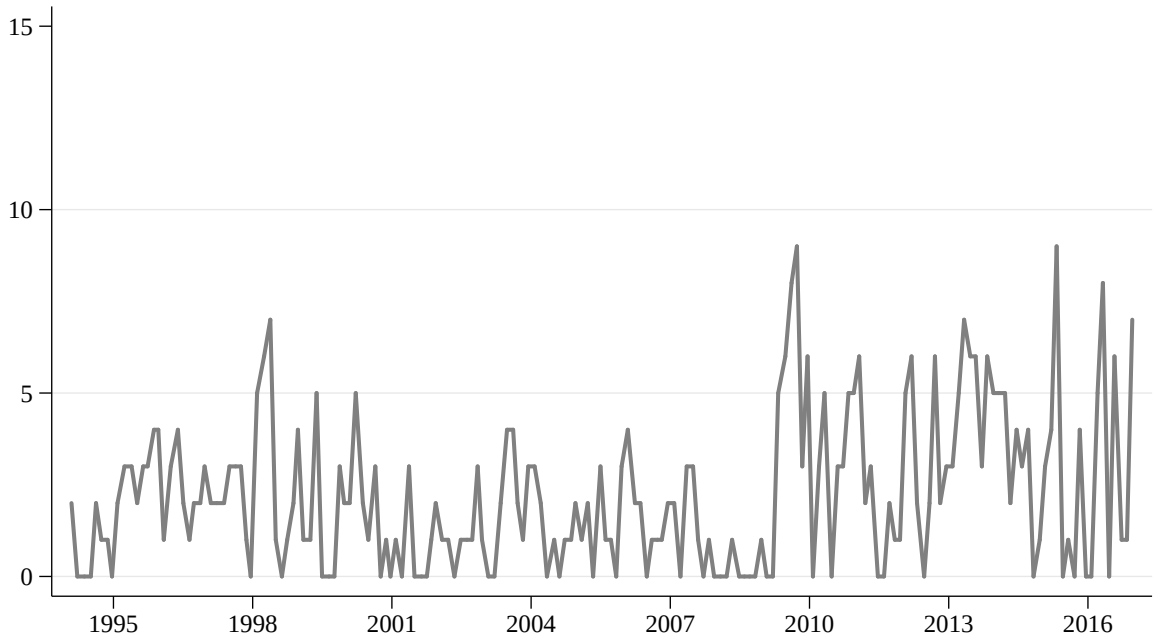
Panel A reports the number of stock market phrases, by section of the FOMC minutes. Panel B presents the total number of positive and negative stock market phrases, split by participants and staff, respectively. The left graph is based on manual coding of the phrases, and the right graph on the algorithm-based coding. The sample period is 1994–2016.

Figure 3. Time series of positive and negative stock market phrases in FOMC minutes

Panel A. Negative phrases count

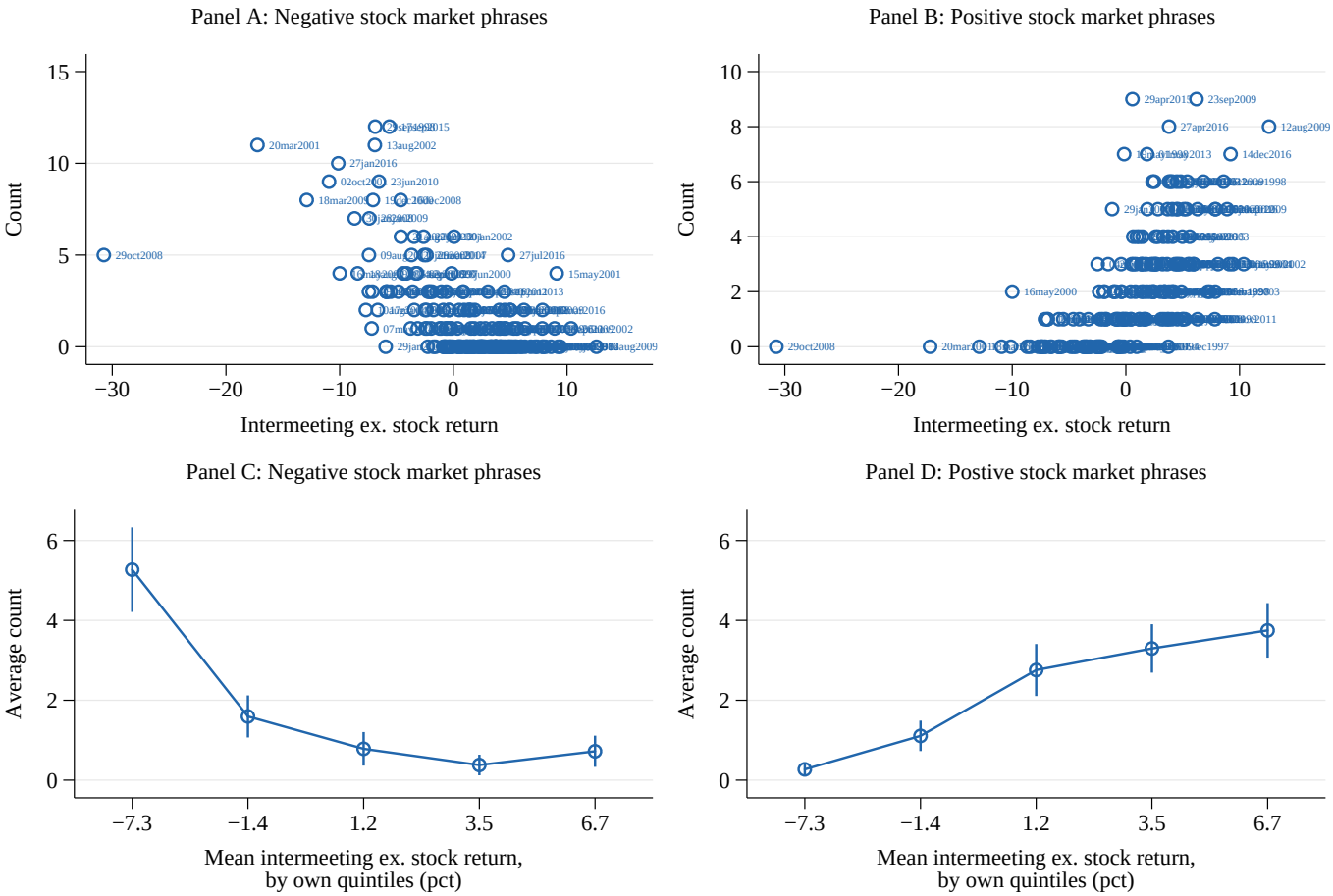


Panel B. Positive phrases count



The figure presents the time series of negative and positive stock market phrases in FOMC minutes based on manual coding. The sample period is 1994–2016. The triangles in Panel A indicate FOMC meetings that were preceded by intermeeting stock market returns in the lowest quintile.

Figure 4. Impact of intermeeting stock returns on negative and positive stock market phrases in FOMC meetings



The figure presents nonparametrically the relationship between intermeeting stock market excess returns and number of positive and negative stock market mentions in FOMC minutes. The bottom panels present the average count of positive and negative stock market phrases conditional on the quintiles of intermeeting stock market excess returns (x-axis labels report the average intermeeting return within a given quintile). The sample period is 1994–2016. The results are based on manual coding of the minutes content.

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Appendix for
The Economics of the Fed Put

A.I. Details on the algorithm-based textual analysis

We develop an algorithm to search for positive and negative phrases associated with economic and financial conditions in FOMC minutes and transcripts. We build dictionaries associated with the following categories: The stock market; financial conditions; economic growth; inflation and wages. For each category, the dictionary contains a list of noun phrases along with two groups of direction word (group 1 and 2). Word groups 1 and 2 are assigned to each of the noun phrases to form a positive or negative match. The dictionaries are available in Table A-I through Table A-IV.

All FOMC documents are downloaded from the FRB website. The documents are available in a pdf format (for transcripts) and in a pdf and web formats for the minutes and statements. We convert all documents into a txt format and use utf-8 encoding.

Below we describe the main steps in the algorithm.

Defining a sentence. In order to avoid incorrect matches that neglect the sentence structure, we apply several rules for defining a "sub-sentence." Typically one sentence contains several sub-sentences. The matching of noun phrases with direction words happens within a sub-sentence. The rules for defining a sub-sentence are as follows:

- Treat ",", ".", "!", "?", ";", "and", "as", "or", "to", "of", "after", "because", "but", "from", "if", "or", "so", "when", "where", "while", "although", "however", "though", "whereas", "so that", "despite" as the start of a new sub-sentence.
  - The need to include "as" in the above list is sentences like: "Subsequently, interest rates fell as stock prices tumbled."
  - The need to include "to" in the above list is sentences like: "adjustments in financial markets to low rates."
  - The need to include "of" in the above list is sentences like: "These negative factors might be offset to some extent by the wealth effects of the rise in stock market prices."
- Remove period marks (".") that do not indicate an end of a sentence. For example, we remove periods in abbreviations (U.S. replaced by US, a.m. by am, etc.), periods indicating decimals (e.g., "The unemployment rate rose to 9.3, but inflation went up." will be treated as as two sub-sentences separated by a comma: "The unemployment rate rose to 93, but inflation went up."), and periods indicating abbreviations of names (e.g., in transcripts "Robert P. Forrestal" will be coded as "Robert P Forrestal").

Word combinations. For every noun phrase, we allow combinations with *"rate* of, growth of, level* of, index* of, indices of"* at the beginning of the noun phrase. Then, we use those

new combinations to match group words. The direction of the combined phrase is the same as of the original phrase. For example, for "employment", we have combined phrases such as: rate of employment, level of employment and so on, which we match with group words. The direction of "rate of employment" is the same as "employment."

Ordering of words. We do not count matches in which an economic/financial phrase is followed by "reduced", "reduce", "reducing ", "boosted", "boost", "boosting", "fostered", "foster", "fostering", "encouraged", and "encourage". For example, in the sentence "Credit conditions continued to tighten for both households and businesses, and ongoing declines in equity prices further reduced household wealth", we do not count "equity prices reduced" but we do count "declines in equity prices" and "reduced household wealth."

Negative phrases without direction words. Phrases such as financial crisis, financial turmoil, inflation* pressure*, are counted as negative. These are listed separately in Table A-II and Table A-IV.

Removing descriptive words. We remove common descriptive adverbs and adjectives (e.g. "somewhat", "unusual*" , "remarkabl*", "much", "rapid*" as in "bond market rapidly improved"), and verbs ("experience*", "show", "register*" as in "Core PCE price inflation registered an increase of 1.6 percent").

Removing stop words. After making the above adjustments, we remove stop words ("a", "the", "are", "had", etc.) using the list of English language stop words (Phyton `stop_words` package) unless they appear as part of a direction phrase (e.g., we allow for matches of nouns with "mov* down", although "down" is a stop word).

Treatment of "not". We do not treat the word "not" as a stop word, and thus we keep it in the text. This avoids misclassification of cases like: "Several participants indicated that recent trends in euro-area equity indexes and sovereign debt yields had not been encouraging." We code "not" plus a group 1 word as a group 2 word (i.e., "not encouraging" is the opposite of the "encouraging"), and "not" plus a group 2 word as a group 1 word.

Stemming. We take into account different grammatical forms of words. These are marked with a "*" in our dictionary lists. For example, "decreas*" would include decrease, decreased, decreasing.

Distance parameter. A central parameter in the algorithm determines the distance between a noun phrase and a positive/negative group word. The lower this distance is, the more accurately a financial/economic phrase is classified as positive or negative but the more likely it is that no match is found. We currently use a distance of zero words, i.e. the match is found if a direction word directly precedes or follows a financial/economic phrase.

Sectioning of documents. We assign each matched phrase into a "staff" or "participants" category:

- For the minutes, the assignment is made by section of the document. We divide minutes into sections listed in Section IV of the paper. Sections 1–3 are classified as presenting the views of the staff, and sections 4–5 as presenting the views of participants. Section headings appear explicitly in the minutes from April 2009 onward. However, given

that the structure of the documents has remained essentially unchanged since the early 1990s, for the period between the start of 1994 and March 2009, we manually assign text to sections. We drop other parts of the minutes, e.g. discussions of special topics occurring only in particular meetings.

- For the transcripts, we have direct information about the speaker. A comment by a speaker starts with his/her capitalized name (e.g., CHAIRMAN GREENSPAN, MR. BROADDUS). For each meeting, we assign all governors and regional Fed presidents (who were in office at the time of the meeting) to the participants' category, and everybody else to the staff category. The names and start/end dates for the tenures of regional Fed presidents as well as members of the Board of the Governors are collected from the websites of the Federal Reserve Board and regional Federal Reserve Banks.[14]

[14] E.g., information about the membership at the Board of Governors can be accessed at: https://www.federalreserve.gov/aboutthefed/bios/board/boardmembership.htm#members.

Table A-I. Noun phrases and direction words related to the stock market

Nouns	Match w/ direction words		Direction words	
	Positive	Negative	Group 1	Group 2
asset index*	2	1	*adjust* downward*	*acceler**
asset indic*	2	1	*adverse*	*adjust* upward*
asset market*	2	1	*burst**	*advanc**
asset price index*	2	1	*contract**	*bolster**
asset price indic*	2	1	*cool**	*boost**
asset price*	2	1	*deceler**	*edge* up*
asset valu*	2	1	*declin**	*elevat**
equities	2	1	*decreas**	*encourag**
equity and home price*	2	1	*deteriorat**	*expand**
equity and home valu*	2	1	*down*	*fast**
equity and house price*	2	1	*downturn*	*favor**
equity and housing price*	2	1	*downward*	*gain**
equity index*	2	1	*downward adjust**	*go* up*
equity indic*	2	1	*downward movement*	*high**
equity market index*	2	1	*downward revision*	*improv**
equity market indic*	2	1	*drop**	*increas**
equity market price*	2	1	*eas**	*mov* high**
equity market valu*	2	1	*edge* down*	*mov* up*
equity market*	2	1	*fall**	*mov* upward*
equity price index*	2	1	*fell*	*pick* up*
equity price indic*	2	1	*go* down*	*rais**
equity price measure*	2	1	*limit**	*rallied*
equity price*	2	1	*low**	*rally**
equity valu*	2	1	*moderate**	*rebound**
financial wealth	2	1	*moderati**	*recoup**
home and equity price*	2	1	*mov* down*	*revis* up**
house and equity price*	2	1	*mov* downward*	*rise**
household wealth	2	1	*mov* lower*	*rising*
household* net worth	2	1	*plummet**	*rose*
housing and equity price*	2	1	*pressure**	*run up*
price* of risk* asset*	2	1	*pull* back*	*runup*
ratio of wealth to income	2	1	*pullback*	*stop decline*
risk* asset price*	2	1	*reduc**	*strength**
s p 500 index	2	1	*revis* down**	*strong**
stock index*	2	1	*slow**	*tick* up*
stock indic*	2	1	*slow* down*	*up*
stock market index*	2	1	*soft**	*upward*
stock market price*	2	1	*stagnate**	*upward adjust**
stock market wealth	2	1	*stall**	*upward movement*
stock market*	2	1	*strain**	*upward revision*
stock price indic*	2	1	*stress**	*went up*
stock price*	2	1	*subdu**	
stock prices index*	2	1	*take* toll on*	
stock val*	2	1	*tension**	
us stock market price*	2	1	*tick* down*	
wealth effect*	2	1	*tight**	
wealth to income ratio	2	1	*took toll on*	
			*tumbl**	
			*weak**	
			weigh on*	
			went down	
			*worse**	

Table A-II. Noun phrases and direction words related to financial conditions

Nouns	Match w/ direction words		Direction words	
	Positive	Negative	Group 1	Group 2
appetite* risk taking	2	1	*adjust* downward*	*acceler**
appetite* risk*	2	1	*adverse*	*adjust* upward*
appetite* risk* asset*	2	1	*contract**	*advanc**
appetite* risk* investment*	2	1	*cool**	*bolster**
appetite* taking risk*	2	1	*deceler**	*boost**
condition* credit market*	2	1	*declin**	*eas**
condition* financial market*	2	1	*decreas**	*elevat**
credit condition*	2	1	*deteriorat**	*encourag**
credit growth	2	1	*down*	*expand**
credit market	2	1	*downturn*	*fast**
credit market conditions	2	1	*downward*	*favor**
credit market demand	2	1	*downward adjust**	*gain**
development financial market*	2	1	*downward revision*	*go* up*
financial condition*	2	1	*drop**	*high**
financial development*	2	1	*fall**	*improv**
financial instabilit*	1	2	*fell*	*increas**
financial market condition*	2	1	*go* down*	*loos**
financial market confidence	2	1	*limit**	*mov* higher*
financial market development	2	1	*low**	*mov* up*
financial market index*	2	1	*moderate**	*mov* upward*
financial market indic*	2	1	*moderati**	*normaliz**
financial market pressure*	1	2	*mov* down*	*pick* up*
financial market price*	2	1	*mov* downward*	*rais**
financial market sentiment	2	1	*mov* lower*	*rallied*
financial market*	2	1	*pressure**	*rally**
financial situation	2	1	*pullback*	*rebound**
financial stability	2	1	*reduc**	*recoup**
investor* appetite*	2	1	*restrictive*	*revis* up**
investor* appetite* risk*	2	1	*revis* down**	*rise**
investor* confidence	2	1	*slow**	*rising*
investor* risk appetite*	2	1	*soft**	*rose*
investor* sentiment	2	1	*stagnate**	*run up*
investor* sentiment toward risk*	2	1	*stall**	*runup*
investor* sentiment toward risk* asset*	2	1	*strain**	*stop decline*
liquidity	2	1	*stress**	*strength**
pressure* financial market	1	2	*subdu**	*strong**
risk appetite*	2	1	*take a toll on*	*tick* up*
			*tension**	*up*
			tick down*	*upward*
			*tight**	*upward adjust**
			took toll on	*upward revision*
			turbulent	*went up*
			*weak**	
			weigh on*	
			went down	
			*worsen**	
Negative phrases:	financial strain*; financial crisis; financial turmoil; financial turbulence; financial dislocat*; financial stress*; financial distress*			

Table A-III. Noun phrases and direction words related to economic growth

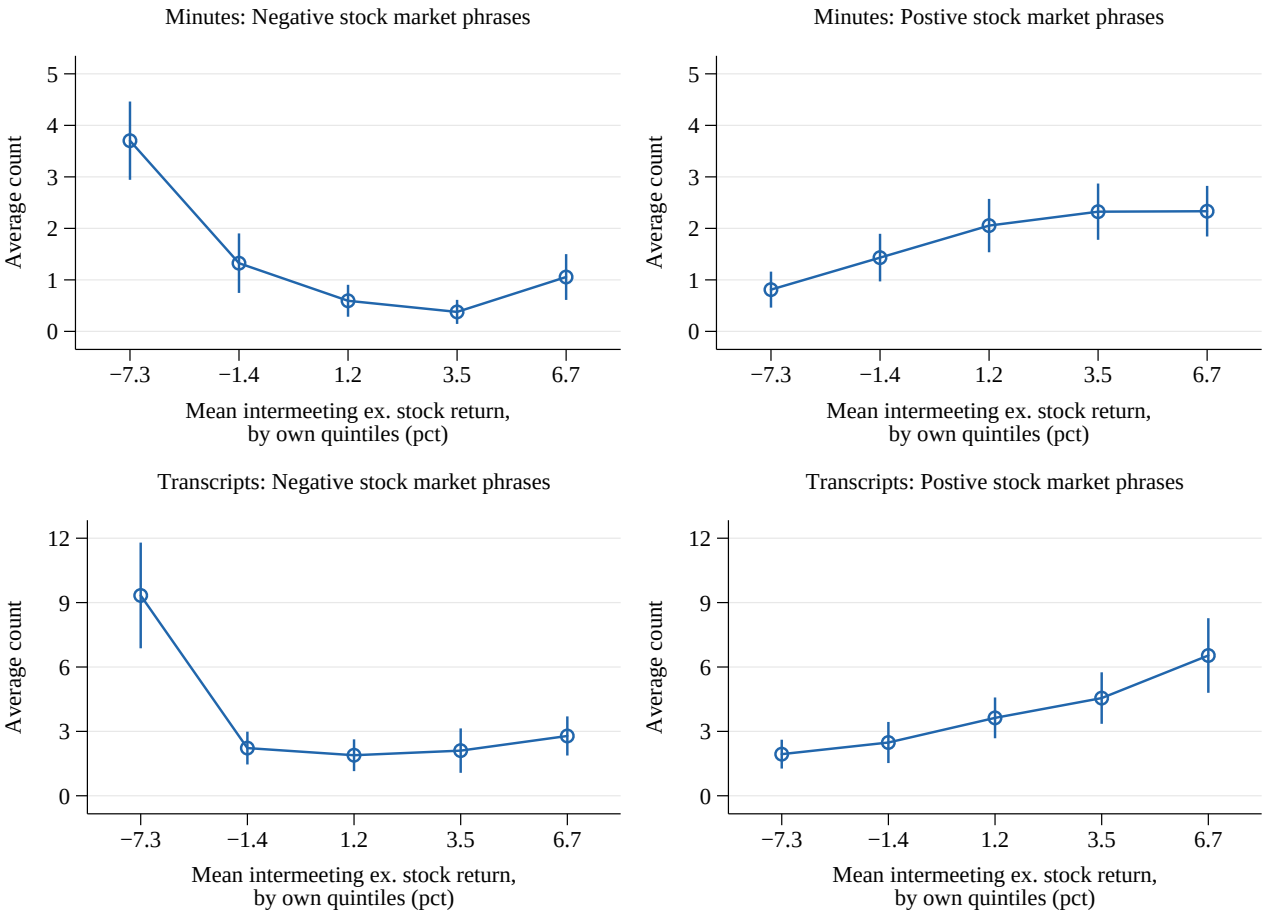
Nouns	Match w/ direction words		Direction words	
	Positive	Negative	Group 1	Group 2
aggregate demand	2	1	*adjust* downward*	*acceler**
aggregate spending	2	1	*adverse*	*adjust* upward*
business activity	2	1	*contract**	*advanc**
business equipment spending	2	1	*cool**	*better*
business fixed investment	2	1	*cut**	*bolster**
business fixed investment and household spending	2	1	*deceler**	*boost**
business investment	2	1	*declin**	*elevat**
capacity utilization	2	1	*decreas**	*encourag**
capital investment	2	1	*deteriorat**	*expand**
capital spending	2	1	*disappoint**	*fast**
consumer confidence	2	1	*down*	*favor**
consumer spending	2	1	*downturn*	*gain**
consumption	2	1	*downward*	*go* up*
consumption spending	2	1	*downward adjust**	*heighten**
crude oil	1	2	*downward revision*	*high**
current account deficit	1	2	*drag**	*improv**
current account surplus	2	1	*drop**	*increas**
domestic components of spending	2	1	*eas**	*mov* higher*
domestic spending	2	1	*fall**	*mov* up*
domestic spending components	2	1	*fell*	*mov* upward*
economic activity	2	1	*go* down*	*pick* up*
economic development*	2	1	*held down*	*rais**
economic growth	2	1	*hold down*	*rallied*
economic outlook	2	1	*increas* at slow* rate*	*rally**
employment	2	1	*limit**	*rebound**
employment rate	2	1	*low**	*recoup**
gdp growth	2	1	*moderate**	*revis* up**
gross domestic product	2	1	*moderati**	*rise**
household spending and business fixed investment	2	1	*mov* down*	*rising*
household* spending	2	1	*mov* downward*	*rose*
inventories	2	1	*mov* lower*	*run up*
inventory investment	2	1	*pressur**	*runup*
investment conditions	2	1	*pullback*	*stop decline*
investment demand	2	1	*reduc**	*strength**
investment manufacturing	2	1	*revis* down**	*strong**
investment situation	2	1	*slow**	*tick* up*
investment spending	2	1	*slow* down*	*tight**
labor force participation	2	1	*soft**	*up*
labor market	2	1	*stagnat**	*upward*
labor productivity	2	1	*stall**	*upward adjust**
new orders	2	1	*strain**	*upward revision*
outlook economic activity	2	1	*stress**	*went up*
output gap	1	2	*subdu**	
pce	2	1	*take* toll on*	
personal consumption expenditure*	2	1	*tension**	
potential output	2	1	*tick* down*	
private expenditures business equipment	2	1	*took toll on*	
private sector investment	2	1	*weak**	
private spending	2	1	*weigh* down*	
productivity	2	1	*weigh* on*	
productivity growth	2	1	*went down*	
real business spending	2	1	*worse**	
resource utilization	2	1		
spending and production	2	1		
spending nonresidential structures	2	1		
unemployment	1	2		
unemployment level	1	2		
unemployment rate	1	2		

Table A-IV. Noun phrases and direction words related to inflation and wages

Nouns	Match w/ direction words		Direction words	
	Positive	Negative	Group 1	Group 2
consumer prices	1	2	*abated*	*acceler**
core inflation	1	2	*adjust* downward*	*adjust* upward*
cost basic materials	1	2	*contract**	*advanc**
cost* goods services	1	2	*cool**	*bolster**
cost* health care	1	2	*deceler**	*boost**
cost* labor	1	2	*declin**	*elevat**
cost* living	1	2	*decreas**	*expand**
cost* us goods and services	1	2	*down*	*fast**
disinflation	2	1	*downturn*	*gain**
disinflation* pressure*	1	2	*downward*	*go* up*
energy prices	1	2	*downward adjust**	*heighten**
headline inflation	1	2	*downward revision*	*high**
health care cost*	1	2	*drop**	*increas**
inflation	1	2	*eas**	*mov* higher*
inflation expectations	1	2	*fall**	*mov* up*
inflation level	1	2	*fell*	*mov* upward*
inflation rate	1	2	*go* down*	*pick* up*
inflation wages	1	2	*limit**	*rais**
labor cost pressure*	1	2	*low**	*rallied*
labor cost*	1	2	*moderate**	*rally**
manufacturing prices	1	2	*moderati**	*rebound**
material prices	1	2	*mov* down*	*recoup**
oil price	1	2	*mov* downward*	*revis* up**
pressure* inflation	1	2	*mov* lower*	*rise**
pressure* wages	1	2	*pullback*	*rising*
price stability	2	1	*reduc**	*rose*
prices durable goods	1	2	*revis* down**	*run up*
prices durable*	1	2	*slow**	*runup*
prices manufacturing	1	2	*slow* down*	*stop decline*
prices material*	1	2	*soft**	*strength**
producer price*	1	2	*stagnate**	*strong**
real oil prices	1	2	*stall**	*tick* up*
unit labor cost*	1	2	*subdu**	*up*
wage pressure*	1	2	*tick* down*	*upward*
wage price pressure*	1	2	*tight**	*upward adjust**
wages	1	2	*weak**	*upward revision*
			weigh on*	*went up*
			went down	
Negative phrases:	inflation* pressure*			

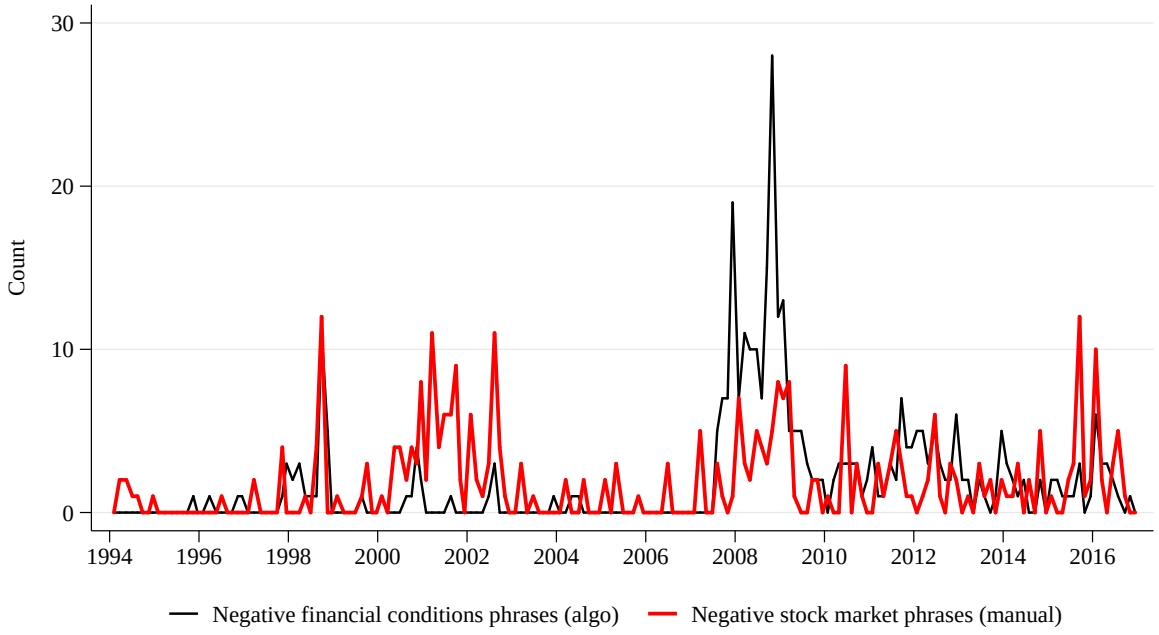
A.II. Additional tables and figures

Figure A-1. Impact of stock market returns in FOMC minutes and transcripts: Algorithm-based searches



The figure presents the average count of positive and negative stock market phrases in FOMC documents conditional on the quintiles of intermeeting stock market excess returns. The x-axis reports the mean of intermeeting stock return within a quintile. The counts of stock market phrases are based on our automated search algorithm. The upper panels display the results based on the FOMC minutes (sample: 1994–2016), and the bottom panels display results based on the FOMC transcripts (sample: 1994–2011).

Figure A-2. Negative financial conditions versus stock market phrases in FOMC minutes



The figure superimposes the counts of negative financial conditions phrases against negative stock market phrases in FOMC minutes over the 1994–2016 sample. Financial conditions phrases are obtained using algorithm-based coding, and stock market phrases are obtained by manual coding.

Table A-V. Predicting negative and positive stock market phrases in the FOMC minutes by intermeeting stock market excess returns (algorithm-based coding)

This table reproduces results from Table III, but uses the algorithm-based coding of the positive and negative stock market phrases.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Negative stock market phrases				Positive stock market phrases			
Sample:	1994-2016	1994-2016	1994-2008	2009-2016	1994-2016	1994-2016	1994-2008	2009-2016
rx_m	-0.18***				0.11***			
	(-5.78)				(4.59)			
rx_{m-1}	-0.11***				0.063***			
	(-4.77)				(3.05)			
rx_{m-2}	-0.058**				0.020			
	(-2.24)				(1.07)			
rx_m^-		-0.27***	-0.26***	-0.35***		0.035	0.014	0.12***
		(-3.66)	(-3.11)	(-3.21)		(1.34)	(0.53)	(4.05)
rx_{m-1}^-		-0.22***	-0.25***	-0.069		-0.006	-0.027	0.076**
		(-6.73)	(-10.94)	(-0.84)		(-0.35)	(-1.46)	(2.01)
rx_{m-2}^-		-0.067	-0.18**	0.007		0.034	0.065	-0.0097
		(-1.20)	(-2.27)	(0.25)		(1.00)	(1.25)	(-0.29)
rx_m^+		-0.060	-0.13**	0.024		0.20***	0.15***	0.26***
		(-1.28)	(-2.05)	(0.65)		(4.67)	(3.12)	(4.27)
rx_{m-1}^+		0.092*	0.095**	0.007		0.20***	0.21***	0.14**
		(1.81)	(2.08)	(0.08)		(4.25)	(3.08)	(2.15)
rx_{m-2}^+		0.045	0.11	-0.047		0.061	0.079	0.003
		(0.94)	(1.37)	(-0.93)		(1.43)	(1.23)	(0.05)
Constant	1.60***	0.26	-0.099	1.01**	1.69***	0.86***	0.73***	1.43***
	(8.85)	(0.73)	(-0.24)	(2.18)	(10.22)	(3.27)	(2.68)	(5.40)
N (meetings)	184	184	120	64	184	184	120	64
R^2	0.41	0.52	0.65	0.35	0.19	0.26	0.20	0.38

Table A-VI. Predicting positive/negative financial conditions phrases with intermeeting returns

This table provides evidence analogous to Table III, but using financial condition phrases as the dependent variable. Financial condition phrases are classified into positive and negative applying the algorithm-based approach to FOMC minutes.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Negative fin. cond. phrases				Positive fin. cond. phrases			
Sample:	1994-2016	1994-2016	1994-2008	2009-2016	1994-2016	1994-2016	1994-2008	2009-2016
rx_m	-0.24*				0.043			
	(-1.88)				(1.10)			
rx_{m-1}	-0.16***				0.032			
	(-3.24)				(1.13)			
rx_{m-2}	-0.13**				-0.073*			
	(-2.11)				(-1.76)			
rx_m^-		-0.45**	-0.47**	-0.23**		-0.080*	-0.062	-0.059
		(-2.35)	(-2.11)	(-2.40)		(-1.69)	(-1.27)	(-1.01)
rx_{m-1}^-		-0.18***	-0.19***	-0.13*		-0.042	-0.021	-0.10
		(-2.72)	(-2.59)	(-1.81)		(-0.99)	(-0.66)	(-1.30)
rx_{m-2}^-		-0.18**	-0.092	-0.29***		-0.11**	-0.024	-0.19***
		(-2.48)	(-0.73)	(-8.46)		(-2.01)	(-0.40)	(-3.77)
rx_m^+		0.063	-0.064	0.10*		0.22***	0.035	0.35***
		(0.69)	(-0.45)	(1.71)		(3.16)	(0.90)	(4.56)
rx_{m-1}^+		-0.029	-0.16	0.043		0.20**	0.025	0.36***
		(-0.30)	(-1.12)	(0.61)		(2.48)	(0.38)	(4.43)
rx_{m-2}^+		0.036	-0.11	0.15**		0.071	-0.039	0.081
		(0.41)	(-0.86)	(2.45)		(1.46)	(-1.00)	(0.93)
Constant	2.17***	0.35	0.81	0.78*	1.26***	-0.23	0.40	-0.22
	(3.79)	(0.39)	(0.63)	(1.80)	(4.73)	(-0.49)	(1.06)	(-0.48)
N (meetings)	184	184	120	64	184	184	120	64
R^2	0.24	0.31	0.34	0.55	0.060	0.19	0.070	0.44

Table A-VII. Predicting target changes with financial conditions and stock market phrases

This table extends the regression specification from Table IV, predicting FFR target changes with financial conditions phrases in addition to stock market phrases. The sample period is 1994–2008. The counts are obtained by algorithm-based coding of FOMC minutes.

	(1)	(2)	(3)	(4)	(5)	(6)
			Algo for #Stocks		Manual for #Stocks	
	1994-2008	1994-2007	1994-2008	1994-2007	1994-2008	1994-2007
ΔFFR$_{m-1}$	0.25***	0.24**	0.16*	0.15*	0.17*	0.15
	(2.63)	(2.20)	(1.87)	(1.68)	(1.84)	(1.53)
ΔFFR$_{m-2}$	0.34***	0.44***	0.24*	0.31**	0.29**	0.37***
	(2.67)	(3.68)	(1.81)	(2.04)	(2.47)	(2.94)
#Fin.cond.$^{-}_{m}$	-0.011*	-0.005	-0.007	-0.005	-0.009	-0.007
	(-1.67)	(-0.54)	(-1.07)	(-0.61)	(-1.29)	(-0.80)
#Fin.cond.$^{-}_{m-1}$	-0.038***	-0.035***	-0.029**	-0.018	-0.029**	-0.011
	(-3.87)	(-2.92)	(-2.43)	(-1.27)	(-2.52)	(-0.84)
#Fin.cond.$^{+}_{m}$	0.052*	0.019	0.027	-0.0037	0.030	-0.006
	(1.74)	(0.96)	(0.93)	(-0.24)	(1.06)	(-0.36)
#Fin.cond.$^{+}_{m-1}$	0.050**	0.044**	0.026	0.012	0.032	0.019
	(2.57)	(2.40)	(1.16)	(0.64)	(1.49)	(1.01)
#Stocks$^{-}_{m}$			-0.014	-0.002	-0.013	-0.010
			(-1.21)	(-0.20)	(-1.53)	(-0.97)
#Stocks$^{-}_{m-1}$			-0.040*	-0.057***	-0.031**	-0.040***
			(-1.79)	(-4.05)	(-2.24)	(-3.62)
#Stocks$^{+}_{m}$			-0.016	-0.012	-0.015	-0.015
			(-1.00)	(-0.86)	(-1.26)	(-1.41)
#Stocks$^{+}_{m-1}$			0.002	-0.003	-0.007	-0.007
			(0.18)	(-0.30)	(-0.51)	(-0.50)
Constant	-0.008	-0.003	0.093*	0.11**	0.11**	0.12**
	(-0.27)	(-0.11)	(1.87)	(2.35)	(2.12)	(2.41)
N (meetings)	119	111	119	111	119	111
R^2	0.51	0.43	0.56	0.54	0.56	0.53

Table A-VIII. Predicting the tone of economic content in FOMC minutes with intermeeting stock excess returns

The figure reports regressions of counts of positive and negative phrases related to economic activity (panel A) and inflation (panel B) on intermeeting stock market returns. The coding of economic phrases is based on our algorithm applied to the FOMC minutes. The dictionary is available in the online Appendix. All regressions include a lagged value of the dependent variable as a regressor. The sample period is 1994–2016. HAC t-statistics are reported in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Economic activity conditions						
	Negative phrases			Positive phrases		
	All	Staff	Particip.	All	Staff	Particip.
rx_m^-	-0.15	-0.13**	-0.034	0.28***	0.13***	0.20**
	(-1.45)	(-2.42)	(-0.49)	(3.33)	(3.14)	(2.18)
rx_{m-1}^-	-0.47***	-0.29***	-0.19***	0.081	0.11**	0.039
	(-3.97)	(-3.01)	(-3.97)	(1.14)	(2.19)	(0.67)
rx_m^+	0.048	0.024	0.014	0.12	-0.018	0.093
	(0.33)	(0.28)	(0.19)	(0.87)	(-0.29)	(0.85)
rx_{m-1}^+	0.19	0.12	0.066	0.062	-0.052	0.078
	(1.10)	(1.29)	(0.62)	(0.40)	(-0.84)	(0.56)
Lag of dept. var.	Y	Y	Y	Y	Y	Y
Constant	3.04***	1.23***	1.67***	3.25***	3.68***	1.93**
	(4.89)	(2.95)	(4.14)	(3.68)	(6.95)	(2.41)
N (meetings)	183	183	183	183	183	183
R^2	0.29	0.30	0.23	0.66	0.21	0.65
Panel B. Inflationary conditions						
	Negative phrases			Positive phrases		
	All	Staff	Particip.	All	Staff	Particip.
rx_m^-	0.37***	0.11***	0.21***	0.029	0.039	-0.026
	(4.35)	(2.81)	(3.26)	(0.35)	(1.60)	(-0.37)
rx_{m-1}^-	0.032	0.0054	0.055	-0.16	-0.19**	0.024
	(0.36)	(0.20)	(0.62)	(-1.29)	(-2.23)	(0.44)
rx_m^+	-0.16	-0.082*	-0.090	-0.023	0.021	-0.022
	(-1.13)	(-1.71)	(-0.70)	(-0.18)	(0.37)	(-0.21)
rx_{m-1}^+	-0.32***	-0.12*	-0.23**	-0.012	0.0013	0.022
	(-2.92)	(-1.88)	(-2.34)	(-0.09)	(0.02)	(0.21)
Lag of dept. var.	Y	Y	Y	Y	Y	Y
Constant	5.61***	2.39***	4.50***	2.29***	1.18***	1.39***
	(6.36)	(6.57)	(5.64)	(4.01)	(4.92)	(2.59)
N (meetings)	183	183	183	183	183	183
R^2	0.35	0.14	0.25	0.33	0.20	0.39

Table A-IX. Predicting the tone of economic content in FOMC transcripts with intermeeting stock excess returns

The table reports regressions of counts of positive and negative phrases related to economic activity (panel A) and inflation (panel B) in FOMC transcripts on intermeeting stock market returns, in analogy to Table A-VIII, which contains similar results based on FOMC minutes. The coding of economic phrases is obtained using our algorithm-based approach, and the dictionary is available in the online Appendix. All regressions include a lagged value of the dependent variable as a regressor. The sample period is 1994–2011. HAC t-statistics are reported in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Economic activity conditions						
	Negative phrases			Positive phrases		
	All	Staff	Particip.	All	Staff	Particip.
rx_m^-	-0.42***	-0.25**	-0.59**	0.50*	0.042	0.81**
	(-2.66)	(-2.14)	(-2.33)	(1.82)	(0.33)	(2.53)
rx_{m-1}^-	-0.80*	-0.31***	-0.21	0.35*	-0.095	0.021
	(-1.83)	(-4.12)	(-1.49)	(1.67)	(-0.55)	(0.06)
rx_m^+	0.49**	0.055	0.072	0.60	0.34	0.46
	(2.08)	(0.49)	(0.21)	(1.11)	(1.64)	(0.81)
rx_{m-1}^+	0.36	0.24*	0.64*	0.63	0.39*	-0.16
	(0.88)	(1.85)	(1.93)	(1.38)	(1.82)	(-0.44)
Lag of dept. var.	Y	Y	Y	Y	Y	Y
Constant	6.56***	2.30**	9.10***	13.6***	3.06**	14.4***
	(2.99)	(2.27)	(4.42)	(3.31)	(2.21)	(3.94)
N (meetings)	144	144	144	144	144	144
R^2	0.38	0.16	0.14	0.33	0.097	0.25
Panel B. Inflationary conditions						
	Negative phrases			Positive phrases		
	All	Staff	Particip.	All	Staff	Particip.
rx_m^-	0.90**	0.19*	0.60***	0.37	-0.039	0.56**
	(2.54)	(1.96)	(2.96)	(1.48)	(-0.38)	(2.20)
rx_{m-1}^-	0.44	0.0031	0.55	-0.19	-0.020	-0.041
	(1.44)	(0.04)	(1.57)	(-0.62)	(-0.24)	(-0.19)
rx_m^+	-0.94**	-0.21	-0.60	0.11	-0.040	-0.32
	(-2.31)	(-1.51)	(-1.35)	(0.34)	(-0.40)	(-1.20)
rx_{m-1}^+	-0.61	-0.087	-1.11***	0.55	0.24*	0.46
	(-1.10)	(-0.62)	(-2.74)	(1.57)	(1.79)	(1.32)
Lag of dept. var.	Y	Y	Y	Y	Y	Y
Constant	19.3***	3.83***	21.8***	11.4***	2.46***	13.5***
	(5.10)	(3.70)	(6.08)	(3.89)	(3.08)	(5.37)
N (meetings)	144	144	144	144	144	144
R^2	0.41	0.21	0.21	0.14	0.073	0.10