# Stock Returns over the FOMC Cycle

ANNA CIESLAK, ADAIR MORSE and ANNETTE VISSING-JORGENSEN*

## ABSTRACT

We document that since 1994, the equity premium is earned entirely in weeks zero, two, four and six in FOMC cycle time, that is, even weeks starting from the last FOMC meeting. We causally tie this fact to the Fed by studying intermeeting target changes, Fed funds futures, and internal Board of Governors meetings. The Fed has affected the stock market via unexpectedly accommodating policy, leading to large reductions in the equity premium. Evidence suggests systematic informal communication of Fed officials with the media and financial sector as a channel through which news about monetary policy has reached the market.

* Cieslak (corresponding author) is with Duke University and CEPR. Morse is with the University of California Berkeley and NBER. Vissing-Jorgensen is with the University of California Berkeley and NBER. We thank seminar and conference participants at Harvard Business School, Federal Reserve Bank of Boston, Federal Reserve Board, NBER EASE meeting, NBER Summer Institute Monetary Economics meeting, NBER Asset Pricing meeting, London School of Economics, University of Minnesota, MIT Sloan, University of Michigan, Michigan State University, Washington University St. Louis, European Central Bank, University of California Berkeley (Haas and Economics), Stanford University, NYU Stern, Duke University (Economics), Columbia, ASU Sonoran conference, BIS Research Network meeting, Texas A&M, Dartmouth, Bocconi, University of Amsterdam, University of Washington, Goethe University Frankfurt, Frankfurt School of Finance & Management, University of Zurich, AQR, Singapore Management University, Nanyang Technological University, Hong Kong University, HKUST, Vanderbilt, Nationalbanken, American Finance Association, European Finance Association, Western Finance Association, Midwest Finance Association, Society of Economic Dynamics, CEPR ESSFM in Gerzensee, BlackRock, Universidad Católica de Chile Finance Conference, the Financial Intermediation Research Society Conference, Central Bank Workshop on Market Microstructure, and the Red Rock Finance Conference. We also thank Tim Loughran, David Romer, Christina Romer, Andrew Rose, Ken Singleton, Julio Ruitort, Kosuke Aoki, Pavel Savor, Lars Svensson, Michela Verardo, Brian Weller, Mungo Wilson, Bryan Kelly, David Reeb, and various current and former Federal Reserve officials for their help and feedback. Corresponding author information: anna.cieslak@duke.edu. We have no conflicts of interest to disclose.

Electronic copy available at: https://ssrn.com/abstract=2687614

Does the Federal Reserve have a substantial impact on the stock market? How much of realized stock returns can be attributed to the Fed, if any? And what is the economic mechanism behind any impact? Prior work on these questions focuses on Federal Open Market Committee (FOMC) announcement days (starting with Bernanke and Kuttner (2005)) or the 24-hour period just before scheduled FOMC announcements (Lucca and Moench (2015)). However, monetary policy news may not arrive only on FOMC announcement dates. If so, the overall impact of the Fed on the stock market could be much larger than previously thought. From Kuttner (2001), who uses federal funds futures data to decompose target rate changes on FOMC announcement dates into expected and surprise components, we know that the news driving investors' updates of monetary policy expectations does not principally come out at the time of FOMC statements.[1] Furthermore, with only eight scheduled FOMC meetings per year, focusing only on FOMC announcement dates could lead to small-sample issues.[2]

To overcome these challenges, in this paper we study the evolution of stock returns over the full cycle of days between scheduled FOMC meetings. Our main finding is that in the period from 1994 to 2016, the average excess return on stocks over Treasury bills follows a biweekly pattern over the FOMC cycle. In particular, the equity premium over this 23-year period was earned entirely in weeks 0, 2, 4, and 6 in FOMC cycle time, which we refer to as "even weeks," where week 0 of the FOMC cycle starts the day before a scheduled FOMC announcement day. Moreover, average excess returns are statistically significantly higher in even weeks than in odd weeks in FOMC cycle time, with this fact holding up in the 2014 to 2016 period following the first draft of our paper, which covered the 1994 to 2013 period. The pre-FOMC announcement drift of Lucca and Moench (2015), resulting in average stock returns of about 0.5% over the 2pm to 2pm period prior to scheduled FOMC announcements, is thus part of a broader biweekly pattern in stock returns over the FOMC cycle.

To support the view that the biweekly cycle in excess returns on stocks over Treasury bills is causally driven by monetary policy news from the Fed, we provide four pieces of evidence. First, changes to the federal funds (Fed funds) target tend to take place in even weeks in FOMC cycle time. This is the case both in the 1994 to 2016 period, which has only seven

[1] The surprise component tends to be small in Kuttner's data for 1994 to June 2008. For example, on the 25 occasions when the FOMC increased the federal funds rate target by 25 basis points, the market expectation on average was off by only 2 basis points from the realized change (the average absolute value of the surprise).
[2] As an example of potential small-sample issues, in Internet Appendix Table IA.1, we show that neither the main result of Bernanke and Kuttner (2005) nor that of Lucca and Moench (2015) is significant in post-publication data.



Electronic copy available at: https://ssrn.com/abstract=2687614

intermeeting changes and in the period from 1982 to 1993, during which time about two-thirds of target changes took place between scheduled FOMC meetings. Second, on average, Fed funds futures rates decline in even weeks, consistent with unexpectedly accommodating news arriving in even weeks. Third, stock returns are particularly high on the even-week days that also have more Fed information production and decision making. Specifically, we document higher even-week returns on days that follow board meetings of the Fed's governors. We also present narrative evidence suggesting that these board meetings (also called "discount rate meetings") are an important venue for the free exchange and aggregation of monetary policy views among the chair, vice-chair, and governors. Fourth, we document that about half of the high even-week stock returns arises due to stock market mean-reversion in even weeks after significant stock market declines. This pattern fits a "Fed put" interpretation, meaning that the Fed reacts to low stock returns by providing (a promise of) monetary policy accommodation, with this accommodation being unexpectedly strong in our sample. In support of this interpretation, we show that the intermeeting target changes over the 1994 to 2016 period were preceded by low stock returns. We also show that high even-week stock returns that follow market declines predict future reductions in the Fed funds target. Return patterns are thus consistent with a commonly mentioned narrative of Fed decision making. We rule out the possibility that the high even-week returns could be driven by other regular economic events, notably reserve maintenance periods, macroeconomic news releases or corporate earnings announcements.

Turning to how the Fed drives the stock market, we argue that even-week changes in Fed funds futures rates are economically too small to account for most of the high even-week stock returns. Using equity premium estimates from Martin (2017), we instead provide evidence that even-week reductions in the equity premium are large and can account for most of the high realized even-week stock returns. This suggests that the Fed reduces the amount or price of uncertainty, thereby *lowering* the equity premium. One way how the Fed may have reduced uncertainty is through reducing downside risk via a promise to act (i.e., to provide stimulus) as needed.

The channel through which the Fed reduces uncertainty helps explain why reductions in Fed funds futures are modest relative to either the reduction in the equity risk premium or the average even-week stock returns. In particular, the Fed's promise to act aggressively if needed leads markets to expect a lower Fed funds rate in bad states of the world. However, if this promise succeeds in shifting the probability distribution across economic states to the right



Electronic copy available at: https://ssrn.com/abstract=2687614

(making bad states less likely), the net effect on expected Fed funds rates could be small. By contrast, for stocks, the two effects of reduced downside risk work in the same direction, with both lower Fed funds rates in bad states of the world and an improved distribution across states being good news for stocks.

This "downside-risk channel" appears particularly important for explaining even-week mean-reversion in stocks -- the Fed put. Specifically, the equity premium falls on even-week days that follow stock market declines, while Fed funds futures rates do not fall on these days. The fact that high stock returns on even-week days following stock market declines predict target changes despite no reduction in Fed fund futures rates implies that the economy turned out worse and monetary policy easier ex-post than expected ex-ante. This interpretation is in line with evidence based on short-rate expectations from both private sector surveys and the Fed's own forecasts in Cieslak (2018).

The Fed downside-risk channel adds a new dimension to the importance of Fed communication suggesting that to some extent forward guidance is about an unlimited promise to act as needed, similar to Draghi's "whatever it takes" speech in the ECB context. For evidence on the stock market rally following that speech see Krishnamurthy, Nagel, and Vissing-Jorgensen (2017). It is interesting to note that while Draghi's speech in Europe was sufficient to calm asset markets, the ECB – just like the U.S. Fed following stock market declines – eventually had to take additional steps to increase inflation and growth (the ECB started quantitative easing (QE) in 2015, which eventually amounted to over 20% of GDP).

Finally, we study possible channels of monetary policy information flowing from the Fed to asset markets. First, we document that formal Fed public releases do not account for the high excess stock returns in even weeks. Instead, we find evidence of systematic informal communication, in the form both of outright leaks emerging in the media and private newsletters and of systematic preferential access to the Fed that private financial institutions enjoy. We document four motives for the use of informal communication. Informal communication offers the Fed (i) *flexibility* in implementing more continuous policy and conveying state-dependencies, (ii) *a tool for explaining* Fed policy and decision making, (iii) *a channel for learning* how the Fed's assessment of the economy compares to that of the financial sector and how markets are likely to react to a particular policy decision, and (iv) *a way for disagreements* among FOMC members to play out, with each member seeking to drive the market perception toward their own desired policy outcome.



Electronic copy available at: https://ssrn.com/abstract=2687614

We conclude the paper with a discussion of social welfare consequences, mapped to motives (i) through (iv) above. Informal communication used to achieve flexibility, explain policy, or as a result of disagreements is unlikely to be welfare-enhancing. Fed learning from private financial institutions may provide benefits, but those benefits must be weighed against the costs of providing profitable information advantages to financial private parties and of eroding trust in both the financial system and the credibility of the Fed. A vindication of these motives and our concern about negative welfare effects appears in the transcripts of the October 15, 2010 and November 3, 2010 FOMC meetings (not available until after the working paper version of our article became publicly available). In these meetings, Chair Bernanke initiates a discussion about uncontrolled information flows, specifically acknowledging (a) media leaks of confidential materials and the views expressed at the meetings, (b) inappropriate access to information by "well-connected" outsiders, and (c) the tendency of FOMC participants to take strong, inflexible public policy positions before the meetings. Further ex-post validation comes from the resignation of Jeffrey Lacker, Richmond Federal Reserve Bank President, in 2017, following admission of his involvement in the Medley Global Advisors leak (described later).

## I. The New Fact: Stock Returns Over the FOMC Cycle

### *A. Main Result*

Figure 1 shows the main empirical result of the paper – the behavior of U.S. stock market excess returns over the FOMC cycle from 1994 through 2016. Date 0 on the horizontal axis is the day of a scheduled FOMC meeting.[3] For two-day meetings, date 0 refers to the second day, the announcement day. The graph omits weekends and sets returns to zero on holidays. Therefore, 10 days on the horizontal axis represent two calendar weeks after an FOMC meeting, and so on. On the vertical axis, we graph the five-day cumulative stock return from (and including) day $t$ to day $t$+4 minus the five-day cumulative return on 30-day Treasury bills from day $t$ to day $t$+4.[4] The vertical axis is in percent, so 0.5 means an excess return of a half percent. The figure shows a surprising regularity: five-day stock market excess returns are high in even weeks in FOMC cycle time.

[3] Since 1981, the Fed has held eight scheduled meetings per year roughly six to eight weeks apart. Since 1994, the Fed publicly announces their decision following a scheduled FOMC meeting.

[4] For ease of replicating the result, we use stock returns and T-bill rates from the Fama-French factor file on Ken French's website.



Electronic copy available at: https://ssrn.com/abstract=2687614

**[Figure 1 about here.]**

Over the last 23 years (i.e., over 184 scheduled FOMC meetings), the average excess return has been 0.57% in week 0 in FOMC cycle time (defined as days -1 to 3), 0.33% in week 2 in FOMC cycle time (defined as days 9 to 13), 0.46% in week 4 in FOMC cycle time (defined as days 19 to 23), and 0.60% in week 6 in FOMC cycle time (defined as days 29 to 33). In contrast, the average returns in odd weeks have been poor, with an average excess return around zero in week -1 one (days -6 to -2), -0.18% in week 1 (days 4 to 8), -0.18% in week 3 (days 14 to 18), and -0.09% in week 5 (days 24 to 28). This implies that the *entire equity premium over the last 23 years* has been earned in even weeks in FOMC cycle time.[5, 6] While we know from Lucca and Moench (2015) that since 1994, excess returns in the 24 hour period from 2pm on day -1 to 2pm on day 0 leading up to the FOMC announcement have been high, averaging 0.49% by their estimate from September 1994 to March 2011, the biweekly pattern in the average excess return has not been previously documented. Most FOMC cycles include week 0, 2, and 4, but the number of data points drop off quickly past week 4. There are 920 days in week 0, 924 days in week 2, 831 days in week 4, and 120 days in week 6. Thus, economically, the first three average return peaks are each about equally important whereas the fourth peak matters less given the smaller number of data points.

### *B. Statistical Significance*

To assess the statistical significance of our finding, we test whether the average excess return in even weeks in FOMC cycle time is statistically different from that in odd weeks in FOMC cycle time. An easy-to-interpret approach is to run a regression in daily data of the stock market excess return on dummies for FOMC cycle weeks. The results are reported in Table I, Panel A. In column (1), we regress the stock market excess return on a dummy for the day being in week 0, 2, 4, or 6 in FOMC cycle time. The average excess return is 12 basis points (bps) higher on even-week days than odd week days, with the difference significant at the 1% level based on *t*-statistics that are robust to heteroskedasticity. For robustness, we also report *t*-

[5] When we refer to even and odd weeks in what follows, this will always refer to weeks in FOMC cycle time as opposed to weeks of the year.

[6] Three days over the last 23 years fall beyond day 33 of the FOMC cycle into what would be week 7 in FOMC cycle time. For simplicity of interpretation, we drop these three days from our analysis throughout.



Electronic copy available at: https://ssrn.com/abstract=2687614

statistics that allow for correlation of error terms within a given even week or a given odd week,[7] as well as Newey-West standard errors with 10 daily lags. The autocorrelation in the error terms is slightly negative. Therefore, the last two approaches result in larger *t*-statistics but the differences are quite small. Since *t*-statistics robust to heteroskedasticity are the most conservative, in the subsequent tables we report results only from that approach.

**[Table I about here.]**

From Lucca and Moench (2015), we know that the average excess return in week 0 in FOMC cycle time is high. We are therefore particularly interested in documenting whether the average excess returns in weeks 2, 4, and 6 are statistically different from those in odd weeks. In column (2), we include two dummies, one for being in week 0 and another for being in any of weeks 2, 4 and 6. The results show that the average excess return per day is 14.1 bps higher on days that fall in week 0 in FOMC cycle time and 10.9 bps higher on days that fall in week 2, 4, or 6 compared to days that fall in odd weeks in FOMC cycle time. Both the week 0 dummy and the weeks 2, 4, or 6 dummies are significant at the 1% level. In column (3), we test whether the even-week dummies are individually significant, by including separate dummies for weeks 0, 2, 4, and 6. All of these dummies are significant at the 5% level.

### *C. Out-of-Sample Robustness*

To further assess the robustness of our results, we split the 23-year sample period into two sub-periods based on the data used in the first draft of our paper. That version employed data for 1994 to 2013 whereas we now have data up to 2016. Column (1) of Table I Panel B shows that in the out-of-sample period, the coefficients on both the dummy for even week 0 and the dummy for even weeks 2, 4, and 6 are even larger than those for the original sample period. Moreover, both dummies are significant at the 10% level or better using only the past three years of data. Column (3) reports results for the period from 1982:9 to 1993. The even-week dummy is smaller but still significant at the 10% level in this earlier period. Overall, the FOMC cycle in stock returns appears to be a general phenomenon, present since 1982, but strengthening over time in economic magnitude.

### *D. Economic Significance: Trading Strategies Based on the FOMC Cycle*

[7] Specifically, we cluster by a variable ($w$) that increases by one every time we move to a new week in FOMC cycle time. Over the 1994 to 2016 period (which has 5,997 days), we have 184 FOMC cycles and $w$ runs from one to 1,247 (this is not quite 5,997/5 since the last week in a given FOMC cycle may have fewer than five observations).



Electronic copy available at: https://ssrn.com/abstract=2687614

To assess the economic significance of our results, we compare the performance of three trading strategies. The first row in Table I, Panel C shows the performance of a strategy (Strategy A) that simply holds the stock market all the time. This strategy would have earned an average excess return of 8.48% per year over the last 23 years, with an annual standard deviation of about 19% and a Sharpe ratio of 0.45. Strategy B exploits the timing of returns over the FOMC cycle: the investor invests in the stock market only in even weeks in FOMC cycle time. This is an easily implementable strategy since FOMC calendars are announced well in advance of a given FOMC cycle and the strategy can be executed with low transaction costs using an ETF. Strategy B would have had a Sharpe ratio of 0.92, twice that of Strategy A, achieved by adding 3.67 percentage points of average annual excess return and reducing the standard deviation of annual excess returns by about a third. Strategy C instead invests in odd weeks only and results in a negative average return. While the negative return on Strategy C indicates that shorting the market in odd weeks could be beneficial, it also adds volatility and overall does not improve on the Sharpe ratio of Strategy B.

The last column of Table I Panel C reports the value of $1 invested at the start of 1994. Investing in even weeks only would have resulted in a value of $15.22 by the end of 2016, about twice the $7.68 obtained by investing on all days.

### *E. International Stock Returns over the FOMC Cycle*

Motivated by Rey (2013), who discusses the interconnectedness of global finance via the monetary policy of the center country (the U.S.), we study whether our return regularity arises with similar strength in stock markets outside the U.S. Table II presents the results from regressing daily returns of MSCI equity indices on dummies for FOMC cycle weeks over the 1994 to 2016 sample. The table contains results for the developed market index excluding the U.S. (columns (1) to (2)), and the global emerging market index (columns (3) to (4)). We use returns for day $t$+1 as the dependent variable since news from the U.S. will be reflected in most non-U.S. markets only on day $t$+1 due to the difference in time zones. The indices are in U.S. dollars.

**[Table II about here.]**

The results in Table II indicate that the FOMC cycle in returns emerges in other markets as well. The returns earned in even weeks of the FOMC cycle are statistically significant and positive for both developed markets excluding the U.S. and emerging markets. Interestingly, this



Electronic copy available at: https://ssrn.com/abstract=2687614

pattern holds particularly strongly in both economic and statistical terms for emerging market stocks, earning 18.6 bps per day (*t*-statistic=4.09) higher returns in week 0 and 16.9 bps per day (*t*-statistic=5.05) higher returns during weeks 2, 4, and 6, as compared to odd weeks returns, which average -6.7 bps per day (*t*-statistic=-3.22). To illustrate these findings graphically, Internet Appendix Figure IA.1 plots the five-day cumulative returns over the FOMC cycle for the three series, providing evidence that the biweekly pattern in stock returns in FOMC cycle time is present around the world.

It is possible that the fact we document of the biweekly FOMC return cycle extending beyond the U.S. could be driven by movements in the dollar exchange rate. However, using the trade-weighted dollar exchange rate from the Federal Reserve Economic Data (FRED) database, we find no tendency for the dollar to appreciate in even weeks in FOMC cycle time against a broad set of currencies.

### F. *The Cross-Section of Stock Portfolios*

We also explore the behavior of the cross-section of U.S. stocks over the FOMC cycle. The biweekly return cycle is even more pronounced for high-beta stocks than it is for the aggregate market. Using CRSP beta deciles or industry-sorted portfolios, we find that the security market line is upward sloped in even weeks and downward sloped in odd weeks of the FOMC cycle. This result echoes the finding of Bernanke and Kuttner (2005) that the CAPM explains industry-sorted portfolios well on FOMC announcement days as well as Savor and Wilson's (2014) finding that the CAPM does much better on macro announcement days than on other days.

## II. Documenting Causality

In this section, we first rule out a series of possible non-Fed-related explanations of the FOMC cycle in stock returns. We then provide evidence linking the FOMC cycle in returns to the Fed.

### A. *Ruling Out Explanations not Related to the Fed: Macroeconomic Data Releases, Corporate Earnings Releases and the Reserve Maintenance Period*



Electronic copy available at: https://ssrn.com/abstract=2687614

Since 1981, the FOMC has held eight scheduled meetings per year. The schedule of meetings for a particular year is announced ahead of time, generally in the summer prior to the calendar year. Figure 2 plots a histogram of the day of the year on which FOMC meetings took place over the 1994 to 2016 period. For each of the eight meetings, there is quite wide dispersion across years in terms of what day of the year the meeting takes place. The change in the FOMC schedule from year to year makes it less likely that the FOMC calendar systematically lines up with other important economic calendars. Nevertheless, in this section, we explore the possibility that the high even-week returns line up with alternative calendars and sources of news.

**[Figure 2 about here.]**

First, we explore macroeconomic news releases. We use all U.S. macroeconomic data releases in Bloomberg over the November 1996 to December 2016 period. The start of the sample in November 1996 is dictated by the availability of Bloomberg data. In total, we have 20,846 non-Fed macro releases. The number of releases per day ranges from one to 26 with an average of 3.5. There are 165 different types of macro data releases, with 115 types having at least 50 releases over the sample period.

Since not all macroeconomic data releases are equally important for asset prices, we exploit a relevance variable provided by Bloomberg. For each type of macro release, Bloomberg calculates a relevance measure based on how many Bloomberg users have set up "alerts." The relevance variable takes a value between zero and one. The most-followed macro releases are the change in nonfarm payrolls, initial jobless claims, and GDP growth. These are about as popular as the FOMC announcements. To calculate a relevance-weighted count of macroeconomic data released on a given day, we sum the relevance variable for each date. Internet Appendix Figure IA.2 plots the average number of macroeconomic data releases both unweighted and weighted by relevance. Both exhibit a clear weekly pattern in FOMC cycle time, not a biweekly pattern as we observe for stock returns.

Table III presents formal evidence ruling out the possibility that macro news is driving our result. In column (1), we reproduce our Table I, column (2) main results as a starting point. Column (2) adds to our baseline specification a control for the relevance-weighted number of macroeconomic data releases. This has almost no effect on either the coefficient or significance of the dummies for FOMC week 0 or FOMC weeks 2, 4, or 6. We find no substantial effect of controlling for the most important macroeconomic releases separately.

**[Table III about here.]**



Electronic copy available at: https://ssrn.com/abstract=2687614

Second, we show that corporate earnings announcements do not explain our results. For each day in the 1994 to 2016 sample, we compute the total number of quarterly earnings per share announcements by U.S. firms in the IBES database as well as the fraction of positive surprises relative to the consensus analyst expectation. The average number of earnings announcements per day is 62 with a standard deviation of 81. Column (3) of Table III shows that controlling for the number of earnings announcements and the fraction of these that are positive (i.e., above consensus) has little impact on the FOMC cycle dummies.

Third, we test whether including dummies for the days of banks' reserve maintenance periods changes the size of the coefficient on the even-week dummies. Banks are required to hold an average amount of reserves over a two-week period called the reserve maintenance period.[8] If banks are more risk-averse toward the end of the reserve maintenance period and if reserve maintenance periods end in even weeks in FOMC cycle time, this could potentially explain the biweekly stock returns cycle. However, since reserve maintenance periods are biweekly in calendar time while the FOMC calendar is more irregular, reserve maintenance periods are about as likely to end in even weeks in FOMC cycle time as they are to end in odd weeks, thus making it unlikely that they drive our results. Nonetheless, in Table III column (4), we formally explore this possibility. Adding to the baseline specification, we include 10 dummies for the days of the reserve maintenance period. We find little change in the coefficient and significance of the dummies for FOMC week 0 or FOMC weeks 2, 4, or 6.

Finally, in column (5) we include fixed effects for day of the week, day of the month, and the last day of the month, quarter, or year. This has little effect on the coefficients of the even week dummies and suggests that the high even week returns are not driven, for example, by any tendency of even weeks to overlap with particular calendar days on which other news may be more prevalent.

## *B. Linking the FOMC Cycle to the Fed*

### *B.1. Intermeeting Target Changes*

Since 1994 the Fed has predominantly changed the federal funds target at scheduled FOMC meetings, with only 7 of 62 changes over the 1994-2016 period taking place in between

[8] Banks also often hold excess reserves, historically for transaction purposes (to avoid overdrafts) and recently because of reserves earning interest (to make banks willing to hold the large amounts of reserves used to finance the Fed's purchases of bonds under quantitative easing).



Electronic copy available at: https://ssrn.com/abstract=2687614

scheduled meetings. Table IV, Panel A provides the details on these seven changes. While few in number, the timing of the intermeeting changes within the FOMC cycle (column (3)) is nonetheless informative as it provides evidence on when decision making tends to happen at the Fed. We find that all but one of the seven changes took place in even weeks in FOMC cycle time.

**[Table IV about here.]**

Column (1) of Table IV, Panel B, reports results from a probit estimation relating the probability of an intermeeting target rate change to dummies for week 0 and weeks 2, 4, and 6. We find that the coefficients on both even-week dummies are significant at the 10% level or better.

Given the small number of intermeeting changes in the 1994 to 2016 period, it is also informative to study the period prior to 1994, when it was more common for the Fed to change the target in between, rather than at, scheduled FOMC meetings. The time series of the federal funds target rate changes going back to September 27, 1982 is constructed by Thornton (2005) and is available via FRED Economic Data.[9] From September 1982 to 1993, only 31 of 93 target rate changes happened at scheduled meetings, whereas 62 (two thirds) took place between scheduled meetings.

Figure 3 Panel A plots the pre-1994 probability of a federal funds target change (happening on any of days $t$ to $t$+4) over the FOMC cycle. Four clear peaks can be seen. Peak 1 is necessarily higher in scale because of the scheduled meeting actions, but this does not diminish the importance of the other three peaks. These peaks appear delayed a couple of days relative to the peaks in the average excess stock returns over the FOMC cycle, reflecting the fact that prior to 1994, the FOMC did not make an announcement after the target had been changed. Thornton dates target changes based on when they were likely implemented in open market operations by the Trading Desk of the Federal Reserve Bank of New York. This is generally one to two days after the date those changes were decided at an FOMC meeting, on an FOMC conference call, or by the Fed chair.[10] The timing of target changes pre-1994 thus offers

[9] We count all target changes that are dated on the meeting date or on one of the two following dates as having been decided at the meeting and count all other target changes as intermeeting changes.

[10] For example, for changes decided at FOMC meetings, Thornton assumes that target changes decided at a given meeting were implemented on the first business day following the meeting unless this day is a reserve settlement day. If the next business day is settlement Wednesday, Thornton assumes the new target is implemented on the Thursday following the settlement day unless documentary evidence suggests otherwise. A similar approach is used for changes that follow conference calls.



Electronic copy available at: https://ssrn.com/abstract=2687614

additional evidence that information-processing and decision-making at the Fed tends to happen in even weeks in FOMC cycle time.

**[Figure 3 about here.]**

Column (2) of Table IV, Panel B reports the results of a probit estimation of a dummy for a change in the target on day $t$+2 (decided by the Fed on day $t$ or $t$+1 given Thornton's (2005) timing based on open market operations) on a dummy for week 0 and a dummy for weeks 2, 4, and 6. Coefficients on both dummies are significant at the 1% level.

As previously mentioned, column (3) of Table 1, Panel B shows that the FOMC cycle stock return pattern exists in the pre-1994 period. Combined with the evidence in Table IV, this suggests not only that Fed decision-making was on the same schedule pre-1994 as post-1994, but also that information about Fed decisions may have arrived to the market before Thornton's (2005) dating of open market operations. Such a pattern is consistent with our argument below that the Fed uses informal communication. The pre-1994 data on intermeeting changes are useful because they provide direct evidence that Fed information-processing and decision-making take place disproportionately in even weeks in FOMC cycle time.

### *B.2. Federal Funds Futures*

While the small number of intermeeting changes in the 1994 to 2016 period are informative about the timing of Fed information processing and decision making, these changes are unlikely to constitute a substantial fraction of news from the Fed for this period. We therefore turn to data for ederal funds futures to be able to get more data on the timing of Fed news. We document that Fed funds futures rates decline significantly in even weeks, consistent with our sample period being characterized by unexpectedly accommodating monetary policy news (relative to market expectations) arriving in even weeks.

We focus our analysis of Fed funds futures on the period from 2000 to 2016, since there is almost no trading volume (open interest) in Fed funds futures until 2000 (as documented in Internet Appendix Figure IA.3, Panel A). This lack of volume may be related to the fact that before 2000, the Fed let the effective Fed funds rate fluctuate widely around the Fed funds target (see Panel B in the same figure). Since Fed funds futures contracts are based on the effective Fed funds rate, these contracts would not be an attractive place to express views about future monetary policy since the realized payment on the contract depended not only on monetary policy but also on demand shocks in the Fed funds market. Based on these observations, we use



Electronic copy available at: https://ssrn.com/abstract=2687614

the sample from 2000 onward for our Fed funds futures analysis.[11] We similarly drop the last four months of 2008 when the effective Fed funds rate also deviated substantially from the target.

In terms of contract maturity, before 2009 we use the second-month futures contract (since the current month contract may end before the next FOMC meeting). The 2009 to 2016 period is a time when short rates were at the zero lower bound and policy worked mainly via forward guidance and QE. Therefore, we use the 24th-month futures contract for this period.

Figure 3 Panel B plots average five-day changes in futures rates over the FOMC cycle. As can be seen, futures rates decline in even weeks. Table V column (1) tests whether rate changes in even weeks are significantly lower than in odd weeks. Following the approach for stocks, we regress daily changes in futures rates on a dummy for week 0 and a dummy for weeks 2, 4, and 6. Coefficients on both dummies are significant at the 10% level or better.

**[Table V about here.]**

To establish that reductions in expected policy rates helped drive high even-week stock returns, we show in Figure 3 Panel C that the covariance between daily changes in Fed funds futures rates and daily stock returns is lower in even weeks than in odd weeks. This is what would be expected if more monetary policy news were to come out in even weeks; accommodating monetary policy news that lowers futures rates increases stock returns (and conversely for contractionary policy news).[12]

### *B.3. Board of Governors' Board Meetings*

Evidence that Fed decision-making happens biweekly in FOMC cycle time also comes from the timing of a little-known set of Board of Governors meetings, referred to as *board meetings* in Chairman Bernanke's and Chair Yellen's calendars (obtained via FOIA requests). The Federal Reserve Board complies with the Government in the Sunshine Act of 1976, implying that FOMC members may not meet to discuss policy without advance public notice.[13]

---

[11] Consistent with Fed funds futures data being of better quality from 2000 onward, a regression of excess stock market returns on Kuttner surprises results in the expected negative relation using data from 2000 to June 2008 (using data from Kenneth Kuttner's website available up to June 2008) but a coefficient close to zero using data for 1994 to 2000.

[12] To assess whether covariances are statistically significantly lower in even weeks, we regress $(x - \bar{x})(y - \bar{y})$ on a dummy for week 0 and a dummy for weeks 2, 4, and 6, where $x$ is the daily change in the futures yield, $y$ is the daily excess return on stocks, and $\bar{x}$ and $\bar{y}$ are sample averages of $x$ and $y$ by week in FOMC cycle, calculated over the sample used for the figure. The regression uses standard errors robust to heteroskedasticity. Both dummies are significant at the 10% level or better.

[13] The Fed's view of its relation to this Act can be found at:



Electronic copy available at: https://ssrn.com/abstract=2687614

Other than the FOMC meetings, the only other series of advance-notice meetings are the Board of Governors' required discussions of discount rate requests submitted by Federal Reserve Banks. (The meetings referred to by the Chairs' calendars as *board meetings* map to these advance-notice *discount rate meetings*.) Under the Federal Reserve Act, as amended in 1935, each of the regional Federal Reserve Banks submits biweekly requests concerning their preferences on any changes to the discount rate.[14] What is important for us is the timing of the Governors' board meetings to review these discount rate requests and perhaps have other policy discussions.

A Governors' board meeting to review the regional preferences typically occurs on one of the days just prior to a scheduled FOMC meeting. Then, it takes two weeks for the Board of Governors to receive a full set of updated recommendations of the Reserve Banks over monetary policy. Thus, because of the reset that happens with a board meeting before the FOMC scheduled time, discussions of monetary policy at these meetings may disproportionately happen biweekly in FOMC time.[15] Minutes exist from these board meetings, but the minutes primarily provide record-keeping of discount rate requests.[16] The board meetings, as this section describes, are the forum for both a briefing on current economic and financial conditions as well as a discussion of monetary policy among the Governors.

Former Governor Meyer (2004) explains that, similar to the FOMC meetings, the board meetings are "highly structured events" where Governors and the Fed Chair have a chance to express opinions as "discussions circle the table in go-arounds." Bernanke (2015) further describes the briefing content and the fact that the board meetings are one of the few occasions where the full Board of Governors meets:

> *"When I joined, the full Board met infrequently; much of the substantive work was done by committees. We did convene every other Monday morning for a staff briefing on*

---

https://www.federalreserve.gov/monetarypolicy/files/FOMC_SunshineActPolicy.pdf.

[14] The board of each of the regional Federal Reserve Banks has to set their discount rate at least every two weeks, subject to approval of the Board of Governors.

[15] In the early years of our 1994 to 2016 sample, the board meetings were more frequent than biweekly with around 40 annual meetings. This number gradually declines to around 20 board meetings per year. However, even in the early period, the biweekly cycle of getting a full set of fresh inputs from the regional Federal Reserve Banks (as well as from bank supervision and the trading desk) would imply that fresh monetary policy discussions probably happen biweekly. This presumption has been confirmed by a former senior Fed official who in an email exchange with us stated that although meetings used to take place weekly: *"Every other one included a type 3 discussion [i.e., as she or he explained, predictions of how forecasts of the economy map into policy choices] with regard to discount window requests.*"

[16] Records of these discount rate meetings are on the Federal Reserve Board website starting from May 2001. We obtained records back to 1994 via a FOIA request.



Electronic copy available at: https://ssrn.com/abstract=2687614

*economic, financial, and international developments."* (Bernanke (2015), Kindle Locations 1051-1052).

Discussion of the biweekly discount rate requests from the Federal Reserve Banks imply that the board meetings serve as a conduit for the reserve banks to convey their monetary policy stances and for board members to discuss monetary policy. Indeed, former Fed Governor Meyer (2004) states that "*[The Reserve Bank presidents] have their own devices for influencing the policy discussion in between meetings. They do this specifically through requests to change the discount rate."* Jinushi and Kuttner (2008) find that the average change in the discount rate requested by the reserve banks has strong predictive power for the change in the federal funds target rate. Meyer (2004) also describes in relation to the pre-FOMC board meeting, how the governors-only board meeting offers a genuine exchange of ideas and formation of policy:

> *"Unlike the FOMC meeting the next day, the discussions at the Monday Board meeting did not consist of prepackaged presentations. They were a much truer give-and-take, a serious exchange of ideas, with each of us questioning one another along the way. I often used the pre-FOMC Monday Board meetings as an opportunity to engage the Chairman in a discussion of the outlook and monetary policy, as I had previously done in the individual meetings. While we may not have always explicitly voiced our support of his policy recommendation at the end of the individual meetings, and later, at the end of the pre-FOMC Monday Board meetings, there was, in my view, an implicit commitment to support the Chairman the next day. Of course, if you were not prepared to support the Chairman at the FOMC meeting the next day, you had the obligation to tell him so at the Monday Board meeting."* (Meyer (2004), Kindle Locations 1055-1061)

The role of board meetings in policy deliberations has recently been summarized by former Fed governor Kevin Warsh (2015) as follows:

> *"In my experience, there is no attempt by FOMC members to avoid the transcripts per se, but policy deliberations happen on a rather continuous basis. Given the large number of FOMC participants and the even larger number of staff in attendance at meetings, some discussions inevitably happen more routinely in small groups. The Government in the Sunshine Act-- a law designed to ensure the public's right to know of policy discussions-- is diligently followed. But, hallway discussions by two or three members of the Committee are not uncommon. Moreover, the board of governors (as distinct from the FOMC) typically meets biweekly to discuss, among other things, the state of the economy and the establishment of so-called discount rates. While distinct from the FOMC's policy decision, these discussions by the board of governors are not totally unrelated to FOMC policy discussions."*



Electronic copy available at: https://ssrn.com/abstract=2687614

Highlighting the importance of the board meetings, all intermeeting target changes post-1994 were preceded by a board meeting taking place either on the day of the intermeeting move or the day before (see column (4) of Table IV, Panel A).

To provide statistical evidence on the role of even-week board meetings, we test whether the stock returns in even weeks are driven by news coming out on even-week days that follow the board meetings. Over the 1994 to 2016 period, even week days $t$ for which there was a board meeting on one of days $t$-5,…,$t$-1 account for 32% of all days (dropping weekends). In Table VI, we regress daily excess stock returns on interaction terms between each of the even weeks and a dummy for whether any of days $t$-5 to $t$-1 had a board meeting. The regression also includes two further interactions – the interaction between this board meeting variable and a dummy for even-weeks with *no* board meeting and the interaction between this board meeting variable and an odd-week dummy. The omitted category is thus odd weeks that do not follow a board meeting.

**[Table VI about here.]**

We find that the interaction terms for even-week days that follow board meetings are significant. The coefficients on each interaction term range between 16 and 19 bps, which compares favorably to 12 bps for the even-week dummy in column (1) of Table I, Panel A. By contrast, there is no significant excess stock return for even weeks that do not follow a board meeting or for odd weeks that do follow a board meeting. As such, the market appears to earn a significantly positive average excess return only on even-week days that follow board meetings. We interpret this as showing that even-week board meetings are important to monetary policy decision making, most likely because the Board of Governors has a full set of economic updates and recommendations of the Reserve Banks every two weeks following the pre-FOMC board meeting.

### *B.4. Even-Week Mean-Reversion in Stock Returns: The "Fed Put"*

As the fourth piece of evidence, we argue that the behavior of stock returns over the FOMC cycle is consistent with the Fed acting according to a "Fed put" policy. This term, initially known as a "Greenspan put", refers to the view among some market participants that since the aftermath of the 1987 stock market crash, the Fed has reacted to poor stock market realizations – or the economic news that drove these stock market realizations – with accommodating monetary policy. Our interpretation relies on the Fed's behavior not being entirely anticipated by the market.



Electronic copy available at: https://ssrn.com/abstract=2687614

If the Fed has provided unexpectedly strong monetary policy accommodation following poor stock market returns (through current policy actions or through communication about future actions), and if this news has become public mainly in even weeks in FOMC cycle time, then we would expect the stock market to mean-revert following low stock market returns, with this mean-reversion observed only in even weeks. We first test the even-week mean-reversion hypothesis and then tie it to the Fed. In addition to establishing evidence of a Fed put, these tests help establish causality by showing that return patterns are consistent with a commonly mentioned narrative of Fed decision-making.

Figure 4, Panel A provides graphic evidence of even-week mean-reversion. We sort daily data for all 5,997 observations over the 1994 to 2016 period into five buckets based on the five-day excess stock return over day *t*-5 to *t*-1. The quintile buckets are defined without conditioning on FOMC cycle time. The x-axis in Figure 4, Panel A is the average past five-day excess return by quintile. For each of the five quintiles, we calculate the average excess stock return for day *t* separately for even-week days and odd-week days and graph these averages on the y-axis. The relation between the past five-day excess returns and the day *t* return for even-week days displays a clear asymmetry (resembling the payoff on a put option): following five-day excess returns in the lowest quintile, the average excess returns are 30 bps on even-week days and about -5 bps on odd-week days, consistent with mean-reversion being present only in even weeks. Figure 4, Panel B shows that the even-week mean-reversion pattern is very similar for weeks 0, 2, and 4 (it is more erratic for week 6 due to a lower number of observations).

**[Figure 4 about here.]**

To assess the statistical significance of these results, in column (1) of Table VII, Panel A we repeat our regression from column (2) of Table I, Panel A using only observations in the lowest quintile based on the excess stock return over day *t*-5 to *t*-1. Consistent with Figure 4, the even-week dummies are large and significant in the lowest quintile. In column (2), we report results from the same regression but using observations for days not in the lowest quintile. The even-week coefficients are smaller and only the week-zero coefficient is significant.

**[Table VII about here.]**

It is not clear what look-back period the Fed would use to assess whether a low stock return warrants accommodation.[17] Therefore, in column (3) and (4) of Table VII, Panel A, we

[17] Focusing their analysis at the frequency of scheduled FOMC meetings, Cieslak and Vissing-Jorgensen (2017) show that the Fed responds to stock market returns realized over at least two past intermeeting periods.



Electronic copy available at: https://ssrn.com/abstract=2687614

rerun the dummy variable regression on more restricted sets of observations. In column (3), we focus on observations for which both the past five-day (i.e., one week since we omit weekends) excess return and the past one-month excess return have been in their respective lowest quintiles. In column (4), we further restrict the sample to observations that have also been in the lowest quintile based on the past three months' excess return.[18] The more restrictive the sample we use, the more likely it is that the Fed – if following a put policy – would provide accommodation on a given even-week day in the sample. Consistent with this intuition, the coefficients on the dummy variables increase substantially going from column (1) to column (3) and from column (3) to column (4).

The coefficients in column (4) (107 and 72 bps per day) suggest that a large fraction of the realized equity premium must have been earned on a small number of days. In Table VII, Panel B, we decompose the log compound (gross) stock market return. The total log compound stock return across all 5,997 days in the 1994 to 2016 period was 2.04, meaning that $1 would have grown to exp(2.04)=$7.68 over this sample. Column (2) shows that of this log return, 2.72 was earned in even weeks. Even-week days that followed returns over the past week in the lowest quintile constitute only 20% of even-week days (557 of 2,795 days) but account for 1.62 of the total log return (these days fall not just on day 0 but are dispersed across weeks 0, 2, 4, and 6). All remaining even-week days (2,238 days) jointly account for 1.10 of the total log return. Absent the extra boost from even-week mean-reversion, returns on even-week days that follow returns over the past week in the lowest quintile would have been only 1.10/4=0.275, implying that even-week mean-reversion (which we argue below is driven by the Fed put) accounted for (1.62-0.275)/2.72=0.49 or about half of the total even-week stock returns.

We now turn to evidence that the even-week mean-reversion in returns is plausibly due to the Fed reacting to poor stock returns with this reaction in turn boosting the stock market. Focusing first on the stock market as a driver of Fed behavior, for each intermeeting rate change over the 1994 to 2016 period, Table VIII documents the cumulative excess stock returns since (and not including) the most recent day 0 of the current FOMC cycle, as well as the cumulative excess stock returns since day 0 of the prior cycle, the second prior cycle, etc. Out of the seven intermeeting moves, only one (April 18, 1994) was a hike. The six intermeeting rate reductions all follow a period of poor stock market performance, with stock market returns over the past

[18] To ensure comparable look-back period lengths for all days, we define one month as 22 days and three months as 65 days.



Electronic copy available at: https://ssrn.com/abstract=2687614

several FOMC cycles being in the lowest quintile.[19] Related, in Cieslak and Vissing-Jorgensen (2017), we show that poor stock returns predict reductions in the Fed funds target when focusing on all target changes in the 1994 to 2008 period, not only those that took place between meetings. We argue based on textual analysis that the stock market is causal for Fed policy and show that this is due mainly to a substantial impact of the stock market on the Fed's expectations of economic growth.

**[Table VIII about here.]**

If the even-week mean-reversion is due to news about monetary policy, then high stock returns on even-week days that follow market declines should predict subsequent reductions in the Fed funds target. We document support for this hypothesis in Table IX. We predict changes in the Fed funds target with stock returns on even-week days that follow stock market declines. We consider the same three definitions of stock market declines as in Table VII (low returns over the past week, low returns over the past week and past month, and low returns over the past week, past month, and past three months). Using data for the past one year, we sum returns on even-week days that follow stock market declines and use these to predict target changes. We find that high returns on even-week days do predict reductions in the target. Results are statistically stronger the more we restrict the definition of what constitutes a stock market decline leading up to high even-week returns.

**[Table IX about here.]**

## III. How Does the Fed Move the Stock Market?

The evidence on Fed funds futures and on predictability of target changes by even-week stock returns that follow market declines suggests that unexpectedly accommodating monetary policy is a likely driver of the even-week effect in stock returns. However, in terms of magnitudes, the change in Fed funds futures rates on even-week days is small. From Table V column (1) futures rates fall on average less than 1 bps on even-week days. Unless expected short rates many years in the future fall by equal amounts, changes in the expected path for short rates cannot rationalize all of the 12 bps higher excess stock returns on even-week days (from

[19] Leading up to the rate hike in April 1994, the stock market dropped by about 6% from the prior day 0. The losses took place in late March and early April, a period during which bond yields increased sharply in expectation of Fed tightening. Thus, the poor stock returns likely did not cause a tightening, but rather the expectation of a tightening may have caused the poor stock returns in this episode.



Electronic copy available at: https://ssrn.com/abstract=2687614

Table I column (1)). We next provide evidence that high realized even-week stock returns are driven in larger part by unexpected reductions in the equity risk premium on even-week days. We argue that the Fed lowers the equity premium (thus raising realized stock returns) by reducing downside risk via a promise to provide stimulus as needed.[20] We also argue that markets (and policy makers) systematically underestimated the magnitude of the policy accommodation that would be needed following market declines.

### *A. Unexpected Even-Week Reductions in the Equity Premium Lead to High Realized Stock Returns*

Martin (2017) derives a lower bound on the equity premium. This lower bound is the conditional risk-neutral variance (scaled by the gross risk-free rate):

$$E_t(R_T) - R_{f,t} \geq \frac{1}{R_{f,t}} var_t^* R_T.$$

Martin (2017) then estimates the bound based on equity options data for horizons ranging from one month to a year and argues that the bound is likely to be tight in the sense that (i) the time-series average of the bound is around 5% (which is close to typical estimates of the equity premium) and (ii) regressions of realized excess returns on ex-ante values of the bound lead to a regression coefficient around one. Using Martin's (2017) data, available at the daily frequency from January 1996 to January 2012, along with his equations (17) and (21), we calculate the forward equity premium for month 1, month 2, month 3, month 4 to 6, and month 7 to 12 (all annualized).

Figure 5 plots the average five-day changes in the one-month equity premium over the FOMC cycle. The equity premium falls in even weeks thus contributing to the high even-week stock returns. In Table X, we regress daily changes in a given forward equity premium on an

[20] This explanation is very different from one of the Fed causing risk with an associated risk premium for Fed news. Several other arguments go against a risk premium explanation. First, Brusa, Savor, and Wilson (2017) find no evidence for high excess returns on announcement dates of other major central banks, suggesting that there is not a risk premium for monetary policy news in general. Second, prior to our paper, no one appears to have been aware of the biweekly cycle in stock returns. Related, there is no systematic spike in realized stock return volatility in even weeks. This makes it unlikely that the Fed itself causes large amounts of risk with an associated risk premium.

Note that the evidence in Brusa, Savor, and Wilson (2017) is different from our evidence on international stock returns. We document how stock returns around the world react to news from the Fed over the FOMC cycle. Brusa, Savor, and Wilson (2017) document how stock markets react to announcements from central banks other than the Fed.



Electronic copy available at: https://ssrn.com/abstract=2687614

even-week dummy and find that the equity premium falls significantly in even weeks. The economic magnitude of the reduction in the equity premium is much larger than that for Fed funds futures rates. While the daily change in Fed fund futures was 0.3 bps lower on even-week days than odd week days (see Table V), the even-week regression coefficients for the one-year equity premium are -0.035 (-3.5 bps) for the week 0 dummy and -0.024 (-2.4 bps) for the week 2, 4, 6 dummy (Table X, column (6)).[21]

**[Figure 5 about here.]**

**[Table X about here.]**

The even-week dummy coefficients in Table X show a non-monotonic effect of monetary policy on the term structure of the equity premium. The near-term equity premium moves the most, the month 4 to 6 equity premium the least, and then the magnitude increases (in absolute value) again for the month 7 to 12 equity premium. Extrapolating, it is likely that monetary policy also affects the equity premium beyond one year. To assess which fraction of the overall even-week effect in realized excess stock returns comes from reductions in the equity risk premia, we regress daily excess stock returns on daily changes in the one-year equity premium. If changes in the equity premium beyond one year are correlated with changes in the one -year equity premium, the coefficient on the one-year premium will capture the effects of both changes in the one-year premium and changes in the equity premium beyond one year. We estimate a coefficient of -3.3 ($p$-value<1%) using all days (and an even larger coefficient of -3.7 using even-week days only). This suggests that 9.2 bps (=-2.8bps*(-3.3)) of the even-week effect of 12 bps per day can be accounted for by a Fed-induced reduction in the equity premium. This leaves only a small portion of the 12 bps even-week effect to be accounted for by cash flow effects induced by a lower cost of capital.[22]

The large effect of the Fed on the stock market via the risk premium channel over the FOMC cycle complements results in Bernanke and Kuttner (2005). Using a VAR setting and monetary policy shocks on FOMC announcement days, they show that the Fed affects the stock market mostly via the risk premium as opposed to the real rate or dividend growth channels: An

[21] The regression coefficient on a combined even-week dummy is -0.028 (-2.8 bps).

[22] It is possible that the regression coefficient of -3.3 in the regression of the daily excess stock returns on daily change in the one-year equity premium is picking up not only equity premium changes but also changes in expected cash flows that are correlated with the one-year equity premium. If so, this would suggest a larger role for cash flow effects.



Electronic copy available at: https://ssrn.com/abstract=2687614

accommodating shock identified from Fed funds futures increases stock prices by lowering the expected equity premium.

### *B. How Does the Fed Lower the Equity Premium? Reduced Downside Risk via a Promise to Act as Needed*

It is possible that the Fed lowered the equity premium via reductions in the riskless rate resulting in reaching for yield. However, it is well established in the literature (e.g., Gurkaynak, Sack, and Swanson (2005)) that Fed funds futures changes on FOMC announcement days have only modest explanatory power for stock market movements, even when focusing on tight windows around the FOMC announcement. A channel through which the Fed may affect the equity premium and the stock market without a substantial impact on Fed funds futures is by lowering downside risk via a promise to accommodate *as needed*.

Such a promise could lead to high returns on stocks yet have little effect on Fed funds futures because of two off-setting effects for futures. In particular, a promise to act more aggressively should lead markets to expect a *lower* Fed funds rate in bad states of the world. However, if this promise succeeds in making bad states less likely (via consumers and firms being less concerned about a severe recession), the net effect on the expected Fed funds rates could be small. Importantly, while the net effect of a reduction in downside risk on Fed funds futures rates is theoretically ambiguous, the two effects work in the same direction for stocks. Both a lower rate in some states of the world and reduced probabilities that these bad states will occur should be good news for the stock market. An important role for Fed-induced reductions in down-side risk would thus explain why it is harder to detect the FOMC cycle in Fed funds futures than in the stock market. Similarly, since reduced uncertainty tends to be bad for bonds, a role for monetary policy working via reduced downside risk also helps explain why it is harder to detect the FOMC cycle in bonds than in stocks.

In Internet Appendix Table IA.II we regress daily changes in Treasury yields on an even-week dummy. Panel A uses 1994 to 2016 data and documents that even-week yield changes are significantly lower than odd-week yield changes for both 2- and 10-year Treasuries on even-week days that are not in the lowest quintile based on the excess return over the past week



Electronic copy available at: https://ssrn.com/abstract=2687614

(column (3) and (6)). This is not the case on even-week days that are in the lowest quintile (column (2) and (5)).[23]

We provide several additional pieces of evidence to support the claim that the Fed lowered downside risk via a promise to lower the policy rate (or provide additional accommodation via unconventional measures), as needed. First, one would expect this promise to be most important following increases in uncertainty, which tend to coincide with declines in the stock market. This is when there is the greatest need for a reduction in downside risk and also the largest scope for the Fed to affect the economy by reducing downside risk. If this is true, we should see little evidence of even-week reductions in Fed funds futures following declines in the stock market because of the offsetting effects of Fed policy on the riskless rate. Yet we should still see large positive even-week stock returns given that a Fed-induced reduction in downside risk boosts the stock market. Indeed, Table V columns (2) and (3) show that the reductions in Fed funds futures rates on even-week days are driven entirely by days that *are not* in the lowest quintile based on the excess stock return over the past week. Columns (4) though (7) show that this is true for both the 2000 to 2008 period and the 2009 to 2016 period. By contrast, Table X columns (7) and (8) document that the decline in the equity premium is stronger on even-week days that *are* in the lowest quintile based on the excess stock return over the past week than on even-week days that are not.

A concrete example that is consistent with the Fed reducing downside risk by promising accommodation, should it be needed, is the FOMC's press release on August 17, 2007. Over the prior five days, the cumulative excess return on the stock market was -5.9%. The Fed reacted with the following press release:

> *"Financial market conditions have deteriorated, and tighter credit conditions and increased uncertainty have the potential to restrain economic growth going forward. In these circumstances, although recent data suggest that the economy has continued to expand at a moderate pace, the Federal Open Market Committee judges that the downside risks to growth have increased appreciably. The Committee is monitoring the situation and is prepared to act as needed to mitigate the adverse effects on the economy arising from the disruptions in financial markets."*

On that day, the stock market increased by 2.4%, while the second month Fed funds futures rate *increased* 2.5 bps and the 24th month Fed funds futures rate *increased* 7 bps. It appears that the

[23] The sample period also plays a role for bonds. Panel B of Internet Appendix Table IA.II shows that even-week yield changes are significantly lower than odd-week yield changes in the zero-lower bound period 2009-2016 when monetary policy worked via forward guidance and quantitative easing, both policies with a more direct impact on bond yields than changes to the Fed funds target.



Electronic copy available at: https://ssrn.com/abstract=2687614

Fed's statement that it was "prepared to act as needed" calmed the stock market without any reduction in Fed funds futures (on the same date the Fed cut the discount rate by 50 bps which may have helped increase confidence that the Fed really was prepared to act as needed going forward).

Second, the fact that ex-post the Fed did in fact have to provide large amounts of accommodation following both the 2001 recession and the Great Recession does not contradict our explanation for modest declines in Fed funds futures following stock market declines. Had everyone foreseen that the economy would be struggling for years after the onset of recession, then we should have seen large drops in futures ex-ante. However, Cieslak (2018) shows that ex-post the economy turned out substantially worse than expected. Professional forecasters' expectations of the federal funds rate – and even expectations from the Fed's own Summary of Economic Projections – do not decline "enough" following bad economic news. Expectational errors are significantly negative, as forecasters overestimated the level of future short rates. Thus, ex-post, the Fed lowered rates more than investors and even the Fed itself anticipated.[24]

## IV. Channels for How Information Gets from the Federal Reserve to Asset Markets

In this section, we consider how news gets from the Fed to asset markets via either formal channels – open market operations, official public releases, and speeches by Fed officials – or informal (intentional or unintentional) Fed communication.

### *A. Open Market Operations*

In February 1994, the FOMC started announcing its Fed funds rate decision right after the meeting. Before February 1994, the Fed did not announce policy changes, and the market instead inferred changes to the target Fed funds rate from open market operations. Might the Fed have continued to communicate with the market via open market operations in the post-1994 period? We have spoken with senior Federal Reserve officials who stated that no such signaling

[24] Another possible explanation for why the Fed put does not show up in Fed funds futures is that following stock market declines, information communicated by the Fed about its outlook for the economy was systematically better than expected. An emerging literature (Campbell, et al. (2012) and Nakamura and Steinsson (2018)) documents that news from the Fed has a substantial macro news component (in addition to the policy news component). However, it seems unlikely that the Fed systematically released positive macro information after stock market declines. Cieslak and Vissing-Jorgensen (2017) document that the Fed updates its expectations for real GDP growth and unemployment about the same in response to poor stock returns than do private sector forecasters from the Survey of Professional Forecasters. This is not indicative of the Fed having positive macro information at these times.



Electronic copy available at: https://ssrn.com/abstract=2687614

via OMOs takes place. Consistent with this, no private sector Fed watchers we have asked attempt to infer Fed policy from OMOs in the post-1994 period. Perhaps more importantly, the FOMC cycle is equally strong during the zero-lower bound period were markets were flooded with reserves and signaling via open market operations was not possible.

### *B. Public Information Releases and Speeches*

A second possible communications channel is public information releases and public speeches by Fed officials.

#### *Public information releases*

The main public release documents are the official FOMC Statement, the FOMC Minutes, the Discount Rate Minutes (i.e., minutes of the Board of Governors board meetings), and the Beige Book.[25] The FOMC Statement is released publicly just after the FOMC meeting has ended. As shown by Lucca and Moench (2015), the return in week 0 in FOMC cycle time is earned prior to the FOMC statement. The FOMC statement thus cannot be viewed as a direct explanation for the high average exress stock returns in week 0.

Before December 2004, FOMC Minutes were released on average 47 days after the meeting (i.e., after the next FOMC meeting). Since December 2004, FOMC minutes have been released on average 21 days after the meeting.[26] Since May 2001, Discount Rate Minutes have been released once per FOMC cycle, around four weeks after the FOMC meeting. Before this, we have only the Discount Rate Minute release dates for the 1994 and 1995 minutes, which were released in bundles, with two releases in 1994, two in 1995, and one in 1996. The Beige Book, which summarizes economic conditions across the 12 Reserve Bank districts, is made public two weeks *prior* to each scheduled FOMC meeting. Internet Appendix Figure IA.5, Panel A, illustrates the timing of public releases of the three documents. The release of FOMC Minutes

[25] The FOMC Transcripts and Greenbook/Bluebook (now called the Tealbook), which describes the national economic situation and provides a proposal on monetary policy options, are released publicly with a delay of five years and thus contain little news at the time of the public release.

[26] To reconstruct the historical minutes release dates, we follow the minutes publication rules discussed in the 2005 Federal Reserve Bulletin (Danker and Luecke (2005)). Historically, the publication rules were as follows: from the beginning of 1994 through December 1996 – Friday following the next scheduled FOMC meeting; from 1997 through 2004 – Thursday after the next scheduled FOMC meeting; from 2005 onward – 21 days after the FOMC meeting. We further verify the dates implied by these rules as follows: from January 1997 to January 2004, we use the date on which Fed minutes were updated on the FRB website. From June 2002, we are able to cross-check those dates with Bloomberg economic calendar. On one occasion, the Bloomberg release date is one day after the date on the FRB website in which case we use the latter. For minutes released after January 2004, we use the official release date reported on the FRB website under "Transcripts and Other Historical Materials."



Electronic copy available at: https://ssrn.com/abstract=2687614

does not line up with even weeks in FOMC cycle time after 2004. Before that time, they fall just *after* the next FOMC meeting, which is in week 0 in FOMC cycle time, but the high week 0 returns are earned *prior to* the announcement. However, Beige Book and Discount Rate Minutes releases tend to take place in week 4 in FOMC cycle time and therefore, if sufficiently informative, could help explain the high average excess stock returns in this week.

In Table XI, we test whether Discount Rate Minutes and Beige Book releases help to account for the high average excess returns in week 4. Table XI column (1) is the specification from Table I column (2). Table XI column (2) includes controls for public Fed releases related to monetary policy. None of the public release dummies is significant. Importantly, including the public release dummies has little effect on the coefficients and statistical significance of the even-week dummies. One may be concerned that a public release occurs after the end of trading or that the full effect on markets is not realized until the following day.[27] When we add the lagged value of the public release dummies (not shown for brevity), we find that these are insignificant and the even-week dummy coefficients are largely unchanged.

**[Table XI about here.]**

*Speeches*

The Fed also may release information via the speeches of Fed officials. Internet Appendix Figure IA.5, Panel B presents the timing of such speeches, with data collected from Federal Reserve System web pages and shifting weekend speeches to Mondays. Our sample includes 498 days on which the Chair gave a public speech, 215 days for the Vice-Chair, 637 days for a governor, and 1,589 days for a president of a Reserve Bank. (Note that few speeches surround the FOMC meetings themselves, since this period is part of the "blackout period" that runs from seven days before the start of the FOMC meeting to the end of the day after the day on which the FOMC meeting ends. The blackout policy was extended from covering staff to also cover the FOMC members themselves in 2011, but, based on the frequency of public speeches, it appears to have been informally adhered to prior to 2011.) The only peak in speech frequency that overlaps with an even week in FOMC cycle time corresponds to speeches by Reserve Bank presidents in week four in FOMC cycle time. This lines up with the release of Beige Books and Discount Rate Minutes.

[27] Beige book and FOMC minutes were released at 2:00pm or earlier (each on a different date) throughout our sample, with the exception that before 1996, FOMC minutes were released at 4:30pm. We do not have time of day information for the Discount Rate Minutes releases.



Electronic copy available at: https://ssrn.com/abstract=2687614

In Table XI column (3), we test whether there is a stock market excess return associated with speeches by Federal Reserve officials. We include speech dummies and lagged speech dummies since we do not know the time of day for all speeches. We find that days with speeches by governors, and not others, are associated with excess returns. Excess returns are on average about 9 bps higher on days of governor speeches, significant at the 10% significance level. However, the importance of the even-week dummies is essentially unchanged by the inclusion of the speech dummies.

We also analyze whether speeches in even weeks are more important than speeches in odd weeks. Even-week days with governor speeches are associated with 21 bps excess returns (*t*-statistic=3.45) whereas odd-week days with governor speeches have zero excess return (*t*-statistic=0.1). The fact that governors' speeches and especially even-week governors' speeches are associated with significant excess returns supports the importance of the Board of Governors as a source of important market-moving information. However, since even-week dummies remain unaffected by the inclusion of speech dummies or public release dummies, these events are likely to be only one of the channels through which information gets from the Fed to financial markets in even weeks in FOMC cycle time.

### *C. Systematic Informal Communication with the Media and the Financial Sector*

To better understand how information flows from the Fed to the markets, we compile various pieces of evidence consistent with an informal communication channel. We start with a quote by Richard Fisher, then president of the Dallas Fed, in the November 2010 FOMC meeting transcript stating that the Fed has a leak problem:

> *"On the second issue of people that have close relationships with market participants, I think of it as akin to insider trading. There are people who do profit. There is one former Governor who recently visited my Bank […] who told the staff […] that this individual—I'll let you guess who it is—was, in essence, the 18th or 19th member, depending on how many we have, of the FOMC, and the equivalent of a voting member. He makes money off of us when he talks and sells. If we can't solve this, then I think we should seriously look at some kind of firm legal strictures that are equivalent to the prosecution of insider trading. If people make money off inside knowledge about our decisions, it's no different from people who make money off inside information trading securities. In fact, I think it's a more grievous abuse."* [28]

[28] According to media reports that followed the transcript release in January 2016, the former governor referred to in the quote is Larry Meyer, who as of 2010 was with Macroeconomic Advisers. See, in particular, the January 15, 2016 *Wall Street Journal* article written by Josh Zumbrun. According to the article, Meyer left the firm a few weeks before the transcript of the November 2010 FOMC meeting was released to the public (in January 2016).



Electronic copy available at: https://ssrn.com/abstract=2687614

*C.1. Evidence of Fed Leaks to the Media "Signal Corps"*

Our first evidence of media leaks comes from the literature. Belongia and Kliesen (1994) study the congressional *Gonzales Hearings* of 1993. On 11 occasions from 1989 to May 1993, the essence of the FOMC directive to the open market operations desk was leaked to the *Wall Street Journal* within one week of the meeting and prior to its public release.[29] Congressional dissatisfaction with these leaks led to the Fed's concessions to release its Fed funds target decision right after the FOMC meeting and to make transcripts of FOMC meetings available, with a five-year lag (Lindsey (2003)).[30]

This use of the media to leak information is a systematic feature of Fed communication according to Meyer (2004), who provides a historical list of recent reporters involved in what he calls the "signal corps":

> "*The use of reporters as part of the Fed's signal corps is not official Board or FOMC doctrine. The public affairs staff and the Chairman like to pretend it doesn't happen… John Berry, longtime reporter for The Washington Post and now at Bloomberg is the more widely recognized in this role. But The Wall Street Journal reporter covering the Fed – it was David Wessel, then Jake Schlesinger, and most recently Greg Ip during my term – was also a regular member of the signal corp." (p. 98) […] "I was surprised, then, one Monday before an FOMC meeting, to pass John Berry coming out of the Chairman's office." (p. 99)*

In Bernanke's (2015) book, he lists his most used reporters as Jon Hilsenrath (*Wall Street Journal*), Greg Ip (*The Economist*), Krishna Guha (*Financial Times*), Neil Irwin (*Washington Post*), John Berry (*Bloomberg*), Steve Liesman (*CNBC*), and Ed Andrews (*New York Times*).

To link the information obtained by the signal corps with the FOMC cycle, we collect the dates of news articles (dropping commentaries and book reviews) by David Wessel in the *Wall Street Journal* that contain any of the words "FOMC," "open market committee," or "fed board." Among those in the signal corps, we focus on Wessel because his writing stays relatively focused on monetary policy. Our Proquest search identifies 79 articles over the 1994 to 2016 period. The left graph in Figure 6 plots the probability of an article on day *t*. Many of the articles cover public releases from the Fed (primarily FOMC statements and FOMC minute releases), which is not our focus in this exercise that aims to document informal communication. Thus, in the right

[29] The most famous articles in this series of leaks were two stories by David Wessel in May 1992 and May 1993 on the FOMC's decision to switch to a "symmetric tilt" in 1992 and an "asymmetric tilt" toward tightening in 1993.
[30] Woodward (1994) suggests that Greenspan was the likely source of the 1989-1993 leaks.



Electronic copy available at: https://ssrn.com/abstract=2687614

graph of Figure 6 we drop any article published the day after either of those two public events and plot the probability of any of days $t$ to $t$+4 having an article. The figure displays a biweekly pattern in FOMC cycle time.

**[Figure 6 about here.]**

We also provide anecdotal evidence that ties Fed leaks to the information aggregation in board meetings. Table XII, Panel A lists seven examples of board meeting discussions emerging in the public domain through the media or Fed watcher newsletters. The first five are leaks to the media. The similarity of article content to discount rate minute content (right column) strongly suggests that the signal corps writer had conversations with a Fed official in attendance at the board meeting.

**[Table XII about here.]**

### *C.2. Evidence of Fed Leaks to Financial Institutions*

The last three entries of Table XII, Panel A are examples of board meeting discussions emerging through Fed watcher newsletters. Furthermore, Table XII, Panel B provides a list of Fed leaks of nonpublic FOMC meeting content, illustrating the access that financial institutions have to confidential monetary policy information. By the nature of this task, we are only able to employ evidence that has emerged in the public domain. However, the detail of the leaked information and the lack of discretion of letter writers as to the origins of their information are telling.

The most well-known example (item 6 in Panel B) is the October 3, 2012 leak to Medley Global Advisors (MGA), a policy intelligence firm.[31] Regina Schleiger, the MGA analyst, had a copy of the FOMC minutes from the September 2012 FOMC meeting, which were due to be released the day after her article. In addition, she provided a step-by-step account of the policy debate among FOMC members ahead of the September 2012 FOMC meeting, information that goes beyond the content of the minutes. After this leak emerged, Congress demanded the list of Fed personnel in contact with MGA. The list is confidential. Jeffrey Lacker later resigned after admitting involvement but claims he was not the source of MGAs information. Yellen's calendars reveal several meetings with MGA though not at the time of the September leak.

[31] Their promotion material (website) reads: "Medley Global Advisors delivers accurate, unbiased intelligence on macroeconomic and political events by cultivating relationships with senior policymakers around the globe. Our network includes central banks, finance ministries, regulatory and intelligence agencies, and international finance and trade organizations." Medley Global Advisors is a Financial Times company.



Electronic copy available at: https://ssrn.com/abstract=2687614

The first item in Panel B is the famous Geithner leak, from the FOMC transcript of August 2007 detailing Geithner's leak of changes to the discount facility to Bank of America's CEO. In Item 2, PIMCO's Bill Gross discusses the content of the Greenbook live on CNBC on a day 0, *before* the FOMC announcement. Item 3 discusses how Larry Meyer, then the president of Macroeconomic Advisers, had the details of the August 2010 FOMC meeting weeks before the information was to emerge publicly.[32] Item 4 is a reference to a newsletter outlining the Fed's plans to conduct another Operation Twist (what became known as the Maturity Extension Program) in 2011, following a meeting with Bernanke. Item 5 recounts how a Fed watcher (in this case, a former Fed governor) changed his view and predicted a surprise move by the Fed, after having watched Fourth of July Fireworks with Fed officials.

The words of FOMC participants themselves are also informative about the extent of leaks. In addition to November 2010 transcripts, discussion of information leaks appear in about a third of the 144 transcripts available for 1994 to 2011 with different FOMC members expressing concerns about information leaks.

### *C.3. Fed Motives for Systematic Informal Communication*

If leaks of information are systematic and intentional, the Fed must have a motive. From off-the-record conversations with Fed officials and reading biographies, we identify four motives.

First, informal communication facilitates policy *flexibility*. Flexibility involves several dimensions of the Fed valuing being able to make policy in a more continuous manner. A closely related concept is gradualism in monetary policy (see, for example, Coibion and Gorodnichenko (2012)). In his speech on May 24, 2004, Governor Bernanke explains: "*Because policymakers cannot be sure about the underlying structure of the economy or the effects that their actions will have on economic outcomes, and because new information about the economic situation arrives continually, the case for policymakers to move slowly and cautiously when changing rates seems intuitive*." Informal communication is more gradual than public communication in the sense that policy makers, faced with an uncertain environment, can make incremental policy changes outside of the discrete FOMC meetings schedule. Moreover, the Fed is averse to surprising the market. Stein and Sunderam (2018) model the Fed as behaving as if it is averse to bond-market

[32] Perhaps it is not very surprising that the macroeconomic forecasting by Macroeconomic Advisers ranks first among private models in Bauer, Eisenbeis, Waggoner, and Zha (2006)'s analysis of forecast accuracy.



Electronic copy available at: https://ssrn.com/abstract=2687614

volatility. A *Wall Street Journal* article (3/17/2015) quotes former Governor Stein's view: "*To avoid unsettling markets, he [Stein] said, Fed officials have an incentive to stick to the path investors infer*." By using informal communication, the Fed can – without the commitment a publicly announced policy change would imply – steer the expectations of investors by engaging with the macro policy forecasting and newsletter firms that set the market's perception of monetary policy.

Second, informal communication is a *tool for* e*xplaining* the Fed policy and the Fed's decision making process. By explaining the weights of various economic inputs in Fed decision making as they change dynamically over time in between meetings, the Fed can use informal communication to reduce uncertainty about the policy rule and guide policy expectations. Blinder, et al. (2008) provide an overview of the benefits of central bank communication, arguing that openness increases the efficiency of monetary policy. As far back as 1936, in his treatise on the Fed, Burgess (vice president of the New York Fed) writes of communication through the press: *"There have frequently also been informal conversations with the representatives of the press reviewing the general factors having weight in the discount rate discussions"*(Burgess (1936), p. 222).

Third, informal communication is a channel for Fed *learning* from the private sector. Given its aversion to Fed-induced market volatility, the Fed perceives a benefit from getting a sense of how the market would react to a given policy move. This could be either through learning how the macro models used by the private sector would forecast the market's reaction to a particular move, or through direct feedback on its potential policy decisions. Item 4 in Table XII, Panel B is an example of such feedback. A *Wall Street Journal* article by Susan Pullman, 11/22/2011, quotes Blackrock CEO Laurence Fink explaining the Fed's quid pro quo relationship with financial institutions:

> *"…But hedge fund managers and Wall Street executives who meet regularly with [Chair Bernanke] and other Fed officials -- both in his office and through advisory committees -- say they get valuable insights during the face-to-face talks. "It's like an inquisition; they have a topic;" said Laurence Fink; chief executive of investment-management giant BlackRock Inc. "By the questions they ask; by definition; you know what's on their mind."*

Fourth, informal communication is an equilibrium outcome of *disagreements* among FOMC members. The transcript of the 9/15/2003 FOMC meeting contains a 69-page debate on the difficulty of drafting a policy statement that reflects the views of all members. Meyer (2004),



Electronic copy available at: https://ssrn.com/abstract=2687614

describing the situation inside the Fed at the time of the Clary leak (item 2 of Table XII, Panel A), refers to the positioning of Reserve Bank presidents and governors against Greenspan as the reason for the leak, calling it "political hardball inside the Fed" and "an uprising within the Committee [the FOMC]." Individual FOMC members may seek to drive the market's perceptions of Fed's thinking by communicating with the media and newsletter writers. One top official used the terminology of "setting the record straight" to describe this behavior. Leaks as an outcome of disagreement fit naturally with the Fed's concern not to cause market volatility: if one FOMC member succeeded in representing his or her view as that of the Fed more broadly and markets reacted accordingly, the Fed would be compelled to act as the market (incorrectly) expected. To avoid this outcome, FOMC members have an incentive to all talk to the same members of the press and the same newsletter writers. Consistent with this view, an investigation into the sources behind a particularly detailed *Wall Street Journal* article by Jon Hilsenrath on 9/28/2012 found that before publishing the article "*its author had talked, in some cases multiple times, with every Reserve Bank president and most members of the Board of Governors*."[33] The pre-FOMC stock returns documented by Lucca and Moench (2015) may be due to leaks intended to influence the public's interpretation of the FOMC statement – by necessity, such leaks would need to come before the statement itself to be useful (we test this idea below).

The motives for informal communication by the Fed are surprisingly similar to the motives for leaks from other parts of the U.S. government (particularly the White House) documented by Pozen (2013). Leaks due to internal disagreements are what Pozen (drawing on earlier work by Hess (1984)) calls "internecine leaks" and "counter-leaks." Similarly, what we refer to as a Fed learning motive to obtain feedback on potential policy moves is denoted a "trial-balloon leak" by Pozen, "meant to test the response of key constituencies." As for flexibility, Pozen advances a theory of how executive branch interests are served by leakiness: "*These interests include preserving ambiguity as to the origins of unattributed disclosures and therefore the communicative flexibility of top officials*."

### *C.4. Tests of the Fed's Motives*

We can test the Fed's motives for informal communication. First, if we are correct that the Fed values flexibility, the Fed would be expected to make fewer target changes post-1994,

[33] See "Staff Summary of Review of Potential Breach of FOMC Policies Protecting Confidential FOMC Information," available at http://www.federalreserve.gov/foia/files/staff-summary-of-review-of-potential-breach-of-fomc-policies-20150323.pdf



Electronic copy available at: https://ssrn.com/abstract=2687614

because changes necessitate public statements. This is precisely what happened. The fraction of intermeeting target changes drops discretely in 1994 from a mean of 66.7% for 1982:9 to 1993 to a mean of 11.3% for 1994 to 2016 (significant at the 0.1% level). To our knowledge, no other explanations have been put forward for the decreased use of intermeeting changes post-1994.

Second, if we are correct that the Lucca and Moench (2015) pre-FOMC effect is driven by leaks before the FOMC statement, then the pre-FOMC effect should not be present before 1994. However, as long as a similar amount of information is released in week 0 in its entirety, the total week 0 excess return on stocks should be similar before and after 1994. Only the timing should differ, with the post-1994 week 0 returns condensed prior to the announcement due to the information reaching the market via informal channels, and pre-1994 week 0 returns spread out after the end of the FOMC meeting as the market gradually learns about any target change. In Table XIII, we report tests of this prediction, where we decompose the total week 0 returns into the period before the end of the FOMC meeting and after the end of the FOMC meeting (splitting at 2 pm). The first column presents results for pre-1994, and the second column for post-1994. Overall, week 0 returns are large and statistically significant in both periods, but are concentrated before the FOMC statement in the post-1994 period and after the end of the meeting in the pre-1994 period.

**[Table XIII about here.]**

## V. Policy Discussion

What are the social welfare implications of informal communication? If the primary motive for informal communication is to explain policy, there is little reason for explanations to be private. If Fed motives are primarily flexibility and disagreements, then the core issue is the extent to which the Fed is concerned with not being perceived as driving financial markets. A Fed less concerned with moving the market would not lose flexibility by using public communication and would not need to resort to informal communication in response to disagreement. Stein and Sunderam (2018) argue that society would be better off with a Fed that cared less about surprising the market. If it is difficult to make state-contingent policy statements, greater efforts around conveyance via informative, nuanced formal statements would seem to be preferred over informal communication.



Electronic copy available at: https://ssrn.com/abstract=2687614

In our view, the only potentially defensible motive for informal communication is Fed learning. However, learning involves a tradeoff as, in the process, the Fed is likely to give an information advantage to some in the financial sector. The optimal point on this tradeoff depends on how insider trading on Fed information affects inequality (given that those getting insider information are likely concentrated at the top of the wealth distribution) and the public's confidence in financial markets and the Fed. Even if some leaks necessitated by learning may be beneficial to society, increased sanctioning of other leaks would be welfare increasing.

## VI. Conclusion

In this paper, we have documented a novel pattern in stock returns in the U.S. and around the world. Over the last 23 years, the equity premium has been earned entirely in even weeks in FOMC cycle time. This pattern is statistically robust and continues to be present over the 2014 to 2016 period following the first draft of our paper.

The FOMC calendar is irregular across years and does not appear to line up with calendars for reserve maintenance periods, macro releases or corporate earnings releases. Four pieces of evidence makes it likely that the FOMC cycle in stock returns is driven by monetary policy news from the Fed. Intermeeting target changes tend to be in even weeks, Fed funds futures yields on average fell in even weeks, high even-week stock returns are disproportionately driven by even-week days with Board of Governors board meetings, and even-week returns are particularly high following poor stock market performance, consistent with a Fed put. A central mechanism through which the Fed appears to move the market is by reducing the equity premium, with this mechanism particularly important for explaining the Fed put.

To establish the channel for how information gets from the Fed to asset markets, we show that the biweekly peaks in average excess stock returns over the FOMC cycle do not systematically line up with official public releases or speeches by Fed officials. Instead, we argue based on both documented leaks and narrative evidence (including the FOMC's own deliberations about leaks) that the Fed systematically uses informal communication channels. We lay out motives for the Fed's systematic informal communication emphasizing flexibility, explaining policy, learning from the market, and disagreement among Fed officials. Only learning from the private financial sector could have benefits from a public policy perspective,



Electronic copy available at: https://ssrn.com/abstract=2687614

but any such benefits must be balanced against the risk of insider trading and informal communication undermining the public's trust in financial markets and the Fed.

## References


Bauer, Andrew, Robert A. Eisenbeis, Daniel F. Waggoner and Tao Zha, 2006, Transparency, expectations, and forecasts, *Federal Reserve Bank of Atlanta Economic Review*, First Quarter.

Belongia, Michael T., and Kevin L. Kliesen, 1994, "Effects on interest rates of immediately releasing FOMC directives," *Contemporary Economic Policy* 12, 79-91.

Bernanke, Ben, 2015, *The Courage to Act: A Memoir of a Crisis and Its Aftermath,* (W. W. Norton, New York).

Bernanke, Ben, and Kuttner, Kenneth N., 2005, What explains the stock market's reaction to Federal Reserve Policy? *Journal of Finance* 60, 1221-1257.

Blinder, Alan S., Michael Ehrmann, Marcel Fratzscher, Jakob de Haan and David-Jan Jansen, 2008, Central bank communication and monetary policy: A survey of theory and evidence" *Journal of Economic Literature* 46, 910-945.

Brusa, Francesca, Pavel Savor, and Mungo Wilson, 2015, One central bank to rule them all, working paper, Oxford University.

Burgess, W. Randolph, 1936 (reprint edition, 1946). *The Reserve Banks and the Money Market, The United States of America*, (Harper & Brothers, New York).

Campbell, Jeffrey R., Evans, Charles L., Fisher, Jonas D., and Justiniano, Alejandro, 2012, Macroeconomic effects of FOMC forward guidance, *Brookings Papers on Economic Activity* 43, 1-80.

Cieslak, Anna, 2018, Short rate expectations and unexpected returns in Treasury Bonds, *Review of Financial Studies*, 31, 3265-3306.

Cieslak, Anna, and Annette Vissing-Jorgensen, 2017, The economics of the Fed Put, working paper.

Coibion, Olivier, and Yuriy Gorodnichenko, 2012, Why are target interest rate changes so persistent?" *American Economic Journal – Macroeconomics*, 4, 126–162.

Deborah J. Danker and Luecke, Matthew M., 2005, Background on FOMC meeting minutes, *Federal Reserve Bulletin*, Spring.

Gurkaynak, R. S., B. Sack and E. T. Swanson, 2005, Do actions speak louder than words? The response of asset prices to monetary policy actions and statements, *International Journal of Central Banking* 1, 55-93.

Hess, Stephen, 1984, *The Government/Press Connection,* (Brookings Institution, Washington D.C.).

Jinushi, Toshiki, and Kenneth N. Kuttner, 2008, The information content of discount rate requests. Working Paper.




Electronic copy available at: https://ssrn.com/abstract=2687614

Krishnamurthy, Arvind, Stefan Nagel and Annette Vissing-Jorgensen, 2017, ECB policies involving government bond purchases: Impact and channels, *Review of Finance* 22, 1-44.

Kuttner, Kenneth N., 2001, Monetary policy surprises and interest rates: Evidence from the Fed funds futures market, *Journal of Monetary Economics* 47, 523-544.

Lindsey, David E., 2003, A modern history of FOMC communication: 1975-2002, Class I - FOMC Document, authorized for public release.

Lucca, David O., and Emanuel Moench, 2015, The pre-FOMC announcement drift, *Journal of Finance* 70, 329-371.

Martin, Ian, 2017, What is the expected return on the market?, *Quarterly Journal of Economics* 132, 367-433.

Meyer, Laurence H., 2004, *A Term at the Fed,* (Harper-Collins Publishers Inc., New York).

Nakamura, Emi, and Jon Steinsson, 2018, High frequency identification of monetary non-neutrality: The information effect. *Quarterly Journal of Economics* 133, 1283-1330.

Pozen, David E., 2013, The leaky Leviathan: Why the government condemns and condones unlawful disclosures of information, *Harvard Law Review* 127, 512-635.

Rey, Helene, 2013, Dilemma not trilemma: The global financial cycle and monetary policy independence, *Jackson Hole Conference Proceedings*, (Federal Reserve Bank of Kansas City, Kansas City).

Savor, Pavel, and Mungo Wilson, 2017, Asset pricing: A tale of two days, *Journal of Financial Economics* 113, 171-201.

Stein, Jeremy, and Adi Sunderam, 2018, The Fed, the bond market, and gradualism in monetary policy, *Journal of Finance 73,* 1015-1060.

Thornton, Daniel L., 2005, A new Federal funds rate target series: September 27, 1982 – December 31, 1993, Working Paper 2005-032A, Federal Reserve Bank of St. Louis.

Warsh, Kevin, 2015, Institutional settings: Designs, deliberations and decisions", remarks prepared for the Stanford University Hoover Institution conference "Central Bank Governance and Oversight Reform: A Policy Conference".

Woodward, Bob, 1994, *The Agenda: Inside the Clinton White House*, (Simon and Schuster, New York).



Electronic copy available at: https://ssrn.com/abstract=2687614

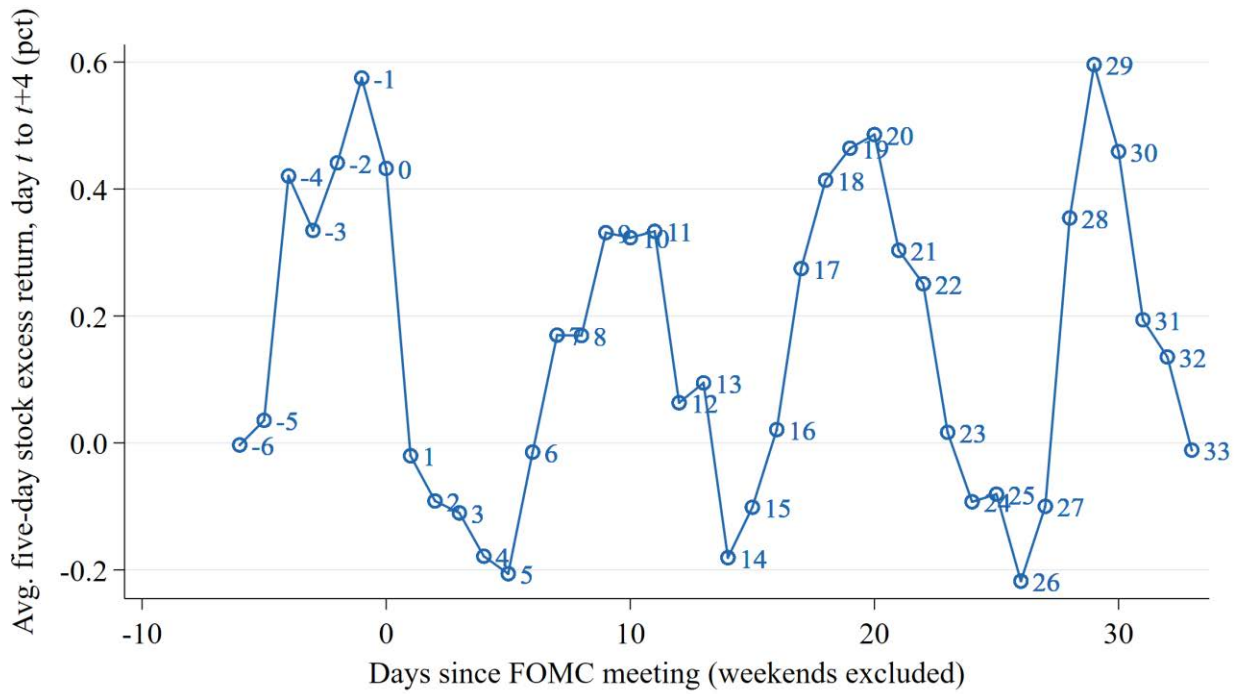



**Figure 1. Stock returns over the FOMC cycle, 1994 to 2016.** The plot is based on data covering 184 FOMC cycles (eight scheduled FOMC meetings per year). The numbers along the line indicate the value on the horizontal axis. The five-day (forward) returns computed for any of days -6 through -1 of the FOMC cycle are not used in the right part of the graph, so points to the right do not use any data for days -2 and later.

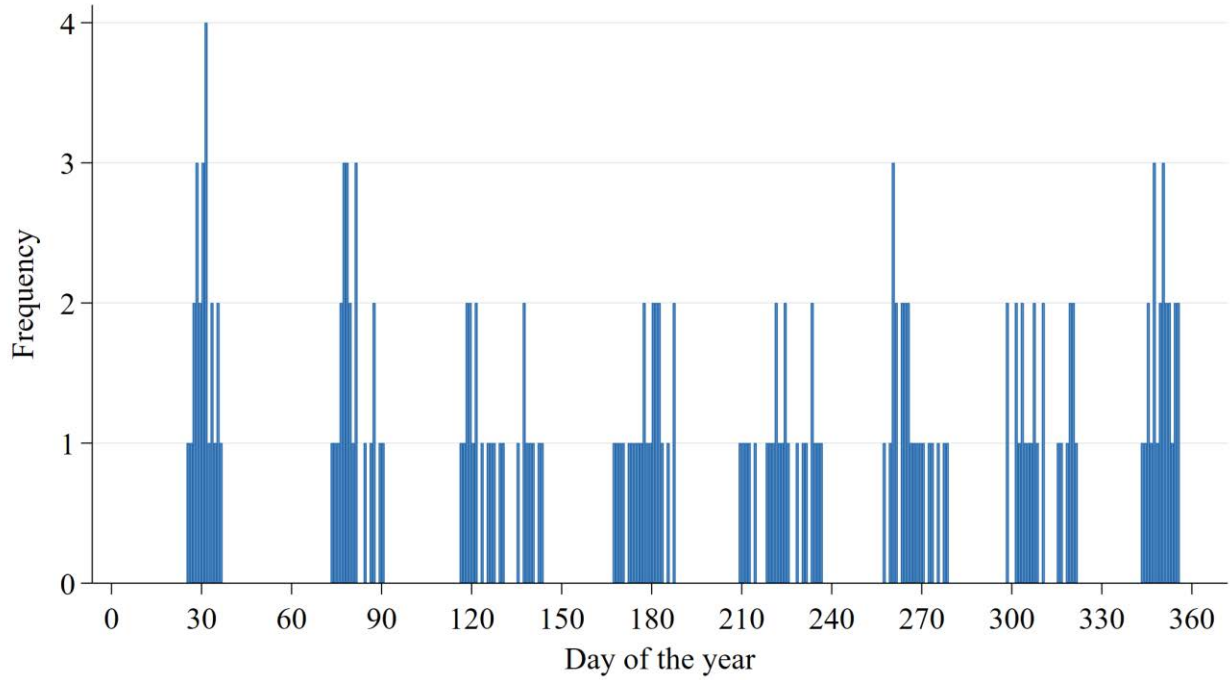
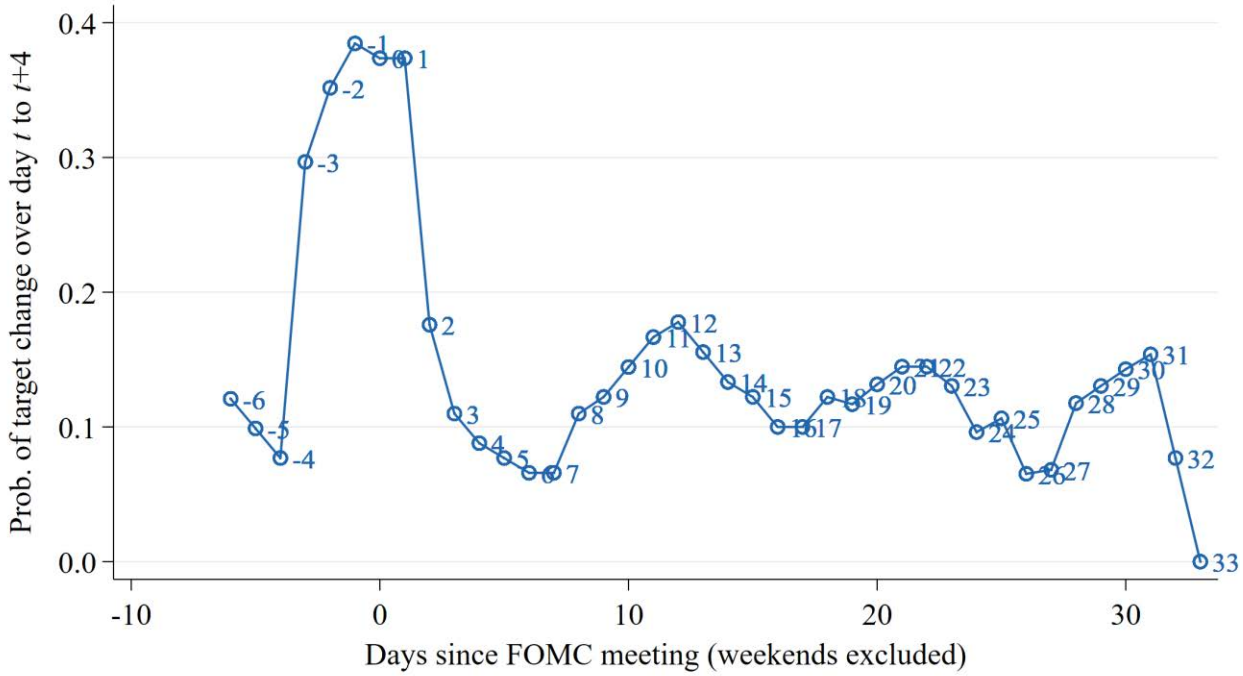



**Figure 2. Timing of the eight FOMC meetings within the year, 1994 to 2016.** The figure presents the histogram of the day of the year on which FOMC meetings took place. For two-day meetings, we set the FOMC meeting day equal to the second day.

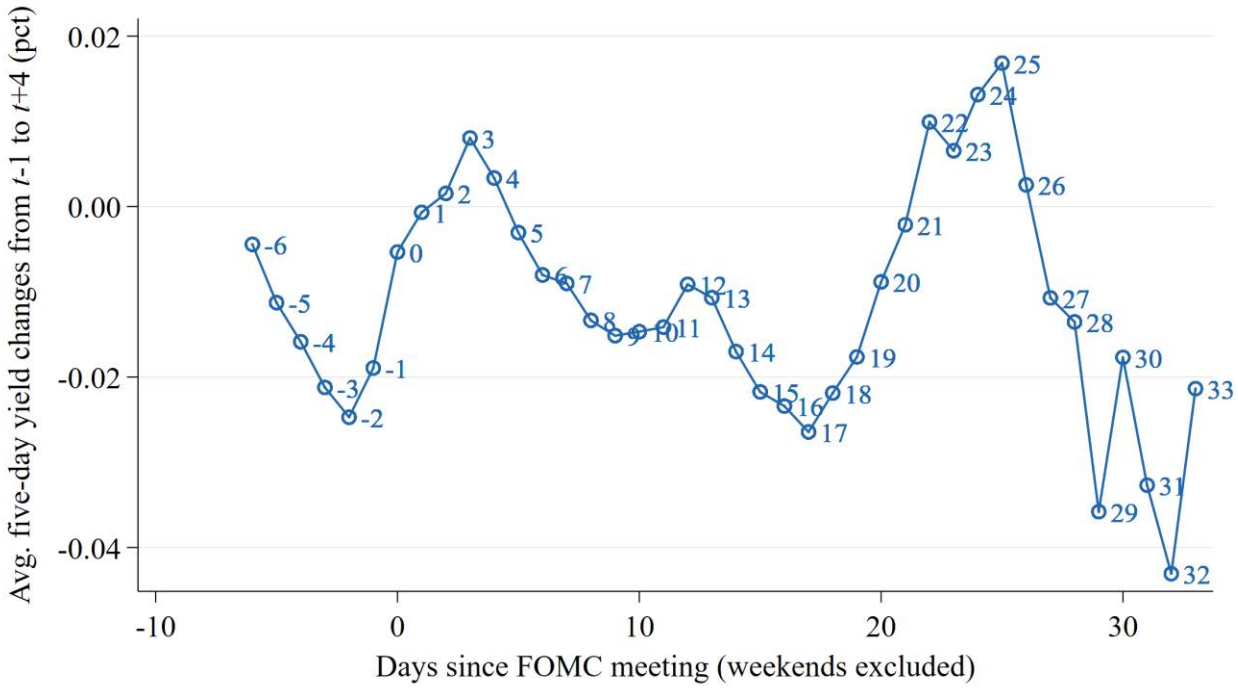


Electronic copy available at: https://ssrn.com/abstract=2687614

Panel A. Probability of federal funds target change over the FOMC cycle, 1982:9 to 1993




Panel B. Federal funds futures yield changes over the FOMC cycle, 2000 to 2016






Electronic copy available at: https://ssrn.com/abstract=2687614

Panel C. Covariance between daily changes in federal funds futures yield and daily excess stock returns, by FOMC cycle week, 2000 to 2016

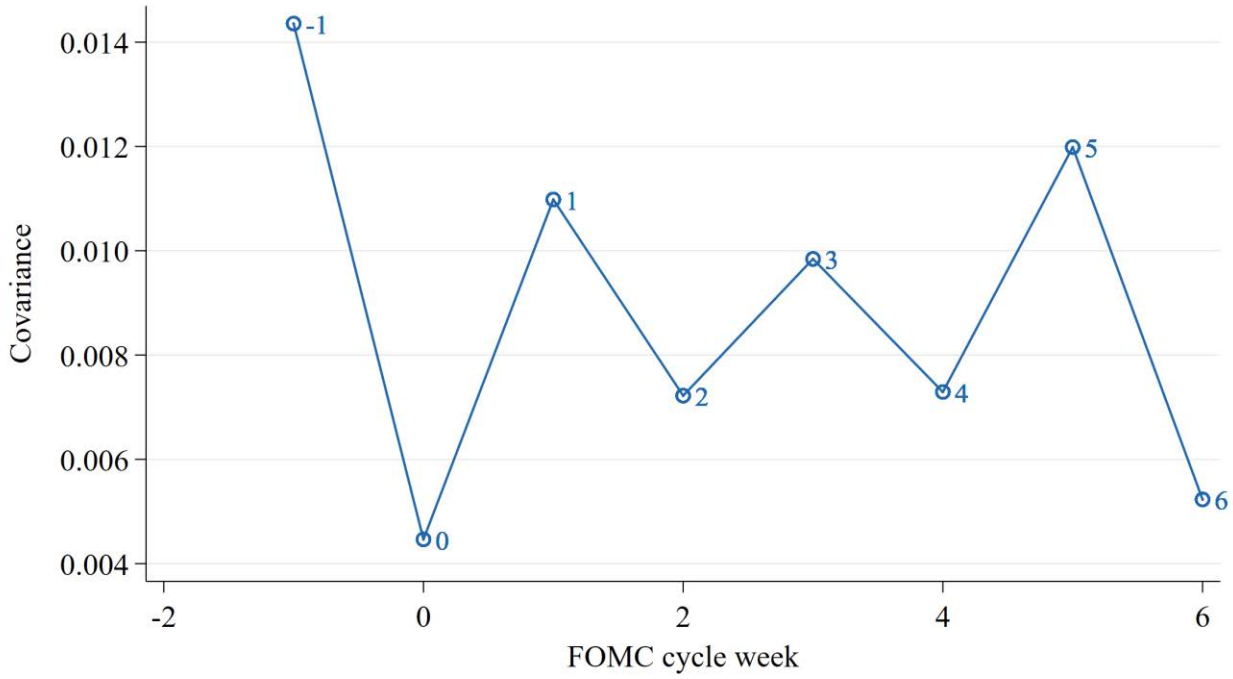
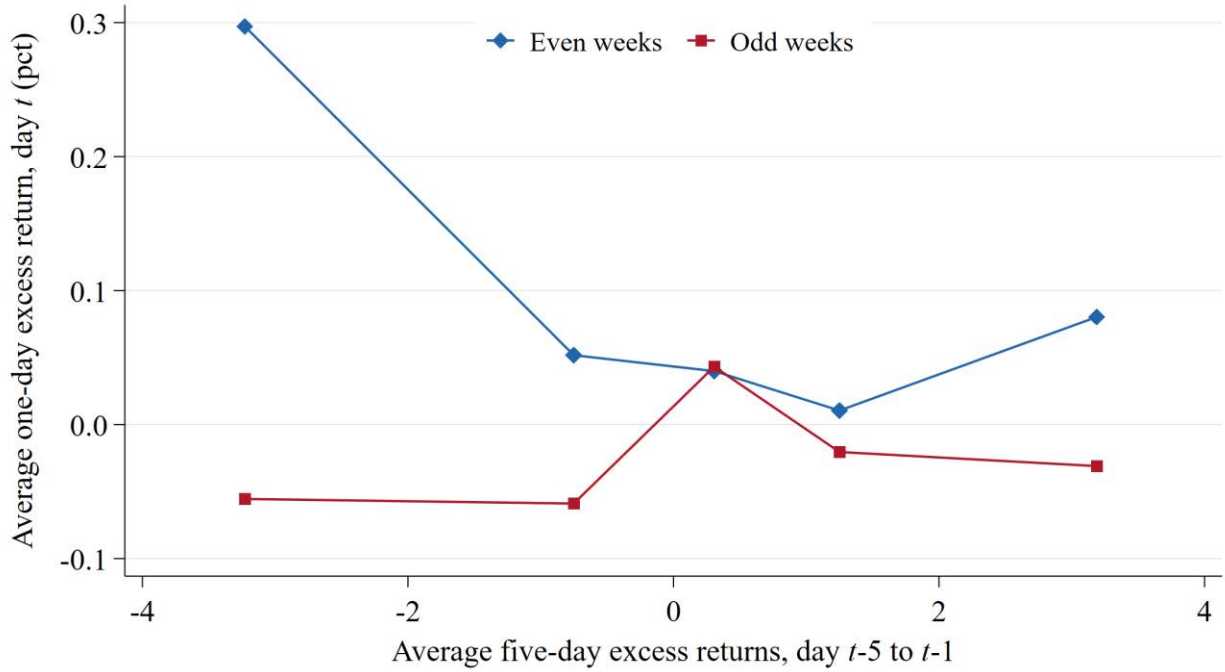



**Figure 3. Even-week decision-making at the Fed.**



Electronic copy available at: https://ssrn.com/abstract=2687614

Panel A. Average excess return on day *t* as a function of average five-day excess return over day *t*-5 to *t*-1, even versus odd weeks in FOMC cycle time




Panel B. Average excess return on day *t* as a function of average five-day excess return over day *t*-5 to *t*-1, shown for each week in FOMC cycle time

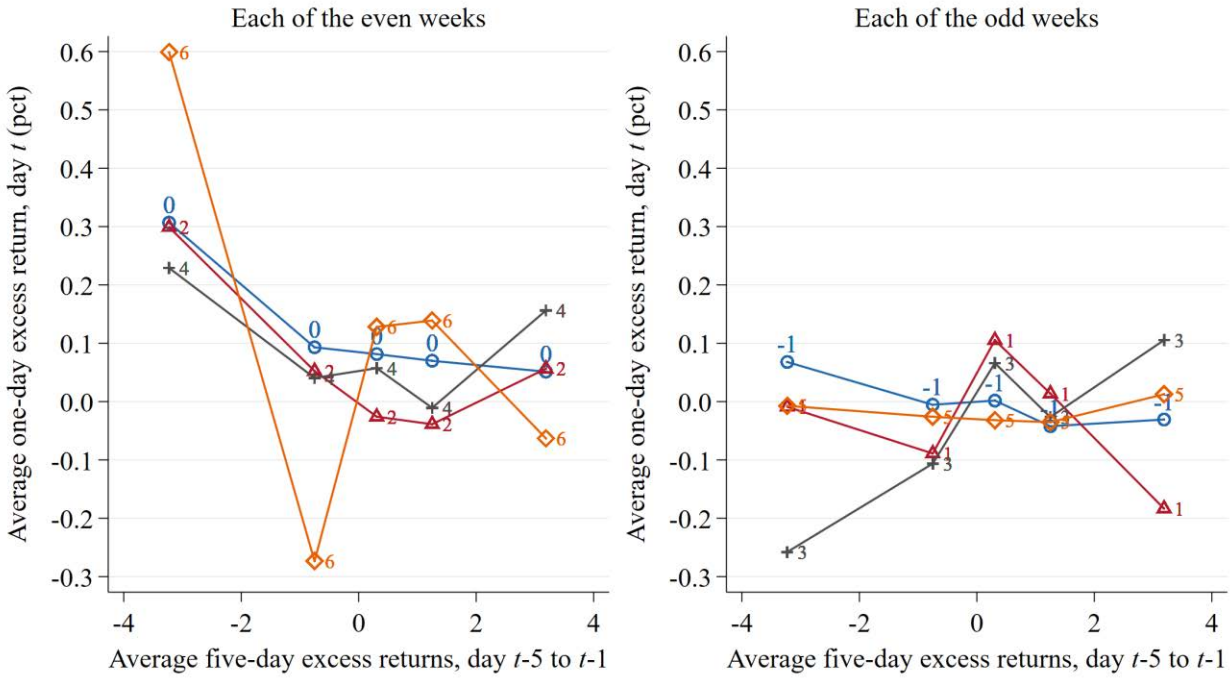



**Figure 4. The Fed put in stock returns: even-week mean-reversal, 1994 to 2016.** Daily data for all 5,997 observations are sorted into five buckets based on quintiles of the x-variable (quintiles are defined without conditioning on FOMC cycle time). Within each bucket we calculate the average of the y-variable and the average of the x-variable and graph the y-average against the x-average.



Electronic copy available at: https://ssrn.com/abstract=2687614

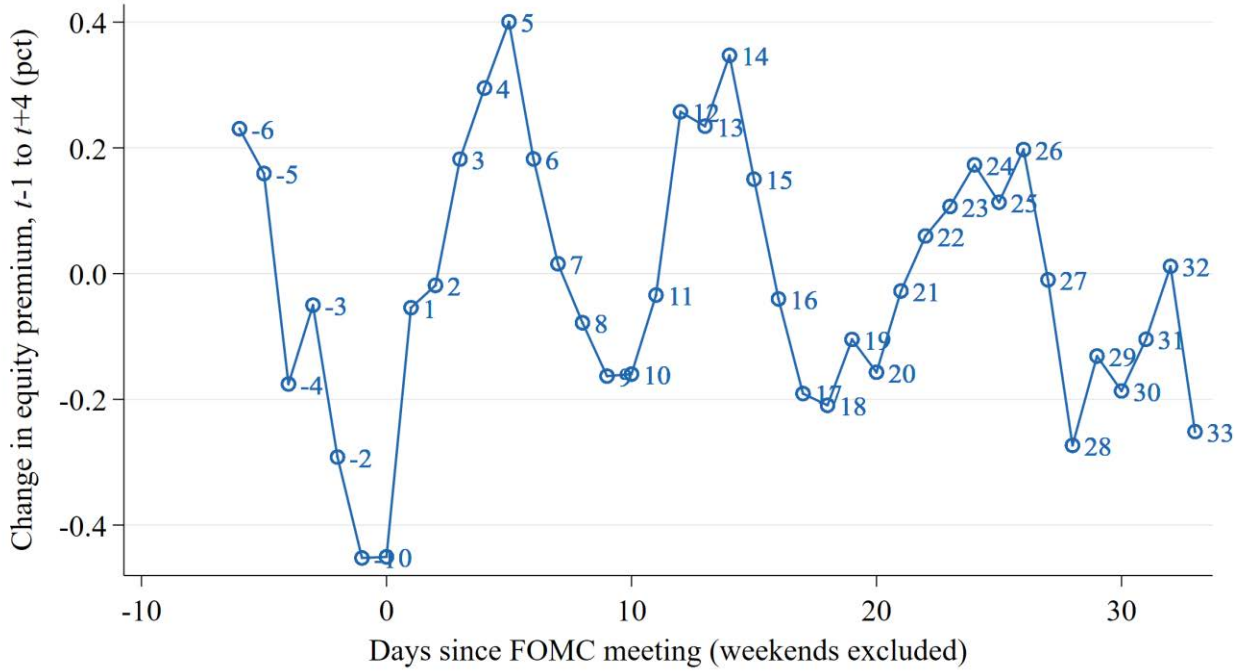



**Figure 5. The equity premium over the FOMC cycle, 1996 to 2012:1.** The figure presents the average change in the one-month equity premium bound based on data from Martin (2017), by day of the FOMC cycle.

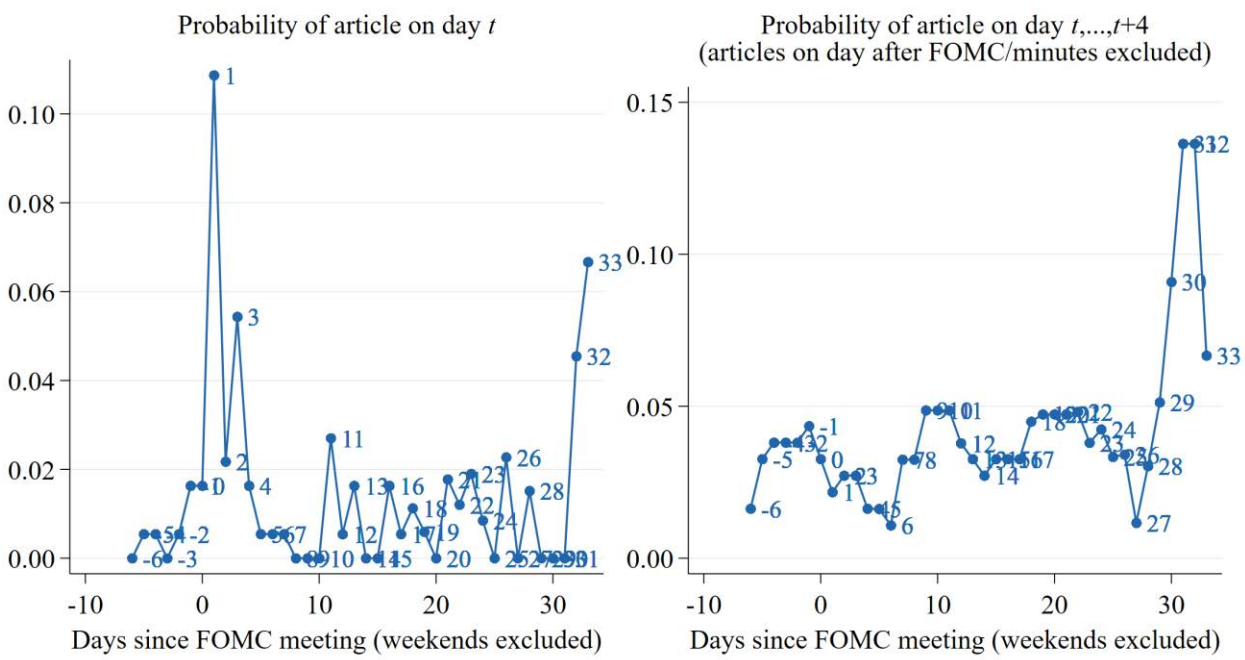



**Figure 6. Wall Street Journal articles by David Wessel, 1994 to 2016.** Linear regression estimates on daily data for 1994 to 2016 (5,997 days) are given by:

$$\text{Dummy}(Wessel\ article\ on\ day\ t) = 0.0035 + 0.017 \times 1_{Week\ 0} + 0.007 \times 1_{Week\ 2,4,6}$$
$$+0.088 \times 1_{day\ after\ FOMC\ meeting} + 0.071 \times 1_{day\ after\ FOMC\ minutes\ release}$$

where $1_X$ indicates a dummy variable. All coefficients are significant at the 5% level or better (with standard errors robust to heteroskedasticity).



Electronic copy available at: https://ssrn.com/abstract=2687614

**Table I**

**Regressions of Daily Excess U.S. Stock Returns on FOMC Cycle Dummies**

This table presents regressions of daily excess U.S. stock returns on FOMC cycle dummies. The definition of weeks in FOMC cycle time are: Week -1: Days -6 to -2; Week 0: Days -1 to 3; Week 1: Days 4 to 8; Week 2: Days 9 to 13; Week 3: Days 14 to 18; Week 4: Days 19 to 23; Week 5: Days 24 to 28; Week 6: Days 29 to 33. The left-hand-side variable is in percent, so (for example) 0.1 means 10 bps per day. Holidays are included with returns set to zero, but regression results are almost identical if holidays are dropped. In Panel B, results for 1982:9 to 1993 omit data from October 19, 1987 (Black Monday), when the market fell by over 17% in one day. In panel A, we report three sets of *t*-statistics in the following order: robust to heteroskedasticity, clustered by five-day periods (with a given five-day period consisting of only even-week or only odd-week observations), and Newey-West with 10 daily lags. In Panel B, we only report *t*-statistics robust to heteroskedasticity. In this and subsequent tables, ***/**/* indicates significance at the 1/5/10% level.

Panel A. Main sample: 1994 to 2016

| | Dependent variable: Excess return on stocks over T-bills | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| Dummy=1 in Week 0, 2, 4, 6 | 0.120*** | | |
| | (4.00) [4.15]{3.98} | | |
| Dummy=1 in Week 0 | | 0.141*** | 0.141*** |
| | | (3.17)[3.51]{3.38} | (3.17)[3.51]{3.38} |
| Dummy=1 in Week 2, 4, 6 | | 0.109*** | |
| | | (3.24)[3.37]{3.25} | |
| Dummy=1 in Week 2 | | | 0.090** |
| | | | (2.10)[2.16]{2.19} |
| Dummy=1 in Week 4 | | | 0.120** |
| | | | (2.52)[2.71]{2.56} |
| Dummy=1 in Week 6 | | | 0.187** |
| | | | (2.07)[2.62]{2.49} |
| Constant | -0.025 | -0.025 | -0.025 |
| | (-1.25) [-1.21]{-1.24} | (-1.25) [-1.21]{-1.24} | (-1.25) [-1.21]{-1.24} |
| N (days) | 5,997 | 5,997 | 5,997 |

Panel B. 1982 to 1993, 1994 to 2013, 2014 to 2016

| | Dependent variable: Excess return on stocks over T-bills | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| | 2014-2016 | 1994-2013 | 1982:9-1993 |
| Dummy=1 in Week 0 | 0.174* | 0.136*** | 0.075* |
| | (1.92) | (2.76) | (1.78) |
| Dummy=1 in Week 2, 4, 6 | 0.176*** | 0.099*** | 0.067* |
| | (2.67) | (2.65) | (1.68) |
| Constant | -0.049 | -0.021 | 0.004 |
| | (-1.15) | (-0.96) | (0.19) |
| N (days) | 783 | 5,214 | 2,937 |



Electronic copy available at: https://ssrn.com/abstract=2687614

| Panel C. Profitability of various trading strategies, 1994 to 2016 | | | | |
|---|---|---|---|---|
| Trading strategy: | Average annual excess return | Standard deviation of annual excess return | Sharpe ratio for annual returns | Value of $1 invested at start of 1994 |
| A. Hold stocks on all days | 8.48 | 18.71 | 0.45 | 7.68 |
| B. Hold stocks in weeks 0, 2, 4, 6 only | 12.15 | 13.15 | 0.92 | 15.22 |
| C. Hold stocks in weeks -1, 1, 3, 5 only | -3.13 | 14.23 | -0.22 | 0.51 |



Electronic copy available at: https://ssrn.com/abstract=2687614

**Table II**
**International Stock Returns over the FOMC Cycle, 1994 to 2016**

The table presents regressions of international stock returns on FOMC cycle dummies. The dependent variable is a daily return to various MSCI equity indices, expressed in percent. To account for time zone differences, we use returns realized on day *t*+1 relative to the U.S. calendar. MSCI indices are obtained from Bloomberg (ticker MXWOU for developed market excluding the U.S. and ticker MXEF for emerging markets). Returns are in USD. *t*-statistics robust to heteroskedasticity are in parentheses.

| | Developed market excluding U.S. | | Emerging markets | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4_ |
| Dummy=1 in week 0 | 0.141*** | 0.141*** | 0.186*** | 0.186*** |
| | (3.37) | (3.37) | (4.09) | (4.09) |
| Dummy=1 in week 2 4 6 | 0.087*** | | 0.169*** | |
| | (2.93) | | (5.05) | |
| Dummy=1 in week 2 | | 0.076** | | 0.187*** |
| | | (2.08) | | (4.44) |
| Dummy=1 in week 4 | | 0.083** | | 0.140*** |
| | | (1.96) | | (2.99) |
| Dummy=1 in week 6 | | 0.210** | | 0.237*** |
| | | (2.52) | | (2.94) |
| Constant | -0.033* | -0.033* | -0.067*** | -0.067*** |
| | (-1.81) | (-1.81) | (-3.22) | (-3.22) |
| N (days) | 5,996 | 5,996 | 5,996 | 5,996 |



Electronic copy available at: https://ssrn.com/abstract=2687614

**Table III**

**Ruling out Non-Fed Explanations: Regressions of Daily Excess U.S. Stock Returns on FOMC Cycle Dummies with Controls for Non-Fed News, 1994 to 2016**

This table presents regressions of daily excess U.S. stock returns on FOMC cycle dummies with controls for non-Fed news. The left-hand-side variables are in percent, so (for example) 0.1 means 10 bps per day. Earnings announcements are from IBES. Macro announcements are from Bloomberg Economic Calendar and exclude FOMC-related news. *t*-statistics robust to heteroskedasticity are in parentheses.

| | Dependent variable: Excess return on stocks over T-bills | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Dummy=1 in week 0 | 0.141*** | 0.137*** | 0.141*** | 0.141*** | 0.131*** |
| | (3.17) | (2.99) | (3.16) | (3.17) | (2.91) |
| Dummy=1 in week 2 4 6 | 0.109*** | 0.108*** | 0.111*** | 0.110*** | 0.099*** |
| | (3.24) | (3.21) | (3.28) | (3.26) | (2.95) |
| Number of macro releases, relevance weighted | | 0.0114* | | | |
| | | (1.72) | | | |
| Number of corp. earnings announcements (/10,000) | | | 0.820 | | |
| | | | (0.40) | | |
| Fraction of positive earnings surprises | | | 0.079 | | |
| | | | (1.12) | | |
| Constant | -0.025 | -0.047** | -0.072* | -0.245 | 0.050 |
| | (-1.25) | (-2.07) | (-1.73) | (-1.61) | (0.48) |
| Dummies for day of the reserve maintenance period | No | No | No | Yes | No |
| Dummies for day of week/month/ end of month/quarter/year | No | No | No | No | Yes |
| N | 5,997 | 5,997 | 5,997 | 5,997 | 5,997 |



Electronic copy available at: https://ssrn.com/abstract=2687614

**Table IV**
**Intermeeting target changes**

This table presents evidence on the timing of intermeeting target changes. Panel A summarizes the intermeeting target changes in the 1994 to 2016 sample in relation to dates of the board meetings and FOMC conference calls. Panel B reports results from probit regressions of intermeeting target change dummies on the FOMC cycle dummies for week 0 and weeks 2, 4, and 6. *t*-statistics robust to heteroskedasticity are in parentheses.

Panel A. Timing of intermeeting target changes, 1994 to 2016

| Date of intermeeting change in Federal funds target | Federal funds target change | Date in cycle | Date of prior board meeting | FOMC conference call |
|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) |
| 10/8/2008 | -0.5 | 16 | 1 day before | 1 day before |
| 1/22/2008 | -0.75 | -6 (30 of last cycle) | 1 day before | 1 day before |
| 9/17/2001 | -0.5 | 19 | Same day | Same day |
| 4/18/2001 | -0.5 | 21 | Same day, 2 days before | Same day |
| 1/3/2001 | -0.5 | 11 | 1 day before | Same day |
| 10/15/1998 | -0.25 | 12 | 1 day before | Same day |
| 4/18/1994 | 0.25 | 19 | Same day | Same day |

Panel B. Predicting intermeeting target changes with even week dummies, 1994 to 2016 and 1982:9 to 1993

| | Dependent variable: | |
|---|---|---|
| | 1994 to 2016 | 1982:9 to 1993 |
| | Dummy=1 if target change on day *t* | Dummy=1 if target change on day *t*+2 |
| | (1) | (2) |
| Dummy=1 in Week 0 | 1.671*** | 0.738*** |
| | (7.86) | (6.39) |
| Dummy=1 in Week 2, 4, 6 | 0.441* | 0.301*** |
| | (1.77) | (2.68) |
| Constant | -3.227*** | -2.134*** |
| | (-15.96) | (-27.34) |
| N (days) | 5,997 | 2,937 |



Electronic copy available at: https://ssrn.com/abstract=2687614

**Table V**

**Federal Funds Futures Yield Changes over the FOMC Cycle, 2000 to 2016**

This table presents regressions of daily changes in Fed funds futures yields on FOMC cycle dummies. Futures data are from Bloomberg. When calculating the daily change from the last day of month *m* to the first day of month *m*+1, we use the yield on the *N*-th month contract for the last day of month *m* and the yield on the *N*-1th contract or the first day of month *m*+1. Regressions omit the last four months of 2008. *t*-statistics robust to heteroskedasticity are in parentheses.

| | Dependent variable: Daily change in futures yield | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2nd-month contract 2000 to 2008, 24th-month contract 2009 to 2016 | | | 2nd-month contract, 2000 to 2008 | | 24th-month contract, 2009 to 2016 | |
| | All days | Quintile 1 days | Not quintile 1 days | Quintile 1 days | Not quintile 1 days | Quintile 1 days | Not quintile 1 days |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Dummy=1 in | -0.0031* | 0.0034 | -0.0048** | 0.0057 | -0.0023 | 0.0013 | -0.0074** |
| Week 0 | [-1.77] | [0.86] | [-2.45] | [1.58] | [-1.30] | [0.17] | [-2.09] |
| Dummy=1 in | -0.0032** | 0.0031 | -0.0048*** | 0.00031 | -0.0041*** | 0.0071 | -0.0055** |
| Week 2, 4, 6 | [-2.36] | [0.95] | [-3.27] | [0.09] | [-3.04] | [1.20] | [-2.10] |
| Constant | -0.00064 | -0.0062*** | 0.0008 | -0.0045* | 0.00011 | -0.0087** | 0.0015 |
| | [-0.78] | [-2.90] | [0.93] | [-1.81] | [0.23] | [-2.28] | [0.90] |
| N (days) | 4,300 | 891 | 3,409 | 521 | 1,714 | 370 | 1,695 |

**Table VI**

**Even-Week Effect is Driven Disproportionately by Even Weeks that Follow Board of Governors Board Meetings, 1994 to 2016**

This table presents regressions of daily excess stock returns on FOMC cycle dummies interacted with a dummy for days that follow board meetings of the Board of Governors. The left-hand-side variables are in percent, so (for example) 0.1 means 10 bps per day. *t*-statistics robust to heteroskedasticity are in parentheses.

| | Dependent variable: Daily excess return on stocks |
|---|---|
| (Dummy=1 in Week 0)*(Dummy=1 if *t*-5 to *t*-1 had board meeting) | 0.179*** |
| | (3.69) |
| (Dummy=1 in Week 2)*(Dummy=1 if *t*-5 to *t*-1 had board meeting) | 0.187*** |
| | (3.31) |
| (Dummy=1 in Week 4)*(Dummy=1 if *t*-5 to *t*-1 had board meeting) | 0.166** |
| | (2.63) |
| (Dummy=1 in Week 6)*(Dummy=1 if *t*-5 to *t*-1 had board meeting) | 0.166 |
| | (1.48) |
| (Dummy=1 in Week 0,2,4,6)*(Dummy=1 if *t*-5 to *t*-1 had no board meeting) | 0.040 |
| | (0.81) |
| (Dummy=1 in Week -1,1,3,5)*(Dummy=1 if *t*-5 to *t*-1 had board meeting) | 0.032 |
| | (0.81) |
| Constant | -0.038 |
| | (-1.41) |
| N (days) | 5,997 |



Electronic copy available at: https://ssrn.com/abstract=2687614

**Table VII**

**The Fed Put in Stock Returns: Even-Week Mean-Reversal, 1994 to 2016**

This table documents the even-week mean-reversal in stock returns. Panel A presents regressions of excess stock returns on even-week dummies for various categories of observations based on lagged excess stock returns. *t*-statistics robust to heteroskedasticity are in parentheses. Panel B decomposes the log compound (gross) stock market return into return earned on even- and odd-week days, with returns on even and odd days further decomposed based on lagged excess stock returns.

Panel A. Main regression, based on excess stock return over various look-back periods

| | Regressions of excess stock returns on even week dummies for various categories of observations based on lagged excess stock returns | | | |
|---|---|---|---|---|
| | Quintile 1 days (based on last week) | Not quintile 1 days (based on last week) | Quintile 1 days (based on last week and last month) | Quintile 1 days (based on last week, last month, and last three months) |
| | (1) | (2) | (3) | (4) |
| Dummy=1 in Week 0 | 0.362** | 0.090** | 0.594** | 1.072** |
| | (2.46) | (2.11) | (2.36) | (2.21) |
| Dummy=1 in Week 2, 4, 6 | 0.348*** | 0.047 | 0.591*** | 0.724*** |
| | (3.23) | (1.48) | (3.34) | (2.74) |
| Constant | -0.055 | -0.017 | -0.111 | -0.128 |
| | (-0.87) | (-0.89) | (-1.08) | (-0.84) |
| N (days) | 1,200 | 4,797 | 630 | 376 |

Panel B. Decomposition of log stock returns

| | Sum of $\ln(1+r_m)$ for various categories of observations based on lagged excess stock returns | | | | | |
|---|---|---|---|---|---|---|
| | All days | | Even week days | | Odd week days | |
| | (1) | | (2) | | (3) | |
| Overall total | 2.04 | *(n=5,997)* | 2.72 | *(n=2,795)* | -0.68 | *(n=3,202)* |
| Quintile 1 days (based on last week) | 1.24 | *(n=1,200)* | 1.62 | *(n= 557)* | -0.38 | *(n= 643)* |
| Not quintile 1 days (based on last week) | 0.80 | *(n=4,797)* | 1.10 | *(n=2,238)* | -0.30 | *(n=2,559)* |
| | 2.04 | *(n=5,997)* | 2.72 | *(n=2,795)* | -0.68 | *(n=3,202)* |
| Quintile 1 days (based on last week and last month) | 0.99 | *(n= 630)* | 1.39 | *(n= 297)* | -0.40 | *(n= 333)* |
| Quintile 1 days (based on last week, last month, and last three months) | 0.81 | *(n= 376)* | 1.11 | *(n= 170)* | -0.29 | *(n=206)* |



Electronic copy available at: https://ssrn.com/abstract=2687614

**Table VIII**

**The Fed Put in Intermeeting Target Changes: Stock Returns Leading Up to the Intermeeting Target Changes, 1994 to 2008**

This table presents, for each intermeeting target rate change over the 1994 to 2016 period, the cumulative excess stock returns since (and not including) the most recent day 0 of the current FOMC cycle, as well as the cumulative excess stock returns since day 0 of the prior cycle, the second prior cycle, etc. Return calculations by FOMC cycle omit days -1 and 0, which are particularly influenced by Fed policy.

| Date of intermeeting change in Federal funds target | Cumulative excess stock return (pct) since day 1 of: | | | | | Quintile of cumulative excess stock return (1=lowest) since day 1 of: | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cycle *N* (this cycle) | Cycle *N*-1 | Cycle *N*-2 | Cycle *N*-3 | Cycle *N*-4 | Cycle *N* (this cycle) | Cycle *N*-1 | Cycle *N*-2 | Cycle *N*-3 | Cycle *N*-4 |
| 10/8/2008 | -18.2 | -20.0 | -23.6 | -26.5 | -22.8 | 1 | 1 | 1 | 1 | 1 |
| 1/22/2008 | -13.9 | -16.7 | -15.3 | -15.1 | -19.9 | 1 | 1 | 1 | 1 | 1 |
| 9/17/2001 | -11.6 | -15.7 | -18.0 | -10.6 | -26.4 | 1 | 1 | 1 | 1 | 1 |
| 4/18/2001 | 5.3 | -12.9 | -8.6 | -15.2 | -21.5 | 5 | 1 | 1 | 1 | 1 |
| 1/3/2001 | 1.5 | -5.7 | -12.5 | -15.4 | -14.2 | 4 | 1 | 1 | 1 | 1 |
| 10/15/1998 | -1.7 | -8.5 | -16.3 | -15.4 | -15.6 | 1 | 1 | 1 | 1 | 1 |
| 4/18/1994 | -6.3 | -5.4 | -1.6 | -2.0 | 0.9 | 1 | 1 | 2 | 2 | 2 |



Electronic copy available at: https://ssrn.com/abstract=2687614

**Table IX**

**Predicting Target Changes with Even-Week Returns that Follow Market Declines, 1994 to 2008**

This table presents regression results for predicting changes in the Fed funds target with stock returns on even-week days that follow stock market declines. The three definitions of stock market declines are as in Table VII (low returns over the past week, low returns over the past week and the past month, and low returns over the past week, the past month and the past three months). *t*-statistics robust to heteroskedasticity and autocorrelation (up to seven lags) are in parentheses.

| | Dependent variable: $y_m$=Change in Fed funds target (FOMC meeting m compared to FOMC meeting $m$-1) | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| $y_{m-1}$ (lag one of change in Fed funds target) | 0.390*** | 0.342*** | 0.326*** |
| | (3.45) | (3.07) | (2.92) |
| $y_{m-2}$ (lag two of change in Fed funds target) | 0.316** | 0.314** | 0.332** |
| | (2.17) | (2.22) | (2.44) |
| Even-week excess stock return on quintile 1 days over past year (quintile 1 days based on last week) | -0.806 | | |
| | (-1.50) | | |
| Even-week excess stock return on quintile 1 days over past year (quintile 1 days based on last week and last month) | | -1.049** | |
| | | (-2.44) | |
| Even-week excess stock return on quintile 1 days over past year (quintile 1 days based on last week, last month, and last three months) | | | -1.313*** |
| | | | (-3.20) |
| Constant | 0.0335 | 0.0317 | 0.0306 |
| | (0.85) | (1.17) | (1.19) |
| N (FOMC announcement days) | 120 | 120 | 120 |



Electronic copy available at: https://ssrn.com/abstract=2687614

**Table X**

**The Equity Risk Premium over the FOMC Cycle, by Maturity**

This table presents regressions of daily changes in the forward equity premium on an even-week dummy. *t*-statistics robust to heteroskedasticity are in parentheses.

| Dependent variable: Daily change in equity premium | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Using all days | | | | | | Quintile 1 days | Not quintile 1 days |
| | 1st month | 2nd month | 3rd month | 4th to 6th month | 7th to 12th month | One year | One year | One year |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Dummy=1 in Week 0 | -0.136*** | -0.061** | -0.051* | -0.009 | -0.025* | -0.035** | -0.073* | -0.025* |
| | (-2.63) | (-2.11) | (-1.77) | (-0.59) | (-1.84) | (-2.54) | (-1.68) | (-1.92) |
| Dummy=1 in Week 2, 4, 6 | -0.077* | -0.053*** | -0.023 | -0.008 | -0.019** | -0.024** | -0.067** | -0.011 |
| | (-1.93) | (-2.60) | (-1.01) | (-0.67) | (-2.22) | (-2.46) | (-2.26) | (-1.18) |
| Constant | 0.045* | 0.026** | 0.016 | 0.005 | 0.011 | 0.014** | 0.022 | 0.011** |
| | (1.92) | (2.22) | (1.14) | (0.64) | (1.62) | (2.16) | (1.06) | (2.09) |
| N (days) | 4,190 | 4,190 | 4,190 | 4,190 | 4,190 | 4,190 | 968 | 3,222 |



Electronic copy available at: https://ssrn.com/abstract=2687614

**Table XI**

**Regressions of Daily Excess Stock Returns on FOMC Cycle Dummies with Controls for Public Fed Releases and Speeches, 1994 to 2016**

This table presents regressions of daily excess stock returns on FOMC cycle dummies with controls for public Fed releases and speeches. *t*-statistics robust to heteroskedasticity are in parentheses.

| | (1) | (2) | (3) |
|---|---|---|---|
| Dummy in week 0 | 0.141*** | 0.147*** | 0.139*** |
| | (3.17) | (3.24) | (3.09) |
| Dummy in week 2, 4, 6 | 0.109*** | 0.108*** | 0.109*** |
| | (3.24) | (3.17) | (3.24) |
| *Controls for public releases of Fed documents:* | | | |
| Dummy for Beige book release on day *t* | | 0.089 | |
| | | (0.97) | |
| Dummy for FOMC minutes release on day *t* | | -0.072 | |
| | | (-0.82) | |
| Dummy for discount rate meeting | | -0.081 | |
| minutes release on day *t* | | (-0.81) | |
| *Controls for speeches by Fed officials:* | | | |
| Dummy for Governor speech on day *t* | | | 0.091* |
| | | | (1.84) |
| Dummy for Vice Chair speech on day *t* | | | -0.044 |
| | | | (-0.44) |
| Dummy for Chair speech on day *t* | | | 0.006 |
| | | | (0.10) |
| Dummy for President speech on day *t* | | | -0.057 |
| | | | (-1.53) |
| Dummy for Governor speech on day *t*-1 | | | -0.018 |
| | | | (-0.38) |
| Dummy for Vice Chair speech on day *t*-1 | | | 0.020 |
| | | | (0.20) |
| Dummy for Chair speech on day *t*-1 | | | -0.082 |
| | | | (-1.35) |
| Dummy for President speech on day *t*-1 | | | 0.036 |
| | | | (0.98) |
| Constant | -0.025 | -0.024 | -0.019 |
| | (-1.25) | (-1.19) | (-0.83) |
| N (days) | 5997 | 5997 | 5997 |



Electronic copy available at: https://ssrn.com/abstract=2687614

**Table XII**

**Examples of Fed Leaks**

Panel A presents examples of news articles or newsletter content (column (1)), parallel with information discussed in Federal Reserve Board of Governors Board Meetings (column (2)), sourced from *Discount Rate Minutes* posted on the Fed's website with a lag. Discount rate requests refer to requests by the Federal Reserve Banks regarding their preference for the discount rate (now called primary rate), generally taken as a broader signal of their preference for monetary policy. Panel B presents examples of leaks to financial institutions or Fed watchers of the FOMC outcome or FOMC minutes' content, found by searching the words "leak" and "Federal Reserve" in Factiva.

Panel A. Fed leaks to media and newsletters of information from Fed board meetings

| | Media or newsletter content in the public domain | Private discussions at the Fed Board Meeting |
|---|---|---|
| | (1) | (2) |
| 1 | Wessel, David, *Wall Street Journal*, June 19, 1995<br>"In speeches and interviews; the outspoken Mr. Blinder has made it clear he is increasingly worried…. Two other Fed governors; fellow Clinton appointee Janet Yellen and Bush appointment Lawrence Lindsey; are said to be ready to cut interest rates; too. All three supported the round of interest-rate increases that ended four-and-a-half months ago." | *Discount Rate Minutes*, June 19, 1995<br>"Vice Chairman Blinder believed that the requests for a reduction in the discount rate had merit...Governor Lindsey stated …, in his view, this outlook for a relatively weak economy called for a reduction in the overall structure of interest rates. Governor Yellen believed that the inflation risk had moderated and that economic conditions warranted a monetary easing action." |
| 2 | Clary, Isabelle, *Reuters*, September 17, 1996<br>"Eight of the 12 district banks in the Federal Reserve System have requested a hike in the discount rate amid mounting evidence the pace of economic expansion is likely to remain brisk in the second half of 1996, a senior Fed official said Tuesday. "Eight (Fed) banks have requested a discount rate hike and (of those) three have requested a 50-basis-point (one-half percentage point) discount rate hike," the source told Reuters."… The source said the requests for a discount rate hike have been submitted by banks in Fed districts that are experiencing rapid growth and tight labour markets or that have a "hawkish" anti-inflation tradition. The three district banks calling for a half-point discount rate hike are in Minneapolis, Richmond, Va., and San Francisco, according to the source. The source said the August employment report -- though its strength may have been exaggerated by special factors -- "gave the hawks fresh ammunition and raised questions about how far the (non-inflationary growth threshold) experiment can go." The source added that some of the Fed governors known for their moderate views on monetary policy -- such as Laurence Meyer -- were sympathetic to the bank presidents' concern that the economy may be overheating. The votes favouring a higher discount rate were taken at various regional Fed board meetings in recent weeks. Bank board meetings are held on regular dates, but the schedules differ from bank to bank." | *Discount Rate Minutes*, September 16, 1996<br>"Requests by eight Reserve Banks to increase the discount rate; requests by four Reserve Banks to maintain existing rates."…"Subject to review and determination by the Board of Governors, the directors of the Federal Reserve Banks of Boston, Richmond, and St. Louis had voted on September 12 to establish a basic discount rate of 5-1/2 percent (an increase from 5 percent)".<br><br>*Greenbook*, September 18, 1996<br>"The decision at the August FOMC meeting to keep reserve conditions unchanged had little impact on financial market prices. However, interest rates have been volatile over the intermeeting period, responding sharply at times on the release of data suggesting greater or lesser growth and inflationary pressure.<br>Reports of the attitudes of Federal Reserve officials also precipitated significant market moves on occasion, with a reported leak of discount rate proposals causing rates to rise yesterday." |
| 3 | Wessel, David, *Wall Street Journal*, March 17, 1997<br>"In short; Fed officials privately say the risks of the economy growing too fast and setting off an unwelcome round of price and wage increases outweigh the risks of an imminent recession. … Certainly; no one will be shocked if he opts to lift rates at the March 25 meeting of the Fed's policy committee." | *Discount Rate Minutes*, March 17, 1997<br>"At today's meeting, Chairman Greenspan observed that, based on data now available, an equally strong case could be made for increasing the federal funds rate … He noted that the Board could tighten policy as a preemptive move against the potential for increased inflationary pressures." |
| 4 | Berry, John, *Washington Post*, March 30, 1999<br>"Federal Reserve officials aren't likely to make any change in | *Discount Rate Minutes*, March 29, 1999<br>"At today's meeting, Chairman Greenspan observed that, |



Electronic copy available at: https://ssrn.com/abstract=2687614

| | | |
|---|---|---|
| | short-term interest rates at a policymaking session this morning, according to comments from several of the officials and analysts who watch them... A small minority of the 18 Fed officials scheduled to attend the meeting probably favor raising rates ..." | based on data now available, an equally strong case could be made for increasing the federal funds rate … He noted that the Board could tighten policy as a preemptive move against the potential for increased inflationary pressures." |
| 5 | Wessel, David, *Wall Street Journal*, December 18, 2000<br>"But Fed insiders say there is discussion of doing more; although not yet any firm consensus. Both private and Fed staff forecasts have been marked down in the past several months; and there is some concern inside the Fed that the U.S. economy's momentum is slowing more rapidly than desired. Incoming data is mixed; but a slew of companies have reported surprisingly abrupt drops in sales and orders; and consumer confidence has fallen sharply. Fed officials welcome a slowdown; but differ on how much of a slowdown -- and how much of an increase in unemployment -- is desirable…Members of the Federal Reserve Board in Washington are scheduled to meet with staff economists for an important review of the outlook today."<br><br>Note the market effect in the follow-up article:<br>Ip, Greg, *Wall Street Journal*, December 19, 2000<br>"Hopes that the Fed could be poised to reverse its 19-month anti-inflation stance sent blue chips soaring yesterday; …The Fed has either raised rates or maintained a bias to higher rates at each of its meetings since May of last year…. But an article in The Wall Street Journal yesterday said Fed officials were contemplating a more-aggressive response…." | *Discount Rate Minutes*, December 18, 2000<br>"Reserve Bank directors recommending a reduction in the discount rate generally reported that many national economic indicators were softening. Some noted that growth in the real Gross Domestic Product had slowed in response to tightening financial conditions, with noticeable weakness in retail sales and manufacturing. Others cited decreased retail sales, in combination with slower growth in employment, as signaling that the expansion was slowing by more than was needed to maintain growth at a sustainable pace... Reserve Bank directors in favor of maintaining existing rates acknowledged that there were signs of an economic slowdown... In light of these considerations, they favored no change in existing rates at this time, but recognized that if economic conditions continued to soften, there might be a need to lower rates in the near term. " |
| 6 | Newsletter of Paul Markowski, *MES Advisors*, April 29, 2010<br>Reported by Cooke, Kristina, Pedro da Costa, and Emily Flitter, *Reuters*, September 30, 2010<br><br>"I had two interesting phone conversations with senior Fed officials --one last night and another this morning. What I heard was that going into the meeting the staff were split 50:50 as to the recommendation on rates; there were 6 members who favored some change in the asset sales issue and 3-4 who favored changing (the Fed's commitment to keep rates low for an extended period), with another 1-3 suggesting putting the change off to the next meeting." | *Discount Rate Minutes*, April 26, 2010<br><br>"Requests by nine Reserve Banks to maintain the existing rate; requests by three Reserve Banks to increase the primary credit rate." |
| 7 | Newsletter of Laurence Meyer, *Macroeconomic Advisers*, August 18, 2010. Reported by Pullman, Susan, *Wall Street Journal*, November 22, 2011<br>"On Aug. 18; 2010; former Fed governor Laurence Meyer; who runs a research service predicting and analyzing Fed actions; told clients in a note the central bank's "bazooka is loaded" to buy bonds to stimulate the economy. The note described how the Fed's "doves;" members inclined to ease monetary policy; had said the Fed couldn't "sit on its hands;" according to Mr. Meyer's account." | *Discount Rate Minutes*, August 6, 2010<br><br>"Federal Reserve Bank directors noted that recent economic conditions were indicative of a slower pace of recovery in output and employment than had been anticipated. While some directors said that growth in certain sectors, including manufacturing, had been slightly higher than expected, others commented that consumer spending had softened somewhat... Overall, directors anticipated only modest near-term economic expansion. With inflation subdued and inflation expectations stable, most directors recommended that the current accommodative stance of monetary policy be maintained." |



Electronic copy available at: https://ssrn.com/abstract=2687614

| | |
|---|---|
| | Panel B. Fed leaks to newsletter writers and financial institutions of the FOMC outcome or the FOMC minute contents |
| 1 | Leak to Bank of America of FOMC meeting outcome prior to FOMC meeting<br>*FOMC Transcript,* August 16, 2007<br>"MR. LACKER. Vice Chairman Geithner, did you say that (the banks) are unaware of what we're considering or what we might be doing with the discount rate?<br>VICE CHAIRMAN GEITHNER. Yes.<br>MR. LACKER. Vice Chairman Geithner, I spoke with Ken Lewis, President and CEO of Bank of America, this afternoon, and he said that he appreciated what Tim Geithner was arranging by way of changes in the discount facility. So my information is different from that." |
| 2 | Leak to PIMCO of Greenbook content (and thus likely FOMC outcome) prior to FOMC meeting<br>Interview of Bill Gross, PIMCO, on *CNBC*<br>Reported by Taibbi, Matt, *The Rolling Stone*, October 8, 2010<br>"A hilarious example of this cozy insiderism popped up just a few weeks ago, when PIMCO bond fund chief Bill Gross let it slip on a live CNBC interview that he was getting inside info from the Fed. The interview is with former Goldman analyst and (now) CNBC anchor Erin Burnett, as well as… Steve Liesman... Gross at one point says this: `What is important going into November is the staff forecast for economic growth for the next 12-18 months. Our understanding is that the Fed is about to downgrade their forecast from 3% down to 2%. Which in turn would suggest that unemployment won't be coming down… and so that would be the trigger to my way of thinking for Quantitative Easing in November.' The admission is so untoward that the ex-Goldmanite Burnett immediately races to clean up the problem, saying to Liesman, who is also on the panel, 'We don't have that forecast yet, right, Steve?' At which point (Liesman) replies, `We won't get that for 3 weeks, Erin. That's when it comes out with the minutes of this meeting.'" |
| 3 | Leak to Fed watcher of FOMC minutes prior to public release<br>Newsletter, Laurence Meyer, Founder & Senior Managing Director, *Macroeconomic Advisers*<br>Reported by Cooke, Kristina, Pedro da Costa, and Emily Flitter, *Reuters,* September 30, 2010<br>"On August 19, just nine days after the U.S. central bank surprised financial markets by deciding to buy more bonds to support a flagging economy, former Fed governor Larry Meyer sent a note to clients of his consulting firm with a breakdown of the policy-setting meeting. The minutes from that same gathering of the powerful Federal Open Market Committee, or FOMC, are made available to the public -- but only after a three-week lag. So Meyer's clients were provided with a glimpse into what the Fed was thinking well ahead of other investors."<br>(Later in the article, concerning former Fed employees and outsiders:)<br>"Fed board staffers who retire even get to keep their pass for the central bank's building, which boasts fitness facilities, a barber and a dining room… they are not restricted to where they can go once inside the building." |
| 4 | Leak to Fed watcher (former governor) of FOMC outcome prior to FOMC meeting<br>Calls by Nancy Lazar to clients, *International Strategy & Investment*, August 15, 2011<br>Reported by Pullman, Susan, *Wall Street Journal*, November 22, 2011<br>"Hours after an Aug. 15 meeting with Federal Reserve Chairman Ben Bernanke in his office, Nancy Lazar made a hasty call to investor clients: The Fed was dusting off an obscure 1960s-era strategy known as Operation Twist…Ms. Lazar is among a group of well-connected investors and analysts with access to top Federal Reserve officials who give them a chance at early clues to the central bank's next policy moves; according to interviews and hundreds of pages of documents obtained by The Wall Street Journal through open records searches." |
| 5 | Leak to Fed watcher (former governor) of FOMC debate prior to release of FOMC minutes<br>Advice to clients, Wayne Angell, *Bear, Stearns & Co*.<br>Reported by Wessel, David, *Wall Street Journal*, July 7, 1995<br>"One Fed watcher who called it right -- barely -- was former Fed governor Wayne Angell; now an economist at Bear; Stearns & Co. Mr. Angell had been among those confidently predicting that the Fed would hold rates steady at this week's meeting. But on Wednesday -- after joining current Fed officials and others the night before to watch Fourth of July fireworks from the roof of the Fed's building in Washington -- Mr. Angell abruptly announced that he had changed his view and anticipated a one-quarter-point cut. Mr. Angell said he changed his mind while riding a bike on Tuesday before going to the fireworks." |
| 6 | Leak to Fed watcher (policy intelligence firm) of FOMC debate prior to release of FOMC minutes<br>Newsletter to clients, Regina Schleiger, *Medley Global Advisors*, October 3, 2012<br>(Full text at https://www.propublica.org/documents/item/1372212-fed-dec-bound.html) |



Electronic copy available at: https://ssrn.com/abstract=2687614

**Table XIII**

**The Impact of Changing Incentives for Private Communication on Returns Before and After 1994**

This table presents the decomposition of the total week 0 return into return earned before the end of the FOMC meeting and after the end of the FOMC meeting. We construct the intraday stock returns from the S&P 500 futures (after 2000, we use prices of E-mini futures). In row (2), we calculate the return from the close on day -2 to the end of the FOMC meeting on day 0, where the end of the meeting is 2pm on day 0. In cases where the Fed's announcement time (in post-1993 sample) deviated from 2:15pm EST, we compute the returns earned up to five minutes before the announcement time (as reported by Bloomberg). Returns in row (3) are calculated from the end of the meeting cut-off time to the close on day 3. The regular trading hours for the S&P 500 futures are between 9:30am and 4:15pm EST. *t*-statistics robust to heteroskedasticity are in parentheses.

| | 1982:9 to 1993 | 1994 to 2016 |
|---|---|---|
| (1) Avg. return from close | 0.452** | 0.533*** |
| of day -2 to close on day 3 | (2.04) | (3.03) |
| | | |
| (2) Avg. return from close | 0.067 | 0.414*** |
| of day -2 to end of FOMC meeting on day 0 | (0.46) | (3.55) |
| | | |
| (3) Avg. return from end of FOMC | 0.389** | 0.122 |
| meeting on day 0 to close on day 3 | (2.00) | (0.86) |
| N (FOMC meetings) | 91 | 184 |



Electronic copy available at: https://ssrn.com/abstract=2687614