

## Stock Returns over the FOMC Cycle

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**Abstract:** We document that since 1994 the equity premium in the US and in the rest of the world is earned entirely in weeks 0, 2, 4 and 6 in FOMC cycle time, i.e. in time since the last Federal Open Market Committee meeting. This likely reflects a risk premium for news (about monetary policy or the macro economy) coming from the Federal Reserve: (1) The FOMC calendar is quite irregular and changes across sub-periods over which our finding is robust. (2) Even weeks in FOMC cycle time do not line up with important macro releases. (3) Volatility in the federal funds market peaks during even weeks in FOMC cycle time. (4) Information processing/decision making within the Fed tends to happen bi-weekly in FOMC cycle time: The bi-weekly cycle is driven mainly by even week observations that follow Board meetings of the Board of Governors. Furthermore, before 1994, intermeeting target changes were common and disproportionately took place during even weeks in FOMC cycle time. High return weeks do not line up with public information releases from the Federal Reserve or with the frequency of speeches by Fed officials. Systematic informal communication of Federal Reserve officials with the media and the financial sector is a more plausible information transmission mechanism. We discuss the social costs and benefits of this method of communication.

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## 1. Introduction

This paper documents a striking new fact about U.S. stock returns. Over the last 20 years, the average excess return on stocks over Treasury bills follows a bi-weekly pattern over the Federal Open Market Committee (FOMC) meeting cycle. The equity premium over this 20-year period was earned entirely in weeks 0, 2, 4 and 6 in FOMC cycle time, where the FOMC cycle starts on the day before a scheduled FOMC announcement day and resets at each of the eight times the FOMC meets per year. We document that this stock return pattern reflects a large risk premium for news coming from the Federal Reserve.

The fact that stocks do well in week 0 in FOMC cycle time has recently been documented by Lucca and Moench (2015), who show that since 1994 stock returns have averaged about  $\frac{1}{2}$  percent over the 2pm to 2pm period prior to scheduled FOMC announcements.<sup>2</sup> The bi-weekly pattern in stock returns over the FOMC cycle that we document here is a novel finding and appears surprisingly robust. Average excess returns are statistically significantly higher in even weeks than in odd weeks in FOMC cycle time. Furthermore, the pattern is robust across three sub-periods of this 20-year sample and is also present in stock markets outside the United States. Implied volatilities peak in a pattern consistent with the fact, showing that at least some market participants worry more about news coming out in even weeks.

Having established this fact, we present evidence that the pattern likely reflects a risk premium for news (about monetary policy or about the macro economy) coming from the Federal Reserve. First, we document that the timing of the FOMC meetings across days of the year is quite irregular; it changes across the three sub-periods over which our finding is robust, and it does not line up with reserve maintenance periods (two-week periods over which reserve requirements on banks are applied). Second, using Bloomberg macroeconomic data releases, we document that our “even week” effect in FOMC cycle time does not line up with other important macro news. Third, we show that volatility in the fed funds market peaks in even weeks in FOMC cycle time, suggesting that news about monetary policy is coming out during these weeks (this claim relies on the assumption that banks change their trading in the federal funds market in response to news about future short rates). Volatilities of both

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<sup>2</sup> Lucca and Moench build on earlier work by Savor and Wilson (2014) who document a higher equity risk premium on days with macro announcements but do not separately focus on FOMC announcement and the exact timing of returns around FOMC announcements.

stocks and 10-year Treasuries do not show similar bi-weekly patterns indicating that what drives our main fact is not that more news comes out during even weeks in FOMC cycle time but that the type of news that comes out changes. Fourth, we provide evidence that information aggregation and decision making within the Federal Reserve tends to happen bi-weekly in FOMC cycle time. Prior to 1994, the timing of Fed decision-making can be inferred from changes made to the federal funds target rate, which was frequently changed in between scheduled meetings. Over the 1982:9-1993 period, the frequency of target changes shows distinct peaks in even weeks in FOMC cycle time. In the 1994-2013 period, intermeeting target changes are rare. However, it is still the case that information aggregation and important policy discussions within the Fed occur in between meetings. We document a special role for board meetings of the Board of Governors of the Federal Reserve. We find that the bi-weekly stock return cycle is driven mainly by even week observations that follow those meetings.

The board meetings exist back to 1935. Under the Federal Reserve Act (as amended in 1935) the 12 Reserve Banks must each make a discount rate (now called primary credit rate) request, and the Board of Governors must review the requests, at least every two weeks. The requests coming from the regionals are a way for them to convey their monetary policy preferences, not just discount rate preferences (Meyer, 2004). At the board meetings, the Board of Governors also receives updates from the Federal Reserve staff on economic and financial developments. Each of the 12 Reserve Banks follows a different schedule for their discount rate requests. The board considers the requests a day or two before the FOMC meeting at its pre-FOMC board meeting; every two weeks following that, the board then has a full set of updated discount rate recommendations from the Reserve Banks. Therefore, we argue that it is meaningful to have more board meetings in even weeks and to include at these meetings a more detailed discussion of discount window requests and the governors' own views about the appropriate policy outcome for the following FOMC meeting. This would explain the importance of board meetings going into even weeks, and suggest that news about voting is more important than any informational advantage of the Fed about the macro economy. The importance of the board meetings stems from them not having transcripts and from the Government in the Sunshine Act which implies that FOMC members (or governors, a subset of the FOMC) may not meet to discuss policy without advance notice that a meeting will take place. The board meetings are the only meetings, other than the FOMC meetings, for which notice is given. While

there are eight scheduled FOMC meetings per year, the board of governors has board meetings 30 times per year on average.

While these various pieces of evidence help document that the stock return pattern is a risk premium for news coming from the Federal Reserve, they do not establish *how* information gets from the Fed to asset markets. We consider various possible mechanisms. Based on detailed conversations with several Federal Reserve officials, we rule out that the Fed signals changes in its policy stance via open market operations. We then study the timing of public releases from the Federal Reserve (the various books of updates, the FOMC statement, minutes of the FOMC meeting and minutes of the Board's discount rate meetings) but find no risk premium for these public releases. We argue that a more plausible mechanism for information getting to asset markets is systematic informal communication of the Fed with the media and the financial sector.

We provide direct evidence of leaks, lay out a framework for the Fed's motives for informal communication, and provide asset pricing tests of this framework. Evidence on leaks comes from (i) the content of media and private newsletter advice to financial clients lining up with the content of board meetings, (ii) the timing of Wall Street Journal articles on monetary policy, and (iii) examples characterizing the systematic access to the Fed that private parties (financial institutions) enjoy, especially with regards to the FOMC outcome and the FOMC minutes. To document the Fed's motives for informal rather than formal communication we rely on public statements made by Fed officials as well as our own conversations with current and former Fed officials. We document three motives playing an essential role for understanding the use of informal communication. First, informal communication retains more flexibility for the Fed in terms of the future path of monetary policy. The need for informal communication to ensure flexibility appears partly driven by a difficulty of making sufficiently state-contingent statements. This difficulty implies that public communication may force the Fed to either take the action expected by the market or be seen as re-trenching on prior statements. Second, informal communication facilitates learning by the Fed from the financial sector about how the Fed's assessment of the economy compares to that of the financial sector and about how markets are likely to react to a particular policy decision. Third, informal communication – in form of competitive leaking to drive the market's perception of the likely Fed policy – results naturally as an equilibrium outcome of disagreement among FOMC members. The framework of

informal communication we lay out for the Fed is surprisingly similar to that documented in the political economy literature (notably Pozen (2013)) about leaks from other parts of the US government. We provide two asset pricing tests of this communication framework. Both tests rely on a comparison of the period before versus after 1994 when Congress mandated that the Fed must publicly announce any changes to its policy stance. Within our framework, this disclosure mandate should make intermeeting target changes (i.e., changes to the Fed funds target in between scheduled FOMC meetings) less likely, and it should concentrate week 0 stock returns in the period prior to the announcement as policy makers competitively leak to influence the public's interpretation of the FOMC statement. Both predictions hold up in the data.

We finish the paper with a discussion of social welfare and informal communication, especially through private financial institutions. While informal communication has benefits in terms of flexibility and learning, it also has costs in that the Fed is giving a potentially very profitable information advantage to a subset of the financial sector. Beyond the purely economic transfer of providing insider information, the practice erodes the public's trust in the Fed. This loss of trust is worsened if (as we document) some of those in the financial sector with inside access are former Fed officials and if leaks are driven by competition between policy makers who disagree about the appropriate outcome for policy and leak for personal political gain.

## **2. The new fact: Stock returns over the FOMC cycle**

### **a. Main result**

Figure 1, Panel A, shows the main result of the paper, the pattern of US stock excess returns over the FOMC cycle from 1994 through 2013. Date 0 on the horizontal axis is the day of a scheduled FOMC meeting. For two-day meetings, date 0 refers to the second day. The graph omits weekends and sets return to zero on holidays. Therefore, 10 days on the horizontal axis represents 2 calendar weeks after an FOMC meeting, 20 days represents 4 weeks after an FOMC meeting and so on. On the vertical axis, we graph the 5-day cumulative stock return returns from (and including) day  $t$  to day  $t+4$  minus the 5-day cumulative return on 30-day Treasury bills from

day  $t$  to day  $t+4$ .<sup>3</sup> The vertical axis is in percent, so 0.5 means an excess return of a half percent. The figure shows a surprising regularity. 5-day stock market excess returns are high in even weeks in FOMC cycle time.

On average over the last 20 years (i.e., over 160 scheduled FOMC meetings), the average excess return has been 0.57 percent in week zero in FOMC cycle time (which we define as day -1 to 3), 0.30 percent in week two in FOMC cycle time (defined as days 9 to 13), 0.42 percent in week four in FOMC cycle time (defined as days 19 to 23), and 0.61 percent in week six in FOMC cycle time (defined as days 29 to 33). In sharp contrast to the high average excess returns in even weeks in FOMC cycle time, the average returns in odd weeks have been dismal, with an average excess return around zero in week minus one (days -6 to -2), -0.17 percent in week 1 (days 4 to 8), -0.17 percent in week 3 (days 14 to 18), and -0.12 percent in week 5 (days 24 to 28). This implies that the *entire equity premium over the last 20 years* has been earned in even weeks in FOMC cycle time.<sup>4</sup> While it is known from Lucca and Moench (2015) that on average since 1994, the excess return in the 24 hours from 2pm on day -1 to 2pm on day zero, leading up to the FOMC announcement have been high, averaging 0.49 percent in their sample from September 1994 to March 2011, the bi-weekly pattern in the average excess return has not been previously documented.

We have constructed the graph such that if a given day is day -6 or closer to the next meeting, the 5-day return starting on this day is not used. Therefore, points in the right part of the graph do not use any data for days -2 and later. Figure 1, Panel B, shows the number of data points that are available for each day in FOMC cycle time. While most FOMC cycles include week 0, 2 and 4, the number of data points drop off quickly past this. Economically, the first three average return peaks are thus each about equally important whereas the fourth peak matters less given the smaller number of data points.<sup>5</sup>

## **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. The simplest approach is

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<sup>3</sup> For ease of replicating the result, we use stock returns and T-bill returns from Ken French's website.

<sup>4</sup> 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.

<sup>5</sup> There are 3 days over the last 20 years which fall into what would be week 7 in FOMC cycle time. For simplicity of interpretation we drop these 3 days from our analysis throughout.

to run a regression in daily data of the stock market excess return on dummies for FOMC cycle weeks. We do this in Table 1, column (1) and (2). Since it is known that the average excess return in week 0 in FOMC cycle time is high, we are particularly interested in documenting whether the average excess return in weeks 2, 4, and 6 in FOMC cycle time are statistically different from those in odd weeks. In column (1), we thus include two dummies, one for being in week 0 and another for being in any of weeks 2, 4 and 6. Standard errors are robust to heteroscedasticity. The results show that the average excess return per day is 13.6 basis points (bps) higher on days that fall in week 0 in FOMC cycle time and 10 bps higher on days that fall in week 2, 4, or 6 compared to days that fall in odd weeks in FOMC cycle time. Importantly, both the week 0 and the weeks 2, 4 and 6 dummies are significant at the one percent level. In column (2), we ask whether the even weeks are individually significant, a less powerful specification. We include separate dummies for week 2, 4, and 6, two of which are significant at the 5 percent level and one at the 10 percent level.

We supplement the regression approach with a test of when during the FOMC cycle the equity premium is positive (as opposed to comparing whether it is higher in some weeks than others). In Figure 1, Panel C, we plot bootstrapped confidence intervals around the average 5-day excess return. The figure implies that 5-day excess returns are significantly positive at the 10 percent level or better at the start of weeks 0, 4 and 6, with the significance slightly worse for the 5-day excess return at the start of week 2.

### **c. Sub-sample robustness**

To further assess the robustness of our new fact, we break the 20-year sample period into three roughly equal sub-periods, 1994-2000, 2001-2007 and 2008-2013 and calculate average 5-day excess returns in FOMC cycle time for each sub-period. The result is displayed in Figure 2 Panel A. The bi-weekly pattern is surprisingly robust across sub-periods of the 1994-2013 sample, with each of the three sub-periods showing four peaks in average excess returns at roughly the same bi-weekly frequency. In Figure 2 Panel B we consider the pre-1994 period back to September 27, 1982, the first day for which the federal funds rate target is available and thus the start of the period during which the Fed has been targeting interest rates as opposed to money supply growth rates. The figure shows a bi-weekly pattern for the pre-1994 period. Notably, however, the week 1 average excess return is

higher in the pre-1994 period. We later argue that this fact is consistent with news from the Fed driving the stock market risk premium since the timing of news emerging from FOMC decisions was a less discrete event in the pre-1994 period, with news trickling out gradually after an FOMC meeting.

#### **d. International stock returns over the FOMC cycle**

Motivated by Rey (2015), who discusses the interconnectedness of global finance via monetary policy of the center countries, in this subsection we study whether our return regularity arises with a similar strength in other stock markets outside the US. Table 2 presents the results for regressions of daily returns for various MSCI equity indices onto dummies for FOMC cycle weeks over the 1994-2013 sample. The three columns contain the results for (1) the world index (WI) composed of stocks in the developed and emerging markets, (2) the developed market index excluding the US (DMxUS), and (3) the global emerging market index (EM). We use returns for day  $t+1$  since news from the US will only be reflected in most non-US markets on day  $t+1$  due to the difference in time zones. The indices are in US dollars.

The results in Table 2 indicate that the FOMC cycle pattern of returns does emerge 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 US and for emerging markets. Interestingly, our fact holds particularly strongly for the emerging market stocks, which earn a return that is on average 19 bps per day (t-stat=3.77) higher in week 0 and 18 bps per day (t-stat=4.75) higher during FOMC cycle weeks 2, 4 and 6 than it is in odd FOMC cycle weeks where it averages -6.5 bps per day (t-stat=-2.84). To illustrate these findings graphically, Figure 3 plots the 5-day cumulative US returns over the FOMC cycle with the world index returns for developed non-US countries and emerging market returns, confirming that the bi-weekly patterns in stock returns in FOMC cycle time is present around the world.

The fact that the bi-weekly FOMC return cycle extends beyond the US is not driven simply by movements in the dollar exchange rate. Using the trade-weighted dollar exchange rate from the FRED database, we find no tendency for the dollar to appreciate in even weeks in FOMC cycle time against a broad set of



currencies. Below we will consider patterns relative to particular countries when analyzing the returns to carry trade strategies over the FOMC cycle.

**e. Further evidence that the bi-weekly excess return cycle reflects a cycle in the equity risk premium**

To further alleviate any concerns about the statistical robustness of our finding, we analyze whether implied volatility from US options markets moves systematically over the FOMC cycle and whether its ability to predict the excess return on the US stock market changes over the cycle.

Figure 1, Panel A graphs the average ratio of implied stock volatility on day  $t$  to implied stock volatility on day  $t-5$  over the FOMC cycle. We measure the implied stock market volatility using the VIX index, which reflects risk-adjusted market expectations of stock market volatility over the next 30-day period. The figure shows that implied volatility is high (relative to 5 days earlier) at the start of the even weeks. The prices paid for options (i.e., the prices paid to protect against volatility) are higher going into the even weeks. This could either be due to investors expecting higher realized volatility in even weeks or due to them assigning a higher risk premium in even weeks. We have found no clear bi-weekly patterns in realized stock volatility suggesting that the bi-weekly implied volatility pattern reflects a higher risk premium going into even weeks. This finding is useful for two reasons. First, it makes it less likely that our finding is a statistical accident. Second, it shows that at least some market participants worry more about stock market news coming out in even weeks than odd weeks, consistent with our bi-weekly stock return pattern reflecting a bi-weekly cycle in the equity risk premium.

We next test an additional direct implication of the claim that the bi-weekly excess return cycle reflects a cycle in the equity risk premium. If this claim is correct, then even-week excess returns should be predictably higher when implied volatility is higher, since the risk premium component of implied volatility should also be reflected in average realized excess returns. Figure 4 Panel B provides evidence in favor of this implication. For each day in FOMC cycle time we predict 5-day excess stock returns for days  $t$  to  $t+4$  with implied volatility at the end of day  $t-1$ . The graph plots the  $t$ -statistics from this set of regressions and shows that higher implied volatility predicts higher excess stock returns in the even weeks, with the  $t$ -statistic being above 1.96 at several points over the cycle. For comparison, higher implied volatility does not predict higher excess stock returns in the odd weeks.

$t$ -statistics going into the odd weeks are negative and in some cases below -1.96. Selling pressure in odd weeks by investors trading out of their stock positions in fear of the upcoming even week news could result in negative odd week returns, more so when implied volatility, and thus potentially selling pressure, is higher.

**f. Economic significance: Trading strategies based on the FOMC cycle**

From a portfolio perspective our new fact has large implications. To show this, we consider various trading strategies that exploit the bi-weekly pattern of the equity premium over the FOMC cycle. We focus on US data and calculate annual excess returns for a given strategy by compounding stock returns across days on which the strategy invests in stocks and subtract the compounded T-bill returns over those same days. We then tabulate the means, standard deviations, and Sharpe ratios based on annualized excess returns. Table 3 shows the results.

For reference, the first row in Table 3 shows the performance of a strategy which simply holds the stock market all the time. This strategy would have earned an average excess return of about 8.5 percent per year over the last 20 years, with an annual standard deviation of about 20 percent and a Sharpe ratio around 0.4. Strategy B seeks to exploit our new fact in the simplest possible way: the investor stays out of the stock market in the odd 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 since it could be implemented with very low transactions costs using an existing ETF that covers the overall stock market. Strategy B would have a Sharpe ratio of 0.8, twice that of Strategy A. This is achieved by adding about 3 percentage points of average annual excess return and reducing the standard deviation of annual excess returns by about a third. Below the results for Strategy B, we show results for holding stocks in a given even week only and staying out of the market in all other weeks. This shows that week 0, 2 and 4 each contribute substantially to the overall performance of Strategy B, whereas week 6 is less important because that are fewer data points for that week, as shown earlier in Figure 1 Panel B.

Given the slightly negative average excess returns in the odd weeks documented above one may wonder whether shorting the market in odd weeks would improve upon Strategy B. This is not the case. Strategy C in Table 3 holds the market only in odd weeks, and Strategy D is long the stock market in even weeks and short in odd weeks. While the negative return on Strategy C indicates that shorting could be beneficial, it also adds

volatility. This implies that while Strategy D obtains a higher average excess return than Strategy B, it has a sufficiently high standard deviation that its Sharpe ratio is worse than that of Strategy B. Therefore, among the simple strategies we have considered here, the most attractive is to simply stay out of the stock market in odd weeks in FOMC cycle time. Following this advice would have resulted in a Sharpe ratio of 0.8 over the last 20 years, twice that of the stock market.

#### **g. Other asset classes**

We study whether a similar return pattern emerges in other asset classes. We first consider US Treasury bonds. Figure 5, Panel A displays 5-day cumulative returns on the 10-year Treasury bond (using CRSP fixed term indices) in excess of the one-month T-bill rate. While average Treasury returns do vary over the FOMC cycle, the even week effect is less pronounced than for stocks. Over the 1994-2013 period, the 10-year excess bond return is on average 2.4 bps per day higher in week 0 and 1.3 bps per day higher in weeks 2, 4 and 6 compared to odd weeks in FOMC cycle time. The average excess return in odd weeks is only 0.4 bps per day. However, the even week returns are not statistically significantly higher than the odd week returns at conventional confidence levels (this holds for other maturities as well). There are several reasons why weaker results for bonds than for stocks could perhaps be anticipated. First, the correlation between stocks and bonds is negative (-0.26) over the 1994-2013 sample. Thus one would not necessarily expect the risk premium on bonds to correlate positively with the one on stocks. Second, it is known that variables which predict future stock returns tend to do poorly in forecasting Treasury returns, and vice versa, suggesting that risk premia in stocks and bonds are driven by distinct state variables. Finally, information coming out from the Fed over the FOMC cycle may affect firm earnings whereas Treasury bonds have little or no (nominal) cash flow risk.

Another investment strategy whose returns one would expect to be sensitive to monetary policy news is the currency carry trade. The strategy relies on simultaneous borrowing at a low short-term interest rate in one country in order to invest in another country at a higher short-term interest rate. A large literature documents that countries whose short rate is higher than the short rate in the US earn positive average currency excess returns, i.e. the interest rate differential earned by investors is greater than the average currency depreciation against the US

dollar.<sup>6</sup> To study the pattern of average carry trade returns over the FOMC cycle, we use quintile portfolios formed on the interest rate differential between G10 countries and the US from a recent study by Kroencke, Schinder and Schrimpf (2014).<sup>7</sup> The top (bottom) quintile portfolio includes currencies with the highest (lowest) interest rate differential against the US. We present results for the top quintile portfolio which borrows in US dollar, as well as for a high-minus-low (HL) portfolio which takes the spread between returns on the top and bottom quintile portfolio. The HL strategy amounts to borrowing in low interest rate countries and investing in high interest rate countries. Figure 5 Panel B displays the 5-day excess currency returns on the two portfolios over the FOMC cycle. Both portfolio returns show a clear bi-weekly pattern with high returns earned in even weeks in FOMC cycle time. Estimating our baseline regression from Table 1 column (1), we find that even week dummies are statistically significant, and carry returns earned in even weeks are by about 5 bps per day higher than in odd weeks (untabulated).<sup>8</sup> Interestingly, we fail to detect a similar bi-weekly pattern in the so-called dollar portfolio returns, defined as the average portfolio of a US investor who goes long all foreign currencies. Thus, the bi-weekly pattern in currency returns over the FOMC cycle depends on sorting currencies on interest rate differential between the foreign country and the US, and similar to our evidence for international stock returns, is not driven by the movements in the dollar exchange rate.

We have also explored the behavior of various stock portfolios over the FOMC cycle. The bi-weekly stock return pattern 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 – a result that echoes Savor and Wilson’s (2014) findings for macro announcement and non-announcement days.

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<sup>6</sup> Following Lustig, Roussanov and Verdelhan (2011), we define the excess return on a currency as:  $RX_{t+1} = f_t - s_t - \Delta s_{t+1}$  where  $s_t$  and  $f_t$  are the logs of the spot and (one-month) forward exchange rate, respectively, expressed in units of foreign currency per US dollar. By no-arbitrage (covered interest rate parity), the forward discount,  $f_t - s_t$  equals the interest rate differential against the US,  $i_t^{foreign} - i_t^{US}$ .

<sup>7</sup> We focus on G10 economies because many of the emerging countries have imposed capital controls on inflows over our sample period (see e.g., Baba and Kokenyne, 2011), thus possibly distorting the functioning of the money market. We thank Andreas Schrimpf for sharing the data with us.

<sup>8</sup> Similar to the results for international stock market returns, in these regressions we line up day t in FOMC cycle with carry return realized on day t+1 to account for time-zone differences.

### 3. Evidence that the new fact is driven by news coming from the Federal Reserve

This section presents evidence that the bi-weekly stock return pattern in FOMC cycle time is likely to be driven by news coming from the Federal Reserve. The stock return pattern shows that there is a high risk premium for news bi-weekly in FOMC cycle time. We put forward a series of arguments going from general to specific for why news from the Federal Reserve is likely to drive our main fact. Our goals are to rule in that our fact is driven by news from the Fed, to rule out other sources of information, and to begin to pin down what information gets from the Federal Reserve to asset markets, moving in Section 4 to the possible mechanisms.

Before turning to the evidence tying the bi-weekly cycle to the Fed, it is worth pointing out that it is well known from prior work that monetary policy news does not predominantly come out at the time of the FOMC statement. Kuttner (2001) uses market prices in fed funds futures contracts at a given date to measure the expected value of the average federal funds rate over the remainder of the month. The difference in this forecast of the federal funds rate and the current federal funds target is Kuttner's estimate of how the market expects the Fed to change the target. Comparing actual changes in the federal funds rate to the change the market expected as of the day before the FOMC announcement, one can measure how much of the announced change in the federal funds target, if any, was expected and how much comes as a surprise to the market.

In Table 4, we use Kuttner's data for 1994-June 2008 to quantify how much monetary policy news comes out on the FOMC announcement day and how much comes out in the intermeeting period.<sup>9</sup> This table provides a summary of the well-appreciated fact that the news component of the FOMC announcement (Kuttner surprise) tends to be small compared to the size of the federal funds target change. As an example, on the 25 occasions when the FOMC increased the federal funds rate target by 25 bps, the market on average expected a change of 25 bps. Furthermore, the market expectation on average was only off by 2 bps from the realized change (see the last column of the table showing the average absolute value of the surprise). Even for target changes of 50 bps, the market's expectation error averaged only 9 bps. Therefore, the vast majority of news about monetary policy

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<sup>9</sup> Kuttner's data are available <http://econ.williams.edu/people/knk1/research>. We do not update Kuttner's data since the federal funds target has been a constant range from 0 to 25 bps since December 16, 2008, i.e. for most of the period following Kuttner's sample period.

comes out in the period between FOMC meetings, not on the day of the FOMC statement. Our added value is to show *when* during the intermeeting period Fed news comes out, with our evidence documenting bi-weekly clustering of news from the Fed. We now turn to the evidence tying the bi-weekly cycle to the Fed.

**a. The FOMC calendar changes across sub-periods over which our finding is robust and does not line up with the calendar for reserve maintenance periods**

Since 1981, the FOMC has had 8 scheduled meetings per year. The schedule of meetings for a particular year is announced ahead of time. For example, the schedule of meetings for 2013 was announced in May of 2012. Figure 6, Panel A, shows a histogram of the day of the year on which FOMC meetings took place over the 1994-2013 period. For each of the 8 meetings, there is a quite wide dispersion across years in what day of the year the meeting takes place on. The dispersion is the largest for the third meeting of the year for which the difference between the first and last day of the year on which this meeting took place is 27 days.

Within our 20-year sample, the scheduling principles appear to have changed over time. Figure 6, Panel B, reports that the typical timing of each of the eight meetings varies across the three sub-periods we studied in Figure 2. The fact that the FOMC calendar changes from year to year and that the typical calendar changes across the three sub-periods is the first argument that our main finding is related to news coming from the Federal Reserve.

A potentially important issue is whether the FOMC calendar is aligned with the calendar for reserve maintenance periods. Reserve maintenance periods in the US are two weeks long. Over a given reserve maintenance period banks have to hold an average amount of reserves which (since 1998) is known at the start of the reserve maintenance period and calculated based on an earlier computation period. Banks also often hold excess reserves, historically for transactions purposes (to avoid overdrafts) and recently because of reserves earning interest (in order to make banks willing to hold the large amounts of reserves used to finance the Fed's purchases of bonds under quantitative easing). If banks are more risk averse toward the end of the reserve maintenance period and if reserve maintenance periods ended in even weeks in FOMC cycle time, this could potential explain the bi-weekly stock returns cycle. However, reserve maintenance periods are bi-weekly in

calendar time with no exceptions around holidays and are about equally likely to end in even weeks in FOMC cycle time as they are to end in odd weeks. While reserve maintenance periods end on a Wednesday and FOMC meetings typically end on a Tuesday or a Wednesday, the irregularity of the FOMC calendar implies that it is about equally likely that the Wednesday of/the Wednesday after an FOMC meeting is the end of a reserve maintenance period as it is that it is the middle of a reserve maintenance period. In Table 5 column (2) we rerun our main regression for the excess return on the stock market including day of the reserve maintenance period dummies (10 dummies total) and find almost identical results for the coefficient or significance of the dummies for FOMC week 0 or FOMC week 2, 4, or 6.

**b. Even weeks in FOMC cycle time do not line up with macroeconomic data releases or corporate earnings releases**

We next document that other important macroeconomic data does not arrive at a bi-weekly frequency in FOMC cycle time. To show this, we use all US macroeconomic data releases in Bloomberg for the November 1996-2013 period. The start of the sample in November 1996 is dictated by the availability of Bloomberg data. In total, we have 16,487 non-Fed macro releases. The number of releases per day ranges from 1 to 21 with an average of 4.4. There are over 150 different types of macro data releases, with 99 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 measure of how many Bloomberg users have set up “alerts”. The relevance variable is a number between 0 and 1. The most followed macro releases are initial jobless claims, the change in nonfarm payrolls, GDP growth and consumer confidence. These are about as popular as the FOMC announcements (on day zero in FOMC cycle time) which rank just after initial jobless claims and the change in nonfarm payrolls. To calculate a relevance-weighted count of macroeconomic data released on a given day, we simply sum the relevance variable for each date. Figure 7 shows the average number of macroeconomic data releases both un-weighted and weighted by relevance. Both exhibit a clear weekly pattern in FOMC cycle time, not a bi-weekly pattern that we observe for stock returns. Moreover,

Table 5 shows that when we control for macroeconomic releases, our regression results remain largely unchanged. Column (1) presents our baseline regression from Table 1. Column (3) adds the relevance-weighted number of macroeconomic data releases. This has almost no effect on the coefficient or significance of the dummies for FOMC week 0 or FOMC week 2, 4, or 6. We have also not found any substantial effect of controlling for the most important macroeconomic releases separately. Furthermore, in column (4) we control for day of the month and day of the week fixed effects with little effect on the coefficient of the even week dummies. This ensures that the even week effects are not driven, e.g., by any confounding calendar seasonalities that occur on particular days of the month or week.

As an additional robustness check, we also confirm that the frequency of corporate earnings announcements does not have a bi-weekly pattern in FOMC cycle time. We use corporate earnings announcements from IBES. For each day in the 1994-2013 sample, we compute the total number of quarterly earnings per share announcements by US firms in the IBES database as well as the fraction of positive surprises, i.e. earnings announcements that exceed the consensus analyst expectation. The average number of earnings announcements per day is 84 with a standard deviation of 104. Column (5) of Table 5 shows that controlling for these variables has little impact on our results.

### **c. Volatility in the federal funds market peaks bi-weekly in FOMC cycle time**

If the pattern of stock returns over the FOMC cycle is driven by news coming from the Fed about monetary policy, or about the macro economy but reflected in monetary policy decisions, we should see high volatility in markets tied to monetary policy at the same times over the FOMC cycle when we observe high average excess returns on stocks. To capture market reactions to updated expectations about monetary policy, we focus on the federal funds market.

A natural market to study would be the federal funds futures market since federal funds futures are commonly used to gauge market expectations about the future path of monetary policy. However, the fact that intermeeting target changes are possible (as we study separately below) makes it difficult to use federal funds futures to determine when monetary policy news comes out during the intermeeting period.



Each fed funds futures contract refers to a particular calendar month and payoff is based on the average realized federal funds rate over that month. Suppose on the 15<sup>th</sup> of a month with 30 days, we observe a reduction of 12.5 basis points in the futures-implied rate (which equals 100 minus futures price). This could be the result of the market expecting the Fed to reduce the federal funds target rate by 25 basis points the following day, or it could result from the market expecting the Fed to reduce the target rate by 50 basis points about a week later (other combinations are possible too). This example shows that it is difficult to assess whether a particular fed funds futures change is large or small in the sense that the change reflects a combination of updated expectations about *how much* the Fed may change the target and *when* this may occur. This problem is not severe when studying the Kuttner surprises on the FOMC announcement day (day 0 in FOMC cycle time) because the Fed rarely changes the target soon after an FOMC meeting. Therefore, around day 0 the timing of potential changes are pinned down to day 0 implying that one can infer the market's expected FOMC outcome from the futures contract rate as of day -1 and thus the surprise component of the decision on day 0 from the announced target minus the expected target.<sup>10</sup>

Instead of studying federal funds futures we focus on the federal funds market itself. Changes in expected monetary policy may be reflected not only in futures contracts but also in the daily effective federal funds rate. This will be the case if (1) financial institutions adjust their demand for federal funds as they receive news about the future federal funds rate, and if (2) the Fed's open markets desk does not fully adjust its open market operations to keep the effective funds rate equal to the current target rate. The Fed has managed the effective federal funds rate much more closely since around 2001 (e.g., Hilton, 2005), so (2) is more likely to hold in the pre-2001 period. Therefore, when analyzing volatility of the effective fed funds rate we focus on the 1994-2001 period.

Figure 8 shows the volatility of the effective federal funds rate over the FOMC cycle for the 1994-2001 period (we include the few FOMC cycles with intermeeting target changes but the graph looks similar with or without those FOMC cycles). For each day in FOMC cycle time, we calculate the rate change as the change from day  $t-1$  to  $t$ . We then calculate the standard deviation of all available rate changes for that day in FOMC cycle

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<sup>10</sup> Kuttner (2001) thus notes about his methodology that "Under the assumption that no further changes are expected within the month, this method delivers a nearly put measure of the 1-day surprise target change."

time (e.g., for day 0 we calculate the standard deviation across 160 observations of daily rate changes from day -1 to 0). We then average these standard deviations across day t up to t+4 in FOMC cycle time, since we are interested in which risks may drive the risk premium observed in the 5-day excess returns on stocks on those same days. While there appears to be a downward trend in effective federal funds rate volatility over the FOMC cycle, the figure shows clear peaks in the volatility of the effective federal funds rate in the even weeks. Volatility in week -1 (day -6 to -2) is also quite high.

To make sure the even week volatility peaks are driven by news from the Fed, we have verified that the graph looks similar if one controls for known determinants of effective federal funds rate volatility. It is known that effective federal funds rate volatility varies with the day of the reserve maintenance period (Hamilton (1996)). The other known determinant of volatility in the effective federal funds rate is high payment flows, i.e. large payments between banks to facilitate transactions for their customers (households and firms). Judson and Klee (2009) state: “Payment flows tend to be elevated at month-start, mid-month, the twenty-fifth of the month, month-end, and on days after holidays, owing in part to corporate tax due dates, principal and interest payments on securities, and pent-up flows after a long weekend. (...) On such days, DIs [depository institutions] likely face greater uncertainty about their end-of-day balances and thus have a greater incentive to hold excess balances as a precaution against overdrafts.” Following Bartolini, Gudell, Hilton and Schwarz (2005), we define high payment flow days as the first and last business days of each month, the first business day after the fourteenth of each month, and the first day after each Monday holiday. Following Judson and Klee (2009), we also include the 25<sup>th</sup> of the month as a high payment flow day which is a principal and interest payment date for Fannie Mae. We then regress the absolute value of the daily effective federal fund rate changes on dummies for the days of the reserve maintenance period and a dummy for a given day being a high payment flow day. We save the residuals and use these to reconstruct the volatility graph in Figure 8. The resulting graph looks very similar so we do not report it separately. For completeness, in Table 5 column (6), we show that our main finding about average excess stock returns over the FOMC cycle is robust to controlling for a dummy for high payment flow days.

To support the argument that news originate from monetary policy we have verified that, in general, volatility in assets markets (the stock market or the bond market) is not elevated in even weeks in FOMC cycle

time. We omit those graphs for brevity. These volatility patterns indicate that it is not the total realized volatility that moves over the FOMC cycle but the amount of volatility coming from news from the Fed.

#### **d. Federal funds target changes before 1994 tend to be bi-weekly in FOMC cycle time**

Since 1994 the Fed has predominantly changed the federal funds target at scheduled FOMC meetings, with only 7 out of 60 changes over the 1994-2013 period taking place in between meetings. This differs from the period prior to 1994 when it was more common to change the target in between meetings than at the meetings. As noted, the Federal Reserve provides a series of the federal funds target rates going back to September 27, 1982. From September 1982 to 1993, only 31 of 93 target rate changes happened at one of the eight scheduled meetings per year, whereas 62 (about two thirds) took place between meetings. Prior to 1994 the FOMC did not make an announcement after the target had been changed, and the market instead had to infer target changes from open market operations. The series of target rate values provided by the Federal Reserve in the FRED database is constructed by Thornton (2005) based on a variety of Fed sources.<sup>11</sup> The timing of intermeeting target rate changes provides evidence on when decision making tends to happen within the Fed, with the pre-1994 period being more informative due to the larger number of intermeeting target rate changes.

Figure 9 shows the probability of a federal funds target change on any of days  $t$  to  $t+4$  over the FOMC cycle. The left graph focuses on the pre-1994 period and shows four clear peaks in the probability of rate changes. The peaks appear a few days delayed relative to the peaks in the average excess stock returns over the FOMC cycle. It is possible that Thornton's approach (described in footnote 11 above) dates those changes after they were already known by the market.<sup>12</sup>

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<sup>11</sup> Thornton (2005) uses information from transcripts of FOMC meetings, Blue Books, the Report of Open Market Operations and Money Market Conditions and data on open market operations obtained from the Open Market Desk at the Federal Reserve Bank of New York. In order to capture the timing of when the market knew of target rate changes, 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. 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.

<sup>12</sup> Indeed, regressions of excess stock market returns on Thornton's target changes in the pre-1994 period suggest that stock returns on day  $t$  are as negatively related to target changes on date  $t+2$  or  $t+3$  as they are to the target change on date  $t$ . This may suggest that many of the target changes became known to the market before the date Thornton assumed they did.

Table 6 tabulates the timing of the seven intermeeting target changes in the 1994-2013 period showing that six of these took place in even weeks in FOMC cycle time. Overall, the evidence on the timing of intermeeting changes suggests that information aggregation and policy decision making within the Fed tends to be bi-weekly in FOMC cycle time.

**e. Board of Governors discount rate meetings: Information processing and decision making within the Fed still tends to be bi-weekly in FOMC cycle time**

The most direct evidence that information-processing and decision making within the Fed still tends to be bi-weekly in FOMC cycle time in the 1994-2013 period comes from studying the timing of a little known set of minutes from what is called the Board of Governors discount rate meetings. These meetings are called board meetings in Chairman Bernanke's and Chair Yellen's calendars (which we obtained via a Freedom of Information Act (FOIA) request) so we will refer to them as board meetings going forward.<sup>13</sup> In this section, we document that the high average excess stock returns in even weeks are driven by even week days that follow board meetings. This result is due to both there being more board meetings going into even weeks and, conditional on a board meeting taking place, average excess stock returns being higher in even weeks.

The discount rate is the interest rate charged to commercial banks and other depository institutions on loans they receive from their regional Federal Reserve Bank's lending facility--the discount window. Since 2003, the discount rate has been called the primary credit rate. Under the Federal Reserve Act, Section 14, as amended in 1935, the boards of each of the regional Federal Reserve Banks (the "Reserve Banks" in what follows) have to set their discount rate at least every two weeks, subject to approval of the Board of Governors.<sup>14</sup> With the exception of the recent financial crisis, discount window borrowing in our period is small, typically less than \$1B. Therefore, the importance of discount rate requests made by regional Reserve Banks to the Board of Governors is not so much about the discount facility itself. Rather, Reserve Banks use their discount rate recommendations as a way to express their policy views regarding the federal funds target. In his book, former Fed governor Larry Meyer states: "While the Reserve Bank presidents are not part of the pre-meeting discussions at the Board, they

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<sup>13</sup> There are occasional Board meetings which are not discount rate meetings. We exclude those from our analysis.

<sup>14</sup> The Federal Reserve Act is available at <http://www.federalreserve.gov/aboutthefed/section14.htm>

have their own devices for influencing the policy discussion in between meetings. They do this specifically through requests to change the discount rate” (Meyer (2004), pg. 54).

The charter for each Reserve Bank lays out when the board of directors and executive committee of the Reserve Bank meet to fulfill their obligation to report discount rate opinions to the Board of Governors. For example, a charter might say “second and fourth Thursday”, but these schedules differ across Reserve Banks. Ahead of a Governors’ board meeting, the Reserve Banks submit their “memos” of requests. There is always a Governor’s board meeting review of regional preferences on one of the days just prior to each FOMC meeting. Following that, it takes two weeks for the Board of Governors receive a full set of updated opinions of the Reserve Banks over monetary policy. Minutes of the Governors’ board meetings, called the Discount Rate Minutes, are posted on the Federal Reserve’s web page starting from May 2001. We obtained the dates of discount rate meetings back to 1994 via a FOIA request, with the exception of the period February-December 1996 for which we did not get data.

Although the Governors’ board meetings are referred to as discount rate meetings, the meetings themselves can be a point of aggregating, analyzing, and discussing a lot more information than the discount rate requests made by the Reserve Banks. According to Chairman Bernanke’s daily schedule, the board meetings typically last two hours. There are no transcripts of these meetings. The minutes are brief but give a sense of which types of economic data are discussed. Appendix A contains two examples of these minutes. Axilrod (2009) describes a dispute between board members at one of such meetings as follows:

*“The dispute—which was, to me, about as dramatic as things get at the Fed—broke out at a usual weekly board meeting on Monday, February 24, 1986, a day when the staff made its weekly presentation about the latest economic and financial developments. Following the presentation, the board met in a more limited session to consider discount-rate proposals from Reserve Banks.”*

The quote clarifies that board meetings on days of discount rate meetings involve not only discussions of Reserve Bank discount rate requests and regional economic conditions but also updates of the Board of Governors by the board staff. We do not have direct information about which Fed staff provide updates, but the most likely would be (i) updates on national economic conditions and forecasting from Fed staff economists in charge of the

Greenbook (now Tealbook), (ii) updates on trading operations and market conditions from the Open Markets Desk, and (iii) updates on bank conditions from bank supervision economists in the Fed system.

We want to test whether the stock market risk premium in even weeks is driven by a risk premium for news coming out following the board meetings about monetary policy and/or the Fed's view of the state of the economy. Note that in the prior quote, Axilrod referred to the board meetings as weekly. In the early years of our sample, the board meetings were more frequent with around 40 annual meetings. This number declines gradually to around 20 annual board meetings. However, even in the period with close to weekly meetings, the bi-weekly cycle of getting a full set of fresh inputs from the Regional Banks would likely imply that monetary policy discussions happen in the even FOMC weeks. We can directly test whether board meetings and especially those going into even weeks are important for the equity risk premium.

We decompose Figure 1 Panel A into the contributions from observations that do, or do not, follow within five days of a board meeting. Figure 10 Panel A shows that the bi-weekly stock return pattern is driven mainly by the subset of observations in even weeks that follow board meetings. These days (even week days  $t$  for which there was a board meeting on one of days  $t-5, \dots, t-1$ ) account for 32.2% of all days in the 1994-2013 period (dropping February-December 1996 and weekends). The likely interpretation for this pattern is that information is created at or around the time of board meetings and gradually makes its way into the market over the following 5-day period.

In Figure 10 Panel B and C we assess whether the result in Figure 10 Panel A is driven by there being more board meetings prior to even weeks or by expected returns conditional on a prior board meeting being higher in even weeks. The answer is that both factors appear to contribute. Figure 10 Panel B plots the fraction of observations on days  $t$  to  $t+4$  for which there was a board meeting on one of the prior five days (for example, day  $t+2$  would be categorized as being in this category if there was a board meeting on any of days  $t-3$  to  $t+1$ ). There is always a board meeting on one of days -3, -2, and -1 before a scheduled FOMC meeting so for day  $t=0$  most observations on days  $t$  to  $t+4$  had a board meeting on one of the prior five days.<sup>15</sup> The frequency of subsequent

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<sup>15</sup> The line in Figure 9 Panel B does not quite reach one on day zero because observations on day +3 may not be within five days following a board meeting. Thus, one day  $t=0$ , less than all of the observations for days  $t$  to  $t+4$  fall within five days following a board meeting.

meetings has a bi-weekly pattern in FOMC cycle time though the week 2 and week 4 peaks are modest. Figure 10 Panel C shows, however, that average returns conditional on a prior board meeting are substantially higher in each of the four even weeks. The difference between Panel A and Panel C in Figure 10 is that in Panel A, we set a return to zero if it does not fall in the particular category (after or not after a board meeting) whereas in Panel C we drop that return to calculate conditional averages (the figure notes contain the exact definitions). Figure 10 Panel C suggests that board meetings going into even weeks appear have more important content than board meetings going into odd weeks since average daily returns conditional on board meeting are higher in even weeks than in odd weeks. In Figure 9 Panel C there is also a spike in week 6 in the conditional expected return for observations where the prior five days did not have a board meeting. However, there is little data in that part of the graph because most days in week 6 follow a board meeting as shown in Figure 10 Panel B. Only four cycles have data for days that do not follow board meeting and for which cycle equals 30 or higher. A read of market commentary on those days suggests that events on these days were driven partly by market expectations about upcoming Fed decisions. For example, the highest return from days where cycle is equal to 30 or higher, not following a board meeting, is on June 13, 2008 about which the Wall Street Journal writes “Investors breathed a sigh of relief after May's consumer prices excluding food and energy came in as expected, and the Reuters/University of Michigan consumer-sentiment index was reported at a 28-year low, reducing the likelihood of an imminent interest-rate increase by the Fed.”

Table 7 assesses the statistical significance of our claim that high even week stock returns are driven by even week days that follow board meetings. Table 7 column (1) repeats our regression from Table 1 column (2) for the sub-sample of data that excludes February to December of 1996 with very similar results. Table 7 column (2) is the regression equivalent of Figure 10 Panel A. We include interaction terms of even weeks and a dummy for whether any of days  $t-5$  to  $t-1$  had a board meeting. This results in larger, and with the exception of week 6, more significant coefficients. The regression in column (2) also includes a term interacting even weeks with a dummy for days  $t-5$  to  $t-1$  not having a board meeting and a term interacting odd weeks with a dummy for whether any of days  $t-5$  to  $t-1$  had a board meeting (the omitted category is thus odd weeks that do not follow a board meeting). These two interaction terms are economically and statistically insignificant suggesting that there

is no risk premium for even weeks that do not follow a board meeting and no risk premium for odd weeks that do follow a board meeting. Instead, the market appears to assign a risk premium only to even week days that follow board meetings.

We have motivated why a bi-weekly cycle might be natural for monetary policy discussions, but we have not fully laid out why the Board of Governors uses the board meetings rather than only the FOMC meeting or more casual governor meetings to do monetary policy thinking. The fact that there are no transcripts of the board meeting could be an important factor contributing to their importance because it allows for a more open debate between board members than is possible at the FOMC meetings which are transcribed. The smaller set of people present at the board meetings (the chairman, vice-chairman and governors) than the FOMC meetings may also be important for facilitating frank discussion. The Government in the Sunshine Act of 1976 is a third factor that could drive the importance of the board meetings. This act implies that FOMC members may not meet to discuss policy without advance notice that a meeting will take place. The board meetings are the only meetings for which such notice is given (the notices are available a few days before the board meetings on the Fed's web page).

Former governor Kevin Warsh emphasizes all three issues in Warsh (2015):

*“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 bi-weekly 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.”*

Before discussing potential channels through which the information may get from the Fed to asset markets, we give a quick summary of the many papers in the literature documenting that information about the Reserve Banks' policy views and economic updates from Federal Reserve staff would be relevant for asset prices. Using data for 1974-1993, Tootell (2000) shows that the FOMC vote of a regional bank president is strongly correlated with the most recent discount rate recommendation of that president's regional Fed board. Jinushi and Kuttner (2008) use data for 1990-June 2008 and find that the average change in the discount rate requested by regional feds has strong predictive power for the change in the federal funds target rate at the subsequent FOMC



meeting (or the subsequent intermeeting date at which the FOMC target was changed). Equally important, they show that the average discount rate change request has predictive power for one- and two-month ahead changes in the federal fund target rate, even controlling for the change implied by prices of federal funds futures. Romer and Romer (2000) compare the quality of inflation forecasts prepared by the Fed staff (for the Greenbook) and by the private sector. They find that the Fed staff possesses a significant information advantage. Having access to inflation forecasts by the staff and by the private sector, an econometrician would put essentially no weight on the latter. Cieslak (2014) shows that similar conclusions pertain to the Fed staff forecasts of the future path of the federal funds rate. Peek, Rosengren and Tootell (1999, 2003) document that the bank supervision duties of the Fed lead to valuable information; in particular, confidential bank information (CAMEL ratings) could be used to improve upon both private sector and Greenbook forecasts of inflation and unemployment rates. This literature thus suggest that the types of information that becomes available to policy makers in the context of board meetings would be highly relevant for market participants both because of the information's impact on subsequent policy decisions and because of the information's usefulness for understanding the state of the economy.

#### **4. Possible mechanisms for how information gets from the Federal Reserve to asset markets**

We have documented a new fact that the equity premium is earned in even weeks in FOMC cycle time and have tied this in several ways to the timing of decision making processes within the Fed: The FOMC calendar is irregular, it changes across sub-periods over which our finding is robust and even weeks in FOMC cycle time do not line up with other macro releases. Kuttner monetary policy surprises show that news about monetary policy mainly comes out between FOMC meetings, not at the FOMC announcement. Volatility patterns for federal funds futures and the effective fed funds rate over the FOMC cycle line up with average excess stock return patterns over the FOMC cycle. Finally, we reported evidence that information processing for monetary policy decisions happen bi-weekly in FOMC time. In particular, the timing of fed funds target changes before 1994 suggests that information aggregation and processing tended to happen bi-weekly in FOMC cycle time before 1994, and the timing of Board of Governors discount rate meetings post-2001 suggests that this is still the case.

While these facts make it highly likely that the stock return FOMC cycle is in fact driven by news coming from the Fed, we have not provided a mechanism for precisely how news gets from the Fed to asset markets. In this section we consider several possibilities. We argue that signaling via open market operations is not the channel. We then describe how (with the exception of week four in FOMC cycle time) the high return weeks do not systematically line up with official information releases from the Federal Reserve or the frequency of speeches by Fed officials. This leads us to a discussion of intentional or unintentional communication from the Fed lined up with its decision making process.

#### **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 inform us that no such signaling via OMOs takes place.

#### **b. Public information releases and public speeches by Federal Reserve officials**

Another obvious communications channel is public information releases and public speeches by Fed officials. The main public releases from the Fed are as follows:

- *FOMC statement*: The FOMC statement summarizes the outcome of the FOMC meeting and is released publicly just after the FOMC meeting has ended, typically around 2.15pm. As shown by Lucca and Moench (2015) the return in week 0 in FOMC cycle time is earned prior to the FOMC statement. The statement release thus cannot be viewed as the direct explanation for the high average excess stock returns in week 0 in FOMC cycle time, and has no bearing on the other weeks in FOMC cycle time.
- *Beigebook*: The Beigebook summarizes economic conditions across the 12 Reserve Bank districts. It is prepared by the Reserve Banks and is made public two weeks *prior* to each scheduled FOMC meeting.

- *Minutes of FOMC meetings*: These are released once per FOMC cycle. Before December 2004, minutes of a given FOMC meeting 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.<sup>16</sup>
- *Minutes of Board of Governors discount rate meetings (board meetings)*: Since May 2001, minutes for all discount rate meetings in a given FOMC cycle are released together, around four weeks after the FOMC meeting. Before this, we have the minute release dates only for the 1994 and 1995 minutes which were released in bundles, with two releases in 1994, two in 1995 and one in 1996.
- *Greenbook and Bluebook (now merged into the Tealbook) and FOMC transcripts*: These are only released to the public with a five-year lag, with all information for eight FOMC cycles released once per year.<sup>17</sup> We are unable to determine the specific dates of the yearly releases but the five-year lag is intended to make the releases contain little news at the time of the release.

Figure 11, Panel A, illustrates the timing of public releases of Beigebooks, FOMC minutes, discount rate meeting minutes. Beigebook releases and releases of discount rate minutes tend to take place in week 4 in FOMC cycle time and may thus, if sufficiently informative, help explain the high average excess stock returns in this week. Release of FOMC minutes do 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. However, within week 0 the high excess stock returns are earned mainly on day 0 so releases of FOMC minutes do not help explain the high average excess stock returns in week 0 in FOMC cycle time. For reference, Appendix Figure 1 shows a daily version of Figure 1, Panel A.

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<sup>16</sup> To reconstruct the historical minutes release dates we follow the minutes publication rules discussed in the 2005 Federal Reserve Bulletin (Dankner and Luecke, 2005). Historically, the publication rules were: 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”.

<sup>17</sup> The Green/Blue/Tealbooks are released internally within the Fed a few days before the FOMC meeting.

In Table 8 we test whether Beigebook releases and releases of discount rate minutes do in fact help account for the high average excess returns in week 4. Table 8 column (1) is the specification from Table 1 column (2). Table 8 column (2) includes controls for public Fed releases related to monetary policy. None of the public release dummies are significant. Importantly, including the public release dummies has little effect on the coefficients and statistical significance of the even week dummies. One may worry that a public release is done after the end of trading or that the full effect on markets is not realized until the following day.<sup>18</sup> Adding the lagged value of the public release dummies (not shown for brevity) has little effect on results. The lag dummies are insignificant and the even week dummy coefficients are largely unchanged.

Figure 11, Panel B presents the timing of speeches by Fed officials. We collect dates of speeches from the web page of the Board of Governors of the Federal Reserve and the web pages of the Reserve Banks. Our sample includes 570 days when the Chair gave a public speech, 179 days for the Vice-Chair, 517 days for a governor, and 1,286 days for a president of a Reserve Bank. If a speech takes place on Saturday or Sunday, we include it in the dummy variable on Monday following the weekend. There are 22 days with weekend speeches given by the Chair, 10 days for the Vice-Chair, 21 days for a governor and 31 days for a Reserve Bank president. It is clear from Figure 11, Panel B that there are few speeches around the FOMC meetings themselves since this period is part of the “blackout period” which 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. During this period, the Fed’s self-imposed communications policy prohibits staff from communicating with the public about macroeconomic or financial developments or about monetary policy issues. The blackout policy was extended to the FOMC members themselves in 2011 but, based on the frequency of public speeches, it appears to have been informally adhered to prior to that.<sup>19</sup> The only peak in speech frequency which overlaps with an even week in FOMC cycle time is speeches by Reserve Bank presidents in week four in FOMC cycle time. This lines up with the release of Beigebooks (which, as noted, cover

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<sup>18</sup> 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 a time of day information for the discount rate meeting minutes releases or the releases of Green/Blue/Tealbook and FOMC transcripts.

<sup>19</sup> The policies on external communications for staff and FOMC members are available at [http://www.federalreserve.gov/monetarypolicy/files/FOMC\\_ExtCommunicationStaff.pdf](http://www.federalreserve.gov/monetarypolicy/files/FOMC_ExtCommunicationStaff.pdf) and [http://www.federalreserve.gov/monetarypolicy/files/FOMC\\_ExtCommunicationParticipants.pdf](http://www.federalreserve.gov/monetarypolicy/files/FOMC_ExtCommunicationParticipants.pdf).

regional economic conditions). In Table 8 column (3) we test whether there is a stock market risk premium associated with speeches by Federal Reserve officials. Since we do not have a time of day information for many of the speeches we include both a set of speech dummies and a set of lagged speech dummies. We find no evidence of any such risk premia. We have also analyzed whether speeches in even weeks are more important than speeches in odd weeks (omitted from the table for brevity), finding little evidence of this.

Overall, the evidence in Table 8 documents that public releases or public speeches by Federal Reserve officials are unlikely to be the main channel through which information gets from the Fed to markets in even weeks in FOMC cycle time.

### **c. Systematic informal communication with the media and the financial sector**

In this subsection, we argue that the most important and likely channel through which information gets from the Fed to asset markets is informal communication with the media or private financial institutions. Our objective is to make the case that informal communication is frequent and takes place systematically over the FOMC cycle, with more information disclosed in even weeks.

By its nature, documenting informal communication is a difficult task. We take several approaches. First, we provide direct evidence of leaks. We report a series of examples documenting the media and financial sector obtaining information from the discussions within the Board of Governors around the time of the board meeting, well before the release of the minutes from these board meetings. We also provide a list of Fed leaks of FOMC outcomes or related decision-making to financial institutions. To further document the importance of even weeks for informal communication, we document the frequency of articles covering the Fed over the FOMC cycle by David Wessel, a particularly well-known reporter writing for the Wall Street Journal. We then provide evidence on the Fed's motives for informal communication based on statements made by current and former Fed officials and market participants. Finally, we tie the pieces together with two asset pricing tests that support the importance of particular motives.

### **c.1. Evidence of Fed informal communication (leaks)**

Some direct evidence of leaks of monetary policy information from board meetings over the 1994-2013 sample period can be documented by studying board meeting minutes, media articles and newsletters written by private Fed watchers.<sup>20</sup> Table 9, Panel A lists eight examples of board meeting discussions emerging in the public domain, and thus asset markets. We include the media article or newsletter content as well as the excerpt from the *Discount Rate Minutes*, describing the discussions at the board meeting. The similarity of article/newsletter content to discount rate minute content is striking and highly suggestive that the writer had prior conversations with a Fed official. The first five items are leaks to the media. The remaining three are leaks appearing in Fed watcher newsletters. The newsletters are expensive, with one media article stating the price of \$75,000 per year for the Macroeconomic Advisers newsletters covering the Fed. The high price of the newsletters is perhaps by itself suggestive of inside access of the newsletter writer. We do not have access to newsletters; thus we only can provide examples of leaks to newsletters that later appear in the media.

As an example of the items in Table 9 panel A, consider item 6, written on April 29, 2010 (a day +1). The newsletter writer explicitly mentions conversations with Fed officials who told him the views of FOMC participants going into the FOMC meeting. The disagreement in these views is apparent in the minutes from the pre-FOMC board meeting (taking place on day -2 of that FOMC cycle). These minutes were released only on May 25, 2010. Other examples are similar, which together paint a picture of informal communication leaking either the policy views of the Reserve Bank presidents discussed at the board meetings (and the governors view of presidents' requests) or the board meeting information about the latest economic outlook of the Fed.

Prior to our 1994-2013 sample period, there is additional direct evidence of systematic leaks from the Fed to the Wall Street Journal. As part of Congressional hearings in 1993, known as the Gonzalez hearings, it became clear that from 1989 to May 1993 on 11 occasions, the essence of the FOMC directive to the open market operations desk was leaked the Wall Street Journal within one week of the meeting (Belongia and Kliesen

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<sup>20</sup> We use the word Fed watchers narrowly to mean for-profit macroeconomic forecasters, policy intelligence financial consultants, or Fed watchers at other financial firms.

(1994)), prior to its public release.<sup>21</sup> Lindsey (2003) provides a detailed discussion of how 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, albeit with a 5-year lag. Woodward (1994) suggests that Greenspan is the likely source of the 1989-1993 leaks. Irrespective of whether he personally informed the WSJ, communication with the media would not have been something Greenspan invented. 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, page 222)*

Meyer (2004) provides a historical list of recent reporters involved in what he calls the *signal corps*, stating:

*"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." (pg 98)*

*"I was surprised, then, one Monday before an FOMC meeting, to pass John Berry coming out of the Chairman's office." (pg 99)<sup>22</sup>*

We can be more systematic in documenting informal communication around the time of board meetings, by looking to the timing of media articles on monetary policy. Figure 12 graphs the frequency, in FOMC cycle time, of articles by David Wessel in the Wall Street Journal which contain any of the words "FOMC", "open market committee", or "fed board", obtained using Proquest searches. We focus on this reporter because of his documented access to the Fed as indicated by the leaks over the 1989-1993 period and because his writing stays relatively focused on monetary policy. We drop articles that are classified as commentaries or book reviews or are duplicates, selecting those published in New York to avoid international editions duplication. Our search renders 76 articles over the 1994-2013 period. Figure 12, Panel A plots the probability of an article on day  $t$ . Many of the

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<sup>21</sup> 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.

<sup>22</sup> Note that the timing to which former Governor Meyer (2004) refers is after the Board Meeting that always occurs before the FOMC

articles cover public releases from the Fed (primarily FOMC statements, FOMC minute releases), which is not our focus in this exercise to document informal communication. Thus, we drop any article published the day after either of those two public events and show in Figure 12, Panel B, the probability of any of days  $t$  to  $t+4$  having an article. The figure displays a clear bi-weekly pattern in FOMC cycle time. Of course, this is just an example of informal communication to one reporter, but one that is highly suggestive of both the importance of board meetings and of informal communication.

Panel B of Table 9 documents leaks to private financial institutions, and thus illustrates the access these financial institutions have to confidential monetary policy information. In Panel B, we provide a list of Fed leaks of the FOMC outcome (or key determinants thereof) or the FOMC minutes to private financial institutions, again being constrained in seeing only the leaks that emerge in the public domain. The most well-known example (item 6 in this panel) is the October 3, 2012 leak to Medley Global Advisors (MGA), a policy intelligence firm.<sup>23</sup> We include the full MGA newsletter at the heart of this leak as Appendix B. It is clear from that document that 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 provides 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.

Two things are notable about this example beyond the leak itself. First, it is informative that the analyst wrote the newsletter without a concern for the legality of extracting and conveying inside information to those who could trade ahead of the minute release announcement. One possible interpretation of this is that leaks are commonplace and not prosecuted. Pozen (2013) makes this argument in the context of leaks from other parts of the US government. Second, the subsequent investigations of the MGA leak offers evidence of the systematic nature of informal communication between the Fed and the financial sector. After the leak emerged, Congress demanded the list of Fed employees with whom MGA had contacted. Chair Yellen has herself met with MGA on

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<sup>23</sup> 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.



multiple occasions, but not during the leak period.<sup>24</sup> After some debate with Yellen in congressional hearings about the Fed not disclosing this list because of a Department of Justice insider trading investigation that had since ensued, the Fed ultimately provided the list to Congress. None of the parties has made the list public. One current staff told us that the list has many names and that one of that staff's job assignments was regular conversations with MGA.

Other financial institution leaks are equally revealing of the systematic nature of Fed leaking to the private sector. In Table 9, Panel B, the first item is the famous Geithner Leak, from the FOMC transcript of August 2007. President Lacker questions Geithner about the leaking of information which Geithner then denies. President Lacker then says, "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."

Item 2 is an example of PIMCO's Bill Gross knowing the Greenbook content (highly relevant for predicting the FOMC outcome) on a day 0, before the FOMC announcement, and revealing that knowledge live on CNBC. Like the MGA leak this example is informative because of Gross' willingness to discuss leaked information publicly with no concerns for legal ramifications.

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.<sup>25</sup> Item 4 is a reference to a newsletter writer writing about the Fed's plans to do another Operation Twist in 2010, following a meeting with Bernanke. Item 5 recounts how a former Fed governor, and then a Fed intelligence executive, 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. The word leak appears in many FOMC transcripts since 1994 with different FOMC members expressing concerns about leaks. Those expressing concern include Lacker, Rosengren, McDonough, Jordan, Boehne, Moskow and Bernanke. Bernanke reminds FOMC members on two occasions in 2007 and 2009 not to leak (FOMC transcripts

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<sup>24</sup> Chair Yellen reported her schedule to Jon Hilsenrath of the WSJ as a part of a Freedom of Information Act request.

<sup>25</sup> Perhaps it is not terribly surprising that the macroeconomic forecasting by Macroeconomic Advisers ranks 1<sup>st</sup> among private models in Bauer, Eisenbeis, Waggoner, and Zha (2006)'s analysis of forecast accuracy.

of October 31, 2007 and transcript of FOMC conference call on February 7, 2009). Transcripts from later years are not available yet.

To further document that informal communication with private parties is part of a systematic pattern, we submitted Freedom of Information Act requests for the schedules of Chairs Greenspan, Bernanke, Yellen, and all the sitting governors over the 1994-2013 period, as of 2013. The chairs complied, but with varying degrees of detail and redactions, some justified under code (b.4) of the Freedom of Information Act.<sup>26</sup> Among governors, only Governor Tarullo provided his schedule. The redactions and lack of content in entries like “conference call” (with whom?) and the lack of governor calendars cause us to defer detailed analysis of the calendars to future work.

## **c.2. Evidence of Fed motives for systematic informal communication**

We next turn to evidence on the Fed’s motives for informal communication focusing on statements by Fed officials themselves. Understanding the motives is of interest both because it helps make it plausible that informal communication is systematic and because the motives are central for assessing the optimality of a system of informal communication from a social welfare perspective.

Three reasons emerge as important drivers of Fed informal communication. First, informal communication is much more flexible than public communication in the sense that it does not bind policy makers hands as much going forward. We can see this motive clearly in Greenspan’s testimonies surrounding the 1989-1993 leaks of policy changes. Trying to prevent congress from mandating FOMC statements, Greenspan wrote in a letter of September 23, 1991, to Representative Stephen Neal:

*“With an obligation to announce all changes as they occurred, the distinction between making changes either quite publicly or more subtly, as conditions warrant, would evaporate; all moves would be accompanied by announcement effects. If markets always accurately assessed the implications of such announcements, incorporating them into the structure of prices, then market efficiency might be enhanced by making our open market objectives public immediately. However, prices can, and do, overreact to particular announcements. [...]*

*[...] Earlier release of the Directive would [...] force the Committee itself to focus on the market impact of the announcement as well as on the ultimate economic impact of its actions. To avoid*

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<sup>26</sup> (b.4) reads: “This section does not apply to matters that are trade secrets and commercial or financial information obtained from a person and privileged or confidential.”

*premature market reaction to mere contingencies, FOMC decisions could well lose their conditional character. Given the uncertainties in economic forecasts and in the links between monetary policy actions and economic outcomes, such an impairment of flexibility in the evolution of policy would be undesirable.”*

In the quote above, Greenspan views the need for flexibility as partially resulting from the difficulty of making a sufficiently state-dependent projection about policy. The Fed (if forced to make public statements and these were insufficiently state-dependent) could be forced to make ex-post suboptimal policy choices to not surprise the market. Informal communication is beneficial to the extent that it allows policy makers to convey not just decisions but less concrete inputs, debates, and weights of what matters in their decision making. An aversion to surprise the market is a necessary ingredient for the Fed to view its hands as being partly tied by the market's expectations. Ex-governor Stein assumes in his recent paper (Stein and Sunderam (2015)) that the Fed behaves as if it is averse to bond-market volatility suggesting a potential reason for the Fed to stick to pre-announced projections. A *Wall Street Journal* article (3/17/2015 written by Jon Hilsenrath) quotes Stein's view on this issue: "To avoid unsettling markets, he [Stein] said, Fed officials have an incentive to stick to the path investors infer." How does the Fed make sure it is "sticking to the path that investors infer"? It must control the inference of investors and informal communication helps it do that. Stein and Sunderam (2015) argue, however, that this aversion is counter-productive and that society would be better off with a central banker who cares less about the bond market (presumably that conclusion would extend to caring about the stock market if that market is also driven by Fed decisions as we argue here).

The second motive for informal communication we have identified is a need for the Fed to learn from market participants. The Fed benefits from comparing its assessment of the economy to that of the private sector. Furthermore, the Fed benefits from getting a sense of how the market would react to a given policy move. This could be via knowing how private sector macro-models project the markets would react to a particular policy move or through feedback on potential non-traditional policy moves. Item 4 in Table 9, Panel B is an example of such feedback on what came to be called the Maturity Extension Program (MEP). A *Wall Street Journal* article by Susan Pullman, 11/22/2011, quotes Blackrock CEO Laurence Fink explaining the Fed's desire to learn from the private sector:

*“Mr. Bernanke discusses only matters already public; a spokeswoman said. But hedge fund managers and Wall Street executives who meet regularly with him 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.”**... There are central bank rules that bar officials from discussing confidential Fed actions not yet public. But gleaning clues about the thinking of Fed officials during private talks can be as valuable to investors making bets on the direction of the economy.”*

Fink’s words clearly convey a quid pro quo relationship with financial institutions.

The third motive for Fed leaks is that it is an equilibrium outcome of disagreements among FOMC members. Several current and former officials have emphasized the need to set the record straight by communicating with the media and with those writing influential newsletters. Meyer (2004) in referring to what was going on inside the Fed at the time of the Clary leak (item 2 of panel A of Table 9) refers to the positioning of reserve bank presidents and governors (including possibly Meyer himself) against Greenspan causing this leak, calling it “political hardball inside the Fed” and “an uprising within the Committee [the FOMC]” (page 65).

Leaks as an outcome of disagreement fits naturally with the desire to not 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 do 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, an investigation into the sources behind a particularly detailed WSJ 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. He had also spoken to a number of staff members.” When we asked about the high pre-FOMC stock returns documented by Lucca and Moench (2015), one former official stated that this was likely 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. 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. A short statement accompanied by leaks may be a natural equilibrium response to such difficulties.

In sum, informal communication retains more flexibility for a Fed which is averse to surprising the market, it facilitates learning by the Fed from financial institutions, and is a natural outcome of disagreement

among FOMC members. While these motives for informal communication are not widely appreciated in the literature on monetary policy, they are surprisingly similar to the motives for leaks from other parts of the US government 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”. Pozen states: “Significant subtypes of the policy leak might include the *internecine leak* through which competing agencies or factions within the executive branch strive to strengthen their relative positions, and the *counter-leak*, intended to neutralize or dispute prior disclosures”. Similarly, what we refer to as a Fed motive to get 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”.

We finish this section by providing two asset pricing tests of the Fed’s motives for informal communication. The first test is based on the following question: How should the Fed respond to the congressional mandate imposed in 1994 to make a public statement after any change in the federal funds target rate? If we are correct that the Fed still values flexibility, the Fed would be expected to make fewer changes to the target post-1994, because changes necessitates public statements. This is precisely what happened. Post-1994 target changes take place almost exclusively at the FOMC meeting on day 0. The fraction of target changes that happen at the FOMC meeting drops discretely in 1994 from a mean of 65% for 1982:9-1993 to a mean of 7% for 1994-2013. This difference in means is significant at the 1% level and consistent with a continued desire for flexibility and the importance of disclosure rules. To our knowledge no other explanations have been put forward for the decreased use of intermeeting changes post-1994.

Our second asset pricing test of the informal communications framework concerns the timing of stock returns around day 0 in FOMC cycle time. If we are correct that the Lucca and Moench (2015) pre-FOMC effect is driven by competing leaks prior to the FOMC statement, then the pre-FOMC effect should not be present pre-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 competing leaks, and pre-1994 week 0 returns spread out after the announcement as the market gradually learns about any target change from the Fed's open market operations. In Table 10 we test this prediction. We show the pre-announcement, post-announcement and total week 0 returns for the pre-1994 period and the post-1994 period. Overall week 0 returns are large and statistically significant in both periods, but are concentrated before 2pm on day 0 in the post-1994 period (with post-announcement returns small and statistically insignificant) and after that time in the pre-1994 period (with returns prior to the end of the FOMC meeting small and insignificant). Aside from providing a test of our communications framework, the more gradual information dissemination after the FOMC meeting pre-1994 could help explain why the week 1 trough in Figure 2, Panel B is not as sharp as the week 1 trough in the post-1994 period in Figure 1, Panel A.

## **5. Conclusion and policy discussion**

We have documented a novel pattern in stock returns in the U.S. and around the world. Over the last 20 years, the equity premium has been earned entirely in even weeks in FOMC cycle time, with the equity premium in odd weeks being close to zero or negative. This pattern is statistically robust and stable across sub-samples of this 20-year period. Several pieces of evidence link the pattern to information coming from the Federal Reserve. The FOMC calendar is irregular and it changes across sub-periods over which our finding is robust. Even weeks in FOMC cycle time do not line up with macroeconomic data releases or corporate earnings releases. Volatility in the federal funds market peaks bi-weekly in FOMC cycle time. Most importantly, there is direct evidence that Fed policy making tends to take place in even weeks. Before 1994, when intermeeting target changes were frequent, they disproportionately took place in even weeks. After 1994, the bi-weekly stock return cycle is driven mainly by even week observations that follow board meetings (discount rate meetings) of the Board of Governors.

These results document that either there is a large risk premium associated with macro news revealed by the Fed as part of its policy making process or there is a large risk premium for monetary policy news. While our evidence on the importance of even week board meetings suggest that a risk premium for monetary policy news is more likely we view the relative importance of these two types of news from the Fed as still somewhat

unresolved. A quote from Bernanke from the FOMC meeting on 9/15/2003 is supportive of a role for monetary policy news itself, as opposed to an informational advantage of the Fed:

*“...the outside world doesn’t have all the information we have. They may not have information about our objectives. They may not have information about our views on the economy, which may be relevant even if they’re wrong. For those reasons, what we say might be instructive to the public.”*

To document the mechanism for how information gets from the Fed to asset markets we document that the bi-weekly peaks in average excess stock returns over the FOMC cycle do not systematically line up with official information releases from the Fed or with the frequency of speeches by Fed officials. We argue that systematic informal communication is instead an important mechanism. We provide direct evidence of how information from the board meetings of the Board of Governors is obtained by the media, newsletters, and the financial sector around the time of the board meeting as well as examples of Fed leaks of the FOMC outcome and the FOMC minutes to financial institutions and newsletter writers. We also lay out a framework for the Fed’s motives for systematic informal communication emphasizing three motives: Informal communication retains more flexibility for the Fed because of the difficulty of making precise state-contingent statements. The Fed values flexibility because of its aversion to surprising the market. Furthermore, informal communication facilitates learning by the Fed from the financial sector, and it results naturally as an equilibrium outcome of disagreement among FOMC members.

If we are correct that systematic informal communication plays a central role in the Fed’s communication should one be concerned with that from a social welfare perspective? There is a substantial literature on the benefits of central bank communication. Blinder, Ehrmann, Fratzscher, de Haan and Jansen (2008) provide an overview and emphasize how communication guides market expectations about interest rates and inflation and for reducing uncertainty about the policy rule. The question is, however, whether communication needs to contain a large informal component. If it is difficult to make state-contingent policy statements, the solution is not to make informal statements to a set of reporters or private newsletters (who benefit privately from this) but to try harder making informative public statements and speeches. Furthermore, as Stein and Sunderam’s (2015) argue, perhaps the Fed should care less about surprising the market. Similarly, while Fed learning from the private sector necessarily involves some private communication, other types of Fed learning do not. For example, if the Fed

wants feedback on a potential unconventional monetary policy, why would the optimal way to get this feedback be to communicate with a for-profit private newsletter? Informal communication has benefits in terms of flexibility and learning, but it also has costs – the Fed is giving an information advantage to a subset of the media and the financial sector. Having this information is likely highly profitable. A former Fed official put it like this:

*“Talking to people poses a tradeoff between potentially conveying an information advantage to a subset of the public against refining the outside understanding of policy and improving the inside view of the economy.”*

The optimal point on this tradeoff depends on ones’ views of how detrimental it is to the public’s trust in the Fed that it gives inside, profitable, access to some in the media and the financial sector. The fact that some of those in the financial sector with inside access are former Fed officials (as we documented above) is likely particularly harmful for public perceptions of the Fed. Furthermore, the type of informal communication that is motivated by competing leaks between policy makers who disagree puts us in an undesirable equilibrium, where leaks beget leaks and society would be better off with increased sanctioning of leaks for personal political gain.



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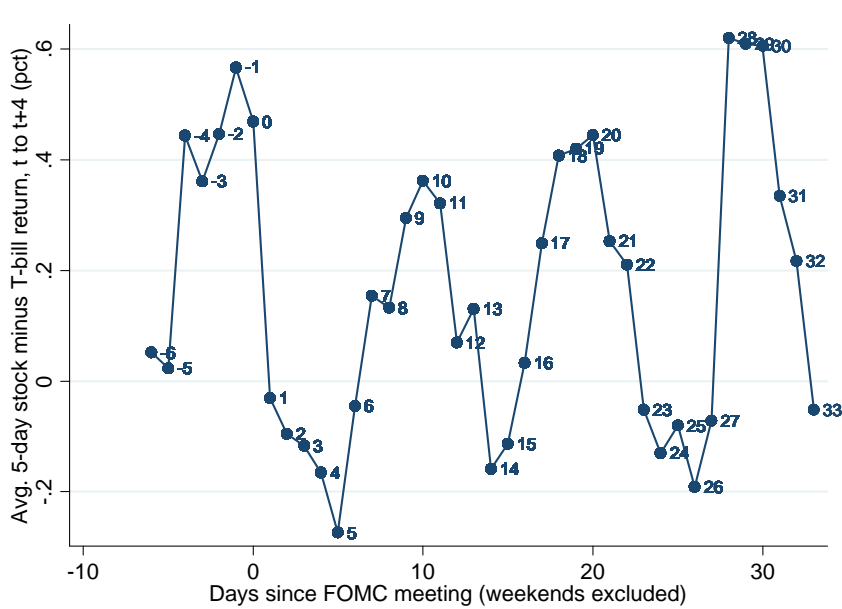
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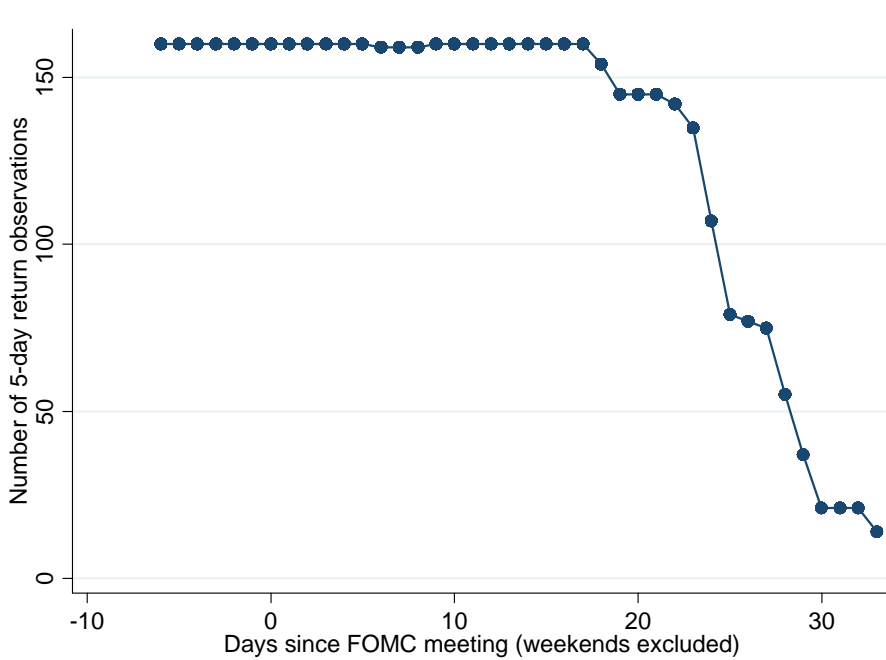
**Figure 1. Stock returns over the FOMC cycle, 1994-2013**

**Panel A. Average 5-day stock return minus bill return over the FOMC cycle, percent**

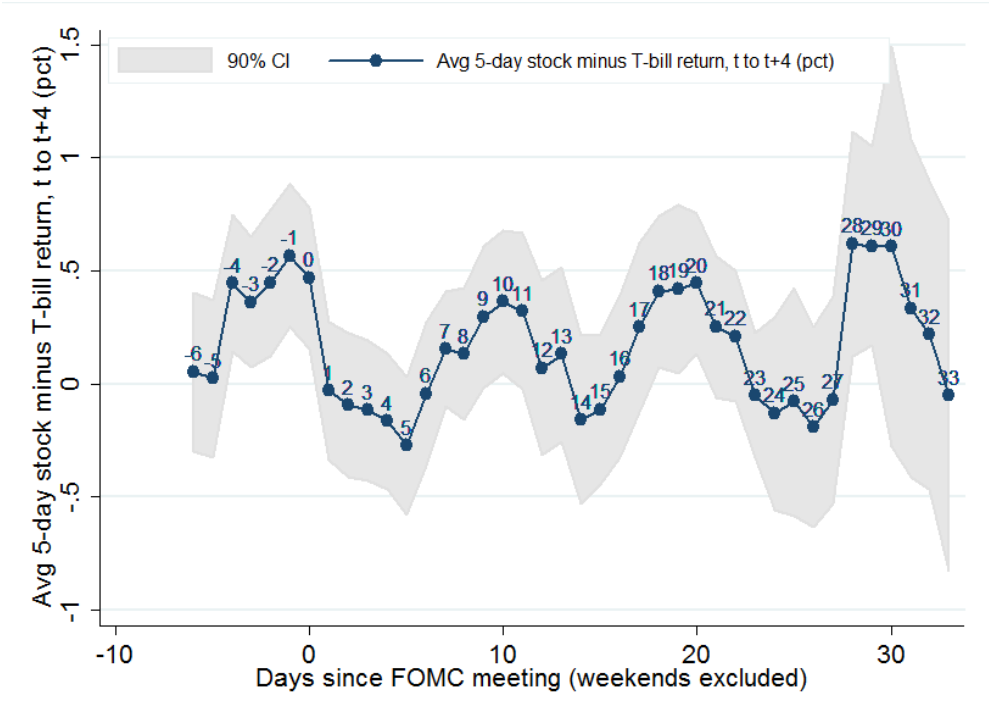


Note. Based on 160 FOMC cycles (8 scheduled FOMC meetings per year). The numbers along the line indicate the value on the horizontal axis. If a given day is day -6 or closer to the next meeting, the 5-day (forward) return for this day is not used in the right part of the graph, so points to the right do not use any data for days -2 and later.

**Panel B. Number of 5-day return observations**



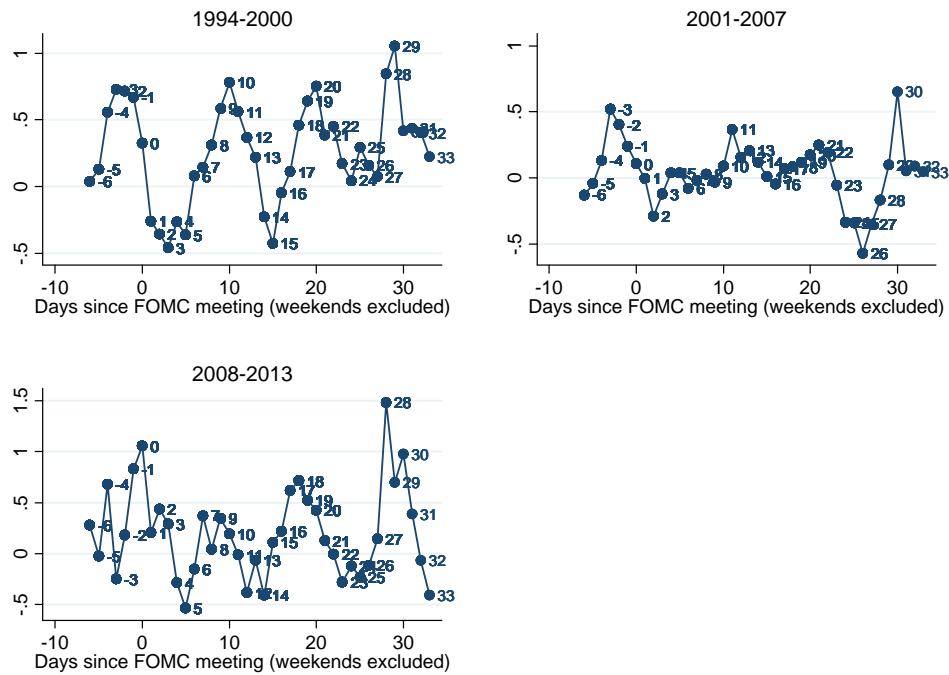
**Panel C. Average 5-day stock return minus bill return over the FOMC cycle, percent, with 90 percent bootstrapped confidence band**



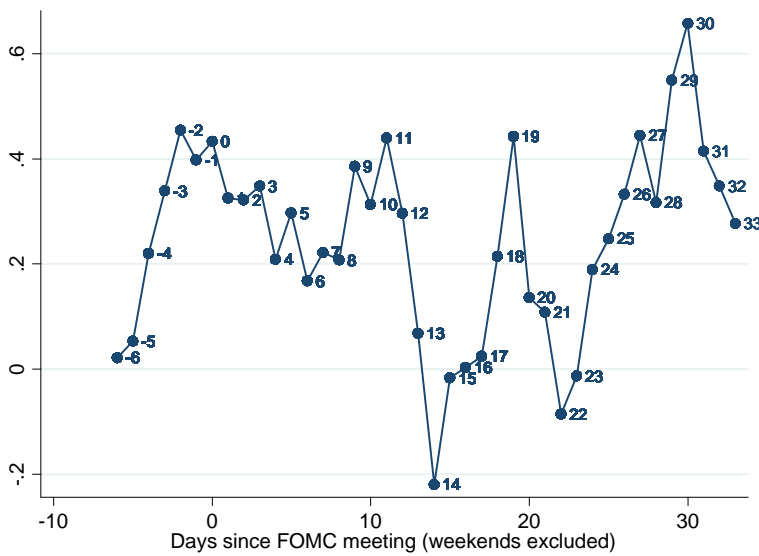
Note. The numbers along the line indicate the value on the horizontal axis.

**Figure 2. Stock returns over the FOMC cycle, by time period**

**Panel A. Sub-periods of 1994 to 2013. Average 5-day excess return,  $t$  to  $t+4$  (percent)**

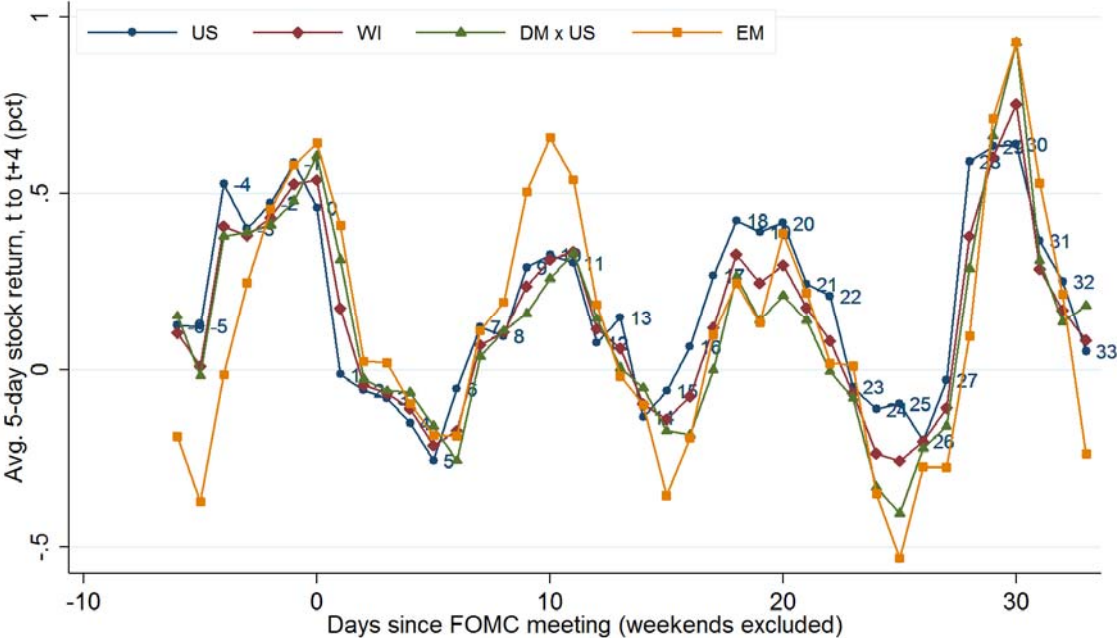


**Panel B. 1982:9 to 1993. Average 5-day excess return,  $t$  to  $t+4$  (percent)**



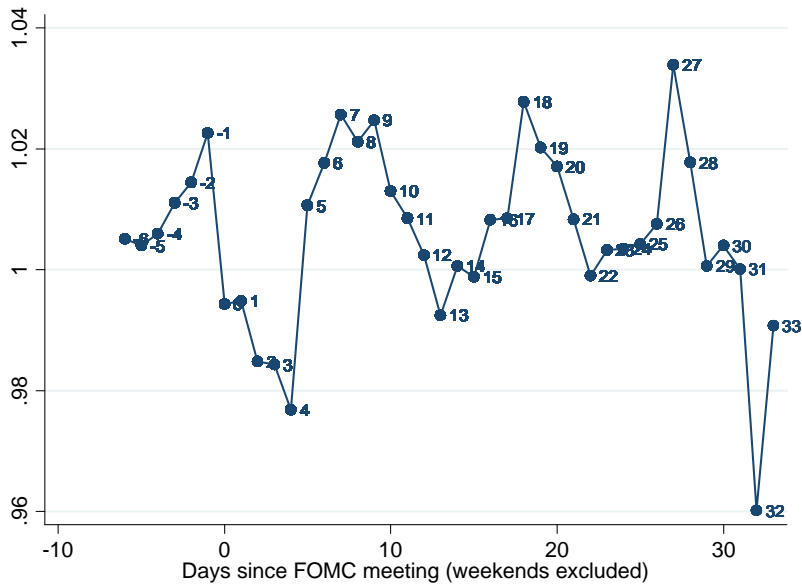
Note. The figure omits data from October 19, 1987 (Black Monday) on which the market fell by over 17 percent in one day.

**Figure 3. International stock returns over the FOMC cycle, percent, 1994-2013**



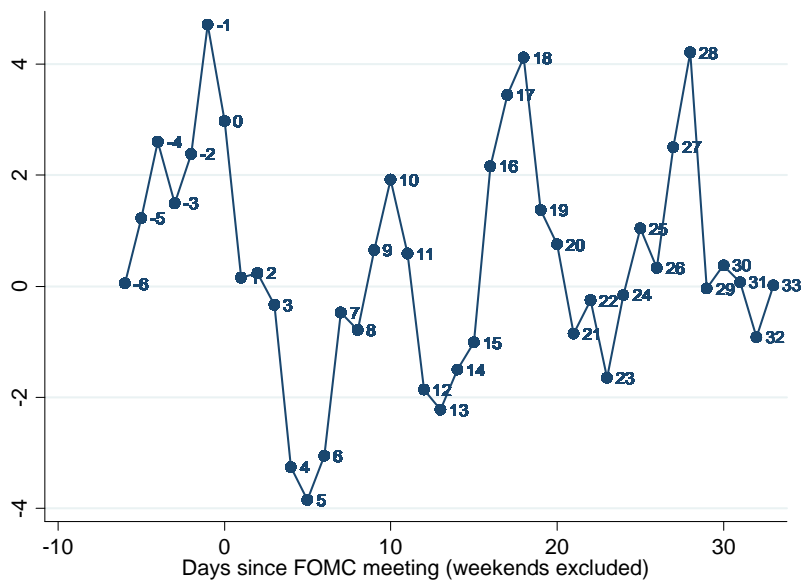
Note. All returns, including US, are based on the MSCI indices obtained from Bloomberg. WI is the world index, DMxUS is the developed market index excluding US, EM is the emerging market index. All indices are in USD.

**Figure 4. Implied volatility and its predictive power over the FOMC cycle, 1994-2013**  
**Panel A. Average ratio of VIX at time t to VIX at time t-5**



Note. We measure implied stock market volatility using the VIX index. This index is based on S&P500 index options and measures implied stock market volatility over the next 30-day period.

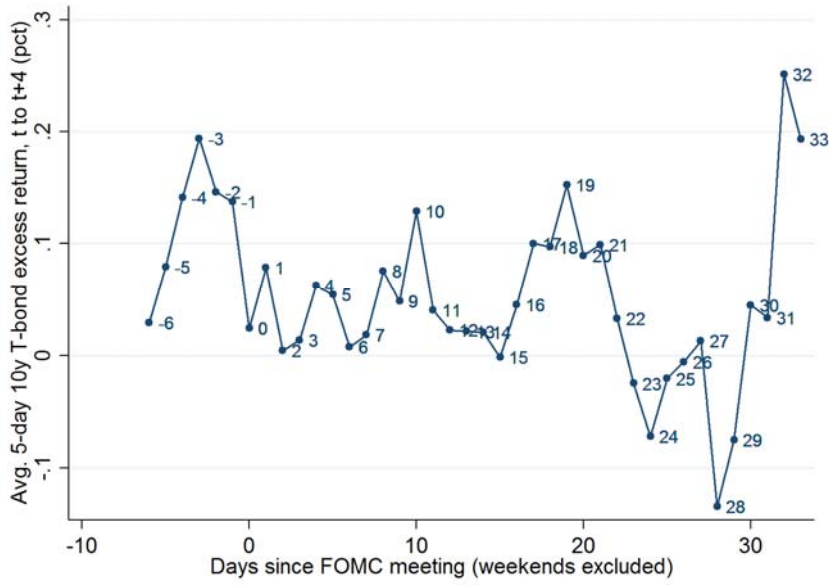
**Panel B. t-statistics from predicting 5-day excess stock return with lagged implied volatility**



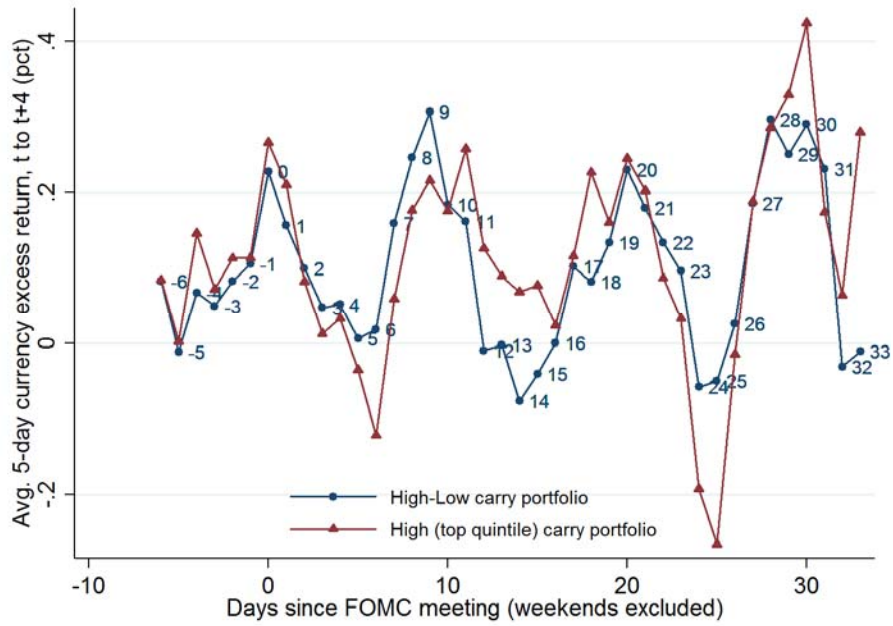
Note. A separate regression is estimated for each day in the FOMC cycle. The dependent variable is the 5-day excess stock return on days t to t+4. The explanatory variable is the implied stock market volatility (VIX) at the end of day t-1. The figure illustrates the t-statistics (based on standard errors robust to heteroscedasticity).

**Figure 5. Other asset classes, 1994-2013**

**Panel A. Excess returns on 10-year Treasury bonds over 30-day T-bills**



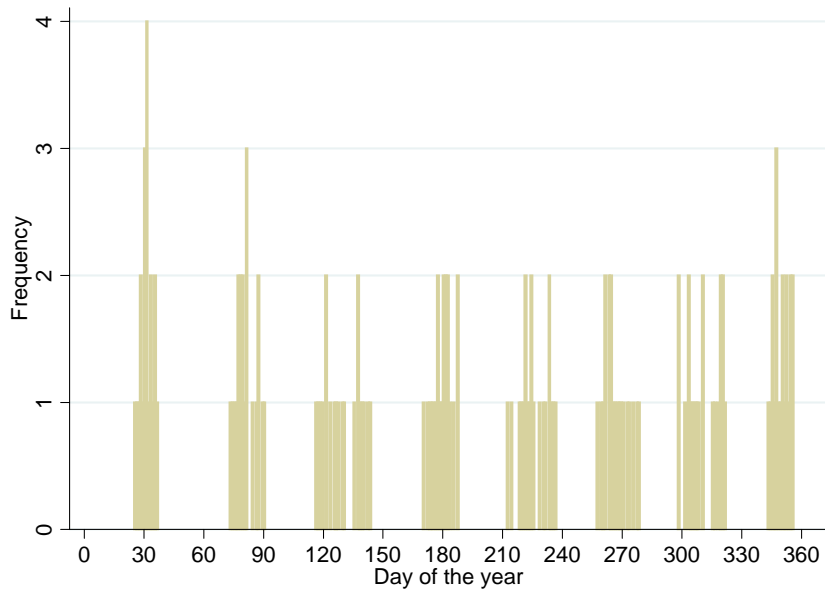
**Panel B. Carry trade**





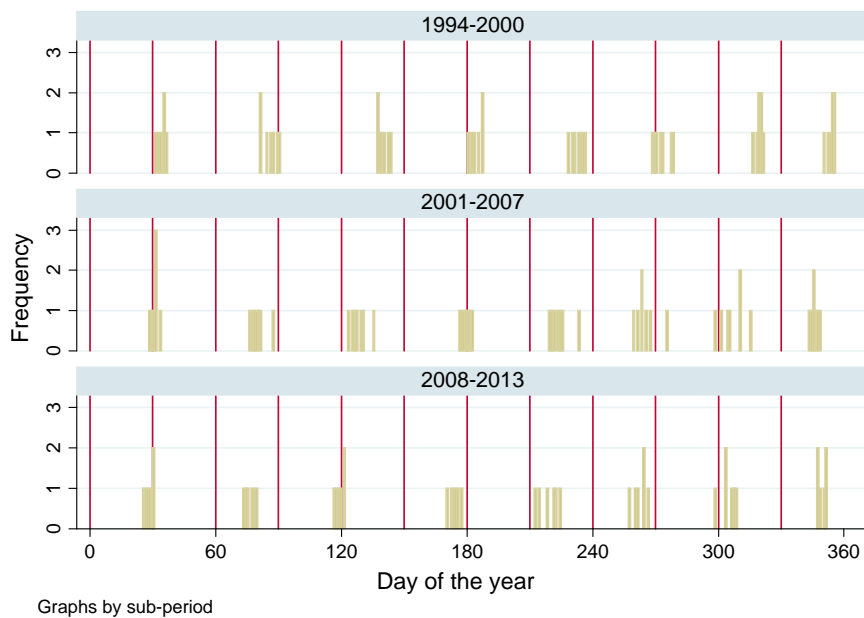
**Figure 6. Timing of the eight FOMC meetings within the year**

**Panel A. Histogram of the day of the year on which FOMC meetings took place, 1994-2013**



Note. For 2-day meetings, we set the FOMC meeting day equal to the second day.

**Panel B. Histogram of the day of the year on which FOMC meetings took place, by sub-period**



Note. Vertical lines are inserted every 60 days in order to facilitate comparisons across the three graphs.

**Figure 7. Number of macroeconomic data releases per day in FOMC cycle time, Bloomberg data, 1996:11-2013:12**

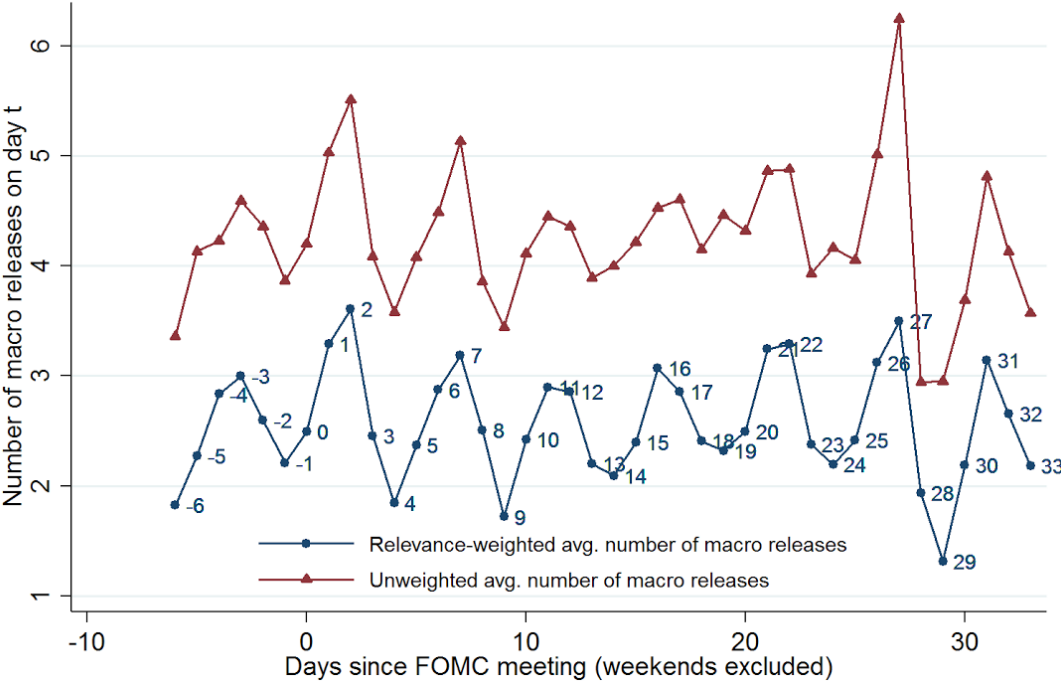


Figure 8. Volatility of the effective federal funds rate over the FOMC cycle, 1994-2001

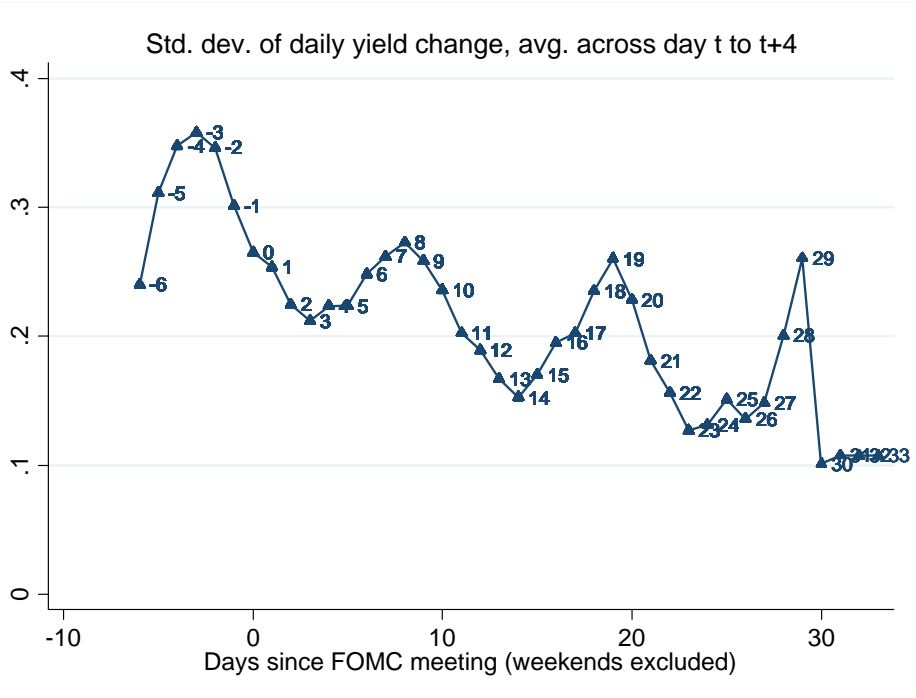
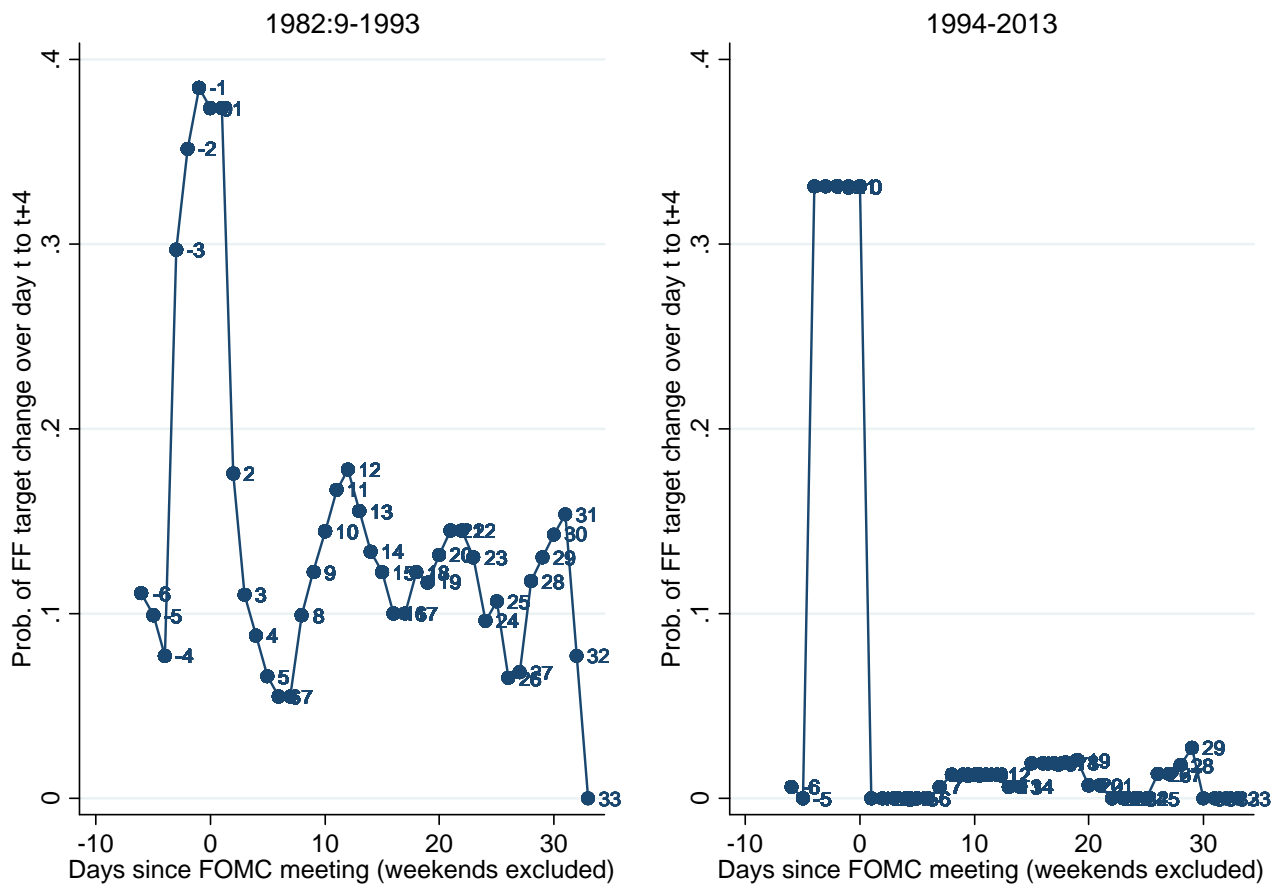
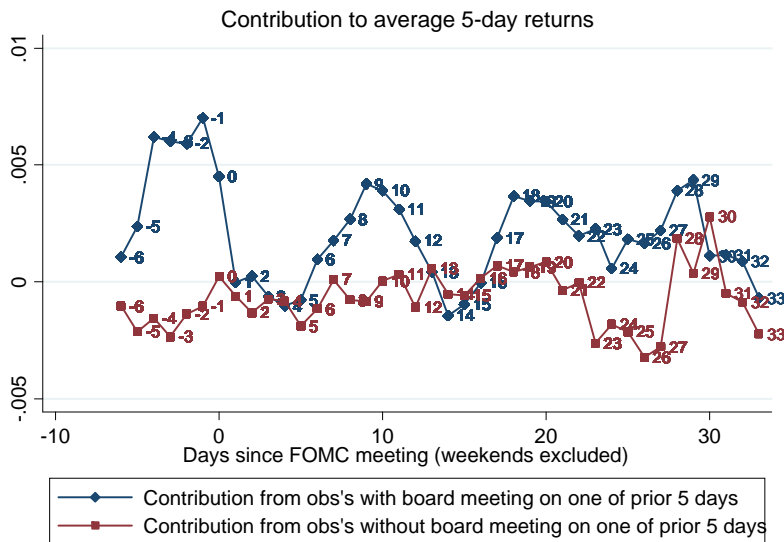


Figure 9. Probability of federal funds target change over the FOMC cycle



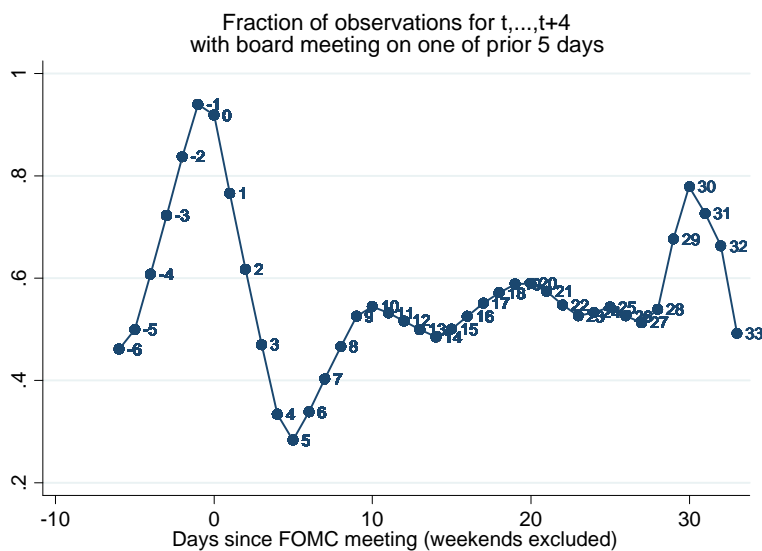
**Figure 10. Board of Governors board meetings**

**Panel A. Decomposing Figure 1 Panel A. Contributions from observations that follow or do not follow a Board of Governors board meeting, 1994-2013**



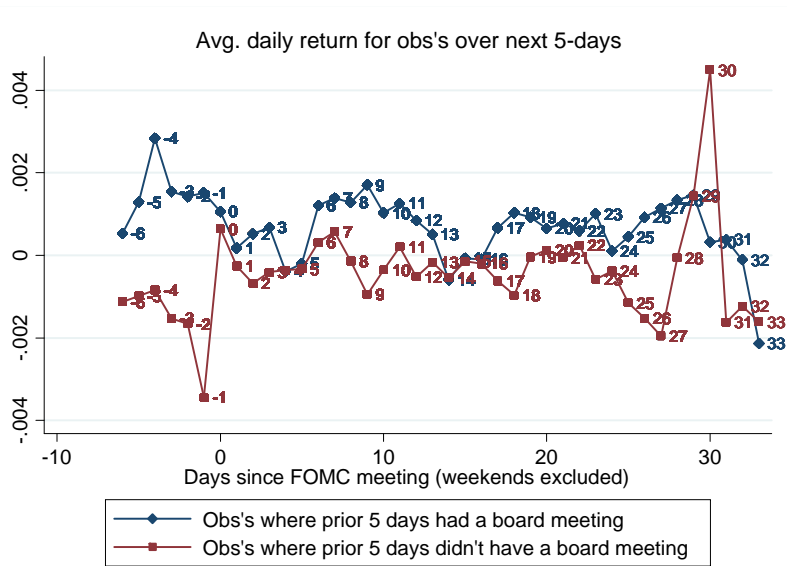
Note. The line denoted “Contribution from obs's with board meeting on one of prior 5 days” is the average of 5-day excess returns for days  $t$  to  $t+4$  where excess returns are set to zero for days where none of the prior 5 days had a board meeting. The line denoted “Contribution from obs's without board meeting on one of prior 5 days” is the average of 5-day excess returns for days  $t$  to  $t+4$  where excess returns are set to zero for days where one of the prior 5 days had a board meeting. The figure omits data from Feb-Dec of 1996 due to missing information about board meetings.

**Panel B. Frequency of Board of Governors board meetings, 1994-2013**



Note. The figure omits data from Feb-Dec of 1996 due to missing information about board meetings.

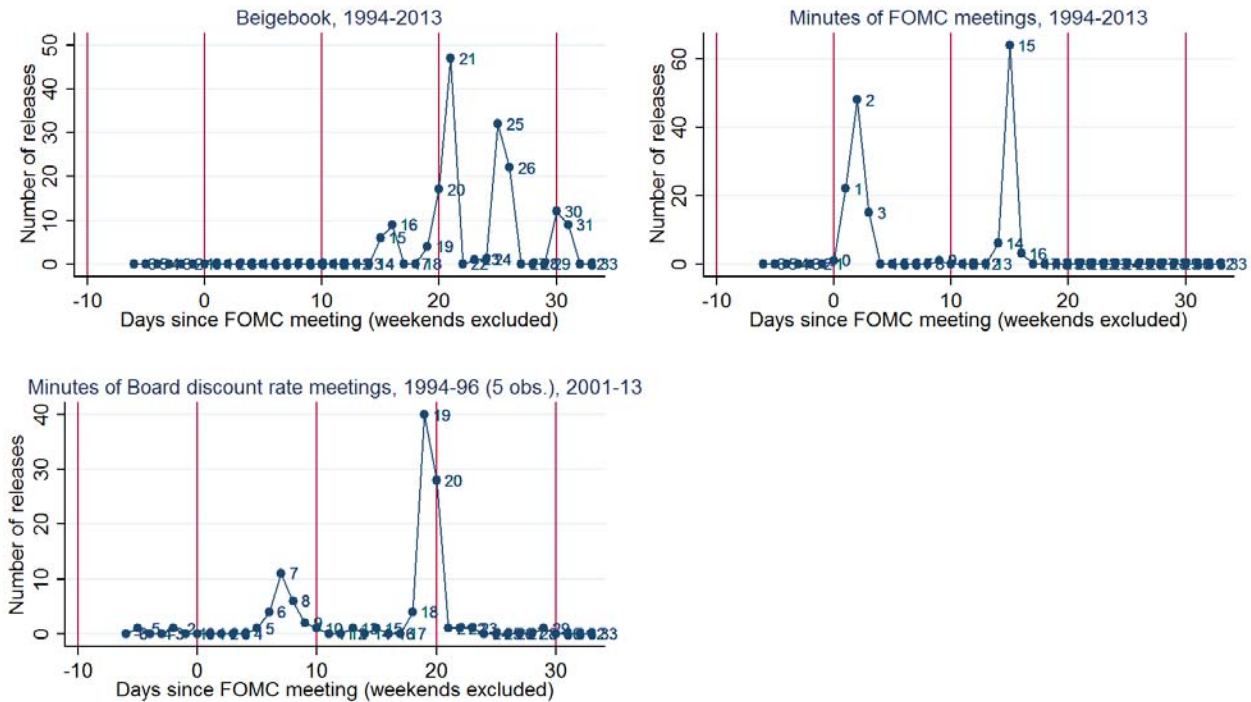
**Panel C. Average daily returns conditional on whether prior five days had a Board of Governors board meeting or not, 1994-2013**



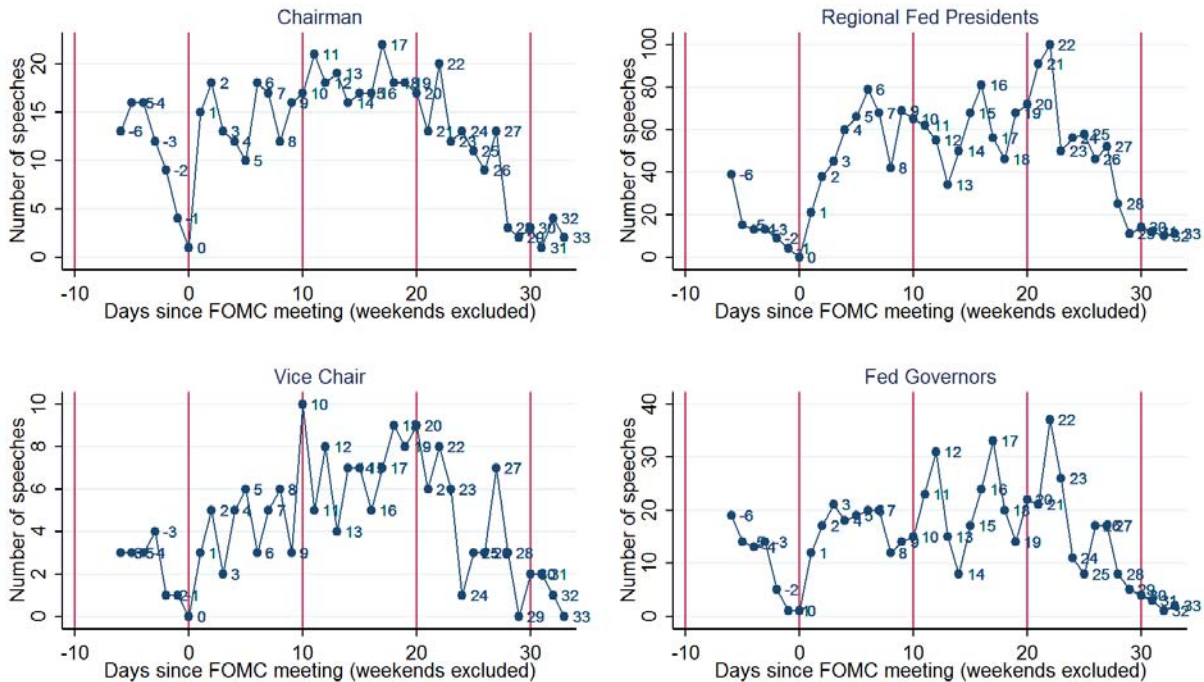
Note. The line denoted “Obs’s where prior 5 days had a board meeting” measures the average daily returns using only those observations from day  $t$  to  $t+4$  with a board meeting on one of the prior 5 day (so unlike panel A, here we are not setting any returns to zero, and averages are calculated over only the observations used in order to get conditional averages). The other line is constructed similarly. The figure omits data from Feb-Dec of 1996 due to missing information about board meetings.

**Figure 11. Public releases and speeches over the FOMC cycle**

**Panel A. Public releases**

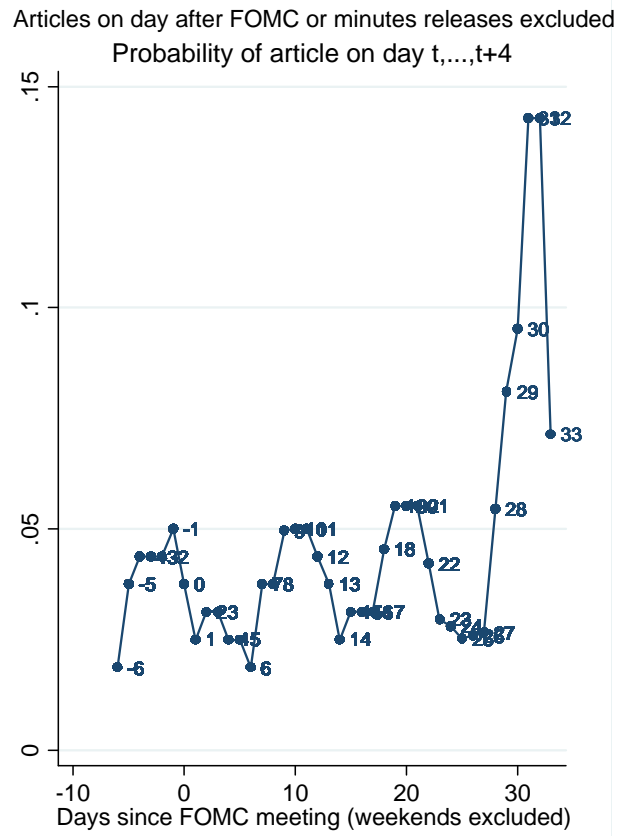
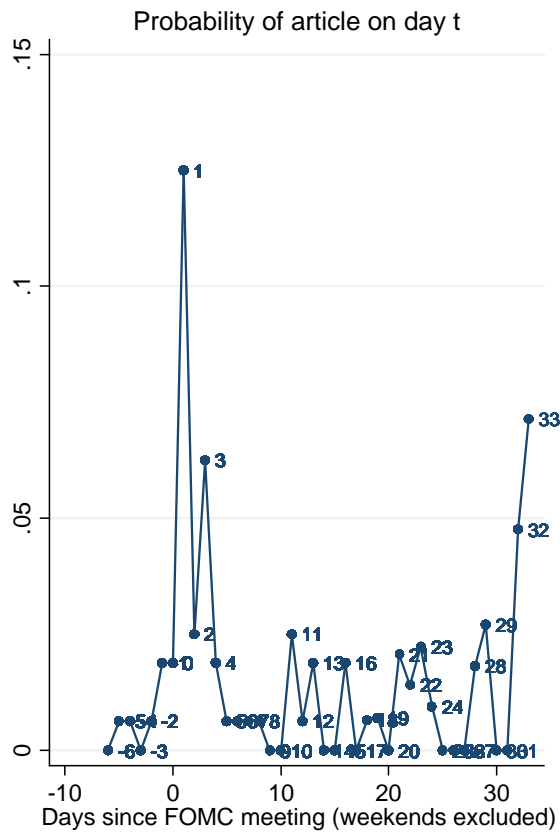


**Panel B. Speeches by Federal Reserve officials over the FOMC cycle**



Note. The figure displays the total number of speeches and testimonies given by Fed officials at each point of the FOMC cycle during the period 1994:01-2013:12. The dates of speeches have been collected from the Federal Reserve Board website and from the websites of the regional Feds.

Figure 12. Wall Street Journal articles by David Wessel, 1994-2013





**Table 1. Regressions of daily excess US stock returns on FOMC cycle dummies, 1994-2013**

	Dependent variable: Excess return on stocks over T-bills	
	(1)	(2)
Dummy=1 in Week 0	0.136*** (2.75)	0.136*** (2.75)
Dummy=1 in Week 2, 4, 6	0.0995*** (2.65)	
Dummy=1 in Week 2		0.081* (1.70)
Dummy=1 in Week 4		0.108** (2.00)
Dummy=1 in Week 6		0.178** (1.99)
Constant	-0.021 (-0.96)	-0.021 (-0.96)
<i>N (days)</i>	5214	5214

Note. 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 24-28. Week 6: Days 29-33. t-statistics robust to heteroscedasticity are in parentheses. The left hand side variable is in percent, so (for example) 0.1 means 10 basis points per day. \*\*\* indicates significance at the 1 pct level, \*\* significance at the 5 pct level, and \* significance at the 10 pct level.

**Table 2. International stock returns over the FOMC cycle, 1994-2013**

	(1)	(2)	(3)
	WI	DMxUS	EM
Timing of return	t+1	t+1	t+1
Dummy=1 in week 0	0.132*** (3.30)	0.151*** (3.29)	0.189*** (3.77)
Dummy=1 in week 2 4 6	0.0916*** (3.09)	0.0875*** (2.66)	0.176*** (4.75)
Constant	-0.0250 (-1.35)	-0.0308 (-1.52)	-0.0647*** (-2.84)
N ( <i>days</i> )	5213	5213	5213
Dummy=1 in week 0	0.132*** (3.29)	0.151*** (3.29)	0.189*** (3.77)
Dummy=1 in week 2	0.0860** (2.34)	0.0810** (2.03)	0.193*** (4.15)
Dummy=1 in week 4	0.0839** (2.01)	0.0726 (1.53)	0.144*** (2.73)
Dummy=1 in week 6	0.178** (2.51)	0.226*** (2.71)	0.259*** (3.33)
Constant	-0.0250 (-1.35)	-0.0308 (-1.52)	-0.0647*** (-2.84)
N ( <i>days</i> )	5213	5213	5213

Note. t-statistics robust to heteroscedasticity are in parentheses. \*\*\* indicates significance at the 1 pct level, \*\* significance at the 5 pct level, and \* significance at the 10 pct level. The dependent variable is a daily simple 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 US calendar. MSCI indices are obtained from Bloomberg. WI is the world index including developed and emerging markets (Bloomberg ticker MXWD); DMxUS is the developed market index excluding US (ticker MXWOU); EM is the emerging markets index (ticker MXEF). Returns are in USD.

**Table 3. Profitability of various trading strategies, 1994-2013**

Trading strategy:	Average annual excess return	Standard deviation of annual excess return	Sharpe ratio for annual returns
<b>Standard buy and hold strategy</b>			
A. Hold stocks all the time	<b>8.47</b>	<b>19.99</b>	<b>0.42</b>
<b>Alternating FOMC week strategies for the overall stock market</b>			
B. Hold stocks in weeks 0, 2, 4, 6 only	<b>11.58</b>	<b>13.92</b>	<b>0.83</b>
Hold stocks in week 0 only	4.76	9.06	0.53
Hold stocks in week 2 only	2.44	6.78	0.36
Hold stocks in week 4 only	3.02	6.69	0.45
Hold stocks in week 6 only	0.93	1.57	0.59
C. Hold stocks in weeks -1, 1, 3, 5 only	<b>-2.67</b>	<b>15.04</b>	<b>-0.18</b>
D. Long stocks in weeks 0, 2, 4, 6 and short stocks in weeks -1, 1, 3, 5 (strategy B minus strategy C)	14.24	21.78	0.65

**Table 4. Expected and surprise components of federal funds target changes in basis points, daily data, 1994-2008:06**

Actual change	Number of changes	Avg. expected change	Avg. surprise	Avg. absolute value of surprise
-75	1	-92	17	17
-50	8	-42	-8	9
-25	12	-25	0	5
0	65	1	-1	2
25	25	25	0	2
50	4	41	9	9
75	1	61	14	14

Note. The table is based on 116 scheduled FOMC meetings.

**Table 5. Regressions of daily excess stock returns on FOMC cycle dummies with controls for non-Fed news, 1994-2013**

	Dependent variable: Excess return on stocks					
	(1) Baseline from Table 1	(2)	(3)	(4)	(5)	(6)
<b>Main regressors:</b>						
Dummy=1 in Week 0	0.136*** (2.76)	0.136*** (2.75)	0.147*** (2.60)	0.134*** (2.69)	0.135*** (2.66)	0.135*** (2.73)
Dummy=1 in Week 2, 4, 6	0.101*** (2.68)	0.101*** (2.67)	0.108** (2.50)	0.091*** (2.43)	0.100*** (2.61)	0.098*** (2.65)
<b>Controls for reserve maintenance period:</b>						
Dummies for day of reserve maintenance period		Yes				
<b>Controls for macro and corporate news:</b>						
No. of macro releases, relevance weighted			0.019* (1.94)			
Dummies for days of the month and day of the week				Yes		
Number of corp. earnings announcements ( $\times 10^4$ )					0.003 (0.18)	
Fraction of positive corp. earnings surprises ( $\times 10^4$ )					-0.035 (-0.38)	
Dummy for high payment flow day						0.073* (1.64)
Constant	-0.021 (-0.98)	-0.031 (-1.23)	-0.068** (-2.1)	-0.054 (-1.33)	-0.021 (-0.34)	-0.033 (-1.43)
<i>N</i> (days)	5214	5214	4475	5214	5214	5214

t-statistics robust to heteroscedasticity in parenthesis.

The left hand side variables is in percent, so (for example) 0.1 means 10 basis points per day.

**Table 6. Timing of the seven intermeeting Federal funds rate changes from 1994-2013 relative to Board of Governors board meeting**

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

**Table 7. The importance of board meeting weeks: Even week effects driven by even weeks that follow Board meetings**

	Dependent variable: Daily excess return on stocks	
	(1)	(2)
Dummy=1 in Week 0	0.145*** (2.82)	
Dummy=1 in Week 2	0.094* (1.91)	
Dummy=1 in Week 4	0.111** (1.99)	
Dummy=1 in Week 6	0.177* (1.83)	
(Dummy=1 in Week 0)*(Dummy=1 if t-5 to t-1 had board meeting)		0.186*** (3.27)
(Dummy=1 in Week 2)*(Dummy=1 if t-5 to t-1 had board meeting)		0.197*** (3.05)
(Dummy=1 in Week 4)*(Dummy=1 if t-5 to t-1 had board meeting)		0.158** (2.15)
(Dummy=1 in Week 6)*(Dummy=1 if t-5 to t-1 had board meeting)		0.168 (1.44)
(Dummy=1 in Week 0,2,4,6)*(Dummy=1 if t-5 to t-1 had no board meeting)		0.018 (0.31)
(Dummy=1 in Week -1,1,3,5)*(Dummy=1 if t-5 to t-1 had board meeting)		0.025 (0.57)
Constant	-0.026 (-1.14)	-0.037 (-1.16)
<i>N (days)</i>	4975	4975

Note. The figure omits data from Feb-Dec of 1996 due to missing information about discount rate meetings. t-statistics robust to heteroscedasticity in parenthesis. The left hand side variables is in percent, so (for example) 0.1 means 10 basis points per day. \*\*\* means significant at the 1 pct level, \*\* significant at the 5 pct level, and \* significant at the 10 pct level.

**Table 8. Regressions of daily excess stock returns on FOMC cycle dummies with controls for public Fed releases and speeches, 1994-2013**

Dependent variable: Excess return on stocks			
	(1) Baseline from Table 1	(2)	(3)
Dummy=1 in Week 0	0.136*** (2.75)	0.148*** (2.90)	0.133*** (2.66)
Dummy=1 in Week 2	0.081* (1.70)	0.079* (1.66)	0.082* (1.73)
Dummy=1 in Week 4	0.108** (2.00)	0.111** (2.00)	0.107** (1.97)
Dummy=1 in Week 6	0.178** (1.99)	0.159* (1.75)	0.180** (1.98)
<b><u>Controls for public Fed monetary policy releases:</u></b>			
Dummy for Beige book release on day t		0.086 (0.83)	
Dummy for FOMC minutes release on day t		-0.139 (-1.42)	
Dummy for discount rate meeting minutes release on day t		-0.141 (-1.21)	
<b><u>Controls for speeches by Fed officials:</u></b>			
Dummy for chair speech on day t			-0.076 (-1.28)
Dummy for vice chair speech on day t			0.001 (0.00)
Dummy for governor speech on day t			0.085 (1.56)
Dummy for president speech on day t			-0.037 (-0.88)
Dummy for chair speech on day t-1			-0.081 (-1.34)
Dummy for vice chair speech on day t-1			-0.004 (-0.03)
Dummy for governor speech on day t-1			-0.023 (-0.53)
Dummy for president speech on day t-1			0.036 (0.87)
Constant	-0.021 (-0.96)	-0.018 (-0.81)	-0.011 (-0.44)
<i>N (days)</i>	5214	5214	5214

**Table 9. Examples of Fed leaks**

**Panel A. Fed leaks to the media and newsletter writers of information from Fed board meetings**

Below are examples of news columns or newsletters content (column 1) parallel with information discussed in Federal Reserve Board of Governors Board Meetings (column 2). *Discount Rate Minutes* are posted on the Fed's website with a lag. Discount rate refers to the votes by the Federal Reserve Bank Presidents regarding their preference for the discount rate (now called primary rate), generally taken as a broader signal of their preference for monetary policy. Other matters in addition to votes are discussed at the meetings, as these examples convey. Not all *Discount Rate Minutes* contain additional content other than the votes. We found these examples either because of the articles moving the market (and thus making further news) or by reading relevant newspapers around the dates when the *Minutes* contained a discussion of the Board's discussion topics.

	Media or Newsletter content in the public domain	Private discussions at the Fed Board Meeting
1	<p>Wessel, David. <i>Wall Street Journal</i>, June 19, 1995</p> <p>"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."</p>	<p><i>Discount Rate Minutes</i>, June 19, 1995</p> <p>"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."</p>
2	<p>Clary, Isabelle. <i>Reuters</i>, September 17, 1996</p> <p>"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."</p>	<p><i>Discount Rate Minutes</i>, September 1996</p> <p>[Federal Reserve did not supply FOIA request for <i>Discount Rate Minutes</i> for 1996]</p> <p><i>Greenbook</i>, September 18, 1996</p> <p>"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.</p> <p>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."</p>
3	<p>Wessel, David. <i>Wall Street Journal</i>, March 17, 1997</p> <p>"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."</p>	<p><i>Discount Rate Minutes</i>, March 17, 1997</p> <p>"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."</p>
4	<p>Berry, John. <i>Washington Post</i>, March 30, 1999</p> <p>"Federal Reserve officials aren't likely to make any change in 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</p>	<p><i>Discount Rate Minutes</i>, March 29, 1999</p> <p>"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</p>



	officials scheduled to attend the meeting probably favor raising rates ..."	potential for increased inflationary pressures."
5	Wessel, David. <i>Wall Street Journal</i> , December 18, 2000	<i>Discount Rate Minutes</i> , December 18, 2000
	"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."	"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. "
	Note the market effect in the follow-up article: Ip, Greg. <i>Wall Street Journal</i> , December 19, 2000 "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...."	
6	Newsletter of Paul Markowski, <i>MES Advisors</i> , April 29, 2010 Reported by Cooke, Kristina , Pedro da Costa and Emily Flitter. <i>Reuters</i> , September 30, 2010 "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."	<i>Discount Rate Minutes</i> , April 26, 2010  "Requests by nine Reserve Banks to maintain the existing rate; requests by three Reserve Banks to increase the primary credit rate."
7	Newsletter of Jan Hatzius, <i>Goldman Sachs</i> , August 9, 2010	<i>Discount Rate Minutes</i> , August 6, 2010
8	Newsletter of Laurence Meyer, <i>Macroeconomic Advisers</i> , August 18, 2010 Reported by Pullman, Susan. <i>Wall Street Journal</i> , November 22, 2011	
	"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. ...Jan Hatzius; chief economist at Goldman Sachs; was also ahead of the pack; telling clients on Aug. 9 [2010] that he believed another round of bond buying by the Fed was coming. Mr. Hatzius is a regular guest of Mr. Bernanke and he meets privately with Mr. Dudley -- his former boss at Goldman -- according to calendar records."	"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."

## Panel B. Fed leaks to newsletter writers and financial institutions of the FOMC outcome or the FOMC minute contents

Below are examples of private news leaks, found by searching the words leak and Federal Reserve in Factiva.

1	<p>Leak to Bank of America of FOMC meeting outcome prior to FOMC meeting  <i>FOMC Transcript</i> August 16, 2007</p> <p>"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?          VICE CHAIRMAN GEITHNER. Yes.          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."</p>
2	<p>Leak to PIMCO of Greenbook content (and thus likely FOMC outcome) prior to FOMC meeting          Interview of Bill Gross, PIMCO, on <i>CNBC</i>.          Reported by Taibbi, Matt, <i>The Rolling Stone</i>. October 8, 2010</p> <p>"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 <i>CNBC</i> interview that he was getting inside info from the Fed. The interview is with former Goldman analyst and (now) <i>CNBC</i> 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.'"</p>
3	<p>Leak to Fed watcher of FOMC outcome prior to FOMC meeting          Newsletter, Laurence Meyer, Founder &amp; Senior Managing Director, <i>Macroeconomic Advisers</i>          Reported by Cooke, Kristina, Pedro da Costa and Emily Flitter. <i>Reuters</i>, September 30, 2010</p> <p>"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."          [Later in the article, concerning former Fed employees and outsiders:]          "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."</p>
4	<p>Leak to Fed watcher (former governor) of FOMC outcome prior to FOMC meeting          Calls by Nancy Lazar to clients, <i>International Strategy &amp; Investment</i>, August 15, 2011          Reported by Pullman, Susan. <i>Wall Street Journal</i>, November 22, 2011.</p> <p>"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."</p>
5	<p>Leak to Fed watcher (former governor) of FOMC debate prior to release of FOMC minutes          Advice to clients, Wayne Angell, <i>Bear, Stearns &amp; Co.</i>          Reported by Wessel, David. <i>Wall Street Journal</i>, July 7, 1995</p> <p>"One Fed watcher who called it right -- barely -- was former Fed governor Wayne Angell; now an economist at Bear; Stearns &amp; 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."</p>
6	<p>Leak to Fed watcher (policy intelligence firm) of FOMC debate prior to release of FOMC minutes          Newsletter to clients, Regina Schleiger, <i>Medley Global Advisors</i>, October 3, 2012 (Included as Appendix A)</p>

**Table 10. The impact of changing incentives for private communication on return patterns before and after 1994**

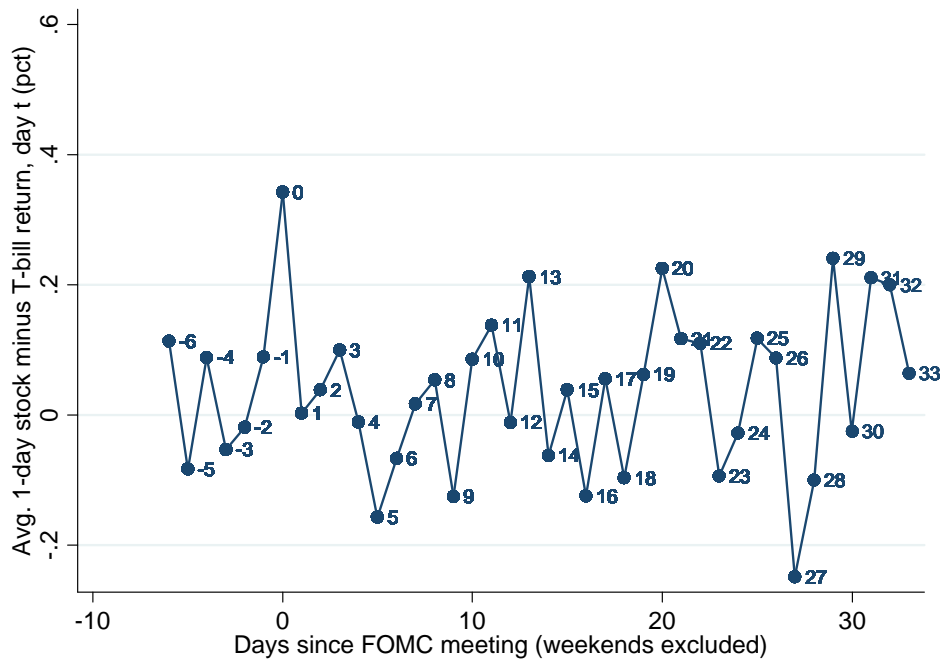
	1994-2013	1982:9-1993
Average excess stock return, 5-days from day -1 to 3	0.567*** (2.89)	0.397** (2.15)
Average excess stock return, day -1 (all day) and day 0 to 2pm	0.451*** (4.38)	0.074 (0.57)
Average excess stock return, day 0 after 2pm and days 1, 2, 3 (all day)	0.116 (0.72)	0.323* (1.90)

Note. We construct the intra-day stock returns from the S&P 500 futures in order to break up the day 0 return into the parts earned before and after 2pm. We do not have intra-day returns on T-bills so assume that T-bill return is earned evenly throughout the day when calculating the parts earned before and after 2pm on day 0. Using stock returns as opposed to excess stock returns leads to very similar results.

## Appendix

Appendix Figure 1. Stock returns over the FOMC cycle, 1994-2013.

Average 1-day stock return minus bill return over the FOMC cycle, percent



## Appendix A. Examples of the minutes of the Board of Governors discount rate meeting

### **DISCOUNT RATES - Requests by two Reserve Banks to increase the discount rate; requests by ten Reserve Banks to maintain existing rates.**

**Existing rates maintained.**

**January 5, 1998.**

Subject to review and determination by the Board of Governors, the directors of the Federal Reserve Banks of Cleveland and Richmond had voted on December 24, 1997, to establish a basic discount rate of 5-1/4 percent (an increase from 5 percent), with appropriate changes in related rates. The directors of the other ten Reserve Banks had voted to maintain the rates in their existing schedules. At its meeting on December 15, 1997, the Board had considered, but had taken no action on, similar requests by the Federal Reserve Banks of Cleveland and Richmond to increase the discount rate.

At today's meeting, no sentiment was expressed in favor of an increase in the discount rate, and existing rates were maintained.

Participating in this determination: Chairman Greenspan, Vice Chair Rivlin, and Governors Kelley, Phillips, Meyer, Ferguson, and Gramlich.

Background: Office of the Secretary memorandum, January 2, 1998.

Implementation: Wire from Mr. Wiles to the Reserve Banks, January 5, 1998.

### **DISCOUNT RATES -- Requests by three Reserve Banks to lower the discount rate; requests by nine Reserve Banks to maintain existing rates.**

**Existing rates maintained.**

**June 19, 1995.**

Subject to review and determination by the Board of Governors, the directors of the Federal Reserve Banks of Cleveland and San Francisco had voted on June 8, and the directors of the Federal Reserve Bank of Minneapolis had voted on June 15, 1995, to establish a basic discount rate of 5 percent (a reduction from 5-1/4 percent), with corresponding one-quarter percentage point reductions in related rates. The directors of the other nine Banks had voted to maintain the rates in their existing schedules. At its meeting on June 12, 1995, the Board had considered, but had taken no action on, similar requests by the Cleveland and San Francisco Banks. Directors of the Reserve Banks requesting a reduction in the discount rate believed that monetary tightening actions taken through February 1995 had set the economy on a path that would contain price pressures and that the run-up in inflation had, in fact, moderated. Moreover, given the signs of a softer economy and the risks of a cumulative decline in economic activity, they felt that a reduction in the discount rate was desirable. In their view, such an action would minimize the risks of excessive monetary tightness and still provide sufficient restraint to meet longer-term inflation objectives.

Directors of the Banks that had voted to reestablish existing rates agreed that the national economy was showing signs of slower growth, but they saw no indications of a cumulating downturn. Some noted that the data on economic activity had been negative for a relatively short time, and they said they needed further confirmation of weakening before requesting a reduction in the discount rate. While the risks of further economic weakness could not be ruled out, some directors commented that the delayed impact of sharply lower long-term interest rates would tend to sustain further economic expansion.

The Board's discussion of the requests today disclosed that, while some members believed that easing of monetary policy might be necessary at some point, no member favored a decrease in the discount rate at this time. Chairman Greenspan acknowledged that the recent economic data displayed weakness, but, in his view, the balance of the evidence did not at this stage point to a cumulating deterioration in the economy. Even so, he wanted to leave open the possibility of some easing of monetary policy. He would argue at this point against a reduction in the discount rate and would be inclined to postpone consideration of any easing through open market operations until the meeting of the Federal Open Market Committee on July 5 and 6. In the interim, he would urge members to keep an open mind on the need for policy action. Vice Chairman Blinder believed that the requests for a reduction in the discount rate had merit; and he believed that an easing action would be warranted soon, but that the action might appropriately be a reduction in the federal funds rate, an approach that had been recommended by the Federal Reserve Bank of New York. In his view, the longevity of the recovery and the outlook for the economy in mid-1996 would be key considerations in any decision to ease policy.

Governor Kelley saw indications that inflation pressures might be moderating, which gave the Board more latitude to maneuver. He added that if a change were made, it would not need to be a change in the discount rate, but it could be a reduction in the federal funds rate alone. Governor Lindsey stated that the prospects for fiscal contraction suggested that aggregate demand would be lower next year than it otherwise would have been; and, 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, but she also would start with the federal funds rate. Thereupon, at the conclusion of the discussion, the Board maintained existing rates.

Participating in this determination: Chairman Greenspan, Vice Chairman Blinder, and Governors Kelley, Lindsey, and Yellen.

Background; Office of the Secretary memorandum, June 16, 1995.

Implementation: Wire from Mr. Wiles to the Reserve Banks, June 19, 1995.

## Appendix B: Medley Global Advisors newsletter transcribed

MGA – Special Report

“Fed: December Bound”

October 3, 2012

Summary: Though tomorrow’s FOMC minutes will highlight the extent of dissension over the efficacy of additional policy easing announced at the September meetings, more is likely after the US presidential elections.

Analyst Regina Schleiger

The US Federal Reserve has stepped to the sidelines ahead of the presidential elections, to work on its evolving policymaking framework following September’s decision to embark on further significant easing.

The minutes of September’s meeting will show, however, that the groundwork for further action in coming months has been laid and that labor market improvement is unlikely to be substantial enough to stave off new Treasury purchases into 2013.

The minutes, due at 2 p.m. EDT tomorrow, will also highlight the intense debate between Federal Open Market Committee participants over the efficacy of using the balance sheet to ease conditions further and reference again, other potential policy tools, including changes to the 2015 predictive guidance.

While the minutes will reveal greater contention over large-scale asset purchases than chairman Ben Bernanke’s August Jackson Hole speech did, the tone will clearly convey that economic risks remain tilted to the downside and will lean in the direction of more action.

Assuming economic conditions have not vastly improved, the FOMC is therefore likely to vote as early as its December meeting (at which point there will be a new system-wide forecast round) to cease the Maturity Extension Program (MEP) on schedule and replace it with monthly Treasury bond purchases of around \$45 billion - similar to the current monthly average.

The committee will attach a predictive timeline outlining the duration of these purchases, that will be dependent on the economy recovering substantially. The monthly MBS purchases of around \$40 billion launched in September will continue alongside this new program. Tomorrow’s minutes will reference a staff paper that concludes the market has capacity to absorb purchases this large for a period of time.

The minutes will also show the dovish voting majority was ready to cease the MEP and replace it with open-ended MBS and Treasury purchases as early as last month. By year end, they are likely to get what they want.

### A motley crew

While not highly unusual, within the menu of three policy options finally presented to the FOMC at the meeting were subsets of drafts of potential policy actions, denoted as “primes” in Fed-speak. The first main option is usually an extremely hawkish proposal, the last is very dovish and contains elements some participants lightly jest, serve as “trailers” for policy decisions in subsequent meetings. The middle option, though not always the case, is traditionally the chairman’s preferred outcome.

In this meeting, there were multiple drafts within the middle proposal including the eventual outcome of September’s meeting. The language in these drafts can be tweaked at the meeting by participants determined to have some input.

In the week leading up to the meetings, the options are circulated and can change- sometimes markedly--by the time the participants gather around the table. The “Teal Book,” which contains the staff forecasts and the policy options, is circulated in two parts. The staff forecasts circulate first and what used to be known as the “Blue Book,” which contains the policy options, follows.

It is not unusual for board staff to pull all-nighters working on the final draft of the policy recommendations, once these has been commented on. This one took until after midnight.

Within one of the “primes” was included a proposal to denote conditional guidance around employment and inflation conditions under which the committee might consider withdrawal of policy accommodation and a hike in the Fed funds rate. With Minneapolis Fed president Narayana Kocherlakota’s input, a 6.5% (as opposed to the 5.5% later trailed publicly) unemployment threshold was floated in print as a trial balloon.

The leadership knew this would not get anywhere that day but it served to propel forward a vigorous debate between committee participants about assigning potential numerical parameters on conditionality for “lift-off” which has led to some of the recent public expositions of preferred thresholds. It has also implied a degree of inevitability over the Fed deciding to put numerical conditionality around its forward guidance on rates.

So varied were views on the committee going into September’s meeting that many participants were unsure of the outcome. Committee members who at the time of the Jackson Hole meeting said they were prepared to dissent over additional action were coaxed into doing more in the ensuing weeks and fell into line behind the chairman by the time the FOMC met.

### Swapping calendar lift-off for conditionality

After the September meeting, Kocherlakota publicly suggested the Fed should not consider lift-off as long as the medium-term outlook for inflation does not exceed 2.25%, or until the unemployment rate has fallen below 5.5%. Many Fed system officials believe so-called “full employment” to be between 5.5-6.5%. The Fed’s current longer-run goal on unemployment is 5.2-6.0%.

While Kocherlakota’s proposal is viewed as far fetched, the policy optionality he emphasizes if either side breaches thresholds to maintain Fed funds at an extraordinarily low level (0-0.25%) depending upon conditions, appeals to the leadership.

The committee has been debating such conditionality for a year and a half already. The ultimate objective of specifying such parameters is to reassure markets that policy will remain highly accommodative for a considerable time after the economy strengthens -- which is currently not expected to occur for four more years. Chicago Fed President Charlie Evans has long advocated what he calls a “7/3 threshold”: no rise in fed funds unless unemployment falls below 7% or the outlook for inflation over the medium term exceeds 3%.

As an illustration of the difficulty the committee has had on agreeing parameters, when putting together its principles on longer-run goals an monetary policy strategy earlier this year, it nailed an inflation target but failed on the employment/growth side of the mandate. It settled on a rate of 2%, as a longer-run goal for inflation but noted that unemployment was largely determined by non-monetary factors and not directly measurable, rendering a fixed employment goal inappropriate.

Within the meeting options over several months, some versions of numerical conditionality have shown up in the hawkish “A” option, mostly to spur ongoing discussion. While the committee got close to potentially articulating one such version at an earlier meeting, there remained too much opposition to the proposal at the time and participants were too evenly split to form a majority consensus. Still the momentum behind a collective desire to get away from the 2015 calendar guidance in the FOMC statement will likely force agreement on numerical conditionality before too long.