The Pre-FOMC Announcement Drift

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ABSTRACT

We document large average excess returns on U.S. equities in anticipation of monetary policy decisions made at scheduled meetings of the Federal Open Market Committee (FOMC) in the past few decades. These pre-FOMC returns have increased over time and account for sizable fractions of total annual realized stock returns. While other major international equity indices experienced similar pre-FOMC returns, we find no such effect in U.S. Treasury securities and money market futures. Other major U.S. macroeconomic news announcements also do not give rise to pre-announcement excess equity returns. Pre-FOMC returns are higher in periods when the slope of the Treasury yield curve is low, implied equity market volatility is high, and when past pre-FOMC returns have been high. We discuss challenges at explaining these returns with standard asset pricing theory.

JEL classification: G10, G12, G15.

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In the past few decades stocks in the U.S. and several other major economies have experienced large excess returns in anticipation of U.S. monetary policy decisions made at scheduled policy meetings. We refer to this phenomenon as the pre-FOMC announcement drift, and discuss that it is difficult to explain with standard asset pricing theory.

Members of the FOMC—the Federal Reserve's monetary policy-making body—regularly convene at scheduled meetings to make monetary policy decisions. These FOMC meetings have taken place eight times per year since the early 1980s, and were scheduled much more frequently before then. Starting in 1994 the decisions of scheduled meetings have been announced to the public within a few minutes of 2:15 pm Eastern Time. Prior to 1994 monetary policy decisions were not announced, and investors had to indirectly infer policy actions through the size and type of open market operations in the days following each meeting.

We document that since 1994, the S&P500 index has on average increased 49 basis points in the 24 hours before scheduled FOMC announcements. These returns do not revert in subsequent trading days and are orders of magnitude larger than those outside the 24-hour pre-FOMC window. As a result, about 80% of annual realized excess stock returns since 1994 are accounted for by the pre-FOMC announcement drift. The statistical significance of the pre-FOMC return is very high; a simple trading strategy of holding the index only in the 24 hours leading up to right-before an FOMC announcement would have yielded an annualized Sharpe ratio of above 1.1. Other major foreign stock markets exhibit similarly large and significant pre-FOMC returns.

Prior to 1994 we study excess returns on days of scheduled FOMC meetings which mark the last trading session before investors could observe signals about policy decisions. We find statistically significant average pre-FOMC returns on the S&P500 index of 20 basis points between 1980 and 1993, while returns on other days were an order of magnitude smaller. Combining the samples before and after 1994 we find that about half of the realized excess stock market returns were earned during the pre-FOMC window between January 1980 and March 2011. We find no evidence of pre-FOMC returns before 1980.

We show that the pre-FOMC returns are not explained by outliers and that they remain highly statistically significant when we account for potential data-snooping or small-sample effects. The returns are also broad-based across U.S. industry and size portfolios. A single market factor model captures a significant fraction of the cross-sectional variation of these returns. Fixed income assets do not feature pre-FOMC effects, and other major U.S. macroeconomic news announcements do not give rise to pre-announcement equity returns.

Based on one-year rolling averages, we find the pre-FOMC drift to be positive for the vast majority of the 1980-2011 sample. Pre-FOMC returns tend to be higher in periods when the slope of the Treasury yield curve is low and when implied equity market volatility, as measured by the VIX index, is high. Even after accounting for these factors pre-FOMC returns feature substantial serial correlation. The pre-FOMC drift is not significantly different in monetary policy easing versus tightening cycles and is uncorrelated with the unexpected component of the yet-to-be-realized policy decision, as measured by the surprise component of federal funds rate futures (Kuttner (2001)), or

by the conditional response of the S&P500 index to the actual announcement.

Finally, we find that realized volatility and trading volume are lower in the hours before FOMC announcements compared to other days. These indicators then jump at the announcement, as the new information is incorporated into prices. Yet, the average return on the S&P500 index from right before the announcement until the market close is essentially zero.

What explains these findings? One possible explanation is that pre-FOMC returns reflect a premium required by equity investors for bearing non-diversifiable risk. FOMC decisions provide information about interest rates and the economic outlook, and therefore systematic risk is likely high on FOMC announcement days. However, while it is common for FOMC members to provide monetary policy information through speeches and interviews between meetings, they refrain from these discussions in the week before FOMC meetings (a time interval known as the *blackout* period), and more importantly, in the 24 hour pre-FOMC window over which we document the large returns. Of course, investors may still aggregate other information in the pre-FOMC window, for example through market commentaries. That said, as evidenced by the jump in realized volatility and trading volumes, and the fact that these measures are proportional to the information flow in a large set of models (for example Ross (1989) and Kim and Verrecchia (1991)), the key monetary policy information on FOMC days is revealed in the announcement. Thus, a key challenge for a risk-based explanation is to jointly explain the large positive mean of pre-FOMC returns and the zero mean of announcement returns.

As an alternative explanation, a reallocation of market risk may result in a higher premium even in the absence of higher systematic risk in the pre-FOMC window. In the paper, we discuss a model by Duffie (2010) that features time-varying market participation due to slow-moving capital that can generate price drifts ahead of scheduled announcements. In this model, a subset of investors may trade out of the market ahead of the announcement, thus leaving the burden of market risk with the remaining investors who seek a compensation for holding it. While such a model can give rise to a return ahead of the announcement even in the absence of new information, it is not clear why it would be optimal for the inattentive investors to sell out of their positions. We also point out some additional potential shortcomings of this model as a theory of the pre-FOMC drift.

A further possible explanation for the pre-FOMC drift is that returns were not expected by investors, thus not reflecting any compensation for risk, but were, instead, the result of unexpectedly good news. Monetary policy news have arguably been positive on average over the sample period as the federal funds rate has trended down since the early 1980s, reaching historically low levels at the end of our sample. That said, it is not clear why the positive news would have been reflected in prices only during the pre-FOMC window rather than at the time of the announcement or on other days when returns have essentially averaged to zero. The same argument applies to a "government put" story (Diamond and Rajan (2011)), according to which the monetary policy response to stock price appreciation or depreciation is asymmetric. In addition, a good news explanation would also require investors to have been systematically surprised over a long sample. Even so, we discuss in the paper that the magnitude of the pre-FOMC returns would be difficult to reconcile with

estimates of stock price sensitivity to monetary policy (Bernanke and Kuttner (2005)). We finally consider other explanations, including unexpected declines in volatility and liquidity (Campbell and Hentschel (1992) and Amihud (2002)), but do not find strong evidence in their support.

In addition to the work cited thus far, our paper is related to different strands of the literature. We document that since the 1980s a large fraction of realized equity excess returns can be accounted for by returns earned in the 24 hour pre-FOMC window, a finding that may help shed light on alternative theories trying to explain the equity premium puzzle (see Campbell (2003) for a review). A large literature has also studied asset price responses to monetary policy rate decisions (e.g. Kuttner (2001)).[1] For U.S. equities, Bernanke and Kuttner (2005) characterize stock market responses to unexpected federal funds rate shocks. We see our results as complementary to these studies as we document the existence of an *unconditional* excess return that is earned *ahead* of the FOMC announcement. These returns are thus likely driven by an anticipation rather than the actual realization of policy decisions. A related literature has documented sizable conditional responses of various asset classes to macroeconomic news announcements (Fleming and Remolona (1999), Andersen, Bollerslev, Diebold, and Vega (2003)). More closely related to our paper, Jones, Lamont, and Lumsdaine (1998) study unconditional fixed income returns around macroeconomic releases (inflation and labor market), and Savor and Wilson (2013) find positive excess equity returns on days of inflation, labor market and FOMC releases from 1958 through 2009. Our paper differs from the latter because we study returns *ahead* of scheduled announcements while they look at unconditional returns on announcement days. For the post-1994 sample, when FOMC announcements have been made around 2:15 pm, our results indicate that the unconditional FOMC announcement day returns are due to the pre-FOMC drift rather than returns earned at the announcement.[2]

The title of our paper is inspired from the earnings announcement literature which finds evidence of positive excess returns for single stocks at the earnings release (for example, Beaver (1968)), as well as post-announcement (Bernard and Thomas (1989)) and pre-announcement drifts. Lamont and Frazzini (2007), in particular, have documented an upward drift of individual firms' stock prices prior to their scheduled earnings announcements. While these authors focus on a behavioral "attention grabbing" effect as a potential explanation, we mainly consider theories based on rational expectations or unexpected news. Nonetheless we stress in the paper that, due to the lack of significant new public information ahead of scheduled FOMC announcements, informational frictions may play an important role in explaining the drift. Recently, for example, Tetlock (2011) shows that stale news can affect stock prices. We discuss additional relevant literature along the way.

The remainder of the paper is organized as follows. Section 1 provides a brief discussion of the monetary policy decision process in the U.S., and Section 2 reviews the data. In Section 3, we

[1] A more recent literature has also focused on financial asset responses to communication about future, rather than the actual realization of current, monetary policy actions (Gürkaynak, Sack, and Swanson (2005), Lucca and Trebbi (2009))

[2] Because there are no FOMC announcements prior to 1994, our samples do not overlap in this period because we study close-to-close returns on days of scheduled FOMC meetings. On the other hand, Savor and Wilson (2013) focus on returns earned on the day after, which is when investors would have learned about the policy action in most cases. We characterize excess returns in the 10-day window centered around FOMC meeting days in Section 3.3.

present the main empirical findings. Section 4 analyzes a number of candidate explanations, and Section 5 provides a concluding discussion of our findings.

1 Federal Reserve Policy and FOMC Meetings

The Federal Open Market Committee (FOMC, or Committee) is the monetary policy-making body of the U.S. Federal Reserve System. The FOMC makes policy decisions under the statutory dual mandate of maximum employment and stable prices at FOMC meetings.[3] The FOMC convenes regularly at scheduled meetings, and, much less frequently, at unscheduled meetings, which are typically conducted via teleconference calls. Only the occurrence of scheduled meetings is known to investors in advance, and because we study returns ahead of monetary policy news we exclusively consider these meetings in this paper.[4] The FOMC sets its policy in terms of intermediate targets. Since the early 1960s, which is when our analysis starts, these targets have gradually shifted from the level of non-borrowed reserves (banks' balances at the Fed not resulting from borrowing at the discount window) to the federal funds rate, with the important exception of the period from 1979 until 1982, when, under Chairman Volcker, the intermediate target was set in terms of monetary aggregates (see Meulendyke (1998) for a more detailed discussion).

In terms of policy instruments the FOMC has mainly relied on daily open market operations (OMOs) since the 1960s, which are purchases and sales of Treasury and Agency securities in the open market by the Federal Reserve Bank of New York's trading desk (the "Desk"), and much less frequently on changes in the discount window rate or the level of required reserves. Daily OMOs are typically in the form of temporary repurchase agreements, with important exceptions such as permanent OMOs under the post-2008 Large Scale Asset Purchase programs.

Monetary policy in the U.S. underwent other major changes in the last few decades related to the communication of monetary policy decisions to investors, the frequency of meetings and their timing. Prior to 1994, the FOMC did not disclose policy actions and market participants had to infer those from the size and type of OMOs. In this period, we study excess returns on days of scheduled FOMC meetings. These days mark the last trading session before investors could observe signals about the likely policy action. While most of the time investors could infer changes in policy targets from OMOs on the day following the meeting, at times volatility in banks' demand for reserve balances made this inference difficult (see Kuttner (2003) and Gürkaynak et al. (2005)).

[3] The Committee is composed of twelve members: the seven members of the Board of Governors and five of the twelve Reserve Bank presidents. The Federal Reserve Board Chairman also serves as the FOMC Chairman. With the exception of the president of the Federal Reserve Bank of New York, who is a permanent voting member and FOMC vice-Chair, presidents of all other Banks take voting positions on a rotating basis that last one year. Policy decisions are made under a majority rule at FOMC meetings.

[4] Before Sep 11, 2001 the Public Affairs Division at the Board of Governors provided information sheets to the press with the dates of scheduled meetings, while after that schedules have been posted on the Board's public website. The calendar of past FOMC meetings and those scheduled for the next year can be found at `www.federalreserve.gov/monetarypolicy/fomccalendars.htm`. The website clearly marks conference calls, which are always unscheduled. We distinguish the very infrequent unscheduled meetings not conducted via teleconference from scheduled ones based on whether staff material for FOMC members (the "Greenbook") had been prepared in advance of each meeting.

On a few occasions before 1994, the Board of Governors of the Federal Reserve coincidentally released statements about discount rate changes on days of scheduled FOMC meetings. From these announcements market participants could have correctly inferred a change in the Fed's targets already on the day of the meeting. Kuttner (2003) identifies one such event between 1989 and 1992. We expand his analysis to the full 1960-1994 sample, using discount rate press releases that we obtain from the Federal Reserve's historical archive. We exclude days of coincidental discount window releases from our regression analysis in order to ensure that the pre-FOMC windows that we consider do not include policy announcements.[5]

Finally, as discussed in Bernanke and Kuttner (2005), on a few occasions before 1994 the Desk appeared to let the federal funds rate drift in the direction of the new target level ahead of the meeting and investors interpreted this inaction as signaling a policy change. Analyzing the *Credit Markets* columns of the *Wall Street Journal*, Kuttner (2003) identifies five such likely "tacit" policy moves over the sample 1989-1992, all of which occurred ahead of unscheduled FOMC meetings that are not included in our analysis. Using the same approach, we find three instances when investors possibly inferred policy changes on the day of scheduled meetings in the post-1980 sample. As the identification of these dates through newspaper articles involves our judgment and investors' and journalists' interpretation of daily conditions in the often volatile federal funds market, we do not exclude these dates from our analysis. However, we verified that our results are unaffected by their exclusion.

Starting in February 1994, the FOMC began to announce its decisions and publish accompanying statements (FOMC statements) after pre-scheduled meetings.[6] Between September 1994 and May 1999 statements were released only when a change to the current policy was made. Otherwise, the FOMC announced that no statement would be released, indicating to investors that no policy action had been taken. Starting in May 1999, statements were released after every scheduled meeting irrespective of whether a policy change occurred or not. From September 1994 to March 2011, FOMC statements were regularly released at, or a few minutes after, 2:15 pm following each scheduled meeting.[7] Since April 2011, the time of the release has varied between 12:30 pm and 2:00 pm on days of FOMC meetings on which a press conference by the FOMC Chairman is held at 2:15 pm.

Our intraday analysis focuses on the sample from September 1994 through March 2011 over which FOMC releases were known to be consistently made at, or within a few minutes of, 2:15 pm. We report the times of each FOMC announcement since 1994 in the Internet Appendix, based on an analysis of time-stamps of Bloomberg and Dow Jones newswires as in Fleming and Piazzesi (2005). Based on this analysis, no announcement was ever made before 2:10 pm. Hence, the 2pm-2pm

[5] The meeting dates that we exclude are December 17, 1968, September 18, 1979, October 6, 1979, and December 18, 1990. The last is the day identified by Kuttner (2003).

[6] The FOMC publishes a more detailed discussion of the policy meeting with the release of the minutes several weeks after the meeting and of the full verbatim transcripts five years after the meeting.

[7] The only exception to the time of the announcement is the statement of March 26, 1996 which was released in the morning because the Chairman was scheduled to testify in Congress later that day. The timing of the release was pre-announced to investors. We exclude that day from our analysis.

pre-FOMC window that we study in the post-1994 sample does not contain any announcement information.

Beyond FOMC announcements, since the early 1990s, members of the FOMC have increasingly employed speeches, testimonies to Congress and other means to communicate to market participants the likely path of monetary policy. Importantly for the analysis in this paper, however, FOMC participants refrain from any policy discussion in the week leading up to each FOMC meeting (the "purdah" or "blackout" period, see Ehrmann and Fratzscher (2009)), meaning that no such information is communicated in the pre-FOMC time window.

In addition to changes in the communication of monetary policy decisions, the meetings' frequency and timing of policy actions has also changed over time. Scheduled FOMC meetings occurred up to 18 times per year in the 1960s and up to 14 times per-year in the 1970s. From 1981 to the end of our sample, scheduled meetings have, instead, always occurred eight times per year. Similarly, the number of unscheduled meetings or conference calls has also declined significantly since the early 1980s.[8] In addition to the lower frequency of meetings, the timing of policy decisions has become much more explicit post-1994 with a significant fraction of policy actions taken at scheduled meetings rather than at other times. For example, based on data from Thornton (2006) and Bomfim and Reinhart (2000) only 22 out of 92 target changes were taken at scheduled meetings in the ten years ending in 1994. In contrast, 54 out of a total of 60 federal funds rate target changes were made at scheduled meetings between 1994 and 2011. In sum, monetary policy decisions in the U.S. have become more "lumpy" starting in the 1980s, and both their timing and communication has become much more transparent starting in 1994.

2 Data

Our analysis focuses on financial asset returns around scheduled FOMC meetings between January 1960 and March 2011 with a special emphasis on the post-1980 and post-1994 samples. Most of the evidence on the latter subsample is based on intraday data and focuses on the 24-hour period from 2 pm on the day before a scheduled FOMC announcement until 2 pm on the day of a scheduled FOMC announcement, or about fifteen minutes before the announcement release time. Hence, by construction, returns computed over this time interval do not contain meeting outcomes and therefore allow us to exclusively study anticipatory effects associated with FOMC announcements.[9]

The evidence prior to 1994 is based on daily data. Over that period we consider as pre-FOMC returns those earned on days of scheduled FOMC meetings, which mark the last trading session

[8] We show this evolution in the Internet Appendix. Since 1994, which is a key sample for our analysis, unscheduled meetings have occurred on the following dates: April 18, 1994, October 15, 1998, January 3, 2001, September 17, 2001, January 21, 2008, and October 7, 2008. In addition intermeeting statements related to "liquidity facilities" were released on: August 10/16, 2008 and May 9, 2010. Over the same sample period, 24 other unscheduled meetings took place without any immediate release of a statement. These meetings were made public only with the release of the minutes of the subsequent scheduled meeting (about one to two months after the original meeting took place).

[9] Due to limited availability of intraday data the cross-sectional analysis of pre-FOMC returns is based on daily data.

before investors could observe signals about the likely policy action. Throughout the entire 1960-2011 sample, we use as the risk-free rate the daily rate on a one-month Treasury bill locked as of the beginning of each month.

We use several data sources: Thomson Reuters TickHistory and Tickdata.com for intraday data, Bloomberg for dividend data as well as international stock returns and foreign central bank announcements, and Ken French's website for daily returns on size and industry sorted U.S. stock portfolios as well as the risk-free rate. We obtain historical newspaper coverage of the *Wall Street Journal* and the *Financial Times* from ProQuest and Factiva. Table 1 provides summary statistics on pre-FOMC windows and at other times for the main variables used in our empirical analysis. Since most of our analysis refers to mean returns in these two subsamples, we omit a detailed discussion here and instead refer interested readers to the table.

[Table 1 about here]

3 Empirical Results

In this section we present the empirical findings of the paper. We first document excess returns on the S&P500 index in anticipation of U.S. monetary policy decisions. We then look at the persistence of these returns and show the robustness of their statistical significance. We then report some cross-sectional and international evidence. Finally we study returns on other asset classes and of the S&P500 index before other major macroeconomic data releases.

3.1 The Pre-FOMC Announcement Drift since 1994

Figure 1 shows a striking pattern of U.S. stock returns around FOMC announcements. The black solid line in the chart represents the mean point-wise cumulative intraday percentage return of the S&P500 index (SPX henceforth) over a three-day window from the market open of the day ahead of scheduled FOMC meetings to the day after. The mean is taken over the 131 scheduled FOMC meetings from September 1994 to March 2011.[10]

[Figure 1 about here]

As seen in the figure, the SPX displays a strong upward drift in the hours ahead of FOMC announcements. First, the SPX rises slightly on the afternoon of the day before the FOMC (left panel), and it then drifts sharply higher in the morning of scheduled FOMC announcements (middle panel). Right before the time of the announcement (vertical red dashed line) it reaches a level about 50 basis points higher than on the previous day's open. Following the announcement at 2:15 pm the SPX is on average flat, both in the hours immediately after the announcement and on the following day (right panel). As evidenced by the point-wise 95% confidence interval for the mean

[10]Relative to the dates reported in the Internet Appendix we lose one observation (Jul 1, 1998) because of missing intraday data. The close-to-close return on that day was 1.3%.

return (light grey area), the cumulative return earned prior to scheduled FOMC announcements is strongly significantly different from zero.

To put the economic magnitude of this pre-FOMC drift in perspective, the dashed black line in Figure 1 shows the average cumulative returns on all other three-day windows in the sample excluding day triplets centered around FOMC announcements, along with the point-wise 95% confidence bands (dark gray shaded area).[11] On average cumulative returns on these days have been essentially zero in the sample period.

The mean intraday returns in the chart do not include dividend payments and do not account for the level of the risk-free rate. To assess the magnitudes of excess stock market returns prior to scheduled FOMC announcements more formally we run the simple dummy-variable regression model:

$$rx_t = \beta_0 + \beta_1 \mathbb{1}_t(\text{pre-FOMC}) + \beta_x X_t + \epsilon_t, \tag{1}$$

where rx_t denotes the cum-dividend log excess return on the SPX over the risk-free rate in percentage points. In the main specification, the explanatory variable is a dummy variable, which is equal to one on scheduled pre-FOMC announcement windows and zero otherwise. In alternative specifications in Section 4 we also include additional control variables denoted by the vector X_t.

In the regression excluding the vector of other controls X_t, the coefficient β_1 is the mean return on pre-FOMC windows when the constant β_0 is omitted, and the mean excess return differential on pre-FOMC windows versus other days when the constant is present. The constant β_0 measures the unconditional mean excess return earned on all time periods outside of the pre-FOMC window.

Table 2 reports coefficient estimates for these two parameters over different return windows. The dependent variable in the first two columns is the 2pm-to-2pm SPX excess return. By construction, this 24-hour return ending on 2 pm on the day of scheduled FOMC announcements does not include the realized policy decision, which is yet to be announced. As seen in the first column, for the 131 FOMC observations in the sample, the 24-hour return right before the FOMC meeting has on average been 49 basis points, with a t-statistic of more than 4.5 based on Huber-White standard errors (squared brackets). As shown in the second column, this excess return has been orders of magnitude larger than the mean excess return on all other 2pm-to-2pm windows in the sample (less than .5 basis points). Yet, there are only eight scheduled FOMC meetings each year. To gauge the impact of this return difference on the total annual realized stock returns in the sample, the middle panel of Table 2 presents annualized returns earned in the pre-FOMC window and on all non-FOMC days. While the excess return on the SPX over the 24 hours prior to the FOMC announcement has on average been 3.89% per year, it has only been 0.88% on all remaining trading days. These point estimates thus imply that since 1994 about 80% of realized excess stock returns in the U.S. have been earned in the 24 hours before scheduled monetary policy announcements. The simple strategy that consists in buying the SPX at 2 pm the day before a scheduled FOMC

[11] Because we consider returns on all other days, we use Newey-West standard errors when computing the confidence intervals of the mean returns to account for the the cumulative returns' one- and two-day overlaps, respectively, when computing means in the second and third day of the chart.

announcement, selling fifteen minutes before the announcement and holding cash on all other days would have earned a large annualized Sharpe ratio of 1.14 as reported in the Table.[12]

[Table 2 about here]

Consistent with Figure 1, the excess SPX return between 2 pm and the market close on the day of the announcement has instead been zero (column 3). In other words, while the SPX has displayed a large positive drift in the 24 hours leading up to the announcement, stock returns have on average been zero at or following the announcement. This implies that while equity market investors have at times been surprised by the FOMC decision (Bernanke and Kuttner (2005)), these surprises averaged out to zero in our sample period.

Looking at the close-to-close excess returns on the SPX (column 4), which include the afternoon following the announcement, rather than the afternoon before, the FOMC return differential has been somewhat lower at about 33 basis points in the sample period. However, the average close-to-close return on all other days is less than a basis point, and the annualized FOMC day return on a close-to-close basis still accounts for more than half of realized excess stock returns (2.7% compared to 2.08% on all other days) in the sample. Moreover, the close-to-close FOMC day return still remains highly significant and yields a considerable annualized Sharpe Ratio of 0.84 as reported in the Table.

One may worry that the properties of the pre-FOMC returns crucially depend on the exact 24-hour time window that we consider. This is not the case. Indeed in the last two columns we consider a close-to-2pm and a close two days prior to 2 pm window. In both cases the pre-FOMC return remains highly significant, with a Sharpe Ratio of 1.43 for the close-to-2pm window and a pre-FOMC drift of 54 basis points with associated Sharpe ratio of about 1 in the close two days prior to 2 pm window.

A further obvious concern is the sensitivity of these results to potential outliers. Table 3 provides summary statistics of the 2pm-to-2pm return on the SPX on FOMC days versus all other days in the post-1994 sample. The mean excess returns (and its standard errors) are the same as in Table 2. The standard deviation of the excess returns is about 1.2% both on FOMC days and on other days implying that, in terms of variance, stocks do not appear to be riskier on FOMC days (we discuss the relation between volatility and returns in Section 4.2). The skewness of the two return distributions, however, displays a notable difference. While equity returns exhibit a strong positive skew ahead of FOMC announcements, they are slightly negatively skewed on all other days. Indeed, 98 of the 131 pre-FOMC announcement returns are positive in our sample—or three quarters of the total—but only 33 are negative (not reported in the Table). On the other hand, positive and negative excess returns are roughly equally split on non-FOMC days in the sample.

[Table 3 about here]

[12]Since there are eight scheduled FOMC meetings per year, we compute the annualized Sharpe ratio as $\sqrt{8}$ times the per-meeting Sharpe ratio (sample mean of pre-FOMC return divided by its sample standard deviation).

The distributional differences in the empirical densities are shown in Figure 2. The 2pm-2pm FOMC return density (black line) is similar to that on non-FOMC days (grey), but importantly omits a left tail, with most of the corresponding density mass instead concentrated in positive returns. While at this point it is clear that outliers do not dominate the results we have seen so far, Table 3 shows that the kurtosis of pre-FOMC returns is slightly higher than on regular days suggesting a somewhat more fat-tailed distribution on FOMC days. As a final check we thus drop the top and bottom percentile and compare the resulting moments of the FOMC and non-FOMC day distributions in the last two columns of Table 3.[13] None of the summary measures are qualitatively affected when we exclude outliers. Dropping the top and bottom 1% of all observations, the mean pre-FOMC announcement return is still very large at 45 basis points while the mean return on all other days is 1 basis point (as evidenced in the second row, the statistical significance increases). The standard deviation of returns remains very similar to each other. While the skewness of pre-FOMC announcement returns falls somewhat when excluding the tails of the distribution, it is still positive in contrast with the skewness on other days, which remains negative. Finally, the kurtosis is now similar in both trimmed samples.

[Figure 2 about here]

3.2 Pre-FOMC Returns Before 1994

Thus far we have focused on the 1994-2011 sample when FOMC decisions have been explicitly announced to investors at known times. As discussed in Section 2, before 1994 market participants inferred policy decision through the size and type of OMOs in the days after FOMC meetings. Following the convention in Kuttner (2001) and Bernanke and Kuttner (2005) we therefore set the pre-announcement window to be the day of scheduled FOMC meetings in the pre-1994 sample.[14]

Table 4 presents the parameter estimates of the dummy variable regression (1) of pre-FOMC returns for different sample periods. In these regressions, we splice together the daily SPX excess return series prior to 1994 and the 2pm-to-2pm excess return series after 1994. The first column provides the regression results for the sample from 1960-2011, covering more than 50 years of daily data and a total of 524 scheduled FOMC meetings. Over that sample, the average excess return earned on non-FOMC days is estimated to be a statistically insignificant 0.9 basis points. In contrast, the return differential earned in the pre-FOMC window is estimated to be 16.7 basis points which is statistically significant at the 1% level.

[Table 4 about here]

[13] The top and bottom 1% of pre-FOMC returns amount to only two observations. The largest positive outlier is a 9.5% return on October 29, 2008. News reports on that day partly attributed the surge in equity prices to speculation that the FOMC may cut interest rates the next day. Moreover, talk of a federal rescue for General Motors and Chrysler also may have contributed to the price action. The largest negative outlier is a -2.9% return on June 26, 2002, driven mainly by news of an accounting fraud at phone company WorldCom.

[14] As discussed before, we exclude from the sample four days on which the Federal Reserve Board of Governors released discount rate decisions on days of scheduled FOMC meetings. The average excess return on the SPX on those five days is -0.5 basis points.

While it is still highly statistically significant, the average pre-FOMC return is considerably smaller in magnitude relative to the 49 basis points that we found in the post-1994 sample. It is therefore interesting to ask how much of the average pre-FOMC return from 1960-2011 is accounted for by different subsamples. To this end, we split the period prior to 1994 into two sub-periods. Columns 2 and 3 in Table 4 show estimates for the periods from 1960-1979 and 1980-1993, respectively. Prior to 1980, pre-FOMC returns were essentially zero while between 1980 and 1993 they averaged to a statistically significant 20 basis points in excess of the 2 basis points earned on all non-FOMC days. As shown in Column 4, average excess pre-FOMC returns on the SPX amounted to 36 basis in the 1980-2011 sample with with a t-statistic of 4.86. Moreover, pre-FOMC returns have accounted for more than half of the realized excess stock returns over this 30-year period and the simple strategy of holding stocks only right ahead of FOMC announcements and cash otherwise would have delivered an annualized Sharpe ratio of 0.92.[15]

Based on the results in this section pre-FOMC returns have started to be prevalent in the 1980s, have increased in magnitude and significance over time, accounting for a large fraction of realized U.S. excess stock returns in the three decades spanning 1980 to 2011.

3.3 Persistence

We have argued that the pre-FOMC returns accounted for large fractions of total realized excess stock returns over the last few decades. Such a decomposition relies on the presumption that pre-FOMC returns are not reversed on subsequent days and are not associated with offsetting negative returns in prior days. We address this potential issue by estimating the pre-FOMC regression (1) for the five days before and after FOMC announcements. Table 5 summarizes results from these regressions for the two sample periods 1994-2011 and 1980-2011. In both samples, we find that only the pre-FOMC dummy is significant. While the SPX features a few small negative returns in the five-day windows before and after the pre-FOMC window in the post-1994 sample, they are all statistically not different from zero, and only add up to a few basis points. Moreover, cumulative returns on the five days before and on the five days after pre-FOMC news windows are also economically and statistically zero in the 1994-2011 sample (bottom panel of the Table). Interestingly, in the 1980-2011 sample, which includes the pre-1994 period when investors learned policy actions from daily OMOs rather than from a single-day public announcement, we find an economically meaningful (15 basis points) but statistically insignificant positive cumulative return over the five days following the pre-FOMC trading session. Most importantly for the issue of decomposing historical S&P500 returns in pre-FOMC and other time windows, we do not find evidence of pre-FOMC return reversals in either sample.

[Table 5 about here]

[15] We report in the Internet Appendix the empirical distributions of pre-FOMC returns and the returns on all other days from 1980-2011.

3.4 Inference

In the regression tables above, we relied on asymptotic normality for gauging the statistical significance of the estimated coefficients. However, one may be concerned that the asymptotic distribution provides a poor approximation to the small sample distribution of the estimated coefficients given the relatively small number of observations and fat tails of the empirical distribution of pre-FOMC returns. In this section, we address this concern through different bootstrap exercises. As we will see the results of this analyses show that the statistical significance based on asymptotic inference is in fact not due to small sample issues or data snooping. We provide a qualitative summary of these results and give a more detailed account in the Internet Appendix.

We first compute small sample standard errors for the point estimates of the dummy variable coefficients reported in the previous sections using a simple bootstrap procedure. Precisely, we draw with replacement from the observed distribution of pre-FOMC returns a series of length equal to the number of FOMC dates and from the observed distribution of non-FOMC returns another series of length equal to the number of non-FOMC days. With the two series at hand, we re-estimate the dummy variable regression (1) and record the estimated coefficients. For both the 1994-2011 and the 1980-2011 samples, we find the empirical distribution of the estimated pre-FOMC dummy coefficients across bootstrap replications to have a mean and standard deviation that are very close to the regression results in Table 2.

As a second bootstrap exercise, we assess how likely would it be to observe an average return as large as the pre-FOMC drift in a sample drawn from the return distribution on all other days. To that end we draw with replacement from the empirical distribution of non-FOMC returns time series of length equal to the number of scheduled FOMC announcement days. For both estimation samples, the probability of obtaining a series with an average greater than the sample mean of pre-FOMC returns is zero. Hence, it is essentially impossible to have observed such a large mean had one drawn from the distribution of returns outside the pre-FOMC window.

In a similar vein, one might be concerned that it is not unlikely to observe a sample mean as large as the pre-FOMC return in a short sample drawn from a distribution with a population mean of zero but with the higher moments observed on the pre-FOMC windows.[16] We assess this possibility by constructing pseudo zero-mean pre-FOMC return distributions for the 1994-2011 and 1980-2011 samples. Precisely, we subtract the sample means of pre-FOMC returns from all observations so that, by construction, the resulting distributions have a sample mean of zero but identical higher moments as the distribution of pre-FOMC returns. We then randomly draw with replacement from the pseudo pre-FOMC distributions series of length equal to the number of FOMC days. For both estimation samples, we find that the probability of observing a sample mean greater or equal to the average pre-FOMC return is essentially zero.

Finally, one might also worry that the significance of our finding (and thus the Sharpe-ratios) could be the artificial outcome of an extensive search across the universe of economic news announcements for the highest t-statistic. Of course, such a search would not bias the large economic

[16] We thank an anonymous referee for raising that point.

magnitude of the return. We address this concern by conducting a reality-check à la White (2000). We draw with replacement from the empirical distribution of 24-hour returns and record the largest absolute t-statistic among ten dummy variable regressions that include as individual regressors dummies for FOMC announcements as well as nine other economic news announcements considered in Table 7. For both the 1994-2011 and the 1980-2011 samples, we find that the probability of finding a t-statistic as large as the ones we document for the average pre-FOMC returns is smaller than 0.02%. Hence, the statistical significance of our finding is extremely unlikely to be the result of data-snooping.

3.5 Realized Volatility and Liquidity in the Pre-FOMC Window

In this subsection we briefly document intraday realized volatility and liquidity patterns on the S&P500 index around FOMC announcements. Figure 3 plots the five-minute moving sums of squared tick-by-tick returns on the SPX (available about every 15 seconds) in the three-day window around the FOMC announcement (black line). For comparison, we superimpose intraday average realized volatility on non-FOMC days (red line). Volatility on the day prior (and after) FOMC announcements follow the typical U-shaped pattern observed on other days. On FOMC days, prior to the announcement, realized volatility is somewhat lower, and, as discussed below in Section 3.5, the same holds for implied volatility (as measured by the VIX). As one may suspect, realized volatility jumps at 2:15 pm on scheduled FOMC days when the FOMC statement is released.

[Figure 3 about here]

While we do not observe trades or bid-ask spreads for all SPX constituents on an intraday basis, we proxy liquidity measures for the cash-index with corresponding tick-by-tick measures based on the SP500 E-mini futures, which started trading in September 1997. The E-mini tracks the SPX very closely and exhibits almost identical pre-FOMC announcement returns as the cash index itself.[17] Figure 4 shows five minute average trading volumes on the most traded (either first- or next-to-front) SP500 E-mini futures contract over the same three-day window as above. Because trading volume has a low-frequency trend in our sample period, we display volume levels relative to their prior 21-day mean. The liquidity patterns match those for realized volatility: both are lower in the pre-FOMC drift time window but spike at the announcement.[18]

[Figure 4 about here]

3.6 International and U.S. Cross-sectional Evidence

In this subsection, we document a pre-FOMC drift in major international equity indices and show that FOMC announcement day returns are widespread across U.S. portfolios sorted by size

[17] The patterns described below are similar when using the SPDR S&P500 exchange traded fund rather than the E-mini future.

[18] These results are consistent with a "quiet-before-the-storm" effect found by Jones et al. (1998) for inflation and labor market releases, and by Bomfim (2003) for FOMC announcements between 1994 and 2001.

and industry.

Previous research (for example, see Karolyi and Stulz (1996)) finds ample evidence of international stock return comovement. This evidence suggests that international equity indices may also feature an FOMC equity return differential. To assess this question, we reestimate model (1) with a constant and a pre-FOMC dummy on daily close-to-close (local currency and ex-dividend) returns of major OECD stock indices for the sample period from September 1994 to March 2011. The results of these regressions are documented in the upper panel of Table 6.[19] The first five columns report estimates based on returns on the German DAX, the British FTSE 100, the French CAC40, the Spanish IBEX, as well as the Swiss SMI. Importantly, because of the time offset, the close-to-close returns on these European stock indices never include scheduled FOMC announcements and thus provide estimates of pre-FOMC announcement returns.[20] The pre-FOMC dummy variables are highly statistically significant and economically large in all five countries, with pre-FOMC estimates ranging from 29 basis points in Switzerland to 52 basis points in France. In all five countries the Sharpe ratios of an FOMC only investment strategy range between 0.75 and 1.04. Results for the Canadian TSX index and the Japanese NIKKEI 225 are reported in the last two columns of Table 6. The TSX shows a statistically significant albeit lower FOMC announcement day return than the European indices.[21] Interestingly, the NIKKEI index is the only major stock market index that does not feature a significant FOMC announcement day return. In the bottom panel of the Table we repeat the same regressions in the post-1980 sample, and also find evidence of large pre-FOMC returns on major international stock indexes in this longer sample. In unreported results, we also investigated whether European, UK and Japan stock indices feature similar return patterns before their corresponding central banks' monetary policy announcements, but we do not find such effects. While a global phenomenon, the pre-announcement return is thus specific to U.S. monetary policy decisions.

[Table 6 about here]

Having established that U.S. and international stock market indexes exhibit economically large and statistically highly significant pre-FOMC returns, we next analyze the cross-sectional variation of U.S. equity portfolio returns on days of scheduled FOMC announcements. Because of a more limited availability of intraday data at the disaggregated level to us, this analysis is based on daily close-to-close returns. To the extent that individual stocks mirror the pre-FOMC drift that we document for the market as a whole, the close-to-close returns should be good proxies for pre-FOMC drifts of disaggregated portfolios.

We estimate the dummy variable regression (1) including a constant, and an FOMC dummy using as dependent variables the daily excess returns on the CRSP value and equal weighted market

[19] For lack of comparable dividend and risk-free rate data, these regressions are based on ex-dividend gross returns rather than cum-dividend excess returns as in the analysis of the SPX above.

[20] In the Internet Appendix we compare intraday cumulative returns on these international stock indices in their respective trading hours to the SPX cumulative return on day triplets around FOMC announcements .

[21] Note that the TSX is computed from close prices taken after the FOMC announcement and therefore contains both a pre-announcement and a post-announcement component.

index, ten value weighted portfolios sorted by firm size and 49 value-weighted industry portfolios. We qualitatively summarize the results of these regressions here and report detailed regression tables in the Internet Appendix. We find evidence of large and statistically significant FOMC day returns across stock portfolios of firms with different market caps and from different industries, and results are similar for both the 1994-2011 and the 1980-2011 samples. Firms in the second to tenth size decile have similar FOMC announcement day returns while small firms feature somewhat lower returns on those days. Moreover, the majority but not all of the 49 industry portfolios feature statistically significant excess returns on FOMC days. Financials and banks show the largest FOMC day returns while industries typically considered to be less volatile such as agriculture and food feature smaller and insignificant FOMC day returns.

It is natural to ask whether the average excess returns on FOMC announcement days in different industries and size deciles are in line with their typical comovement with the market portfolio, as would be implied by the Capital Asset Pricing Model (CAPM). To answer this question, we estimate portfolio betas from a regression of each portfolio's excess return on the excess return of the CRSP value-weighted market portfolio.[22] We then estimate a cross-sectional regression of average excess returns on the 59 industry and size portfolios on the estimated betas. Figure 5 shows a scatter plot of observed average FOMC announcement day returns against the fitted values from this regression. We superimpose the estimated regression line (dashed) as well as the 45 degree line (solid). The chart shows that the single market factor model provides a good description of the cross-section of FOMC day returns. Indeed, the slope coefficient λ, which represents the price of market risk, is estimated to be 47 basis points and highly statistically significant. By contrast, the constant α in the regression is not statistically different from zero. Moreover, the adjusted R-squared of the CAPM regression on FOMC announcement days is 65%. These results thus indicate that the observed cross-sectional variation of FOMC announcement day returns is well captured by exposure to aggregate market risk.[23] This finding is in contrast to the well-documented failure of the CAPM to explain the cross-sectional variation of average excess returns on equities. Many authors (see, e.g., Fama and French (1993)) have argued that additional risk factors beyond the return on the market portfolio are needed to explain the cross-section of stock returns. To the extent that risk exposures are not different on FOMC announcement days and that the additional risk factors do not earn differential excess returns on these days in contrast to the market portfolio, it may not be surprising that the CAPM explains average excess equity returns better on FOMC days than on other days.

[Figure 5 about here]

[22] We run this regression using daily data including FOMC announcement days. Dropping these days from the sample barely affects the β estimates.

[23] At announcement, Bernanke and Kuttner (2005) also find that the CAPM does a good job at explaining the cross-sectional variation of the response of different industry portfolio returns to monetary policy shocks. Moreover, in a recent paper Savor and Wilson (2012) find that on days when news about inflation, unemployment, or FOMC decisions is announced, stock market beta is significantly related to returns on individual stocks, equity portfolios, as well as other asset classes.

3.7 Other Macroeconomic Announcements and Other Assets

In this Section, we first document that the SPX does not feature abnormal excess returns ahead of other major macroeconomic announcements. We then show that fixed income assets do not exhibit abnormal pre-FOMC announcement returns.

We consider a set of nine major U.S. economic releases: total nonfarm payroll employment (NFPAY) published monthly by the Bureau of Labor Statistics (BLS), weekly initial claims for unemployment insurance (INCLM) released by the U.S. Department of Labor, the advance GDP (GDPADV) estimate released quarterly by the Bureau of Economic Analysis (BEA), the monthly Institute for Supply Management's (ISM) manufacturing index, Industrial Production (IP) released monthly by the Federal Reserve Board, Housing Starts (HS) published monthly by the Census Bureau, Producer Price Index (PPI) and Consumer Price Index (CPI) data published monthly by the BLS, as well as Personal Income (PI) released monthly by the BEA. Except for IP, which is released at 9:15 am ET, and the ISM, which is released at 10:00 am ET, all these data releases occur at 8:30 am ET. To assess whether there are pre-announcement returns for these macroeconomic data releases, we run a dummy variable regression where the dummy variable equals one on the day prior to the release.

As shown in the upper panel of Table 7, none of the other macroeconomic releases feature statistically significant pre-announcement returns in the 1994-2011 sample. The largest coefficient is the one for housing starts which implies a 13 basis points excess return on the SPX on days prior to that announcement. However, the standard deviation of that return is also quite large at 9 basis points. We repeat these regressions for the 1980-2011 sample (lower panel of Table 7), and find qualitatively similar results. In this longer sample, the PPI release is the only macroeconomic news that exhibits a pre-announcement return that is significant at the 10% level. However, the estimated coefficient is negative. As documented in the data-snooping exercise in Section 3.4, one is bound to find coefficients that are significant at marginal levels if one runs enough dummy variable regressions. We thus conclude that no other major macroeconomic announcement is associated with large and statistically significant pre-announcement returns.

[Table 7 about here]

We next study the pre-FOMC announcement effects on Treasury securities of different maturities as well as interest rate futures.[24] The short-term rate derivatives that we consider are standard market implied measures of monetary policy expectations: the front month fed funds futures contract (or the second-month contract if the FOMC falls in the last third of the month to address data-noise issues) and the fourth Eurodollar contract. These interest rate futures measure policy expectations about one month and one year out, respectively. FOMC dummy regression results for these securities for the sample periods 1994-2011 and 1980-2011 are provided in Table 8. For the 1994-2011 sample none of the coefficients is statistically significant at conventional confidence

[24] See Kuttner (2001) and Bernanke and Kuttner (2005) for asset responses to policy rate decisions, and Gürkaynak et al. (2005) and Lucca and Trebbi (2009) for responses to the content of the statements.

levels. For the 1980-2011 sample the on-the-run ten-year Treasury is significant at the 10% level with a coefficient of less than a basis point.[25] In sum, the results in this section show that the pre-announcement drift that we report is specific to equities ahead of FOMC announcements. It does not exist ahead of other macroeconomic announcements and in fixed income securities ahead of FOMC announcements.

[Table 8 about here]

3.8 The Time Series of Pre-FOMC Returns

Before turning to potential explanations for our empirical findings, in this section we study the correlation over time of pre-FOMC returns with a number of observable variables. Figure 6 shows the time series of pre-FOMC returns (green line) along with their one-year moving average (black line) and the one-year moving average on non pre-FOMC returns (red line) from 1980-2011.[26] One-year average pre-FOMC returns remained positive for the majority of the sample and turned negative only for brief periods of time. Moreover, it appears that pre-FOMC returns are somewhat higher around recessions and in periods of financial turbulence such as the 1987 stock market crash or the 1998 LTCM crisis. To study potential determinants of pre-FOMC returns more formally we regress next the time series of these returns on explanatory variables capturing business cycles, monetary policy cycles, market expectations of future Fed policy, market uncertainty, and the surprise component of monetary policy decisions.

[Figure 6 about here]

The results of these regressions are reported in Table 9 for the 1994-2011 sample and in Table 10 for the 1980-2011 sample. All explanatory variables except for dummy regressors are standardized to have a zero mean and unit variance in each of the two samples in order to facilitate interpretation of the coefficients. The first column in the tables shows a regression of the pre-FOMC returns on a NBER recession dummy. In the 1994-2011 sample the point estimate on the dummy is positive and significant at the 10% level. However, while still positive, the coefficient is not statistically different from zero in the longer 1980-2011 sample. Hence we only find weak evidence that pre-FOMC returns are counter-cyclical based on NBER recessions. Of course, a recession dummy is only a coarse measure of economic activity and furthermore only known to market participants ex-post. We therefore consider annual growth rates of industrial production (IP) as well as annual inflation as measured by the consumer price index (CPI) as regressors (column 2). Both series are computed using real-time data that we obtain from the ALFRED St Louis Fed database. The two coefficients are slightly negative but statistically insignificant in the two samples, confirming that pre-FOMC

[25] A closer inspection of this result reveals that it is entirely driven by a few outlier observations in 1980, a year in which money supply numbers were sometimes coincidentally released on days of FOMC meetings. When we start the sample in 1981, the FOMC dummy becomes insignificant for the ten-year Treasury.

[26] The large right-tailed observation (October 29, 2008) that we exclude in Table 3 is excluded from the pre-FOMC moving average and marked with an "X". We also exclude this observation from the regressions discussed next.

returns are not strongly countercyclical.[27] Regressing pre-FOMC returns on dummy variables for periods of monetary policy easing and tightening (column 3), we see that the pre-FOMC returns are considerably larger in periods of monetary policy easing (which to a good extent overlap with recessions) in the shorter 1994-2011 sample, but the coefficient is not significant.[28] The coefficients on both the easing and tightening dummies are economically and statistically zero in the longer sample from 1980-2011.

[Tables 9 and 10 about here]

We next assess whether pre-FOMC equity returns are related to market participants' expectations about the future path of monetary policy, as measured by the first two principal components (level and slope) from the cross-section of Treasury yields. We use daily zero-coupon yields from Gürkaynak, Sack, and Wright (2007) for maturities from one through five years. As we do not have access to intraday yield curve data, we lag the principal components by two days with respect to the FOMC announcement day to get an ex-ante, albeit approximate, snapshot of the yield-curve information available to market participants before the pre-FOMC window. The slope enters with a negative coefficient that is significant at the 10% level (column 4). The point estimates imply that a one standard deviation increase in the slope lowers the pre-FOMC drift by about 19 (15) basis points in the post-1994 (post-1980) sample. Thus up to term premia, the pre-FOMC drift is lower when investors expect the Fed to tighten policy.

We next assess whether pre-FOMC returns are related to equity market uncertainty as measured by the VIX at the market close two days before scheduled meetings. As shown in Column 5, the VIX is strongly significant with a coefficient of 0.31 in the 1994-2011 sample. In other words, a one-standard deviation increase in the VIX is associated to pre-FOMC returns that are 31 basis points higher in that sample. In the longer sample (the VIX is only available starting in 1990), the coefficient on the two-day lagged level of the VIX drops slightly, but remains strongly statistically significant.

We next assess whether pre-FOMC returns are related to ex-post monetary policy surprises as measured by federal funds rate futures and stock market responses to FOMC announcements (column 6). In the post-1994 sample, fed funds (and SPX) surprises are constructed as in Bernanke and Kuttner (2005) and Gürkaynak et al. (2005) using the 2pm to 3pm time window around FOMC announcements.[29] The coefficients on the futures-implied policy surprise are statistically

[27] In unreported results we also do not find a significant link with the annual growth of nonfarm payroll employment as well as a simple measure of the output gap constructed from detrended IP as in Cooper and Priestley (2009).

[28] We define tightening cycles as periods between local troughs and peaks of the target federal funds rate and easing cycles as periods between local peaks and troughs of the target rate or when the Federal Reserve conducted large-scale asset purchase programs. The chronology that we obtain with this simple dating approach is very similar to the one in Adrian and Estrella (2008). The constant in the regression measures the average pre-FOMC returns in the third regime in which the Federal Reserve is tightening nor easing.

[29] From 1994-2011 we follow Gürkaynak et al. (2005) and take the change from 2 pm to 3 pm as the surprise measure. Before 1994, we follow Bernanke and Kuttner (2005) and use the daily change in the contract instead. The return on the SPX is from 2 pm to 3 pm on FOMC announcement days from 1994 onwards, and we use the daily return of the SPX on the day after the FOMC meeting before 1994 as our equity-based measure of monetary policy surprises.

and economically zero in both samples. The coefficient on the stock market surprise is estimated to be negative 12 basis points in the post-1994 sample, but is also statistically insignificant. Thus the magnitude of the ex-ante returns are (unsurprisingly) not associated with the ex-post policy surprise.

As evidenced by the one-year moving average of pre-FOMC returns in Figure 6 there seems to be some persistence in the pre-FOMC return. To assess whether there is some time series predictability of pre-FOMC returns at low frequencies, we regress them on their average over the past eight FOMC meetings (a variable that we label MA8). We find that the backward-looking moving average is a highly statistically significant explanatory variable for future pre-FOMC returns with a large positive sign in both samples (column 7). Above, we have documented that the slope of the Treasury yield curve and the level of the VIX also predict some of the time series variation in pre-FOMC returns. To gauge whether there is serial correlation in pre-FOMC returns beyond the variation explained by these two variables, we run a regression that includes the slope, the VIX as well as the past moving average of pre-FOMC returns as regressors. The results show that all three variables retain their significance in the joint regression in both samples and explain a sizable fraction (18%) of the time series variation in pre-FOMC returns (column 8).

In sum, pre-FOMC returns tend to be higher when investors expect the Fed to ease its stance of monetary policy, when implied equity market volatility is high, and when past pre-FOMC returns have been positive.

4 Potential Explanations

In this section, we attempt to rationalize the pre-FOMC drift with a number of alternative explanations. We first discuss risk-based explanations and then consider other potential candidates.

4.1 Risk-Based Explanations

In standard asset pricing theory, excess returns are earned as compensation for undiversifiable risk. For example, in consumption based models, investors demand compensation for holding assets whose payoffs are negatively correlated with their marginal utility of consumption. FOMC announcements provide investors with information about policy actions, the likely path of interest rates, and the macroeconomic outlook. Therefore, systematic and political risk (in the sense of Pastor and Veronesi (2013)) are high on FOMC announcement days as investors receive signals about future consumption growth and asset payoffs. Yet, while FOMC members often discuss monetary policy in speeches and interviews between meetings, they do not do so in the blackout period which starts one week before FOMC meetings. Of course, investors may learn about monetary policy indirectly through other economic releases or market commentaries in the pre-FOMC window. That said, as discussed in Section 3.5, both realized volatility and trading volume are low in the hours before the announcement but then jump when the statement is released. These patterns indicate that the flow of new information is significantly lower in the pre-FOMC window as compared to

the time of the announcement or on other days. Indeed, in a large set of asset pricing models, absence of arbitrage implies that price volatility is proportional to the rate of the information flow (Ross (1989)). In terms of trading volumes, market microstructure models such as Kim and Verrecchia (1991) predict that volumes increase around public announcements with the precision of the announcement and decrease with the precision of pre-announcement information. Combined these models and our evidence thus support the view that the key information on FOMC days is, not surprisingly, received by investors at the announcement and not in the pre-announcement window. In contrast, returns are high in the pre-FOMC window but have averaged to zero at the announcement. The main challenge for explanations based on higher systematic risk is precisely this disconnect between the time when the returns are earned and when the news is revealed.[30]

Even if systematic risk is not higher ahead of the announcement, a reallocation of that risk may result in a higher premium. Duffie (2010) presents a model in which inattentive investors trade only infrequently while specialists trade frequently. In his model, prices decline ahead of scheduled bond issuance as specialists temporarily hold a larger share of total market risk. In the case of pre-FOMC returns, when the supply of assets does not change, one could assume that inattentive investors may sell out of their positions ahead of the announcement for fear of trading with better-informed specialists. As a result, a larger share of the market risk would be borne by the specialists, and in the mean-variance setup of Duffie (2010), they would demand compensation in the form of higher expected returns ahead of the announcement. While this framework would have the attractive feature of not requiring higher aggregate risk in the pre-FOMC window to generate a premium, it is not immediately clear why it would be optimal for the inattentive investors to sell out of their positions. Indeed, in the informational disadvantage story just discussed, simply not trading in the pre-FOMC window would also protect non-specialist investors against an informed trade but would earn them a premium and not require them to trade out of their (presumably preferred) original position. That said, while a complete characterization of this framework is beyond the scope of this section, we note that such a time-varying limited participation model seems to fit some but not all of the empirical evidence.[31]

4.2 Other Explanations

In this section we consider a few alternative explanations including a "good news" story, an information leakage story, as well as explanations related to volatility and liquidity shocks.

[30] In addition, a standard risk-based explanation appears difficult to reconcile with the absence of a pre-FOMC drift in fixed income instruments and of pre-announcement returns on equities ahead of other major economic releases. Finally, we do not find the pre-FOMC drift to be substantially higher in economic downturns when equity risk premia tend to be high.

[31] For example, the volatility and volume patterns are consistent with a reallocation of market risk among investors. Assuming that the fraction of monetary policy specialists is larger in fixed income markets, this story could potentially also match the fact that the returns are present in equity but not in fixed-income markets. However, within the confines of this story it is not immediately clear why there are no pre-announcement equity returns ahead of other key macroeconomic releases. Finally, it remains an open question whether such a model implies that pre-FOMC returns persist on subsequent trading sessions (Section 3.3) as risk gets reallocated to all investors following the announcement.

Under a "good news" explanation, one may presume that pre-FOMC returns were not expected by investors and thus did not reflect a risk compensation, but were rather earned as a result of news that positively surprised investors. Consistent with this view, one may argue that monetary policy news have on average been "positive" for stocks since the 1980s as the federal funds rate has trended down over the past 30 years, and has reached historically low levels at the end of our sample while inflation remained contained. In addition, under a "government put" view (for example, Diamond and Rajan (2011)), monetary policy has an asymmetric impact on stocks as financial conditions are eased in times of trouble but not tightened correspondingly in good times. Potentially consistent with such a story, the pre-FOMC drift is larger in periods of financial stress when the VIX is high (Section 3.8). That said, it is not clear why the positive news or the notion of a put should have been incorporated into prices only during the pre-FOMC window, and not at the announcement (or on other days) when the flow of monetary policy news is significantly larger but when returns have averaged to zero.

One possible way to rationalize the timing of returns would be to assume that investors have restricted information sets or short investment horizons due to myopic preferences. For example, investors may be slow at updating their information sets in models of inattention such as Sims (2003) because they face constraints as to how much information they can process. For example, in Kacperczyk, Nieuwerburgh, and Veldkamp (2009) investors allocate their attention between signals about aggregate and idiosyncratic components of cash flows, and at each point in time they optimally focus on shocks that have the largest impact on returns. Along these lines, one could interpret the pre-FOMC window as a time when investors focus on monetary policy news because of the upcoming announcement, even if the news may have been available before.[32]

That said, explanations based on informational frictions may conflict with rational expectations as investors should not be systematically surprised over long samples such as ours. Even relaxing this assumption, nonetheless, it seems that the economic magnitude of the average pre-FOMC return is difficult to square with a good news story. For example, based on estimates from Bernanke and Kuttner (2005) and Gürkaynak et al. (2005), an unexpected one basis point decline in the federal funds rate implies an increase in the SPX of two to four basis points (depending on the specification). Based on these estimates, to account for the 49 (37) basis point average pre-FOMC return in the post-1994 (post-1980) sample, equity investors would have had to be surprised by at least 12 (9) basis points per scheduled FOMC meeting. To put these implied surprises in perspective, the revision in federal funds rate expectations based on fed funds futures since 1989 averaged to only about negative one basis point both in a one-hour window around the announcement and in the 24 hour pre-FOMC window. Thus, the magnitude of the implied surprises that a good news story would require appears unrealistically large.

[32]Consistently, media coverage of the Federal Reserve picks up markedly before the meeting as measured by the number of articles about the Fed in the print issues of the *Wall Street Journal* and the *Financial Times* that are shown in the Internet Appendix. Related to this interpretation, Tetlock (2011) provides evidence that stale firm-specific news predict future returns, indicating that investors trade based on media articles which contain old information. Huberman and Regev (2001) and Carvalho, Klagge, and Moench (2011) discuss specific examples where media reports containing stale or false news have large effects on individual companies' stock prices.

Instead of informational frictions, an alternative explanation for the mismatch between the time of the announcement and when the returns are earned could be that monetary policy information somehow leaks into the market before the release of the statement. Aside from the fact that these information leaks are unrealistic from an institutional viewpoint, we contend that they would also be an implausible explanation for the pre-FOMC drift for a number of reasons. First, because the pre-FOMC drift is an average return, such a story could only explain our findings if the information was somehow consistently positive or because it created risk. We discussed evidence against both types of explanations above. Second, assuming that the hypothetical leaks were informative for some investors but not others, one would expect pre-FOMC returns to be correlated with announcement returns. However, as discussed in Section 3.8 we find the two returns to be uncorrelated. Third, if, instead, the hypothetical leaks had been informative to all investors and thus did not predict a correlation between pre- and post-announcement returns, it is not clear why we would observe pre-FOMC returns on equities worldwide but not in U.S. fixed income assets such as Treasuries and money market futures, which are very sensitive to monetary policy news.

We finally consider two explanations that are motivated by lower levels of liquidity and volatility in the pre-FOMC window as discussed in Section 3.5. Among others, Campbell and Hentschel (1992) find evidence of a negative contemporaneous correlation between volatility and returns which they explain through a "volatility feedback" effect: because of its persistence, an unexpected decline in volatility leads to a downward revision of future expected volatility, and thus to lower risk and higher contemporaneous returns. A large literature has also documented a negative correlation between equity returns and trading liquidity.[33]

We assess the role of liquidity and volatility by including them as controls X_t in our main regression (1). Since their expected and unexpected components may play different roles depending on the theory, we first decompose all measures of volatility and liquidity into an innovation and a $t-1$ measurable component using simple univariate AR(1) models. Because we do not have intraday measures of liquidity for the market as a whole, we use trading volumes on the front-month E-mini futures contract (or second contract if more highly traded on a given day) as a market-wide liquidity proxy. Data on the E-mini futures contract are available starting in September 1997.[34]

As a benchmark, the pre-FOMC drift is larger at 54 basis points and highly statistically significant in this shorter sample (column 1 in Table 11). When including the 24-hour lagged trading volume on the 2pm-to-2pm window and its contemporaneous innovation, we find only the coefficient on the innovation to be strongly statistically significant with an negative sign (column 2). The pre-FOMC dummy coefficient drops to 48 basis points, but remains highly statistically significant. Moving to stock market volatility, we control for the lagged (2 pm on the previous day) level and

[33]While most of the work focuses on the cross-section of returns, a few papers have studied the impact of liquidity on market-wide returns. Amihud (2002), for instance, constructs a simple measure of illiquidity and documents a positive relationship between illiquidity and future excess returns as well as a negative relationship between contemporaneous unexpected illiquidity and excess returns on U.S. equities.

[34]Regression results using trading volumes on the SPDR ETF are very similar. We also ran similar analyses using bid-ask spreads and the Amihud price impact measure on these instruments as measures of liquidity. They provide qualitatively similar results, albeit somewhat weaker in terms of their economic and statistical significance.

the daily innovation of the VIX index, which measures option-implied volatility on SPX. While the lagged level of the VIX has virtually no impact on contemporaneous returns, consistent with Campbell and Hentschel (1992), the innovation is very strongly negatively correlated with returns (column 3). More importantly, adding the VIX innovation as a control variable reduces the point estimate on the pre-FOMC dummy by 18 basis points, or a third of the average pre-FOMC return in this sample. Even so, the estimated dummy coefficient of 36 basis points is still economically and statistically very significant. When we control for liquidity and volatility in a joint regression (column 4) we find that the innovations to both the VIX and to trading volume remain significant. The coefficient on the pre-FOMC dummy is now 32 basis points but remains highly statistically significant.

[Table 11 about here]

According to the volatility feedback effect, we could interpret the link between volatility and returns in a causal sense if the estimated innovations in the VIX were true surprises, and these innovations may have been temporary if market prices quickly incorporated new information (see Jones et al. (1998)). To better gauge if these innovations could have been surprises, we decompose the VIX and trading volume using an alternative AR(1) model that also includes a pre-FOMC dummy as a control. When we estimate the pre-FOMC regression controlling for the estimated innovations from these regressions (column 5), we find that while the coefficient on the VIX and the volume innovation are unaffected (as compared to column 4), the level of the pre-FOMC dummy is almost exactly equal to the benchmark (column 1). In conclusion, a fraction of the pre-FOMC returns could be accounted for by lower market volatility and liquidity right ahead of FOMC announcements if these declines were truly unexpected by investors. However, one would still have to rationalize the declines in volatility and liquidity in order to explain the pre-FOMC drift in a fundamental way, and even so, a large component of the return remains unexplained.

5 Concluding Remarks

In this paper we document that U.S. equities experienced large average excess returns in anticipation of U.S. monetary policy actions taken at scheduled FOMC meetings since the 1980s. Pre-FOMC returns have been increasing over time and have accounted for large fractions of total realized returns in the past few decades. A key challenge when explaining these returns is the timing disconnect between monetary policy news and when these returns are earned. We discuss a number of potential driving forces behind pre-FOMC returns ranging from higher systematic risk and its reallocation among investors, to unexpected positive news, liquidity or volatility. We argue that it is difficult to square these explanations with all of the empirical evidence.

We find evidence of pre-FOMC returns since the 1980s, but not before. Moreover, the magnitude of these returns has been greatest in the post-1994 sample. One might speculate that these patterns could be related to changes in the conduct of U.S. monetary policy. First, the appointment of Chairman Volcker in 1979 represents a key shift in the Fed's policy vis-a-vis inflation (see

e.g. Bernanke, Blinder, and McCallum (2005)) suggesting that monetary policy may have been perceived by investors as more active and consequential after that date. Consistently, Clarida, Gali, and Gertler (2000) find a significant shift in the parameters of estimated monetary policy reaction functions in the third quarter of 1979.

Furthermore, we discussed in the paper that the frequency of scheduled meetings declined significantly in the early 1980s, resulting in a more discrete conduct of monetary policy. Another key monetary policy shift occurred in 1994 when the FOMC began announcing its actual policy decisions. Although prior to 1994 investors could have learned about policy actions indirectly through open market operations, this inference was at time complex (Kuttner (2003)) and relied on each investor's information updating process rather than on a public signal. In conjunction with the introduction of policy announcements in 1994, the timing of policy decisions also shifted substantially with policy actions becoming much more concentrated at scheduled meetings. Related to these changes, Bomfim (2003) finds evidence of a "quiet-before-the-storm" effect in realized volatility ahead of FOMC announcements, an effect that had been previously documented by Jones et al. (1998) on Treasury securities ahead important macroeconomic announcements. In sum, the increasing magnitude of the pre-FOMC drift may potentially be related to the increased importance and clarity of the information collected by investors at scheduled FOMC meetings.

Understanding how asset prices incorporate payoff-relevant information is a key question in finance. We discuss in the paper that one can potentially reconcile the puzzling fact that returns are earned at a time when the information flow is limited by assuming that investors are subject to more complex information structures than in standard theory, for example due to constraints in information processing. Under models such as Kacperczyk et al. (2009), investors optimally choose what signals to pay attention to, and accordingly pre-FOMC windows may be a time when equity investors process monetary policy information that might have been publicly available before. This would be qualitatively consistent with Tetlock (2011) who finds evidence of stale news affecting asset prices. Under an alternative explanation along the lines of Duffie (2010), the information flow may in fact be very limited in the pre-FOMC window, but premia could arise due to a reallocation of risk towards a smaller number of investors before the upcoming announcement.

Financial asset returns are often decomposed into expected and unexpected components, with the first generally being ascribed to risk compensation and the latter to news. As in most analyses, pre-FOMC returns in this paper do not represent news from an econometrician's perspective, because the returns are explained by a statistical model. Yet, one may wonder how quickly investors could have been able to learn about the magnitude and statistical significance of the pre-FOMC drift in real-time. Aside from the importance of this question on its own, this distinction may also help guide future work aimed at explaining the source of the pre-FOMC drift. To that end we reestimate the main specification model (1) for different subsamples and weights assigned to past observations. We use five- and ten-year rolling windows as well as schemes that exponentially down-weight past observations with half lives of five and ten years. By giving a smaller weight to older observations, we proxy for investors' guarding against the various structural changes in

monetary policy that we discussed above.

[Table 12 about here]

For each of the different regression specifications, we estimate the pre-FOMC dummy for samples ending at five-year increments from 1990 through 2010 (Table 12). For example, the rolling five-year regression for the sample ending in 1990 uses data from 1985 to 1990, and the regression with exponential down-weighting uses data from 1960 to 1990 but discounting older observations. Across all specifications and sample periods considered, the magnitude of pre-FOMC returns are always economically large, although greater in the latter part of the sample consistent with our previous findings. More importantly, based on the t-statistics, pre-FOMC returns are significant as early as 1990 in some specifications and as of 2000 across all specifications. These results thus indicate that pre-FOMC returns have not only been detectable ex-post to an econometrician, but also to an investor in real-time that had run a similar analysis. While this evidence points towards explanations that characterize the pre-FOMC announcement drift as an expected return, none of the off-the-shelf risk-based theories that we discussed matches our empirical evidence. Thus, as of this paper's writing, the pre-FOMC announcement drift is a puzzle.

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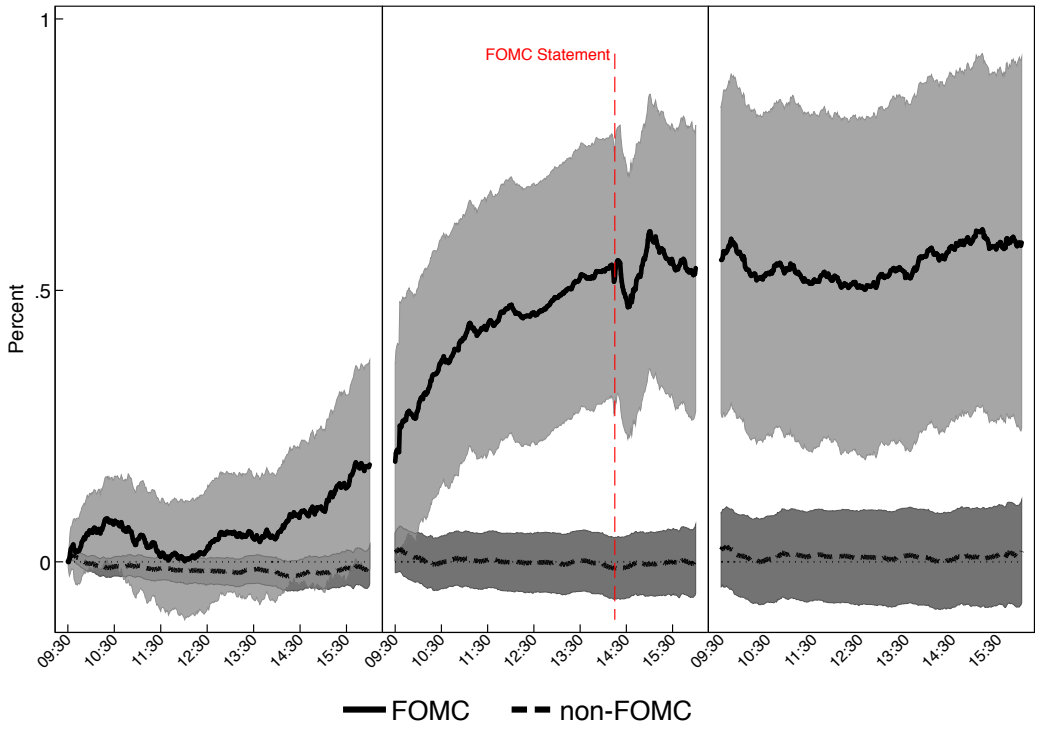


Figure 1. Cumulative Returns on the S&P500 index. This chart shows the average cumulative minutely return on the S&P500 index on three day windows. The solid black line is the average cumulative return on the SPX from 9:30 a.m. EST on days prior to scheduled FOMC announcements to 4:00 p.m. EST on days after scheduled FOMC announcements. The dashed black line shows average cumulative returns on the SPX on all other three day windows that do not include FOMC announcements. The gray shaded areas are pointwise 95% confidence bands around the average returns. The sample period is from September 1994 through March 2011. The dashed vertical red line is set at 2:15 p.m. EST, the time when FOMC announcements were typically released in this sample period.

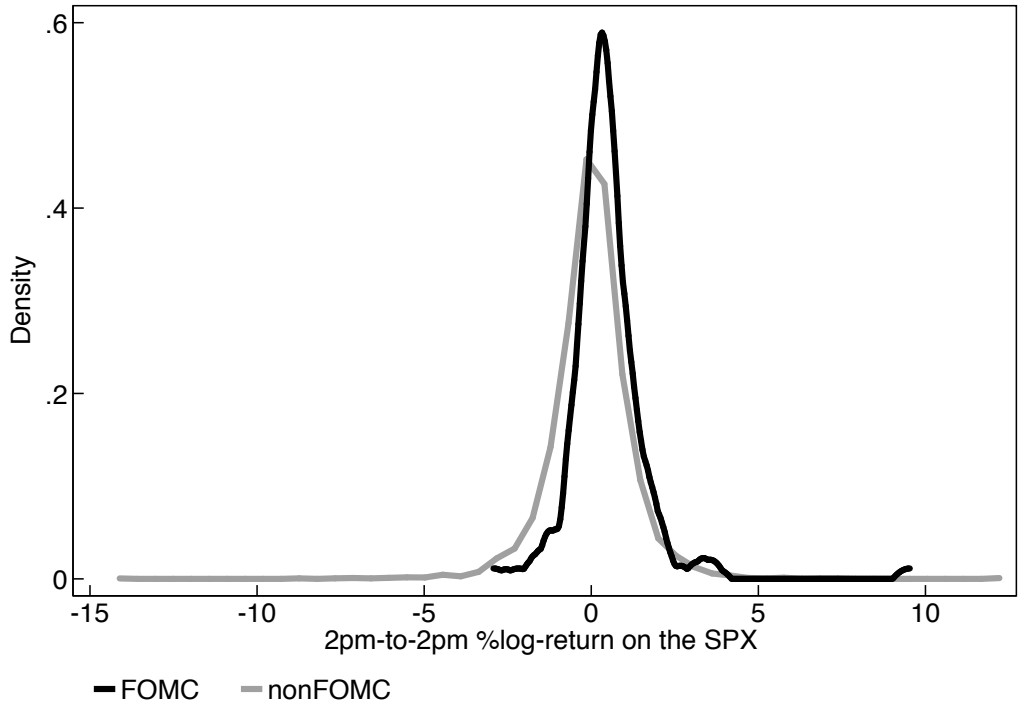


Figure 2. Empirical Densities of 2pm-to-2pm S&P500 Returns: 1994-2011. This chart plots empirical densities of the 2pm-to-2pm cum-dividend excess returns on the S&P500. The solid black line is the return distribution in the pre-FOMC window and the gray line is the return distribution on all other days. The sample period is from September 1994 through March 2011.

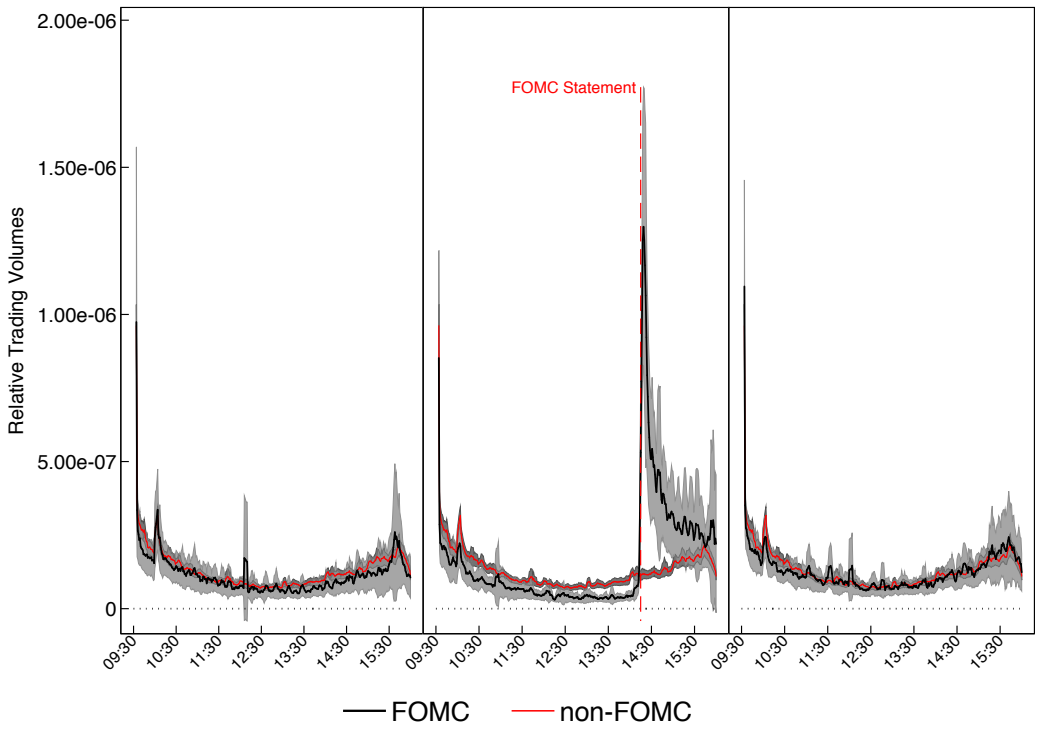


Figure 3. Intraday Realized Volatility of S&P500 Returns. This chart shows intraday realized volatility over three-day windows. The solid black line is the average five minute rolling sum of squared tick-by-tick returns on the S&P500 from 9:30 a.m. EST on days prior to scheduled FOMC announcements to 4:00 p.m. EST on days after scheduled FOMC announcements. The sample period is from September 1994 through March 2011. The dashed black line is the result of the same calculation on all other three-day windows that do not contain FOMC announcements. Shaded areas represent pointwise 95% confidence bands around means.

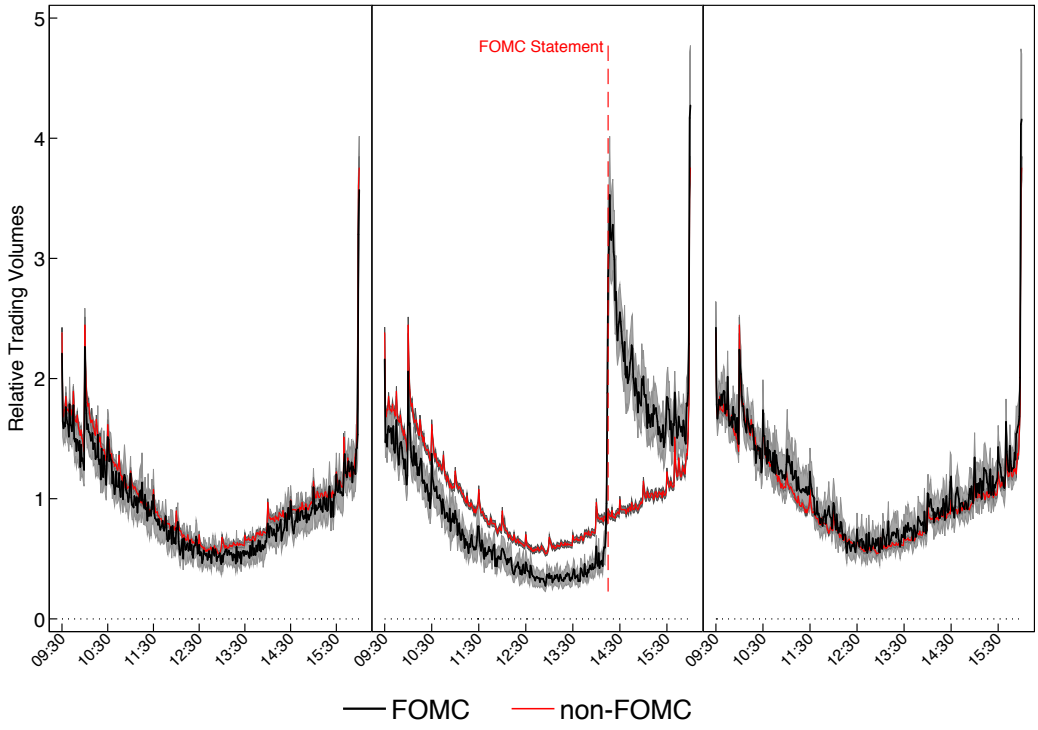


Figure 4. Intraday Trading Volumes for the E-mini SP&500 Future. This chart shows intraday trading volume of E-mini SP500 futures over-three day windows. The solid black line is the average five minute (scaled) rolling average number of contracts traded from 9:30 a.m. EST on the days before scheduled FOMC announcements until 4:00 p.m. EST on days after scheduled FOMC announcements. For each minute, the rescaling is relative to the 21-day-prior average trading volume. The dashed black line is the same object over all other three day windows that do not contain FOMC announcements. The dashed black line is the result of the same calculation on all other three day windows that do not contain FOMC announcements. Shaded areas represent pointwise 95% confidence bands around means.

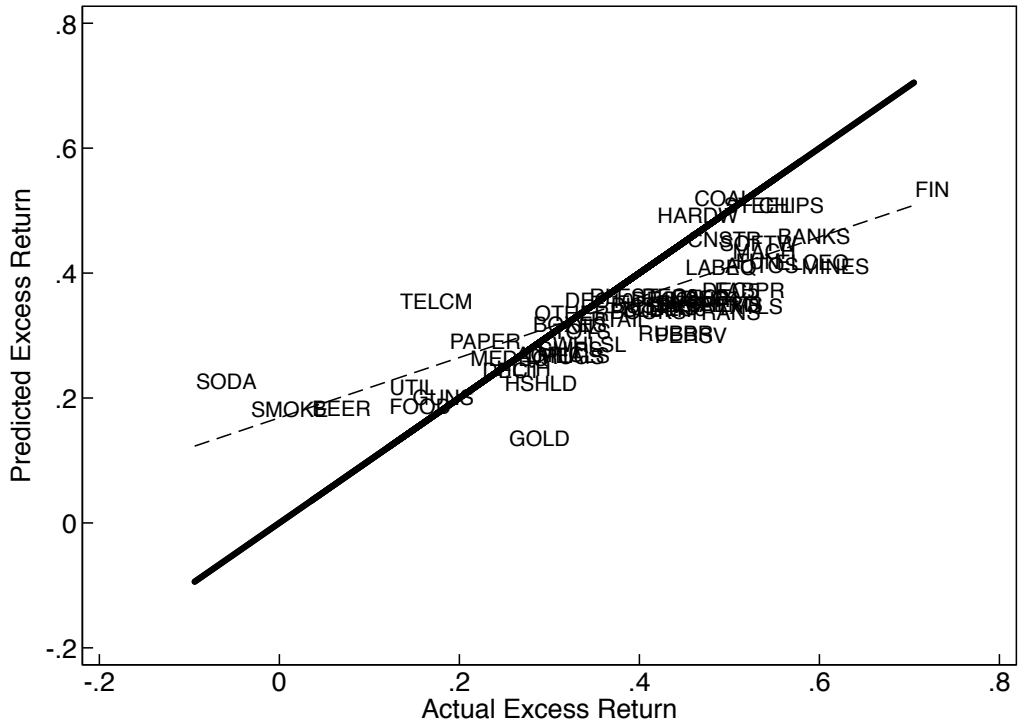


Figure 5. CAPM for Industry and Size Portfolios on FOMC Announcement Days. This chart shows the fit of the CAPM for the 49 Fama-French industry portfolios and the ten size decile portfolios on FOMC announcement days. For each portfolio, the horizontal axis shows the average excess return earned on scheduled FOMC announcement days (in percent) whereas the vertical axis shows the excess return implied by the CAPM. The sample period is from September 1994 through December 2010. The betas are estimated from a regression of the portfolio's excess return on the excess return of the market portfolio at daily frequency (using all days in the sample). The result from the second-stage cross sectional regression is $\bar{R}_{FOMC} = -.099_{[0.10]} + 0.468_{[0.149]}\hat{\beta}$, where the standard errors are adjusted for the estimation error in betas following Shanken (1992). The R^2 of the regression is 65%. The dashed line shows the estimated regression line and the solid black line shows the 45 degree line.

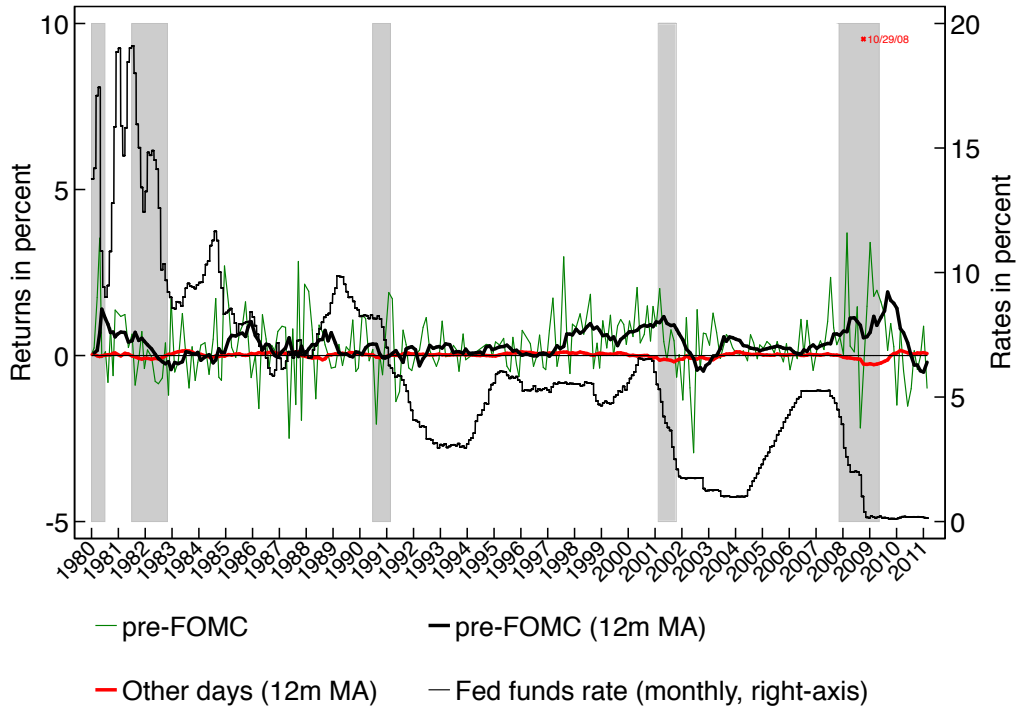


Figure 6. Time Series of pre-FOMC Announcement Returns on the SPX. The green line is the time series of pre-FOMC announcement returns from Jan 1980 through Mar 2011 (post-1994, cum dividend log excess return on the S&P500 from 2pm on the day prior to a scheduled FOMC announcement to 2 pm on that day; pre-1994, daily close-to-close cum dividend log excess return on the SPX on days of scheduled FOMC meetings). The solid black line shows the one-year moving average of these returns. The red line is the one-year moving average of 24 hour returns on all other (non pre-FOMC) days. The thin grey line is the monthly average of the effective federal funds rate.

	pre-FOMC					Other				
	Mean	St.Dev.	Max	Min	N.Obs.	Mean	St.Dev.	Max	Min	N.Obs.
Post-1994 sample										
SPX-2pm	.488	1.215	9.531	-2.927	131	.004	1.218	12.064	-13.962	4010
SPX	.338	1.144	5.006	-2.571	132	.009	1.261	10.953	-9.464	4043
DAX	.449	1.222	4.418	-3.241	131	.014	1.571	10.797	-9.791	3965
FTSE100	.347	1.204	7.744	-3.492	132	.004	1.222	9.384	-9.266	3968
CAC40	.517	1.422	8.833	-2.538	132	-.001	1.49	10.595	-9.472	3970
IBEX	.491	1.369	9.002	-3.449	132	.013	1.489	13.484	-9.586	3939
SMI	.301	1.141	5.992	-3.016	132	.012	1.258	10.788	-8.108	3942
TSX	.231	.981	3.752	-2.06	131	.022	1.156	9.37	-9.788	3956
NKY	.006	1.806	7.456	-11.153	125	-.02	1.579	13.235	-12.111	3818
FF	-.005	.034	.125	-.155	132	-.001	.026	.355	-.52	4032
ED4	.006	.07	.37	-.26	132	-.001	.08	.83	-.435	4193
TSY-3M	.000	.043	.144	-.15	132	-.001	.06	.84	-.78	4078
TSY-2Y	.005	.047	.185	-.192	132	-.002	.064	.585	-.607	4193
TSY-5Y	-.001	.047	.142	-.166	132	-.001	.067	.517	-.382	4193
TSY-10Y	-.003	.044	.124	-.175	132	-.001	.062	.349	-.37	4193
VOLUME	.825	.351	2.675	.294	120	1.041	.419	5.283	.129	3686
lVIX-2pm	23.612	9.501	75.52	11.04	121	23.108	9.092	80.69	9.69	3855
Post-1980 sample										
SPX-pre	.366	1.124	9.531	-2.927	244	.011	1.123	12.064	-22.911	7598
FF	-.004	.031	.125	-.155	171	-.002	.03	.38	-.52	5431
ED4	.007	.082	.46	-.26	193	-.001	.085	.83	-1.18	6261
TSY-3M	-.011	.106	.54	-.68	245	-.001	.109	1.69	-1.13	7622
TSY-2Y	-.005	.08	.37	-.52	245	-.001	.092	.89	-.84	7741
TSY-5Y	-.006	.074	.42	-.37	245	-.001	.086	.72	-.77	7741
TSY-10Y	-.009	.07	.33	-.33	245	-.001	.08	.65	-.75	7741

Table 1 Summary Statistics. This table reports summary statistics on pre-FOMC 24-hour windows and at other times. The sample period is 1994:09-2011:03 in the top panel and 1980:01-2011:03 in the bottom panel. SPX-2pm is the cum-dividend log excess return on the S&P500 index from 2pm at date $t-1$ to 2pm on date t. SPX denotes the close-to-close log excess return on the S&P500 index. DAX, FTSE100, CAC40, IBEX, SMI, TSX and NIKKEI denote close-to-close ex-dividend log returns on the German, British, French, Spanish, Swiss, Canadian, and Japanese benchmark stock indexes, respectively. FF and ED4 are daily rate changes implied by the first (and second) Federal funds futures contract in the first two-thirds (last third) of the month as well as the fourth Eurodollar contract. Tsy-3M,...,Tsy-10y are daily rate changes for the on-the-run Treasury bills and 2-,5- and 10-year notes. VOLUME denotes the trading volume (number of shares traded) for the SPY relative to its past 21-day moving average. lVIX is the level of the VIX at 2 pm on the previous day. SPX-pre and all other rate changes in the bottom panel are based on 2pm-to-2pm windows in the post-1994 sample, and are close-to-close on the day of the FOMC meeting (day before FOMC news) in the 1980-1993 sample.

Return Window:	2pm-to-2pm		2pm-to-close	close-to-close	close-to-2pm	close(t-2)-to-2pm
pre-FOMC dummy	0.488	0.485			0.335	0.544
	[0.11]***	[0.11]***			[0.06]***	[0.14]***
FOMC dummy			0.002	0.330		
			[0.09]	[0.10]***		
Const.		0.004		0.009		
		[0.02]		[0.02]		
Annual ex-return FOMC		3.89		2.70		
Annual ex-return non-FOMC		0.88		2.08		
Sharpe Ratio	1.14	1.14	0.01	0.84	1.43	0.98
Obs.	131	4141	131	4175	131	131
N. of FOMC	131	131	131	132	131	131

Table 2 Main Regression Table: Daily SP&500 returns This table shows results for the (pre-)FOMC dummy variable regression (1) based on returns on the S&P500 computed over different windows. The dependent variables are: (1&2) the cum dividend log excess return on the S&P500 from 2pm at date $t-1$ to 2pm on date t, (3) the ex-dividend log return on the S&P500 for same-day 2pm to 4pm time window, (4) the cum dividend log excess return on the S&P500 from close (4pm) at date $t-1$ to the date t close, (5) the cum dividend log excess return on the S&P500 from the close of date $t-1$ to 2pm on date t, and (6) the log excess return on the S&P500 from close at date $t-2$ to 2pm on date t. "pre-FOMC dummy" is a variable that is equal to one when a scheduled FOMC announcement has been released in the following 24 hour interval and zero otherwise. "FOMC dummy", instead, is equal to one when a scheduled FOMC announcement has been released in the return window. "Annual ex-return FOMC" is the cumulative annual excess return earned in the 24 hours pre-FOMC trading window and "Annual ex-return non-FOMC" is the cumulative annual excess return earned on all other days in the year. "FOMC Sharpe Ratio" is the annualized Sharpe-ratio on pre-FOMC returns. The sample period is from Sep 1, 1994 to Mar 30, 2011. *** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard errors shown in brackets.

	All Observations		Excl. top/bottom 1	
	pre-FOMC	Other	pre-FOMC	Other
Mean	.488	.004	.445	.008
	[.11]	[.02]	[.08]	[.02]
St. Dev.	1.22	1.22	.88	.99
Skew	3.18	-.24	.61	-.16
Kurtosis	25.61	15.91	5.22	3.71
Max	9.53	12.06	3.69	3.08
Min	-2.93	-13.96	-2.18	-3.25
Obs.	131	4010	129	3930

Table 3 Summary Statistics: 2pm-to-2pm SP&500 excess returns. This table reports summary statistics for the 2pm-2pm cum-dividend log excess returns on the S&P500 on the pre-FOMC window and at other times. The right panel excludes the top 1% and bottom 1% of returns. Standard errors for the mean are reported in square brackets. "Obs." is the number of observations in each subset of days. The sample period is Sep, 1 1994 to Mar 31, 2011.

Dependent Variable: %Log-excess-return on SP500 stock market index				
pre-FOMC dummy	0.167	0.005	0.204	0.355
	[0.04]***	[0.04]	[0.09]**	[0.07]***
Const.	0.009	0.006	0.020	0.011
	[0.01]	[0.01]	[0.02]	[0.01]
Annual ex-return FOMC	1.81	0.16	1.81	2.87
Annual ex-return non-FOMC	2.27	1.45	4.98	2.80
Sharpe Ratio	0.53	0.04	0.64	0.92
Obs.	12854	5012	3539	7842
N. of FOMC	524	280	113	244
Samples	196001.201103	196001.197912	198001.199312	198001.201103

Table 4 Daily S&P500 excess returns: Alternative samples This table reports pre-FOMC dummy variable regression results for different samples as reported in the bottom row. From Sep 1994 onwards, the dependent variable is the cum dividend log excess return on the S&P500 from 2pm at date $t-1$ to 2pm on date t, while before 1994, the dependent variable is a close-to-close (4pm-to-4pm) excess return. "pre-FOMC dummy" is a variable that is equal to one when FOMC news (an announcement post-1994 or OMOs on the day following FOMC scheduled meetings) are scheduled to take place in the following time interval, and it is zero otherwise. "Annual ex-return FOMC" is the cumulative annual excess return earned in the 24 hours pre-FOMC trading window and "Annual ex-return non-FOMC" is the cumulative annual excess return earned on all other days in the year. "FOMC Sharpe Ratio" is the annualized Sharpe-ratio on pre-FOMC returns.*** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard errors shown in brackets.

FOMC news at:	Post-1994 sample		Post-1980 sample	
$t+6$	-0.02	[0.09]	0.04	[0.06]
$t+5$	-0.10	[0.10]	-0.07	[0.06]
$t+4$	0.09	[0.09]	0.03	[0.06]
$t+3$	-0.06	[0.09]	0.04	[0.07]
$t+2$	0.06	[0.08]	-0.02	[0.06]
$t+1$ (pre-FOMC)	0.49***	[0.11]	0.37***	[0.07]
t	0.04	[0.12]	0.06	[0.07]
$t-1$	-0.02	[0.10]	0.05	[0.07]
$t-2$	0.08	[0.11]	0.09	[0.07]
$t-3$	-0.03	[0.10]	-0.08	[0.07]
$t-4$	-0.08	[0.08]	0.03	[0.06]
$\sum_{i=2}^{6}$ (FOMC at $t+i$)	-0.041		0.027	
P-value	0.842		0.853	
$\sum_{i=0}^{4}$ (FOMC at $t-i$)	-0.018		0.147	
P-value	0.939		0.335	

Table 5 S&P500 returns before, at, or after the FOMC news. This table reports results for dummy variable regressions for average excess returns on the S&P500 index on days prior, of, and after scheduled FOMC announcements. The sample in the left panel is Sep 1, 1994 to Mar 30, 2011, and on the right panel is January 1980 to Mar 30, 2011. Refer to Table 4 for the exact dependent variable definition. FOMC news at $t+i$ ($t-i$) denotes a dummy that is equal to 1 for the i-th trading session before (after) a scheduled FOMC meeting day. $\sum_{i=2}^{6} \mathbb{1}(FOMC_{t+i})$ denotes the sum of the coefficients on the dummy variables for the five days before while $\sum_{i=0}^{4} \mathbb{1}(FOMC_{t-i})$ denotes the sum of coefficients on the dummy variables for the five days after FOMC news became available. *** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard errors in brackets.

Dependent Variable: %Log-return of stock market indexes							
Stock Market Index:	DAX	FTSE100	CAC40	IBEX	SMI	TSX	NIKKEI
			Post-1994 sample				
pre-FOMC Dummy	0.43	0.34	0.52	0.48	0.29	0.21	0.03
	[0.11]***	[0.11]***	[0.13]***	[0.12]***	[0.10]***	[0.09]**	[0.16]
Const.	0.01	0.00	−0.00	0.01	0.01	0.02	−0.02
	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.03]
FOMC Sharpe Ratio	1.04	0.81	1.03	1.01	0.75	0.67	0.01
Obs.	4096	4100	4102	4071	4074	4087	3943
N. of FOMC	131	132	132	132	132	131	125
			Post-1980 sample				
pre-FOMC dummy	0.16	0.21	0.38	0.38	0.20	0.14	0.03
	[0.08]**	[0.08]***	[0.10]***	[0.10]***	[0.09]**	[0.06]**	[0.11]
Const.	0.03	0.02	0.01	0.01	0.02	0.02	0.00
	[0.02]*	[0.01]	[0.02]	[0.02]	[0.02]	[0.01]*	[0.02]
FOMC Sharpe Ratio	0.44	0.57	0.78	0.79	0.55	0.54	0.05
Observations	7686	6753	5842	5930	5585	7716	7453
N. of FOMC	244	211	182	185	175	241	235
Sample	198001.201103	198401.201103	198707.201103	198701.201103	198807.201103	198001.201103	198001.201103

Table 6 International Stock Market Index Regressions This table reports estimates of pre-FOMC dummy coefficients for daily close-to-close returns on the German DAX, the British FTSE 100, the French CAC40, the Spanish IBEX, the Swiss SMI, the Canadian TSX index, and the Japanese NIKKEI 225. The sample in the upper panel is Sep 1, 1994 to Mar 31, 2011. Samples in the lower panel differ across indexes depending on data availability and are reported in the bottom row. *** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard errors shown in brackets.

Dependent Variable: %Log-return of SP&500 stock market index										
Event:	NFPAY	INCLM	GDPADV	ISM	IP	HSTART	PPI	CPI	PI	ALL
Post-1994 sample										
pre-News Dummy	−0.08	−0.01	0.07	−0.09	0.01	0.13	−0.10	−0.09	−0.01	−0.04
	[0.09]	[0.05]	[0.14]	[0.08]	[0.09]	[0.09]	[0.08]	[0.10]	[0.08]	[0.04]
No. of events	198	861	66	199	211	197	204	206	201	1866
Post-1980 sample										
pre-News Dummy	−0.08	0.04	0.02	0.04	0.01	−0.02	−0.11	−0.08	0.04	−0.00
	[0.06]	[0.03]	[0.10]	[0.05]	[0.06]	[0.08]	[0.06]*	[0.07]	[0.05]	[0.03]
No. of events	369	1627	125	375	386	372	375	381	374	3561

Table 7 Other Economic News Regressions This table reports pre-announcement dummy variable regressions for various macroeconomic news announcements as discussed in Section 3.7. The dependent variable is the daily close-to-close cum dividend log excess return on the S&P500. The sample in the top panel starts on Sep 1, 1994 and ends on Mar 30, 2011. The sample in the bottom panel start on Jan 2, 1980 and ends on Mar 30, 2011. The table does not report the coefficient on a constant, which is always included. The macroeconomic releases are: Employment Report (NFPAY), Initial Claims (INCLM), Advance GDP (GDPADV), ISM manufacturing index (ISM), Industrial Production (IP), Housing Starts (HS), Producer Price Index (PPI), Consumer Price Index (CPI), Personal Income (PI), and All economic releases (ALL).*** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard errors shown in brackets.

Instrument:	FF	ED-4	TREAS-3M	TREAS-2Y	TREAS-5Y	TREAS-10Y
			Post-1994 sample			
pre-FOMC dummy	0.001	0.007	0.001	0.006	0.001	−0.002
	[0.001]	[0.006]	[0.004]	[0.004]	[0.004]	[0.004]
Const.	−0.002	−0.001	−0.001	−0.002	−0.001	−0.001
	[0.0004]***	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Obs.	4322	4325	4210	4325	4325	4325
N. of FOMC	131	132	132	132	132	132
			Post-1980 sample			
pre-FOMC dummy	0.002	0.008	−0.010	−0.004	−0.006	−0.009
	[0.001]	[0.006]	[0.007]	[0.005]	[0.005]	[0.005]*
Const.	−0.002	−0.001	−0.001	−0.001	−0.001	−0.001
	[0.0004]***	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Obs.	5765	6454	7867	7986	7986	7986
N. of FOMC	170	193	245	245	245	245
Dates	198812.201103	198604.201103	198001.201103	198001.201103	198001.201103	198001.201103

Table 8 Fixed Income Instruments. The sample in the top panel is Sep 1, 1994 to Mar 30, 2011 and the dependent variables are percent yield changes from 2pm on date $t-1$ to 2pm on date t. "pre-FOMC dummy" is a variable that takes the value of one if the next 24 hour trading interval comprises a scheduled FOMC announcement, and zero otherwise. Samples in the bottom panel differ depending on the data availability as reported in the bottom row and start no earlier than Jan 2, 1980 and end on Mar 30, 2011. The dependent variables in this sample are close-to-close yield changes in percent prior to 1994, and yield changes in percent from 2pm on the day before a scheduled FOMC announcement to 2 pm on the announcement day after 1994. "FF" are rates implied by the front (next month) in the first two-thirds (last-third) of each month. "ED-4" is the 4th eurodollar implied rate. Variables denoted "TREAS" refer to yields on the 3m, 2y, 5y and 10y benchmark Treasury issues.*** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard errors shown in brackets.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
NBER Dummy	0.62							
	[0.33]*							
$\Delta^{12}Log$(IP)		−0.13						
		[0.12]						
$\Delta^{12}Log$(CPI)		−0.03						
		[0.13]						
Tight. Cycle			0.06					
			[0.14]					
Ease Cycle			0.48					
			[0.32]					
Level				−0.04				
				[0.11]				
Slope				−0.19				−0.23
				[0.10]*				[0.08]***
VIX					0.31			0.26
					[0.08]***			[0.10]***
SPX surprise						−0.12		
						[0.10]		
Kuttner Surprise						0.04		
						[0.10]		
pre-FOMC(MA8)							0.28	0.17
							[0.08]***	[0.08]**
Const.	0.33	0.42	0.33	0.42	0.42	0.42	0.42	0.42
	[0.08]***	[0.08]***	[0.10]***	[0.08]***	[0.08]***	[0.08]***	[0.08]***	[0.07]***
Adjusted R2	0.05	0.01	0.02	0.02	0.10	0.01	0.08	0.18
Obs.	130	130	130	130	130	130	130	130

Table 9 Time series regressions (post-1994) This table reports results time series regressions of pre-FOMC announcement returns on various explanatory variables, discussed in Subsection 3.8. The sample starts on Sep 1, 1994 and ends on Mar 30, 2011. The dependent variable is a time series of cum dividend log excess returns on the S&P500 from 2pm on days before to 2 pm on days of scheduled FOMC announcements. "NBER Dummy" is a (daily) recession dummy indicator. "$\Delta^{12}Log$(IP)" is the 12-month log change of the real-time Industrial Production Index, "$\Delta^{12}Log$(CPI)" is the 12-month log change of the real-time Consumer Price Index. "Ease Cycle" and "Tight. Cycle" are dummy variables that are equal to one if the corresponding observation can be classified as falling into a period of monetary loosening or tightening, respectively. "Level" and "Slope" are the first two principal components from the cross-section of daily one-five year zero-coupon Treasury yields from Gürkaynak et al. (2007), lagged by two days with respect to the FOMC announcement day. "VIX" is the level of the VIX index at the market close two days before the scheduled meeting. "Kuttner Surprise" is a monetary policy surprise measure constructed as in Bernanke and Kuttner (2005) and Gürkaynak et al. (2005) on a 2pm-to-3pm window around FOMC announcements. "SPX surprise" is the 2pm-to-3pm FOMC announcement return on the SPX. "pre-FOMC(MA8)" is the moving average of pre-FOMC returns over the past eight meetings. *** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard errors shown in brackets.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
NBER Dummy	0.20							
	[0.21]							
$\Delta^{12}Log$(IP)		−0.05						
		[0.07]						
$\Delta^{12}Log$(CPI)		−0.01						
		[0.08]						
Tight. Cycle Dummy			0.00					
			[0.14]					
Easing Cycle Dummy			0.02					
			[0.15]					
Level				−0.05				
				[0.07]				
Slope				−0.15				−0.16
				[0.06]**				[0.06]**
VIX					0.26			0.19
					[0.08]***			[0.09]**
SPX surprise						−0.06		
						[0.09]		
Kuttner Surprise						0.02		
						[0.07]		
pre-FOMC(MA8)							0.18	0.15
							[0.06]***	[0.08]**
Const.	0.29	0.33	0.32	0.33	0.37	0.35	0.33	0.37
	[0.06]***	[0.06]***	[0.09]***	[0.06]***	[0.07]***	[0.07]***	[0.06]***	[0.07]***
Adjusted R2	0.00	−0.01	−0.01	0.02	0.08	−0.01	0.03	0.12
Obs.	243	243	243	243	161	169	243	161
N. of FOMC	243	243	243	243	161	169	243	161
Sample	198001.201103	198001.201103	198001.201103	198001.201103	199002.201103	198811.201103	198001.201103	199002.201103

Table 10 Time series regressions (post-1980) This table reports results for regressions of the time series of pre-FOMC announcement returns on various explanatory variables for the sample period 1980-2011, discussed in Subsection 3.8. The dependent variable is a time series of cum dividend log excess returns on the S&P500 from 2pm on days before to 2 pm on days of scheduled FOMC announcements starting in 1994, and of close-to-close cum dividend log excess returns on the S&P500 on days of scheduled FOMC meetings before 1994. For other variable definitions refer to Table 9. Depending on data availability, the sample periods may differ across the various explanatory variables, as indicated by the bottom row. *** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard errors shown in brackets.

	(1)	(2)	(3)	(4)	(5)
pre-FOMC dummy	0.54	0.48	0.36	0.32	0.53
	[0.13]***	[0.13]***	[0.07]***	[0.07]***	[0.07]***
Trade Vol (innov.)		-0.61		-0.14	
		[0.06]***		[0.03]***	
Trade Vols(lag)		0.02		-0.08	-0.08
		[0.05]		[0.03]***	[0.03]***
VIX(innovat.)			-0.60	-0.60	
			[0.02]***	[0.02]***	
VIX(lag)			0.004	0.004	0.004
			[0.003]	[0.003]	[0.003]
Trade Vols. (FOMC-innov.)					-0.14
					[0.03]***
VIX (FOMC-innovat)					-0.60
					[0.02]***
Const.	-0.01	-0.01	-0.09	0.00	-0.01
	[0.02]	[0.06]	[0.06]	[0.07]	[0.07]
Adjusted R2	0.01	0.04	0.69	0.69	0.69
Obs.					3363
N. of FOMC					107

Table 11 Liquidity and Volatility Risk Regressions. This table reports results for regression 1 controlling for measures of liquidity and volatility. The dependent variable is the cum dividend 2pm-to-2pm log excess return on the S&P500. The sample period starts at September 12, 1997 (introduction of E-mini futures) and ends at Mar 30, 2011. "pre-FOMC dummy" is a dummy variable that is equal to one if there is a scheduled FOMC announcement in the next 24 hour trading interval. "Trade Vol (innov.)" is the residual from an AR(1) regression of the relative trading volume on the front-month E-mini S&P500 stock market index futures contract as of 2 pm on a constant and its previous 2 pm level. "Trade Vols (lag)" denotes the prior day 2 pm level. "VIX (innov.)" denotes the residual from an AR(1) regression of the VIX index at 2 pm on a constant and its previous day 2 pm level. "VIX (lag)" denotes day 2 pm level of the VIX index on the previous trading day. "Trade Vols. (FOMC-innov.)" and "VIX (FOMC-innov.)" denote residuals from the same AR(1) regressions but augmented with the pre-FOMC dummy. *** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard errors shown in brackets.

	Five years rolling regression					Ten years rolling regression				
pre-FOMC dummy	0.26	0.11	0.40	0.39	0.65	0.25	0.19	0.26	0.40	0.52
	[1.5]	[0.8]	[3.1]***	[2.8]***	[3.7]***	[2.1]**	[1.7]*	[2.8]***	[4.1]***	[4.6]***
Const.	0.03	0.02	0.06	−0.03	−0.04	0.02	0.02	0.04	0.02	−0.04
Obs.	1263	1257	1237	1245	1257	2526	2519	2493	2481	2501
	Five years exponential weight. regress.					Ten years exponential weight. regress.				
pre-FOMC dummy	0.15	0.14	0.29	0.32	0.51	0.10	0.10	0.19	0.24	0.37
	[1.7]*	[1.9]*	[3.9]***	[4.2]***	[4.7]***	[1.6]	[1.8]*	[3.4]***	[4.4]***	[5.4]***
Const.	0.02	0.02	0.04	0.01	−0.02	0.01	0.02	0.03	0.01	−0.00
Obs.	7566	8823	10060	11306	12563	7566	8823	10060	11306	12563
Sample ends in:	1990	1995	2000	2005	2010	1990	1995	2000	2005	2010

Table 12 Out-of-sample analysis This table reports results for regression 1 estimated over different subsamples and using different weighting schemes for the observations. The dependent variable is the cum dividend 2pm-to-2pm log excess return on the S&P500. "pre-FOMC dummy" is a dummy variable that is one if there is a scheduled FOMC announcement in the next 24 hour trading interval. The upper panel shows results for regressions using a rolling five (left panel) or ten years rolling window (right panel). The samples in these regressions end at the first FOMC meeting of the year indicated in the last row and start five or ten years earlier, respectively. The lower two panels provide results for regressions where past observations (that is on an expanding window) are discounted with exponentially declining weights. We choose weighting functions with half-lives of five years (left panel) and ten years (right panel), respectively. That is, in these regressions a five (ten) year lagged observation is given a weight of 0.5 in the estimation. *** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard errors shown in brackets.

A Appendix

A.1 Bootstrap Analysis

This section gives a detailed account of the bootstrap analysis discussed in Section 3.4.

Bootstrapped standard errors for dummy variable regression We assess the small sample standard errors of the estimated constant and dummy variable coefficient in regression (1) with a simple bootstrap approach. Precisely, we draw with replacement a return series of length 131 from the observed distribution of pre-FOMC returns in our 1994-2011 sample, and a series of length 4010 from the observed distribution of non-FOMC returns. With the two artificial series at hand, we reestimate the dummy variable regression (1) and record the estimated coefficients. The empirical distribution of the estimated FOMC dummy coefficient across bootstrap replications is centered around a mean of 48.5 basis points with a standard deviation of 10.8 basis points (upper-left panel of Figure A.1). These numbers are very close to the regression results in Table 2 and show that the asymptotic standard errors do not understate the sampling variability of the estimated means. For the 1980-2011 sample (upper-left panel of Figure A.2) we also find bootstrapped coefficients that are very similar to our regression results in Table 4.

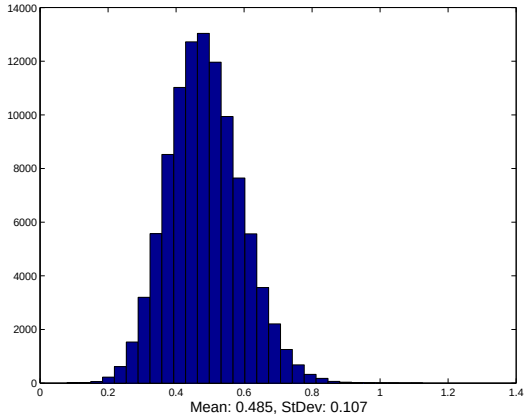
Random Sampling from Non-FOMC Return Distribution One might ask how likely it is to observe an average of 49 basis points in a short random sample of non-FOMC day returns. We address this question in another bootstrap exercise by drawing with replacement from the distribution of non-FOMC returns a time series of length equal to the number of FOMC announcement days. The bootstrap distribution of sample averages for the 1994-2011 sample (upper-right panel of Figure A.1) is centered around a mean of 0.7 basis points with a standard deviation of 10.5 basis points. More importantly, the probability of observing a mean greater than the 48.8 basis points sample average of pre-FOMC returns is zero. Repeating this exercise for the 1980-2011 period (upper-right panel of Figure A.2), we find the same result. In summary, for both samples, it is essentially impossible that one could have observed such a large mean had one drawn from the distribution of returns outside the pre-FOMC window.

Random Sampling from Pseudo Pre-FOMC Return Distribution with Zero Mean In light of the relatively small number of FOMC meetings and the high kurtosis of pre-FOMC day returns, one might be concerned that it is not unlikely to observe a sample mean as large as the documented pre-FOMC return in a short sample that is drawn from a distribution which has a population mean of zero. We assess that possibility in the following exercise. We construct a pseudo zero-mean pre-FOMC return distribution by subtracting the sample mean of 48.8 basis from all 131 observations in the 1994-2011 sample. Thus, by construction the resulting distribution has a sample mean of zero but identical higher moments as the observed distribution of pre-FOMC returns. We then randomly draw with replacement from the pseudo pre-FOMC distribution series of length 131. The histogram of sample means is shown in the lower-left panel of Figure A.1. As expected, the distribution is tightly centered around zero. More importantly, we reject with a probability of 99.99 percent that we could have observed pre-FOMC returns with an average of 48.8 basis points

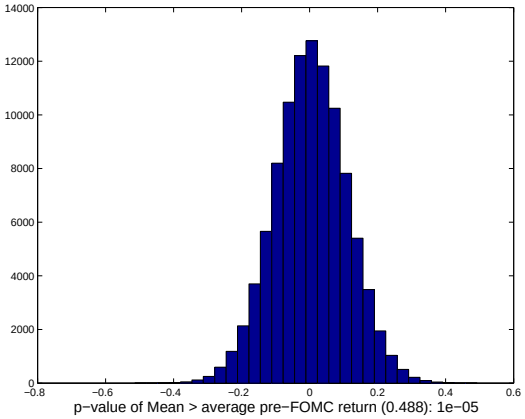
if the true distribution had a population mean of zero. Repeating this exercise for the 1980-2011 sample (lower-left panel of Figure A.2), we find that not a single series of draws has a mean greater than the 36.6 basis points that we observe for the pre-FOMC return over this period. Hence, we can safely rule out that the distribution of pre-FOMC returns has a population mean of zero.

Data-Snooping As previously discussed, we find the pre-FOMC returns to be highly statistically significant while the SPX does not display excess returns ahead of other major U.S. macroeconomic announcements. A skeptical reader may worry that the significance of our finding (and thus the Sharpe-ratios) could be the artificial outcome of an extensive search across the universe of economic news announcements for the highest t-statistic. Of course, such a search would not bias the size of the return. We address this concern by carrying out a reality check in the spirit of White (2000). In particular, we simulate the snooping bias by resampling the 2pm-to-2pm excess return on the SPX and collecting the largest absolute t-statistic among the economic announcements considered in Table 7 as well as FOMC announcements. The bootstrap distribution for the 1994-2011 sample (lower-right panel of Figure A.1) shows that 99.98 percent of maximum absolute t-statistics are smaller than the value of 4.51 that we find for the pre-FOMC announcement return in the SPX for that sample (Table 2, column 1). Repeating this exercise for the 1980-2011 period (lower-right panel of Figure A.2), we find an even smaller probability of having snooped a t-statistic larger than 4.86, which is the estimated asymptotic t-statistic of the pre-FOMC dummy for that sample (Table 4, last column). In other words, the statistical significance of our finding is extremely unlikely to be the result of a data-snooping exercise.

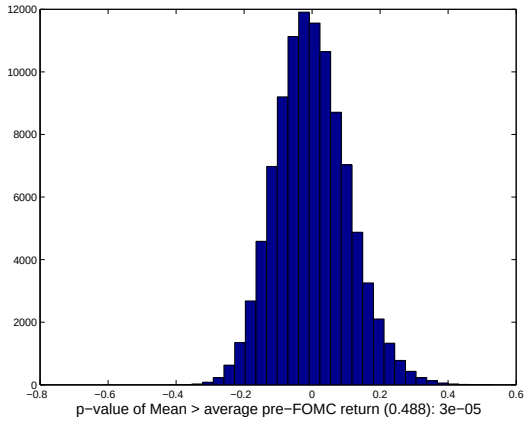
Bootstrapped standard errors for FOMC dummy



Sampling from non-FOMC Returns



Zero-Mean Pseudo Pre-FOMC Return Distribution



Data-Snooping

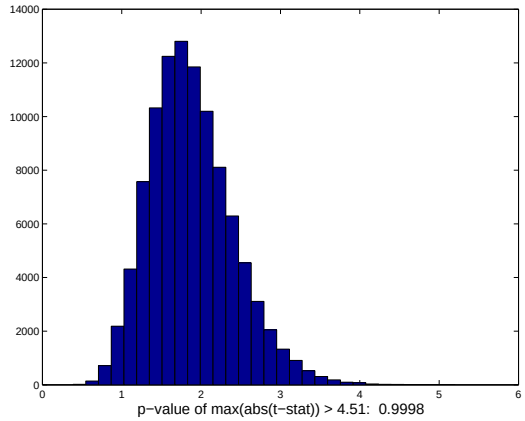
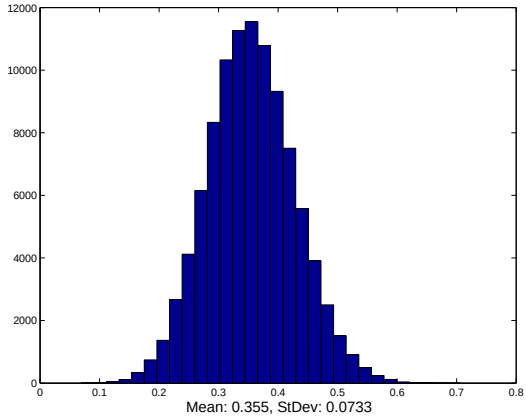
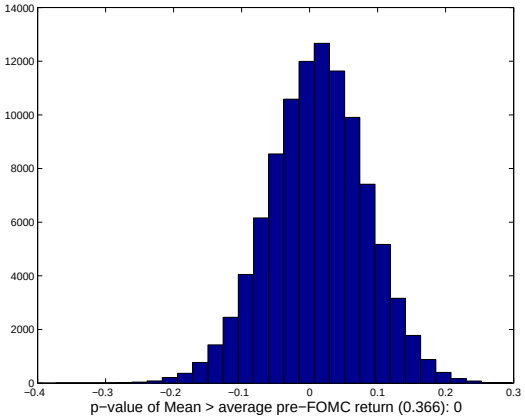


Figure A.1. Bootstrap Analysis 1994-2011. This Figure provides histograms of the bootstrap distributions discussed in Section 3.4 for the sample period Sep 1994 - Mar 2011.

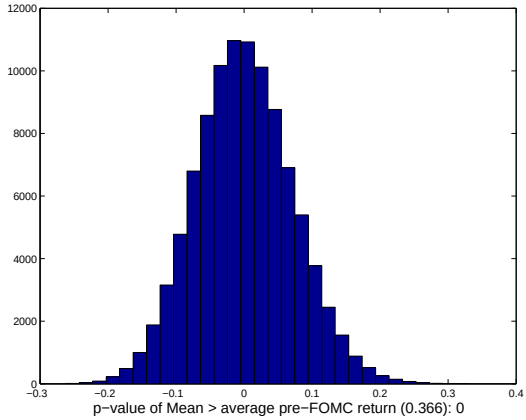
Bootstrapped standard errors for FOMC dummy



Sampling from non-FOMC Returns



Zero-Mean Pseudo Pre-FOMC Return Distribution



Data-Snooping

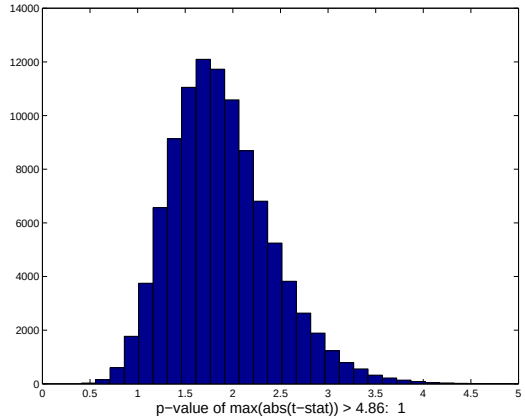


Figure A.2. Bootstrap Analysis 1980-2011. This Figure provides histograms of the bootstrap distributions discussed in Section 3.4 for the sample period January 1980 - Mar 2011.

B Additional Figures and Tables

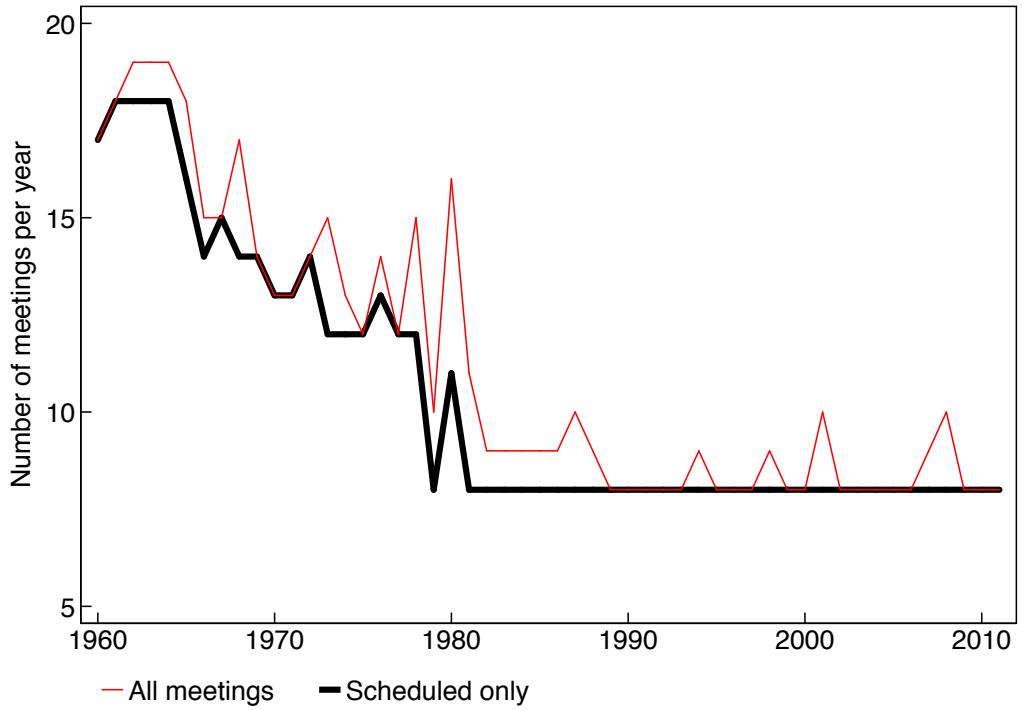


Figure B.1. Number of FOMC Meetings Per Year. This chart plots time series of the number of scheduled and the total number of scheduled and unscheduled FOMC meetings per year from 1960 - 2011.

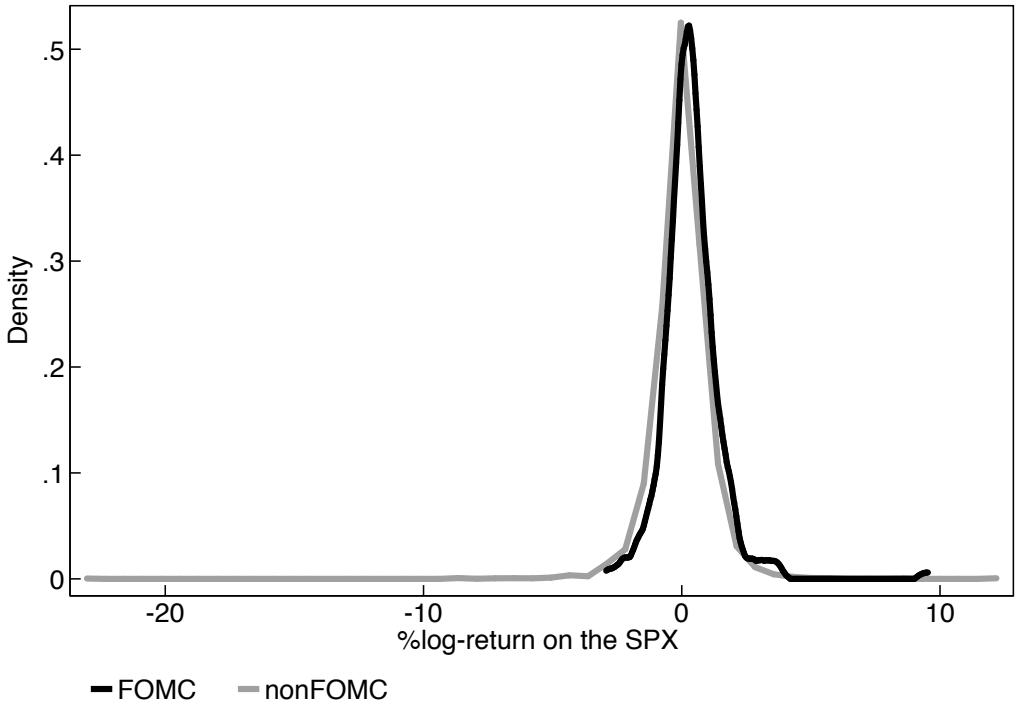


Figure B.2. Empirical Densities of pre-FOMC Returns: 1980-2011. This chart plots empirical densities of the 2pm-to-2pm return on the SPX. The solid black line shows the return on days ahead of scheduled FOMC announcements and the gray line shows the return on all other days. The sample period is from January 1980 through March 2011.

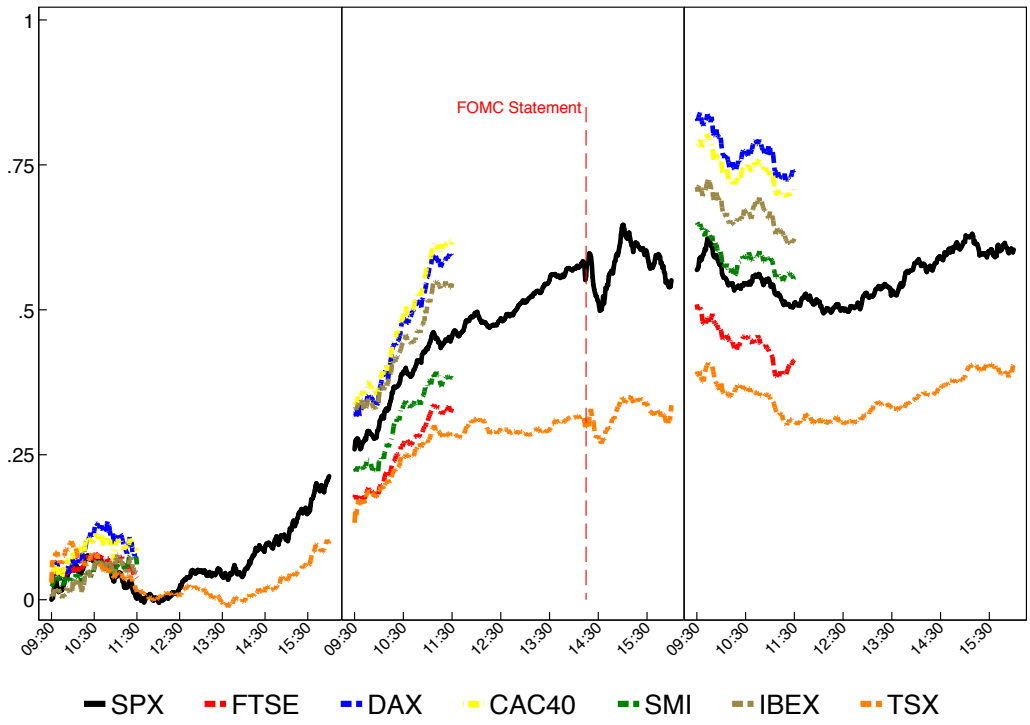


Figure B.3. Cumulative Returns on International Stock Market Indexes Around FOMC Announcements. This chart plots the average cumulative one-minute return on the SPX and other major international equity market indexes over the three day window around scheduled FOMC announcements. The solid black line shows the average cumulative return on the SPX from 9:30 a.m. EST on the days before scheduled FOMC announcements until 4:00 p.m. on days after scheduled FOMC announcements. The colored dashed lines show the cumulative returns on the German DAX, the U.K.'s FTSE100, the French CAC40, the Spanish IBEX, the Swiss SMI, and the Canadian TSX over the same three day window. All stock indexes are only shown during hours of trading on the respective exchanges. The sample period is from January 1996 through March 2011. The dashed vertical red line is set at 2:15 p.m. EST, the time when FOMC announcements were typically released during that period.

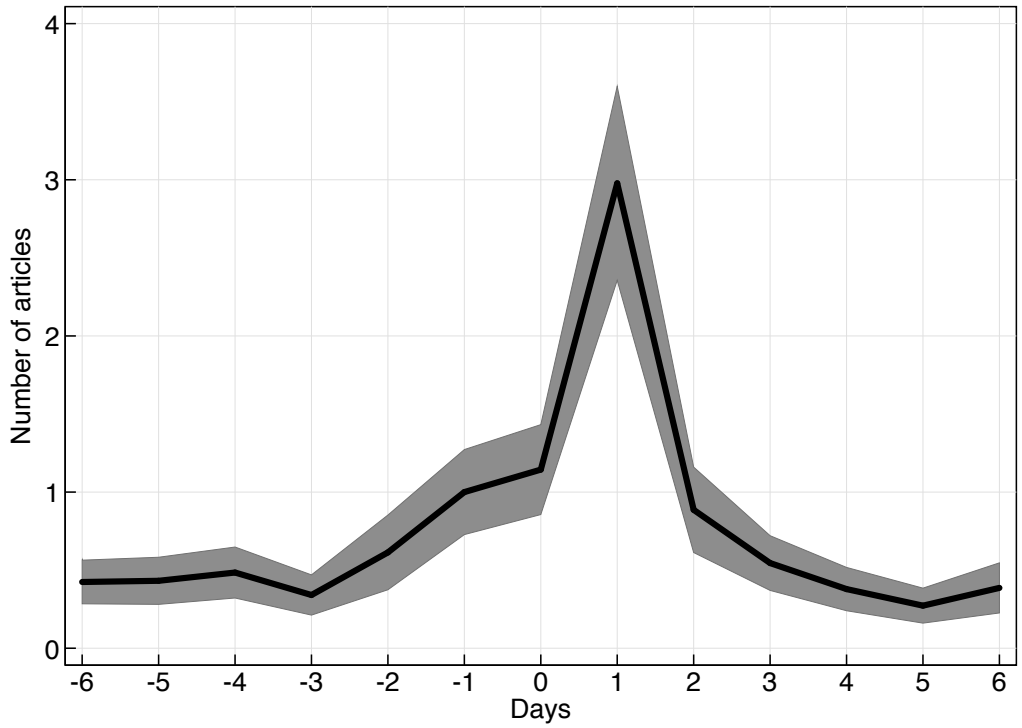


Figure B.4. Number of Fed-related articles in WSJ&FT around FOMC Announcement Days. This chart plots the average number of articles that appear in the print issues of the *Wall Street Journal* and the *Financial Times* around days of scheduled FOMC announcements. The gray shaded area shows the two standard error deviation bands around the average. The sample period is from February 1994 through March 2011.

year	1st	2nd	3rd	4th	5th	6th	7th	8th
1994	4-Feb-94[e]	22-Mar-94[e]	17-May-94[e]	6-Jul-94[e]	16-Aug-94[e]	27-Sep-94	15-Nov-94	20-Dec-94
	[11:05]	[14:20]	[14:26]	[14:18]	[13:17]	[14:18]	[14:20]	[14:17]
1995	1-Feb-95	28-Mar-95	23-May-95	6-Jul-95	22-Aug-95	26-Sep-95	15-Nov-95	19-Dec-95
	[14:14]	[14:13]	[14:13]	[14:15]	[14:13]	[14:14]	[14:16]	[14:15]
1996	31-Jan-96	26-Mar-96[e]	21-May-96	3-Jul-96	20-Aug-96	24-Sep-96	13-Nov-96	17-Dec-96
	[14:16]	[11:39]	[14:16]	[14:14]	[14:17]	[14:14]	[14:17]	[14:16]
1997	5-Feb-97	25-Mar-97	20-May-97	2-Jul-97	19-Aug-97	30-Sep-97	12-Nov-97	16-Dec-97
	[14:13]	[14:14]	[14:15]	[14:15]	[14:15]	[14:13]	[14:12]	[14:15]
1998	4-Feb-98	31-Mar-98	19-May-98	1-Jul-98	18-Aug-98	29-Sep-98	17-Nov-98	22-Dec-98
	[14:12]	[14:14]	[14:13]	[14:14]	[14:12]	[14:17]	[14:19]	[14:13]
1999	3-Feb-99	30-Mar-99	18-May-99	30-Jun-99	24-Aug-99	5-Oct-99	16-Nov-99	21-Dec-99
	[14:12]	[14:12]	[14:11]	[14:15]	[14:14]	[14:12]	[14:16]	[14:13]
2000	2-Feb-00	21-Mar-00	16-May-00	28-Jun-00	22-Aug-00	3-Oct-00	15-Nov-00	19-Dec-00
	[14:14]	[14:15]	[14:13]	[14:15]	[14:14]	[14:12]	[14:12]	[14:16]
2001	31-Jan-01	20-Mar-01	15-May-01	27-Jun-01	21-Aug-01	2-Oct-01	6-Nov-01	11-Dec-01
	[14:15]	[14:13]	[14:15]	[14:12]	[14:13]	[14:15]	[14:20]	[14:14]
2002	30-Jan-02	19-Mar-02	7-May-02	26-Jun-02	13-Aug-02	24-Sep-02	6-Nov-02	10-Dec-02
	[14:16]	[14:19]	[14:14]	[14:13]	[14:14]	[14:12]	[14:14]	[14:13]
2003	29-Jan-03	18-Mar-03	6-May-03	25-Jun-03	12-Aug-03	16-Sep-03	28-Oct-03	9-Dec-03
	[14:16]	[14:15]	[14:13]	[14:16]	[14:15]	[14:19]	[14:14]	[14:14]
2004	28-Jan-04	16-Mar-04	4-May-04	30-Jun-04	10-Aug-04	21-Sep-04	10-Nov-04	14-Dec-04
	[14:14]	[14:15]	[14:16]	[14:18]	[14:15]	[14:15]	[14:15]	[14:15]
2005	2-Feb-05	22-Mar-05	3-May-05	30-Jun-05	9-Aug-05	20-Sep-05	1-Nov-05	13-Dec-05
	[14:17]	[14:17]	[14:16]	[14:15]	[14:17]	[14:17]	[14:18]	[14:13]
2006	31-Jan-06	28-Mar-06	10-May-06	29-Jun-06	8-Aug-06	20-Sep-06	25-Oct-06	12-Dec-06
	[14:14]	[14:17]	[14:17]	[14:16]	[14:14]	[14:13]	[14:13]	[14:14]
2007	31-Jan-07	21-Mar-07	9-May-07	28-Jun-07	7-Aug-07	18-Sep-07	31-Oct-07	11-Dec-07
	[14:14]	[14:15]	[14:15]	[14:14]	[14:14]	[14:15]	[14:15]	[14:15]
2008	30-Jan-08	18-Mar-08	30-Apr-08	25-Jun-08	5-Aug-08	16-Sep-08	29-Oct-08	16-Dec-08
	[14:14]	[14:14]	[14:15]	[14:19]	[14:13]	[14:14]	[14:17]	[14:11]
2009	28-Jan-09	18-Mar-09	29-Apr-09	24-Jun-09	12-Aug-09	23-Sep-09	4-Nov-09	16-Dec-09
	[14:14]	[14:17]	[14:16]	[14:18]	[14:16]	[14:16]	[14:18]	[14:15]
2010	27-Jan-10	16-Mar-10	28-Apr-10	23-Jun-10	10-Aug-10	21-Sep-10	3-Nov-10	14-Dec-10
	[14:17]	[14:14]	[14:14]	[14:16]	[14:15]	[14:15]	[14:16]	[14:15]
2011	26-Jan-11	15-Mar-11						
	[14:16]	[14:13]						

Table B.1 Scheduled FOMC meeting dates and times 1994-2011. This table reports dates of scheduled FOMC meetings. The marker "e" denotes meetings that are excluded from our sample. The time of the announcements, reported in square brackets, from 1994 to 2004 are from Fleming and Piazzesi (2005) and are based on the time-stamp of Bloomberg or Dow Jones newswires. We update this list for the remaining sample using the same method.

	All Observations		Excl. top/bottom 1	
	FOMC	nonFOMC	FOMC	nonFOMC
Mean	.366	.011	.34	.018
	[.07]	[.01]	[.06]	[.01]
St. Dev.	1.12	1.12	.9	.9
Skew	2.31	-1.34	.37	-.11
Kurtosis	20.7	36.87	4.19	3.63
Max	9.53	12.06	3.54	2.77
Min	-2.93	-22.91	-2.18	-2.97
Obs.	244	7598	240	7448

Table B.2 Summary Statistics in 1980 sample: SP500 excess returns. This table reports summary statistics for the daily log excess returns on the SPX on FOMC days and non-FOMC days. Standard errors for the mean are reported in square brackets. The sample period is January 2, 1980 to March 31, 2011.

Dependent Variable: %Log-excess-return of CRSP portfolio index						
Portfolio:	Value Weighted	Equal Weighted	1st Decile	2nd Decile	3rd Decile	4th Decile
FOMC dummy	0.35	0.25	0.20	0.40	0.42	0.44
	[0.10]***	[0.08]***	[0.08]**	[0.12]***	[0.12]***	[0.11]***
Const.	0.01	0.06	0.02	0.02	0.02	0.01
	[0.02]	[0.02]***	[0.02]	[0.02]	[0.02]	[0.02]
Annual ex-return FOMC	2.90	2.45	1.79	3.32	3.47	3.56
Annual ex-return non-FOMC	2.34	14.66	5.77	3.92	3.69	2.20
FOMC Sharpe Ratio	0.92	0.93	0.71	0.86	0.93	0.98
Portfolio:	5th Decile	6th Decile	7th Decile	8th Decile	9th Decile	10th Decile
FOMC dummy	0.46	0.40	0.39	0.39	0.37	0.31
	[0.11]***	[0.10]***	[0.10]***	[0.10]***	[0.10]***	[0.10]***
Const.	0.01	0.01	0.02	0.01	0.02	0.01
	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]
Annual ex-return FOMC	3.73	3.26	3.26	3.20	3.10	2.52
Annual ex-return non-FOMC	2.61	3.35	4.23	3.36	3.66	1.80
FOMC Sharpe Ratio	1.06	1.03	1.05	0.99	0.98	0.80

Table B.3 CRSP Size Portfolio Regressions: 1994-2011. This table provides results for FOMC dummy variable regressions for different U.S. equity portfolios for the sample period from Sep 1, 1994 through Mar 30, 2011. The dependent variables are the daily excess returns on the value-weighted and equally-weighted market portfolio from CRSP as well as the ten size decile portfolios provided on Ken French's website. "FOMC dummy" denotes a variable that takes on the value of one on days of scheduled FOMC announcements and zero otherwise. "Annual ex-return FOMC" is the average cumulative annual excess return on FOMC days, and "Annual ex-return non-FOMC" denotes the average cumulative annual excess return on non-FOMC days in the sample. "FOMC Sharpe Ratio" is the annualized Sharpe-ratio on pre-FOMC returns.*** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard errors shown in brackets.

Dependent Variable: %Log-excess-return of CRSP portfolio index						
Portfolio:	Value Weighted	Equal Weighted	1st Decile	2nd Decile	3rd Decile	4th Decile
FOMC dummy	0.27	0.13	0.10	0.23	0.26	0.28
	[0.07]***	[0.05]**	[0.05]*	[0.07]***	[0.07]***	[0.07]***
Const.	0.01	0.06	0.02	0.02	0.02	0.02
	[0.01]	[0.01]***	[0.01]*	[0.01]	[0.01]	[0.01]
Annual ex-return FOMC	2.20	1.48	0.89	1.89	2.20	2.28
Annual ex-return non-FOMC	3.42	14.56	4.36	3.79	4.49	3.68
FOMC Sharpe Ratio	0.78	0.66	0.41	0.60	0.72	0.76
Portfolio:	5th Decile	6th Decile	7th Decile	8th Decile	9th Decile	10th Decile
FOMC dummy	0.29	0.26	0.26	0.27	0.29	0.26
	[0.07]***	[0.06]***	[0.06]***	[0.07]***	[0.07]***	[0.07]***
Const.	0.02	0.02	0.02	0.02	0.02	0.01
	[0.01]	[0.01]	[0.01]*	[0.01]	[0.01]	[0.01]
Annual ex-return FOMC	2.39	2.21	2.22	2.24	2.40	2.15
Annual ex-return non-FOMC	4.38	4.80	5.00	4.53	4.29	3.05
FOMC Sharpe Ratio	0.81	0.82	0.83	0.78	0.84	0.72

Table B.4 CRSP Size Portfolio Regressions: 1980-2011. This table provides results for FOMC dummy variable regressions for different U.S. equity portfolios for the sample period from Jan 2, 1980 through Mar 30, 2011. The dependent variables are the daily excess returns on the value-weighted and equally-weighted market portfolio from CRSP as well as the ten size decile portfolios provided on Ken French's website. "FOMC dummy" denotes a variable that takes on the value of one on days of scheduled FOMC announcements and zero otherwise. "Annual ex-return FOMC" is the average cumulative annual excess return on FOMC days, and "Annual ex-return non-FOMC" denotes the average cumulative annual excess return on non-FOMC days in the sample. "FOMC Sharpe Ratio" is the annualized Sharpe-ratio on pre-FOMC returns.*** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard errors shown in brackets.

Dependent Variable: %log-excess-return of CRSP Industry portfolio							
Industry Portfolio:	AGRIC	FOOD	SODA	BEER	SMOKE	TOYS	FUN
FOMC dummy	0.24	0.10	−0.14	0.01	−0.07	0.32	0.50
	[0.17]	[0.08]	[0.22]	[0.09]	[0.15]	[0.12]**	[0.19]***
FOMC Sharpe Ratio	0.39	0.38	−0.10	0.09	−0.06	0.61	0.66
Industry Portfolio:	BOOKS	HSHLD	CLTHS	HLTH	MEDEQ	DRUGS	CHEMS
FOMC dummy	0.37	0.23	0.38	0.24	0.19	0.25	0.44
	[0.12]***	[0.09]**	[0.13]***	[0.11]**	[0.10]*	[0.10]***	[0.12]***
FOMC Sharpe Ratio	0.73	0.67	0.77	0.57	0.54	0.72	0.98
Industry Portfolio:	RUBBR	TXTLS	BLDMT	CNSTR	STEEL	FABPR	MACH
FOMC dummy	0.39	0.51	0.38	0.44	0.50	0.51	0.49
	[0.12]***	[0.16]***	[0.13]***	[0.18]**	[0.16]***	[0.19]***	[0.13]***
FOMC Sharpe Ratio	0.80	0.77	0.70	0.63	0.78	0.63	0.97
Industry Portfolio:	ELCEQ	AUTOS	AERO	SHIPS	GUNS	GOLD	MINES
FOMC dummy	0.53	0.51	0.45	0.25	0.13	0.26	0.56
	[0.14]***	[0.14]***	[0.15]***	[0.14]*	[0.13]	[0.22]	[0.16]***
FOMC Sharpe Ratio	0.98	0.86	0.79	0.49	0.29	0.28	0.89
Industry Portfolio:	COAL	OIL	UTIL	TELCM	PERSV	BUSSV	HARDW
FOMC dummy	0.40	0.29	0.10	0.13	0.42	0.37	0.40
	[0.27]	[0.12]**	[0.09]	[0.12]	[0.13]***	[0.10]***	[0.17]**
FOMC Sharpe Ratio	0.43	0.67	0.34	0.28	0.82	0.93	0.63
Industry Portfolio:	SOFTW	CHIPS	LABEQ	PAPER	BOXES	TRANS	WHLSL
FOMC dummy	0.48	0.54	0.44	0.18	0.27	0.45	0.30
	[0.15]***	[0.16]***	[0.14]***	[0.10]*	[0.12]**	[0.11]***	[0.10]***
FOMC Sharpe Ratio	0.80	0.82	0.83	0.46	0.57	0.99	0.76
Industry Portfolio:	RTAIL	MEALS	BANKS	INSUR	RLEST	FIN	OTHER
FOMC dummy	0.33	0.27	0.56	0.42	0.35	0.70	0.30
	[0.12]***	[0.11]**	[0.19]***	[0.14]***	[0.16]**	[0.19]***	[0.12]***
FOMC Sharpe Ratio	0.74	0.64	0.72	0.77	0.53	0.92	0.61

Table B.5 Value-Weighted Industry Portfolio Regressions: 1994-2011. This table provides results for FOMC dummy variable regressions for different U.S. equity portfolios for the sample period from Sep 1, 1994 through Mar 30, 2011. The dependent variables are the daily excess returns on the 49 Industry portfolios provided on Ken French's website. "FOMC dummy" denotes a variable that takes on the value of one on days of scheduled FOMC announcements and zero otherwise. "FOMC Sharpe Ratio" is the annualized Sharpe-ratio on pre-FOMC returns.*** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard errors shown in brackets.

Dependent Variable: %log-excess-return of CRSP Industry portfolio							
Industry Portfolio:	AGRIC	FOOD	SODA	BEER	SMOKE	TOYS	FUN
FOMC dummy	0.12	0.14	−0.02	0.08	0.09	0.25	0.33
	[0.10]	[0.06]**	[0.13]	[0.08]	[0.10]	[0.09]***	[0.12]***
FOMC Sharpe Ratio	0.26	0.53	0.02	0.29	0.24	0.49	0.55
Industry Portfolio:	BOOKS	HSHLD	CLTHS	HLTH	MEDEQ	DRUGS	CHEMS
FOMC dummy	0.27	0.20	0.28	0.25	0.17	0.30	0.30
	[0.08]***	[0.07]***	[0.08]***	[0.08]***	[0.07]**	[0.07]***	[0.08]***
FOMC Sharpe Ratio	0.65	0.60	0.65	0.62	0.48	0.82	0.75
Industry Portfolio:	RUBBR	TXTLS	BLDMT	CNSTR	STEEL	FABPR	MACH
FOMC dummy	0.22	0.37	0.25	0.28	0.31	0.40	0.30
	[0.08]***	[0.09]***	[0.08]***	[0.11]**	[0.10]***	[0.11]***	[0.08]***
FOMC Sharpe Ratio	0.53	0.73	0.58	0.48	0.58	0.63	0.69
Industry Portfolio:	ELCEQ	AUTOS	AERO	SHIPS	GUNS	GOLD	MINES
FOMC dummy	0.39	0.35	0.32	0.21	0.18	0.29	0.33
	[0.09]***	[0.10]***	[0.10]***	[0.10]**	[0.09]**	[0.15]*	[0.10]***
FOMC Sharpe Ratio	0.81	0.67	0.66	0.38	0.39	0.34	0.59
Industry Portfolio:	COAL	OIL	UTIL	TELCM	PERSV	BUSSV	HARDW
FOMC dummy	0.33	0.22	0.11	0.10	0.26	0.25	0.30
	[0.16]**	[0.09]**	[0.06]**	[0.08]	[0.08]***	[0.07]***	[0.11]***
FOMC Sharpe Ratio	0.40	0.51	0.43	0.28	0.57	0.72	0.52
Industry Portfolio:	SOFTW	CHIPS	LABEQ	PAPER	BOXES	TRANS	WHLSL
FOMC dummy	0.33	0.38	0.30	0.16	0.23	0.34	0.24
	[0.11]***	[0.10]***	[0.10]***	[0.07]**	[0.08]***	[0.08]***	[0.07]***
FOMC Sharpe Ratio	0.56	0.71	0.60	0.47	0.55	0.80	0.68
Industry Portfolio:	RTAIL	MEALS	BANKS	INSUR	RLEST	FIN	OTHER
FOMC dummy	0.24	0.22	0.32	0.28	0.15	0.47	0.25
	[0.08]***	[0.07]***	[0.11]***	[0.08]***	[0.10]	[0.11]***	[0.08]***
FOMC Sharpe Ratio	0.62	0.60	0.54	0.63	0.25	0.80	0.56

Table B.6 CRSP Value-Weighted Industry Portfolio Regressions: 1980-2011. This table provides results for FOMC dummy variable regressions for different U.S. equity portfolios for the sample period from Jan 2, 1980 through Mar 30, 2011. The dependent variables are the daily excess returns on the 49 Industry portfolios provided on Ken French's website. "FOMC dummy" denotes a variable that takes on the value of one on days of scheduled FOMC announcements and zero otherwise. "FOMC Sharpe Ratio" is the annualized Sharpe-ratio on pre-FOMC returns.*** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard errors shown in brackets.