The Pre-FOMC Announcement Drift

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First Draft: September 2011
This Draft: February 28, 2013

Abstract

We document large 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. The abnormal pre-FOMC returns have increased over time and account for large 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 other fixed income instruments. Other U.S. macroeconomic news announcements also do not give rise to analogous pre-announcement equity returns. The pre-FOMC return is 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 a few possible sources of the pre-FOMC announcement drift, none of which appears to be fully consistent with the vast empirical evidence that we assemble.

Keywords: FOMC announcements, equity premium, information choice
JEL classification: G10, G12, G15

*We are grateful to Tobias Adrian, Yakov Amihud, Nina Boyarchenko, John Cochrane, Richard Crump, Itamar Drechsler, Darrell Duffie, Fernando Duarte, Thomas Eisenbach, Arvind Krishnamurthy, Ken Kuttner(discussant), Michael Fleming, Charles Jones, Thomas Mertens, Lubos Pastor, Simon Potter, Asani Sarkar, Ernst Schaumburg, Pietro Veronesi, Annette Vissing-Jorgensen (discussant) Jonathan Wright and seminar participants at the New York Fed, NYU Stern Finance, Deutsche Bundesbank, Banque de France, the Swiss National Bank, NBER Asset Pricing Meeting, as well as the Boston University/Fed Conference on Macro-Finance Linkages for useful comments. Steve Kang and Kirby Fears provided valuable research assistance. Emails: david.lucca@ny.frb.gov, emanuel.moench@ny.frb.gov. The views expressed in the paper are those of the authors and do not necessarily reflect views at the Federal Reserve Bank of New York or the Federal Reserve System.

1 Introduction

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 meetings. These returns are puzzling and difficult to explain with standard asset pricing models.

Members of the FOMC—the Federal Reserve's (Fed) monetary policy-making body—convene at pre-scheduled meetings to make monetary policy decisions. These meetings have occurred eight times per year since the early 1980s, while before then, meetings were scheduled much more frequently. Starting in 1994 the decisions of these meetings have been announced to the public at known times, while before 1994, investors had to glean the outcomes indirectly through the size of the open market operations conducted 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 prior to the FOMC announcements. The abnormal 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 percent of the annual realized excess stock returns since 1994 is accounted for by the 24 hours before FOMC announcements. 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 an FOMC announcement would have yielded an annualized Sharpe ratio of above 1.1. Other major foreign stock markets exhibit similarly large pre-FOMC returns.

Before 1994 we study excess returns on days of scheduled FOMC meetings, which mark the last trading session before investors could observe signals about the likely policy action. Between 1980 and 1993, we find results that are comparable to the post-1994 sample. For example, pre-FOMC returns on the S&P500 index averaged to a statically significant 20 basis points, while returns on other days were an order of magnitude smaller. We find no evidence of pre-FOMC announcement returns before 1980.

We show that the pre-FOMC returns since 1980 are not explained by outliers and that they remain highly statistically significant even when we account for data-snooping or small-sample effects. We find pre-FOMC returns to be broad-based across U.S. industry and size portfolios. Indeed, 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 are somewhat countercyclical and tend to be higher in periods when the slope of the Treasury yield curve is low, and when the implied equity market volatility as measured by the VIX is higher. Even after accounting for these factors pre-FOMC returns feature substantial serial correlation. Pre-FOMC returns are not significantly different in easing versus tightening monetary policy cycles, and are 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 the stock market.

What explains these findings? The federal funds rate has trended down since the early 1980s, reaching historically low levels at the end of the sample. In addition, interest rate policy has sometimes been characterized as having an asymmetric impact on riskier asset values through implicit floors, or so called "government puts" (for example, Diamond and Rajan [2011]). Consistently, we find that pre-FOMC returns are higher when the slope of the yield curve implies future rate cuts and when the VIX is higher. If these were the true sources of the drift, however, it is not clear why they would have impacted stock prices only in the 24 hours before the meetings, rather than on all days in the sample. Indeed, while FOMC members regularly discuss monetary policy in speeches and interviews, they typically refrain from any such discussion ahead of FOMC meetings (a time interval known as the *purdah* period). In fact, we find that realized stock market volatility and trading volumes are low before and then jump at the time of the announcement.

One could argue that investors may be slow at updating their information sets on the basis of theories featuring informational frictions such as Sims [2003]. In the paper we discuss how a model with rationally inattentive investors (Kacperczyk, Nieuwerburgh, and Veldkamp [2009]) can potentially generate price drifts ahead of scheduled announcements. However, to quantitatively match the pre-FOMC returns, such a model would require agents to have biased priors for long periods of time, which would be inconsistent with rational expectations. In addition, the learning process would likely result in higher trading volumes and volatility in the hours before the announcement, contrary to what we observe in the data. Similar arguments can be made regarding the model of political risk by Pastor and Veronesi [2011], which, as we discuss in the paper, can also generate price drifts ahead of scheduled announcements under certain conditions.

We consider several other candidate explanations. First, jumps are unlikely to be the source of the drift as the pre-FOMC return accrues prior to the announcement when volatility is low. Second, an explanation based on a purely consumption-based pricing kernel would

either require high-frequency movements in consumption or new information about future consumption right before the FOMC. Third, previous work finds that negative innovations in liquidity and volatility are associated with higher contemporaneous excess returns (Campbell and Hentschel [1992] and Amihud [2002]). While we find that the lower liquidity and volatility ahead of the FOMC announcement can account for some of the pre-FOMC returns, a large and significant fraction remains unexplained. In addition, it is unclear to what extent the declines in volatility and liquidity have been unexpected. Moreover, one would need to rationalize these declines. In the paper, we discuss one such theory by Duffie [2010] featuring time-varying stock market participation which is also capable of generating price drifts ahead of scheduled announcements. However, this model appears to be at odds with the absence of a return reversal on subsequent days, as well as with the absence of similar drifts ahead of other macroeconomic announcements. Finally, we discuss that our empirical evidence is at odds with an information leakage story along several dimensions.

In addition to the work cited thus far, our paper is related to different strands of the literature. A vast literature has tried to explain the equity premium puzzle (see for example Campbell [2003] for a review). Our paper documents that since the 1980s a large fraction of realized excess returns on equities can be accounted for by returns in the 24 hours before FOMC policy decisions become known, a finding that may help shed light on alternative theories. 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] document large 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 realization of policy decisions. A related literature has documented a sizeable conditional response of various asset classes to other economic news announcements (Jones, Lamont, and Lumsdaine [1998], Fleming and Remolona [1999], Andersen, Bollerslev, Diebold, and Vega [2003]). More recently, Savor and Wilson [2010] find positive excess equity returns on days of scheduled macroeconomic data releases, including FOMC announcements, from 1958 through 2009. Our paper differs from Savor and Wilson [2010] as 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 at or a few minutes around 2:15PM, our results indicate that the FOMC announcement day returns are driven by the pre-FOMC drift. Lamont and Frazzini [2007] have recently documented a qualitatively similar upward drift of individual stock

[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])

prices prior to 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. Nonetheless we stress in the paper that, due to the absence of 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 2 provides a brief discussion of the monetary policy decision process in the U.S. and reviews the data used in this paper. In Section 3, we present the main empirical findings. Section 4 discusses a list of potential explanations for our findings, and Section 5 concludes.

2 Federal Reserve Policy, FOMC meetings, and Data

2.1 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.[2] Policy decisions are made under a majority rule at FOMC meetings, which from 1981 through today have been scheduled to occur eight times per year (or about once every six to eight weeks). Before 1981, scheduled FOMC meetings occurred much more often, ranging from a frequency of about every three weeks in the 1960s to about every five weeks in 1980.[3]

In this paper, we focus on those scheduled FOMC meetings. A list of the meeting dates and announcement times since 1994 is reported in Table A.1. The FOMC can also meet at other times in unscheduled meetings or conference calls. These meetings have been rather infrequent, especially in the past two decades, and their occurrence is unknown to investors in

[2]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.

[3]The calendar of past FOMC meetings and those already scheduled for the next year can be found at http://www.federalreserve.gov/monetarypolicy/fomccalendars.htm. Before Sep 11, 2001, the Public Affairs Division at the Board of Governors provided information sheets with the dates of scheduled meetings to the public.

advance.[4] Figure A.1 in the Appendix plots the evolution of the number of scheduled as well as the total number of scheduled and unscheduled FOMC meetings since 1960. This chart shows that monetary policy decisions in the U.S. have been made about twice as frequently in the 1960s and 1970s compared to the 1980s.

Starting in February 1994 the FOMC began to announce its decisions and accompanying statements (FOMC statements) after pre-scheduled meetings only when a change to the current policy was made. Starting in May 1999, statements have been released after every pre-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, 2:15pm ET following each scheduled meeting.[5] Since April 2011, the time of the release has been 12:30pm on days of FOMC meetings, after which a press conference by the FOMC Chairman is held at 2:15pm. 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, 2:15pm, as reported in Table A.1.

Prior to 1994, the FOMC did not disclose its policy decisions and market participants generally inferred the target federal funds rate from the size of open market operations on the days following the FOMC meeting. This often left investors with considerable uncertainty as to what the actual decision had been for a few days (Kuttner [2003]). On the other hand, on a few occasions before 1994, the Board of Governors of the Federal Reserve coincidentally released statements about a decision to change the discount rate on days of scheduled FOMC meetings. From these announcements market participants could have correctly inferred a change in the federal funds rate or non-borrowed reserve target (see e.g. Kuttner [2001] and Gürkaynak, Sack, and Swanson [2005] for a set of these dates in the post-1989 sample). We obtained the full history of discount rate press releases from the Federal Reserve;s historical records and identified a total of four FOMC meeting days in the 1960-2011 period when discount rate announcements occurred on the day of a scheduled FOMC meeting. We exclude those days from our analysis in order to ensure that the pre-FOMC windows do not include any policy announcements.[6]

[4]Unscheduled meetings typically occur via teleconference and are known to investors right after the meeting only when a target rate change occurs. Since 1994, such 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).

[5]The only exception to this rule 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.

[6]The meeting dates that we exclude are Dec 17 1968, Sep 18 1979, Oct 6 1979, and Dec 18 1990.

Changes in the frequency of monetary policy decisions and in the communication of those decisions are only some of the many policy changes since the 1960s ranging from policy instruments to operating procedures. Clarida, Gali, and Gertler [2000] study parameter shifts in monetary policy reaction functions between 1960 and 1996, and consider two main subperiods. The first, from 1960:Q1 through 1979:Q2, encompasses the tenures of Chairmen Martin, Burns, and Miller and the following one that spans the terms of Chairmen Volcker and Greenspan. They find evidence that interest rate policy in the post-Volcker period has been much more sensitive to changes in expected inflation than in the pre-Volcker period. While other researchers have questioned the importance of policy changes relative to exogenous changes in the volatility of shocks (see e.g. Sims and Zha [2006]), the appointment of Volcker as Chairman in 1979 is generally considered to be a key shift in the Fed's policy vis-a-vis inflation (see e.g. Bernanke, Blinder, and McCallum [2005]).

To enhance transparency in communicating their policy decisions over the past 30 years, 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. While this communication is today considered a key policy instrument in its own regard (e.g. Blinder, Ehrmann, Fratzscher, Haan, and Jansen [2008]), importantly FOMC participants refrain from any policy discussion in the week leading up to each FOMC meeting (the purdah period, see Ehrmann and Fratzscher [2009]). Hence, no such information about the likely outcome of the policy decision is released in the days before FOMC meetings. This is an important fact to bear in mind when interpreting the evidence presented in this paper.

2.2 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 1994 samples. Most of the evidence on the latter subsample is based on intraday data and focuses on the 24-hour period from 2pm on the day before a scheduled FOMC announcement until 2pm on the day of a scheduled FOMC announcement, which is 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.[7]

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

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

trading session before investors could observe signals about the likely policy action.

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. We use information on the number of articles published in the financial press from Factiva and also obtain historical *Wall Street Journal* coverage from ProQuest. Table 1 provides summary statistics on FOMC days and non-FOMC days 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.

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 percent return of the S&P500 index (SPX henceforth) over a three-day window from the market open on 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.[8]

As seen in the figure, the SPX index displays a strong upward drift in the hours ahead of FOMC announcements. First, the SPX index rises slightly on the afternoon of the day before the FOMC (left panel). It then drifts sharply higher in the morning of scheduled FOMC announcements. Right before the time of the announcement (vertical red dashed line) it reaches a level about 50 basis points above that of the previous day's open. Following

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

the announcement at 2:15pm the SPX is on average essentially 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 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).[9] On average cumulative returns on these days have essentially been zero over our 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.[10] 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 X_t.

In the regression excluding 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 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 2pm on the day of scheduled FOMC announcements does 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 window return right before the FOMC meeting has on average been 49 basis points, with a t-statistic of more than 4.5 based on the Huber-White standard errors (squared brackets). As shown in the

[9] These intervals account for the serial correlation due to the overlapping window structure of these returns using Newey-West standard errors. Truncation lags are wider than the actual daily overlap because of the kernel down-weighting: three-day window on the second day, and a five-day window on the third day.

[10] We use as risk-free rate the daily rate on a one-month T-Bill locked in the month before.

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 on FOMC and 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 percent per year, it has only been 0.88 percent on all remaining trading days. These point estimates imply that since 1994 about 80 percent 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 2pm the day before a scheduled FOMC announcement and selling fifteen minutes before the announcement while holding cash on all other days would have earned a large annualized Sharpe ratio of 1.14 as reported in the Table.

Consistent with Figure 1, the excess SPX return between 2pm and 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 percent compared to 2.08 percent 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 of two day prior to 2pm 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 point in the close of the two day prior to 2pm window.

Moreover, one might be concerned about potential outliers. Table 5 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 return and its standard error (first two rows) are the same as in Table 2. The standard deviation of excess returns is 1.2 per cent both on FOMC days and on other days, implying that, in terms of variance, stocks are not more risky on FOMC days (we discuss the relation between volatility and returns in Section 4.1). 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.

The distributional differences in the empirical densities are shown in Figure A.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 5 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 (last two columns in Table 5).[11] 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 in both samples. While the skewness of pre-FOMC announcement returns somewhat falls without the tail observations, it is still positive while that on all other days remains negative. Finally, the kurtosis is now similar in both trimmed samples.

3.2 Pre-FOMC Returns Before 1994

We have focused thus far on the 1994-2011 sample when FOMC decisions have been explicitly announced to investors at known times. As discussed in Section 2, prior to 1994 market

[11] 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.

participants inferred policy decision on the days after the FOMC meeting through open market operations of the New York Fed's trading desk. Following the convention in Kuttner [2001] and Bernanke and Kuttner [2005] we set the pre-announcement window to be the day of scheduled FOMC meetings.[12]

Table 3 presents the estimation results for the dummy variable regression (1) of pre-FOMC returns for different samples including data before 1994. In these regressions, we splice together the daily excess return on the SPX before 1994 and the 2pm-to-2pm excess return 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 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 percent level.

While highly statistically significant, this average pre-FOMC return is considerably smaller than 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 the latter part of the sample. To do so, we split the period prior to 1994 into two subperiods. Columns 2 and 3 in Table 3 show the regression outputs for the period from 1960-1979 and 1980-1993, respectively. These results show that prior to 1980, pre-FOMC returns have been essentially zero while between 1980 and 1993 they have averaged a statistically significant 20 basis points in excess of the 2 basis points earned on all non-FOMC days. Column 4 in Table 3 provides the regression results for the sample from 1980-2011. According to these, the excess pre-FOMC return on the SPX has averaged a highly significant 36 basis points over the last 30 years. Moreover, pre-FOMC returns have accounted for more than half of the realized excess stock returns over that 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.

In sum, the results in this section show that pre-FOMC returns have started to be prevalent in the 1980s, have increased in magnitude and significance over time and account for a large fraction of U.S. realized excess stock returns over the past few decades.

[12] 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.

3.3 Persistence

We have argued thus far that the pre-FOMC returns account 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 the days prior. We assess this issue by estimating regression (1) for the five days before and after FOMC announcements. Table 4 summarizes results from these regressions for the two sample periods from 1994-2011 and 1980-2011, respectively. 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, none of which is statistically significant. Moreover, the cumulative returns on the five days before and on the five days after pre-FOMC news windows is essentially zero in the 1994-2011 sample. Interestingly, in the 1980-2011 sample we see an economically meaningful (15 basis points) but statistically insignificant additional positive cumulative return over the five days following the pre-FOMC trading session. Most importantly, in either sample we do not find evidence of pre-FOMC return reversals.

3.4 Inference

In the regression tables above, we have relied on asymptotic normality in gauging the statistical significance of the estimated coefficients. However, one may be concerned that the relatively small number of observations and the relatively fat tails of the empirical distribution of pre-FOMC returns may invalidate standard asymptotics. In order to address this concern, we carry out three different bootstrap exercises and confirm that the statistical significance is not due to small sample issues. Moreover, we carry out a reality-check exercise which shows that the large significance of the pre-FOMC returns that we document is highly unlikely to explained by data-snooping across different macroeconomic news releases.

Bootstrapped standard errors for dummy variable regression In the first exercise, we assess the statistical significance of the estimated constant and dummy variable coefficient in regression (1) using a simple bootstrapping 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. We also draw with replacement from the observed distribution of non-FOMC returns a series of the same length as the total number of non-FOMC days (4010) in our sample. With the two artificial series at hand, we then reestimate the dummy variable regression (1) and record the estimated coefficients. We repeat this process 100,000 times.

The empirical distribution of the estimated coefficient on the FOMC dummy variable is shown in the upper left panel of Figure A.3 in the Appendix. It is centered around a mean of 48.5 basis points with a standard deviation of 10.8 basis points. The empirical distribution of the regression constant which measures the excess return on the SPX on all other days which we do not report to conserve space is centered around a mean of 0.4 basis points with a standard deviation of 1.9 basis points. These numbers are very close to the OLS regression results in Table 2 and show that the asymptotic standard errors do not understate the sampling variability of the estimated means.

Our conclusion is not altered when we repeat this exercise for the 1980-2011 sample. Indeed, as shown in Figure A.4, for that sample period the bootstrap distribution of dummy variable coefficients has a mean of 35.5 basis points with a standard deviation of 7.3 basis points, which is again very similar to our OLS regression results in Table 3. Hence, the strong significance of average pre-FOMC returns clearly survives when we use bootstrapped rather than asymptotically normal standard errors.

Random Sampling from Non-FOMC Return Distribution One might worry that the large observed average pre-FOMC return is simply due to luck. To address that concern we use another simple bootstrapping exercise to answer the question "how likely is it that one would observe a sample average of 49 basis points in a short random sample of non-FOMC day returns"? In particular, we sample with replacement from the observed distribution of non-FOMC returns in our 1994-2011 sample a time series of length 131, the total number of scheduled FOMC dates in the 1994-2011 period. We then record the sample average of that bootstrapped return series. We repeat this process 100,000 times. The bootstrap distribution of sample averages for the 1994-2011 sample (upper-right panel of Figure A.3) is centered around a mean of 0.7 basis points with a standard deviation of 10.5 basis. More interestingly, the p-value of observing a mean greater than the sample average of pre-FOMC returns of 48.8 basis points is one. Repeating this exercise for the 1980-2011 period (upper-right panel of Figure A.4), we find the same result. In summary, for both samples it is extremely unlikely to have observed a time series of pre-FOMC returns with such a high sample mean by pure luck.

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 pre-FOMC return that we document in a short sample that is drawn from

a distribution which has a population mean of zero.[13] We assess that probability in the following simple way. First, 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. Hence, this pseudo distribution by construction has a sample mean of zero but an identical sample standard deviation, skewness, and kurtosis as the observed distribution of pre-FOMC returns. We then randomly draw with replacement from the pseudo pre-FOMC distribution 100,000 samples of length 131 and record the empirical distribution of sample means from those draws. The resulting histogram of sample means is given in the lower-left panel of Figure A.3. As expected, the distribution is tightly centered around zero. More importantly, we can 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 period (lower-left panel of Figure A.4), we find that not a single draw out of 100,000 has a sample 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 in our sample. 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 100,000 times the 2pm-to-2pm excess return on the SPX and collecting the largest absolute t-statistic among the ten economic announcements considered in Table 8 (including the FOMC) for each replication. The bootstrap distribution of maximum absolute t-statistics is provided in the lower-right panel of Figure A.3. It shows that 99.98 percent of the empirical density 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 the 1994-2011 sample (Table 2, column 1). Repeating this exercise for the 1980-2011 sample (lower-right panel of Figure A.4), we find an even smaller probability of having snooped a t-statistic larger than 4.86, which is the asymptotic t-statistic of the pre-FOMC dummy that we estimate for the 1980-2011 sample (Table 3, last column). In other words, the statistical significance of our finding is extremely unlikely to be the result

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

of a data-snooping exercise.

3.5 Cross-sectional Evidence

Having established that aggregate U.S. stock market exhibits economically large and statistically highly significant pre-FOMC returns, this section shows that U.S. equity excess returns around FOMC announcements have been broad based across industry- and size-sorted portfolios. We also characterize the cross-section of these returns and show that a single market factor model captures a significant fraction of the portfolio variation on FOMC announcement days. Because of limited availability of intraday data at the disaggregated level, this evidence is based on daily close-to-close returns. We start by discussing the evidence for the 1994-2011 sample.

Table A.5 summarizes results of the dummy variable regression (1) including a constant, a FOMC dummy for excess returns on the CRSP value/equal weighted, and ten value weighted portfolios sorted by firm size. Not surprisingly, the return pattern for the value-weighted portfolio (column 1) is very similar to that for the close-to-close return on the S&P500 index (Table 2). Indeed, the return differential has been a highly significant 36 basis points, FOMC announcement days have accounted for the majority of the annual excess returns in the sample, and the Sharpe ratio of an FOMC-only investment strategy has been equal to 0.92.

The daily excess return differential on the CRSP equal weighted market portfolio (column 2) on FOMC days has been somewhat smaller at 25 basis points, but still highly statistically significant. Since the equal weighted portfolio attributes a large weight to small firms relative to their share of total market capitalization, this finding suggests the FOMC return differential may be somewhat lower for small firms. This conjecture is confirmed by the results for the size decile portfolios shown in the remaining columns of Table A.5. Indeed, the portfolio containing the smallest firms earned an average excess return of 20 basis points on FOMC announcement days.[14] All remaining decile portfolios, instead, displayed differential returns ranging between 31 to 46 basis points, with Sharpe ratios between 0.8 to 1.07.

Table A.3 provides estimates for the dummy variable regressions for the 49 industry sorted portfolios from Ken French's website. While there is some cross-sectional dispersion of FOMC announcement day returns across industries, the excess return differential is broad-based. Indeed, 36 out of 49 industry portfolios feature excess returns on FOMC announcement days that are significantly different from zero at least at the 5 percent level. Among

[14] This smallest market cap portfolio contains on average about 50 percent of all firms in the CRSP universe.

these, the dummy variable coefficients range from 23 basis points for the consumer goods industry (HSHLD) to 69 basis points for trading firms (FIN). A group of only ten industries as diverse as Agriculture (AGRIC), Food products (FOOD), Utilities (UTIL), and Telecommunication (TELCM) do not feature statistically significant excess returns on scheduled FOMC announcement days.

It is natural to ask whether the average FOMC announcement day returns in different industries 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 industry betas from a regression of the excess return in each industry on the excess return of the CRSP value-weighted market portfolios.[15] We then estimate a regression of average excess returns on the 59 industry and size portfolios on the estimated betas. Figure 4 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 fairly good description of the cross-section of FOMC announcement day returns. Indeed, the slope coefficient λ, which represents the price of market risk, is estimated to be 49 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 64 percent. In sharp contrast to the poor fit of the CAPM on all daily returns (Fama and French [1993]), these results suggest that the observed cross-sectional variation of FOMC announcement day returns is well captured by exposure to aggregate market risk.[16]

The cross-sectional distribution of pre-FOMC returns is qualitatively very similar in the longer sample from 1980-2011, as shown in Tables A.6 and A.4 in the appendix. Indeed, while the point estimates are somewhat lower over the longer sample, a larger total number of portfolios is shown to have pre-FOMC returns that are statistically significant at least at the 5% level. Moreover, also in the longer sample the CAPM does a reasonable job explaining the cross-sectional dispersion of pre-FOMC returns.

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

[16] 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 scheduled to be announced, stock market beta is significantly related to returns on individual stocks, equity portfolios, as well as other asset classes.

3.6 International Evidence

Previous research has documented ample evidence of international stock return comovement (e.g. Karolyi and Stulz [1996], Forbes and Rigobon [2002], and Bekaert, Hodrick, and Zhang [2009]). This evidence suggests that international equity indices may also feature an FOMC equity return differential.

To assess this question, we first reestimate model (1) with a constant and a FOMC dummy on daily close-to-close returns of major OECD stock indices for the sample period from September 1994 to March 2011. The results of these regressions are documented in Table 6.[17] 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. The FOMC dummy variables in all five countries are highly statistically significant and economically large, with 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.[18] 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.

Figure 5 visualizes these results. It displays cumulative returns over the trading hours of the respective exchange on the international stock indices on three days around scheduled FOMC announcements, and the SPX cumulative return is superimposed for reference (it is the same as in Figure 1). The international pattern of intraday stock returns is very similar to that of the U.S. In other words, the large pre-FOMC return appears to be a global phenomenon. In unreported results, we also investigated whether European, UK and Japan stock indices feature similar return patterns around its corresponding central bank's monetary policy announcement days, but we failed to find such effects. While a global phenomenon, the pre-announcement return is thus specific to U.S. monetary policy

[17] For lack of comparable dividend and risk-free rate data, these regressions are based on ex-dividend raw returns rathern than cum-dividend excess returns as in the case of the U.S.

[18] 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.

decisions. In the next section, we show that this effect is also absent for other major U.S. macroeconomic announcements.

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 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 Board of Governors of the Federal Reserve, 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 8, 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 15 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 and report the results in the lower panel of Table 8. The results are qualitatively similar. In this longer sample, the PPI release is the only macroeconomic news that exhibits a pre-announcement return that is slightly significant (and negative). As documented in the reality check exercise in Section 3, one is bound to find coefficients that are significant at some given level if one is running enough dummy variable regressions. We thus conclude that no other major macroeconomic announcement is associated with large and statistically significant pre-announcement returns.

We next study the pre-FOMC announcement effects on Treasury securities of different ma-

turities and interest rate futures.[19] The short-term rate derivatives that we consider are standard market implied measures of policy rate expectations: the front month fed funds futures contract and the fourth Eurodollar contract, which measure policy expectations 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 7. For the 1994-2011 sample none of the coefficients is statistically significant at conventional confidence levels. For the 1980-2011 sample the on-the-run ten-year Treasury is significant at the ten percent level with a coefficient of less than a basis point. [20] 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. We now turn to potential explanations of the empirical findings documented thus far.

4 Potential Explanations

In this section, we attempt to rationalize the pre-FOMC drift with a number of alternative explanations. We start by discussing a few standard risk-based explanations. We then try to reconcile our findings with models of political risk, investor inattention, and time varying stock market participation.

4.1 Standard Risk-Based Explanations

Recent specifications of the canonical consumption-based asset pricing model, for example featuring habit preferences (Campbell and Cochrane [1999]) or long-run risks (Bansal and Yaron [2004]) have been shown to be consistent with the magnitude of U.S. equity risk premium in the post-war period. In consumption based models, investors demand compensation for holding assets whose payoffs are positively correlated with their marginal utility of consumption. While, of course, it is hard to measure consumption at intraday frequencies, it seems unlikely that its covariance with stock returns would be significantly different in the 24-hour window ahead of FOMC announcements. Similarly, it is not clear why new informa-

[19] See Kuttner [2001] and Bernanke and Kuttner [2005], for asset responses to policy rate decisions, and Gürkaynak, Sack, and Swanson [2005] and Lucca and Trebbi [2009] for responses to the content of the statements.

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

tion about future consumption would be released right before FOMC announcements. While this leaves the door open for potential shifts in risk aversion over the 24-hour windows, as a source of the change in the covariance, such shifts would still require an explanation.

Financial asset prices may jump in response to large unexpected realizations of economic news announcements. As the direction of the surprise is not predetermined, holding financial assets around economic announcements is a risk that investors need to be compensated for. Previous research has found that this risk is priced in equities (e.g., Pan [2002]). Figure 6 plots the five-minute moving sums of squared tick-by-tick returns on the SPX in the three-day window around the FOMC announcement. As one may suspect, realized volatility jumps at 2:15pm on scheduled FOMC days. Yet, as we documented before, the FOMC announcement return is earned before the actual release. Because of the timing difference, it is therefore difficult to reconcile the pre-FOMC drift with pure jump risk at the announcement. That being said, we will discuss alternative models below in which informational frictions or limited market participation can give rise to smooth asset price adjustments in anticipation of events that represent jump risks.

We turn next to volatility and liquidity risk. First we note from Figure 6 that realized volatility is somewhat lower ahead of the FOMC announcement, and, as discussed below, the same holds for implied volatility (as measured by the VIX). Starting with Black [1976], a number of papers have shown a negative contemporaneous correlation between volatility and returns. Campbell and Hentschel [1992], in particular, discuss a "volatility feedback effect" where causality runs from volatility to returns. In that explanation, because of its persistence, an unexpected decline in volatility leads to a downward revision of future expected volatility, and thus to lower risk.

A large literature has also documented a negative correlation between equity returns and trading liquidity (Amihud and Mendelson [1986], Campbell, Grossman, and Wang [1993], Pastor and Stambaugh [2003] and Acharya and Pedersen [2005] among others). While most of the literature focuses on the cross-section of returns, a few papers have also studied the impact of liquidity on market-wide returns.[21]

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 basket with measures on tick-by-tick trades and quotes on the SP500 E-mini futures, which started trading in 1997, and the

[21] Amihud [2002], for instance, constructs an simple measure of illiquidity and documents a positive relationship between illiquidity and future excess returns, and a negative relationship between contemporaneous unexpected illiquidity and excess returns in U.S. equities. He rationalizes the latter result with the notion that higher realized illiquidity increases expected illiquidity which in turn raises expected stock returns and lowers contemporaneous stock prices.

SPDR S&P500 exchange-traded fund (SPY, available to us since 1996). Both track the SPX very closely and exhibit almost identical pre-FOMC announcement returns as the cash index itself.

Figure 7 shows five minute average trading volumes on the most traded (either first- or next-to-front) E-mini SP500 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. For comparison, we also superimpose intraday average relative volumes on non-FOMC days. Trading volumes on the day prior to an FOMC announcement follow the typical U-shaped pattern on other days. Not surprisingly, on days of scheduled FOMC meetings volumes spike at the time of the FOMC announcement. Earlier in the day, trading volumes slowly decline from the high opening levels, as on other days, but bottom out at about a 15% lower level than on regular days.

In sum, realized volatility and liquidity are both lower in the pre-FOMC drift time window. This is consistent with the fact that no new FOMC information is consistently being released during the purdah period. We assess whether the reduction in these two factors can explain the pre-FOMC return by including volatility and liquidity proxies as controls X_t in our main regression (1). Since their expected and unexpected components may play different roles in explaining stock returns, we first decompose all measures of volatility and liquidity into an innovation and a component known at time $t-1$ using a simple AR(1) model.

Table 11 provides estimation results for the dummy variable regression (1) where the dependent variable is the 2pm-2pm excess return on the SPX. We use liquidity measures defined on the SPY which are available on a longer sample than the E-mini futures. The sample in this regression only starts in January 1996. We first re-estimate the pre-FOMC dummy regression without controls. Over the shorter sample the pre-FOMC drift is 53 basis points for the SPY with a t-statistic well above 4 (column 1). When we include the 24-hour lagged trading volume and its contemporaneous innovation, the coefficients on lagged liquidity and its innovation have the expected signs and are both strongly statistically significant. In particular, innovations to liquidity are negatively correlated with stock returns suggesting that investors demand compensation for being exposed to liquidity risk. The pre-FOMC dummy coefficient drops to 43 basis points, but remains highly statistically significant. This could potentially suggest that the pre-FOMC return is partially compensation for lower aggregate market liquidity ahead of scheduled FOMC announcements.[22]

[22] We run the same regression using the bid-ask spread and the Amihud price impact measure for the SPY as measures of liquidity. While they provide qualitatively similar results, these indicators are less significant and the coefficient on the FOMC dummy drops by a smaller amount compared to the regression based on trading volume.

We next study the impact of stock market volatility on pre-FOMC returns. We control for the lagged (2pm on the previous day) level and the daily innovation of the VIX index, which measures the option-implied volatility of the SPX. Column 2 in Table 11 provides these results. While the lagged level of the VIX has virtually no impact on contemporaneous returns, the innovation is very strongly negatively correlated with returns. As previously discussed, this result is consistent with Campbell and Hentschel [1992]. More importantly, adding the VIX innovation as a control variable reduces the point estimate on the pre-FOMC dummy by 20 basis points, or about a third of the average pre-FOMC return in this sample. However, the estimated dummy coefficient of 33 basis points is still economically and statistically very significant. The results of this regression therefore suggest that a sizeable fraction of the pre-FOMC drift might be explained by the fact that implied equity market volatility drops ahead of scheduled FOMC announcements.

In order to understand whether liquidity and volatility provide independent information about pre-FOMC returns, we control for both in a joint regression, reported in column 4 of the Table. These results show that while the innovation to the VIX retains its significance, both the lagged level and the innovation of SPY trading volume essentially become uninformative. Moreover, the pre-FOMC dummy coefficient remains strongly significant at 32 basis points.

So far, the analysis in this section shows that a reduction in implied volatility, and to some extent also a reduction in trading volume, on days of scheduled FOMC announcements appear to account for some fraction of the average pre-FOMC returns. Moreover, it should be kept in mind that the volatility feedback effect predicts a negative causal effect from *innovations* to volatility and returns. Hence, we can only attribute a share of the pre-FOMC return to volatility if the estimated innovations from the AR(1) regression of the VIX on its lagged level represent actual surprises to market participants. Indeed, these surprises might be overstated on days of scheduled FOMC announcements if volatility were predictably lower on those days. In the last column of the table, we reestimate the joint regression using as regressors the innovations from an AR(1) of the VIX and volume on their own lags and the pre-FOMC dummy. While the coefficient on the VIX innovation is unaffected, the pre-FOMC dummy is now again equal to 52 basis points.

In sum, a fraction of the pre-FOMC returns may be accounted for by the lower market volatility and trading volume ahead of FOMC announcements, to the extent that these declines had been unexpected. Moreover one would still need to rationalize the declines in volatility and liquidity. We discuss one such theory in the next section along with others that can give rise to a drift in stock prices ahead of scheduled announcements.

4.2 Other Explanations

In the previous section, we found it hard to rationalize the pre-FOMC announcement return with standard risk-based explanations. In this section, we consider several other candidate explanations. We then discuss different models which may give rise to price drifts ahead of scheduled announcements. Where these theories imply predictions that are testable with the available data, we perform the relevant tests.

Before turning to that discussion, we argue next that information leakages as a potential source of the pre-FOMC drift is inconsistent with our empirical findings. As discussed in Section 2, there is no official communication by Federal Reserve officials in the pre-FOMC window due to the purdah period, a self-imposed guideline to refrain from any discussion of policy issues in the days ahead of FOMC meetings. Consistently, the volatility of equity returns as well as the trading volume are extremely low before and jump at the announcement. Further, as discussed in the next section, we find that the pre-announcement returns do not predict the post-announcement reaction. Finally, while the pre-FOMC returns are a phenomenon common to equities worldwide, there is no such drift in U.S. fixed income assets which arguably are the most sensitive to monetary policy.

We next build some intuition about the source of the pre-FOMC return by correlating the time-series of these returns with a few explanatory variables.

4.2.1 The Time Series of Pre-FOMC Announcement Returns

Figure 3 shows the time series of pre-FOMC announcement returns (green line) along with the one-year moving average of these returns (black line) and on non-FOMC days (red line) from 1980-2011.[23] As seen from the black line, one-year average pre-FOMC returns remained positive for the majority of the sample, and turned negative only for brief periods of time. Moreover, eye-balling the pre-FOMC return series it appears that they are somewhat higher around recessions and in periods of financial turbulence such as the 1987 stock market crash or the 1998 LTCM crisis. We study the potential determinants of the pre-FOMC returns by regressing the time series of returns on explanatory variables capturing business cycles, monetary policy cycles, market participants' expectations of future Fed policy, market uncertainty, and the surprise component of monetary policy decisions.

The results of these regressions are provided in Table 9 for the 1994-2011 sample and in

[23]The large right-tailed observation (October 29, 2008) that we exclude in Table 5 is excluded from the pre-FOMC moving average and marked with an "X". We also exclude this observation from the regressions discussed next.

10 for the 1980-2011 sample. All explanatory variables except for dummy regressors are standardized to have a zero mean and unit variance 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. Based on this evidence the counter-cyclicality of pre-FOMC returns has been rather weak. Yet, a recession dummy is only a coarse measure of economic activity and furthermore only known to market participants ex-post. To address these issues, in the next column we consider annual growth rates of industrial production (IP) as well as annual CPI inflation as regressors. Both measures are computed from real-time data. The two coefficients are slightly negative but statistically insignificant in the two samples, suggesting indeed that pre-FOMC returns are not strongly countercyclical.[24] The next column of Table 9 shows a regression on dummy variables for periods of monetary policy easing and tightening.[25] The results show 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. The coefficients on both the easing and tightening dummies are economically and statistically zero in the full sample from 1980-2011.

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 daily one through five year zero-coupon Treasury yields from Gurkaynak, Sack, and Wright [2007]. As we do not access intraday yield curve data, we lag the principal components by two days with respect to the FOMC announcement day to get an ex-ante snapshot of the information in the yield curve available to market participants right before the trading window over which we observe the pre-FOMC returns. As shown in the fourth column of Table 9, the slope enters with a negative coefficient that is significant at the 10% level. 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 the pre-FOMC returns are related to equity market uncertainty

[24] 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 **?**

[25] 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 during which the Federal Reserve conducted large-scale asset purchase programs. The chronology that we obtain at is very similar to the one in Adrian and Estrella [2008]. A third regime in which the Federal Reserve is neither tightening nor easing is not included in the regression.

as measured by the VIX at the market close two days before the scheduled meetings. As shown in Column 5, the VIX is strongly significant with a coefficient of 0.31 in the 1994-2011 sample. Hence, a one-standard deviation change in the VIX would have increased the pre-FOMC return by 31 basis points over that sample. Moreover, the adjusted R^2 of the regression is an impressive 10%. 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, and the adjusted R^2 of the regression still remains high at 8%.

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 (column 6). Fed funds surprises are constructed as in Bernanke and Kuttner [2005] and Gürkaynak, Sack, and Swanson [2005] over short windows around FOMC announcements from 2pm to 3pm. For the SPX we use announcement returns over the same window.[26] The coefficients on the futures-implied policy surprise are statistically 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.

As evidenced by the one-year moving average of pre-FOMC returns in Figure 3 there seems to be some persistence in the pre-FOMC return. To assess whether there is time series predictability of the 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 of future pre-FOMC returns with a large positive sign for both samples (column 7). Above, we have found 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. In order to assess whether there is serial correlation in the returns that is not captured 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 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. Below, we attempt to square some of these facts

[26] From 1994-2011 we follow Gürkaynak, Sack, and Swanson [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 in the SPX is from 2 pm to 3 pm on FOMC announcement days from 1994 onwards and the daily return of the SPX on the day after the FOMC meeting before 1994 as our equity-based measure of monetary policy surprises.

with the predictions of models that feature political risk, investor inattention, learning, or limited participation in the stock market.

4.2.2 Political Risk, Investor Inattention, and Limited Participation

Pastor and Veronesi [2011] proposed a general equilibrium model in which the public sector affects stock returns through a policy decision that occurs at specified dates. In their model, investors demand a risk premium for being exposed to political uncertainty regarding the ex-ante unknown policy action. As a result, expected stock returns are higher in periods when investors receive more signals about likely policy changes. Without these signals, stock prices in the political risk model would follow a martingale prior to the announcement and jump at the announcement (driven by a reduction of uncertainty). Hence, learning about the likely outcome of the announcement distinguishes the political risk story from the pure jump risk explanation that we dismissed above.

As discussed before, Federal Reserve officials are subject to a one week purdah period prior to scheduled FOMC announcements. It is therefore implausible to assume that substantial new information about the upcoming policy decision is being released in the 24 hours prior to FOMC announcements. However, media coverage of the Federal Reserve generally picks up markedly before the meeting as illustrated in Figure A.5 in the Appendix. This chart plots the time series average of the combined number of articles about the Federal Reserve that appeared each day in the print issues of the *Wall Street Journal* and the *Financial Times* over a ten day window around FOMC announcements. While typically the largest number of articles was published the day after FOMC meetings, the figure shows that media coverage increased significantly on the day of the announcement (meaning that the articles have been published before the announcement). Thus, to the extent that investors use media reports to update their beliefs (rather than, for example, speeches by Fed officials occurring in the prior weeks), they may indeed receive signals about future Fed policy right ahead of FOMC announcements and consequently political uncertainty might indeed increase.[27]

The model by Pastor and Veronesi [2011] has at least three testable implications that are relevant in our context. First, the political risk premium is larger in weak economic conditions. Second, stock returns should be more volatile in times of higher political uncertainty. Third, stock returns should be more cross-correlated prior to policy changes. As we have seen in Section 4.2.1, the pre-FOMC announcement return is indeed economically slightly larger in

[27] 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 of the large effects of media reports on individual companies' stock prices.

recessions than in expansions, consistent with the political uncertainty model. However, that effect is only marginally statistically significant in the 1994-2011 sample and is not significant at common levels over the full sample from 1980-2011. The model's prediction that stock returns are more volatile in periods of political uncertainty is easily dismissed in our data, see Figure 6. However, our finding that a single market factor appears to be able to explain the cross-sectional variation of industry returns on FOMC announcement days appears to be in line with the implication of the political risk model that the cross correlation of stocks should be larger on days of higher political uncertainty.

In sum, the political risk premium model of Pastor and Veronesi—or some slight modification that allows for media as issuers of public signals—qualitatively captures some of our empirical findings but appears inconsistent with the pre-FOMC volatility pattern.

Lamont and Frazzini [2007] have recently documented an upward drift in individual stock prices prior to scheduled earnings announcements. The authors discuss "attention grabbing" as a potential behavioral explanation of their finding. According to this explanation, investors are more likely to buy stocks which have attracted their attention through media coverage of forthcoming earnings announcements. Since individual investors are often short selling constrained, their decision to sell stocks is likely less affected by such events than their decision to buy stocks. Consequently, information-grabbing events may induce predictable trading behavior of individual investors. While the pre-earnings announcement drift is qualitatively similar to the pre-FOMC announcement drift, and we cannot exclude that such an effect may be at play, it seems unlikely that a bias of small investors could itself generate such large abnormal returns for the aggregate U.S. and other international stock markets.

However, investor inattention is not necessarily an irrational phenomenon and even more sophisticated investors may exhibit some form of inattention. Indeed, as first discussed by Sims [2003], economic agents may face practical constraints as to how much relevant information they can process in real time. Consequently, they may choose to rationally pay attention to some signals with higher precision than others. Such a framework of rationally inattentive investors has recently been employed for example in Kacperczyk, Nieuwerburgh, and Veldkamp [2009] to explain the business cycle variation in the relative performance of mutual fund managers in picking stocks and timing the market. In their model, investors allocate their attention between a signal about the aggregate and a signal about the idiosyncratic component of cash flows, subject to a constraint. At each point in time, investors optimally focus on shocks that have the largest impact on returns.

Such a model might qualitatively explain some of our empirical findings. Indeed, stock

market investors may decide to process information about the likely outcome of the FOMC decision only shortly before the announcement when equity returns are more responsive to news about monetary policy. At other times, instead, equity investors may focus on some of the many other factors that affect equity cashflows. The increased media coverage of the Fed right before FOMC announcements documented above is potentially in line with increased investor attention ahead of the announcement. Hence, provided that the FOMC announcement, on average, has a positive impact on stock returns, the information processing constraint may result in a drift prior to the announcement, as investors focus on the announcement only at that time.[28]

But why should equity prices react positively to FOMC announcements? In a model with Bayesian mean-variance investors as in Kacperczyk, Nieuwerburgh, and Veldkamp [2009], stock prices may rise because, after learning the signals, posterior expected mean returns are higher and/or the posterior variance of payoffs is lower. That is, positive signals (relative to investors' prior) about a likely policy easing may push equity prices higher. Alternatively, as investors learn more about the likely policy action, posterior uncertainty is reduced and stock prices increase. The time-series evidence in Section 4.2.1 suggests that both effects may be at work. Indeed, we find that the pre-FOMC announcement returns are high when market participants expect the Fed to loosen monetary policy and when the uncertainty about future Fed policy (as measured by the disagreement among professional forecasters) is low. Hence, if investors only update their expectations about monetary policy shortly before the FOMC announcement, then these two effects could well be consistent with the drift that we observe.

But even if consistent with the time-series pattern, how likely is it that rational inattention could explain the large unconditional return in our sample? While there may indeed be a reduction of posterior variance ahead of FOMC meetings as investors become better informed about monetary policy, the magnitude of this effect would likely be limited. In addition, it is not clear why a similar effect would not be at play on days of important macroeconomic news announcements, such as the employment report, when investors observe other informative signals about the state of the economy. Indeed, as we saw before, these other announcements do not feature abnormal returns in our sample.

Can higher posterior mean returns explain the large magnitude of the pre-FOMC announcement drift? Our sample from the early 1980s through 2011 featured a secular decline of policy rates. It is precisely in this sample period that some commentators and academic papers have thought of central bank policy as having an asymmetric impact on the financial

[28]Fixed income investors, instead, may pay attention to the Fed at all times, as the future path of short term interest rates is arguably the most important determinant of fixed income returns.

sector, with limited negative impact in booms and support in busts (see, for example, Diamond and Rajan [2011]). Even if one might be inclined to argue that this period has been characterized by such an asymmetry, in a rational expectations equilibrium these investors should not have been consistently surprised. In other words, unless one is willing to assume that the Fed systematically surprised equity investors over this period, the higher posterior means channel in the investor inattention model is unlikely to explain the pre-FOMC announcement drift.

Investor inattention may also give rise to risk premia through time varying stock market participation. Duffie [2010] presents a model where inattentive investors trade only infrequently and where frequent investors (specialists) earn a premium for bearing a larger share of overall market risk around certain events. The original model studies price dynamics ahead of anticipated supply and demand shocks. In our setup, we consider a slight modification and assume that inattentive investors are less likely to trade shortly ahead of FOMC announcements because of the risk of being at an informational disadvantage over specialists. A larger share of the market risk would then be borne by the specialists, and in the mean-variance setup of Duffie [2010], they will demand compensation in the form of higher expected returns ahead of the announcement. In contrast with the political risk premium model or the rational inattention setup discussed earlier, in this framework no additional information or increase in overall uncertainty would be required to boost pre-announcement returns. Instead, the positive excess return would be exclusively driven by a temporary reduction of stock market participation.

Qualitatively, such an explanation is appealing as we find that both instantaneous volatility as well as trading volume are somewhat lower just before FOMC announcements, see Section 4.1. However, the limited participation model would also predict lower returns on days surrounding FOMC announcements when inattentive investors are still in, or returning to, the market. Yet, as we have shown in Section 3.3, the pre-FOMC returns are very persistent and not reversed in previous or subsequent trading sessions. Thus, we find the limited participation model to be counterfactual with respect to the persistence of pre-FOMC returns.

In sum, although we see each of the three theories as somewhat appealing, they appear counterfactual in some dimensions.

5 Conclusion

We have documented that excess returns on U.S. and international equities have been significantly higher in anticipation of monetary policy actions taken at scheduled meetings of the Federal Open Market Committee (FOMC) over the past few decades. The pre-FOMC returns are not reversed in subsequent trading sessions, are robust to outliers, and their statistical significance is not driven by small sample issues or data-snooping. Since the 1980s, pre-FOMC returns have increased over time, especially after 1994 when FOMC decisions became public signals. In both samples, pre-FOMC returns account for large fractions of realized stock returns. We do not find pre-FOMC effects in U.S. Treasuries and in eurodollar or federal funds rate futures, instruments that are highly sensitive to monetary policy. Other major U.S. macroeconomic news announcements also do not feature abnormal pre-announcement returns in U.S. stocks. The time series of pre-FOMC returns is somewhat countercyclical. They also tend to be higher in periods when market participants expect the Fed to ease policy, as implied by the slope of the Treasury curve, when implied equity market volatility is higher, and when past pre-FOMC returns have been higher. Combined, these three factors explain a significant fraction of the time series variation of pre-FOMC returns.

The evidence in this paper suggests that jump risk, and standard consumption-based asset pricing models, and an information leakage story do not explain the pre-FOMC drift. However, we find that a share of the pre-FOMC returns may be accounted for by lower trading volumes and, especially, lower market volatility ahead of FOMC announcements. The "volatility feedback effect" of Campbell and Hentschel [1992] would be consistent with our evidence, but only to the extent that the pre-FOMC volatility declines in volatility had been unexpected. Moreover one would still need to explain the sources of these declines.

We finally discussed three pricing models that could yield a smooth drift ahead of announcements featuring political risk (Pastor and Veronesi [2011]), rationally inattentive investors (Kacperczyk, Nieuwerburgh, and Veldkamp [2009]), and limited stock market participation (Duffie [2010]). None of these models are fully consistent with all our findings. The political risk explanation, with agents learning ahead of the announcement, appears at odds with the lower volatility of stock returns in the hours before the FOMC announcement, among other things. Rationally inattentive investors that optimally focus on FOMC-relevant information only shortly ahead of the announcement may generate a drift either because of lower posterior variance, as agents update their beliefs, or because of higher posterior mean returns following positive signal realizations (that is, when signals point to accommodative policy). Consistent with this theory, we find that pre-FOMC returns are higher when the

slope of the yield curve implies future rate cuts. However, investors would have had to be consistently surprised about monetary policy for long periods of time, and significantly so, to quantitatively explain the magnitude of the pre-FOMC return. Finally the time-varying limited market participation model, which is consistent with the observed liquidity patterns, would predict that the abnormal returns ahead of the announcement are reversed after the event. Instead, we find the pre-FOMC returns to be persistent. In sum, as of this paper's writing, the pre-FOMC announcement drift is a puzzle.

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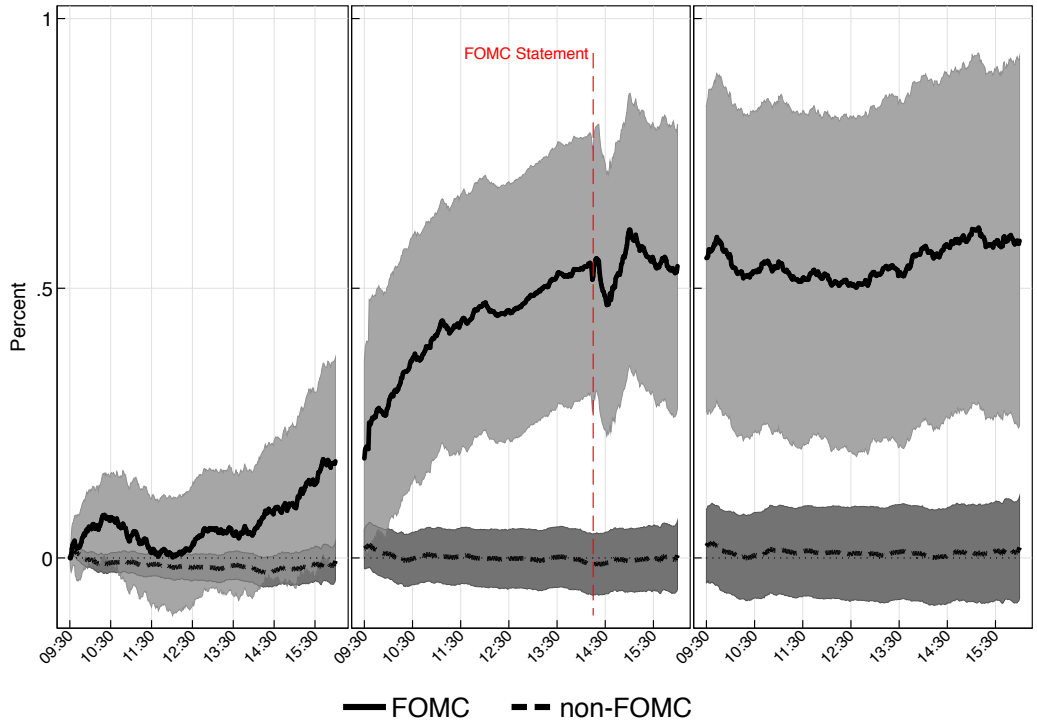
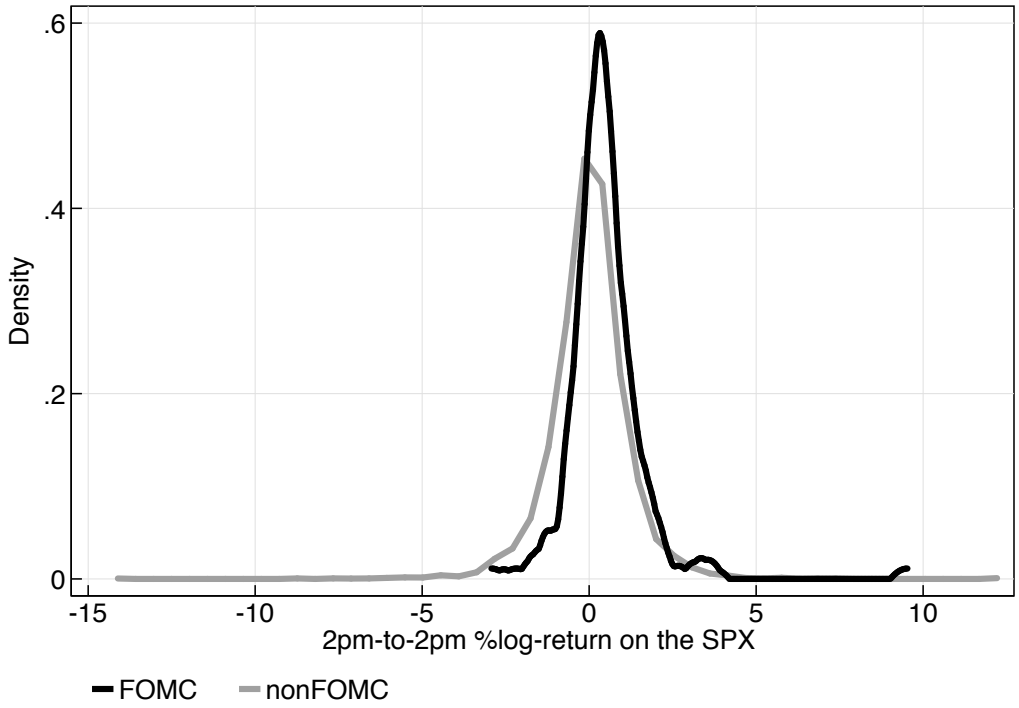
Figure 1: Cumulative Returns on the SPX



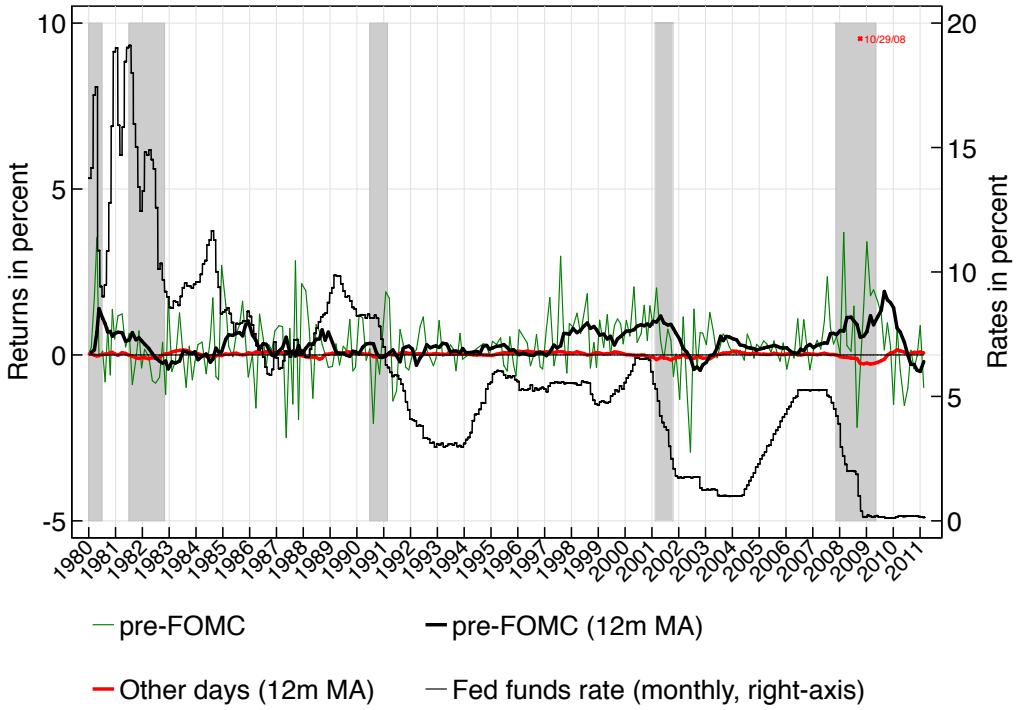
NOTES: This chart plots the average cumulative one-minute return on the S&P500 index (SPX) over a three day window. The solid black line shows the average cumulative return on the SPX from 9:30 a.m. EST on the days before scheduled FOMC announcements until 4:00 p.m. EST on days after scheduled FOMC announcements. The dashed black line shows the cumulative return on the SPX over all other three day windows. The gray shaded areas denote the pointwise 95% confidence bands around the two means, respectively. 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 during that period.

Figure 2: Empirical Densities of 2pm-to-2pm SPX Returns: 1994-2011



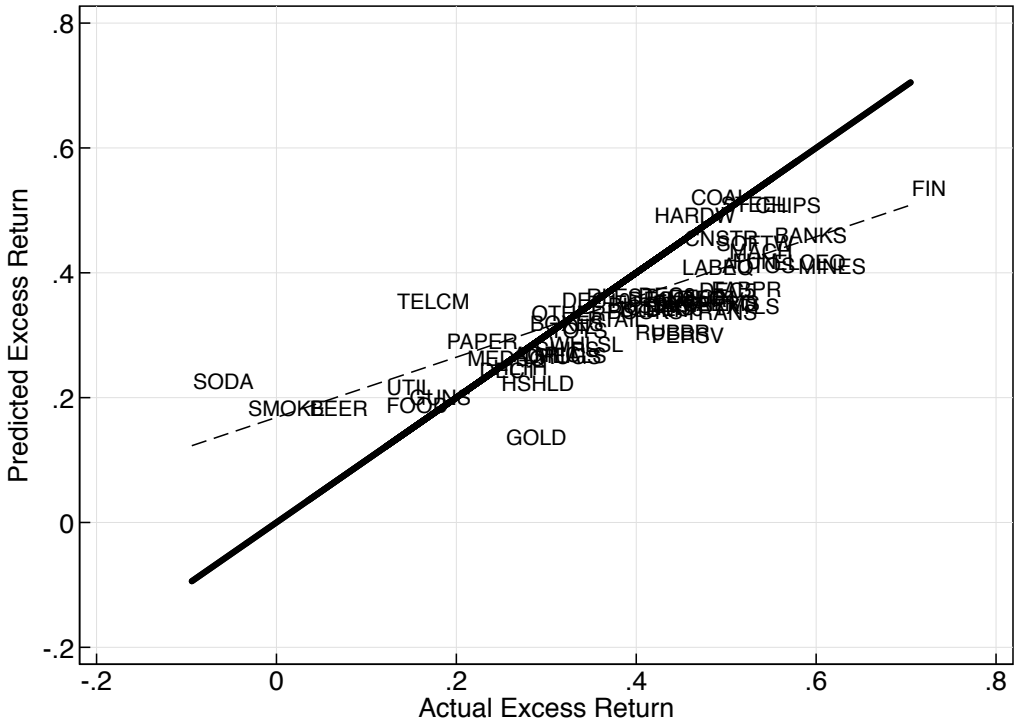
NOTES: This chart plots empirical densities of the 2pm-to-2pm return on the SPX. The solid black line shows the return on days ahead of scheduled FOMC announcements and the gray line shows the return on average cumulative return all other days. The sample period is from September 1994 through March 2011.

Figure 3: Time Series of pre-FOMC Announcement Returns on the SPX



NOTES: This chart plots the time series of pre-FOMC announcement returns (post-1994: cum dividend log excess return on the S&P500 from 2pm on the day before 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) from Jan 1980 through Mar 2011. 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 non pre-FOMC days. The grey line is the monthly average of the effective federal funds rate.

Figure 4: CAPM for Industry and Size Portfolios on FOMC Announcement Days

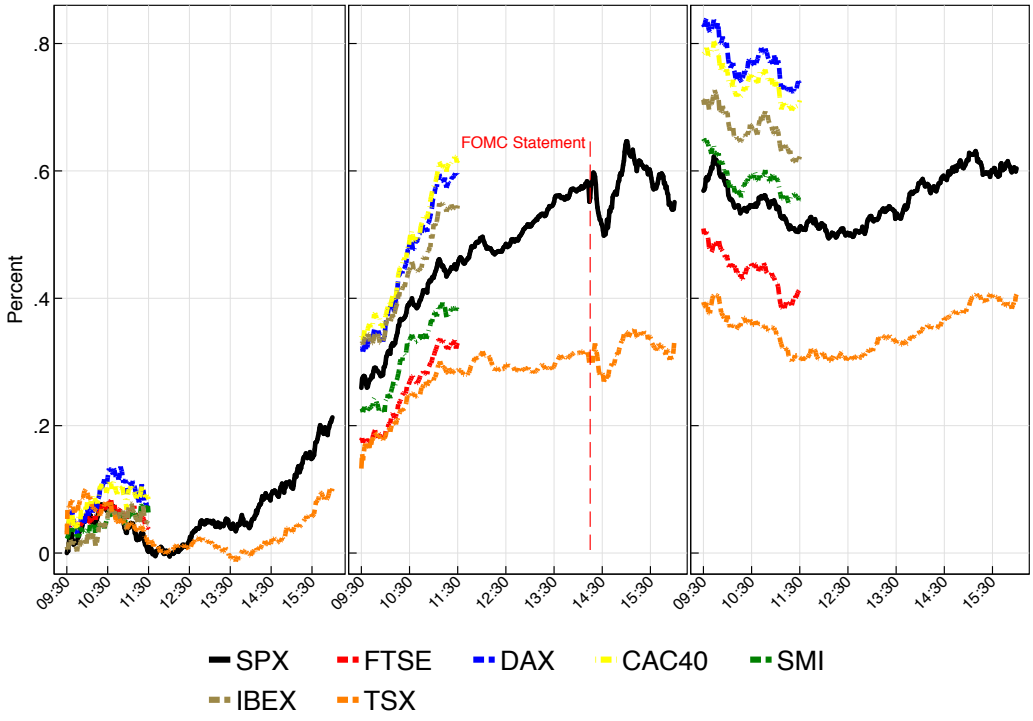


NOTES: This chart documents the fit of the CAPM for the 49 Fama-French industry portfolios and the ten size decile portfolios on FOMC announcement days. For each portfolio, the horizontal axis shows the average excess return earned on scheduled FOMC announcement days (in percent) whereas the vertical 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 the daily frequency (using all days in the sample). The result from the second stage cross sectional regression is

$$\bar{R}_{FOMC} = -.099_{[0.10]} + 0.468_{[0.149]}\hat{\beta}$$

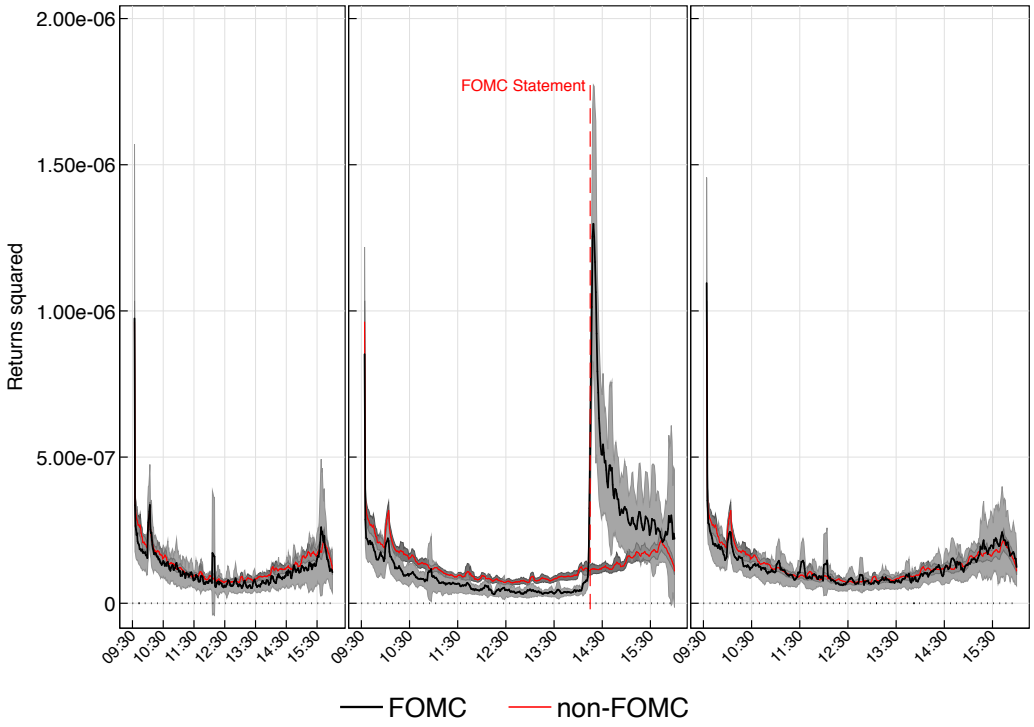
where the standard errors are adjusted for the estimation error in betas following Shanken [1992]. The R^2 of the regression is 65%. The dashed line shows the estimated regression line and the solid black line shows the 45 degree line.

Figure 5: Cumulative Returns on International Stock Market Indexes Around FOMC Announcements



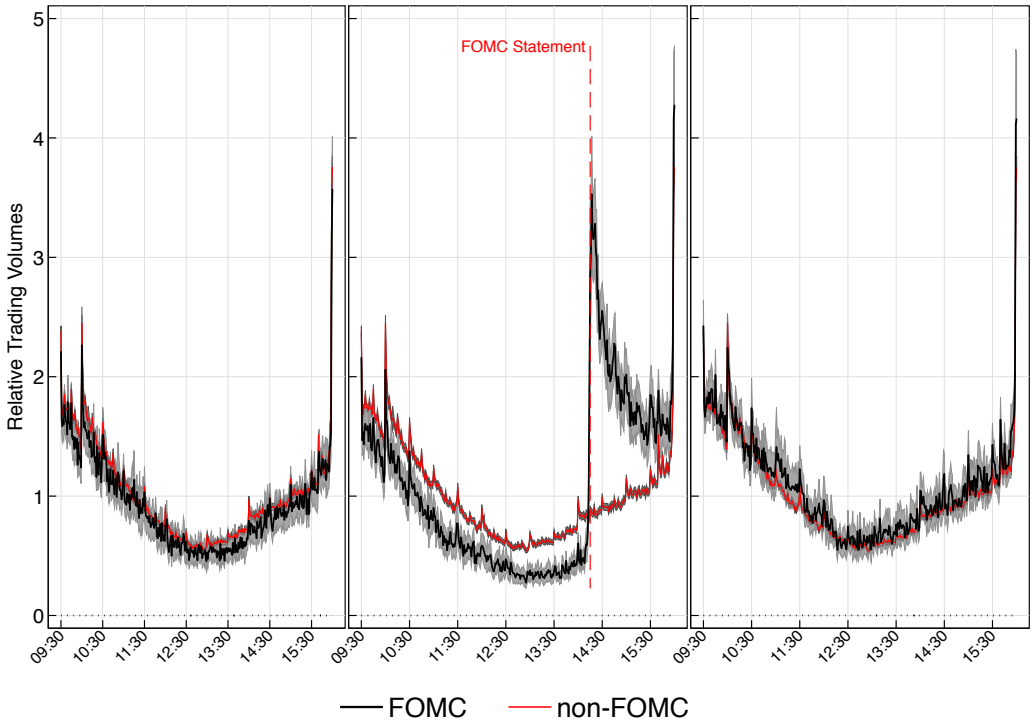
NOTES: This chart plots the average cumulative one-minute return on the SPX and other major international equity market indexes over the three day window around scheduled FOMC announcements. The solid black line shows the average cumulative return on the SPX from 9:30 a.m. EST on the days before scheduled 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 6: Intraday Realized Volatility of SPX Returns



NOTES: This chart documents the pattern of intraday realized volatility over the three day window around scheduled FOMC announcements. The solid black line shows the five minute rolling sum of squared tick-by-tick returns on the SPX from 9:30 a.m. EST on the days before scheduled FOMC announcements until 4:00 p.m. on EST days after scheduled FOMC announcements. The sample period is from September 1994 through March 2011. The dashed black line shows the same object over all other three day windows. Shaded areas represent pointwise 95% confidence bands around the mean.

Figure 7: Intraday Trading Volumes for the E-mini SP500 Future



NOTES: This chart documents the pattern of intraday trading volume of E-mini SP500 futures over the three day window around scheduled FOMC announcements. The solid black line shows the five minute rolling average of the 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. The sample period is from January 1996 through March 2011. The dashed black line shows the same object over all other three day windows. Shaded areas represent pointwise 95% confidence bands around the mean.

Table 1: Summary Statistics

	FOMC					non-FOMC				
	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

NOTES: This table reports summary statistics for the variables used in this paper on FOMC days and non-FOMC days. The sample period is 1994:09-2011:03 in the top panel and 1980:01-2011:03 in the bottom panel. SPX-2pm denotes the cum-dividend log excess return on the S&P500 index from 2pm the previous day to 2pm the current day. SPX denotes the close-to-close log excess return on the S&P500 index. DAX, FTSE100, CAC40, IBEX, SMI, TSX and NIKKEI denote the close-to-close cum-dividend log excess returns on the German, British, French, Spanish, Swiss, Canadian, and Japanese benchmark stock indexes, respectively. FF and ED4 are the 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. Tsy3M,...,Tsy10y are the daily rate changes for the respective on-the-run Treasury bills and notes for the 2-year and 10-year maturity. 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 post-1980 sample are based on 2pm-to-2pm in the post-1994 sample and close-to-close on the day of the FOMC meeting (day before FOMC news) in the 1980-1993 sample.

Table 2: Main Regression Table: Daily SP500 excess returns

Dependent Variable: %Log-return on SP500 stock market index						
Type of return:	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

NOTES: This table summarized results for the (pre-)FOMC dummy variable regression 1 using cum dividend log excess returns on the S&P500 over different windows as the dependent variables. Corresponding to the columns, the dependent variables are: (1&2) the cum dividend log excess return on the S&P500 from 2pm on the day before a scheduled FOMC announcement to 2 pm on that day, (3) the cum dividend log excess return on the S&P500 from 2pm on days of scheduled FOMC announcements until the market close on those days, (4) the excess return on the S&P500 from the market close the day before until the market close on the day of scheduled FOMC announcements, (5) the excess return on the S&P500 from the market close the day before until 2 pm on the day of scheduled FOMC announcements, and (6) the excess return on the S&P500 from the market close two days before scheduled FOMC announcements until 2 pm on the day of scheduled FOMC announcements. "pre-FOMC dummy" is a variable that takes on the value of one when a scheduled FOMC announcement has been released in the following 24 hour interval and zero otherwise. "FOMC dummy" is a variable that takes on the value of one when a scheduled FOMC announcement has been released in the return window studied. "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 error shown in brackets.

Table 3: Daily SP500 excess returns: Alternative samples

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

NOTES: This table reports pre-FOMC dummy variable regression results for different subsamples, as given in the row labeled "Sample". From Sep 1994 onwards, the dependent variable is the cum dividend log excess return on the S&P500 from 2pm on the day before a scheduled FOMC announcement to 2 pm on that day. Before 1994, the dependent variable is the excess return on the S&P500 from the market close the day before until the market close on the day of scheduled FOMC meetings. "pre-FOMC dummy" is a variable that takes on the value of one when a scheduled FOMC announcement has been released in the following 24 hour interval from 1994 onwards, on days of scheduled FOMC meetings (before the policy decision could have been known to market participants) before 1994, and 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 error shown in brackets.

Table 4: SP500 returns before, at, or after the FOMC news

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	

NOTES: This table reports results for dummy variable regressions analyzing average excess returns in the S&P500 before, on, and after days of scheduled FOMC meetings. The sample in the left panel starts on Sep 1, 1994 and ends on Mar 30, 2011. The dependent variable in that panel is the cum dividend log excess return on the S&P500 from 2pm on the day before a scheduled FOMC announcement to 2 pm on that day. The sample in the right panel starts on Jan 2, 1980 and ends on Mar 30, 2011. The dependent variable in that panel is the cum dividend log excess return on the S&P500 on the day of a scheduled FOMC meeting. FOMC news at $t+i$ ($t-i$) denotes a dummy that takes on the value of 1 i trading sessions before (after) the 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. Standard errors in brackets. *** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard error shown in brackets.

Table 5: Summary Statistics: 2pm-to-2pm SP500 excess returns

	All Observations		**Excl. top/bottom 1**	
	FOMC	nonFOMC	FOMC	nonFOMC
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

NOTES: This table reports summary statistics for the 2pm-2pm log excess returns on the SPX on FOMC days and non-FOMC days. 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.

Table 6: International Stock Market Index Regressions

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

NOTES: 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 starts on Sep 1, 1994 and ends on Mar 31, 2011. Samples in the lower panel differ across indexes depending on data availability and are given in the row labeled "Sample". "Observations" denotes the total number of trading days in each sample. "N. of FOMC" denotes the total number of scheduled FOMC meeting days in each sample. *** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard error shown in brackets.

Table 7: Fixed Income

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
	[0.00]	[0.01]	[0.00]	[0.00]	[0.00]	[0.00]
Const.	−0.002	−0.001	−0.001	−0.002	−0.001	−0.001
	[0.00]***	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
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
	[0.00]	[0.01]	[0.01]	[0.01]	[0.00]	[0.00]*
Const.	−0.002	−0.001	−0.001	−0.001	−0.001	−0.001
	[0.00]***	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
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

NOTES: This table reports pre-FOMC announcement dummy variable regressions for some U.S. fixed income assets, discussed in Section 3.7. "pre-FOMC dummy" is a variable that takes on the value of one if the next 24 hour trading interval comprises a scheduled FOMC announcement, and zero otherwise. The sample in the top panel starts on Sep 1, 1994 and ends on Mar 30, 2011. The dependent variables over that sample are yield changes in percent from 2pm on the day before a scheduled FOMC announcement to 2 pm on the announcement day. The samples in the bottom panel differ depending on the data availability but start no earlier than Jan 2, 1980 and all end on Mar 30, 2011. The dependent variables in this sample are close-to-close yield changes in percent on the day prior to the announcement 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 error shown in brackets.

Table 8: ENI Regressions

Dependent Variable: %Log-return of SP500 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

NOTES: 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 included in each regression. 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 error shown in brackets.

Table 9: Time series regressions (post-1994)

	(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

NOTES: This table reports results for regressions of the time series of pre-FOMC announcement returns on various explanatory variables, discussed in Section 4.2.1. 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 variable that takes on the value of one when the corresponding FOMC day falls into a recession as defined by the NBER and zero otherwise. "$\Delta^{12}Log$(IP)" denotes 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 take on the value of 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 through five year zero-coupon Treasury yields from Gurkaynak, Sack, and Wright [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, Sack, and Swanson [2005] over short windows around FOMC announcements from 2pm to 3pm. "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. Standard errors in brackets. *** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard error shown in brackets.

Table 10: Time series regressions (post-1980)

	(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				−0.17
				[0.06]**				[0.07]**
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	0.13
							[0.06]***	[0.07]**
Const.	0.29	0.33	0.32	0.33	0.37	0.35	0.33	0.33
	[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

NOTES: 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 Section 4.2.1. 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. "NBER Dummy" is a variable that takes on the value of one when the corresponding FOMC day falls into a recession as defined by the NBER and zero otherwise. "$\Delta^{12}Log$(IP)" denotes 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 take on the value of 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 through five year zero-coupon Treasury yields from Gurkaynak, Sack, and Wright [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, Sack, and Swanson [2005] over short windows around FOMC announcements from 2pm to 3pm. "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. Depending on data availability, the sample periods may differ across the various explanatory variables, as indicated by the row labeled "Sample". *** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard error shown in brackets.

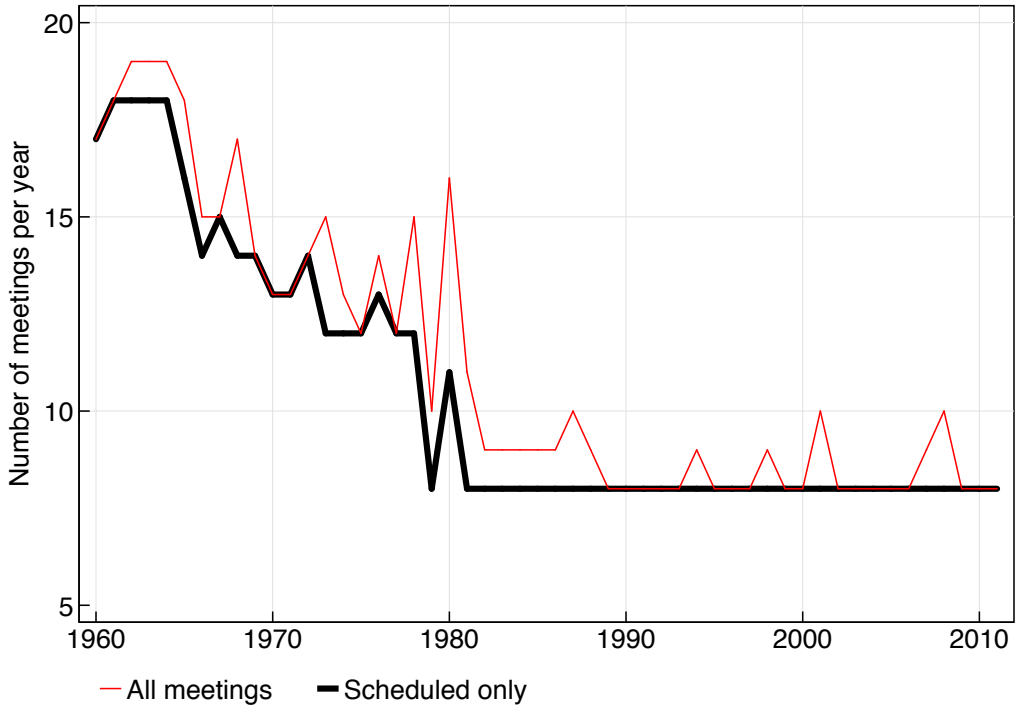
Table 11: Liquidity and Volatility Risk

	(1)	(2)	(3)	(4)	(5)
pre-FOMC dummy	0.53	0.43	0.33	0.32	0.52
	[0.12]***	[0.12]***	[0.07]***	[0.07]***	[0.07]***
Trade Vol (innov.)		−0.69		−0.05	
		[0.06]***		[0.04]	
Trade Vols (lag)		0.15		−0.03	−0.03
		[0.06]***		[0.03]	[0.03]
VIX (innov.)			−0.60	−0.60	
			[0.02]***	[0.02]***	
VIX (lag)			0.00	0.00	0.00
			[0.00]	[0.00]	[0.00]
Trade Vols. (FOMC-innov.)					−0.05
					[0.04]
VIX (FOMC-innov.)					−0.60
					[0.02]***
Const.	−0.00	−0.15	−0.07	−0.04	−0.05
	[0.02]	[0.06]***	[0.06]	[0.07]	[0.07]
Adjusted R2	0.01	0.05	0.68	0.68	0.68
Obs.					3771
N. of FOMC					119

NOTES: 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 Jan 2, 1996 and ends at Mar 30, 2011. "pre-FOMC dummy" is a dummy variable that takes on the value of one if there is a scheduled FOMC announcement in the next 24 hour trading interval. "Trade Vol (innov.)" denotes the residual from an AR(1) regression of the relative trading volume on the SPDR S&P500 exchange-traded fund (SPY) 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 augmented with the pre-FOMC dummy. *** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard error shown in brackets.

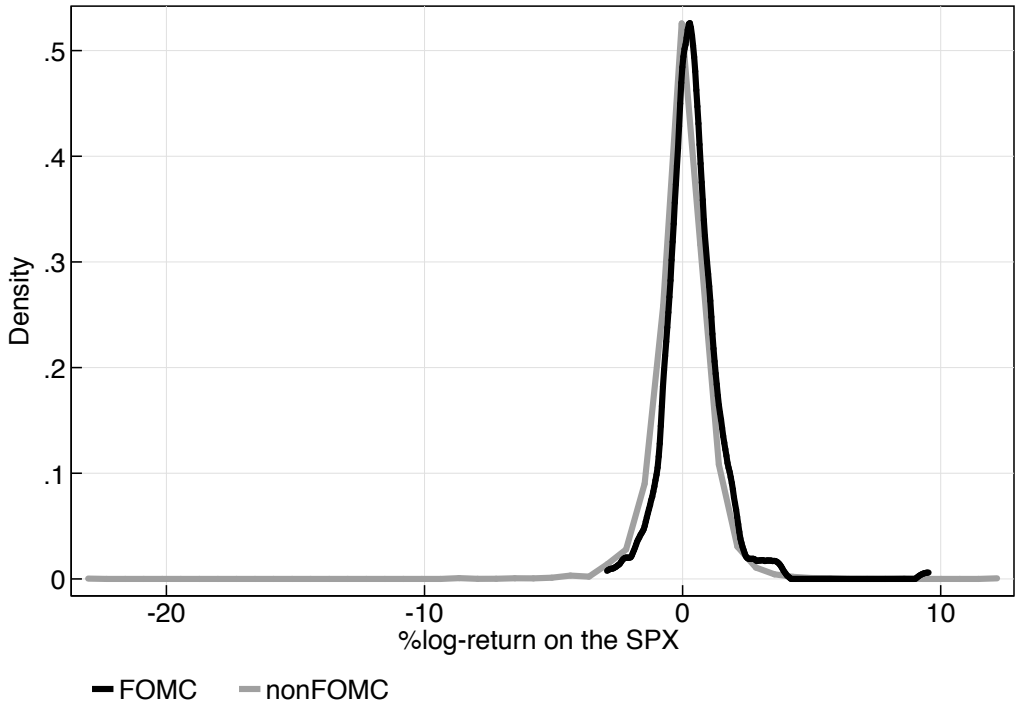
A Additional Figures and Tables

Figure A.1: Number of FOMC Meetings Per Year



NOTES: 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.

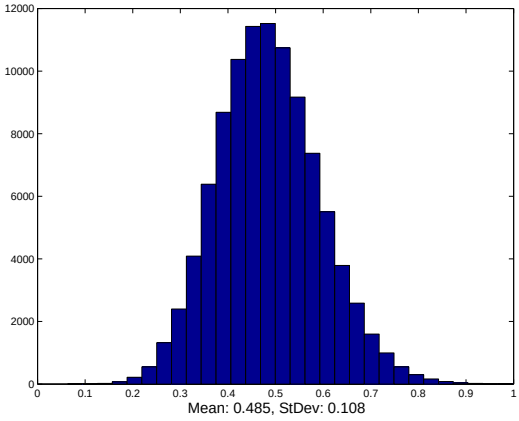
Figure A.2: Empirical Densities of pre-FOMC Returns: 1980-2011



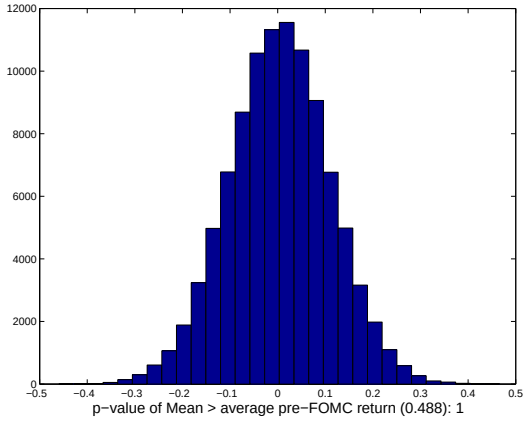
NOTES: This chart plots empirical densities of the 2pm-to-2pm return on the SPX. The solid black line shows the return on days ahead of scheduled FOMC announcements and the gray line shows the return on average cumulative return all other days. The sample period is from January 1980 through March 2011.

Figure A.3: Bootstrap Analysis 1994-2011

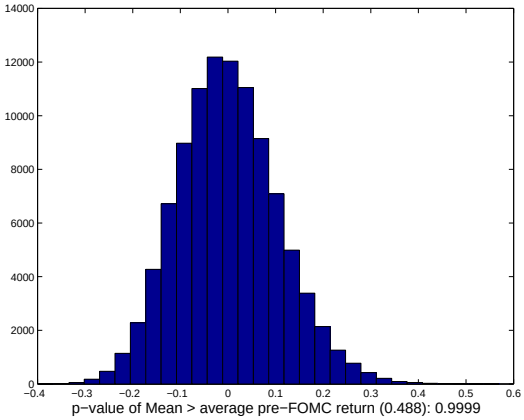
Bootstrapped standard errors for FOMC dummy



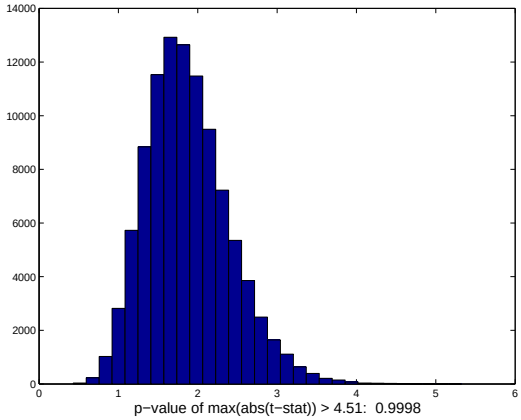
Sampling from non-FOMC Returns



Zero-Mean Pseudo Pre-FOMC Return Distribution



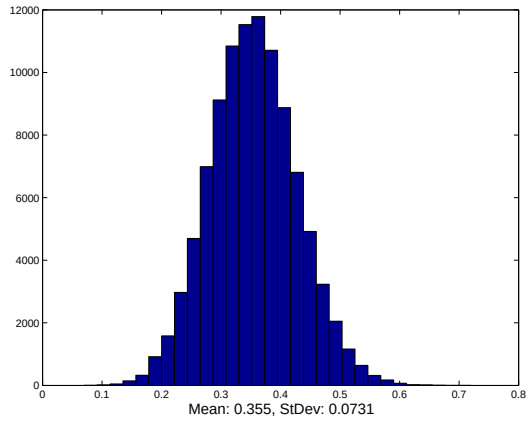
Data-Snooping



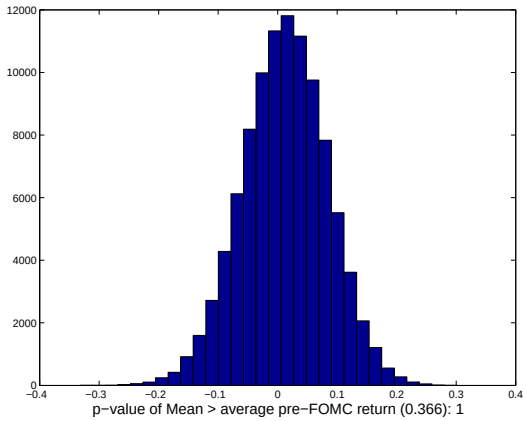
NOTES: This Figure provides histograms of the bootstrap distributions discussed in Section 3.4 for the sample period Sep 1994 - Mar 2011.

Figure A.4: Bootstrap Analysis 1980-2011

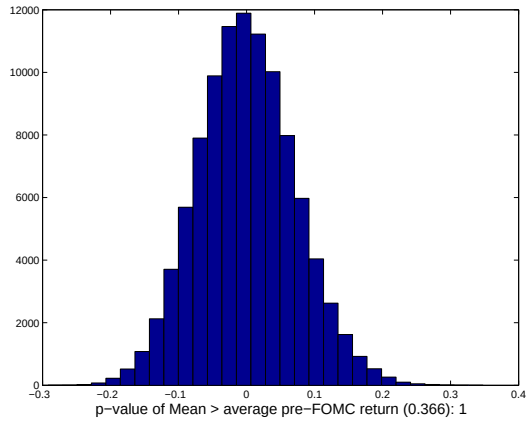
Bootstrapped standard errors for FOMC dummy



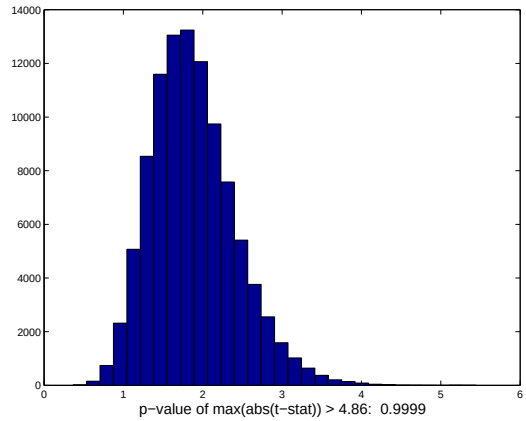
Sampling from non-FOMC Returns



Zero-Mean Pseudo Pre-FOMC Return Distribution

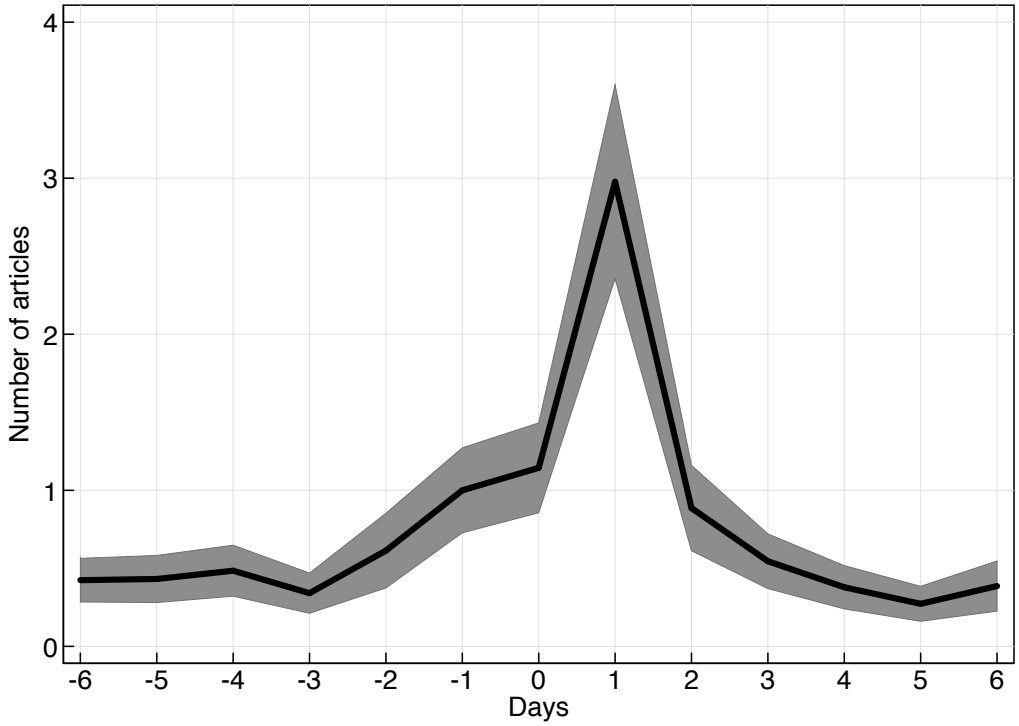


Data-Snooping



NOTES: This Figure provides histograms of the bootstrap distributions discussed in Section 3.4 for the sample period Jan 1980 - Mar 2011.

Figure A.5: Number of Fed-related articles in WSJ&FT around FOMC Announcement Days



NOTES: 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.

Table A.1: Scheduled FOMC meeting dates and times 1994-2011

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]						

NOTES: 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.

Table A.2: Summary Statistics in 1980 sample: SP500 excess returns

	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

NOTES: 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 reported in square brackets. The sample period is Jan 2, 1980 to Mar 31, 2011.

Table A.3: CRSP Value-Weighted Industry Portfolio Regressions: 1994-2011

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

NOTES: 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 0 otherwise. "FOMC Sharpe Ratio" is the annualized Sharpe-ratio on pre-FOMC returns.*** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard error shown in brackets.

Table A.4: CRSP Value-Weighted Industry Portfolio Regressions: 1980-2011

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

NOTES: 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 0 otherwise. "FOMC Sharpe Ratio" is the annualized Sharpe-ratio on pre-FOMC returns.*** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard error shown in brackets.

Table A.5: CRSP Size Portfolio Regressions: 1994-2011

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

NOTES: 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 10 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 0 otherwise. "Annual ex-return FOMC" is the average cumulative annual excess return of FOMC day returns, and "Annual ex-return non-FOMC" denotes the average cumulative annual excess return of non-FOMC day returns 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 error shown in brackets.

Table A.6: CRSP Size Portfolio Regressions: 1980-2011

Dependent Variable: %Log-excess-return of CRSP portfolio index						
Portfolio:	Value Weighted	Equal Weighted	1st Decile	2nd Decile	3rd Decile	4th Decile
FOMC dummy	0.27	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

NOTES: 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 10 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 0 otherwise. "Annual ex-return FOMC" is the average cumulative annual excess return of FOMC day returns, and "Annual ex-return non-FOMC" denotes the average cumulative annual excess return of non-FOMC day returns 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 error shown in brackets.