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The pre-FOMC announcement drift

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The Pre-FOMC Announcement Drift

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Emanuel Moench

Staff Report no. 512
September 2011

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Abstract

Since the Federal Open Market Committee (FOMC) began announcing its policy decisions in 1994, U.S. stock returns have on average been more than thirty times larger on announcement days than on other days. Surprisingly, these abnormal returns are accrued *before* the policy announcement. The excess returns earned during the twenty-four hours prior to scheduled FOMC announcements account for more than 80 percent of the equity premium over the past seventeen years. Similar results are found for major global equity indexes, but not for other asset classes or other economic news announcements. We explore a few risk-based explanations of these findings, none of which can account for the return anomaly.

Key words: FOMC announcements, equity premium

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1 Introduction

Over the past twenty five years a huge body of macroeconomic and financial literature has tried to explain the puzzling fact that, on average, equities earn considerably higher returns than short-dated government debt instruments. While variations of the canonical consumption-based asset pricing model have been proposed as possible solutions to the puzzle, to date, none appears to have garnered widespread support.¹

This paper discusses another puzzling feature of equity returns. We show that since the Federal Open Market Committee (FOMC) began announcing its monetary policy decisions after scheduled meetings in 1994, excess returns on U.S. stocks have on average been more than 30 times larger on announcement days than on other days. Surprisingly, these abnormal returns have been accrued *before* the actual policy announcement which is regularly released at, or around, 2:15 p.m. Eastern Time. Indeed, the excess returns on the S&P500 index earned between 2:00 p.m. the day before scheduled FOMC announcements and 2:00 p.m. on the announcement day account for more than 80% of the U.S. equity premium since 1994. We document very similar pre-announcement effects for other major international equity indices except for Japan.

The pre-FOMC announcement return is persistent and is not reversed on subsequent trading days. It is prevalent across subsamples, but has been highest in the last five years. While the pre-FOMC announcement drift is widespread across U.S. equity prices of different industries and firm sizes, we do not find similar returns in other asset classes. Strikingly, the CAPM does a good job at capturing the cross-sectional dispersion of excess returns on FOMC announcement days, but fails to explain excess returns on all other days. We do not find a pre-FOMC announcement drift in fixed income and foreign exchange instruments. In addition, other major macroeconomic data releases do not feature similar pre-announcement returns.

A large financial and macroeconomic literature has studied asset price responses either to the actual (Cook and Hahn [1989]) or unanticipated (Kuttner [2001]) short-term interest rate decisions of the Federal Reserve (Fed) as well as communication about future policy actions (Gürkaynak, Sack, and Swanson [2005a], Lucca and Trebbi [2009]). For equity markets, Bernanke and Kuttner [2005] document a significant and sizeable stock market response to unexpected policy rate decisions. We see our results as complementary to these

¹While the literature is vast, variations of the standard representative agent consumption-based asset pricing model that help explain the puzzle include time-varying risk aversion due to habit formation (Campbell and Cochrane [1999]), long-run risks (Bansal and Yaron [2004]), rare disasters (Barro [2006]), heterogeneous agents (Constantinides and Duffie [1996]), and behavioral explanations (Barberis, Shleifer, and Vishny [1998], Barberis, Huang, and Santos [2001]).

studies as we document the existence of an unconditional excess return which is earned *ahead* of the FOMC announcement and is thus not directly related to the actual policy decisions. Our paper is closely related to [Savor and Wilson \[2010\]](#) who find statistically large unconditional equity returns on days of major scheduled economic news releases, including FOMC announcements, from 1958 through 2009. As we discuss in detail further below, over the post-1993 sample the findings in our paper indicate that only FOMC announcements are associated with statistically and economically significant announcement day returns, and that the returns are actually earned ahead of these announcements. Our result is also consistent with the findings of [Faust and Wright \[2010\]](#) who show that, unlike for bonds, the bulk of the predictability in equity returns arises outside the 15-minute window around macroeconomic and FOMC releases.

We document that instantaneous realized volatility is somewhat lower before FOMC announcements than on other days but jumps to very high levels at the announcement. The fact that the excess return is earned ahead of the announcement is inconsistent with the idea that it represents a reward for jump risk borne by investors who hold stocks around the announcement. Similar to the intraday pattern of equity market volatility, trading volume is also somewhat lower in the hours prior to a scheduled FOMC decision, but jumps at the announcement. We investigate quantitatively whether the observed patterns of volatility and liquidity can account for the pre-FOMC announcement drift, but do not find any supportive evidence. A number of papers have recently highlighted a qualitatively similar run-up in individual stock prices prior to scheduled earnings announcements (see e.g. [Lamont and Frazzini \[2007\]](#)). These papers discuss “attention-grabbing” as a potential behavioral explanation of the empirical finding. We discuss our results in light of this literature. We see the pre-FOMC announcement drift as a challenge to asset pricing models aiming at understanding the sources of aggregate market equity premium as well as the cross-section of equity returns.

The remainder of the paper is organized as follows. In [Section 2](#), we present the main empirical finding which documents that since 1994 stocks in the U.S. and in other major economies have earned a statistically significant and economically large excess return ahead of scheduled FOMC announcements. [Section 3](#) documents the robustness of our findings. In [Section 4](#) we discuss some potential explanations for our findings but fail to find evidence supporting any of them. [Section 5](#) concludes. We discuss relevant prior literature along the way.

2 The Pre-FOMC Announcement Drift: Evidence

In this section we provide extensive evidence documenting the main result of the paper: equity markets in the U.S. and in other developed economies have earned a strongly significant and economically large excess return prior to scheduled FOMC announcements from February 1994 through March 2011. Most of the presented evidence is based on intraday data and focuses on the 24-hour period from 2 p.m. on the day before a scheduled FOMC announcement until 2 p.m. on the day of a scheduled FOMC announcement, which is fifteen minutes before the announcement has typically been released. Hence, by construction, returns computed over this time interval do not contain news about monetary policy decisions and therefore allow us to exclusively study anticipation effects associated with FOMC announcements.²

Due to limited availability of intraday data some of the evidence in this section is based on daily close-to-close returns which contain both pre-announcement and surprise effects. Based on the intraday results, however, it will be clear that on average the close-to-close returns are more than accounted for by the pre-announcement effect. Thus, we interpret the abnormal close-to-close returns earned on FOMC announcement days as being dominated by the pre-announcement effect.

2.1 The S&P500 Index Around FOMC Announcements

The main empirical result of the paper is best documented by Figure 1. The black solid line in this chart represents the average pointwise cumulative intraday returns of the S&P500 index (SPX henceforth) over the three-day window starting on the open of the day before each scheduled FOMC meetings to the close on the day after. The sample period over which we average these returns starts in February 1994 - when the FOMC first released a statement explicitly announcing its policy decision - through March 2011.³ This sample covers 138 scheduled FOMC meetings.⁴ The shaded area around that line shows the pointwise 95% confidence interval around the average cumulative return. The vertical red line is set at 2:15

²Note that as of April 27, 2011 the FOMC began releasing its policy decision at 12:30 p.m. ET, if in conjunction with the release of the FOMC's quarterly economic projections and a press conference of Chairman Bernanke at 2:15 ET. Our sample ends in March 2011, and it is thus unaffected by this change.

³Prior to this meeting the Federal Reserve did not disclose its target for the federal funds rate (or other policy instruments). Market participants would generally infer the FOMC's target indirectly by the size of the open market operations conducted by the trading desk at the Federal Reserve Bank of New York on the days following the FOMC meeting.

⁴There were also a few unscheduled meetings during that time period. We exclude these from the sample as we are interested primarily in the pre-announcement effect of monetary policy decisions on stock returns.

p.m. on the day of the FOMC to highlight the time when the policy announcement was typically made.

Figure 1 documents a striking pattern of U.S. equity prices around scheduled FOMC announcements. As the left panel of the figure shows, the SPX on average starts to rise in the afternoon of the day before FOMC announcements. As shown by the middle panel, it then continues to rise sharply on the morning of scheduled FOMC announcements and on average trades at about 50 basis points above its opening price the day before the announcement. Right after the announcement, stocks on average fall for about fifteen minutes but then rise again and typically end the day at about the same level they were trading on at 2 p.m., right before the announcement. Finally, the right panel shows that on the day after scheduled FOMC announcements stocks on average move sideways. The light gray shaded area highlights that the cumulative return earned prior to scheduled FOMC announcements is strongly significantly different from zero.

To put the returns before FOMC announcements into perspective, the dashed black line shows the average cumulative returns over all three-day windows excluding the days around FOMC announcements. The dark gray shaded area indicates the pointwise 95% confidence bands around the cumulative returns, taking into account serial correlation due to overlapping windows.⁵ As can be seen, on average cumulative returns on all three-day windows excluding FOMC announcements have essentially been flat since 1994. In sum, Figure 1 shows that U.S. equities have earned strongly significant premia *ahead* of scheduled FOMC announcements since 1994, while, unconditionally, monetary policy decisions have on average barely affected stocks over that period. Moreover, equity returns on all other days have been very close to zero over the same time period.

In order to assess the average excess returns earned on FOMC announcement days and non-announcement days more formally, we consider the simple dummy variable regression model:

$$rx_t = \beta_0 + \beta_1 \mathbb{1}_{t=FOMC} + \beta_x X_t + \epsilon_t, \quad (1)$$

where rx_t denotes cum-dividend log excess return on the SPX expressed in percent. In the main specification, the independent variables only include a constant term and a dummy variable, which is equal to one on scheduled FOMC announcement dates and zero on all other days. In alternative specifications we also include additional control variables X_t . The coefficient β_0 in this regression measures the unconditional mean excess return earned on all

⁵We consider daily overlapping windows excluding days before, of, and after an FOMC announcement. Standard errors are Newey-West using a truncation lag wider than the actual daily overlap because of the kernel down-weighting: three-days on the second day and five days on the third day.

non-FOMC announcement days; the coefficient β_1 is instead equal to the difference between the mean excess return earned on all FOMC announcement days and that earned on all non-FOMC announcement days. Hence, the sum of the two coefficients represents the average excess return earned on FOMC announcement days.

Table 1 reports coefficient estimates for β_0, β_1 , and β_x for model specifications using alternative 24-hour excess returns constructed from the SPX as dependent variable. The first column of the table provides results using the close-to-close excess return on the index for the sample period from February 1994 through March 2011 which captures a total of 138 scheduled FOMC announcement dates. The coefficient β_1 shows that the difference between the excess return of the SPX earned on FOMC announcement days and that earned on non-FOMC announcement days has averaged a strongly statistically significant 32 basis points since 1994. This is in sharp contrast to the average excess return on all non-FOMC announcement days given by β_0 which is estimated to be only one basis point, and is not significantly different from zero. Hence, since 1994, daily excess returns on the SPX have been more than 30 times larger on FOMC announcement days than on other days.

In order to assess the economic significance of this return, Table 1 also provides the total annual excess return earned on FOMC announcement days as well as on all other days over the estimation sample. While the excess return earned on FOMC announcement days added up to 2.61 percent per year since 1994, the total excess return earned on all other days only amounted to 1.97 percent. Hence, investors who held the aggregate index only on the eight FOMC announcement days each year would have earned a larger equity premium than those holding the index over the remaining 244 trading days of the year. In fact, a simple strategy that consists in holding the index only on FOMC announcement days and being uninvested on all other days would have delivered an impressive annualized Sharpe Ratio of 0.8 from 1994 through March 2011, as reported in the last row of the middle panel of the Table.

To analyze whether this result is specific to the post-1993 sample over which policy decisions have been announced publicly on scheduled dates, the second column of Table 1 shows the regression results for the subsample 1970-1993, for a total of 237 FOMC announcement days.⁶ While there was a positive excess return on FOMC announcement days over that sample period, it was small and statistically not different from zero. In addition, the decomposition of the total excess return earned on FOMC announcement days versus non announcement days has been much less tilted towards the FOMC announcement days during that period.

⁶Following Kuttner [2001], we assume that FOMC decisions became public one day after its meeting prior to February 1994, which is typically when the first open market operation following each meeting was conducted. In other words, over this sample the dummy variable takes on the value of one the day after scheduled FOMC meetings and zero on all other days.

The Sharpe ratio of holding stocks only on FOMC announcement days would have been a meager 0.2 prior to 1994.

Without having seen the average path of stock prices around FOMC announcement days in Figure 1, one may have guessed that our finding of large average daily excess returns on FOMC announcement days since 1994 was driven by the surprise component of monetary policy decisions. Indeed, [Bernanke and Kuttner \[2005\]](#) show that U.S. stock returns respond to unanticipated surprises in the announced fed funds rate decision, measured as the rescaled change in the front-month federal funds rate future contract. We assess whether the large excess returns on FOMC announcement days over the post-1993 sample can be explained by such surprises. We do so by augmenting the regression model 1 with the daily revision in market expectations for the funds rate - labeled ‘Kuttner-shock’ - on scheduled FOMC dates and on other dates. The third column of Table 1 shows the results of this augmented regression for the post-1993 sample.⁷ As in [Bernanke and Kuttner \[2005\]](#), we find that stock returns are negatively impacted by a surprise rate hike as measured by the sum of coefficients on the “Kuttner surprise” variable. However the average daily excess return on FOMC announcement dates as measured by the coefficient β_1 is unaffected by the inclusion of the monetary policy surprise measure. This shows that the large excess returns on FOMC announcement days are not related to the actual policy action, but are earned unconditionally.

The fourth column of Table 1 makes this point very clear. Here, we run a regression akin to the one in the first column but replace the close-to-close return on the SPX with the log excess return earned from 2:00 p.m. the day before the FOMC announcement to 2:00 p.m. the day of the FOMC announcement, i.e. fifteen minutes before the policy decision is made public. By construction, this return does not include any announcement effect of the FOMC decision. Interestingly, we find that the average excess return earned over the 24 hours prior to the policy announcement is almost 50% larger than the close-to-close return, amounting to a striking 46 basis points, with a t-statistic of above 4.5.⁸ By contrast, the corresponding 24-hour excess return on all other days is essentially zero. To assess the economic significance of this result, we again compare the annualized excess returns earned the 24 hours prior to the FOMC announcement days with that on non-FOMC announcement days. The differences are striking: while the excess return on the SPX over the 24 hours prior to the FOMC announcement has on average been 3.76 percent per year, it has only

⁷Note that because of availability of fed funds futures data, this regression covers a total of 137, rather than 138, FOMC announcements.

⁸There were three scheduled meetings between February 1994 and March 2011 for which the FOMC decision was released before 2 p.m. ET. When we drop these three meetings from our sample, the point estimate of β_1 increases by one basis point and the corresponding robust t -statistic also increases slightly.

been 0.88 percent on all other days. These point estimates imply that since 1994 more than 80 percent (!) of the U.S. equity premium has been earned in the 24 hours before scheduled monetary policy announcements. The simple strategy that consists in buying the SPX at 2 p.m. the day before a scheduled FOMC announcement and selling fifteen minutes before the actual announcement would have earned a striking annualized Sharpe ratio of 1.1.

2.2 International Evidence

Previous research has documented ample evidence of stock return comovement at the international level, see e.g. [Karolyi and Stulz \[1996\]](#), [Forbes and Rigobon \[2002\]](#), and [Bekaert, Hodrick, and Zhang \[2009\]](#). Given our finding of large and significant stock returns in the U.S. on scheduled FOMC announcement days, this section analyzes the behavior of major international stock indexes on those days. To this end, we reestimate model (1) using daily close-to-close excess returns on major stock indexes of OECD countries as the dependent variables.

The results of these regressions are documented in Table 2. The first column reports the regression estimates using the close-to-close log excess return on the German stock index DAX as dependent variable. The DAX is computed from prices traded at the electronic Xetra trading system which opens at 9:00 a.m. central European time (CET) and closes at 5:30 p.m. CET. Depending on the daylight savings time offset, the close price of the DAX is therefore recorded at 11:30 a.m. Eastern Time (ET) for most of the year and at 12:30 p.m. ET for a few weeks around the daylight savings time change. Hence, important for our analysis, close-to-close returns on the DAX never include scheduled FOMC announcements.

As shown in the first column of Table 2 the β_1 coefficient on the FOMC announcement day dummy is a highly statistically significant 0.43. This indicates that the excess return of the DAX on FOMC announcement days has on average exceeded the excess return on non-announcement days by 43 basis points since 1994. The pre-FOMC announcement drift is therefore of a similar magnitude in Germany as in the U.S. In fact, more than half of the equity premium in the German stock market index has been earned on only eight scheduled FOMC announcement days each year over this sample period. A simple strategy which consists in holding the DAX only on FOMC announcement days and being uninvested on other days would have delivered a high annualized Sharpe ratio of 1.02.

The second column of Table 2 re-estimates the regression model using the close-to-close return on the FTSE100 index as dependent variable. The index captures the performance of the 100 largest UK companies by market cap on the London Stock Exchange. As for

the DAX index, due to the time-zone difference close-to-close returns on the FTSE100 on FOMC announcement days do not include actual FOMC announcements in our sample period.⁹ Point estimates indicate that the announcement daily return of the FTSE100 was about 32 basis points on average since 1994, very similar to the corresponding estimate for the SPX. Interestingly, the average excess return on non-FOMC announcement days was slightly negative over that sample period, implying that the equity premium earned by U.K. stocks since 1994 is more than accounted for by the few FOMC announcement days over that period.

A very similar picture emerges for two other European stock indexes, the French CAC40 and the Spanish IBEX, as shows in the third and fourth column of Table 2, respectively. Both show highly statistically significant FOMC announcement day returns of 52 and 47 basis points, respectively. While the daily excess returns earned on non-FOMC announcement days have also been negative for the CAC40, they have been essentially zero in the IBEX. Thus, once again, the predominant share of the equity premium has been earned on scheduled FOMC announcement days since 1994, and the simple strategy of investing in these indexes only on FOMC announcement days yielded an annualized Sharpe ratio of above 1. We report similar results for the Swiss SMI and the Canadian TSX in columns five and six. Both indexes show statistically significant albeit somewhat lower FOMC announcement day returns.¹⁰

Finally, the last column of Table 2 shows regression results for the Japanese NIKKEI 225 index. The Tokyo Stock Exchange closes at 3 a.m. ET, significantly ahead of the other exchanges discussed thus far. While average excess returns earned on FOMC announcement days have been higher than average excess returns on non-FOMC announcement days for the NIKKEI index, they are substantially smaller than those reported for the other countries and not statistically significant from zero.

Figure 2 visualizes these results by plotting the cumulative returns on the major stock indexes from the U.S. market open the day before a scheduled FOMC announcement to the following day's close. The international indexes are only shown over the trading hours of the respective exchanges. As a reference, we superimpose the cumulative returns for the SPX from Figure 1. This chart clearly shows that international stock indexes follow intraday patterns very similar to the U.S. markets around FOMC announcements.

⁹Closing prices on the FTSE100 occur at 4:35 p.m. Greenwich mean time (GMT) which corresponds to 11:35 a.m. ET most of the year and to 12:35 p.m. ET during a few weeks around the daylight savings time change.

¹⁰It is important to note that the TSX is computed from close prices taken after the FOMC announcement. It therefore is not as clean a measure of pre-announcement returns as the European indexes.

To summarize, the results in this section show that the large pre-FOMC announcement returns not only occur for U.S. stock indexes, but are instead a global phenomenon. In unreported analysis we have also investigated whether international stock indexes feature similar returns on monetary policy announcement days of their respective central banks, but we find no such effects. The pre-announcement return effect thus appears to be specific to anticipations of U.S. monetary policy rather than to monetary policy more generally.

2.3 Cross-Sectional Evidence for U.S. Equities

Given the strong pre-FOMC announcement returns documented for U.S. and international equity indexes above, it is natural to ask which stock is most affected. In this section, we study FOMC announcement day returns for U.S. equities using portfolios sorted by firm size and industry classification. As we do not have high frequency data at this level of disaggregation, we use daily close-to-close returns from the Center for Research in Security Prices (CRSP). In principle these daily returns contain both a pre-FOMC announcement returns as well as the unconditional response of stock prices to monetary policy surprises. However, based on the evidence presented so far, we can attribute the daily excess returns fully to anticipation effects. Indeed, as previously noted for the SPX, the unconditional excess returns earned in the 24 hours prior to FOMC announcements are larger than the close-to-close returns earned on the day of FOMC announcements. Moreover, the surprise component of monetary policy decisions does not explain the unconditional excess return on FOMC announcement days. We first discuss FOMC announcement day returns for the CRSP value weighted and equal weighted market returns as well as for ten value weighted portfolios sorted according to market cap deciles.¹¹

Table 3 summarizes results of the dummy variable regressions (1) for excess returns on these sorted portfolios. The β_1 coefficient on the FOMC dummy in the first column of Table 3 shows that the difference between excess returns on the value-weighted market portfolio on FOMC announcement days and other days has on average been a strongly statistically significant 34 basis points since 1994. In contrast, daily excess returns have amounted to only one basis point on non-FOMC announcement days. Moreover, we find that the total annual excess return earned on scheduled FOMC announcement days for the value-weighted CRSP index amounted to 2.83% while the total annual excess return on non-FOMC announcement days was only 1.84%. The strategy of owning the value weighted CRSP market portfolio on FOMC announcement days and being uninvested on all other days would have earned an annualized Sharpe ratio of 0.89. Overall, these results are very similar to those obtained for

¹¹The market portfolio returns are from CRSP, the size decile returns are from Ken French's website.

the close-to-close returns on the SPX. Hence, the striking FOMC announcement day returns are not specific to stocks included in the SPX.

We next study the daily excess returns on the CRSP equally weighted market portfolio which is a simple average of returns on all the firms listed on the NYSE, AMEX and NASDAQ exchanges, regardless of their market cap. These results, shown in the second column of Table 3, document that the average excess return of the equally weighted market portfolio on FOMC announcement days is 23 basis points higher than on all other days. While this difference is somewhat lower than the excess return on the value weighted indices, it is still highly statistically different from zero. Moreover, an investment strategy that consists of holding the equal weighted market portfolio only on FOMC announcement days would have still earned a Sharpe ratio of 0.87. Interestingly, the average daily excess return of the equal weighted market portfolio on non-FOMC announcement days is estimated to be a highly statistically significant six basis points. Since the equal weighted portfolio attributes a large weight to small firms relative to their share of the total market capitalization, this finding indicates that the return differential between FOMC announcement days and non-announcement days is somewhat lower for small firms.

This interpretation is confirmed by the results for the market cap decile portfolios summarized in the following columns of Table 3. Indeed, the portfolio containing the smallest firms earned an average excess return of 18 basis points on FOMC announcement days.¹² While still significant at the 5 percent confidence level, this is substantially lower than the 36 basis points of the second decile size portfolio. Indeed, the top nine size decile portfolios have all earned average excess returns of at least 31 basis points on FOMC announcement days with the fifth decile recording the largest value of 43 basis points. These excess returns are all highly statistically significantly different from zero. The annualized Sharpe ratios of holding the size portfolios only on FOMC announcement days and being uninvested on all other days are all high for the top nine decile size portfolios, ranging from 0.78 to 1. In sum, the results in Table 3 show that the abnormal returns on FOMC announcement days are broad-based and not restricted to large cap stocks.

We next study the cross section of average FOMC announcement day returns across industries. Table 4 provides estimates for the dummy variable regressions to the 49 industry sorted portfolios from Ken French’s website. These results can be summarized as follows. First, while there is some cross-sectional dispersion of FOMC announcement day returns across industries, the effect is broad-based. Indeed, 36 out of 49 industry portfolios feature excess returns on FOMC announcement days that are statistically significantly different from zero

¹²Note that this smallest market cap portfolio contains on average about 50 percent of all firms in the CRSP universe.

at least at the 5 percent level. Among these, the point estimates obtained for β_1 range from 24 basis points for the consumer goods industry (HSHLD) to 55 basis points for banking institutions (BANKS) and 68 basis points for trading firms (FIN). For the latter portfolio, the annualized Sharpe ratio of holding it only on the eight scheduled FOMC announcement days each year, amounts to a striking 0.9 on a close-to-close basis. Only ten industries do not appear to feature statistically significant excess returns on scheduled FOMC announcement days. This group comprises industries as diverse as Agriculture (AGRIC), Food products (FOOD), Utilities (UTIL), and Telecommunication (TELCM).

Given this significant cross-sectional variation, it is natural to ask whether it is consistent with the CAPM. We assess this question in the following simple way. We first obtain industry betas from a regression of the excess return in each industry on the excess return of the CRSP value-weighted market portfolios.¹³ Figure 3 shows a scatter plot of the average FOMC announcement day returns against the estimated betas for the 49 industry portfolios. We superimpose the fitted line obtained from the following simple cross-sectional regression of the average FOMC announcement day returns on the estimated betas:

$$E[R^i] = \alpha_i + \hat{\beta}_i \lambda.$$

As the chart shows, the linear relationship implied by the CAPM provides a good description of the FOMC announcement day returns. As reported in footnote to the chart, the slope coefficient λ which represents the price of market risk is estimated to be 47 basis points and is highly statistically significant (standard errors shown in square brackets). 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 estimated at 64 percent. Combined, these results suggest that the CAPM does a good job of explaining the observed industry variation on FOMC announcement day returns.¹⁴

This is in sharp contrast to the fit of the model on all other days, which is shown in Figure 4. Indeed, the scatter plot shows no discernable relationship between market beta and average excess return for the 49 industry portfolios on non-FOMC announcement days. Moreover, the adjusted R-squared is negative and the estimated slope coefficient is slightly negative (but not significantly different than zero). Taken together, these results indicate that the

¹³We run this regression using daily data including FOMC announcement days. Dropping these days from the sample barely affects the β estimates.

¹⁴In a presentation of the paper [Savor and Wilson \[2010\]](#) at the New York Fed, Mungo Wilson showed complementary results indicating that the CAPM fits the cross-section of stock returns much better on days of scheduled macroeconomic announcements than on other days. [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.

CAPM is able to explain the cross-sectional return variation on FOMC announcement days but not on other days.

2.4 Other Asset Classes, Other Macroeconomic Announcements

The previous subsections have documented that U.S. and international equity markets have featured highly statistically significant and economically large excess returns prior to scheduled FOMC announcements since 1994. In this section, we analyze whether other asset classes displayed similar patterns and whether similar returns have been earned prior to other major macroeconomic announcements.

In a related study, [Savor and Wilson \[2010\]](#) document excess equity returns on days of major economic news announcements in the U.S. over the sample period 1958-2009.¹⁵ Using a regression model similar to (1), [Savor and Wilson \[2010\]](#) report an average excess return of the CRSP value-weighted market return of 11.4 basis points on those announcement days compared to an average excess return of only 1.1 basis points on all other days. [Savor and Wilson \[2010\]](#) rationalize their findings with a model in which risk-averse investors demand a premium for holding assets exposed to macroeconomic “jump” risk on days when macroeconomic data are announced.

In this section, we revisit the evidence provided in [Savor and Wilson \[2010\]](#) for the SPX using our sample period from February 1994 to March 2011. We include a number of additional macroeconomic data releases which previous research has pointed out as potentially affecting asset prices. These include 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 as well as Personal Income (PI) released monthly by the BEA. Except for IP which is released at 9:15 a.m. ET and the ISM which is released at 10:00 a.m. ET, all these data releases are made public at 8:30 a.m. ET. Hence, in order to parse out the pre-announcement and post-announcement effects, we run two regressions for each release: one where the dummy variable equals one on the day before the release and zero on all other days (pre-announcement effect), and one where the dummy variable equals one on the day of the release and zero on all other days (announcement effect).

¹⁵They use a joint sample of FOMC, employment, and inflation releases and follow [Kuttner \[2001\]](#) in assuming that prior to 1994 FOMC decisions became public only on the day after the meeting.

The results of this analysis are provided in Table 5. Interestingly, only the ISM release features a significant announcement excess return of 22 basis points over our sample period. All other macroeconomic releases, including the ones studied by Savor and Wilson [2010], do not give rise to either statistically significant pre-announcement nor post-announcement returns at the daily frequency over our sample period. We interpret these results as indicating that the excess returns documented by Savor and Wilson [2010] may be mainly driven by the excess returns on scheduled FOMC announcement days. As these returns are earned *before* the actual policy announcement, it is unlikely that they can be rationalized as “jump” risk premia, as we will discuss in Section 4 below.

We next study the pre-FOMC announcement returns on other asset classes. We focus on securities that presumably are mostly affected by monetary policy decisions and anticipations thereof such as various fixed income instruments as well as the exchange rates of the U.S. dollar with the Euro and the Yen. Previous literature has found significant effects of macroeconomic and monetary policy announcements on some of these assets. Cook and Hahn [1989] were among the first to examine assess market reactions to monetary policy actions by studying the one-day response of bond rates to changes in the target fed funds rate from 1974 through 1979. They found statistically significant effects of fed funds rate changes on these assets. Jones, Lamont, and Lumsdaine [1998], on the other hand, reported significant daily excess returns of 5-year, 10-year, and 30-year Treasuries on days of PPI and EMPL releases over the sample period October 1979 through December 1995. Using high frequency data, Fleming and Remolona [1999] further document a two-stage response of Treasury prices and liquidity measures for the same set of macroeconomic releases. Kuttner [2001] studied the responses of Treasury bills, notes, and bonds to monetary policy surprises as measured by federal funds futures quotes. He found that expected interest rate changes have small effects but that unexpected fed funds rate changes have large effects on these assets. More recently, Bernanke and Kuttner [2005] investigate the effect of monetary policy surprises on the U.S. equity market. They find that an unanticipated 25-basis-point cut in the federal funds rate target is associated with a one percent increase in broad stock market indexes. When they exclude outliers, the stock market’s response to unexpected fed funds changes is still significant, but the magnitude of the surprise effect on the stock market is reduced to about 50 basis points.¹⁶

¹⁶Gürkaynak, Sack, and Swanson [2005b] document a strong response of long term Treasury forward rates to surprise changes of macroeconomic variables and the federal funds rate which they argue is inconsistent with the strong levels of mean reversion built into standard macroeconomic models. Gürkaynak, Sack, and Swanson [2005a] study the response of the SPX and various Treasury yields to monetary policy surprises in short windows around monetary policy announcements. They find that surprise changes to the federal funds rate are not the only factor driving the reaction of asset returns to monetary policy surprises, but that changes in the statement language also explain some of the variation. More recently, Lucca and Trebbi [2009] explicitly measure the content of central bank communication quantitatively and provide evidence

We assess whether Treasury yields and other assets feature significant FOMC announcement day returns over the post-1993 sample. Table 6 provides dummy variable regression results for several benchmark securities: yields implied by the first and second fed funds futures contracts, the fourth Eurodollar futures, the two-year and ten-year on-the-run Treasury, as well as the EUR/USD and USD/YEN exchange rates.¹⁷ As the table shows, none of these securities features significant excess returns on scheduled FOMC announcement days since 1994. Hence, the pre-FOMC announcement drift appears to be specific to equities.

3 Robustness

In this section, we study the robustness of our main empirical finding of a large pre-FOMC announcement effect on U.S. equities. We first document that the result is robust to sample choice and the exclusion of outliers, and that no abnormal returns on equities exist before or after FOMC announcement days. Using daily data, we then show that the pre-FOMC announcement return cannot be explained by any of the commonly considered equity risk factors. Finally, we document that our finding is robust to potential data-snooping biases.

3.1 Subsamples, Outliers, and Persistence

We first analyze whether the pre-FOMC announcement effect found over the post-1993 period is due to a particular subsample choice. To this end, we split the sample February 1994-March 2011 into three subsamples: February 1994-November 1999, December 1999-August 2005, and September 2005-March 2011, each covering 46 or 45 scheduled FOMC announcements, respectively. The first three columns of Table 7 show regression results for these three subsamples using the 2p.m.-to-2p.m. excess return on the SPX as the dependent variable. As shown in the table, pre-announcement returns were pervasive and statistically significant in each of the three subsamples. However, the economic magnitude of the effect has increased over time. Indeed, while the point estimates in the six-year period from 1994 through 1999 and from 2000 through mid 2005 averaged to 32 and 40 basis points, respectively, the pre-announcement returns increased to 67 basis points in the subsample September 2005-March 2011 which includes the financial crisis.

that short-term nominal Treasury yields respond to changes in policy rates around policy announcements, but that longer-dated Treasuries mainly react to changes in policy communication.

¹⁷The dependent variables in these regressions are daily yield changes for the fixed income instruments and daily returns (in percent) for the exchange rates. Note further that we use the DM/USD exchange rate prior to January 1999.

Moreover, since the SPX has declined relative to its year-2000 levels, the excess returns earned on non-FOMC announcement days have been negative in the latter two subperiods. This implies that since 2000, the equity premium has been more than accounted for by the excess returns earned on scheduled FOMC announcement days. This is in contrast to the period from 1994 through 1999 when equity markets experienced broad share price increases. Over this period, pre-FOMC announcement returns accounted for “only” about 20 percent of the equity premium. In all three subperiods, however, the simple strategy of holding the SPX only over the 24 hours preceding a scheduled FOMC announcement would have earned an annualized Sharpe ratio of above 1. In sum, these results document that while the pre-FOMC announcement effect has become stronger over time, it was prevalent since the introduction of scheduled Federal Reserve policy announcements in 1994.

The large pre-FOMC announcement return documented for the last subsample is in part driven by one large outlier on October 29, 2008. To assess the sensitivity of our findings to this and other potential outliers, the fourth column of Table 7 repeats the dummy variable regression dropping the top and bottom two FOMC return observations from the sample. The results of this exercise show that the point coefficient decreases to 42 basis points from 46 basis points for all observations. At the same time, the standard error of the regression coefficient declines so that the pre-FOMC announcement return remains highly statistically significant. Finally, the last column of Table 7 reestimates the model (1) using a ‘Mean Absolute Distance’ (MAD) estimator instead of an ordinary least squares. Rather than estimating the mean return, the MAD estimator provides point estimates for the median. While the point estimate of the median is somewhat smaller in magnitude than the mean, it remains highly statistically significant.

In addition to being robust to the sample choice and to outliers, we finally document that the pre-FOMC announcement returns are persistent. This is documented in Figure 5 which shows the cumulative return from 2 p.m. the day prior to the scheduled FOMC announcement until 22 days after the announcement. The chart highlights that the pre-FOMC announcement drift is not temporary phenomenon, but that equities on average have remained at their pre-FOMC announcement level for many days after the announcement. Furthermore, unreported results from regressions akin to equation (1) show that there are no abnormal negative returns on equities on the days prior to FOMC announcement days.

3.2 Common Risk Factors

The asset pricing literature has identified a number of factors from stock characteristics, such as firm size, that jointly with the market portfolio return help explain the cross section of equity returns. A potential explanation of our findings is that the pre-FOMC announcement return simply proxies for one of these factors. In this section, we show that this is not the case. Indeed, Table 8 repeats the regression (1) using as additional control variables X the following set of commonly used risk factors from Ken French’s website: SMB, HML, MOM, STREV, and LTREV. These are returns on long-short portfolios constructed according to firm size, book-to-market ratio, momentum, short-term reversal, and long-term reversal, respectively. Since these returns are only available on a close-to-close basis, we use the daily close-to-close return on the SPX as dependent variable in these robustness regressions. As the second column of Table 8 documents, adding the control variables does not affect our conclusions. Even though all risk factors except LTREV help explain the close-to-close return on the SPX, the coefficient on the FOMC announcement day dummy is estimated to be slightly higher at 33 basis points in the joint regression and remains highly statistically significant. This implies that common risk factors cannot account for the anomalous returns of U.S. equities on FOMC announcement days.

3.3 Data-Snooping

We next assess whether our finding is robust to data-snooping biases. In fact, a skeptical reader might argue that our finding could be the outcome of an extensive search across the universe of economic news announcements which happened to obtain a high t -stat for FOMC announcements. A simple way to address this concern is to carry out a reality check in the spirit of White [2000]. We do this in the following way. We use the block-bootstrap of Politis and Romano [1994] with a smoothing parameter of $q = .5$ to generate 10,000 bootstrap samples of the 2p.m.-to-2p.m. excess return on the SPX. For each sampled return series, we then loop through a list of ten dummy variables pertaining to the nine economic data releases used in Table 5 as well as the FOMC announcements and record the maximum robust t -statistic from the ten different regressions. This exercise is supposed to capture the nature of a potential data snooping technique had we parsed through the major economic announcements in order to find one that would give us a high t -stat in our dummy variable regression. We find that 99.9 percent of the bootstrap distribution of maximum robust t -stats are smaller than the value of 4.63 which is the robust t -statistic obtained for the FOMC announcement day dummy variable in Table 1. This result supports the view that our finding is very unlikely to be the result of data-snooping biases.

4 Possible explanations

In this section, we study potential explanations for the finding that equities both in the U.S. and in other developed countries carry a statistically significant and economically important pre-FOMC announcement return. We start by assessing potential risk-based explanations and then discuss a potential behavioral explanation.

4.1 Risk-based explanations

Standard asset pricing theory implies that investors demand compensation for holding assets whose payoffs are positively correlated with their marginal utility. Hence, under the risk-based asset pricing paradigm, according to our findings holding equities (and only equities) right before FOMC announcements has to be perceived as risky. In this section, we analyze different sources of risk that could potentially explain our result.

4.1.1 Jump Risk

Asset prices often jump in response to large unexpected economic news announcements. As the sign of the surprise is not predetermined, holding financial assets around economic announcements in general represents a risk that investors need to be rewarded for. Indeed, prior research has found that the SPX jumps in response to monetary policy surprises (e.g. [Bernanke and Kuttner \[2005\]](#) and [Gürkaynak, Sack, and Swanson \[2005a\]](#)) for FOMC announcements, and that jump risk in the SPX is generally priced (see e.g. [Pan \[2002\]](#)). Figure 6 plots the five-minute moving sum of squared tick-by-tick returns on the SPX over a three-day window: from the market open on the day before FOMC announcements until the close of the day after FOMC announcements. The chart shows that realized volatility indeed jumps right around the monetary policy announcement at 2:15 p.m. on scheduled FOMC days, and then gradually declines. Hence, one might be inclined to suspect that the average excess return earned on FOMC announcement days represents a premium that equity investors earn as compensation for bearing jump risk on such days.

Yet, there is a simple argument why jump risk cannot explain the observed return pattern. As documented in detail above, the FOMC announcement day return is earned *ahead* of the announcement. Hence, investors who sell their equity positions before the announcement are not exposed to any jump risk, but still earn a statistically and economically significant return. Moreover, as Table 1 shows, a simple trading strategy which consists in buying stocks

at 2 p.m. the day before the scheduled FOMC announcement and selling them 15 minutes before the 2:15 p.m. announcement delivers a higher Sharpe ratio than one that consists in holding the stocks from the close of the day before the announcement until the close on the announcement day. Based on these results it is straightforward to exclude announcement jump risk as a potential explanation of the pre-FOMC announcement return.

4.1.2 Risk

A closer look at Figure 6 reveals that while realized volatility jumps at monetary policy announcements, it is lower in the hours prior to such announcements than on other days. A qualitatively similar pattern can also be observed for the VIX, an option-implied measure of future expected volatility of the SPX. Hence, risk tends to be somewhat lower right ahead of FOMC announcements. In this section, we analyze whether this observed pattern of volatility helps explain the pre-FOMC announcement return.

Starting with Black [1976], a number of articles have documented a negative contemporaneous correlation between volatility and returns. Various explanations have been suggested to rationalize this phenomenon. Black [1976] suggested a feedback from volatility to returns via the so-called “leverage effect”. According to this effect, an exogenous shock to a firm’s share price increases its equity and therefore, mechanically, its leverage declines. Equity investments thus becomes less risky which in turn leads to lower volatility. Another rationale for the negative contemporaneous correlation between volatility and returns has been put forth by Campbell and Hentschel [1992]. Their explanation, which is commonly referred to as the “volatility feedback effect”, relies on the observation that volatility is very persistent. Due to its persistence, an unexpected decline of volatility leads to a downward revision of expected future volatility. Investors holding the stock thus demand lower risk premia and therefore the share price rises contemporaneously. Hence, according to this explanation, the causality goes from volatility to returns.

Given the observation that both realized and implied volatility are somewhat lower ahead of scheduled FOMC announcements, according to the volatility feedback effect we should thus expect stock prices to increase prior to the announcement. Below we assess whether the observed decline in volatility can account for the pre-FOMC announcement drift. We do so by using the expected and unexpected components of volatility as control variables in our standard dummy variable regression of equation (1). This is done in the following way. We first run a time series regression of the 2 p.m. level of the VIX on its own lag (i.e. the 2 p.m. level of the VIX the day before) as well as the FOMC announcement day dummy variable. The estimated residuals from this regression provide us with a simple measure of volatility

surprises that accounts for the fact that volatility is predictably lower on scheduled FOMC days. We use this innovation as an additional control variable in regression (1) along with the lagged (2 p.m.) level of the VIX. We discuss the results of this exercise further below in conjunction with those obtained for the following potential liquidity risk-based explanation of our finding.

4.1.3 Liquidity

An alternative risk-based explanation of the anomalously high average excess returns on equities before scheduled FOMC announcements relates to liquidity conditions in the stock market on those days. A large body of literature discusses the relationship between expected excess returns on stocks and trading liquidity (Amihud and Mendelson [1986], Campbell, Grossman, and Wang [1993] Chordia, Subrahmanyam, and Anshuman [2001], Pastor and Stambaugh [2003], Acharya and Pedersen [2005], etc). The general conclusion from these papers is that expected excess returns on stocks should be high when expected liquidity is low. Empirically, this hypothesis has mainly been tested in the cross-section, but there are a few papers that have studied the time series relationship between measures of aggregate stock market liquidity and the equity premium. Amihud [2002], for instance, constructs a simple measure of illiquidity and documents a significant positive relationship between his measure and future excess returns but a significant negative relationship between contemporaneous unexpected illiquidity and excess returns in U.S. equities over the sample period 1963-1996. Amihud [2002] explains 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. In addition to Amihud's measure, other studies have primarily used trading volume and bid-ask spreads as proxies for liquidity conditions.

As documented above, the pre-FOMC announcement return is earned over the 24 hours prior to scheduled FOMC announcements. In order to assess whether this return is related to liquidity conditions in the equity market, we need to construct measures of trading liquidity over the corresponding period. Since we do not observe the number of trades or the bid-ask spreads for all constituents of the SPX on an intraday basis, we use as proxies the SP500 E-mini futures contract and the SPDR S&P500 exchange-traded fund (SPY). Both track the SPX very closely and exhibit almost identical pre-FOMC announcement returns as the cash index itself. Moreover, for both securities we observe bid-ask spreads and trading volume at a tick-by-tick level.

In order to graphically illustrate the liquidity conditions around scheduled FOMC announcements, 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. For comparison, we superimpose the equivalent volume measure averaged over all other three-day intervals in our sample. The chart documents that trading volumes are very similar on the day ahead of and the day after the announcement than they are on other days. Indeed, intraday trading volume follows the typical U-shaped pattern on these days, being high in the morning, then gradually declining with a low around lunchtime and again slowly rising in the afternoon, but ending the trading day with a huge spike. The pattern is different on scheduled FOMC announcement days, however. On those days the trading volume also slowly declines from the high opening-levels but bottoms at lower levels than those experienced on other days. In contrast, it then exhibits a large positive spike that abates relatively quickly after the announcement.

We jointly assess whether volatility or liquidity can account for the pre-FOMC announcement returns in the SPX. To this end, we add the expected and unexpected components of volatility (as described above) as well as three different measures of liquidity as control variables in the dummy variable regression (1). The results of this regression are summarized in Table 9. The first two columns of the table use intraday SPY quotes to construct the liquidity measures. The third and fourth column use the SP&500 E-mini quotes. Due to limited data availability, the sample for the SPY-based controls starts in January 1996 whereas that for the E-mini starts only in September 1997. We construct a daily series of bid-ask spreads at 2 p.m., relative trading volume (number of contracts/shares traded over the 24 hour period ending at 2 p.m. minus its 22-day lagged moving average), as well as Amihud’s illiquidity measure (absolute return from 2p.m.-to-2p.m. divided by the dollar volume traded over the previous 24 hours) for each of the two securities.

As the results in Table 9 document, controlling for volatility and liquidity the point estimate of the FOMC announcement day dummy is effectively unchanged at 57 (56) basis points for the SPY (E-mini), respectively. Interestingly, the estimated precision of this coefficient becomes higher when the volatility and liquidity control variables are added. While the liquidity measures only partially contribute to the explanation of the returns, the VIX innovation is highly statistically significant and of the expected negative sign. However, neither liquidity conditions just prior to the FOMC announcements nor unexpected changes in volatility appear to explain the pre-FOMC announcement drift.¹⁸

¹⁸Regressions using the lagged and unexpected components of the liquidity measures as control variables obtained qualitatively very similar results.

4.2 Attention grabbing

Recent research has highlighted a qualitatively similar upward drift in prices of individual stocks prior to scheduled earnings announcements (see e.g. [Lamont and Frazzini \[2007\]](#)). These authors discuss “attention-grabbing” as a potential behavioral explanation of that finding. According to this explanation, individual investors are more likely to buy stocks which have attracted their attention e.g. through media coverage of forthcoming firm-related events such as earnings announcements. Since individual investors typically hold only few stocks in their portfolios and 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. Such behavior has been documented e.g. by [Barber and Odean \[2008\]](#) who find that individual investors are more likely to buy stocks that have recently been in the news, or have recently experienced unusual volume or extreme returns. While [Barber and Odean \[2008\]](#) do not specifically consider earnings announcements as information-grabbing events, [Lamont and Frazzini \[2007\]](#) find that both trading volume and stock prices increase sharply around scheduled earnings announcements. They also document evidence of a large and statistically significant excess return on the days before earnings announcements in addition to the previously studied post-earnings announcement drift (PEAD).

Consistent with the hypothesis that the earnings premium is at least partly driven by buying pressure from individual investors, [Lamont and Frazzini \[2007\]](#) document that high announcement premium stocks experience the highest amount of imputed small investor buying. Constructing daily order imbalance measures for large and small trades, they also find that imputed buying of large investors increases a few days ahead of the actual earnings announcements and peaks before the small investor buying. [Lamont and Frazzini \[2007\]](#) suggest the following explanation for their findings: large sophisticated investors accommodate the demand shocks of small uninformed traders by selling ahead of announcements. Interestingly though, this arbitrage behavior does not seem to eliminate the predictability of announcement returns. ¹⁹

¹⁹[Easton, Gao, and Gao \[2010\]](#) document a similar result. They find that firms which announce earnings late in the quarter on average earn a large and significant pre-earnings announcement premium while firms in the same industry which announce their earnings early do not. [Easton, Gao, and Gao \[2010\]](#) provide an explanation of their findings based on transaction costs, arguing that firms which announce late in the quarter tend to be more illiquid than firms which announce early. Somewhat in contrast to the evidence in [Lamont and Frazzini \[2007\]](#) and [Easton, Gao, and Gao \[2010\]](#), [Hirshleifer, Myers, Myers, and Teoh \[2008\]](#) find that individuals are net purchasers of stocks after both good and bad earnings news. Using data on actual retail investor trades they further argue that individual investor behavior cannot explain the post-earnings announcement drift as controlling for net individual investor trading does not reduce the ability of extreme earnings surprises to predict the subsequent returns.

Since FOMC announcements are widely covered by the media it is conceivable that scheduled FOMC announcements represent attention-grabbing events in the spirit of [Lamont and Frazzini \[2007\]](#) and [Barber and Odean \[2008\]](#). According to this explanation, individual investors start paying attention to the stock market ahead of scheduled FOMC announcements. Since individual investors are likely to be short selling constrained, a larger fraction of the investors whose attention may have been caught by the upcoming FOMC announcement may buy rather than sell stocks. This increased buying pressure may in turn drive up prices and result in the pre-FOMC announcement drift that we observe. We do not currently have access to the data necessary to assess this hypothesis empirically, but are planning to incorporate such an analysis in a future revision of the paper.²⁰

However, even evidence in favor of a buy-bias ahead of FOMC announcements due to the attention-grabbing nature of the event, would not easily fit with canonical asset pricing. Indeed, we would still be left with the puzzling question of why the large pre-FOMC announcement drift is not arbitrated away by institutional investors, especially since the strategy is not exposed to jumps or other sources of risk.

5 Conclusion

We document that U.S. and international equities have earned a highly statistically significant and economically large excess return prior to scheduled FOMC announcements since 1994. This return is persistent and robust to exclusions of outliers as well as across subsamples. Other macroeconomic news announcements do not carry analogous pre-announcement returns. Moreover, other asset classes do not feature a pre-FOMC announcement drift. We study various risk-based explanations of the return, and find that none can help explain it. At this point the pre-FOMC announcement drift is a puzzle.

²⁰Under this interpretation, our finding that the magnitude of the pre-FOMC announcement drift has risen over time might be viewed as consistent with the increasing availability of real-time trading tools for individual investors in recent years.

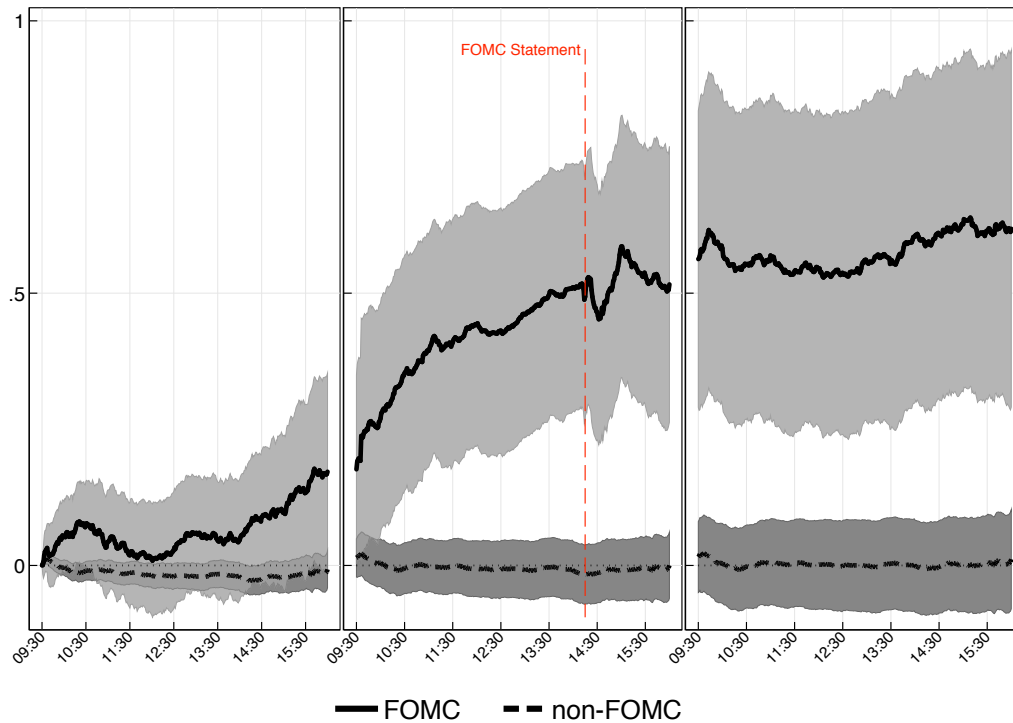
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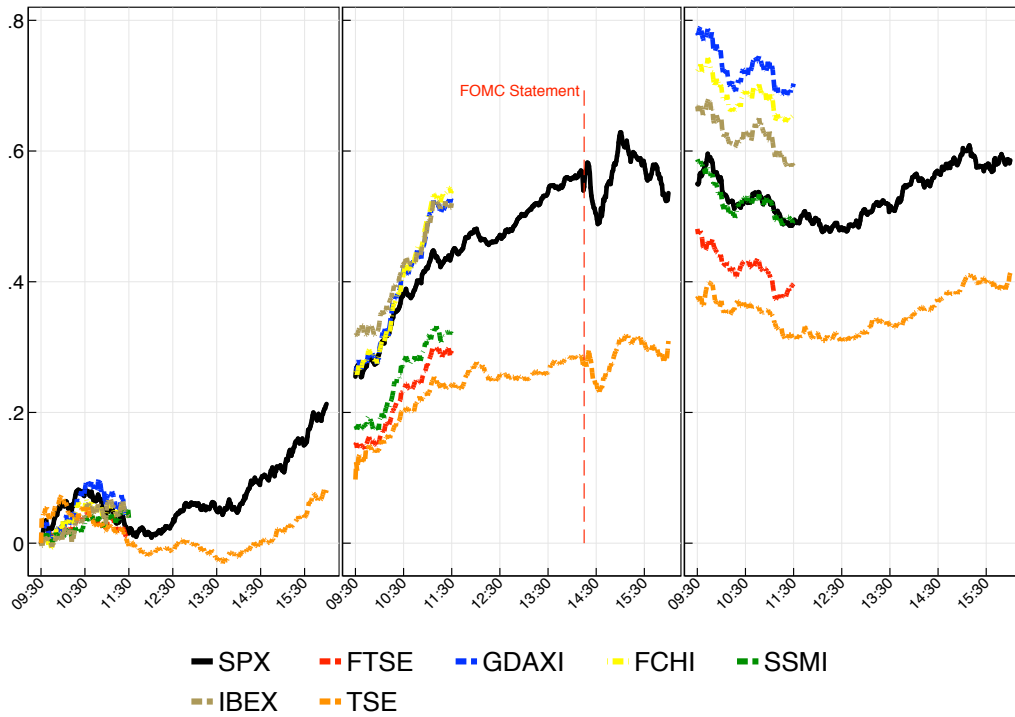
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Figure 1: Cumulative Returns on the S&P500 Around FOMC Announcements



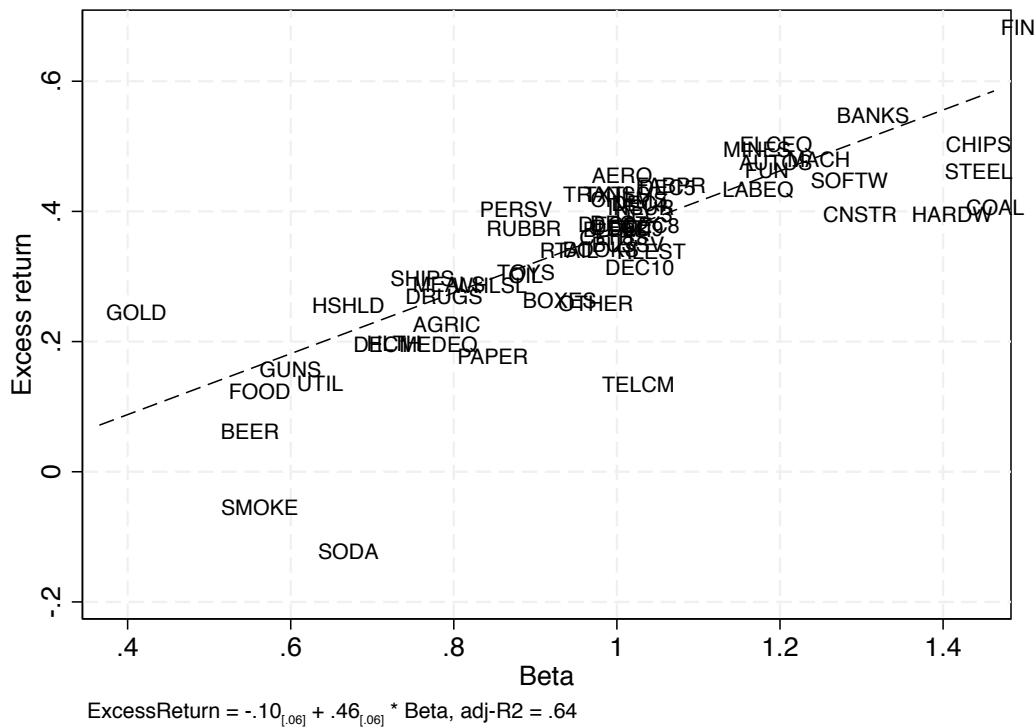
NOTES: This chart plots the average cumulative one-minute return on the SPX over a three day window. The solid black line shows the average cumulative return on the SPX from 9:30 a.m. EST on the days before scheduled FOMC announcements until 4:00 p.m. on days after scheduled FOMC announcements. The dashed 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 February 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: Cumulative Returns on International Stock Market Indexes Around FOMC Announcements



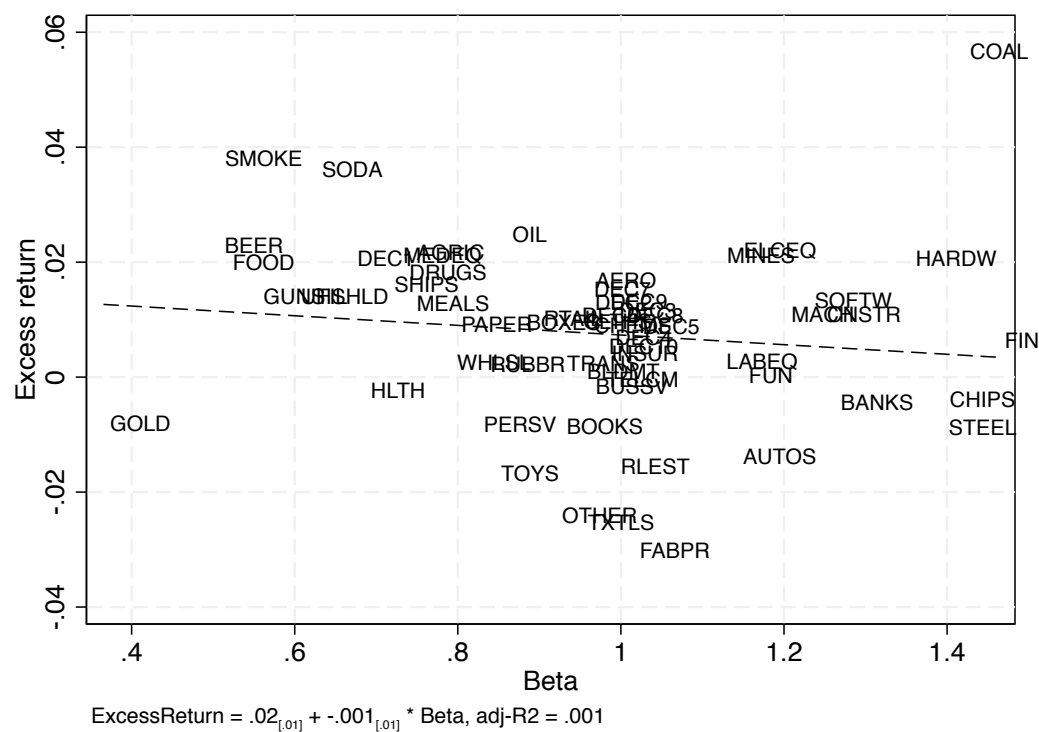
NOTES: This chart plots the average cumulative one-minute return on the SPX and other major international equity market indexes over the three day window around scheduled FOMC announcements. The solid black line shows the average cumulative return on the SPX from 9:30 a.m. EST on the days before scheduled 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 February 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 3: CAPM for 49 Fama-French Industry Returns on FOMC Announcement Days



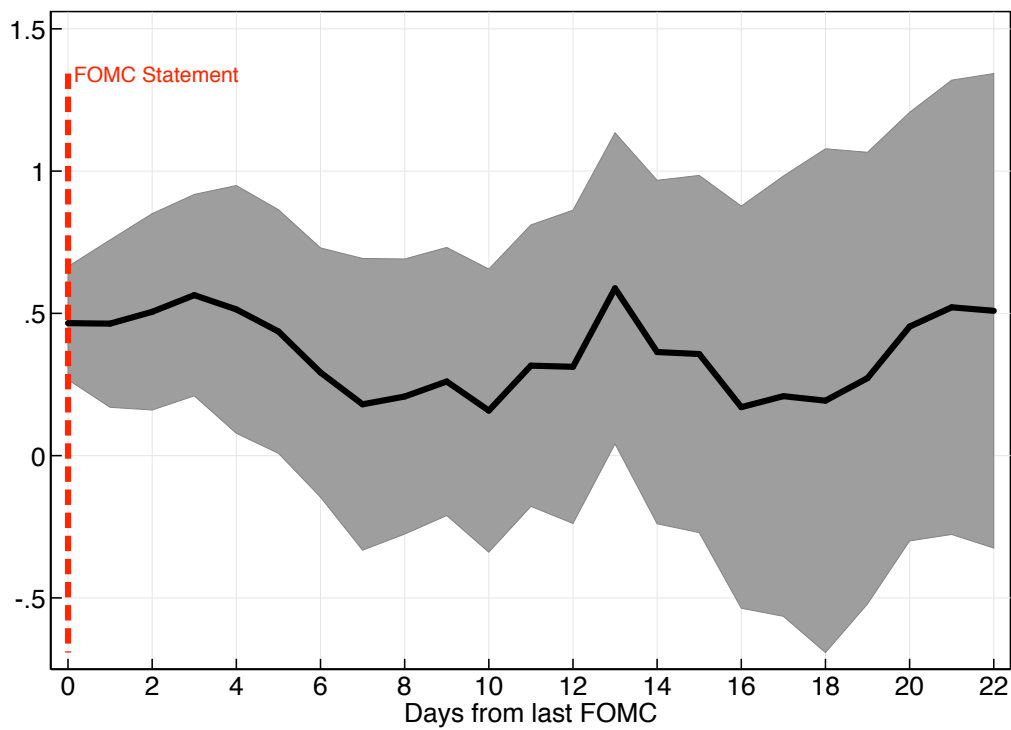
NOTES: This chart documents the fit of the CAPM for the 49 Fama-French industry portfolios on FOMC announcement days. For each industry portfolio, the vertical axis shows the average excess return earned on scheduled FOMC announcement days (in percent) whereas the horizontal axis shows the portfolio’s market beta. The latter are estimated from a regression of the portfolio’s excess return on the excess return of the market portfolio at the daily frequency. The sample period is from February 1994 through March 2011. The dashed line shows the estimated regression of the average excess FOMC announcement day returns onto the betas. The point estimates and standard errors as well as the R-squared of that regression are provided below.

Figure 4: CAPM for 49 Fama-French Industry Returns on non-FOMC Announcement Days



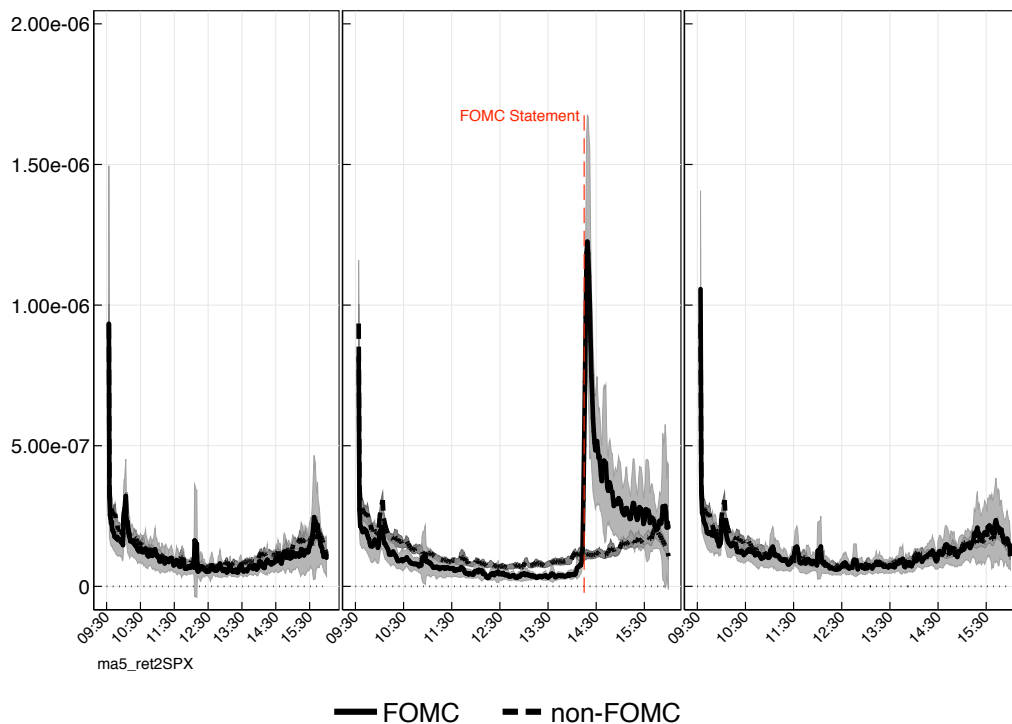
NOTES: This chart documents the fit of the CAPM for the 49 Fama-French industry portfolios on non-FOMC announcement days. For each industry portfolio, the vertical axis shows the average excess return earned on non-FOMC announcement days (in percent) whereas the horizontal axis shows the portfolio’s market beta. The latter are estimated from a regression of the portfolio’s excess return on the excess return of the market portfolio at the daily frequency. The sample period is from February 1994 through March 2011. The dashed line shows the estimated regression of the average excess non-FOMC announcement day returns onto the betas. The point estimates and standard errors as well as the R-squared of that regression are provided below.

Figure 5: Persistence of Excess Returns on S&P500 After Scheduled FOMC Announcements



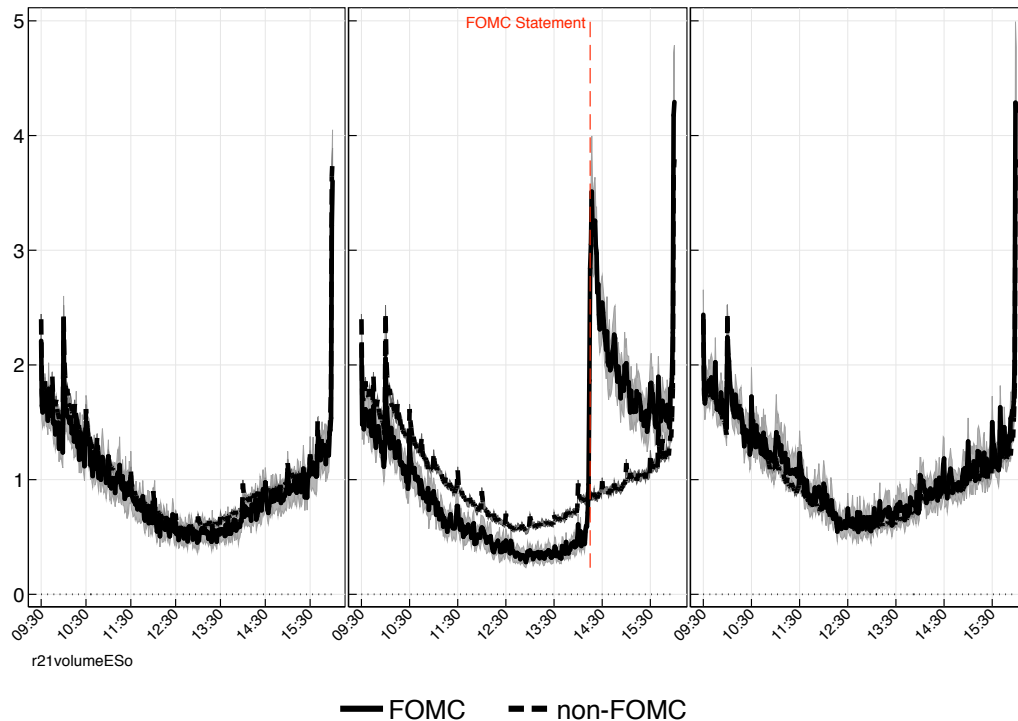
NOTES: This chart documents the persistence of the pre-FOMC announcement drift. The solid line represents the cumulative average daily log 2pm-to-2pm excess return since the day prior to the last FOMC announcement. The sample period is from February 1994 through March 2011. Shaded areas represent pointwise 95% confidence bands around the mean.

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 days after scheduled FOMC announcements. The sample period is from February 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. on days after scheduled FOMC announcements. The sample period is from February 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.

Table 1: Daily S&P500 Excess Returns

Dependent Variable: %Log-excess-return of SP500 stock market index				
Type of return:	close-to-close			2pm-to-2pm
FOMC dummy	0.32 [0.10]***	0.05 [0.06]	0.32 [0.10]***	0.46 [0.10]***
Kuttner-shock			1.46 [1.09]	
Kuttner-Shock * FOMC dummy			−3.90 [3.06]	
Const.	0.01 [0.02]	0.02 [0.01]	0.01 [0.02]	0.00 [0.02]
Annual ex-return FOMC	2.61	0.62		3.76
Annual ex-return non-FOMC	1.97	3.65		0.88
FOMC Sharpe Ratio	0.80	0.20		1.10
Obs.	4314	6066	4169	4289
N. of FOMC	138	236	137	137
Dates	Feb94-Mar11	Jan70-Jan94	Feb94-Mar11	Feb94-Mar11

NOTES: *** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard error shown in brackets. FOMC Sharpe Ratio are annualized Sharpe-ratios on FOMC dates.

Table 2: International Stock Market Index Regressions

Dependent Variable: %Log-excess-return of stock market indexes							
Stock Market Index:	DAX	FTSE100	CAC40	IBEX	SMI	TSX	NIKKEI
FOMC dummy	0.43 [0.11]***	0.32 [0.10]***	0.52 [0.12]***	0.47 [0.12]***	0.29 [0.10]***	0.20 [0.09]**	0.02 [0.16]
Const.	0.01 [0.02]	-0.00 [0.02]	-0.01 [0.02]	0.01 [0.02]	0.01 [0.02]	0.01 [0.02]	-0.02 [0.02]
Annual ex-return FOMC	3.51	2.55	4.09	3.80	2.43	1.75	0.03
Annual ex-return non-FOMC	2.54	-1.13	-1.63	1.26	2.26	3.09	-3.94
FOMC Sharpe Ratio	1.02	0.76	1.05	1.01	0.76	0.62	0.01
Obs.	4342	4332	4350	4314	4298	4295	4219
N. of FOMC	136	138	137	137	138	137	131

NOTES: *** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard error shown in brackets. Sample starts on Feb 1, 1994 and ends on Mar 31, 2011.

Table 3: CRSP Size Portfolio Regressions

Dependent Variable: %Log-excess-return of CRSP portfolio index									
Portfolio:	Value Weighted	Equal Weighted	1st Decile	2nd Decile	3rd Decile	4th Decile			
FOMC dummy	0.34 [0.10]***	0.23 [0.08]***	0.18 [0.08]**	0.36 [0.12]***	0.38 [0.11]***	0.41 [0.11]***			
Const.	0.01 [0.02]	0.06 [0.02]***	0.02 [0.02]	0.01 [0.02]	0.01 [0.02]	0.01 [0.02]			
Annual ex-return FOMC	2.83	2.32	1.58	3.03	3.19	3.32			
Annual ex-return non-FOMC	1.84	14.73	5.08	3.21	2.87	1.72			
FOMC Sharpe Ratio	0.89	0.87	0.62	0.78	0.86	0.91			
Portfolio:	5th Decile	6th Decile	7th Decile	8th Decile	9th Decile	10th Decile			
FOMC dummy	0.43 [0.11]***	0.37 [0.10]***	0.37 [0.10]***	0.37 [0.10]***	0.36 [0.10]***	0.31 [0.10]***			
Const.	0.01 [0.02]	0.01 [0.02]	0.02 [0.02]	0.01 [0.02]	0.01 [0.02]	0.01 [0.02]			
Annual ex-return FOMC	3.52	3.06	3.08	3.05	3.02	2.53			
Annual ex-return non-FOMC	2.16	2.65	3.75	2.65	3.23	1.35			
FOMC Sharpe Ratio	1.00	0.95	0.98	0.93	0.94	0.79			

NOTES: *** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard error shown in brackets. Sample starts on Feb 1, 1994 and ends on Mar 31, 2011 (4261 daily observations).

Table 4: CRSP Value-Weighted Industry Portfolio Regressions

Dependent Variable: %log-excess-return of CRSP Industry portfolio							
Industry Portfolio:	AGRIC	FOOD	SODA	BEER	SMOKE	TOYS	FUN
FOMC dummy	0.21 [0.16]	0.10 [0.08]	-0.16 [0.22]	0.04 [0.10]	-0.09 [0.15]	0.32 [0.12]***	0.46 [0.19]**
FOMC Sharpe Ratio	0.34	0.39	-0.14	0.16	-0.09	0.62	0.61
Industry Portfolio:	BOOKS	HSHLD	CLTHS	HLTH	MEDEQ	DRUGS	CHEMS
FOMC dummy	0.35 [0.12]***	0.24 [0.09]***	0.35 [0.12]***	0.20 [0.10]*	0.17 [0.10]*	0.25 [0.10]***	0.41 [0.11]***
FOMC Sharpe Ratio	0.70	0.69	0.72	0.47	0.50	0.69	0.92
Industry Portfolio:	RUBBR	TXTLS	BLDMT	CNSTR	STEEL	FABPR	MACH
FOMC dummy	0.37 [0.12]***	0.45 [0.15]***	0.37 [0.13]***	0.39 [0.17]**	0.47 [0.15]***	0.47 [0.18]**	0.47 [0.13]***
FOMC Sharpe Ratio	0.76	0.68	0.69	0.56	0.74	0.58	0.93
Industry Portfolio:	ELCEQ	AUTOS	AERO	SHIPS	GUNS	GOLD	MINES
FOMC dummy	0.48 [0.14]***	0.49 [0.14]***	0.44 [0.14]***	0.28 [0.14]**	0.14 [0.13]	0.25 [0.22]	0.47 [0.16]***
FOMC Sharpe Ratio	0.90	0.82	0.79	0.54	0.31	0.28	0.76
Industry Portfolio:	COAL	OIL	UTIL	TELCM	PERSV	BUSSV	HARDW
FOMC dummy	0.35 [0.26]	0.28 [0.11]**	0.12 [0.09]	0.14 [0.12]	0.41 [0.12]***	0.35 [0.10]***	0.38 [0.17]**
FOMC Sharpe Ratio	0.39	0.65	0.38	0.29	0.80	0.88	0.59
Industry Portfolio:	SOFTW	CHIPS	LABEQ	PAPER	BOXES	TRANS	WHLSL
FOMC dummy	0.43 [0.15]***	0.51 [0.16]***	0.43 [0.13]***	0.17 [0.10]*	0.25 [0.12]**	0.43 [0.11]***	0.28 [0.10]***
FOMC Sharpe Ratio	0.73	0.78	0.81	0.44	0.54	0.94	0.73
Industry Portfolio:	RTAIL	MEALS	BANKS	INSUR	RLEST	FIN	OTHER
FOMC dummy	0.33 [0.11]***	0.28 [0.11]**	0.55 [0.19]***	0.40 [0.13]***	0.35 [0.16]**	0.68 [0.19]***	0.28 [0.12]**
FOMC Sharpe Ratio	0.73	0.64	0.72	0.74	0.53	0.90	0.55

NOTES: *** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard error shown in brackets. Sample starts on Feb 1, 1994 and ends on Mar 31, 2011 (4261 daily observations).

Table 5: Other Macroeconomic Announcements

Dependent Variable: %Log-return of SP500 stock market index						
Event:	NFPAY	INCLM	GDPADV	ISM	IP	
Event _t Dummy	0.09 [0.09]	-0.02 [0.05]	0.02 [0.16]	0.22 [0.10]**	0.05 [0.08]	
Event _{t+1} Dummy	-0.09 [0.09]	-0.01 [0.04]	0.11 [0.14]	-0.03 [0.09]	0.02 [0.09]	
No. of events	205	886	62	209	206	
Event:	HSTART	PPI	CPI	PI	ALL	
Event _t Dummy	0.06 [0.09]	0.04 [0.09]	0.04 [0.09]	0.04 [0.09]	0.04 [0.04]	
Event _{t+1} Dummy	0.12 [0.09]	-0.11 [0.08]	-0.07 [0.10]	0.01 [0.08]	-0.00 [0.04]	
No. of events	207	208	209	205	2050	

NOTES: *** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard error shown in brackets. Sample starts on Feb 1, 1994 and ends on Jun 30, 2011 (4386 daily observations). The table does not report the coefficient on a constant, which is included in each regression. The events 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), All economic releases (ALL).

Table 6: Other Asset Classes

Dependent Variable:		%Δ Yields in				%ΔLog Exchange Rates	
Instrument:	FF-1	FF-2	ED-4	TREAS-2Y	TREAS-10Y	USD-EURO	USD-YEN
FOMC dummy	0.00 [0.00]	-0.00 [0.00]	-0.01 [0.01]*	-0.01 [0.01]	-0.00 [0.01]	-0.07 [0.05]	0.08 [0.05]
Const.	-0.00 [0.00]	-0.00 [0.00]	-0.00 [0.00]	-0.00 [0.00]	-0.00 [0.00]	-0.00 [0.01]	-0.01 [0.01]
Obs.	4214	4214	4262	4468	4472	4318	4319
N. of FOMC	137	137	138	138	138	138	138

NOTES: *** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard error shown in brackets. Sample starts on Feb 1, 1994 and ends on Jun 30, 2011. FF-1 and -2 are rates implied by the first and second fed funds futures contracts. ED-4 is the 4th eurodollar implied rate. Treas-2y and -10y are yields on the 2- and 10-y benchmark Treasuries. USD-EURO and USD-YEN and exchange rates in percent

Table 7: Robustness of pre-FOMC Announcement Day Return

Dependent Variable: %Log-excess-return of 2pm-to-2pmSP500 stock market index						
	Subsamples			Excluding Outliers		MAD Regression
FOMC dummy	0.32 [0.11]***	0.40 [0.12]***	0.67 [0.26]**	0.42 [0.07]***		0.30 [0.10]***
Const.	0.05 [0.03]**	-0.03 [0.03]	-0.02 [0.04]	0.00 [0.02]		0.04 [0.02]**
Annual ex-return FOMC	3.00	3.00	5.31	3.28		
Annual ex-return non-FOMC	13.03	-6.74	-3.72	0.88		
FOMC Sharpe Ratio	1.45	1.28	1.05	1.50		
Obs.	1447	1436	1405	4285		
N. of FOMC	46	46	45	133		137
Dates	Feb94-Nov99	Dec99-Aug05	Sep05-Mar11	Feb94-Mar11		Feb94-Mar11

NOTES: *** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard error shown in brackets. FOMC Sharpe Ratio are annualized Sharpe-ratios on FOMC dates.

Table 8: Common Risk Factors

Dependent Variable: %close-to-close SP500		
FOMC dummy	0.32 [0.10]***	0.33 [0.09]***
SMB		-0.27 [0.05]***
MOM		-0.35 [0.03]***
HML		-0.30 [0.06]***
STREV		0.34 [0.04]***
LTREV		-0.08 [0.06]
Const.	0.01 [0.02]	-0.01 [0.02]
Obs.	4314	4314
N. of FOMC	138	138
Dates	Feb94-Mar11	Feb94-Mar11

NOTES: *** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard error shown in brackets. FOMC Sharpe Ratio are annualized Sharpe-ratios on FOMC dates.

Table 9: Controlling for Liquidity and Volatility Risk

Dependent Variable: %Log returns of 2pm-to-2pm SP500 index				
Liqu. defined on:	SPY		SP500 E-mini	
FOMC dummy	0.57 [0.12]***	0.56 [0.07]***	0.56 [0.13]***	0.56 [0.07]***
Amihud Illiquid.		389.44 [299.76]		102.91 [60.52]*
Bid-Ask		0.68 [0.29]**		0.71 [1.20]
Relat. Trade Vols		-0.01 [0.04]		-0.05 [0.04]
VIX(lag)		-0.00 [0.00]		0.00 [0.00]
VIX(innovat.)		-0.59 [0.02]***		-0.59 [0.02]***
Const.	-0.02 [0.02]	-0.03 [0.07]	-0.03 [0.02]	-0.16 [0.30]
Obs.	3032	3032	2646	2646
N. of FOMC	118	118	107	107
Dates	Jan96-Mar11	Jan96-Mar11	Sep97-Mar11	Sep97-Mar11

NOTES: *** significant at 1%, ** significant at 5%, *significant at 10%. Robust standard error shown in brackets. FOMC Sharpe Ratio are annualized Sharpe-ratios on FOMC dates.