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Not So Fast: High-Frequency Financial Data for Macroeconomic Event Studies

Ali K. Ozdagli

Abstract:

Over the last decade, it has become increasingly popular to use event studies with intraday asset pricing data to study the effect of macroeconomic events on the economy. The proponents of this approach argue that asset prices react to macroeconomic events very quickly and that if we know the precise timing of a macroeconomic announcement, a very narrow event window around such an announcement (ranging from 30 minutes to 60 minutes) should be sufficiently long and free from contaminating information that might otherwise cause biased estimates in wider event windows. In contrast, this paper argues that even narrow event windows can lack clean identification because the reaction of asset prices may be affected by other important news that comes out earlier on the same day. We support this argument by studying the relationship between federal funds futures and other asset prices (stocks and Treasuries) on FOMC announcement dates, a relationship widely studied in high-frequency event studies to identify the effect of conventional monetary policy shocks on asset prices. We find that asset prices react significantly more strongly to monetary policy shocks on FOMC announcement dates that overlap with other macroeconomic announcements that come out earlier on the same day. We also find a stronger reaction of asset prices when markets are more volatile. This finding suggests that limitations of investors, such as through rational inattention or asymmetric information, might matter in these event studies. Consequently, one should be cautious before arguing that high-frequency (intraday) event studies adequately address the contamination issues that plague the methods that use low-frequency data.

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1. Introduction

Cleanly identifying macroeconomic shocks and their effects on the economy has been a formidable challenge facing macroeconomists, especially because of the lack of controlled experiments in macroeconomics. Since the 1970s, the main tools in the toolbox of macroeconomists have been Sargent/Hansen-style structural econometrics and Sims-style vector autoregressions, which earned their respective pioneers Nobel Prizes in 2011 and 2013. However, more recently, the increased availability of high-frequency financial market data and our increased understanding of how financial markets function allow us to use the controlled release of macroeconomic news as a quasi-experiment, especially for the study of the relationship between macroeconomic shocks and asset prices.

As pointed out by Gürkaynak and Wright (2013), the main identification assumption of high-frequency (intraday) event studies is that the market quickly incorporates the information from announcements into asset prices. This assumption, combined with the lumpiness and the knowledge of the precise timing of the announcement, allows the researcher to specify a narrow event window around the announcement times that would not only capture the full effect of the announcement, but also be free of contamination from other shocks to the economy. Because this assumption seems plausible to researchers and its implementation is relatively easy, intraday event studies have become increasingly popular over the last decade.[1]

One implication of this assumption is that the reaction of asset prices to particular macroeconomic events should be independent of the earlier news breaking on the day of the event, because the effects of earlier news will have already been incorporated into asset prices by the time of the event window of interest. This paper tests this assumption, and hence the reliability of high-frequency event studies, by studying the reaction of asset prices to monetary

[1] According to some empirical evidence, such as Andersen et al. (2007), the reaction time of liquid assets, such as stocks and government bonds, to macroeconomic news is as little as 10 minutes. For applications of intraday event studies, see, for example, Gürkaynak, Sack, and Swanson (2005b), Wongswan (2006, 2009), Faust et al. (2007), Beechy and Wright (2009), Ammer, Vega, and Wongswan (2010), Hussain (2011), Swanson (2011), Leon and Sebesyten (2012), Wright (2012), English, Skander, and Zakrajsek (2013), and Gorodnichenko and Weber (2013). While most of the papers in this literature belong to the last decade, the use of intraday financial data to study the effects of macroeconomic events can be traced back at least to Jain (1988).

policy announcements, because the pre-announced timing of FOMC meetings makes these announcements especially suitable for event study analysis. We study the relationship of changes in stock prices and Treasury yields to changes in federal funds future prices on FOMC announcement dates; these are relationships that are widely analyzed in high-frequency event studies to identify the effect of conventional monetary policy shocks on asset prices. We find that these relationships are significantly different on those FOMC announcement dates that overlap with other macroeconomic announcements coming out earlier on the same day.[2] We also find a stronger reaction of asset prices when markets are more volatile. These findings suggest that limitations of investors, such as through rational inattention or asymmetric information, in high-frequency markets may matter in these event studies. Consequently, one should be cautious about arguing that high-frequency (intraday) event studies adequately address the contamination issues that plague the methods that use low-frequency data.

2. Data Description

The data are courtesy of Refet Gürkaynak, with our own additions, and consist of changes in the intraday prices of several assets on the pre-scheduled FOMC announcement dates; these dates were chosen in order to ensure that our results are not driven by timing shocks. The data include percentage changes in prices and level changes in yields for the interval of 30 minutes (-10min, +20min) and 60 minutes (-20min, +40min) around the time of the FOMC announcement. We use two different windows because each may be better suited to a different asset. On the one hand, for more liquid assets, such as a stock price index, a tight window may be preferable because it can capture most of the effect of the policy surprise on asset prices, whereas a wider window would lead to more contamination in the measured price reaction, since prices of liquid assets tend to be more volatile. On the other hand, for less liquid assets, a wider window may be preferable, to allow for the delayed reaction of its price, resulting from the relative infrequency of these trades compared with the frequency of trades of more liquid assets.

[2] This result is in line with Dominguez (2003), who finds that the Federal Reserve's interventions to the currency market are more likely to have large effects if they are timed closely to macroeconomic announcements. Our result is stronger because we focus only on scheduled actions of the FOMC and also control for the surprise component of the FOMC's action, two elements missing from the Dominguez (2003) study.

The unexpected (surprise) component of the federal funds target rate announcement is derived from the change in federal funds futures over the same interval. Further details about the calculation of the federal funds target surprise and about the data for stock indices and Treasury yields can be obtained from Gürkaynak, Sack, and Swanson (2005b). We also employ Treasury futures prices from Tickdata/CME in the same 30-minute and 60-minute event windows for our Robustness and Discussion sections.

Following Bernanke and Kuttner (2005), we choose June 1989 as our starting point.[3] Our data on FOMC announcements come from Kuttner's extension of his data and end in June 2008 because the federal funds target rate hit the zero lower bound thereafter.[4] For federal funds futures and stocks, this provides 153 event dates, 67 of which overlap with other macroeconomic announcements that seem to strongly affect interest rates according to Gürkaynak, Sack, and Swanson (2005a).[5] For U.S. government debt yields, this provides 137 event dates, 61 of which overlap with other macroeconomic announcements; these data start in October 1991. The list of scheduled FOMC announcements and other macroeconomic news that overlaps with these FOMC announcement days is provided in the appendix.

3. Empirical Model and Results

Our main regression is

$$\Delta a = constant + \alpha * Surprise + \beta * Surprise * (Macro) + \gamma * Macro + \varepsilon,$$

where Δa is the percentage change in the S&P 500 index or the percentage point change in the yield, *Surprise* is the unexpected change in the federal funds target rate, and *Macro* is a dummy variable equal to one on an event date if this event date overlaps with another macroeconomic announcement, and zero otherwise.

[3] Some studies choose 1994 as the starting point, as the Federal Reserve started to explicitly communicate the target rate in February, 1994. We get similar results when we use post-1994 data.

[4] http://econ.williams.edu/people/knk1/research

[5] See their Table 1. The list of macroeconomic announcements includes capacity utilization, consumer confidence, the CPI (core), the employment cost index, GDP (advance), initial claims for unemployment insurance, leading indicators, the national association of purchasing managers index (NAPM), new home sales, non-farm payrolls, the producer price index (core), retail sales, and the unemployment rate.

Table 1 shows the reaction of the S&P 500 index to monetary policy surprises on scheduled FOMC announcement dates over the narrow (30 minutes) and wide (60 minutes) windows around the time of the announcement. Consistent with the earlier literature, columns 1 and 3 show that stock prices increase by about 3 percent in response to a 1 percentage point surprise decrease in the federal funds target rate.[6] Moreover, we find that the reaction of stock prices to monetary policy shocks is much stronger on the FOMC announcement dates that overlap with other macroeconomic announcements earlier in the day, as indicated by the coefficient of Surprise*Macro. Column 2 shows that almost all the effect of a policy surprise on stock prices in the tight window comes from the dates that overlap with the other macroeconomic announcements. At first, this result might suggest that stock prices react faster when there is another macroeconomic announcement earlier in the day, and using a wider window should solve this problem. However, column 4 shows that the difference in price reaction survives over the wide window—the effect of a policy surprise on stock prices roughly doubles over the wide window on the dates that overlap with the other macroeconomic announcements.

Tables 2–7 show that Treasury yields of different maturities also react differently on FOMC dates that overlap with other macroeconomic announcements. However, we also observe two different patterns compared with the stock index reaction. First, the differential reaction for Treasury yields is greater in wider windows. Second, the differential reaction is stronger for longer maturities, and almost all the effect of a policy surprise on longer (2+ year) yields in the wide window comes from the dates that overlap with other macroeconomic announcements, whereas stocks display the same pattern in the tight window. These patterns provide further evidence that the differential reaction captured by the coefficient of Surprise*Macro does not stem from faster price reaction on the dates that overlap with the other macroeconomic announcements.

[6] See Bernanke and Kuttner (2005) and Gürkaynak, Sack, and Swanson (2005b).

4. Robustness

Before we delve into potential explanations, we check the robustness of our main result that asset prices react more strongly to monetary policy shocks on FOMC dates that overlap with other macro announcements earlier in the day. For this purpose, we first study alternative regression specifications and confirm that our main result is not driven by the tyranny of a few observations. Second, we use prices of Treasury futures, because they are arguably more liquid than Treasury notes and bonds.

We check whether the effect of a particular macroeconomic announcement dominates the effect of other announcements. For this purpose, we discard an FOMC announcement date that overlaps with a given macroeconomic announcement from the sample to see whether the coefficient estimates change.[7] Since this involves 12 regressions for each asset, we discuss only the significant changes in the coefficient of Surprise*Macro, which are relatively few compared with the total number of regressions.[8] Complete results (84 regressions) are available upon request.

There are no economically significant changes in any of the coefficients for any of the assets, in either the tight or the wide window. Surprise*Macro becomes statistically insignificant for the wide window of the S&P 500 index when we discard unemployment reports or core CPI announcements from the sample, although the coefficients are very similar to the ones we saw before, -2.58 versus -2.48 and -2.57, respectively. For the 3-month Treasuries, the Surprise*Macro coefficient becomes statistically insignificant in the wide window when we discard announcements of consumer confidence (0.18), leading indicators (0.16), or new home sales (0.21); the numbers in parentheses give the respective coefficients, which are comparable in magnitude to the full-sample coefficient of 0.23. For 6-month Treasuries, the coefficient in the tight window becomes statistically significant at the 10 percent level when we discard

[7] An alternative way would be to keep, rather than discard, each macroeconomic announcement date, to determine the macroeconomic news that are particularly unimportant. Unfortunately, although a significant number of FOMC announcements overlap with macroeconomic news, they overlap with the same news very rarely.

[8] Since the unemployment report and non-farm payrolls are announced simultaneously, we have 12, rather than 13, regressions per asset.

announcements of capacity utilization (0.26), initial claims for unemployment insurance (0.21), retail sales (0.28), or the unemployment report (0.27), which are comparable to the original coefficient of 0.22. For 30-year Treasuries, the coefficient in the wide window becomes statistically insignificant when we discard the announcements of consumer confidence (0.21), the employment cost index (0.20), initial claims for unemployment insurance (0.17), leading indicators (0.13), the NAPM (0.20), or new home sales (0.16), all of which are comparable to the original coefficient of 0.21. To summarize, of 84 new regressions, 11 lead to statistical insignificance and four lead to statistical significance of the coefficient of Surprise*Macro, whereas the magnitudes of the coefficients are practically unaffected. Therefore, our first analysis concludes that none of the macroeconomic announcements seems to dominate the others in generating our main result.

Next, we use two alternative estimation methods that are robust to influential observations: quantile regression for the median and robust regression as described in Li (1985). We find that the quantile regressions provide essentially similar results to ordinary least squares (OLS) regressions, and hence we focus on the robust regression technique in the following.

The robust regression method explicitly takes into account the fact that some observations may be more influential than others in deriving the OLS regression results. This procedure, already implemented in commercial software packages such as Stata, runs the OLS regression, computes the Cook's distance statistic for each observation, and then drops any observation with a Cook's distance statistic greater than 1.[9] The following steps iteratively reduce the weight of observations that are more influential, rather than discarding them, where the weights are based on absolute residuals.[10] The results, presented in the appendix, are qualitatively very similar to the standard OLS results. More interestingly, the results become stronger for Treasuries with shorter-term maturities (three months and six months) in the tighter event windows.

[9] It turns out that none of our observations has a Cook's distance statistic above 1, which is a widely used threshold that is also automatically implemented by Stata's robust regression (rreg) command. See the Stata manual for details.
[10] Hamilton (1991, 1992) provides the details and performance evaluation of this procedure.

As a third robustness check, we also repeat our analysis restricting the sample to the period starting February 1, 1994, and ending February 1, 2006. Our start date, which is also used in several other studies, marks the date when the Federal Reserve began to explicitly communicate the target rate. Our end date marks the end of the Greenspan era, when Bernanke replaced Greenspan as Chairman of the Federal Reserve; this date was chosen to ensure that our results would not be affected by the change in policy regimes. The results for Surprise*Macro, which are available upon request, are very similar to those obtained in Tables 1–8, except that the coefficient of Surprise*Macro turns out to be statistically insignificant for the stock price index in the wide window, with a regression coefficient of -1.23 and a *t*-statistic of -0.68.

As a final robustness check, we repeat our analysis using the returns on 2-, 5-, 10-, and 30-year Treasury futures, because these futures are considered particularly liquid and are traded in a centralized market, whereas before 2004, the yields on Treasury debt in the secondary market came from voice calls of multiple interdealer brokers.[11] As expected, the prices of Treasury futures are negatively related to interest rates, as shown in Table 8. Moreover, we still see the same pattern as for the Treasury yields: the reaction of Treasury futures is greater on FOMC announcement dates that overlap with other macroeconomic announcements, and most of the effect seems to occur on these overlapping dates, especially in wide event windows in the second panel.

5. Discussion

Our results indicate that traders are more sensitive to monetary policy news at times when other major macroeconomic announcements are released. We have two possible explanations, both of which are related to market volatility: If agents are rationally inattentive, in the spirit of Sims (2003), and if there are fixed costs to acquiring information, then periods of increased volatility, such as times when other macroeconomic news is released, may make investors more

[11] Following Gürkaynak, Sack, and Swanson (2005b), when there is no futures trade exactly at the beginning of the specified window, we use the most recent price. When there is no trade exactly at the end of the specified window, we use the next available trade price.

attentive to the news overall, and therefore more sensitive to monetary policy surprises.[12] Alternatively, periods of high volatility may correspond to periods of high concentration of informed trading, because during high-volatility days, informed traders can more easily hide their trades, which may make asset prices more responsive to monetary policy shocks.

In order to dig deeper into this latter explanation, we calculate intraday volatility on each FOMC announcement date as the standard deviation of the intraday prices of the respective asset, divided by the average price on that date. Figure 1 plots the quantiles of the intraday volatility on the dates that overlap with macroeconomic announcements against the quantiles of the intraday volatility on the dates that do not overlap with macroeconomic announcements. These plots lie above the 45-degree line for a wide range of values, suggesting that intraday volatility is overall higher on days that overlap with other macroeconomic announcements.

Table 9 shows the results of regressions where we include the interaction of the policy surprise with the intraday volatility of the corresponding asset. For ease of comparison, Table 9 uses the standardized version of the volatility variable, *Volatility*, where we demean each value of volatility using the sample mean of the volatility series and then divide each value by the standard deviation of this series. We focus on stock prices and also on Treasury futures because they are traded more frequently than Treasury notes and bonds in our datasets, allowing us to obtain better estimates of intraday volatility, especially starting in the early 2000s.[13]

Consistent with our potential explanations, we find that asset prices react more strongly to monetary policy shocks as volatility increases. This effect seems to be particularly strong for stocks' wide window and for futures on 2-year Treasuries, as the *Surprise*Volatility* term absorbs the effect of Surprise*Macro. However, this effect is weaker for futures of Treasuries with longer maturities, and for these futures the coefficient of Surprise*Macro remains economically and statistically significant even when the coefficient of Surprise*Volatility is insignificant. Overall,

[12] When there is a fixed cost to being attentive on a given day, paying attention will have a real option component that will more likely be exercised as volatility increases.

[13] See Fleming's (2003) discussion of the GovPX dataset. We use minute-by-minute S&P 500 index values from Pitrading and the individual trade quotes of Treasury futures from Tickdata/CME.

these results are consistent with our explanations related to market volatility, but market volatility does not paint the whole picture.

Therefore, we also tried alternative regression specifications to refine the mechanism through which assets react to monetary policy shocks, none of which led to significant and consistent results across different assets. (The results are available upon request.)

First, macroeconomic announcements released earlier on the same day might have different effects depending on how close their announcement time is to the FOMC announcement time. For example, market participants may be paying closer attention when different events are scheduled closer to one another. Alternatively, they may be less concerned with FOMC decisions when other macroeconomic announcements occur very close to the FOMC decision, because the FOMC does not have enough time to incorporate those announcements into its decision. The first channel would imply that the coefficient of Surprise*Macro should be greater in magnitude when macroeconomic announcements occur closer to the time of the FOMC announcement, whereas the second channel would counteract this effect. To test this hypothesis, we separate the announcements into different groups depending on when they occurred and check whether those that were made later in the day, and hence closer to the time of the FOMC announcement, affected the sensitivity of asset prices to a policy surprise differently.[14] The effect of the policy surprises on the dates with late announcements was statistically significantly different from that of early announcements only for stocks and for 3-month and 30-year Treasury securities. However, the sign of the differential effect was not consistent: For stocks, later macroeconomic announcements had less effect than earlier macroeconomic announcements, whereas for 3-month and 30-year Treasury securities most of the additional effect on macroeconomic announcement dates came from late announcements.

Second, macroeconomic announcements that do not overlap with FOMC dates can still affect the reaction of asset prices to monetary policy if they are sufficiently close to an FOMC date.

[14] The employment cost index, GDP (advance), initial claims for unemployment insurance, non-farm payrolls, the producer price index (core), the CPI (core), retail sales, and the unemployment rate are announced at 8.30 am; capacity utilization is announced at 9.15 am; and consumer confidence, NAPM, new home sales, and leading indicators are announced at 10 am.

Therefore, for each FOMC announcement date, we identify the number of days between this date and the last macroeconomic announcement date and check whether there is any similar, possibly smaller, effect stemming from other macroeconomic announcement dates that do not overlap with, but are sufficiently close to, an FOMC announcement date. We find that there is no economically material and statistically significant additional effect of monetary policy surprises on dates that are one or two days after a macroeconomic announcement, compared with announcements on days that are not close to the dates of macroeconomic announcements.

Third, as shown in Gürkaynak, Sack, and Swanson (2005b), some macroeconomic announcements tend to affect Treasury yields more than others. These announcements may attract greater attention by market participants, suggesting that asset prices may react even more strongly on FOMC dates that overlap with these macroeconomic announcements. To test this hypothesis, we group the macroeconomic announcements into strong and weak announcements, depending on the size of the coefficients in Gürkaynak, Sack, and Swanson (2005b), and we check whether the effect of monetary policy announcements on strong announcement dates exceeds the effect of monetary policy announcements on weak announcement dates..[15] We find that the effect of policy surprises on strong announcement dates is statistically significantly different only in the tight-window regressions for 6-month and 30-year securities. However, the direction of the effect is negative, which is counter to the prediction of the hypothesis.

Finally, asset prices may be more responsive to monetary policy shocks that counter market participants' updated expectations of monetary policy in light of the macroeconomic announcements. In order to test this hypothesis, we first use the results from Table 1 of Gürkaynak, Sack, and Swanson (2005b) to calculate the expected change in the one-year-ahead Treasury forward rate. Then we include in our regression an interaction of this term with the policy surprise. While this interacted term is occasionally significant in the Treasury regressions, it never absorbs the effect of Surprise*Macro.

[15] Accordingly, we deem the employment cost index, GDP (advance), non-farm payrolls, NAPM, retail sales, and consumer confidence announcements strong. Alternative groupings do not lead to different results.

6. Conclusion

Using intraday event study techniques, we find that asset prices have a significantly stronger response to monetary policy shocks on the FOMC announcement dates that overlap with other macroeconomic announcements that occur earlier in the day and on FOMC announcement dates with higher market volatility. These findings suggest that limitations of investors, such as rational inattention or asymmetric information, may matter for these event studies. Consequently, one should be cautious about arguing that high-frequency (intraday) event studies adequately address the contamination issues that plague methods that use low-frequency data.

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Figures

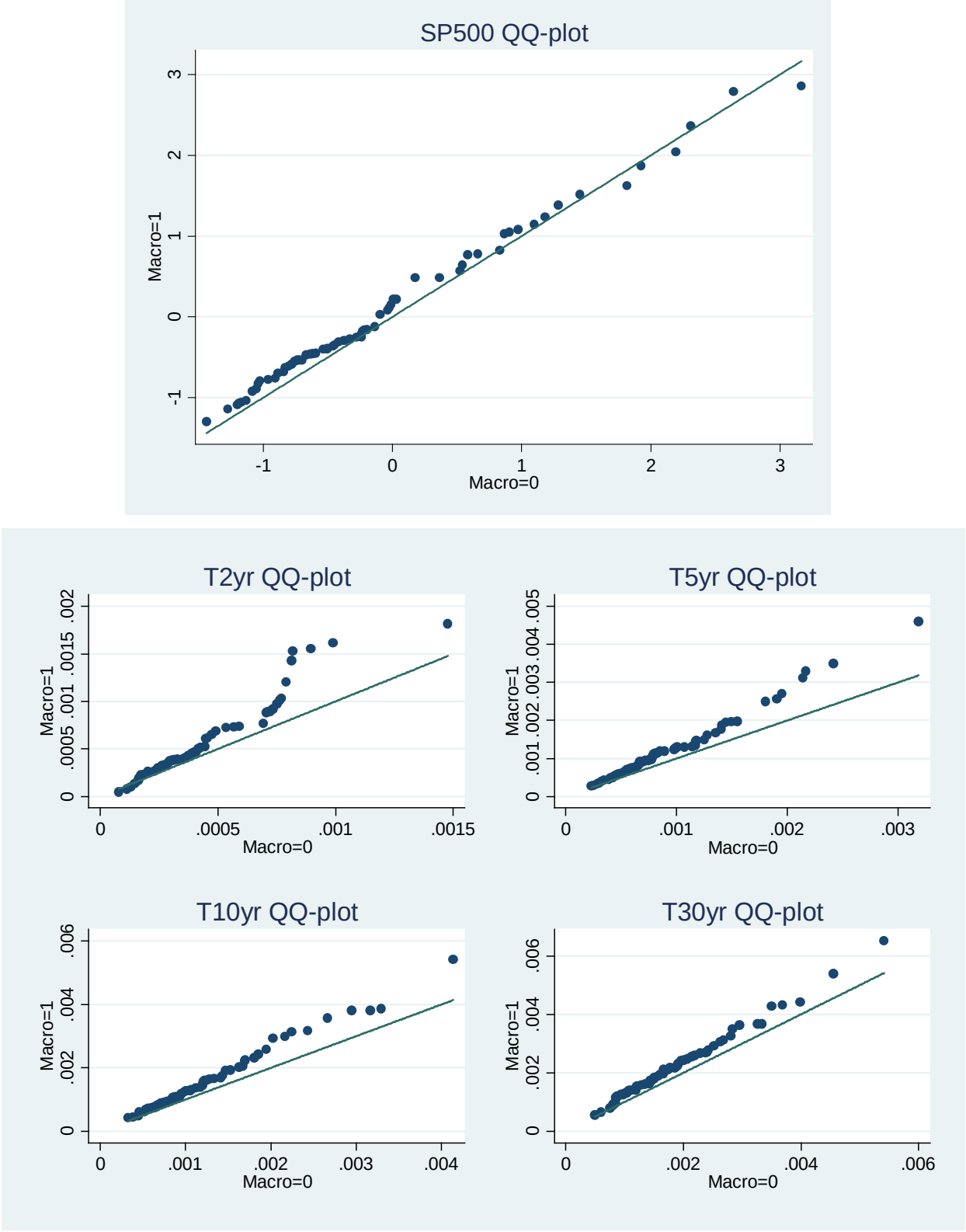

Figure 1. Quantile-Quantile plots for the volatility of different asset prices on FOMC dates

Tables

Table 1. Response of the SP500 Index to Scheduled FOMC Announcements 1989–2008

VARIABLES	(1) Tight	(2) Tight	(3) Wide	(4) Wide
Surprise	-2.64***	-0.78	-3.47***	-2.25**
	(-3.28)	(-0.74)	(-4.47)	(-2.48)
Surprise*Macro		-3.90***		-2.58*
		(-3.03)		(-1.89)
Macro		-0.05		0.05
		(-0.75)		(0.54)
Constant	-0.09***	-0.07	-0.02	-0.03
	(-2.80)	(-1.56)	(-0.36)	(-0.61)
Observations	153	153	153	153
R-squared	0.12	0.19	0.13	0.16

Robust *t*-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2. Response of the ONRUN3M Index to Scheduled FOMC Announcements 1991–2008

VARIABLES	(1) Tight	(2) Tight	(3) Wide	(4) Wide
Surprise	0.55***	0.52***	0.66***	0.55***
	(8.53)	(6.53)	(9.54)	(5.88)
Surprise*Macro		0.06		0.23*
		(0.43)		(1.80)
Macro		0.00		0.00
		(1.00)		(0.74)
Constant	-0.01**	-0.01***	-0.01***	-0.01***
	(-2.50)	(-3.36)	(-3.43)	(-3.69)
Observations	137	137	137	137
R-squared	0.62	0.63	0.64	0.66

Robust *t*-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3. Response of the ONRUN6M Index to Scheduled FOMC Announcements 1991–2008

VARIABLES	(1) Tight	(2) Tight	(3) Wide	(4) Wide
Surprise	0.51***	0.40***	0.58***	0.41***
	(6.35)	(4.77)	(6.66)	(4.22)
Surprise*Macro		0.22		0.36**
		(1.46)		(2.41)
Macro		0.01		0.00
		(1.43)		(0.69)
Constant	-0.00	-0.01**	-0.01**	-0.01***
	(-1.32)	(-2.46)	(-2.27)	(-2.66)
Observations	137	137	137	137
R-squared	0.42	0.45	0.47	0.52

Robust *t*-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4. Response of the ONRUN2 Index to Scheduled FOMC Announcements 1991–2008

VARIABLES	(1) Tight	(2) Tight	(3) Wide	(4) Wide
Surprise	0.38***	0.21**	0.44***	0.19
	(4.57)	(2.24)	(3.85)	(1.47)
Surprise*Macro		0.37**		0.54***
		(2.60)		(2.93)
Macro		0.01*		0.01
		(1.71)		(1.42)
Constant	-0.00	-0.01*	-0.00	-0.01
	(-0.35)	(-1.66)	(-0.36)	(-1.46)
Observations	137	137	137	137
R-squared	0.17	0.23	0.14	0.21

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5. Response of the ONRUN5 Index to Scheduled FOMC Announcements 1991–2008

VARIABLES	(1) Tight	(2) Tight	(3) Wide	(4) Wide
Surprise	0.20***	0.07	0.23**	0.01
	(2.76)	(0.84)	(2.37)	(0.08)
Surprise*Macro		0.28**		0.49***
		(2.07)		(2.87)
Macro		0.02*		0.02*
		(1.95)		(1.68)
Constant	0.00	-0.01	-0.00	-0.01
	(0.25)	(-1.36)	(-0.06)	(-1.40)
Observations	137	137	137	137
R-squared	0.06	0.11	0.05	0.12

Robust *t*-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6. Response of the ONRUN10 Index to Scheduled FOMC Announcements 1991–2008

VARIABLES	(1) Tight	(2) Tight	(3) Wide	(4) Wide
Surprise	0.08	0.01	0.10	-0.05
	(1.28)	(0.19)	(1.34)	(-0.53)
Surprise*Macro		0.13		0.32**
		(1.08)		(2.31)
Macro		0.01*		0.01
		(1.92)		(1.43)
Constant	-0.00	-0.01	-0.00	-0.01
	(-0.09)	(-1.55)	(-0.07)	(-1.19)
Observations	137	137	137	137
R-squared	0.02	0.05	0.01	0.06

Robust *t*-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7. Response of the ONRUN30 Index to Scheduled FOMC Announcements 1991–2008

VARIABLES	(1) Tight	(2) Tight	(3) Wide	(4) Wide
Surprise	-0.05	-0.08	-0.03	-0.13
	(-1.05)	(-1.30)	(-0.47)	(-1.52)
Surprise*Macro		0.05		0.21*
		(0.52)		(1.69)
Macro		0.01**		0.01
		(2.03)		(1.52)
Constant	-0.00	-0.01	-0.00	-0.01
	(-0.18)	(-1.62)	(-0.07)	(-1.19)
Observations	137	137	137	137
R-squared	0.01	0.04	0.00	0.04

Robust *t*-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8. Response of Treasury Futures to Scheduled FOMC Announcements 1989–2008

Tight Window

VARIABLES	(1) T-2yr	(2) T-2yr	(3) T-5yr	(4) T-5yr	(5) T-10yr	(6) T-10yr	(7) T-30yr	(8) T-30yr
Surprise	-0.60***	-0.28	-0.82***	-0.41	-0.64*	-0.18	-0.08	0.39
	(-3.47)	(-1.58)	(-2.66)	(-1.12)	(-1.73)	(-0.41)	(-0.16)	(0.59)
Surprise*Macro		-0.70**		-0.80		-0.91		-0.92
		(-2.27)		(-1.35)		(-1.26)		(-0.93)
Macro		-0.02		-0.06*		-0.07		-0.07
		(-1.40)		(-1.75)		(-1.61)		(-1.21)
Constant	0.00	0.01	0.00	0.03	0.00	0.03	0.00	0.03
	(0.40)	(1.55)	(0.10)	(1.52)	(0.08)	(1.37)	(0.10)	(1.01)
Observations	138	138	148	148	148	148	148	148
R-squared	0.12	0.17	0.05	0.08	0.02	0.05	0.00	0.02

Wide Window

VARIABLES	(1) T-2yr	(2) T-2yr	(3) T-5yr	(4) T-5yr	(5) T-10yr	(6) T-10yr	(7) T-30yr	(8) T-30yr
Surprise	-0.60***	-0.14	-0.89**	-0.08	-0.62	0.40	0.05	1.37*
	(-2.76)	(-0.67)	(-2.41)	(-0.22)	(-1.36)	(0.84)	(0.08)	(1.93)
Surprise*Macro		-1.01***		-1.60**		-2.03**		-2.63**
		(-2.75)		(-2.40)		(-2.46)		(-2.32)
Macro		-0.02		-0.06		-0.08		-0.06
		(-1.21)		(-1.59)		(-1.46)		(-0.83)
Constant	0.01	0.02	0.01	0.04	0.00	0.04	0.00	0.03
	(0.54)	(1.57)	(0.38)	(1.65)	(0.08)	(1.27)	(0.06)	(0.74)
Observations	138	138	148	148	148	148	148	148
R-squared	0.08	0.14	0.04	0.09	0.01	0.06	0.00	0.04

Robust *t*-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 9. Response of S&P 500 and Treasury Futures to Scheduled FOMC Announcements 1989–2008

Tight Window

VARIABLES	(1) SP500	(2) SP500	(3) T-2yr	(4) T-2yr	(5) T-5yr	(6) T-5yr	(7) T-10yr	(8) T-10yr	(9) T-30yr	(10) T-30yr
Surprise	-2.01***	-0.73	-0.28***	-0.21	-0.48***	-0.28	-0.35	-0.07	0.17	0.49
	(-2.80)	(-0.64)	(-3.10)	(-1.64)	(-2.92)	(-0.93)	(-1.55)	(-0.17)	(0.52)	(0.78)
Surprise*Macro		-2.94**		-0.17		-0.43		-0.59		-0.67
		(-1.99)		(-0.70)		(-0.92)		(-0.91)		(-0.64)
Surprise*Volatility	-1.77***	-1.39***	-0.46***	-0.43***	-0.72**	-0.68**	-0.69	-0.63	-0.57	-0.52
	(-4.65)	(-2.82)	(-3.61)	(-2.98)	(-2.43)	(-2.25)	(-1.40)	(-1.28)	(-0.98)	(-0.85)
Observations	153	153	138	138	148	148	148	148	148	148
R-squared	0.20	0.23	0.22	0.24	0.11	0.13	0.05	0.07	0.02	0.03

Wide Window

VARIABLES	(1) SP500	(2) SP500	(3) T-2yr	(4) T-2yr	(5) T-5yr	(6) T-5yr	(7) T-10yr	(8) T-10yr	(9) T-30yr	(10) T-30yr
Surprise	-2.85***	-2.33***	-0.26*	-0.07	-0.57**	0.04	-0.40	0.49	0.22	1.42**
	(-4.83)	(-2.75)	(-1.85)	(-0.38)	(-2.40)	(0.12)	(-1.18)	(1.00)	(0.51)	(2.05)
Surprise*Macro		-1.21		-0.54		-1.32**		-1.87**		-2.55**
		(-0.87)		(-1.53)		(-2.11)		(-2.22)		(-2.21)
Surprise*Volatility	-2.09***	-1.91***	-0.51**	-0.41*	-0.77*	-0.64	-0.58	-0.42	-0.43	-0.21
	(-3.71)	(-3.07)	(-2.60)	(-1.92)	(-1.86)	(-1.58)	(-0.93)	(-0.72)	(-0.59)	(-0.31)
Observations	153	153	138	138	148	148	148	148	148	148
R-squared	0.20	0.20	0.16	0.19	0.08	0.12	0.03	0.07	0.01	0.04

Robust *t*-statistics in parentheses. Uninteracted *Macro* and *Volatility* omitted for brevity.

*** p<0.01, ** p<0.05, * p<0.1

Appendix

List of Scheduled FOMC Meetings and Overlapping Macro Events

Scheduled FOMC Meeting	Macro Events		
07-Jul-1989	Capacity utilization	Non-farm payrolls	Unemployment rate
23-Aug-1989			
04-Oct-1989			
15-Nov-1989	Capacity utilization		
20-Dec-1989			
08-Feb-1990			
28-Mar-1990	New home sales		
16-May-1990	CPI (core)		
05-Jul-1990			
22-Aug-1990			
03-Oct-1990			
14-Nov-1990	Capacity utilization	Retail sales	
18-Dec-1990	CPI (core)		
07-Feb-1991			
27-Mar-1991			
15-May-1991			
05-Jul-1991	Non-farm payrolls	Unemployment rate	
21-Aug-1991			
02-Oct-1991	New home sales		
06-Nov-1991			
18-Dec-1991			
06-Feb-1992	Initial claims		
01-Apr-1992	NAPM		
20-May-1992			
02-Jul-1992	Initial claims	Non-farm payrolls	Unemployment rate
19-Aug-1992			
07-Oct-1992			
18-Nov-1992			
23-Dec-1992			
04-Feb-1993	Initial claims		
24-Mar-1993			
19-May-1993			
08-Jul-1993	Initial claims		
18-Aug-1993			

22-Sep-1993			
17-Nov-1993			
22-Dec-1993			
04-Feb-1994	Non-farm payrolls	Unemployment rate	
22-Mar-1994			
17-May-1994			
06-Jul-1994			
16-Aug-1994			
27-Sep-1994	Consumer confidence		
15-Nov-1994	Capacity utilization	Retail sales	
20-Dec-1994			
01-Feb-1995	Consumer confidence	Leading indicators	NAPM
28-Mar-1995	Consumer confidence		
23-May-1995			
06-Jul-1995	Initial claims	Leading indicators	
22-Aug-1995			
26-Sep-1995	Consumer confidence		
15-Nov-1995	Capacity utilization	CPI (core)	
19-Dec-1995			
31-Jan-1996	PPI (core)		
26-Mar-1996	Consumer confidence		
21-May-1996			
03-Jul-1996			
20-Aug-1996			
24-Sep-1996	Consumer confidence		
13-Nov-1996	PPI (core)		
17-Dec-1996			
05-Feb-1997			
25-Mar-1997	Consumer confidence		
20-May-1997			
02-Jul-1997			
19-Aug-1997			
30-Sep-1997	Consumer confidence	Leading indicators	New home sales
12-Nov-1997			

16-Dec-1997	CPI (core)	
04-Feb-1998		
31-Mar-1998	Consumer confidence	
19-May-1998		
01-Jul-1998	Leading indicators	NAPM
18-Aug-1998	CPI (core)	
29-Sep-1998	Consumer confidence	
17-Nov-1998	CPI (core)	
22-Dec-1998		
03-Feb-1999		
30-Mar-1999	Consumer confidence	
18-May-1999		
30-Jun-1999	Leading indicators	
24-Aug-1999		
05-Oct-1999	Leading indicators	
16-Nov-1999	Capacity utilization	
21-Dec-1999		
02-Feb-2000	Leading indicators	New home sales
21-Mar-2000		
16-May-2000	CPI (core)	
28-Jun-2000		
22-Aug-2000		
03-Oct-2000	Leading indicators	New home sales
15-Nov-2000	Capacity utilization	
19-Dec-2000		
31-Jan-2001	GDP (advance)	New home sales
20-Mar-2001		
15-May-2001		
27-Jun-2001		
21-Aug-2001		
02-Oct-2001		
06-Nov-2001		
11-Dec-2001		
30-Jan-2002	GDP (advance)	
19-Mar-2002		
07-May-2002		
26-Jun-2002	New home sales	
13-Aug-2002	Retail sales	
24-Sep-2002	Consumer confidence	

06-Nov-2002		
10-Dec-2002		
29-Jan-2003		
18-Mar-2003		
06-May-2003		
25-Jun-2003	New home sales	
12-Aug-2003		
16-Sep-2003	CPI (core)	
28-Oct-2003	Consumer confidence	
09-Dec-2003		
28-Jan-2004	New home sales	
16-Mar-2004		
04-May-2004		
30-Jun-2004		
10-Aug-2004		
21-Sep-2004		
10-Nov-2004	Initial claims	
14-Dec-2004	Capacity utilization	
02-Feb-2005		
22-Mar-2005	PPI (core)	
03-May-2005		
30-Jun-2005	Initial claims	
09-Aug-2005		
20-Sep-2005		
01-Nov-2005	NAPM	
13-Dec-2005	Retail sales	
31-Jan-2006	Capacity utilization	CPI (core)
28-Mar-2006	Consumer confidence	
10-May-2006		
29-Jun-2006	Initial claims	
08-Aug-2006		
20-Sep-2006		
25-Oct-2006		
12-Dec-2006		
31-Jan-2007	Employment cost index	GDP (advance)
21-Mar-2007		
09-May-2007		
28-Jun-2007	Initial claims	
07-Aug-2007		
18-Sep-2007	PPI (core)	

31-Oct-2007	Employment cost index	GDP (advance)
11-Dec-2007		
30-Jan-2008	GDP (advance)	
18-Mar-2008	PPI (core)	
30-Apr-2008	Employment cost index	GDP (advance)
25-Jun-2008	New home sales	

Response of the SP500 Index to Scheduled FOMC Announcements 1989–2008
Robust Regressions

VARIABLES	(1) Tight	(2) Tight	(3) Wide	(4) Wide
Surprise	-3.04***	-1.02	-3.04***	-1.89**
	(-6.21)	(-1.51)	(-4.99)	(-2.26)
Surprise*Macro		-3.36***		-2.60**
		(-3.45)		(-2.14)
Macro		-0.09		0.01
		(-1.63)		(0.15)
Constant	-0.08***	-0.03	-0.01	-0.01
	(-2.70)	(-0.73)	(-0.37)	(-0.15)
Observations	153	153	153	153
R-squared	0.20	0.22	0.14	0.17

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Response of the ONRUN3M Index to Scheduled FOMC Announcements 1991–2008
Robust Regressions

VARIABLES	(1) Tight	(2) Tight	(3) Wide	(4) Wide
Surprise	0.44***	0.36***	0.69***	0.35***
	(18.24)	(11.91)	(19.93)	(8.68)
Surprise*Macro		0.19***		0.45***
		(4.24)		(7.46)
Macro		0.00		0.00
		(0.79)		(0.59)
Constant	-0.00***	-0.00***	-0.01***	-0.01***
	(-2.74)	(-2.62)	(-3.51)	(-2.97)
Observations	137	137	137	137
R-squared	0.71	0.76	0.75	0.75

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Response of the ONRUN6M Index to Scheduled FOMC Announcements 1991–2008
Robust Regressions

VARIABLES	(1) Tight	(2) Tight	(3) Wide	(4) Wide
Surprise	0.52***	0.34***	0.59***	0.43***
	(14.61)	(7.27)	(16.04)	(8.30)
Surprise*Macro		0.29***		0.33***
		(4.08)		(4.25)
Macro		0.01		0.00
		(1.48)		(0.55)
Constant	-0.00	-0.01**	-0.00	-0.00
	(-1.11)	(-1.98)	(-1.00)	(-1.48)
Observations	137	137	137	137
R-squared	0.61	0.61	0.66	0.65

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Response of the ONRUN2 Index to Scheduled FOMC Announcements 1991–2008
Robust Regressions

VARIABLES	(1) Tight	(2) Tight	(3) Wide	(4) Wide
Surprise	0.38***	0.21***	0.63***	0.32***
	(6.93)	(2.91)	(9.71)	(3.30)
Surprise*Macro		0.33***		0.36**
		(3.12)		(2.54)
Macro		0.01		0.01*
		(1.35)		(1.73)
Constant	0.00	-0.00	0.00	-0.00
	(0.73)	(-0.52)	(1.29)	(-0.43)
Observations	137	137	137	137
R-squared	0.26	0.30	0.41	0.29

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Response of the ONRUN5 Index to Scheduled FOMC Announcements 1991–2008
Robust Regressions

VARIABLES	(1) Tight	(2) Tight	(3) Wide	(4) Wide
Surprise	0.18***	0.10	0.27***	0.14*
	(3.59)	(1.46)	(4.24)	(1.75)
Surprise*Macro		0.15		0.33***
		(1.43)		(2.73)
Macro		0.01**		0.01
		(2.06)		(1.47)
Constant	0.00	-0.00	0.01	-0.00
	(0.60)	(-1.08)	(1.39)	(-0.02)
Observations	137	137	137	137
R-squared	0.09	0.12	0.12	0.20

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Response of the ONRUN10 Index to Scheduled FOMC Announcements 1991–2008

Robust Regressions

VARIABLES	(1) Tight	(2) Tight	(3) Wide	(4) Wide
Surprise	0.06	0.05	0.11**	0.04
	(1.49)	(0.98)	(2.41)	(0.72)
Surprise*Macro		-0.01		0.16*
		(-0.06)		(1.73)
Macro		0.01**		0.01
		(2.11)		(1.36)
Constant	-0.00	-0.01*	0.00	0.00
	(-0.39)	(-1.70)	(1.43)	(0.16)
Observations	137	137	137	137
R-squared	0.02	0.05	0.04	0.08

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Response of ONRUN30 Index to Scheduled FOMC Announcements 1991–2008

Robust Regressions

VARIABLES	(1) Tight	(2) Tight	(3) Wide	(4) Wide
Surprise	-0.08**	-0.07	-0.03	-0.06
	(-2.10)	(-1.51)	(-0.61)	(-0.97)
Surprise*Macro		-0.02		0.07
		(-0.21)		(0.74)
Macro		0.01*		0.01
		(1.91)		(1.23)
Constant	-0.00	-0.01*	0.00	-0.00
	(-0.82)	(-1.91)	(0.79)	(-0.23)
Observations	137	137	137	137
R-squared	0.03	0.06	0.00	0.02

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1