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SNAP! Should We Be Worried about a Sudden, Sharp Rise from Low Long-Term Rates?

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Abstract:

Despite the expectations of FOMC and market participants at the beginning of 2014 to the contrary, the yield on 10-year U.S. Treasury debt declined by more than 50 basis points, from 2.72 percent at the beginning of 2014 to 2.17 percent as of December 22, 2014. This raises the worrisome possibility that we might observe a sudden change in longer-term yields once the Federal Reserve announces an increase in short-term rates. In other words, longer-term rates could snap, very much as they did in the summer of 2013 after the tapering announcement, once the Fed announces its first hike in short-term rates indicating the end of the zero lower bound era of monetary policy. In order to study this possibility, this paper examines reactions to Fed announcements during the period when conventional monetary policy tools were used in order to investigate whether FOMC announcements that imply reversals in the monetary policy stance have a greater effect on longer-term Treasury yields than similar monetary policy actions that do not imply a policy reversal. The analysis suggests that the effects of a monetary policy surprise on long-term interest rates and corporate bond yields are greater for reversals that involve a rise in interest rates (known as "liftoff"). Overall, the analysis implies that policymakers should exercise caution regarding the timing of the liftoff announcement because the policy surprise might have a sudden and disproportionately large effect on interest rates.

JEL Classification: R11, R23

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This version: December 2014

> How could Wall Street economists have been so wrong? On January 1st the consensus forecast of the 66 most senior economists for the year end 10-year US Treasury yield was 3.44%. At the time, 10 year Treasury yields were hovering around 3%, their highest level in almost three years. Since then the benchmark interest rate has declined as low at 2.34% last week, Treasury bonds have outperformed practically all major asset classes in 2014.
>
> Forbes.com, 8/12/2014[1]

> Yields on short-term U.S. Treasury debt maturing in two to five years hit the highest level since 2011, reflecting an investor scramble to place bets on an expected Federal Reserve rate increase as soon as next spring.
>
> At the same time, yields on government debt maturing in 10 or more years have risen only modestly this week and remain well below their levels at the start of 2014, a year that many analysts forecast would include rising long-term interest rates and falling bond prices. The 10-year U.S. Treasury note was 8/32 lower, yielding 2.629%. That is the highest closing level since July 3 but compares with 3% at the end of 2013.
>
> WSJ.com, 9/19/2014[2]

Introduction:

Not only market participants, as indicated in these quotations, but also the Federal Open Market Committee (FOMC) participants seem to be expecting higher longer-term yields. The *Forbes* article continues with several potential reasons for this expectation, including U.S.-specific reasons, such as midterm elections and demographics, and global reasons, such as a "flight to quality" due to increased geopolitical risk and foreign demand for U.S. Treasuries. However, these potential explanations are not very likely to paint the whole picture:

- Yields on 10-year government securities have been low not only for the United States but also for other developed countries such as Germany, the United Kingdom, and Japan (even lower for Germany than for the United States), and for emerging economies such as Turkey, Thailand, and Brazil. Therefore, U.S.-specific elections or demographics alone cannot explain these low yields.

[1] http://www.forbes.com/sites/larrymcdonald/2014/08/12/unlocking-the-mystery-why-us-10-year-treasury-yields-are-down-at-2-4-ten-things-you-need-to-know/

[2] http://www.wsj.com/articles/u-s-treasury-market-goes-off-script-1411083857

- The flight to quality due to increased geopolitical risk seems to play a role only for securities with maturities around two years (for example, Turkey). To the extent that market participants do not expect a prolonged war, geopolitical risk cannot have a very large effect on longer-term rates.

These observations are consistent with analysis in WSJ.com on August 13, 2014, that relates the low long-term rates to market expectations about central bank policies:

> Government bond yields in the U.S., Germany and the U.K. closed at their lowest levels of the year on Wednesday as bond investors are convinced major central banks will keep interest rates lower for longer to support economic growth.[3]

A possibility that particularly worries policymakers is that we might observe a sudden change in longer-term yields as soon as the Federal Reserve announces an increase in short-term rates.[4] In other words, longer-term rates might snap when the Fed announces its first hike in short-term rates, very much as they did in the summer of 2013 after the tapering announcement.

In order to study this possibility, I examine the behavior of yields during the period when conventional monetary policy tools were used in order to discover whether FOMC announcements that imply reversals of direction in the monetary policy stance have a greater effect on longer-term Treasury yields than similar monetary policy actions that do not imply a reversal.

I find that both short- and long-term Treasuries react more strongly to monetary policy announcements involving surprises in the context of policy reversals than to other monetary policy surprises, where reversals are defined as changes in the federal funds target rate that reverse the direction of the previous rate change. Moreover, the additional responsiveness to policy reversals seems to be concentrated in liftoff reversals, meaning FOMC meetings that result in an interest rate hike when the last rate change was a decrease. As a result of this asymmetry in response, a surprise increase in the federal funds target rate after a momentum

[3] http://online.wsj.com/articles/u-s-government-bonds-higher-after-disappointing-retail-sales-1407935613

[4] A reason might be that low short-term rates create incentives for reaching for yield, and these incentives disappear once short-term rates start increasing.

announcement (where the direction of the target rate change, if any, is the same as the direction of the previous change) moves primarily the short end of the yield curve, whereas the yield curve shifts in a more parallel fashion after announcement of a liftoff. This pattern seems to be consistent with a signaling story where a liftoff provides information about the future of the economy.

Corporate bond yields display a pattern similar to that of long-term Treasury yields; that is, corporate yields respond to monetary policy surprises more strongly on FOMC announcement dates indicating a reversal than to other monetary policy surprises. Stock prices are also more responsive to policy surprises on dates of reversals, although the effect of reversals is not particularly concentrated on the dates of liftoff reversals.

The implication is that policymakers should exercise caution regarding the timing of a liftoff because the policy surprise at liftoff might have a disproportionately large effect.

Data and Method

The data come from various sources. As a measure of monetary policy surprise, I use unexpected changes in the federal funds target rate, calculated using federal funds futures as discussed in Kuttner (2001) and Bernanke and Kuttner (2005). For changes in long- and short-term interest rates, I use Treasury debt yields of various maturities, ranging from three months to 30 years. These measures are available at daily and intraday frequency, where the intraday window range is (-15 min, +45 min) around a monetary policy announcement. To avoid problems with the timing of the shock, I focus only on scheduled meetings. I also look for the same patterns using corporate bonds with various ratings, including Moody's Aaa- and Baa-rated securities and Bank of America Merrill Lynch BBB-rated securities using daily data from Federal Reserve Economic Data (FRED). The daily Treasury and stock market data are from Bloomberg, the intraday changes in Treasury yields and stock prices are courtesy of Refet Gürkaynak, and the corporate bond yields are from FRED.

The question of primary interest is whether longer-term (10-year) yields respond to monetary policy shocks more strongly around the times of policy reversals. To test this, I use the following regression

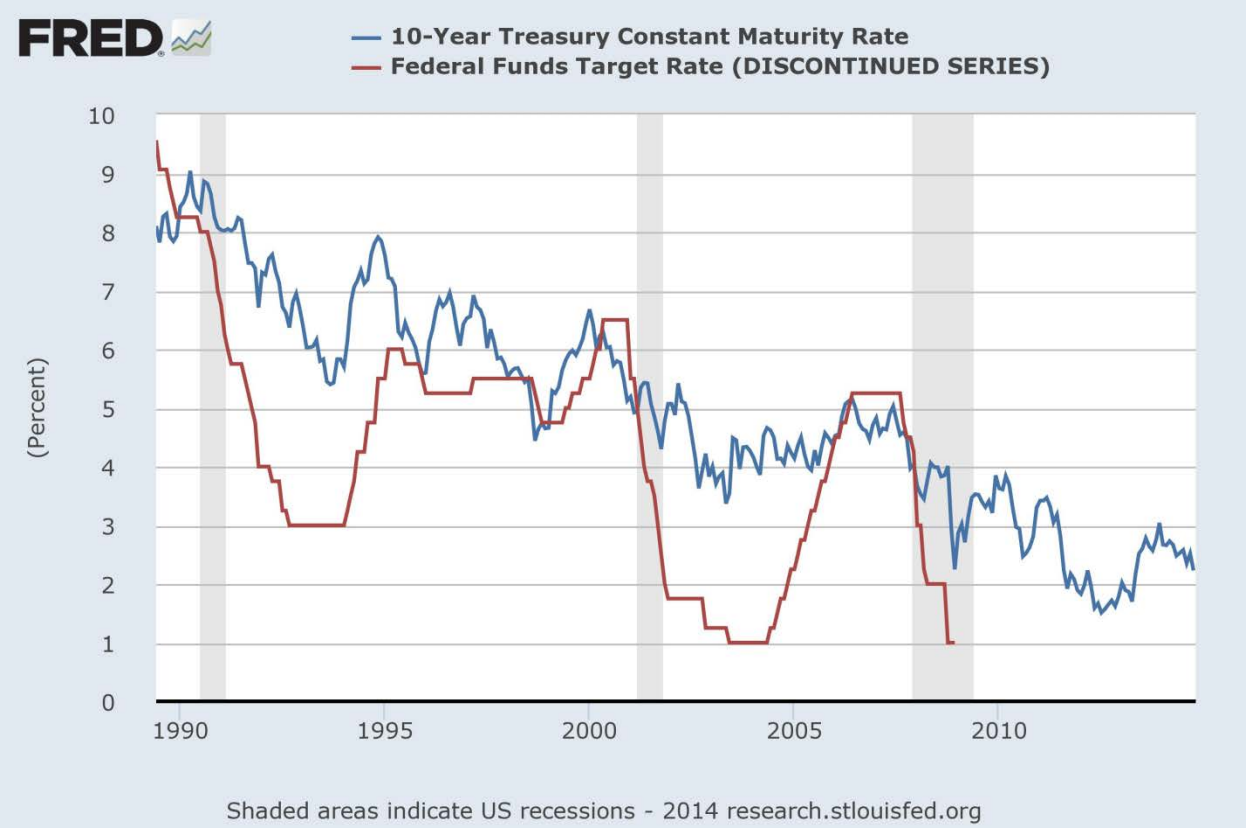
$$\Delta\text{Yield} = \text{constant} + b0*\text{Reversal} + b1*\text{Surprise} + b2*\text{Reversal}*\text{Surprise} + \text{error}, \quad (1)$$

where Surprise is the unexpected change in the federal funds target rate based on federal funds futures, and Reversal is a dummy variable that is equal to one for rate changes that reverse the direction of the previous rate change, and zero otherwise. Figure 1 shows the path of the federal funds target rate over the course of 1989 to 2008, which reveals the seven reversals on scheduled announcement dates: February 4 1994; July 6, 1995; March 25, 1997; September 29, 1998; June 30, 1999; June 30, 2004; and September 18, 2007.

One immediate concern is that the size of the surprises might be different on dates of policy reversals than on the dates of other monetary policy announcements. Therefore, Figures 2A and 2B present the policy surprises and label them as "Scheduled" if the announcement occurred on a scheduled announcement date, and as "Reversal" if it occurred on one of the seven dates listed above.[5] While many of the major surprises occurred on unscheduled announcement dates, the magnitudes of the policy surprises on reversal dates are not noticeably different from the magnitudes of other (momentum) surprises on scheduled announcement dates.

[5] I also label some dates as "Brake," as discussed later.

Figure 1. Federal Funds Target Rate and 10-Year Treasury Yield at Constant Maturity 1989–2008



Source: FRED. The recessions (shaded areas) are dated by the NBER.

Results

The second column of Table 1 shows the intraday reaction of Treasury yields of different maturities to a surprise increase in the federal funds target rate, where both the dependent and independent variables have the same units (percentage points). As a quick robustness check of these results, I find that the coefficients of the policy surprise for 2-, 5-, and 10-year Treasuries are consistent with the results of Gürkaynak, Sack, and Swanson (2005a), although I focus on a longer time period and only on scheduled FOMC announcement dates. In particular, I find that a 1 percentage point surprise increase in the federal funds target rate leads to increases of 44 basis points (bp), 23 bp, and 10 bp in 2-, 5-, and 10-year Treasuries, respectively, whereas

Gürkaynak, Sack, and Swanson (2005a) found increases of 47 bp, 27 bp, and 12 bp for these maturities, respectively.

Table 1. Summary of Treasury Yields' Response to Surprises in the Fed Funds Target Rates

	Regression #1	Regression #2			
Maturity	**Surprise**	**Surprise**	**Surprise*Reversal**	**Reversal**	**Constant**
3-months	0.66***	0.61***	0.25**	-0.03**	-0.01***
6-months	0.58***	0.47***	0.58***	-0.04***	-0.00
2-years	0.44***	0.30***	0.76***	-0.05**	0.00
5-years	0.23***	0.11	0.70***	-0.05**	0.00
10-years	0.10	0.02	0.44**	-0.03*	0.00
30-years	-0.03	-0.07	0.23	-0.02	0.00

Source: Author's calculations.
Note: Column 2 shows the coefficients on the Surprise term in a regression that includes only the Surprise term on the right-hand side. Columns 3 to 6 present the coefficients on each of the independent variables in the more inclusive equation (1) regression. More details of these regressions are shown in Tables 3A and 3B at the end of this brief.

A clear pattern emerges immediately from these regressions: the reaction of Treasury yields to surprise changes in the fed funds target rate decreases with the maturity of the Treasury securities, suggesting that long-term forward rates are inversely related to monetary policy surprises, a result consistent with the findings of Gürkaynak, Sack, and Swanson (2005b) and the references therein.

However, columns 3 to 6 of Table 1 reveal a more interesting pattern: the reaction of longer-term Treasury yields seems to be concentrated on reversal dates. While we also see a stronger reaction of the short-term Treasury yields on reversal dates, the effect of a reversal

announcement, relative to a momentum (non-reversal) announcement, seems to become stronger as the maturity increases, at least at the shorter end of the yield curve. This behavior, combined with the pattern we observe for the momentum announcement dates, implies that a tightening surprise on a momentum announcement date leads to a greater flattening of the yield curve, whereas a tightening surprise on a reversal announcement date produces a more parallel shift in the yield curve.

Overall, we find that the longer-term yields seem to be far less affected by monetary policy during momentum announcements, whereas they react significantly on reversal dates. The lack of reaction of longer-term Treasury yields on momentum dates should not be surprising, given that Gürkaynak, Sack, and Swanson (2005b) reached the same conclusion. The new result is that both short- and long-term yields react more strongly to policy surprises on reversal dates, and to such an extent that the result is an almost parallel shift of the yield curve. In other words, long-term forward rates react much less negatively to monetary policy shocks on reversal dates than to monetary policy momentum announcements.

What is special about reversals that explains why they generate this result? One possibility is the signaling channel of monetary policy. (See Romer and Romer (2000), Nakamura and Steinsson (2013), and Tang (unpublished) for discussions of the signaling channel.) The reversal announcements might differ from other monetary policy announcements because they not only reveal a change in the policy stance, but also provide information that changes the market's expectations about current economic conditions and the future path of the economy. One aspect of this information is the future path of interest rates, since the reversal might be signaling the direction of the new momentum in interest rates. Another signal is the revelation of the FOMC's information about the current state of the economy: an increase in the monetary policy rate after a long period of easy monetary policy (a 'liftoff reversal') might suggest to market participants that the Federal Reserve thinks the economy is in good shape. In this case, a positive policy surprise (a greater than expected increase in the policy rate) would directly move short-term rates upward and long-term forward rates downward, but the signaling content of the surprise

would also move the short- and long-term forward rates upward in the same way that positive macroeconomic news would.[6]

Table 2, reproduced from Gürkaynak, Sack, and Swanson (2005b)'s Table 1, shows that almost all macroeconomic announcements move the short- and long-term forward rates in the same direction, with positive news driving both rates up. Therefore, the signaling channel would suggest that a greater policy surprise during a liftoff reversal would create a greater increase in longer-term yields than would the same surprise in a momentum announcement, consistent with the results shown in Tables 3A and 3B.

Table 2. Responses of Forward Rates to Economic News

	Ending 1 yr. ahead		Ending 5 yrs. ahead		Ending 10 yrs. ahead	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Macroeconomic data releases						
Capacity utilization	1.36	0.33***	1.26	0.57**	0.80	0.61
Consumer confidence	2.11	0.40***	2.88	0.56***	1.97	0.54***
CPI (core)	1.67	0.42***	1.81	0.60***	1.09	0.66*
Employment cost index	3.43	0.89***	4.42	1.13***	3.73	0.93***
GDP (advance)	4.39	1.42***	4.12	2.19*	3.76	1.82**
Initial claims	−0.83	0.24***	−0.79	0.29***	−0.59	0.27**
Leading indicators	0.95	0.34***	0.61	0.57	0.55	0.58
NAPM	3.00	0.51***	3.29	0.54***	1.53	0.63**
New home sales	1.08	0.39***	1.65	0.54***	0.92	0.51*
Non-farm payrolls	5.10	0.57***	3.48	0.91***	1.88	0.97*
PPI (core)	0.39	0.45	1.22	0.56**	1.46	0.50***
Retail sales	2.97	0.72***	2.62	1.03**	1.93	0.92**
Unemployment rate	−1.76	0.51***	−0.77	0.73	0.14	0.66
Monetary policy surprises	0.47	0.10***	−0.04	0.14	−0.16	0.07**

Notes: Huber-White standard errors. *** indicates significance at the 1-percent level, ** at the 5-percent level, and * at the 10-percent level. The estimated coefficient indicates the basis-point response of the one-year forward rate per standard deviation of the macroeconomic variable and per-basis-point surprise in monetary policy announcement. Regressions include constant terms that are not shown in the table.

Source: **Gürkaynak, Sack, and Swanson (2005b), Table 1**

This argument seems to suggest that we should see a similar effect in the case of a decrease in the monetary policy rate after a long period of tight monetary policy (a 'dive reversal'), just as in the case of a liftoff reversal. Therefore, it is of interest to check whether the differential effect of a monetary policy surprise holds similarly during liftoff and dive reversals. For this purpose,

[6] This signaling channel can work by increasing real rates as consumers try to substitute anticipated higher consumption in the future with current consumption, by increasing inflation expectations because future aggregate demand is expected to increase, or by an increase in the risk premium of longer-term bonds due to duration risk or inflation risk. Due to limited data availability, it is very difficult to disentangle these factors.

we classify the reversals into a Positive (liftoff) Reversal, indicating an increase in the federal funds target rate when the prior federal funds target change was a decrease, and a Negative (dive) Reversal, indicating a decrease in the federal funds target rate when the prior federal funds target change was an increase. This classification produces four Positive Reversals (February 4, 1994; March 25, 1997; June 30, 1999; and June 20, 2004) and three Negative Reversals (July 6, 1995; September 29, 1998; and September 18, 2007). As columns 3, 6, and 9 of Tables 3A and 3B show, we find that the reaction of longer-term yields to monetary policy is concentrated on liftoff reversals.

Why do we observe this differential pattern for the liftoff and dive reversals? One reason for the difference between liftoff reversals and dive reversals stems from the fact that we are looking at scheduled meetings to avoid the additional shock tied to the unexpected timing of the policy change. However, sudden rate cuts that reflect a bad state of the economy might be more likely to come at times other than scheduled meetings (like the cuts in 2001 and 2008), whereas the Federal Reserve rarely rushes to raise rates at times other than scheduled meetings. Consistent with this statement, we find that of 24 rate changes not associated with scheduled meetings over 1989–2008, only one was for a rate hike. In order to dig deeper into this issue, I study in unreported regressions whether longer-term yields react differently to policy surprises in scheduled and unscheduled meetings. The difference turns out to be statistically insignificant.

An alternative sensible, but not testable, hypothesis concerns the asymmetry of the duration of expansions and recessions: While expansions are slower and longer, recessions are usually shorter and deeper. Therefore, any sudden rate cut by the Fed that signals a bad recession is less likely to provide information about the distant future, say, 10 years ahead, because recessions tend to be short. Unfortunately, this assumption is difficult, if not impossible, to test because the ideal test would require knowledge of the market's expectations about the length of recessions and expansions.

Robustness Checks: Daily and Two-Day Changes in Yields, the Importance of Each Date, Brake versus Liftoff

As a first robustness check, I repeat the same regression using daily policy surprises and yield changes to see whether the effect is robust to measurement at the daily frequency.[7] While Tables 4A and 4B suggest that the coefficients of Surprise*Reversal in daily regressions are not as large and statistically significant as the coefficients in the intraday regressions of Tables 3A and 3B, the behavior of yield changes at liftoff reversals are more similar when we separate the reversals into subcategories. The same pattern also holds when we consider two-day yield changes in Tables 5A and 5B.

An important problem inherent in this analysis stems from the fact that we have only four liftoff dates, and a single outlier might be generating the result. Alternatively, the nature of liftoffs might differ from one another so that some liftoffs might be more important than others.[8] In order to control for this possibility using a second robustness check, I remove each of the liftoff dates one by one to see whether doing so leads to any significant change in the estimated coefficient; this procedure is akin to using Cook's D statistic to find outliers. In general, I find that the estimated coefficients are robust to this exercise, providing a little more credibility to the results. In particular, in daily regressions for 10-year yields, the exclusion of March 25, 1997, changes the coefficient of (Positive Reversal x Surprise) only slightly—from 1.34 to 1.31 (p=0.01); the exclusion of June 30, 1999, only changes it to 1.14 (p=0.09); and the exclusion of June 30, 2004, only changes it to 1.25 (p=0.03). The only large change occurs with the exclusion of February 4, 1994, which increases the coefficient to 2.74 (p=0.03), although this is about only one standard deviation away from 1.34.

A final robustness check focuses on announcements that interrupt momentum versus reversal announcements. As illustrated in Figure 1 above, the monetary policy decisions of the FOMC

[7] Nakamura and Steinsson (2013) argue that daily regressions can suffer from endogeneity and advocate using a high-frequency, intraday window. In the end, each method has its advantages and disadvantages.

[8] For example, the liftoff in 1997 can be considered a simple blip, and the liftoff in 1999 can be considered an adjustment around a constant federal funds target rate that was earlier reduced as a result of the Long-Term Capital Management crisis.

are similar in an important respect to those in any process involving machinery that can operate in forward and reverse directions, for example, driving a car: the FOMC tends not to raise (lower) the policy rate in the first announcement following a meeting in which it lowered (raised) the policy rate. In terms of the machinery metaphor, it tends not to switch abruptly from forward to reverse motion or vice versa. Rather, a rate hike and a rate decrease are separated by a period of no change in the policy rate. Thus, the first meeting that applies the brakes to the momentum of policy rate changes in a given direction before a policy rate reversal might have an effect similar to that of a reversal. Therefore, it is of interest to see how yields react to such a brake announcement versus other momentum observations or a reversal announcement.

For this purpose, I repeat the analysis in the last section after introducing a dummy variable for brake announcements, where an announcement is considered a brake announcement if it is the first announcement without a rate change following the last momentum rate change prior to the reversal announcement. The brake announcement does not seem to have a statistically significant and consistent effect across yields of different maturities, even after categorizing these brake announcements into two groups based on whether the brake announcement occurred before a liftoff or before a dive reversal. In light of the analysis of the last section and Figure 1 above, the most likely explanation for this result is that it is very difficult for investors to figure out whether a decision not to change monetary policy is actually a prelude to reversing course or is simply a pause in the momentum of monetary policy. For example, the 25 basis point interest rate cut at the end of 2001 was followed by a sustained low interest rate of 1.75 percent during 2002, followed by a 50 basis point interest rate cut at the end of 2002.

Implications for Policy: Corporate Bonds and Stock Returns

What are the implications of these results for policy? Do non-government securities also react to liftoff surprises more than they would respond to non-liftoff surprises, possibly implying that a liftoff tightening might have an effect greater than originally intended? To answer this question,

I look at whether and how the differential effect for reversals is reflected in corporate bond yields and stock prices.

Table 6 presents the same regressions for the yields of corporate bonds of various degrees of quality. We immediately see that corporate bonds of different ratings display a pattern similar to the pattern of Treasury securities: the yields are more affected by monetary policy changes when there is a liftoff reversal. While this suggests that credit will be more costly after a liftoff than after a non-liftoff positive surprise, it does not necessarily imply that companies will be harmed, depending on the extent to which the positive news implied by the signaling channel boosts expected future profits.

Therefore, a more direct way to check this claim would be to investigate whether stocks react differently to monetary policy shocks during liftoff reversals than during momentum announcements. The additional responsiveness of interest rates during liftoff reversals should amplify the effect of a policy surprise on stock prices, whereas the signal about the current and future state of the economy should dampen the effect of the surprise. If the first effect dominates the second, policymakers should exercise caution regarding the timing of the liftoff because the policy surprise at liftoff might have a disproportionately large effect.

The results in Table 7 suggest that stock prices react more strongly to monetary policy surprises on reversal announcements, which mimics the behavior of Treasury yields studied in the previous sections and corporate bonds discussed above. However, unlike Treasury yields and corporate bonds, the effect does not seem to come solely from liftoff reversals. Indeed, the effect of policy surprises on dive reversal dates is also very strong, although the magnitude is somewhat smaller than the effect we observe for liftoff reversals.[9]

[9] One immediate caveat, and perhaps a potential explanation for why positive and negative reversals are both significant for stock prices, is that positive macroeconomic news is not necessarily positive news for stocks all the time; for example. a decrease in unemployment or an increase in the employment cost index might signal stronger demand but also squeeze companies' profit margins. Using stock prices also opens another interesting venue for studying through which channels a liftoff announcement affects the real economy. This analysis is best conducted using intraday data because, as illustrated in Table 7, the daily regressions are not as well identified as intraday regressions, mostly because the effects of outliers are particularly strong. The downside of using the intraday data, however, is that the stocks' liquidity can differ greatly across stocks with different characteristics, such as firm size.

Conclusion

This brief shows that the effect of monetary policy surprises on long-term interest rates may be disproportionately large. The overall implication of these regressions is that policymakers should exercise caution regarding the timing and communication of the liftoff.

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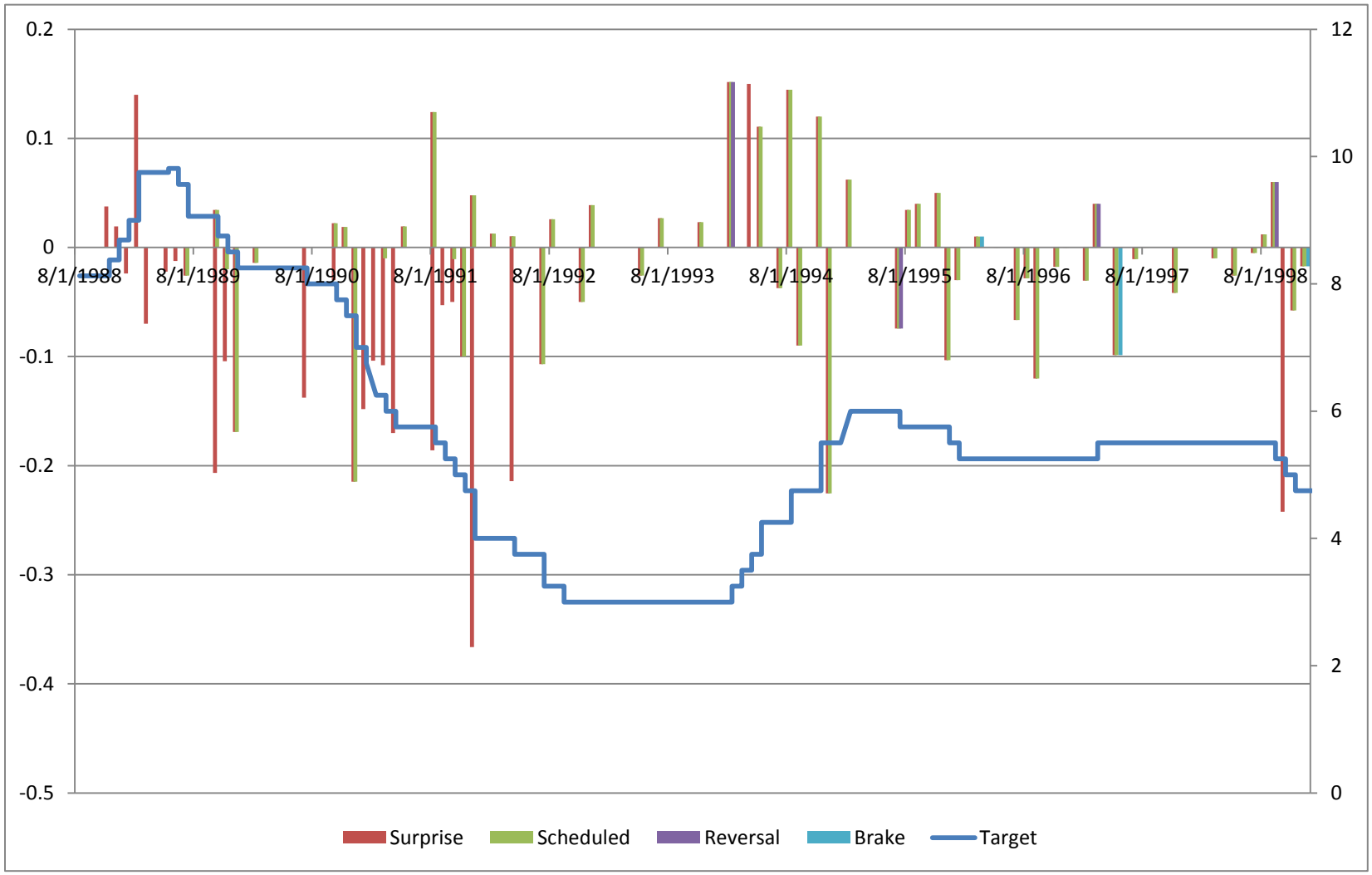
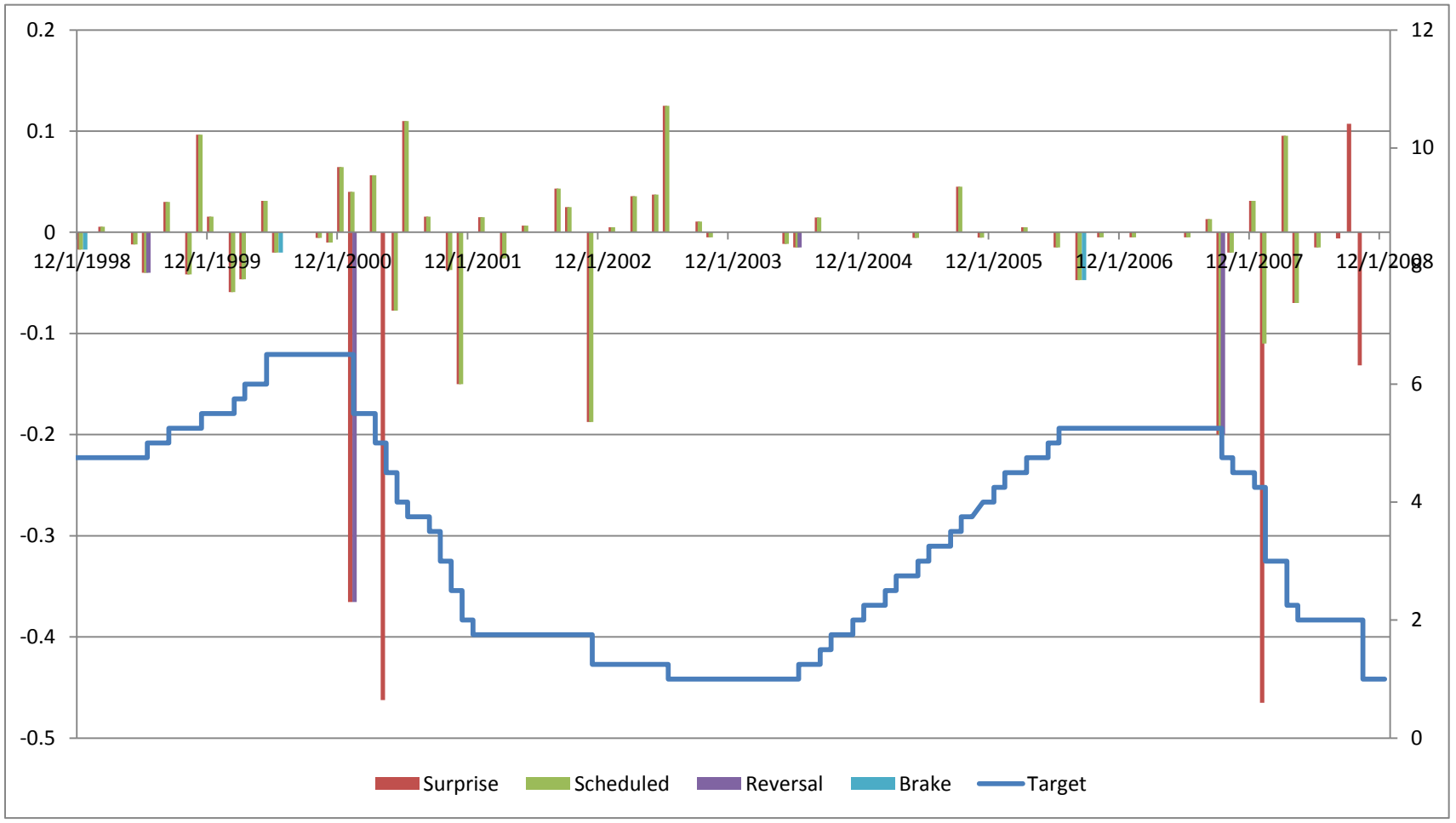
Figure 2A. Federal Funds Target Rate and Monetary Policy Surprises (1988–1998)



Source: FRED and Refet Gürkaynak's data used in the paper; Gürkaynak, Sack, and Swanson (2005a).
Note: Figure 2B continues this display through 2008.

Figure 2B. Federal Funds Target Rate and Monetary Policy Surprises (1998-2008)



Source: FRED and Refet Gürkaynak's data used in the paper; Gürkaynak, Sack, and Swanson (2005a).
Note: Figure 2A shows corresponding information for 1988-1998.

Table 3A. The Effect of Conventional Monetary Policy Shocks on Short-Term Treasuries
Intraday (-15min, +45min), 1991–2008

VARIABLES	(1) T3m	(2) T3m	(3) T3m	(4) T6m	(5) T6m	(6) T6m	(7) T2y	(8) T2y	(9) T2y
Surprise	0.66***	0.61***	0.61***	0.58***	0.47***	0.47***	0.44***	0.30***	0.30***
	(15.62)	(13.81)	(14.37)	(10.93)	(9.19)	(9.39)	(4.77)	(3.19)	(3.20)
Surprise x Reversal		0.25**			0.58***			0.76***	
		(2.27)			(4.62)			(3.25)	
Reversal		-0.03**			-0.04***			-0.05**	
		(-2.55)			(-3.46)			(-2.22)	
Positive Reversal x Surprise			0.59***			0.57***			1.26***
			(3.28)			(2.65)			(3.14)
Negative Reversal x Surprise			-0.13			0.31*			0.37
			(-0.88)			(1.76)			(1.14)
Positive Reversal			-0.03*			-0.02			-0.06*
			(-1.85)			(-1.12)			(-1.96)
Negative Reversal			-0.07***			-0.09***			-0.08**
			(-3.84)			(-4.28)			(-2.06)
Constant	-0.01***	-0.01***	-0.01***	-0.01**	-0.00	-0.00*	-0.00	0.00	0.00
	(-3.36)	(-2.83)	(-2.95)	(-2.21)	(-1.65)	(-1.68)	(-0.36)	(0.12)	(0.13)
Observations	137	137	137	137	137	137	137	137	137
R-squared	0.64	0.68	0.70	0.47	0.59	0.61	0.14	0.24	0.26

Source: Author's calculations.

Notes: Figure 3B continues this display for longer-term Treasuries. *t*-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 3B. The Effect of Conventional Monetary Policy Shocks on Treasuries
Intraday (-15min, +45min), 1991–2008

VARIABLES	(1) T5y	(2) T5y	(3) T5y	(4) T10y	(5) T10y	(6) T10y	(7) T30y	(8) T30y	(9) T30y
Surprise	0.23***	0.11	0.11	0.10	0.02	0.02	-0.03	-0.07	-0.07
	(2.66)	(1.21)	(1.22)	(1.41)	(0.29)	(0.30)	(-0.52)	(-1.15)	(-1.17)
Surprise x Reversal		0.70***			0.44**			0.23	
		(3.10)			(2.38)			(1.52)	
Reversal		-0.05**			-0.03*			-0.02	
		(-2.12)			(-1.84)			(-1.58)	
Positive Reversal x Surprise			1.19***			0.76**			0.41
			(3.07)			(2.42)			(1.58)
Negative Reversal x Surprise			0.23			0.02			-0.11
			(0.73)			(0.09)			(-0.51)
Positive Reversal			-0.05			-0.03			-0.01
			(-1.65)			(-1.10)			(-0.57)
Negative Reversal			-0.10**			-0.08***			-0.07***
			(-2.46)			(-2.66)			(-2.71)
Constant	-0.00	0.00	0.00	-0.00	0.00	0.00	-0.00	0.00	0.00
	(-0.06)	(0.41)	(0.41)	(-0.07)	(0.34)	(0.34)	(-0.07)	(0.29)	(0.29)
Observations	137	137	137	137	137	137	137	137	137
R-squared	0.05	0.15	0.18	0.01	0.08	0.12	0.00	0.04	0.08

Source: Author's calculations.

Notes: Figure 3A shows the corresponding data for shorter-term Treasuries. *t*-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 4A. The Effect of Conventional Monetary Policy Shocks on Treasuries
Daily, 1989–2008

VARIABLES	(1) T3m	(2) T3m	(3) T3m	(4) T6m	(5) T6m	(6) T6m	(7) T2y	(8) T2y	(9) T2y
Surprise	0.53***	0.52***	0.52***	0.49***	0.43***	0.43***	0.59***	0.57***	0.57***
	(7.73)	(7.49)	(7.51)	(7.22)	(6.48)	(6.44)	(6.79)	(6.43)	(6.48)
Surprise x Reversal		0.07			0.95***			0.37	
		(0.26)			(3.63)			(1.06)	
Reversal		-0.04*			-0.05**			-0.06**	
		(-1.82)			(-2.33)			(-2.17)	
Positive Reversal x Surprise			0.48			1.00**			1.25**
			(1.04)			(2.26)			(2.17)
Negative Reversal x Surprise			-0.34			0.84**			-0.27
			(-0.94)			(2.37)			(-0.58)
Positive Reversal			-0.03			-0.04			-0.07*
			(-1.12)			(-1.43)			(-1.95)
Negative Reversal			-0.07**			-0.06*			-0.09**
			(-2.15)			(-1.84)			(-2.06)
Constant	-0.01*	-0.01	-0.01	-0.01**	-0.01**	-0.01**	-0.01	-0.00	-0.00
	(-1.74)	(-1.32)	(-1.32)	(-2.47)	(-2.16)	(-2.14)	(-0.93)	(-0.48)	(-0.49)
Observations	153	153	153	153	153	153	153	153	153
R-squared	0.28	0.30	0.31	0.26	0.34	0.34	0.23	0.26	0.28

Source: Author's calculations.

Notes: Figure 4B continues this display for longer-term Treasuries. *t*-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 4B. The Effect of Conventional Monetary Policy Shocks on Treasuries
Daily, 1989–2008

VARIABLES	(1) T5y	(2) T5y	(3) T5y	(4) T10y	(5) T10y	(6) T10y	(7) T30y	(8) T30y	(9) T30y
Surprise	0.39***	0.36***	0.36***	0.24***	0.23***	0.23***	0.10	0.10	0.10
	(4.22)	(3.83)	(3.88)	(3.04)	(2.79)	(2.84)	(1.52)	(1.52)	(1.55)
Surprise x Reversal		0.45			0.23			-0.03	
		(1.24)			(0.72)			(-0.12)	
Reversal		-0.05			-0.03			-0.02	
		(-1.62)			(-1.26)			(-0.81)	
Positive Reversal x Surprise			1.53**			1.34**			0.95**
			(2.52)			(2.56)			(2.20)
Negative Reversal x Surprise			-0.29			-0.50			-0.68*
			(-0.58)			(-1.20)			(-1.95)
Positive Reversal			-0.07*			-0.06*			-0.04
			(-1.70)			(-1.66)			(-1.38)
Negative Reversal			-0.08*			-0.06			-0.04
			(-1.73)			(-1.50)			(-1.27)
Constant	-0.01	-0.00	-0.00	-0.01	-0.01	-0.01	-0.01*	-0.01	-0.01*
	(-1.01)	(-0.68)	(-0.69)	(-1.46)	(-1.18)	(-1.20)	(-1.88)	(-1.65)	(-1.69)
Observations	153	153	153	153	153	153	153	153	153
R-squared	0.11	0.13	0.16	0.06	0.07	0.12	0.02	0.02	0.08

Source: Author's calculations.

Notes: Figure 4A displays these statistics for shorter-term Treasuries. *t*-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 5A. The Effect of Conventional Monetary Policy Shocks on Treasuries
Two-day reaction, 1989–2008

VARIABLES	(1) T3m	(2) T3m	(3) T3m	(4) T6m	(5) T6m	(6) T6m	(7) T2y	(8) T2y	(9) T2y
Surprise	0.73***	0.76***	0.76***	0.64***	0.60***	0.60***	0.54***	0.50***	0.50***
	(8.40)	(8.49)	(8.61)	(8.73)	(7.98)	(7.96)	(5.45)	(4.95)	(5.04)
Surprise x Reversal		-0.51			0.58*			0.62	
		(-1.45)			(1.97)			(1.58)	
Reversal		0.00			0.01			-0.05	
		(0.04)			(0.38)			(-1.49)	
Positive Reversal x Surprise			0.38			0.94*			2.02***
			(0.65)			(1.90)			(3.11)
Negative Reversal x Surprise			-1.30***			0.56			-0.27
			(-2.75)			(1.39)			(-0.51)
Positive Reversal			-0.00			-0.02			-0.08*
			(-0.10)			(-0.53)			(-1.90)
Negative Reversal			-0.07			0.04			-0.08
			(-1.29)			(0.94)			(-1.56)
Constant	0.00	0.00	0.00	-0.00	-0.00	-0.00	-0.01	-0.01	-0.01
	(0.02)	(0.06)	(0.06)	(-0.67)	(-0.80)	(-0.80)	(-1.42)	(-1.12)	(-1.14)
Observations	151	151	151	151	151	151	152	152	152
R-squared	0.32	0.33	0.36	0.34	0.36	0.36	0.17	0.19	0.23

Source: Author's calculations.

Notes: Figure 5A continues this display for longer-term Treasuries. *t*-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 5B. The Effect of Conventional Monetary Policy Shocks on Treasuries
Two-day reaction, 1989–2008

VARIABLES	(1) T5y	(2) T5y	(3) T5y	(4) T10y	(5) T10y	(6) T10y	(7) T30y	(8) T30y	(9) T30y
Surprise	0.31***	0.27**	0.27**	0.18*	0.15	0.15	0.07	0.06	0.06
	(2.92)	(2.45)	(2.51)	(1.85)	(1.50)	(1.53)	(0.85)	(0.69)	(0.70)
Surprise x Reversal		0.69			0.48			0.20	
		(1.63)			(1.23)			(0.60)	
Reversal		-0.04			-0.03			-0.03	
		(-1.23)			(-0.99)			(-1.08)	
Positive Reversal x Surprise			2.38***			2.02***			1.35**
			(3.39)			(3.13)			(2.42)
Negative Reversal x Surprise			-0.31			-0.40			-0.43
			(-0.56)			(-0.77)			(-0.96)
Positive Reversal			-0.09*			-0.08*			-0.07*
			(-1.93)			(-1.85)			(-1.82)
Negative Reversal			-0.07			-0.05			-0.04
			(-1.28)			(-0.98)			(-0.88)
Constant	-0.01*	-0.01*	-0.01*	-0.01**	-0.01*	-0.01**	-0.01**	-0.01**	-0.01**
	(-1.92)	(-1.68)	(-1.72)	(-2.16)	(-1.94)	(-1.98)	(-2.30)	(-2.02)	(-2.05)
Observations	152	152	152	152	152	152	152	152	152
R-squared	0.05	0.08	0.13	0.02	0.04	0.09	0.00	0.01	0.06

Source: Author's calculations.

Notes: Figure 5A displays these statistics for shorter-term Treasuries. *t*-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 6. The Effect of Conventional Monetary Policy Shocks on Corporate Bonds
Daily, 1989–2008

VARIABLES	(1) Moody's Aaa	(2) Moody's Aaa	(3) Moody's Aaa	(4) Moody's Baa	(5) Moody's Baa	(6) Moody's Baa	(7) Merrill BBB	(8) Merrill BBB	(9) Merrill BBB
Surprise	-0.03	-0.03	-0.03	0.00	-0.01	-0.01	0.28**	0.30**	0.30**
	(-0.49)	(-0.55)	(-0.55)	(0.04)	(-0.10)	(-0.10)	(2.49)	(2.43)	(2.42)
Surprise x Reversal		0.07			0.13			-0.15	
		(0.33)			(0.61)			(-0.43)	
Reversal		-0.01			-0.01			-0.01	
		(-0.52)			(-0.62)			(-0.44)	
Positive Reversal x Surprise			0.80**			0.73**			1.00
			(2.18)			(2.10)			(0.95)
Negative Reversal x Surprise			-0.39			-0.27			-0.20
			(-1.31)			(-0.97)			(-0.54)
Positive Reversal			-0.03			-0.02			-0.02
			(-1.14)			(-1.05)			(-0.56)
Negative Reversal			-0.02			-0.02			0.01
			(-0.87)			(-0.97)			(0.20)
Constant	-0.01**	-0.01*	-0.01*	-0.00	-0.00	-0.00	0.01	0.01	0.01
	(-1.98)	(-1.82)	(-1.85)	(-1.36)	(-1.20)	(-1.22)	(1.05)	(1.11)	(1.11)
Observations	150	150	150	150	150	150	92	92	92
R-squared	0.00	0.00	0.05	0.00	0.01	0.04	0.06	0.07	0.09

Source: Author's calculations.

Notes: t-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 7. The Effect of Conventional Monetary Policy Shocks on Stocks
1989–2008

VARIABLES	(1) SP500 Intraday	(2) SP500 Intraday	(3) SP500 Intraday	(4) SP500 Daily	(5) SP500 Daily	(6) SP500 Daily
Surprise	-3.47***	-2.74***	-2.74***	-0.60	0.63	0.63
	(-4.83)	(-3.60)	(-3.62)	(-0.48)	(0.51)	(0.51)
Surprise x Reversal		-4.94**			-19.02***	
		(-2.46)			(-3.98)	
Reversal		0.20			0.30	
		(1.00)			(0.81)	
Positive Reversal x Surprise			-8.47**			-23.60***
			(-2.41)			(-2.92)
Negative Reversal x Surprise			-5.90**			-14.15**
			(-2.07)			(-2.18)
Positive Reversal			0.58**			0.22
			(2.04)			(0.42)
Negative Reversal			-0.22			0.72
			(-0.61)			(1.20)
Constant	-0.02	-0.02	-0.02	0.23***	0.22***	0.22***
	(-0.36)	(-0.54)	(-0.54)	(2.77)	(2.79)	(2.78)
Observations	153	153	153	153	153	153
R-squared	0.13	0.18	0.20	0.00	0.10	0.11

Source: Author's calculations.
Notes: t-statistics in parentheses; *** p<0.01, ** p<0.05, * p<0.1