Working Papers

FEDERAL RESERVE BANK OF BOSTON™

No. 15-15

The Final Countdown: The Effect of Monetary Policy during "Wait-for-It" and Reversal Periods

Ali Ozdagli

Abstract:

After a long period of loose monetary policy triggered by the Great Recession, some central banks are signaling that they will raise their policy rates soon. Previous research, for example, Bernanke and Kuttner (2005) and Ozdagli (2014), has shown that asset prices react more strongly to monetary policy target surprises on the dates of such a policy reversal announcement. However, we know very little about whether the cross-sectional differences among firms and sectors play a significant role in transmitting a reversal decision to the economy.

First, this paper provides evidence that the financial health or industry of a firm does not seem to play an economically significant role in the differential reaction of stock prices to monetary policy on reversal dates. Therefore, when contemplating a liftoff decision, which is a reversal of a loose monetary policy, a monetary authority does not need to consider credit allocation or weakness in the financial sector as a greater concern than it considers these issues when contemplating a rate change decision that is not a reversal.

Second, the paper notes that, since the 1990s, each reversal in the direction of monetary policy has been preceded by an extended period of constant interest rates, the wait-for-it (WFI) period. The paper finds that, on the FOMC announcement dates during these WFI periods, stock prices respond more strongly to surprises in the future path of monetary policy than they do on other (non-WFI) non-reversal FOMC announcement days.

Moreover, the additional effect of path surprises during the current zero-lower-bound (ZLB) environment closely resembles the effect of the path surprises during the WFI periods in the pre-ZLB environment. Overall, this pattern differs from the results in previous studies, such as Gürkaynak, Sack, and Swanson (2005a) and Ammer, Vega, and Wongswan (2010), that do not find any significant effect on stock prices of path surprises when all FOMC dates are pooled. Combined with the stronger reaction of asset prices to monetary policy on policy reversal dates, this finding lends support to the prediction of previous papers regarding "gradualist" policies: a central bank that adjusts the policy rate slowly can actually lead to a very large reaction to monetary policy, as the market pays closer attention than otherwise to the central bank's medium- or longer-run interest rate target.

Keywords: monetary policy, stock prices, liftoff, gradualism, forward guidance

JEL Codes: E44, E52, E58

Ali K. Ozdagli is an economist in the research department of the Federal Reserve Bank of Boston. His e-mail address is ali.ozdagli@bos.frb.org.

This paper, which may be revised, is available on the web site of the Federal Reserve Bank of Boston at http://www.bostonfed.org/economic/wp/index.htm.

I thank David Brown, Christy Marieni, Delia Sawhney, and Jianlin Wang for research support. I am grateful to Eric Rosengren, Geoff Tootell, and in particular to Refet Gürkaynak for his generosity in providing me the intraday futures changes around FOMC meeting announcements, Jenny Tang for detailed comments, and Joe Peek for his ongoing guidance and mentorship.

This version: September 2015

1. Introduction:

Previous research has shown that asset prices react more strongly to monetary policy surprises on the dates of a policy reversal announcement than on other dates; that is, when an FOMC announcement reverses the direction of the previous nonzero change in the federal funds target rate. For example, Bernanke and Kuttner (2005) find that, on policy reversal dates, stock prices react more strongly to a target rate surprise, identified using the federal funds futures market, than on other FOMC announcement dates. Similarly, Ozdagli (2014) finds that bond yields respond to federal funds target surprises more strongly on policy reversal dates. Together, this evidence suggests that we might observe a sudden change in longer-term bond yields and stock prices once the Federal Reserve signals a liftoff from the zero-lower-bound environment by announcing an increase in short-term rates. This possibility has recently attracted increasing attention as the liftoff of the monetary policy rate nears. For example, Stein and Sunderam (2015) argue that a central bank that adjusts the policy rate slowly, because it is averse to financial market fluctuations caused by monetary policy surprises, can actually trigger an overreaction to monetary policy, as the market pays increased attention to the central bank's medium- or longer-run interest rate target.

The current paper builds on this idea by providing a more detailed picture of the reaction of stock prices to the target, path, and timing shocks from monetary policy, not only on reversal dates, but also on the dates of policy announcements with no federal funds rate change immediately prior to a reversal date. The results can be summarized as follows:

1- Consistent with Bernanke and Kuttner (2005), the S&P 500 index's reaction to target rate surprises is much stronger on policy reversal dates.
2- The additional effect of target rate surprises on reversal dates is equally strong for financially constrained and unconstrained firms, as measured by ratings availability, age, and size. Also, there are no drastic differences between financial and nonfinancial firms in terms of the additional effect of target rate surprises on reversal dates.

3- Consistent with the previous literature, such as Gürkaynak, Sack, and Swanson (2005a) and Ammer, Vega, and Wongswan (2010), stock prices do not react significantly to policy path surprises when all FOMC announcements are pooled, which might suggest at first glance that forward guidance by the Federal Reserve might have only a limited effect. However, a methodical classification of policy dates paints a different picture. In particular, stock prices react to path surprises more strongly during wait-for-it (WFI) periods than on other non-reversal dates, where a WFI period is defined as the interval spanning FOMC announcements without a rate change immediately prior to a reversal. (See Figure 1.) The stock price reaction to path surprises on other non-reversal announcement dates is weak and statistically insignificant.

4- The additional effect of path surprises during WFI periods cannot be attributed to policy timing surprises, calculated as in the earlier literature.

5- The path surprises during the zero-lower-bound (ZLB) period have an effect very similar to those on other WFI dates.

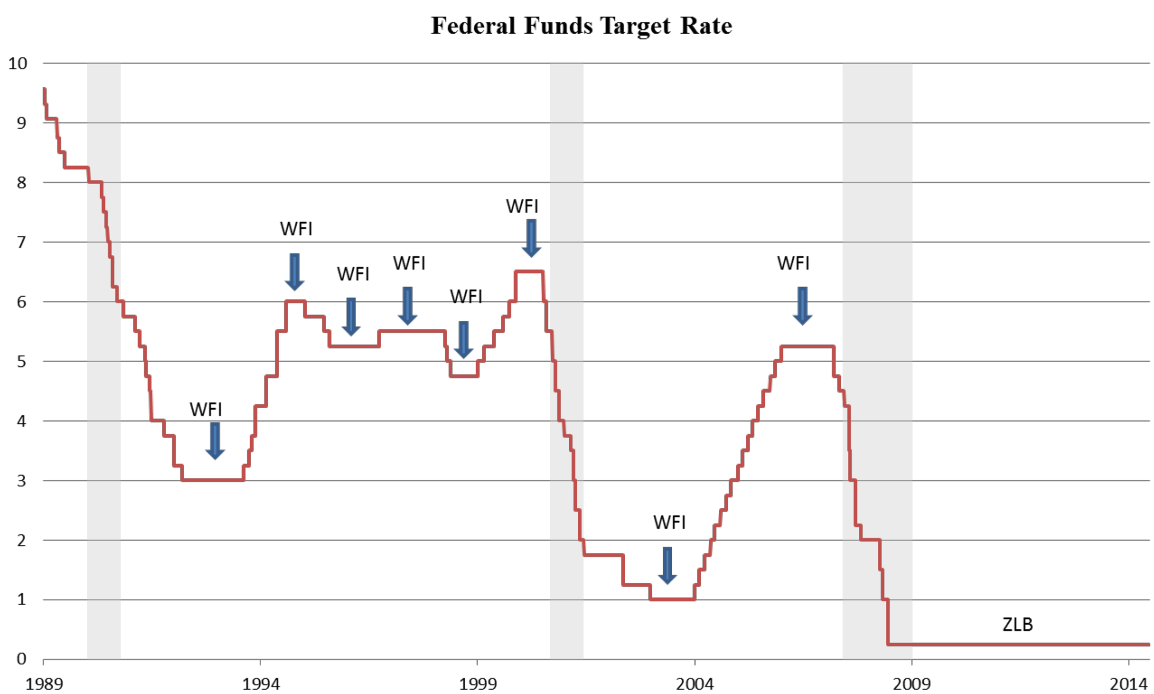


Figure 1. Federal funds target rate (until 12/16/2008) and its upper limit (after 12/16/2008).

Source: FRED

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. Moreover, the findings are consistent with the prediction of previous papers regarding "gradualist" policies: a central bank that adjusts the policy rate slowly can actually lead to a very large reaction to monetary policy, as the market pays closer attention than otherwise to the central bank's medium- or longer-run interest rate target, while waiting for the reversal of the policy.[1]

Finally, upcoming monetary policy decisions when liftoff seems imminent need not raise greater concern regarding credit allocation and financial sector weakness than other monetary policy decisions, because we do not observe a significantly different reaction across different types of firms on reversal dates than on non-reversal dates. There are three caveats regarding this statement. First, the evidence is based on stock price reactions to monetary policy, so the statement implicitly assumes that stock price reactions to monetary policy reflect underlying real effects: if a reversal decision affects a company's stock price more than other rate decisions by the Fed, it is because a reversal affects the company's perceived riskiness or cashflows more, both of which tie to the health of the company.[2] Second, this statement explicitly refers to the credit allocation effect of monetary policy across different firms.[3] It does not necessarily mean that aggregate credit conditions do not matter for the transmission of monetary policy. Third, the results might be interpreted as implying that the Federal Reserve has been timing the market perfectly to minimize potential negative effects of credit allocation. This logic implies that we might have observed a greater adverse effect had the Fed reversed the policy earlier

[1] See Goodfriend (1991) and Woodford (2000, 2003) for early papers, and Stein and Sunderam (2015) for a recent paper on gradualist policies. While these papers are similar in their predictions regarding the effect of monetary policy decisions on longer-duration assets, they differ in their assessment of the optimality of this policy. This paper does not take a stance on the optimality issue.

[2] This assumption has been made very widely by the previous literature, at least since Bernanke and Kuttner (2005), although it is conceivable that other forces, such as market microstructure, might play a role as well. For example, the prices of assets held by highly leveraged institutional investors with short-term goals might respond to shocks differently than the prices of other assets, given that these investors might rebalance their portfolios more often.

[3] The implications of this type of credit allocation have engendered an important debate since the start of the financial crisis, as policymakers were worried whether unconventional policy tools led to an inefficiency in the allocation of credit. See, for example, Thornton (2009) and Haltom and Wolman (2012) for an overview of the concerns of the Federal Reserve and FOMC members. That said, the interplay of monetary policy and credit allocation is far from being a new problem. See, for example, Solomon (1973) and other papers in the same volume.

than it actually did. If this were true, however, we should observe that stock prices react more strongly to target rate surprises or timing surprises on WFI dates because a premature reversal decision would have been averted every time the Fed decided to wait until the time was perfect to raise rates. However, our results suggest that this is not the case, and hence the perfect timing by the Fed is a less likely explanation for what we observe in the data.

2. Data and Methods

The data come from various sources. As a measure of monetary policy surprises, 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), and intraday price changes in the (-15min, +45min) window around an announcement. The intraday changes in futures prices and stock prices are courtesy of Refet Gürkaynak, the daily and weekly returns are from the Center for Research in Security Prices (CRSP), and the firm balance sheet variables are from Compustat.[4] The main focus is on the policy announcements from scheduled FOMC meetings between 1989 and mid-2008, after which the federal funds target rate hit the ZLB and stopped serving as the main monetary policy instrument.[5] The post-2008 period, for which I extend Gürkaynak's database using intraday futures and S&P 500 data from Tickdata (tickdata.com), PiTrading (pitrading.com), and Bloomberg, is discussed separately.

The primary focus in Sections 2 and 3 is whether stock prices respond to monetary policy shocks more strongly at times of policy reversals. To test this, I use the following regression:

$$\text{Return} = a0 + a1*\text{Reversal} + b0*\text{TargetSurprise} + b1*\text{Reversal}*\text{TargetSurprise} + \text{error}, \quad (1)$$

where TargetSurprise is the unexpected change in the federal funds target rate, and Reversal is a dummy variable that is equal to one for rate changes that reverse the direction of the previous nonzero rate change, and zero otherwise. Figure 1 shows the path of the federal funds target

[4] See Gürkaynak, Sack, and Swanson (2005a) for details of the construction of monetary policy surprises using intraday data. This database has also been used by Hanson and Stein (2015).

[5] The dates can be found at http://econ.williams.edu/people/knk1/research.

rate, revealing seven reversals on scheduled meeting dates: February 4, 1994; July 6, 1995; March 25, 1997; September 29, 1998; June 30, 1999; June 30, 2004; and September 18, 2007.[6]

The primary focus in Section 4 is whether expectations about future interest rates (path surprises) affect stock prices more around the times when investors are waiting for a reversal in the path of monetary policy. To test this, I use the following regression for non-reversal dates:

$$\text{Return} = \alpha 0+\alpha 1^{*}\text{WFI}+(\beta 0+\beta 1^{*}\text{WFI})^{*}\text{TargetSurprise}+(\gamma 0+\gamma 1^{*}\text{WFI})^{*}\text{PathSurprise}+\text{error}, \qquad (2)$$

where TargetSurprise is the unexpected change in the federal funds target rate, as before; PathSurprise is the unexpected change in the four-quarter-ahead euro-dollar futures rate, as in Ammer, Vega, and Wongswan (2010), and WFI is a dummy variable that is equal to one for the announcement dates during each of the intervals spanning the zero-change policy announcements immediately prior to a reversal. In Figure 1, this corresponds to the horizontal segments immediately preceding the policy reversal dates. In total, the sample includes 153 announcement dates for scheduled FOMC meetings, seven of which are reversal dates, and 57 of which are WFI dates. Section 5 discusses the implications of this research for the recent environment, and Section 6 concludes. The target and path surprises are presented at the end of the Appendix.

3. Reversals versus Non-Reversals

The results shown in Table 1 suggest that stock prices react more strongly to monetary policy surprises on reversal announcement dates than on other dates. The first three columns present this result when the one-hour (-15min, +45min) event window is used for both the S&P 500 index and for target rate surprises implied by federal funds futures. Column 1 shows that stock prices, on average, decreased by 3.47 percentage points in response to a 1 percentage point surprise increase in the federal funds target rate. Column 2 shows that the stock price reaction was much stronger on reversal dates, with a 2.74 percentage point response for a non-reversal

[6] The one remaining reversal date, January 3, 2001, was not based on a scheduled meeting, and hence is omitted from the sample to preserve homogeneity of reversal dates and prevent contamination of the results with a timing surprise. Adding this unscheduled meeting date to the sample does not change the main results significantly.

date versus 7.68 (2.74+4.94) percentage points for a reversal date. In column 3, the additional effect is shown to be stronger for a positive reversal than for a negative reversal (-8.47 vs. -5.90). However, the additional effects for positive and negative reversal dates are only about one standard deviation away from each other.

The last three columns repeat the same exercise using daily S&P500 index returns. Here, and in the rest of the paper, I continue to use intraday federal funds rate surprises to avoid any identification problems due to other macroeconomic announcements earlier in the day, which occur for about 40 percent of the sample, and any contamination due to pre-FOMC-announcement drift, as illustrated in Lucca and Moench (2015).[7] The results are qualitatively similar but quantitatively stronger in these regressions: the effect of monetary policy surprises on reversal dates is amplified relative to the effect on other dates. Because of the small number of reversal observations, in unreported regressions I check whether the additional effect on reversal dates can be attributed to an outlier observation. This is done by omitting one observation at a time and checking whether the estimates changed significantly, a method akin to using Cook's d statistic, also used in other papers, such as Bernanke and Kuttner (2005). This method suggests that the results are not driven by an outlier, because the magnitude of the coefficient of (Target Surprise x Reversal) remains similar. Overall, these results are qualitatively consistent with the results of Bernanke and Kuttner (2005), who find a stronger stock price reaction on reversal dates.

Table 2 compares the reaction of rated and unrated firms, using individual firm panel data in order to see whether financially constrained firms with limited public debt access (unrated firms, as in Kashyap, Lamont, and Stein (1994)) are affected more strongly than firms with greater access to public debt by this reversal effect. The sample is limited to those firms with a fiscal year ending in December, as is customary in the corporate finance literature in order to ensure that different firms have similar information available to investors at a given date.[8] The coefficient in column 1 (-2.27), where daily stock returns are used, is very similar to that in

[7] Here, I refer to the 13 different types of announcements that have significant effects on interest rates, as discussed in Gürkaynak, Sack, and Swanson (2005b).
[8] See, for example, De Bondt and Thaler (1990), Kashyap, Lamont, and Stein (1994), or Polk and Sapienza (2009).

column 4 of Table 1 (-2.33). However, column 2 reveals that the weekly stock price reaction is more than twice as large as the daily stock price reaction, suggesting that some less liquid stocks might take longer to react to monetary policy. A similar pattern is also observable for reversal dates, as seen by comparing column 3 with Table 1. Therefore, the rest of the regressions in this table use weekly returns with intraday surprises and standard errors clustered at the firm level.[9]

Columns 4 and 5 of Table 2 suggest that unrated firms tend to react to monetary policy surprises relatively more strongly than do rated firms on non-reversal dates (-2.18 vs. 0.04). This pattern may be attributable to the observations that unrated firms tend to use more bank debt (Kashyap, Lamont, and Stein 1994) and that firms with more bank debt are more susceptible to the traditional bank-lending channel and the floating-rate channel for the transmission of monetary policy, as discussed in Ippolito, Ozdagli, and Perez (2015). More importantly, when we compare the effect of a policy surprise on reversal vs. non-reversal dates, the differential effect on reversal dates seems to be comparable in magnitude for rated and unrated firms (-22.10 vs. -19.56). If anything, the additional effect of a reversal is smaller for unrated firms, although the difference is not statistically significant when errors are clustered at the date level (p=0.38). This result is also confirmed by an instrumental variable (IV) approach employed in Faulkender and Petersen (2006), Sufi (2007), and Santos and Winton (2008) where the instrumental variables for being rated capture a firm's visibility and uniqueness, and include: whether the firm is in the S&P 500, whether the firm is listed on the New York Stock Exchange, and the fraction of rated firms in the same three-digit SIC industry as the firm. The IV estimates for rated and unrated firms (not shown in the table) are very similar to estimates from the original regression, with the additional effect of a reversal being -21.33 and -19.39, respectively.

Columns 6 and 7 repeat the same analysis using the financial constraint measure of Hadlock and Pierce (HP, 2010), a measure that is an amalgam of two other widely used measures, firm size and age.[10] The results are qualitatively very similar to those obtained using ratings: firms

[9] The regressions with daily returns clustered at the date level yield qualitatively similar results in terms of comparisons of the reversal and non-reversal dates across different types of firms, as shown in Appendix Table A1.

[10] We choose the HP measure among other candidates, such as Kaplan and Zingales (KZ 1997) and Whited and Wu (WW 2006), because Hadlock and Pierce (2010) show that the KZ and WW indices have very little power to predict

with a high HP index (more-constrained firms) react more strongly to monetary policy on non-reversal dates (-3.77 vs. -0.36), but the differential effect on reversal dates (-20.08 vs. -20.33) is very small, and, if anything, the additional effect of a reversal is smaller for high HP firms.[11] Overall, the results suggest that the additional effect of policy surprises on reversal dates is not very different across firms with different degrees of financial constraint, suggesting that the relative financial constraint of firms does not need to be a more important concern for a policy reversal decision than for a non-reversal decision.

Table 3 presents a comparison of the reversal effect across different Fama-French industries, following the convention in Bernanke and Kuttner (2005). For non-reversal days, the reaction of the business equipment, telecom, and healthcare industries (columns 6, 7, and 10) are particularly responsive to non-reversal monetary policy surprises (-7.56, -4.41, and -4.08), consistent with the results in Bernanke and Kuttner (2005). These are high R&D firms with intangible assets that might make them more susceptible to fluctuations in credit conditions. More interestingly, the reaction of financial firms (column 11) is not any stronger than the reaction of other firms on either non-reversal or reversal dates.[12] This result suggests that any perceived weakness of the financial sector vis-à-vis the nonfinancial sector is unlikely to be a more important concern for a policy reversal decision than it is for a policy change decision that is not a reversal. Still, this result ignores the possibility that financial and nonfinancial firms might react to surprises in expected future rates differently, because many financial firms engage in maturity transformation. The reaction of stock prices to these path surprises is the topic of the next section.

---

financial constraint, and any power they do have comes from firm size and age, the two variables they use to create their composite HP index. Details of the HP index are given in the table notes.

[11] While not the main focus of the paper, it is noteworthy that high-HP firms' stock prices are more responsive to monetary policy. Ozdagli (2015) finds that the financial constraint associated with information frictions causes lower sensitivity of stock prices to monetary policy. This suggests that, on non-reversal dates, the HP index captures a source of financial constraint that goes beyond information frictions, such as the ability to post collateral or borrow from multiple sources.

[12] The result is very similar if we limit the sample of financial firms to commercial banks.

4. Dissecting Non-Reversals: Target and Path Surprises on Wait-for-It (WFI) and Non-WFI Announcement Dates

The analysis in the previous section suggests that stock prices react to monetary policy more strongly on some dates than on other dates. One reason for this differential reaction might be that target rate surprises may provide a signal regarding the future expected path of monetary policy on particular dates.[13] Such a pattern would be consistent with the fact that longer-term Treasury yields also react more strongly to reversal surprises, as illustrated in Ozdagli (2014). Accordingly, Figure 2 shows that the expected path of future interest rates, as captured by the euro-dollar futures for horizons up to eight quarters, seem to move with target rate surprises more strongly on reversal dates.[14] In particular, a 1 percentage point surprise increase in the federal funds target rate today increases the expected LIBOR rate three months from today by about 0.6 percentage points (t=6.96) on non-reversal dates, whereas the effect on reversal dates is about 1.2 percentage points, with the difference being statistically significant (t=3.5). Moreover, the effect seems to be more persistent for reversal dates. The reaction of two-year-ahead interest rate expectations is economically small (0.16) and statistically insignificant (t=0.99) on non-reversal dates, whereas on reversal dates, this reaction is large (0.9) and still statistically significantly different from the reaction on non-reversal dates (t=2.05).

---

[13] See footnote #1.

[14] The euro-dollar futures price is given by 100 points minus the three-month London interbank offered rate for spot settlement on the third Wednesday of the contract month. For example, a price quote of 97.45 signifies a deposit rate of 2.55 percent per annum. Using euro-dollar futures instead of fed funds futures to capture future rate expectations is common because they are more liquid at longer horizons. See also Rigobon and Sack (2004) and Nakamura and Steinsson (2013) for the use of euro-dollar futures, and Gürkaynak (2005) for a discussion of the liquidity of federal funds futures.

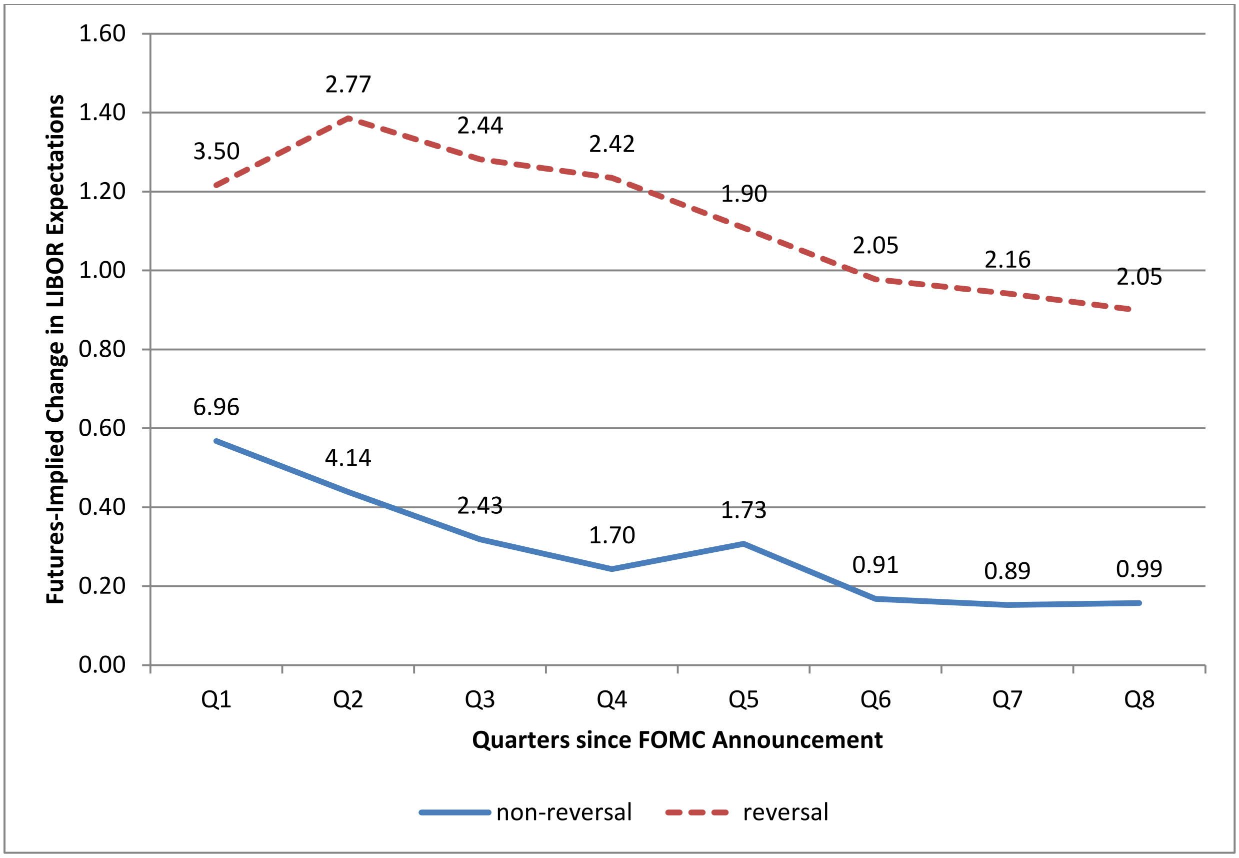


Figure 2. Percentage point reaction of future interest rates, as implied by the euro-dollar futures, to a 1 percentage point target rate surprise.

Note: The numbers above the data points give the heteroskedasticity-robust *t*-statistics associated with the corresponding coefficient. The data for one-to-four-quarter-ahead euro-dollar futures are available for all dates in the 1989–2008 period, whereas longer-term intraday euro-dollar futures data start only in 1994.

If this story has merit, then the differential effect of target surprises on reversal dates should disappear once we control for the changes in expectations regarding the path of future interest rates. As a first pass, Table 4 tests this hypothesis using changes in euro-dollar (ED) futures prices as additional controls. This table includes the changes in euro-dollar futures prices without interacting them with Reversal because it would be challenging to try to identify all the interaction terms with the Reversal dummy variable using only seven policy reversal observations. Nevertheless, one can still study the interaction term of Target Surprise and Reversal in this table for inference: Under the null hypothesis that the story above fully explains the difference between reversal and non-reversal dates, the econometric model should be the same on reversal and non-reversal dates after ED-implied changes in future expected rates are included. Therefore, the coefficient estimates of this restricted regression model, where ED-implied expected rate changes are not interacted with Reversal, will be more efficient under the null hypothesis.

As shown in Table 4, including the euro-dollar futures implied changes in expectations of one- to eight-quarters-ahead interest rates seems to reduce, but not totally eliminate, the differential effect of Target Surprise on reversal dates.[15] In particular, the introduction of near-term euro-dollar-implied interest rate changes generates the largest reduction in the differential effect of Target Surprise on reversal dates (from -4.94 in Table 1 to about -2.4) because these interest rate changes are more highly correlated with the target rate and short-term expectations of monetary policy.[16] However, introducing longer-term euro-dollar-implied interest rate changes, which should capture the changes in expectations regarding future monetary policy better, leads to a smaller reduction in the differential effect of Target Surprise on reversal dates (from -4.94 in Table 1 to about -4). Finally, when all the euro-dollar-implied interest rate changes over the two-year horizon are included together, as shown in the last column of Table 4, the differential effect of Target Surprise on reversal dates becomes -2.82 percentage points for a 1 percentage point surprise increase in the federal funds target rate. Overall, once the changes in the future path of monetary policy are controlled for, the differential effect of Target Surprise on reversal dates becomes smaller, although it is not completely eliminated.

Of course, this test does not rule out an alternative explanation that also is consistent with the previous literature on gradualist policies: the market is more sensitive to information about the medium- and longer-term targets of the Federal Reserve in particular periods. Having only seven reversal observations limits our ability to analyze this explanation for reversal dates. Notwithstanding this limitation, Table A3 in the appendix repeats the regressions by also interacting ED price changes with Reversal. The conclusions from Table 4 do not change

[15] Note that the regressions in Table 4 do not orthogonalize the changes in expectations implied by euro-dollar futures to target surprises because doing so by construction would keep the coefficient of the target surprise constant, which would make this exercise uninteresting.

[16] For example, the first euro-dollar futures contract can have as little as one day to expiration, and for those contracts with expiration dates before the next FOMC meeting, the changes in the first euro-dollar contract prices are very close to target surprises.

qualitatively, as the additional effect of Target Surprise has an economically stronger effect on reversal dates, but the estimates are less efficient, as expected. A similar result holds for changes in expectations of future interest rates, as captured by ED futures. Therefore, Table A3 provides somewhat limited support for this alternative explanation, with the large standard errors inviting a cautious interpretation of these results.

Obviously, these results might be driven by the very limited number of observations and are not enough to confirm or rule out the explanation that the market is more sensitive to information about the medium- and longer-term targets of the Federal Reserve in particular periods. As another way to test this conjecture, I note that, since the 1990s, each reversal in the direction of monetary policy has been preceded by an extended period of unchanged target rates in the wait-for-it period. As shown in Table 5, the distribution of target surprises in WFI periods is much less dispersed than for other (non-WFI) non-reversal dates (standard deviation of 0.03 vs. 0.07), suggesting not only that the target rate was constant on WFI dates, but also that market participants were mostly expecting this. Therefore, the expectations about the future, rather than immediate, actions of the Fed might play a bigger role in WFI periods leading up to reversals than they usually play in other periods. Focusing on WFI and non-WFI periods allows us to circumvent the small-sample problem with reversal dates, as we have 57 WFI dates versus only seven reversal dates.

To test this alternative explanation, we use the Target Surprise variable from the previous section along with the path surprises. As in Ammer, Vega, and Wongswan (2010), we measure the path surprise as the change in the rate implied by the one-year-ahead (four-quarter-ahead) euro-dollar futures. In this regression, the coefficient of the path surprise captures the change in expectations of the one-year-ahead forward rate in LIBOR that is not explained by the current surprise change in the federal funds target, whereas the coefficient of Target Surprise captures the effect of an unexpected change in the federal funds target rate if the market's expectations regarding the LIBOR rates one year from now does not change. The Appendix provides plots of the target and path surprises, along with the component of the path surprise that is orthogonal to the target surprise.[17] In this section, we discard reversal dates to focus our attention on a comparison of WFI days with non-WFI days.[18] We are interested in the coefficient $\gamma 1$ in equation 2, which captures whether stock prices react more strongly to path surprises on WFI dates.

Column 1 of Table 6 begins the analysis by showing the reaction of the intraday S&P 500 index to the monetary policy surprise. Since this regression excludes the reversal dates, the coefficient estimate is the same as in column 2 of Table 1 by construction. Column 2 introduces the path (euro-dollar) surprises to the regression. While the effect of the path surprise is of moderate size, a -0.99 percent change in stock prices in response to a 1 percentage point increase in the one-year-ahead LIBOR, it is not statistically significant, consistent with the earlier work of Gürkaynak, Sack, and Swanson (2005a) and Ammer, Vega, and Wongswan (2010). However, this result changes drastically once we divide the sample into WFI and non-WFI dates. In particular, column 3 shows that the effect of path surprises triples on WFI dates (-3.13+(-0.11)) and becomes statistically significant, whereas it is statistically and economically insignificant on non-WFI dates (-0.11). In comparison, the effects of Target Surprise are similar on both WFI and non-WFI dates, with their difference (0.52) being statistically and economically insignificant.

One immediate question that arises from this analysis is whether the additional effect on WFI dates comes from path surprises or is actually contaminated by timing surprises. In the words of Bernanke and Kuttner (2005), "many of the surprises in the sample may have been interpreted as an advancement or postponement of a more-or-less inevitable change in policy." The surprises in WFI periods might be more likely to be attributable to changes in investors'

---

[17] By construction, the coefficient of the path surprise remains the same regardless of whether it is orthogonalized to Target Surprise or not. Accordingly, the interpretation of the path surprise is similar to the orthogonalized path surprise in Gürkaynak, Sack, and Swanson (2005a) and Ammer, Vega, and Wongswan (2010), but the interpretation of the Target Surprise coefficient is different. If I orthogonalize the path surprise to Target Surprise as in these papers, the coefficient of Target Surprise would answer "what happens to stock prices if the FOMC sets the new current target rate 1 percentage point higher than what the market expected AND the market changes its expectations about rates one year from now by exactly the amount predicted by a regression of euro-dollar futures on federal funds futures?" Therefore, not orthogonalizing surprises makes it somewhat easier to interpret the coefficient of Target Surprise, although it is not essential for our main results.

[18] The comparison of WFI and non-WFI dates in this regression is equivalent to a comparison of these two types of dates using all observations in a fully saturated regression with the Reversal dummy variable and the WFI dummy variable.

expectations regarding the exact timing of an inevitable change in monetary policy, rather than to a change in the path of future interest rates. To the extent that stock prices are more responsive to these timing surprises in WFI periods, the earlier interpretation of path surprises can be misleading. In order to address this issue, column 4 separates the policy surprises into level and timing surprises following the method in Gürkaynak (2005) and Gürkaynak, Sack, and Swanson (2007). On a given FOMC announcement date, this approach involves using the surprise change in the federal funds target rate at the current meeting (mp1) and the change in expectations regarding the rate announcement at the next meeting (mp2). These two surprises are transformed into a *level* and *timing* surprise so that

$$\begin{pmatrix} mp1 \\ mp2 \end{pmatrix} = \begin{bmatrix} 1 & 1 \\ \theta & 0 \end{bmatrix} \begin{pmatrix} level \\ timing \end{pmatrix},$$

where θ is calculated by imposing an orthogonality condition between *level* and *timing*.[19]

Column 4 shows the reaction of stock prices to level and timing surprises for all dates, whereas column 5 compares their effects on WFI and non-WFI dates. The effect of a timing surprise seems to be very similar on WFI and non-WFI dates, with the difference (-0.57) both economically small and statistically insignificant.

When θ=1, the Gürkaynak, Sack, and Swanson (2007) decomposition reduces to the way timing surprises are calculated in Bernanke and Kuttner (2005). That is, *timing* becomes equal to the difference between *mp1* and *mp2*, giving an analytical justification for timing surprises in Bernanke and Kuttner (2005).[20] While θ is close 1 when both scheduled and unscheduled meetings are included in the sample, as in Gürkaynak, Sack, and Swanson (2007), for the sample with only scheduled meeting dates, we have a smaller value of θ (around 0.6). Therefore, I suggest an alternative decomposition based on the assumption that a level surprise

[19] Here, I call the first term *level* following Gürkaynak (2005) rather than following Gürkaynak, Sack, and Swanson (2007), who call this term *path*, because it is not a path factor in the sense of Gürkaynak, Sack, and Swanson (2005a), which might create confusion. *Level* and *timing* are also the terminology used in Bernanke and Kuttner (2005).

[20] To be precise, Bernanke and Kuttner (2005) use ED1 instead of mp2. I stick to mp2 as in Gürkaynak, Sack, and Swanson (2007), as the idea is to capture the surprise generated by the Federal Reserve's taking an action at this meeting instead of at the next meeting, which is better captured by mp2.

should move the current rate and expectations of the future rate by the same amount, causing a parallel shift in the short end of the yield curve; that is,

$$\begin{pmatrix} mp1 \\ mp2 \end{pmatrix} = \begin{bmatrix} 1 & 1 \\ 1 & \theta \end{bmatrix} \begin{pmatrix} level \\ timing \end{pmatrix},$$

where θ can be determined by the same orthogonality condition as in Gürkaynak, Sack, and Swanson (2007). By inverting the matrix on the right side, this can be written as

$$\begin{pmatrix} level \\ timing \end{pmatrix} = \frac{1}{\theta - 1} \begin{bmatrix} \theta & -1 \\ -1 & 1 \end{bmatrix} \begin{pmatrix} mp1 \\ mp2 \end{pmatrix},$$

and hence the timing surprise reduces to the difference between mp1 and mp2 regardless of the value of θ, and is therefore always equal to the Bernanke and Kuttner (2005) timing surprise. Columns 6 and 7 show the results of the same regressions as in the previous two columns, with the level and timing surprises replaced by this new orthogonalization (BK). The results are both qualitatively and quantitatively similar to the results from the previous two columns. Therefore, the pattern observed in column 3 should not be attributed to timing surprises calculated in this manner.

As another way of looking at timing surprises, I study unscheduled meetings, given that the timing surprises should be particularly important on dates when no potential target rate change was scheduled to occur. If the reaction to target and path surprises on WFI dates can be attributed to the timing of monetary policy, stock prices should react to target and path surprises similarly on WFI dates and unscheduled meeting dates that are not reversals, that is, all unscheduled meeting dates except January 3, 2001. Note that none of the WFI dates and unscheduled meetings overlap because, by definition, the fed funds target is constant on WFI dates.

As seen in column 8, unlike WFI dates, the target rate surprise on an unscheduled meeting date does not have any economically (0.65=-2.67+3.32) or statistically (p=0.77) significant effect on stock prices, all but one of which involve a sudden rate cut. Two possible (not mutually exclusive) reasons for this pattern are: (i) the unexpected timing signaled the Fed's private information about the economy, so a sudden rate cut announcement following the Fed's unscheduled meeting suggested that the economy was in worse shape than the market thought (Campbell et. al. 2012, Nakamura and Steinsson 2013, Melosi 2013, and Tang 2015), or (ii) the market was expecting this move, only it came a couple of days or weeks earlier than expected, and hence stock prices were not much affected. If the latter is true, that is, if the market was already pretty sure that a rate change was coming, then market participants might instead be paying more attention to the future goals of the Federal Reserve, in which case we should see a large reaction to path surprises. Consistent with this interpretation, the reaction of stock prices to path surprises on unscheduled meeting dates (-0.11-6.23=-6.34) is larger than the same reaction on both non-WFI days (-0.11) and WFI days (-0.11-3.13=-3.24), although the difference with the WFI days is not statistically significant (p=0.36).

As an additional robustness check, the last column of Table 6 shows that the additional effect of path surprises on WFI dates survives, and is even somewhat stronger (-3.13 vs. -5.90), when we consider daily changes in the S&P 500 index.

A potential concern in this analysis is whether the results would change if we were to use longer-term interest rate expectations to calculate the path surprise. For this reason, Appendix Table A2 repeats the regressions in Table 6 using two-year-ahead euro-dollar futures and compares it with the results using one-year-ahead euro-dollar futures. Since Gürkaynak's intraday change data for euro-dollar futures greater than four quarters start in 1994, these regressions cover only the post-1994 period. Hence, I redo some regressions from Table 6 for this period to make them comparable. Overall, the first four columns of Table A2 provide assurance about robustness in the subsample, as the results with one-year-ahead futures remain very similar to those in Table 6. Moreover, a comparison of the last three columns in Table A2 with the other columns in that table reveals that the one-year-ahead euro-dollar futures are sufficient to capture the path surprises, as the results remain very similar with two-year-ahead euro-dollar futures. This result is probably not surprising, given that a regression of the path surprises implied by two-year-ahead futures on those implied by the four-quarter-ahead futures on these dates produce a coefficient of 0.95 (t=8.65) with an R^2 of 0.78.[21] Finally, the consistency of these results gives us further assurance that the results cannot be attributed to timing surprises, as two-year-ahead interest rates are much less likely to be related to timing surprises because any perceived inevitable change in monetary policy would be much more likely to have happened before the end of the two-year period.

Overall, these results suggest that stock prices react particularly strongly to path surprises on the dates when investors are waiting for a policy reversal. Moreover, this effect cannot be attributed to a signaling channel resulting from the superior information of the Federal Reserve about the state of the economy, because, in the case of a positive reversal, a steeper-than-expected path would signal that the economy is doing better than investors anticipate, and therefore would dampen the negative response of stock prices to such news. A symmetric argument holds for periods before a negative reversal. It is possible that the path surprises signal information regarding the Federal Reserve's objective function, but that is harder to evaluate because the typical reaction function of the Fed, the Taylor rule, involves the current target rate. How future rates react to current economic news would depend on the assumptions underlying a full-blown structural model, which is beyond the scope of this paper. That said, the patterns we observe are consistent with the "gradualist" policies studied in earlier literature, in that a central bank that adjusts the policy rate slowly can actually engender an large reaction to monetary policy, as the market pays attention to the medium- and longer-run target of the central bank.

Following the approach in the previous section, Table 7 follows the structure of Table 2 in order to compare the reactions of rated vs. unrated and low-HP vs. high-HP firms. According to column 1 of Table 7, the coefficient of the target surprise is insignificant for the daily returns, which is consistent with the fifth column of Table 1 for non-reversal dates. For weekly returns in column 2, both effects become stronger, suggesting that it takes some stock prices a little time to react to monetary policy. Column 3 confirms our previous result that path surprises have a

[21] This result is the same regardless of whether we use the raw unexpected changes in these futures or use the changes in these futures that are orthogonal to Target Surprise, consistent with the fact that Target Surprise has very little effect on two-year-ahead futures on non-reversal dates, as shown in Figure 2.

much stronger effect in WFI periods (-7.24). The remaining columns show that the additional effect of path surprises on WFI dates is very similar (-7.12 vs. -7.23) for rated vs. unrated firms (also confirmed by IV estimates), and somewhat stronger for high-HP firms (-8.26 vs. -6.66), although the difference is not statistically significant when errors are clustered at the date level (p=0.5). Moreover, Table 8 shows that the additional effect of path surprises on WFI dates is not particularly strong for financial firms. If anything, high R&D industries, such as business equipment, telecommunications, and healthcare (columns 6, 7, and 10), have a somewhat stronger additional reaction to path surprises on WFI dates (between -10.64 and -12.49) than financial firms (-6.05). Overall, with the possible exception of firms that invest heavily in R&D projects that will pay off in the more distant future, the path surprises on WFI dates do not seem to generate a significantly greater reaction for financial firms or for firms facing greater financial frictions.

5. The Zero-Lower-Bound Environment

What are the implications of this analysis for the recent environment? The answer depends on the nature of the path surprises since the beginning of the zero-lower-bound experience in the United States. For this, I compare the distribution of path surprises between 2009 and July 2015.[22] This provides a total of 52 scheduled FOMC meetings during the ZLB period.

As a start, Table 5 shows that although the WFI and non-WFI dates in the pre-ZLB environment are different in terms of the standard deviation of target surprises, they are similar in terms of the standard deviation of the path surprises, suggesting that the magnitudes of the path surprises were not that different from each other for these two types of dates. Table 9 provides similar distributional statistics for target and path surprises in the post-2008 (ZLB) period. Not surprisingly, the target rate surprises are much smaller in magnitude in this ZLB environment compared to prior observations; this is also reflected in their very small standard deviation (0.005). However, the standard deviations of path surprises are similar to those observed before

[22] For the FOMC announcement on April 27, 2011, I do not have the one-hour window data for the fed funds futures, so I replace the data with the 30-minute window data.

in Table 5, suggesting similar magnitudes of path surprises in the pre-ZLB and the ZLB environments.

How does the stock price reaction to path surprises during the ZLB period compare with other WFI periods? In order to address this question, I expand the regression in equation (2) in the following way:

$$\text{Return} = (\beta 0 + \beta 1{*}\text{WFI} + \beta 2{*}\text{ZLB}){*}\text{TargetSurprise} + (\gamma 0 + \gamma 1{*}\text{WFI} + \gamma 2{*}\text{ZLB}){*}\text{PathSurprise} + \alpha 0 + \alpha 1{*}\text{WFI} + \alpha 2{*}\text{ZLB} + \text{error}. \quad (3)$$

We are interested in whether $\gamma 2=\gamma 1$. Not surprisingly, $\gamma 1=-3.13$ (t=2.09) as in column 3 of Table 6, whereas $\gamma 2=-6.80$ (t=1.96). While the effect of the path surprise is twice as large during the ZLB period as in other WFI periods, their difference is statistically insignificant (p=0.30).

Overall, this analysis suggests that the path surprises during the ZLB period had an effect about as strong as those in the pre-ZLB WFI periods. Hence, the results in this paper can be useful in helping to guide policy regarding forward guidance and liftoff decisions of the monetary authority.

6. Conclusion

With the U.S. economy showing signs of recovery from the recent financial crisis, an interest rate increase by the Federal Reserve may be near. The results in this paper suggest that the historical overreaction of the stock market to policy reversals can be attributed to investors' higher sensitivity to the future path of monetary policy as the date of the reversal nears. Moreover, there is no strong evidence that the financial health or industry status (financial vs. nonfinancial) of the firm plays a very significant role in how different firms react to policy reversals. The paper also provides a refinement of the earlier literature on path surprises and forward guidance by showing that separating the wait-for-it periods from other FOMC announcements is important because forward guidance seems to be more effective during WFI periods. Thus, pooling WFI periods with non-WFI announcements can lead to a more negative conclusion regarding the effectiveness of forward guidance.

The Federal Reserve's policy reversal will likely be followed by other central banks as the world economy recovers, and these results also may provide guidance for them in terms of the timing of their liftoff.

References:

Ammer, J., C. Vega, and J. Wongswan. 2010. "International Transmission of U.S. Monetary Policy Shocks: Evidence from Stock Prices." *Journal of Money, Credit and Banking* 42(s1): 179–198.

Bernanke, Ben S., and Kenneth N. Kuttner. 2005. "What Explains the Stock Market's Reaction to Federal Reserve Policy?" *Journal of Finance* 60(3): 1221–1257.

Campbell, J. R., C. Evans, J. D. M. Fisher, and A. Justiniano. 2012. "Macroeconomic Effects of FOMC Forward Guidance." Brookings Papers on Economic Activity, Spring 2012.

De Bondt, Werner F. M., and Richard H. Thaler. 1990. "Do Security Analysts Overreact?" *American Economic Review* 80(2): 52–57.

Faulkender, Michael, and Mitchell Petersen. 2006. "Does the Source of Capital Affect Capital Structure?" *Review of Financial Studies* 19(1): 45–79.

Goodfriend, Marvin. 1991. "Interest Rate Smoothing in the Conduct of Monetary Policy," *Carnegie-Rochester Conference Series on Public Policy*, 377–30.

Gürkaynak, Refet S. 2005. "Using Federal Funds Futures Contracts for Monetary Policy Analysis." Federal Reserve Board, Finance and Economic Discussion Series 2005-29.

Gürkaynak, Refet S., Brian Sack, and Eric T. Swanson. 2005a. "Do Actions Speak Louder Than Words? The Response of Asset Prices to Monetary Policy Actions and Statements." *International Journal of Central Banking* 1(1): 55–93.

Gürkaynak, Refet S., Brian Sack, and Eric T. Swanson. 2005b. "The Sensitivity of Long-Term Interest Rates to Economic News: Evidence and Implications for Macroeconomic Models." *American Economic Review* 95(1): 425–436.

Gürkaynak, Refet S., Brian Sack, and Eric T. Swanson. 2007. "Market-Based Measures of Monetary Policy Expectations." *Journal of Business and Economic Statistics* 25 (2): 201–212.

Hadlock, Charles J., and Joshua R. Pierce. 2010. "New Evidence on Measuring Financial Constraints: Moving Beyond the KZ Index." *Review of Financial Studies* 23(5): 1909–1940.

Hanson, Samuel G., and Jeremy C. Stein. 2015. "Monetary Policy and Long-Term Real Rates." *Journal of Financial Economics* 115 (3): 429–448.

Haltom, Renee, and Alexander L. Wolman. 2012. "A Citizen's Guide to Unconventional Monetary Policy." Federal Reserve Bank of Richmond Economic Brief 12-2.

Ippolito, F., A. Ozdagli, A. Perez. 2015. “The Transmission of Monetary Policy through Bank Lending: The Floating Rate Channel.” available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2243007

Kaplan, S. N., and L. Zingales. 1997. “Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints?” *The Quarterly Journal of Economics* 112(1):169–215.

Kashyap, Anil K., Owen A. Lamont, and Jeremy C. Stein. 1994. "Credit Conditions and the Cyclical Behavior of Inventories." *The Quarterly Journal of Economics* 109 (3): 565–592.

Kuttner, Kenneth. 2001. “Monetary Policy Surprises and Interest Rates: Evidence from the Fed Funds Futures Markets.” *Journal of Monetary Economics* 47(3): 523–544.

Lucca, David, and Emanuel Moench. 2015. “The Pre-FOMC Announcement Drift.” *Journal of Finance* 70(1): 329–371.

Melosi, Leronardo. 2013. “Signaling Effects of Monetary Policy.” PIER Working Paper No. 13-029.

Nakamura, Emi, and Jon Steinsson. 2013. High Frequency Identification of Monetary Policy Non-Neutrality, Working Paper 19260. National Bureau of Economic Research.

Ozdagli, Ali. 2014. “SNAP: Should We Be Worried about a Sudden, Sharp Rise from Low, Long-Term Rates?” Federal Reserve Bank of Boston Current Policy Perspectives No. 14-11.

Ozdagli, Ali. 2015. “Financial Frictions and Reaction of Stock Prices to Monetary Policy Shocks”, FRB Boston Working Paper No. 14-6, last version: https://goo.gl/FQT5kb

Polk, C., and P. Sapienza. 2009. The Stock Market and Corporate Investment: A Test of Catering Theory. *Review of Financial Studies* 22(1): 187–217.

Rigobon, Roberto, and Brian Sack. 2004. “The Impact of Monetary Policy on Asset Prices.” *Journal of Monetary Economics* 51(8): 1553–1575.

Santos, Joao A. C., and Andrew Winton. 2008. “Bank Loans, Bonds, and Information Monopolies across the Business Cycle.” *Journal of Finance* 63(3): 1315–1359.

Sloan, Richard G. 1996. “Do Stock Prices Fully Reflect Information in Accruals and Cash Flows?” *Accounting Review* Spring: 289–316.

Solomon, Ezra. 1973. "Monetary Policy and Credit Allocation—The Basic Issues" in *Credit Allocation Techniques and Monetary Policy: Proceedings of the 11th Federal Reserve Bank of Boston Annual Conference.*

Stein, Jeremy C., and Aditya Vikram Sunderam. "Gradualism in Monetary-Policy: A Time Consistency Problem?" HBS Working Paper, June 2015.

Sufi, Amir. 2007. "Information Asymmetry and Financing Arrangements: Evidence from Syndicated Loans." Journal of Finance 62(2): 629–668.

Tang, Jenny. 2015. "Uncertainty and the Signaling Channel of Monetary Policy." Federal Reserve Bank of Boston Working Paper No. 15-8.

Thornton, Daniel L. 2009. "The Fed, Liquidity, and Credit Allocation." *Federal Reserve Bank of St. Louis Review*, 91(1): 13–21.

Whited, T. M., & Wu, G. 2006. "Financial Constraints Risk," *Review of Financial Studies* 19(2): 531–559.

Woodford, Michael. 2000. "Pitfalls of Forward-Looking Monetary Policy," *American Economic Review*, 90: 100–104.

Woodford, Michael. (2003. "Optimal Monetary Policy Inertia," *Review of Economic Studies*, 70: 861–886.

Table 1. The Effect of Conventional Monetary Policy Shocks on the S&P500 Index
Scheduled FOMC Meetings, 1989–2008

VARIABLES	(1) SP500 Intraday	(2) SP500 Intraday	(3) SP500 Intraday	(4) SP500 Daily	(5) SP500 Daily	(6) SP500 Daily
Target Surprise	-3.47***	-2.74***	-2.74***	-2.33	-0.34	-0.34
	(-4.47)	(-3.51)	(-3.49)	(-1.25)	(-0.19)	(-0.19)
Target Surprise x Reversal		-4.94***			-13.79***	
		(-3.46)			(-6.16)	
Reversal		0.20			0.15	
		(0.86)			(0.85)	
Positive Reversal x Target Surprise			-8.47**			-18.26***
			(-2.40)			(-8.05)
Negative Reversal x Target Surprise			-5.90***			-10.75***
			(-7.41)			(-5.86)
Positive Reversal			0.58			0.29
			(1.59)			(1.49)
Negative Reversal			-0.22***			0.39***
			(-4.52)			(3.12)
Constant	-0.02	-0.02	-0.02	0.22**	0.22**	0.22**
	(-0.36)	(-0.54)	(-0.54)	(2.59)	(2.53)	(2.52)
Observations	153	153	153	153	153	153
R-squared	0.13	0.18	0.20	0.00	0.10	0.11

Notes: Heteroskedasticity-robust *t*-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Intraday refers to the event window (-15min,+45min) around the time of the FOMC announcement, usually at 2.15pm. Daily refers to the return from the market close of the previous day to the market close of the announcement day. Reversal is a dummy variable that is equal to one on policy reversal dates, as discussed in the text. Positive Reversal refers to an increase in the target rate on a reversal date, whereas Negative Reversal refers to a decrease in the target rate on a reversal date. All regressions use intraday monetary policy surprises.

Table 2. The Effect of Conventional Monetary Policy Shocks on Stock Returns
Panel Regressions, Scheduled FOMC Meetings, 1989–2008

VARIABLES	(1) DAILY	(2) WEEKLY	(3) WEEKLY REVERSAL	(4) RATED REVERSAL	(5) UNRATED REVERSAL	(6) LOW HP REVERSAL	(7) HIGH HP REVERSAL
Target Surprise	-2.27***	-4.74***	-1.54***	0.04	-2.18***	-0.36	-3.77***
	(-22.68)	(-22.74)	(-6.78)	(0.13)	(-7.43)	(-1.62)	(-7.24)
Reversal			-1.18***	-1.23***	-1.17***	-1.25***	-1.10***
			(-21.25)	(-14.65)	(-16.48)	(-21.49)	(-9.79)
Target Surprise x Reversal			-20.15***	-22.10***	-19.56***	-20.33***	-20.08***
			(-40.09)	(-31.16)	(-29.87)	(-38.14)	(-19.59)
Constant	0.22***	0.33***	0.40***	0.40***	0.40***	0.42***	0.35***
	(409.89)	(293.29)	(132.57)	(95.39)	(101.09)	(136.57)	(54.46)
Observations	324,963	324,581	324,581	97,781	226,800	197,606	119,579
R-squared	0.00	0.00	0.01	0.01	0.01	0.01	0.01
Number of permnos	8,258	8,221	8,221	2,066	7,134	3,870	5,762

Notes: Robust *t*-statistics in parentheses after standard errors are clustered at firm level. *** p<0.01, ** p<0.05, * p<0.1. Daily refers to the return from the market close of the previous day to the market close of the announcement day. Weekly refers to the cumulative daily return over five business days starting with the announcement day. All regressions use intraday surprises and weekly returns, except the first regression, which uses daily returns. Rated firms are those with a long-term credit rating from Standard and Poor's. The Hadlock and Pierce (2010) measure is given by HP = -0.548*Size+0.025*Size^2-0.031*Age. Firm size is defined to be the log of assets (in constant 2004 dollars). Age is defined as the current year minus the first year that the firm has a non-missing stock price in CRSP. Firm size and age are winsorized at the 1 percent tails on the low end, and at the $4.5 billion and 37-year points on the high end. A firm is considered high HP if the firm's HP statistic is above the median in a given year.

Table 3. The Effect of Conventional Monetary Policy Shocks on Stock Returns
Panel Regressions, Scheduled FOMC Meetings, 1989–2008

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	1	2	3	4	5	6	7	8	9	10	11	12
Target Surprise	0.15	-0.26	-0.16	-1.52	0.58	-7.56***	-4.41***	-0.69*	-0.16	-4.08***	-0.27	-0.11
	(0.17)	(-0.19)	(-0.25)	(-1.65)	(0.59)	(-7.99)	(-3.86)	(-1.74)	(-0.16)	(-3.80)	(-0.85)	(-0.15)
Reversal	-0.56**	-0.20	-0.42***	-0.43*	-0.55	-2.22***	-1.58***	-0.35***	-1.21***	-1.81***	-1.22***	-1.19***
	(-2.28)	(-0.59)	(-2.87)	(-1.93)	(-1.55)	(-9.94)	(-4.40)	(-3.10)	(-5.06)	(-8.44)	(-15.03)	(-7.21)
T. Surprise x Reversal	-15.72***	-22.68***	-21.10***	-17.10***	-20.12***	-24.63***	-23.87***	-9.01***	-19.09***	-19.10***	-20.06***	-22.82***
	(-6.77)	(-5.98)	(-12.46)	(-8.52)	(-6.48)	(-12.51)	(-8.92)	(-8.92)	(-8.75)	(-9.93)	(-25.83)	(-15.31)
Constant	0.36***	0.25***	0.33***	0.51***	0.38***	0.52***	0.36***	0.45***	0.47***	0.41***	0.38***	0.32***
	(27.93)	(12.96)	(38.35)	(43.82)	(22.23)	(41.91)	(18.79)	(82.13)	(34.11)	(33.88)	(90.34)	(33.20)
Observations	13,388	7,264	32,050	13,954	7,362	38,555	11,349	16,994	18,102	31,148	96,927	37,488
R-squared	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01
Number of permnos	313	162	680	343	150	1,365	373	203	516	923	2,120	1,082

Notes: All regressions use weekly returns and intraday monetary policy surprises. Robust *t*-statistics in parentheses after standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1. The industry codes are:
*1 NonDur: Consumer Nondurables - Food, Tobacco, Textiles, Apparel, Leather, Toys;
*2 Durbl: Consumer Durables - Cars, TVs, Furniture, Household Appliances;
*3 Manuf: Manufacturing - Machinery, Trucks, Planes, Office Furniture, Paper, Commercial Printing;
*4 Enrgy: Oil, Gas, and Coal Extraction and Products;
*5 Chems: Chemicals and Allied Products;
*6 BusEq: Business Equipment - Computers, Software, and Electronic Equipment;
*7 Telcm: Telephone and Television Transmission;
*8 Utils: Utilities;
*9 Shops: Wholesale, Retail, and Some Services (Laundries, Repair Shops);
*10 Hlth: Healthcare, Medical Equipment, and Drugs;
*11 Money: Finance;
*12 Other: Other - Mines, Construction, Building Management, Transportation, Hotels, Business Services, Entertainment.

Table 4. The Effect of Conventional Monetary Policy Shocks on the S&P500 Index
Scheduled FOMC Meetings, 1989–2008

VARIABLES	(1) SP500 Intraday	(2) SP500 Intraday	(3) SP500 Intraday	(4) SP500 Intraday	(5) SP500 Intraday	(6) SP500 Intraday	(7) SP500 Intraday	(8) SP500 Intraday	(9) SP500 Intraday
Target Surprise	-0.52	-1.72*	-2.29***	-2.49***	-2.42**	-2.60**	-2.62**	-2.62**	0.23
	(-0.41)	(-1.88)	(-2.69)	(-2.94)	(-2.17)	(-2.48)	(-2.49)	(-2.46)	(0.12)
Target Surprise x Reversal	-2.41	-2.75*	-3.58**	-3.92***	-4.23***	-4.46***	-4.53***	-4.55***	-2.82*
	(-1.54)	(-1.71)	(-2.51)	(-2.83)	(-2.94)	(-3.07)	(-3.10)	(-3.11)	(-1.73)
ED1	-3.91**								-4.04
	(-2.21)								(-0.83)
ED2		-2.32**							-3.32
		(-2.01)							(-0.55)
ED3			-1.42						3.37
			(-1.65)						(0.87)
ED4				-1.03					0.95
				(-1.36)					(0.12)
ED5					-0.94				-1.41
					(-1.14)				(-0.28)
ED6						-0.64			-8.91*
						(-0.98)			(-1.75)
ED7							-0.56		6.82
							(-0.81)		(1.04)
ED8								-0.57	3.10
								(-0.77)	(0.56)
Reversal	0.05	0.07	0.10	0.13	0.16	0.18	0.19	0.19	0.03
	(0.21)	(0.28)	(0.42)	(0.56)	(0.69)	(0.80)	(0.84)	(0.84)	(0.13)
Constant	-0.03	-0.02	-0.02	-0.02	-0.05	-0.05	-0.05	-0.04	-0.06
	(-0.68)	(-0.60)	(-0.51)	(-0.59)	(-0.84)	(-0.87)	(-0.83)	(-0.83)	(-1.11)
Observations	153	153	153	153	116	116	116	116	116
R-squared	0.24	0.23	0.20	0.19	0.19	0.18	0.18	0.18	0.28

Notes: Heteroskedasticity-robust *t*-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Intraday refers to the event window (-15min,+45min) around the time of the FOMC announcement, usually at 2.15pm. EDX refers to the change in the X-quarter-ahead LIBOR rate implied by euro-dollar futures prices. Reversal is a dummy variable that is equal to one on policy reversal dates, as discussed in the text.

Table 5. Distributional Properties of Target and Path Surprises on WFI and Non-WFI Dates
Scheduled FOMC Meetings, 1989–2008

Non-WFI

TARGET					PATH				
Percentiles	Smallest				Percentiles	Smallest			
1%	-0.225	-0.225			1%	-0.225	-0.225		
5%	-0.150	-0.215			5%	-0.140	-0.210		
10%	-0.100	-0.188	Obs	89	10%	-0.115	-0.185	Obs	89
25%	-0.0200	-0.169	Sum of Wgt.	89	25%	-0.0450	-0.150	Sum of Wgt.	89
50%	0		Mean	-0.00366	50%	0.0100		Mean	-0.00208
		Largest	Std.Dev.	0.0676			Largest	Std.Dev.	0.0796
75%	0.0300	0.120			75%	0.0500	0.155		
90%	0.0622	0.124	Variance	0.00457	90%	0.0800	0.160	Variance	0.00634
95%	0.111	0.125	Skewness	-0.900	95%	0.115	0.180	Skewness	-0.289
99%	0.145	0.145	Kurtosis	5.051	99%	0.215	0.215	Kurtosis	3.747

WFI

TARGET					PATH				
Percentiles		Smallest			Percentiles		Smallest		
1%	-0.120	-0.120			1%	-0.185	-0.185		
5%	-0.0664	-0.0986			5%	-0.120	-0.150		
10%	-0.0417	-0.0664	Obs	57	10%	-0.0800	-0.120	Obs	57
25%	-0.0115	-0.0500	Sum of Wgt.	57	25%	-0.0300	-0.0900	Sum of Wgt.	57
50%	0		Mean	-0.00823	50%	0		Mean	-0.00544
		Largest	Std.Dev.	0.0278			Largest	Std.Dev.	0.0622
75%	0	0.0231			75%	0.0200	0.0800		
90%	0.0119	0.0270	Variance	0.000776	90%	0.0500	0.0950	Variance	0.00387
95%	0.0270	0.0387	Skewness	-1.605	95%	0.0950	0.125	Skewness	0.600
99%	0.0646	0.0646	Kurtosis	8.392	99%	0.245	0.245	Kurtosis	7.517

Table 6. The Effect of Conventional Target and Path Surprises on the S&P500 Index.
Intraday Regressions, Scheduled FOMC Meetings, 1989–2008

VARIABLES	(1) TARGET	(2) TARGET &PATH	(3) TARGET &PATH WFI	(4) LEVEL& TIMING	(5) LEVEL& TIMING WFI	(6) LEVEL& TIMING BK	(7) LEVEL& TIMING BK WFI	(8) TARGET &PATH WFI & UNSCHEDULED	(9) TARGET &PATH WFI DAILY
Target	-2.74***	-2.50***	-2.67***					-2.67***	-0.60
	(-3.53)	(-2.95)	(-2.91)					(-2.88)	(-0.31)
WFI			-0.06		-0.06		-0.04	-0.06	0.09
			(-0.64)		(-0.65)		(-0.46)	(-0.64)	(0.55)
Target x WFI			0.52					0.52	3.25
			(0.16)					(0.16)	(0.62)
Path		-0.99	-0.11					-.11	0.73
		(-1.24)	(-0.12)					(-0.12)	(0.45)
Path x WFI			-3.13**					-3.13**	-5.90***
			(-2.09)					(-2.08)	(-2.94)
Level				-3.32**	-3.31*	-3.18***	-3.08**		
				(-1.99)	(-1.86)	(-2.77)	(-2.42)		
Timing				-2.52**	-2.46**	-2.26*	-2.32*		
				(-2.56)	(-2.34)	(-1.78)	(-1.76)		
Level x WFI					-1.73		-0.56		
					(-0.32)		(-0.20)		
Timing x WFI					-0.57		0.26		
					(-0.18)		(0.05)		
Unscheduled								0.06	
								(0.40)	
Target x Unscheduled								3.32	
								(1.37)	
Path x Unscheduled								-6.23*	
								(-1.88)	
Constant	-0.02	-0.02	-0.01	-0.03	-0.01	-0.03	-0.01	-0.01	0.18
	(-0.54)	(-0.60)	(-0.10)	(-0.63)	(-0.14)	(-0.65)	(-0.20)	(-0.10)	(1.55)
Observations	146	146	146	146	146	146	146	165	146
R-squared	0.08	0.10	0.14	0.09	0.09	0.09	0.09	0.28	0.05

Notes: Robust *t*-statistics in parentheses after standard errors are clustered at the firm level. *** p<0.01, ** p<0.05, * p<0.1. All regressions except (8) use intraday data, whereas regression (8) uses daily returns and intraday surprises. WFI is the wait-for-it period immediately before a reversal. Target refers to the target rate surprise captured by federal funds futures, and Path refers to the path surprise captured by the four-quarter-ahead euro-dollar futures. Level and Timing Surprises capture the changes in expectations regarding the overall tightness of monetary policy versus the timing of a policy move. Further details are in the text.

Table 7. The Effect of Conventional Target and Path Surprises on Stock Returns
Panel Regressions, Scheduled FOMC Meetings, 1989–2008

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
			WEEKLY	RATED	UNRATED	LOW HP	HIGH HP
VARIABLES	DAILY	WEEKLY	WFI	WFI	WFI	WFI	WFI
Target	0.06	-0.78***	-1.77***	-0.39	-2.35***	-0.59**	-4.15***
	(0.52)	(-3.38)	(-7.20)	(-1.11)	(-7.37)	(-2.38)	(-7.32)
WFI			-0.20***	0.04	-0.32***	0.02	-0.67***
			(-7.76)	(1.07)	(-9.13)	(0.90)	(-11.23)
Target x WFI			5.77***	10.86***	4.17***	7.61***	3.95**
			(8.13)	(10.93)	(4.64)	(10.84)	(2.57)
Path	-0.71***	-2.79***	-0.62***	-1.31***	-0.29	-1.12***	0.27
	(-9.37)	(-17.04)	(-3.10)	(-4.49)	(-1.14)	(-5.50)	(0.63)
Path x WFI			-7.24***	-7.12***	-7.23***	-6.66***	-8.26***
			(-21.67)	(-14.60)	(-16.67)	(-19.13)	(-12.45)
Constant	0.22***	0.39***	0.49***	0.40***	0.54***	0.42***	0.65***
	(377.33)	(325.11)	(45.59)	(30.44)	(36.41)	(43.18)	(24.86)
Observations	308,630	308,287	308,287	93,123	215,164	187,715	113,244
R-squared	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Number of permnos	8,251	8,216	8,216	2,066	7,129	3,868	5,756

Notes: Robust *t*-statistics in parentheses after standard errors are clustered at firm level. *** p<0.01, ** p<0.05, * p<0.1. Daily refers to the return from the market close of the previous day to the market close of the announcement day. Weekly refers to the cumulative daily return over five business days starting with the announcement day. All regressions use intraday surprises and weekly returns, except the first regression, which uses daily returns. Rated firms are those with a long-term credit rating from Standard and Poor's. WFI is the wait-for-it period immediately before a reversal. Target refers to the target rate surprise captured by federal funds futures, and Path refers to the path surprise captured by the four-quarter-ahead euro-dollar futures. The Hadlock and Pierce (2010) measure is given by HP = -0.548*Size+0.025*Size^2-0.031*Age. Firm size is defined to be the log of assets (in constant 2004 dollars). Age is defined as the current year minus the first year that the firm has a non-missing stock price in CRSP. Firm size and age are winsorized at the 1 percent tails on the low end, and at the $4.5 billion and 37-year points on the high end. A firm is considered high-HP if the firm's HP statistic is above the median in a given year.

Table 8. The Effect of Conventional Target and Path Surprises on Stock Returns
Panel Regressions, Scheduled FOMC Meetings, 1989–2008

VARIABLES	(1) 1	(2) 2	(3) 3	(4) 4	(5) 5	(6) 6	(7) 7	(8) 8	(9) 9	(10) 10	(11) 11	(12) 12
Target	0.31	-0.24	0.10	-2.12**	0.43	-7.44***	-5.07***	-1.35***	0.61	-5.10***	-0.65*	-0.64
	(0.32)	(-0.16)	(0.14)	(-2.11)	(0.38)	(-7.17)	(-4.01)	(-3.03)	(0.55)	(-4.32)	(-1.88)	(-0.79)
WFI	0.02	0.36**	0.03	-0.14	0.21	-1.22***	-0.47***	0.20***	0.01	-0.80***	0.16***	-0.35***
	(0.20)	(2.57)	(0.39)	(-1.35)	(1.44)	(-10.57)	(-3.16)	(4.44)	(0.13)	(-7.49)	(4.72)	(-4.39)
Target x WFI	2.07	5.69	6.64***	28.72***	7.11*	1.10	5.64	11.42***	2.83	1.03	5.71***	6.51***
	(0.78)	(1.26)	(3.52)	(8.60)	(1.94)	(0.38)	(1.38)	(8.45)	(0.90)	(0.34)	(5.77)	(2.94)
Path	-1.17	-0.62	-2.92***	-9.77***	-1.17	-0.80	1.95	-1.95***	-2.87***	3.30***	0.44*	-0.02
	(-1.50)	(-0.61)	(-4.71)	(-10.80)	(-1.03)	(-0.98)	(1.51)	(-3.69)	(-3.21)	(4.10)	(1.74)	(-0.03)
Path x WFI	-1.69	-6.86***	-6.38***	-2.52**	-7.35***	-12.49***	-12.31***	-0.72	-5.80***	-10.64***	-6.05***	-7.47***
	(-1.16)	(-3.45)	(-5.86)	(-2.08)	(-3.09)	(-9.22)	(-6.53)	(-0.91)	(-4.04)	(-8.40)	(-13.71)	(-7.41)
Constant	0.36***	0.10*	0.33***	0.63***	0.30***	1.04***	0.56***	0.40***	0.46***	0.75***	0.32***	0.48***
	(8.40)	(1.83)	(10.98)	(14.99)	(5.16)	(21.07)	(8.70)	(23.30)	(9.83)	(16.25)	(23.82)	(14.21)
Observations	12,718	6,891	30,431	13,259	7,016	36,543	10,767	16,207	17,160	29,551	92,200	35,544
R-squared	0.00	0.00	0.00	0.02	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.00
Number of permnos	313	162	680	343	150	1,365	372	203	515	922	2,118	1,082

Notes: All regressions use weekly returns and intraday monetary policy surprises. Robust *t*-statistics in parentheses after standard errors are clustered at the firm level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. WFI is the wait-for-it period immediately before a reversal. Target refers to the target rate surprise captured by federal funds futures, and Path refers to the path surprise captured by the four-quarter-ahead euro-dollar futures. The industry codes are:

*1 NonDur: Consumer Nondurables—Food, Tobacco, Textiles, Apparel, Leather, Toys;
*2 Durbl: Consumer Durables—Cars, TVs, Furniture, Household Appliances;
*3 Manuf: Manufacturing—Machinery, Trucks, Planes, Office Furniture, Paper, Commercial Printing;
*4 Enrgy: Oil, Gas, and Coal Extraction and Products;
*5 Chems: Chemicals and Allied Products;
*6 BusEq: Business Equipment—Computers, Software, and Electronic Equipment;
*7 Telcm: Telephone and Television Transmission;
*8 Utils: Utilities;
*9 Shops: Wholesale, Retail, and Some Services (Laundries, Repair Shops);
*10 Hlth: Healthcare, Medical Equipment, and Drugs;
*11 Money: Finance;
*12 Other: Other—Mines, Construction, Building Management, Transportation, Hotels, Business Services, Entertainment.

Table 9. Distributional Properties of Target and Path Surprises
Scheduled FOMC Meetings, 2009 to mid-2012

TARGET

Percentiles	Smallest			
1%	-0.0155	-0.0155		
5%	-0.00717	-0.0103		
10%	-0.00500	-0.00717	Obs	53
25%	0	-0.00692	Sum of Wgt.	53
50%	0		Mean	0.000485
		Largest	Std.Dev.	0.00503
75%	0.00369	0.00834		
90%	0.00555	0.00882	Variance	2.53e-05
95%	0.00882	0.0100	Skewness	-0.0996
99%	0.0155	0.0155	Kurtosis	4.998

PATH

Percentiles	Smallest			
1%	-0.185	-0.185		
5%	-0.120	-0.125		
10%	-0.0750	-0.120	Obs	53
25%	-0.0300	-0.100	Sum of Wgt.	53
50%	-0.00500		Mean	-0.0127
		Largest	Std.Dev.	0.0477
75%	0.0100	0.0500		
90%	0.0350	0.0550	Variance	0.00228
95%	0.0550	0.0700	Skewness	-1.197
99%	0.0800	0.0800	Kurtosis	5.524

APPENDIX

Table A1. The Effect of Conventional Monetary Policy Shock on Stock Returns
Panel Regressions with Daily Returns, Scheduled FOMC Meetings, 1989–2008

VARIABLES	(1) DAILY	(2) DAILY REVERSAL	(3) RATED REVERSAL	(4) UNRATED REVERSAL	(5) LOW HP REVERSAL	(6) HIGH HP REVERSAL
Surprise	-2.27	-0.12	-0.51	0.04	-0.38	0.31
	(-1.49)	(-0.11)	(-0.33)	(0.04)	(-0.31)	(0.25)
Reversal		0.11	0.11	0.10	0.13	0.08
		(0.89)	(1.16)	(0.69)	(1.01)	(0.38)
Surprise x Reversal		-13.16***	-14.02***	-12.76***	-13.44***	-12.75***
		(-9.85)	(-8.93)	(-9.48)	(-8.63)	(-6.11)
Constant	0.22***	0.22***	0.23***	0.22***	0.22***	0.23***
	(3.42)	(3.49)	(3.05)	(3.57)	(3.36)	(3.33)
Observations	324,963	324,963	97,867	227,096	197,786	119,770
R-squared	0.00	0.01	0.02	0.01	0.02	0.01
Number of permnos	8,258	8,258	2,068	7,169	3,872	5,798

Notes: Robust *t*-statistics in parentheses after standard errors are clustered at firm level. *** p<0.01, ** p<0.05, * p<0.1. Daily refers to the return from the market close of the previous day to the market close of the announcement day. Weekly refers to the cumulative daily return over five business days starting with the announcement day. All regressions use intraday surprises and weekly returns, except the first regression that uses daily returns. Rated firms are those with a long-term credit rating from Standard and Poor's. The Hadlock and Pierce (2010) measure is given by HP = -0.548*Size+0.025*Size^2-0.031*Age. Firm size is defined to be the log of assets (in constant 2004 dollars). Age is defined as the current year minus the first year that the firm has a non-missing stock price in CRSP. Firm size and age are winsorized at the 1% tails on the low end, and at the $4.5 billion and 37 year points on the high end. A firm is considered high HP if the firm's HP statistic is above the median in a given year.

Table A2. The Effect of Conventional Target and Path Surprises on the S&P500 Index.
Intraday Regressions, Scheduled FOMC Meetings, 1994–2008

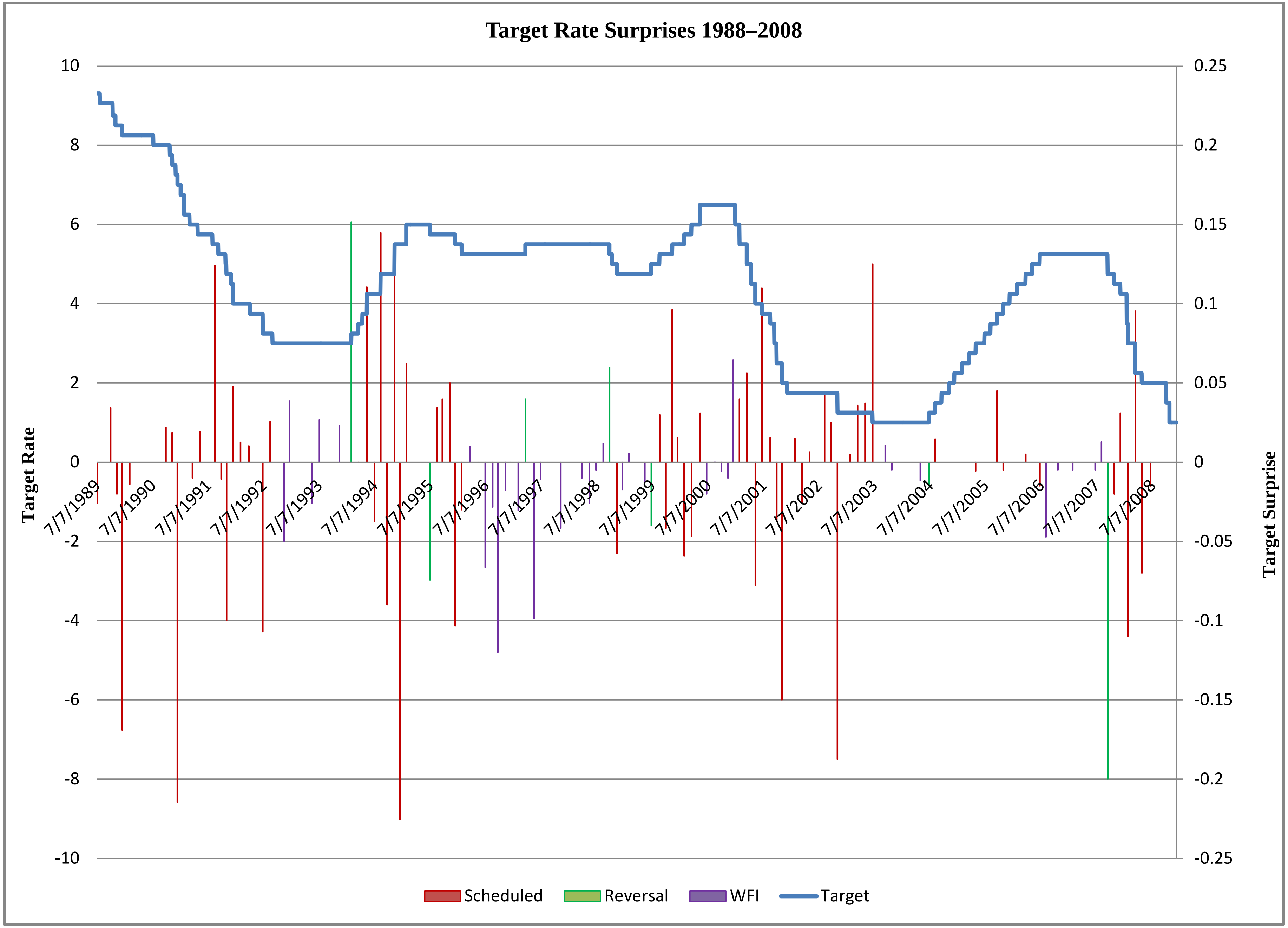
VARIABLES	(1) TARGET	(2) TARGET &PATH (1-year)	(3) TARGET &PATH WFI (1-year)	(4) TARGET &PATH WFI DAILY (1-year)	(5) TARGET &PATH (2-years)	(6) TARGET &PATH WFI (2-years)	(7) TARGET &PATH WFI DAILY (2-years)
Target	-2.71***	-2.39**	-2.62**	-1.18	-2.63**	-2.71**	-1.04
	(-2.71)	(-2.22)	(-2.15)	(-0.54)	(-2.50)	(-2.34)	(-0.49)
WFI			-0.06	0.05		-0.06	0.04
			(-0.49)	(0.24)		(-0.52)	(0.23)
Target*WFI			0.89	6.67		0.59	6.11
			(0.23)	(1.05)		(0.16)	(1.01)
Path		-1.08	-0.15	0.90	-0.47	0.38	0.80
		(-1.27)	(-0.15)	(0.51)	(-0.62)	(0.49)	(0.45)
Path*WFI			-3.25**	-6.47***		-3.46**	-6.36***
			(-2.01)	(-3.06)		(-2.34)	(-3.01)
Constant	-0.04	-0.05	-0.02	0.23	-0.04	-0.02	0.23
	(-0.78)	(-0.85)	(-0.28)	(1.60)	(-0.83)	(-0.24)	(1.60)
Observations	109	109	109	109	109	109	109
R-squared	0.07	0.09	0.13	0.06	0.07	0.12	0.06

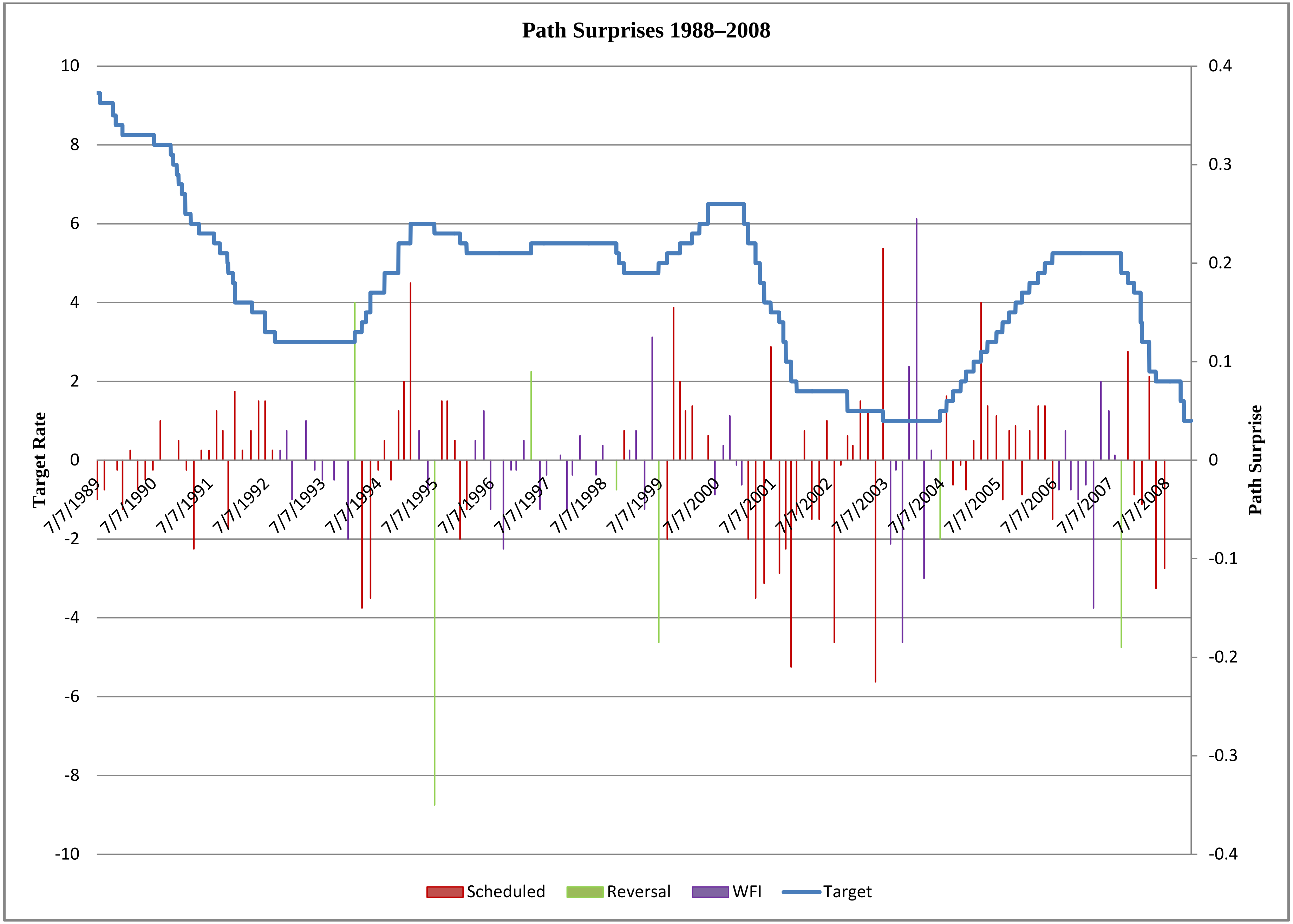
Notes: Heteroskedasticity-robust *t*-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All regressions except (8) use intraday data, whereas regression (8) uses daily returns and intraday surprises. WFI is the wait-for-it period immediately before a reversal. Target refers to the target rate surprise captured by federal funds futures, and Path refers to the path surprise captured by the four-quarter-ahead euro-dollar futures. Level and Timing Surprises capture the changes in expectations regarding the overall tightness of monetary policy versus the timing of a policy move. Further details are in the text. (1-year) and (2-years) in the column titles refer to path surprises generated using one-year-ahead and two-year-ahead euro-dollar futures.

Table A3. The Effect of Conventional Monetary Policy Shocks on the S&P500 Index
Scheduled FOMC Meetings, 1989–2008

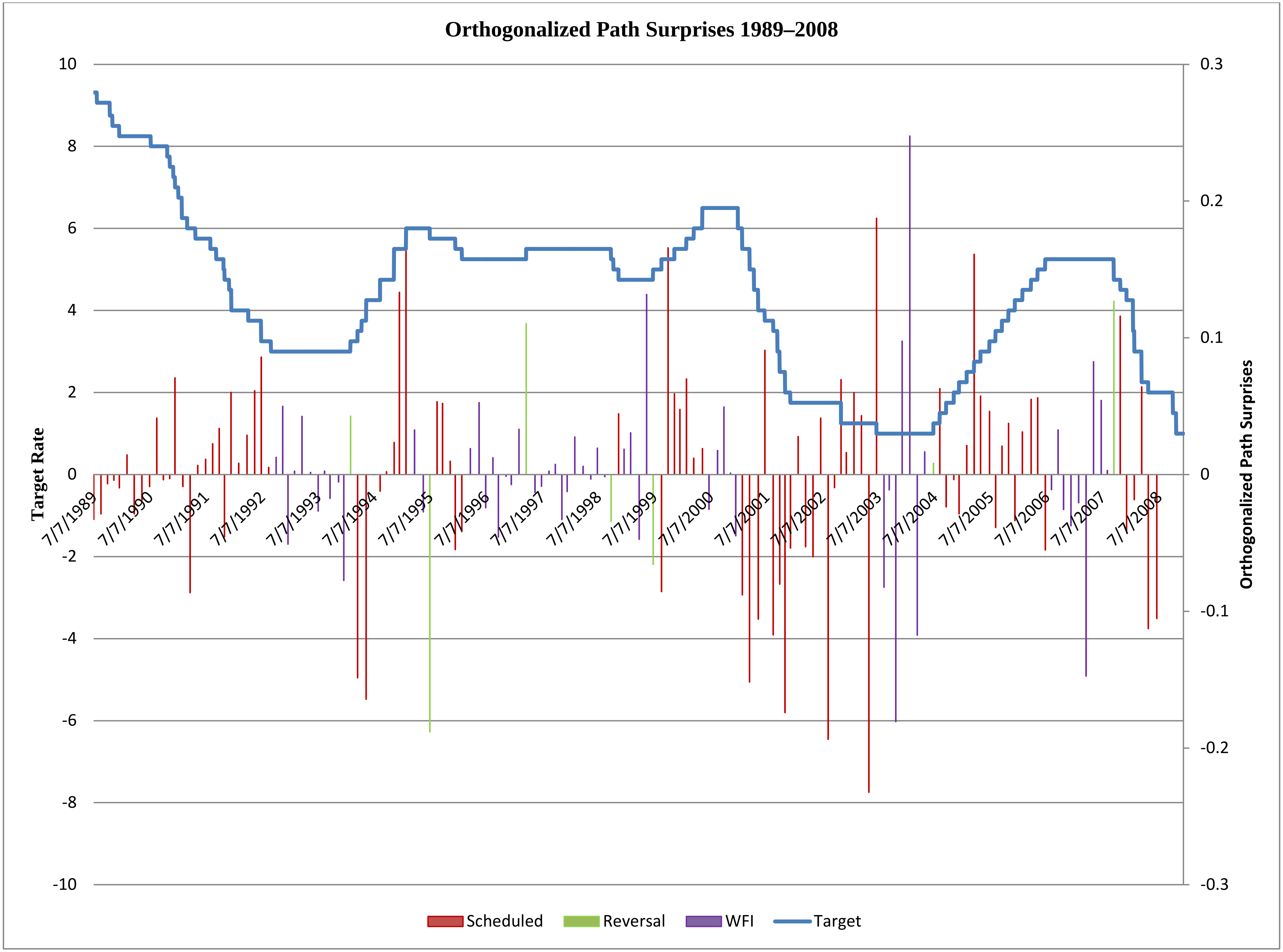
x-quarter ahead ED change VARIABLES	(x=1) SP500 Intraday	(x=2) SP500 Intraday	(x=3) SP500 Intraday	(x=4) SP500 Intraday	(x=5) SP500 Intraday	(x=6) SP500 Intraday	(x=7) SP500 Intraday	(x=8) SP500 Intraday
Target Surprise	-0.48	-1.60*	-2.28***	-2.50***	-2.44**	-2.62**	-2.64**	-2.63**
	(-0.36)	(-1.69)	(-2.63)	(-2.92)	(-2.16)	(-2.49)	(-2.49)	(-2.46)
Target Surprise * Reversal	-3.49	-5.47**	-3.92*	-3.42	-3.24	-2.29	-2.31	-2.86
	(-0.75)	(-2.28)	(-1.77)	(-1.55)	(-1.42)	(-0.99)	(-0.96)	(-1.24)
EDx	-3.98**	-2.60**	-1.45	-0.99	-0.85	-0.52	-0.44	-0.47
	(-2.12)	(-2.07)	(-1.55)	(-1.22)	(-0.97)	(-0.78)	(-0.62)	(-0.61)
EDx * Reversal	0.93	2.16	0.29	-0.43	-0.95	-2.32	-2.47	-1.97
	(0.20)	(1.02)	(0.13)	(-0.20)	(-0.39)	(-0.89)	(-0.88)	(-0.69)
Reversal	0.08	0.17	0.11	0.10	0.10	0.05	0.08	0.11
	(0.37)	(0.71)	(0.54)	(0.52)	(0.57)	(0.30)	(0.47)	(0.60)
Constant	-0.03	-0.02	-0.02	-0.02	-0.04	-0.05	-0.04	-0.04
	(-0.68)	(-0.60)	(-0.51)	(-0.59)	(-0.83)	(-0.85)	(-0.82)	(-0.82)
Observations	153	153	153	153	116	116	116	116
R-squared	0.24	0.23	0.20	0.19	0.19	0.19	0.18	0.18

Notes: Heteroskedasticity-robust *t*-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Intraday refers to the event window (-15min,+45min) around the time of the FOMC announcement, usually at 2.15pm. EDX refers to the change in the X-quarter-ahead LIBOR rate implied by euro-dollar futures prices. Reversal is a dummy variable that is equal to one on policy reversal dates, as discussed in the text.


Target Rate Surprises 1988–2008
Target Rate
Target Surprise
10
8
6
4
2
0
-2
-4
-6
-8
-10
0.25
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
7/7/1989
7/7/1990
7/7/1991
7/7/1992
7/7/1993
7/7/1994
7/7/1995
7/7/1996
7/7/1997
7/7/1998
7/7/1999
7/7/2000
7/7/2001
7/7/2002
7/7/2003
7/7/2004
7/7/2005
7/7/2006
7/7/2007
7/7/2008
Scheduled
Reversal
WFI
Target



Path Surprises 1988–2008
Target Rate
Path Surprise
10
8
6
4
2
0
-2
-4
-6
-8
-10
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
7/7/1989
7/7/1990
7/7/1991
7/7/1992
7/7/1993
7/7/1994
7/7/1995
7/7/1996
7/7/1997
7/7/1998
7/7/1999
7/7/2000
7/7/2001
7/7/2002
7/7/2003
7/7/2004
7/7/2005
7/7/2006
7/7/2007
7/7/2008
Scheduled
Reversal
WFI
Target


Orthogonalized Path Surprises 1989–2008
Target Rate
Orthogonalized Path Surprises
10
8
6
4
2
0
-2
-4
-6
-8
-10
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
7/7/1989
7/7/1990
7/7/1991
7/7/1992
7/7/1993
7/7/1994
7/7/1995
7/7/1996
7/7/1997
7/7/1998
7/7/1999
7/7/2000
7/7/2001
7/7/2002
7/7/2003
7/7/2004
7/7/2005
7/7/2006
7/7/2007
7/7/2008
Scheduled
Reversal
WFI
Target