December 5, 2008

10. Effects of Very Low Interest Rates on the Profitability of Commercial Banks and Other Financial Institutions

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Executive summary

Conventional wisdom holds that financial firms—especially depository institutions—benefit from a steep yield curve, because their primary function is to intermediate funds across maturities by providing relatively short-dated claims to investors while extending longer-term loans to borrowers. According to this view, a steepening of the yield curve should increase financial firms' net interest margins and, all else equal, boost the equity prices of such firms. However, financial institutions may hedge this exposure to interest rate changes, or the effects of changes in rates on net interest margins may be offset by changes in the noninterest components of firms' income or expense. Indeed, the empirical literature offers little consensus regarding the effects of changes in interest rates on the profits of financial institutions.[2]

In this note, we examine the effects of unanticipated changes in short-term interest rates on the behavior of stock returns of financial institutions (commercial banks, insurance carriers, and security brokers and dealers). In addition, we consider whether these effects change in an environment of very low policy interest rates, a situation in which the pricing of some bank assets and liabilities may be influenced by the zero bound on nominal interest rates. Specifically, we adopt the empirical methodology of Bernanke and Kuttner (2005), who analyze the reaction of the broad stock market to changes in the stance of monetary policy.[3] We, in contrast, analyze *firm-specific* stock returns in an environment of very low interest rates—namely, the 2003-04 period when the target funds rate was at 1 percent. By exploiting firm-specific stock returns, we are able to

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[1] English and Zakrajšek: Division of Monetary Affairs; Morgan: Research Department, Federal Reserve Bank of New York; Van den Heuvel: Division of Research and Statistics. Robert Kurtzman provided excellent research assistance.

[2] Empirical research using equity price data has generally found that bank stock returns are negatively related to unpredictable changes interest rates—typically derived from an auxiliary econometric model— indicating that bank stock prices tend to fall when longer-term interest rates rise unexpectedly; see, for example, Flannery, M. J. and C. M. James, 1984. "The Effect of Interest Rate Changes on the Common Stock Returns of Financial Institutions," *Journal of Finance*, 39(4), pp. 1141-1153. In contrast, analysis that looks at the relationship between banks' net interest margins (net interest income as a percentage of interest-earnings assets) and interest rates has generally found little evidence that net interest margins respond systematically to changes in short-term rates or the slope of the term structure; see, for example, English, W. B., 2002. "Interest Rate Risk and Bank Net Interest Margins," *BIS Quarterly Review*, December, pp. 67-82.

[3] See Bernanke, B. S. and K. N. Kuttner, 2005. "What Explains the Stock Market's Reaction to Federal Reserve Policy?" *Journal of Finance*, 60(3), pp. 1221-1257.

identify more precisely the average effect of unanticipated interest rate changes on the equity valuations of financial institutions. Our principal findings are as follows:

- Equity prices of financial institutions increase in response to an unexpected policy easing. For example, a 25-basis-point surprise reduction in the target funds rate boosts, on average, stock prices of commercial banks almost 0.7 percent; stock prices of insurance companies about 0.6 percent; and stock prices of investment banks about 1.3 percent.

- In contrast to the conventional wisdom, stock prices of financial firms also increase in response to FOMC communication that leads investors to anticipate a flatter path for policy in the medium term. The effect on financial stock returns of communication about the future path for policy was especially large during the 2003-04 period of very low interest rates. During that period, communication leading to a 25-basis-point downward revision in medium-term policy expectations resulted, on average, in a 1.5 percent gain in financial share values.

- Abnormal stock returns of financial firms—that is, returns once their usual reactions to the market return and Fama-French factors have been removed—appear to be unrelated to unexpected changes in interest rates. This result suggests that unexpected changes in the stance of monetary policy do not influence financial firms' profits directly, but rather through their effects on broader financial and economic conditions, including the equity risk premium, future profit opportunities, and asset quality.

- To demonstrate the size of effects on stock prices that the Committee's decisions could have, we consider a hypothetical example in which the Committee at its December meeting chooses to lower the target funds rate by 75 basis points, to 25 basis points, and through the accompanying statement indicates its intention to keep the target rate at that level for an extended period of time. Our estimates suggest that in this hypothetical case, the stock prices of financial firms would rise between 2.7 and 3.2 percent and those of nonfinancial firms would increase about 3.8 percent.

The empirical framework

To obtain exogenous variation in short-term interest rates, we analyze the reaction of firm-specific stock returns to unexpected changes in the federal funds target rate on the day of an FOMC announcement—that is, policy actions associated with regularly scheduled FOMC meetings as well as any intermeeting policy moves. Following standard practice, we measure the *target* surprise associated with a specific policy action using the change in the rate on federal funds futures contracts expiring before the subsequent FOMC meeting. Aside from being surprised by the immediate *level* of the funds rate, market participants may also be surprised by indications regarding the path of monetary policy going forward, induced, for example, by the wording of the statement accompanying the policy decision. We estimate such a *path* surprise as the component of the change in the year-ahead expected federal funds rate implied by Eurodollar futures quotes (the ED4 contract) that is not explained by the associated target surprise.

Exhibit 1 depicts the behavior of the target funds rate (top panel), the associated target surprises (middle panel), and the path surprises (bottom panel) since February 1994, when the FOMC began making explicit policy announcements. As indicated by the thin red bars in the middle panel, the largest target surprises are associated with intermeeting policy actions. By contrast, the magnitude of a typical path surprise (bottom panel) does not differ systematically between regularly scheduled FOMC meetings and intermeeting policy moves.

The shaded yellow area in each panel corresponds to the 2003-04 period, during which the target funds rate was kept at 1 percent for a prolonged period—the low interest rate environment according to our definition. As evidenced by the virtual absence of any target surprise of an economically meaningful magnitude, the Committee's communication efforts during that period clearly resulted in little uncertainty regarding policy actions at the FOMC meetings. Nevertheless, as indicated by the considerable variation in path surprises, market participants were surprised by the associated FOMC communication, which led them on a number of occasions to revise significantly their expected path for policy during that period.

To obtain a set of benchmark results, we first estimate the following panel stock return regression:

$$R_{it} = \theta_1 \Delta ff_t^u + \theta_2 \Delta ED4_t^u + \theta_3 \Delta ff_t^e + \eta_i + \varepsilon_{it}; \qquad (1)$$

where R_{it} denotes the daily (total) stock return of firm i on the day of an FOMC announcement; Δff_t^u denotes the target surprise—that is, the unexpected portion of the change in the target rate; $\Delta ED4_t^u$ denotes the path surprise—that is, the change in the year-ahead expected funds rate that is not explained by the associated target surprise; Δff_t^e denotes the expected portion of the change in the target funds rate; η_i is a firm fixed effect; and ε_{it} is a zero-mean error term. Our panel data set consists of all nonfarm publicly traded firms covered by the Center for Research in Security Prices (CRSP) that had a minimum of 252 trading days of returns between January 1, 1994 and June 30, 2008.[4] We consider three categories of financial firms based on 4-digit Standard Industrial Classification (SIC) codes: (1) commercial banks and bank holding companies (807 firms); (2) insurance carriers (280 firms); and (3) security brokers and dealers—that is, investment banks (96 firms). As a robustness check of our results, we also estimate our return regressions on the panel of 9,184 nonfinancial firms. In the time dimension, our sample spans 121 policy actions, including five intermeeting policy moves.[5] We estimate equation 1 by OLS, thus the coefficients θ_1 and θ_2 measure the average effect of target and path surprises on stock returns, respectively. The coefficient θ_3 measures

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[4] To ensure that our results were not driven by a small number of extreme observations, we dropped from our sample all observations with absolute daily return in excess of 25 percent.
[5] Following Bernanke and Kuttner (2005), we omitted the intermeeting 50 basis points cut in the target funds rate on September 17, 2001.

the average effect of the expected change in the target funds rate, which under the efficient markets hypothesis, should be equal to zero.[6]

Benchmark results

Table 1 contains the results from the estimation of equation 1 for our four categories of firms. Consistent with the efficient markets hypothesis, the effect on stock returns of the expected change in target funds rate (Δff_t^e) is statistically and economically indistinguishable from zero for each sector. The estimated effect of target surprises (Δff_t^u) implies that a 25-basis-point surprise cut in the target funds rate, on average, boosts stock prices of commercial banks almost 0.7 percent, those of insurance companies 0.6 percent, and those of investment banks about 1.3 percent. As a comparison, stock prices of nonfinancial firms rise about 1.1 percent, on average, in response to a 25-basis-point unanticipated reduction in the funds rate target.[7]

Turning to FOMC communication, the estimated effect of path surprises ($\Delta ED4_t^u$) implies that an unexpected 25-basis-point downward shift in the expected funds rate at a one-year horizon boosts equity valuations of commercial banks about 0.4 percent, those of insurance companies and investment banks almost 0.5 percent, and those of nonfinancial firms almost 0.7 percent; those effects, although economically significant, are statistically significant only at the 10 percent level and not even at that level for investment banks. All told, our benchmark results indicate that stock prices of both financial and nonfinancial firms generally benefit from unanticipated reductions in the target funds rate as well as from FOMC communication that results in a flatter trajectory of the expected path for monetary policy.

Stock returns and monetary policy surprises in a low interest rate environment

In this section, we examine whether the effects of monetary policy surprises on stock returns of financial institutions are different in an environment of very low policy rates. For example, approaching the zero bound on nominal interest rates is likely to increase concerns about the risk of a prolonged deflationary spiral with its attendant consequences for the health of borrowers' balance sheets. In addition, when rates fall to very low levels, the ability of banks to recover costs and profit from their deposit base by

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[6] Statistical inference about the estimated coefficients is an important issue in such panel-data return regressions because the explanatory variables do not differ across firms and the error terms are likely to exhibit significant cross-sectional—that is, spatial—correlation. Accordingly, we use the methodology developed by Driscoll and Kraay (1998) to compute standard errors that are robust to the presence of arbitrary cross-sectional dependence in the error term; see Driscoll, J. C. and A. Kraay, 1998. "Consistent Covariance Matrix Estimation with Spatially Dependent Data." *The Review of Economics and Statistics*, 80(4), pp. 549-560.

[7] The magnitude of these effects is broadly in line with those reported by Bernanke and Kuttner (2005). The differences reflect, in part, different sample periods and, more importantly, the fact that Bernanke and Kuttner use value-weighted portfolio returns, which give more weight to large firms. Consistent with their findings, we find that stock returns of large banking institutions respond more strongly to monetary policy surprises than those of smaller commercial banks.

offering deposit rates that are set below market rates is likely to become impaired because customers will not accept negative nominal interest rates.

To examine this question empirically, we estimate a variant of equation 1 in which we allow the coefficients on policy surprises to differ across two interest rate regimes: a "low" interest rate environment and a "normal" interest rate environment. Formally,

$$R_{it} = \theta_1^{norm} I(ff_{t-1} > 1)\Delta ff_t^u + \theta_2^{norm} I(ff_{t-1} > 1)\Delta ED4_t^u +$$
$$\theta_1^{low} I(ff_{t-1} \leq 1)\Delta ff_t^u + \theta_2^{low} I(ff_{t-1} \leq 1)\Delta ED4_t^u + \eta_i + \varepsilon_{it};$$

(2)

where $I(ff_{t-1} \leq 1)$ is an indicator function that equals one when the target federal funds target is at (or below) 1 percent on the day immediately preceding an FOMC announcement—the "low" interest rate environment—and zero otherwise. Conversely, the indicator function $I(ff_{t-1} > 1)$ identifies a period in which the target rate was strictly above 1 percent, the "normal" interest rate environment. Using this definition, the low interest rate environment (the shaded yellow vertical bars in Exhibit 1) covers the period from August 12, 2003, to June 30, 2004, for a total of eight regularly scheduled FOMC meetings.

Results of this exercise are reported in Table 2. Because there was no significant variation in target surprises during the period in which the target rate was kept at 1 percent (see middle panel of Exhibit 1), the effect of target surprises on stock returns in that regime is estimated very imprecisely. In contrast, communication about the future path of monetary policy—as captured by path surprises—is estimated to have had an economically large and statistically significant effect on the stock prices of both financial and nonfinancial firms during that period. For example, in the low interest rate environment, a downward revision of 25 basis points in year-ahead policy expectations is estimated to boost the stock prices of financial institutions between 1.3 and 1.5 percent, depending on the sector. In addition to being economically large, the effect of path surprises on stock returns in the low interest rate environment is statistically significantly different from that in the normal interest rate environment. Indeed, according to our estimates, it appears that path surprises had virtually no effect on the stock returns of financial firms outside the period of very low policy rates. This finding, however, is not specific to financial firms. As evidenced by the entries in the last column of the table, the same pattern holds for nonfinancial firms, a sector where we actually find the largest impact (in absolute value) of path surprises on stock returns in the low interest rate environment.

What could account for the heightened importance of FOMC communication during the 2003-04 period of low policy rates? One possibility is that investors were especially concerned about the risk of deflation and the economy falling into a liquidity trap, resulting in a protracted period of economic weakness. Against this backdrop, the Committee's communication efforts, including an indication that the funds rate will be maintained at 1 percent for a prolonged period, may have helped assuage investors'

concerns about the possibility of an especially adverse macroeconomic outcome, thereby giving a larger-than-usual boost to stock prices.

The fact that the stock prices of both financial and nonfinancial firms display heightened sensitivity to FOMC communication in the low interest rate environment strongly suggests that this is a market-wide phenomenon. We test this hypothesis by examining the responses of abnormal stock returns to monetary policy surprises. In particular, we estimate abnormal stock returns for each firm by regressing its daily excess return on the market excess return and the two Fama-French factors, corresponding to size (SMB) and book-to-market (HML).[8] Abnormal returns are defined as the residuals from this regression—that is, by construction, the part of the return that is not accounted for by its usual co-movement with the aggregate risk factors. We then estimate equation 2 using abnormal returns instead of returns as the dependent variable.

The results of this exercise are presented in Table 3. As evidenced by the entries in the table, there is little systematic evidence that monetary policy surprises lead to significant abnormal returns for either financial or nonfinancial firms. We interpret these results as indicating that the reactions of financial stock prices to monetary policy surprises in both the low and normal interest rate environments are in line with their usual response to measures of aggregate risks. In this sense, there is nothing special about the way equity prices of financial institutions react to unanticipated changes in interest rates. That is, unexpected changes in the stance of monetary policy influence financial firms' equity valuations through their effects on broader financial and economic conditions, including the equity risk premium, future profit opportunities, and asset quality.

To evaluate the potential size of the effects of target and path surprises on equity prices, we consider a hypothetical scenario. In this scenario, the Committee lowers its target for the federal funds rate by 75 basis points at the December meeting and through the accompanying statement indicates its intention to keep the target rate at 25 basis points for an extended period of time. Such policy action would entail a negative target surprise of about 15 basis points, which by itself would increase stock prices of financial firms between 0.3 and 0.8 percent—depending on the sector—and those of nonfinancial firms about 0.6 percent.[9] According to Eurodollar futures quotes, investors currently anticipate that the funds rate will be about 75 basis points in November 2009. Assuming

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[8] Our estimates of abnormal returns are based on the standard Fama-French 3-factor model:

$$(R_{it} - i_t^T) = \beta_i^0 + \beta_i^M (R_t^M - i_t^T) + \beta_i^{SMB} SMB_t + \beta_i^{HML} HML_t + \varepsilon_{it} ;$$

where i_t^T is the risk-free rate (daily one-month Treasury yield), R_t^M is the value-weighted total market return from CRSP, and SMB_t and HML_t are the Fama-French "small minus big cap" and "high minus low book-to-market" risk factors. We estimate the firm-specific "betas" using all trading days (not just days of FOMC meetings or intermeeting policy moves) over our sample period.

[9] Because the effect of target surprises on stock returns in the low interest rate environment is estimated very imprecisely and, in fact, is statistically indistinguishable from the effect in the normal interest rate environment (see Table 2), the results discussed in this paragraph are based on the specification of equation 2 in which the coefficient on the target surprise is not allowed to vary between the low and normal interest rate environments; the resulting estimates of the effects of target and path surprises are very similar to those reported in Tables 1 and 2, respectively.

that the FOMC statement lowers the year-ahead expected funds rate to 25 basis points—implying a negative path surprise of about 45 basis points—our estimates suggest that stock prices of financial firms would likely rise an additional 2.4 percent and those of nonfinancial firms would increase an additional 3.2 percent, yielding a total gain of between 2.7 and 3.2 percent for financial firms and about 3.8 percent for nonfinancial firms.

The increases in equity valuations in this hypothetical scenario are, of course, averages across the firms in our sample. In practice, some firms' stock prices would rise by more and other firms' would rise by less, or even decline, depending on the activities and exposures of the particular institutions. In addition, our sample of commercial banks and bank holding companies—which accounts for the bulk of industry assets—consists of publicly traded firms that are listed on major stock exchanges and excludes most smaller community-based banks. To the extent that these smaller institutions have a relatively high fraction of their loan portfolios priced relative to the prime rate—which tends to move in lockstep with the target federal funds rate—they may be more likely to experience a reduction in profitability as a result of a further reduction in the target funds rate.[10]

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[10] The pass-through of the changes in the target federal funds rate to business and household borrowing rates is discussed in note 13 of this package, "The federal funds rate target and business and household borrowing rates."

Table 1. Reaction of Stock Returns to Changes in the Stance of Monetary Policy

Interest Rate Change	Sector			
	Commercial Banks	Insurance Carriers	Investment Banks	Nonfinancial Firms
Target Surprise	**-2.70**	**-2.30**	**-5.25**	**-4.28**
	[3.02]	[2.09]	[2.32]	[2.66]
Path Surprise	-1.64	-1.89	-1.83	-2.67
	[1.78]	[1.70]	[0.80]	[1.81]
Expected Change in Funds Rate Target	-0.04	0.29	-0.23	0.30
	[0.10]	[0.51]	[0.19]	[0.54]
R^2	0.012	0.006	0.015	0.009
No. of observations	54,183	16,326	4,818	531,258
No. of firms	807	280	96	9,184

Notes: Sample period: 121 policy actions between February 1994 and June 2008. Dependent variable is the firm-specific daily stock return on the day of the policy action. All specifications include firm fixed effects and are estimated by OLS. Absolute *t*-statistics based on standard errors that are robust to arbitrary cross-sectional dependence in the error term are reported in brackets. Coefficient estimates highlighted in bold are statistically different from zero at the 5 percent significance level.

Table 2. Reaction of Stock Returns to Changes in the Stance of Monetary Policy in a
Low Interest Rate Environment

Interest Rate Surprise	Interest Rate Environment	Sector			
		Commercial Banks	Insurance Carriers	Investment Banks	Nonfinancial Firms
Target Surprise	Normal	**-2.72**	**-2.18**	**-5.32**	**-4.17**
		[3.27]	[2.11]	[2.52]	[2.58]
	Low	12.2	20.1	13.1	-1.03
		[0.77]	[1.01]	[0.15]	[0.02]
Path Surprise	Normal	-0.90	-1.01	-1.36	-1.69
		[0.87]	[0.78]	[0.53]	[1.04]
	Low	**-5.30**	**-5.94**	**-5.48**	**-7.19**
		[3.94]	[4.90]	[2.14]	[4.20]
Differential effects:					
Target Surprise: (Low – Normal)		15.0	22.2	18.4	3.14
		[0.94]	[1.12]	[0.21]	[0.07]
Path Surprise: (Low – Normal)		**-4.41**	**-4.93**	-4.12	**-5.49**
		[2.62]	[2.82]	[1.14]	[2.33]
R^2		0.014	0.007	0.016	0.009
No. of observations		54,183	16,326	4,818	531,258
No. of firms		807	280	96	9,184

Notes: Sample period: 121 policy actions between February 1994 and June 2008. Dependent variable is the firm-specific daily stock return on the day of the policy action. All specifications include firm fixed effects and are estimated by OLS. Absolute *t*-statistics based on standard errors that are robust to arbitrary cross-sectional dependence in the error term are reported in brackets. Coefficient estimates highlighted in bold are statistically different from zero at the 5 percent significance level.

Table 3. Reaction of Abnormal Stock Returns to Changes in the Stance of Monetary Policy in a Low Interest Rate Environment

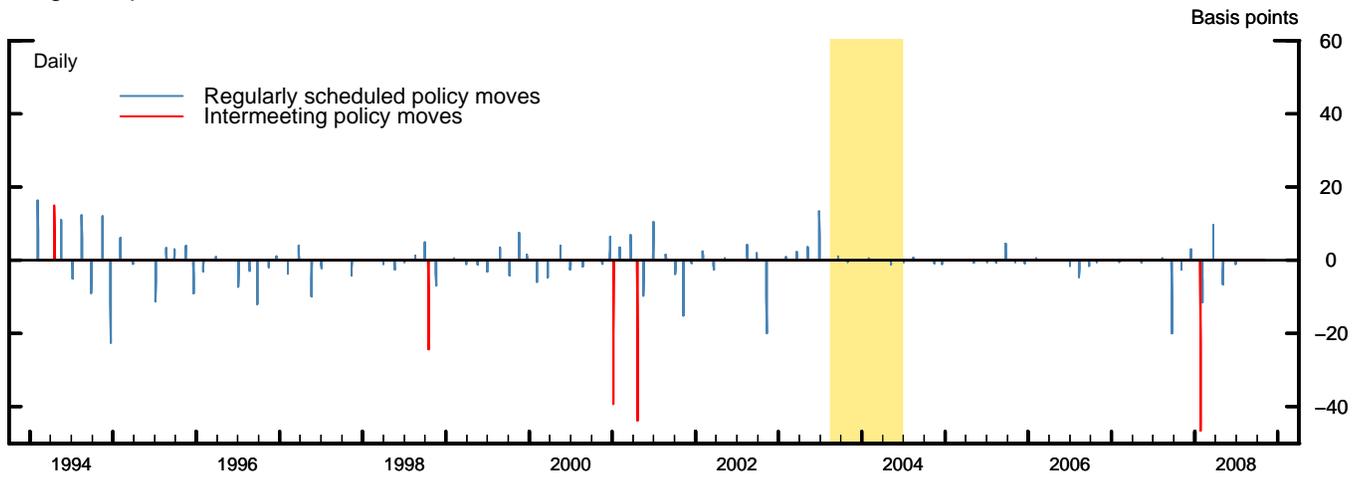| Interest Rate Surprise	Interest Rate Environment	Sector			
		Commercial Banks	Insurance Carriers	Investment Banks	Nonfinancial Firms
Target Surprise	Normal	**-1.12**	-0.14	-1.23	-0.52
		[2.13]	[0.28]	[1.50]	[1.11]
	Low	12.5	17.5	-0.23	-1.98
		[1.06]	[0.94]	[0.00]	[0.24]
Path Surprise	Normal	0.02	-0.36	-0.43	**-0.94**
		[0.03]	[0.67]	[0.26]	[2.38]
	Low	-0.97	-0.04	2.58	0.01
		[0.87]	[0.06]	[1.21]	[0.01]
Differential effects:					
Target Surprise: (Low – Normal)		13.6	17.7	1.00	-1.46
		[1.16]	[0.95]	[0.02]	[0.17]
Path Surprise: (Low – Normal)		-0.99	-0.32	2.15	0.94
		[0.81]	[0.39]	[0.79]	[1.59]
R^2		0.002	0.000	0.001	0.000
No. of observations		54,183	16,326	4,818	531,258
No. of firms		807	280	96	9,184

Notes: Sample period: 121 policy actions between February 1994 and June 2008. Dependent variable is the firm-specific daily abnormal stock return on the day of the policy action. Abnormal stock returns are estimated using the Fama-French 3-factor model (see text for details). All specifications include firm fixed effects and are estimated by OLS. Absolute *t*-statistics based on standard errors that are robust to arbitrary cross-sectional dependence in the error term are reported in brackets. Coefficient estimates highlighted in bold are statistically different from zero at the 5 percent significance level.

Exhibit 1

Monetary Policy Actions and Surprises

Target federal funds rate
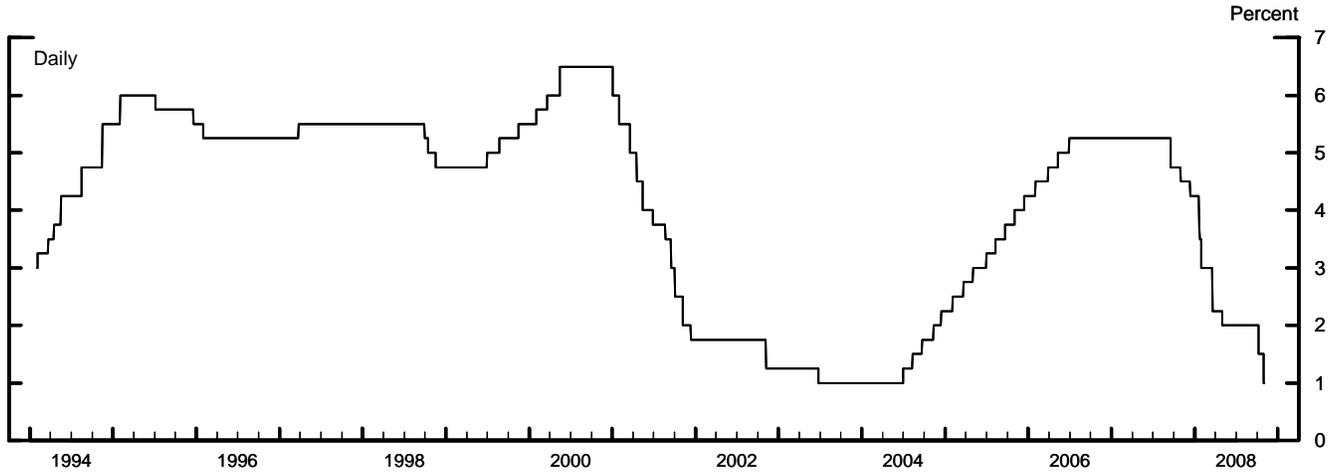
Target surprises

Path surprises