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Federal Funds Target Rate Changes and Sector Equity Returns

Michael King
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Abstract

The purpose of this paper is to investigate how equities of nine individual economic sectors are affected when monetary policy announcements in the form of federal funds rate changes are made over the period January 1, 1999 to May 11, 2005. This sector-analysis is conducted over a recent time period, when the Federal Open Market Committee has adopted a policy of immediate disclosure of its federal funds target rate changes. Our results indicate that the Consumer Discretionary and Technology sectors' equity returns are negatively and significantly related to changes in the federal funds target rate. This negative relationship appears to be especially pronounced for decreases in the federal funds target rate. A positive and significant relationship exists between equity returns in the Consumer Staples Sector and federal funds target rate changes, which is again concentrated in federal funds target rate decreases. A surprising finding is that Utility Sector returns tend to decrease in response to decreases in the federal funds target rate. In summary, we find that the relationship between equity returns and federal funds target rate changes documented in previous studies is more pronounced for some sectors in the economy.

Federal Funds Target Rate Changes and Sector Equity Returns

Introduction

The objective of this paper is to investigate how equities of individual sectors are affected when monetary policy announcements in the form of federal funds rate changes are made over the period January 1, 2000 to December 31, 2004. We contribute to the existing literature in two ways. First, we investigate the announcement effect to federal funds target rate changes for nine separate economic sectors. To our knowledge, a sector-analysis of monetary policy changes has not been performed to date. While some studies have failed to identify an aggregate announcement effect, we believe that the announcement effect may be concentrated in a few select sectors that exhibit a particularly high level of interest rate sensitivity.

Second, this sector-analysis is investigated over a recent time period, when the Federal Open Market Committee has adopted a policy of immediate disclosure of its federal funds target rate change. Other studies have found that this policy, which the FOMC adopted in 1994, has concentrated the market reaction closer to the time of the announcement. Consequently, the effect on separate economic sectors should be more clearly discernible.

This study will examine the announcement effect of changes in the federal funds target rate on specific factors during the January 1, 1999 to May 11, 2005 period. Specifically, we will investigate the equity performance

associated with increases or decreases in the federal funds target rate for the following economic sectors:

1) Consumer discretionary
2) Consumer staples
3) Energy
4) Financial
5) Health care
6) Industrial
7) Materials
8) Technology, and
9) Utilities

The remainder of this paper is organized as follows. Section 2 provides a review of related literature. Section 3 discusses the data and methodology. The results are presented in Section 4. Section 5 concludes.

Review of Related Literature

Many previous studies have investigated the announcement effect. In this section, we will discuss the past work by grouping their contributions into four major themes. The announcement effect and its implications on market efficiency will be the first topic covered. The second topic will look at past studies that have separated the announcement effect into expected or unexpected announcements. This will be followed by looking at the studies that have examined different operation regimes and how this influences the announcement effect. The fourth theme will examine past work that has looked at the practice of immediate disclosure and how this has contributed to the announcement effect.

The relationship between market efficiency and the announcement effect has been the underlying concern of many studies. Particularly, previous studies have investigated how an adjustment in prices due to "expected" information is justified in an efficient market and how quickly information should be absorbed into equity values. Many attempts, using different perspectives, have shown the markets to be efficient in dealing with the announcement effect.[1]

Waud (1970) was one of the first studies done on the announcement effect. His work attempted to isolate how much of the announcement effect was due to economic realities, and how much was due the psychological impact on the public's expectations. If interest rates are adjusted, then it will have a real economic impact in valuating securities, since both expected cash flows and the discount value could be altered, which in turn should impact prices. Once these adjustments are accounted for, any further move in prices could be attributed to some other factor. Waud (1970) does find that an announcement effect does exist outside of the fundamentals. "After removing systematic components from such data, an analysis of the random component strongly suggests that there is an announcement effect on expectations associated with discount rate changes" (Waud [1970]). Waud also finds that there is some anticipation of the change in the days preceding the announcement.

Demiralp (2001) focuses on the anticipation of change in relation to the announcement of the change. According to the author, the increased transparency created by the Fed's 1994 policy of immediate public announcements should result in a more effective prediction of

[1] If market interest rates adjust to target interest rate changes by the Federal Reserve, we should expect an effect on equities. The positive relationship between target interest rates (discount rate and federal funds target rate) and market interest rates has been documented by Cook and Hahn (1988), Cook and Hahn (1989), and Thornton (1998), among others.

monetary adjustments by the market. This anticipation effect moves interest rates prior to the announcement which diminishes the effect of the actual announcement. This study goes on to show that the market only reacts to the unexpected portion of any announcement.

As previously mentioned, many studies have attempted to distinguish between expected and non-expected announcements. These studies typically justify efficient markets by showing that any market reaction is due to some unanticipated factor within the announcement. This supports market efficiency in that prices should only move upon new information. We contend that there is some information even in expected changes. As stated in Madura and Schnusenberg (1998) “even though financial market participants devote much time and resources on Fed watching, announcements about changes in the Fed’s policy tools still contain valuable information.”

The second issue of market efficiency deals with the timing of price adjustments. Many studies address this issue. Smirlock and Yawitz (1985), Chen and Mohan (1998), Prather and Bertin (1999), and Lobo (2002) all conclude that prices quickly adjust to new information contained within the Fed’s announcements on monetary direction. Most studies done on the announcement effect find the markets to be efficient in this regard. Prather and Bertin (1999) state: “Virtually all studies find that such policy changes are quickly reflected in stock prices, thus lending further support to the proponents of market efficiency.” This finding is also confirmed by Chen and Mohan (1998), who investigate intra-day trading and find that the market reacts to unexpected announcement.

Previous studies also attempt to distinguish between expected and unexpected announcements. Smirlock and Yawitz (1985), for instance, separate announced monetary policy into technical and non-technical announcements. Technical announcements are expected or anticipated by the market, while non-technical announcements are a surprise to the market and therefore contain new information. Consistent with he efficient markets hypothesis, the authors argue that technical announcements will have little or no impact on equities whereas non-technical announcements will.

Similarly, Chen and Mohan (1998) find a significant negative stock price reaction for non-technical announcements, but no significant reaction for technical announcements. Likewise, Bomfim (2001) uses several tests to examine the volatility surrounding the day of the announcement and the day before the scheduled FOMC meeting. Bomfim finds significant variations of volatility attributable to unexpected announcements of monetary policy. Specifically, Bomfim's statistical tests show a decrease in volatility of -49 percent of typical levels on pre-announcement days, regardless of whether the announcement was expected or not. Conversely, the tests show that by isolating surprise announcements on announcement day “(it) has the effect of nearly doubling the news effect” (Bomfim [2001]). When not distinguishing between expected and unexpected announcements, the authors find an increase in volatility of 42 percent of typical levels on announcement days. When Bomfim uses

a model to isolate surprise announcements he finds that volatility increases 79 percent of typical levels.

Much of the work that separates expected and surprise announcements contend that the market has already built expected information into prices. Therefore, only new information that surprises the market will have an announcement effect. If the information was expected, under efficient markets, there would be no "announcement effect", because no news would be presented.

We will not attempt to distinguish between technical and non-technical announcements in our research. Although we see the merit in doing so, much work has already covered this issue with similar results. We also see the inherent problem in making this distinction. The abstract nature of exactly how much of the announcement was expected, and how much was not, is difficult to precisely determine. We feel that looking at the announcements without exception will render more reliable results. Furthermore, even if the market correctly predicts a move by the Fed, uncertainty would still exist in the magnitude of the adjustment. If the market could predict the Feds actions with certainty, there would never be an unexpected announcement. Therefore, even with the best estimates, there would still be an element of uncertainty in markets predictions. The conformation of these predictions would reveal new market information.

Other research focuses on the relevant policy tool in relation to market reactions. Madura and Schnusenberg (1998) take into account the "operation regime" when examining the effect monetary policy has on interest rates. This study breaks down different time periods when the Federal Reserve is targeting either reserve levels or interest rates. Depending on the method incorporated by the Fed, either the federal funds target rate or the discount rate would be relevant in interpreting the monetary stance on announcement day. In another study done by Madura and Schnusenberg (2000), the effect of directional changes in the relevant monetary policy tool on banks equities is investigated. They find that there is a significant reaction when the Fed signals the market about the economic outlook through the relevant policy tools.

Mann and Atra (2001) continue the idea of a relevant monetary policy tool. Like previous work, they divide periods of time by what the Fed's target is. As noted in Madura and Schnusenberg (1998), if the Fed is targeting levels of reserves, then the discount rate is the relevant policy tool. If the Fed is targeting the level of interest rates, then the Fed funds target rate is the relevant monetary policy tool.

The studies that emphasis operating regimes use the relevant policy tool when measuring the announcement effect. Distinguishing between these periods allows one to view the market's reaction in light of the relative announcement. If one were to measure the announcement effect using the discount rate only, they would observe little market reaction during periods of the Fed targeting interest rates. Moreover, the market, being aware of the Fed's target, knows which tools imply a shift or continuation of monetary policy. This suggests that the relevant indicator should be used when observing the announcement effect. Mann and Atra (2001), for example, find that the operating procedure and/or target vehicle

used by the Federal Reserve influences the efficacy of the policy indicator. There have been studies that minimize the importance of separating operation regimes. Chen and Mohan (1998) find that there is still a negative effect of equity returns regardless of the operation regime. Chen and Mohan conclude that unexpected discount rate changes have a significantly negative effect on equity returns irrespective of Federal Reserve operating procedures.

For our study, we will consider the relevant indicator in approaching the announcement effect. The policy of the Fed over our sample period from 1999 to 2005 is to target interest rates. Consequently, we will focus on the federal funds target rate. The time span that we examine is relatively short. There have been many studies that have looked at the announcement effect over many years. We feel our work will contribute to existing studies by focusing only on a recent time period. While this will limit are samples, we feel the relevance of the information will be enhanced. Our paper looks at the announcement effect over a period of roughly six years (1999-2005). Because of this small sample we will not study events over multiple operation regimes. Given this simplicity, we will only focus on the federal funds rate, which is the appropriate policy tool during our sample period.

Our entire sample period from 1999 to 2005 encompasses the time when the Fed has used a policy of immediate disclosure of FOMC meeting results. In February 1994, the Federal Reserve Open Market Committee (FOMC) changed its operating procedures. Previously, monetary announcements occurred around 45 days after FOMC meeting (Thornton [1996]). Now the announcements are made as soon as the Fed reaches its decision. This change in procedure is relevant to the announcement effect, in that it eliminated the lag time between the FOMC meeting and the announcement.

Studies have been done to see if this change in policy affected the announcement effect. Bomfim (2001) focused on market volatility surrounding the Fed's announcement. The study finds that volatility is low on the days preceding the announcement while it is high on the day of the announcement. This pre-announcement effect was attributed to the change in policy. "In particular, such pre-announcement effects are present only over the past five years or so, a period when the majority of policy decisions have actually been taken at the FOMC's regularly scheduled meetings" (Bomfim [2001]).

Thornton (1996) finds evidence of an announcement effect before the Fed adopted a policy of immediate disclosure. His work shows that the Fed change in policy did not create an announcement effect, nor did it increase the magnitude of the effect. However, Thornton (1996) does show a change in the timing of the effect. Particularly, the author finds that the announcement effect occurs immediately under a policy of immediate disclosure. Before the change in Fed policy, Thornton (1996) shows that the announcement effect did exist, but was concentrated over several days. The inverse effect on equities is also illustrated by Demiralp and Jorda (2004), who find that Treasury security rates react much more in unison during announcement days after the 1994 policy change. This more direct adjustment of market interest rates should result in more concentrated equity adjustments on announcement dates.

The time span of our study will be under the policy of immediate disclosure of announcements. We feel this to be an advantage because it captures the announcement effect more effectively. We will not examine the effect this change in policy had on the announcement effect, because it is not relevant to our study. This paper will only concern itself with the current policy at hand. However, we do feel that this shift in policy is worth mentioning because of its implications on the announcement effect.

Two studies that are most closely related to the current paper are Madura and Schnusenberg (2000) and Harun, Hassan, and Zaher (2005). Both of these studies examine the performance of equities as a result of changed in Fed monetary policy tools. Madura and Schnusenberg (2000) find a negative relationship between a directional move in the Feds relevant policy tool, which is either the discount rate or the federal funds rate, and bank equity returns.

Harun, Hassan, and Zaher (2005) investigate whether the observed stock price reactions of commercial banks to monetary policy actions are dependent on the stance of monetary policy and the state of the economy. The authors find that the effect of bank equities, particularly the effect on bank holding companies, is more pronounced during periods of favorable business conditions. The present study contributes to these papers by investigate additional economic sectors.

Data and Methodology

We investigate the stock market reaction of the overall market and nine economic sectors to announcements of federal funds target rate changes by the Federal Reserve during the January 1, 1999 to May 11, 2005 period. Data for Federal Open Market Committee (FOMC) meetings and federal funds target rate changes were obtained from the Federal Reserve.

Over the sample period, the Federal Open Market Committee met 54 times. During the 54 meetings, the federal funds target rate was changes 27 times. Specifically, the FOMC increased the federal funds target rate fourteen times and decreased the federal funds target rate thirteen times. Table 1 provides a distribution of the federal funds target rate changes.

Year	Increase	Decrease	Unchanged	Total
1999	3	0	5	8
2000	3	0	5	8
2001	0	11	0	11
2002	0	1	7	8
2003	0	1	7	8
2004	5	0	3	8
2005	3	0	0	3
Total	14	13	27	54

Table 1. Distribution of Federal Funds Target Rate Changes Over the Period January 1, 1999 to May 11, 2005.

As shown in Table 1, the year with the most changes in the federal funds target rate is 2001, when the Fed decreased the target rate eleven times. The most increases occurred in 2004,

when the Fed increased the federal funds target rate five times.

To investigate the effect of the overall market and the nine economic sectors mentioned previously, we utilize exchange-traded funds in the form of Select Sector SPDRs. All of these SPDRs have stock price information available over the entire sample period.

Table 2 presents the daily and annualized returns and standard deviations for the SPDR and for Select Sector SPDRs. The first number in each column for the return and standard deviation represents the average daily percentage over the sample period. The second number for the return and standard deviation represents the annualized percentage over the sample period.

	SPY	XLY	XLP	XLE	XLF	XLV	XLI	XLB	XLK	XLU
Average										
Daily	0.010%	0.026%	0.002%	0.053%	0.035%	0.023%	0.026%	0.035%	-0.008%	0.021%
Annualized	3.723%	10.072%	0.631%	21.309%	13.558%	8.851%	9.904%	13.503%	-2.701%	7.842%
Std. Dev.										
Daily	1.256%	1.552%	1.148%	1.509%	1.818%	1.333%	1.365%	1.547%	2.195%	1.323%
Annualized	24.001%	29.647%	21.937%	28.835%	34.728%	25.457%	26.079%	29.567%	41.943%	25.269%

Table 2. Daily and Annualized Returns and Standard Deviations for Nine Economic Sectors over the Sample Period from January 1, 1999 to May 11, 2005.

Notes to Table 2:

SPY = SPDR
XLY = Select Sector SPDR – Consumer Discretionary
XLP = Select Sector SPDR – Consumer Staples
XLE = Select Sector SPDR – Energy
XLF = Select Sector SPDR – Financial
XLV = Select Sector SPDR – Health Care
XLI = Select Sector SPDR – Industrial
XLB = Select Sector SPDR – Materials
XLK = Select Sector SPDR – Technology
XLU = Select Sector SPDR - Utilities

As can be seen from Table 2, the Select Sector SPDR – Energy (XLE) has the highest annualized return over the sample period of 21.31%. The Select Sector SPDR – Technology (XLK) has the lowest annualized return (and the only negative return) over the sample period of -2.70%. Given the nature of the recession during the sample period, this observation is not surprising. The sectors with the highest annualized standard deviations are the Financial Sector and the Technology Sector with annualized standard deviations of 34.73% and 41.94%, respectively.

Table 3 shows the correlation matrix across the exchange-traded funds utilized in the sample. The correlation coefficients between the Select Sector SPDRs and the S&P 500 SPDR (SPY) range from 0.418 (for the Energy SPDR) to 0.825 (for the Technology SPDR). In general, the correlation coefficients between the Select Sector SPDRs are low, ranging from 0.213 (between the

Consumer Staples SPDR and the Technology SPDR) to 0.730 (between the Consumer Discretionary SPDR and the Industrial SPDR). The low correlation coefficients indicate that the separate economic sectors may be affected differently by changes in the federal funds target rate.

	SPY	XLY	XLP	XLE	XLF	XLV	XLI	XLB	XLK	XLU
SPY	1.000	0.757	0.521	0.418	0.725	0.729	0.817	0.570	0.825	0.498
XLY		1.000	0.460	0.315	0.645	0.636	0.730	0.585	0.575	0.372
XLP			1.000	0.315	0.465	0.396	0.461	0.399	0.213	0.381
XLE				1.000	0.328	0.318	0.420	0.432	0.220	0.385
XLF					1.000	0.581	0.660	0.526	0.503	0.429
XLV						1.000	0.666	0.471	0.599	0.378
XLI							1.000	0.684	0.654	0.438
XLB								1.000	0.376	0.364
XLK									1.000	0.301
XLU										1.000

Table 3. Correlation Matrix Between Returns on the SPDR ETF and Nine Select Sector SPDRs Over the Sample Period from January 1, 1999 to May 11, 2005.

Notes to Table 3:

SPY	=	SPDR
XLY	=	Select Sector SPDR – Consumer Discretionary
XLP	=	Select Sector SPDR – Consumer Staples
XLE	=	Select Sector SPDR – Energy
XLF	=	Select Sector SPDR – Financial
XLV	=	Select Sector SPDR – Health Care
XLI	=	Select Sector SPDR – Industrial
XLB	=	Select Sector SPDR – Materials
XLK	=	Select Sector SPDR – Technology
XLU	=	Select Sector SPDR - Utilities

To isolate the effect of announcements of changes in the federal funds target rate, we utilize a methodology similar to Thorbecke (1997) and Madura and Schnusenberg (2000). Specifically, we utilize the following model to investigate the effect of federal funds target rate changes on each of the nine sectors:

$$R_{SECTORt} = \alpha_0 + \alpha_1 R_{mt} + \alpha_2 \Delta FFT_t + \varepsilon_t , \qquad (1)$$

where

$R_{SECTORt}$	=	the Select Sector SPDR return for the sector under investigation on day *t*;
R_{mt}	=	the return on the SPDR ETF on day *t*; and
ΔFFT_t	=	the amount by which the Fed changed the target federal funds rate on day *t*, orthogonalized with respect to the SPDR ETF.

In equation (1), the federal funds rate variable is equal to zero on any day in which it was not changed by the Fed. However, because a change in the target rate can affect the entire market, a sector's returns could be affected indirectly through its effect on the market. Consequently, we orthogonalize the model to capture the sensitivity of sector equity returns to the change in the federal funds rate target beyond the indirect sensitivity that could occur through the market. To accomplish this, we regess the federal funds target rate change on the return on the SPDR ETF returns and use the resulting residual as the federal funds target rate variable in equation (1).

Also notice in equation (1) that we utilize the SPDR exchange-traded fund as a proxy for the market. Since we utilize Select Sector SPDRs to measure the impact of federal funds target rate changes on economic sectors, using the SPDR as a proxy for the market ensures consistency. Moreover, by using exchange-traded funds throughout our analysis, we utilize tradable proxies for the market. Equation (1) is estimated nine times, once for each of the nine economic sectors.

To investigate whether there is a differential impact on sector equity returns depending on whether the federal funds target rate was increased or decreased, we utilize the following additional models:

$$R_{SECTORt} = \beta_0 + \beta_1 R_{mt} + \beta_2 \Delta PFFT_t + \varepsilon_t \qquad (2)$$

$$R_{SECTORt} = \theta_0 + \theta_1 R_{mt} + \theta_2 \Delta NFFT_t + \varepsilon_t , \qquad (3)$$

where

$\Delta PFFT_t$ = the amount by which the Fed increased the federal funds target rate on day *t*; and

$\Delta NFFT_t$ = the amount by which the Fed decreased the federal funds target rate on day *t*.

Equations (2) and (3) are each estimated nine times, once for each economic sector.

Results

Table 4 displays the regression results from estimating equation (1). The expected coefficient α_1 is positive, as all sectors we investigate are positively correlated with the market. The expected coefficient α_2 is negative; an increase (decrease) in the federal funds target rate is expected to have an unfavorable (a favorable) impact on a given sector's equity returns.

As expected, the coefficient α_1 for the market return (R_{mt}) is highly positive and significant for every sector. This indicates that the market returns and sector returns are highly correlated. This positive relationship is most pronounced for the Industrial Sector (XLI) and the Technology Sector (XLK), with coefficients of 0.89 and 1.44, respectively, indicating that, on average, a one percent increase (decrease) in the S&P 500 SPDR (SPY) leads to an increase (decrease) of 0.89%

and 1.44% in the industrial and technology sectors, respectively. This positive relationship is also confirmed by the very high adjusted R^2 figures of 66.76% and 68.02% for the two sectors, respectively.

As might be expected, the two sectors that are least correlated with the market are the Energy and Utility sectors, with α_1 coefficients of 0.50 and 0.53 and adjusted R^2 values of 17.44% and 24.79%, respectively.

	Intercept	R_{mt}	ΔFFT	Adj. R^2	F-value
XLY	0.000 (0.67)	0.935 (46.34)***	-1.169 (-2.18)**	57.38%	1,076.12***
XLP	-0.000 (-0.12)	0.476 (24.44)***	1.73 (3.34)***	27.53%	304.31***
XLE	0.000 (1.40)	0.503 (18.40)***	0.584 (0.80)	17.44%	169.68***
XLF	0.000 (0.78)	1.049 (42.06)***	-0.15 (-0.23)	52.53%	884.76***
XLV	0.000 (0.68)	0.774 (42.58)***	-0.399 (-0.83)	53.16%	907.06***
XLI	0.000 (0.86)	0.888 (56.64)***	0.274 (0.66)	66.76%	1,604.61***
XLB	0.000 (0.87)	0.702 (27.71)***	-0.646 (-0.96)	32.44%	384.37***
XLK	-0.000 (-0.71)	1.441 (58.27)***	-1.187 (-1.80)*	68.02%	1,699.34***
XLU	0.000 (0.54)	0.525 (22.97)***	0.624 (1.03)	24.79%	264.24***

Table 4. Sensitivity of Sector Returns to Federal Funds Rate Target Changes Over the Sample Period from January 1, 1999 to May 11, 2005. (*t*-statistic in parentheses).

Notes to Table 4:

* Significant at the 10% level
** Significant at the 5% level
*** Significant at the 1% level

SPY = SPDR
XLY = Select Sector SPDR – Consumer Discretionary
XLP = Select Sector SPDR – Consumer Staples
XLE = Select Sector SPDR – Energy
XLF = Select Sector SPDR – Financial
XLV = Select Sector SPDR – Health Care
XLI = Select Sector SPDR – Industrial
XLB = Select Sector SPDR – Materials
XLK = Select Sector SPDR – Technology
XLU = Select Sector SPDR - Utilities

Table 4 also shows the results from estimating the coefficient α_2, which indicates the sensitivity of sector returns to changes in the federal funds target rate. The coefficient has the expected negative sign and is significant for only two of the nine sectors; the Consumer Discretionary Sector has a coefficient of -1.17, and the Technology Sector has a coefficient of -1.19. This indicates that,

on average, the sector returns decrease (increase) by 1.17% and 1.19% for a one percent increase (decrease) in the federal funds target rate for the Consumer Discretionary and Technology Sector, respectively.

A surprising result in Table 4 is the positive sign and high significance of the α_2 coefficient for the Consumer Staples Sector. On average, a one percent increase (decrease) in the federal funds target rate leads to a 1.73% *increase* (*decrease*) in the Consumer Staples Sector. While it may be argued that Consumer Staples, such as food and clothing, are insensitive to changes in interest rates, this result is somewhat surprising. It could be, however, that consumers increase their purchases of staple products when the Fed decides to increase interest rates in order to avoid higher finance charges if consumers are indebted. Likewise, consumer staples firms may be less affected by increases in interest rates if they have long-term borrowing arrangements with their banks or have issued long-term bonds.

The implication that the return to the Consumer Staples Sector decreases when the Fed decreases the federal funds target rate can be explained similarly. If consumer staples firms are locked into long-term borrowing arrangements, then they are unable to benefit from decreasing interest rates as market interest rates decline. From a consumer perspective, it could be argued that consumers delay their purchases of certain consumer staples products when the Fed lowers interest rates to wait until that change manifests itself in other interest rates, such as credit cards.

To further investigate whether the sensitivity of sector returns is due to increases or decreases in the federal funds target rate, equations (2) and (3) are estimated separately in Tables 5 and 6. Table 5 investigates the sensitivity of sector returns to federal funds target rate increases, while Table 6 investigates the sensitivity of sector returns to federal funds target rate decreases. The expected coefficients β_2 and θ_2 in equations (2) and (3), respectively, are negative.

	Intercept	R_{mt}	$\Delta PFFT$	Adj. R^2	F-value
XLY	0.000 (0.71)	0.936 (46.25)***	-0.446 (-0.45)	57.26%	1,070.80***
XLP	-0.000 (-0.20)	0.475 (24.30)***	0.808 (0.84)	27.05%	297.11***
XLE	0.000 (1.40)	0.503 (18.39)***	-0.159 (-0.12)	17.41%	169.30***
XLF	0.000 (0.81)	1.050 (42.04)***	-0.480 (-0.39)	52.54%	884.86***
XLV	0.000 (0.61)	0.773 (42.51)***	0.695 (0.78)	53.15%	906.98***
XLI	0.000 (0.81)	0.888 (56.56)***	0.376 (0.49)	66.75%	1,604.33***
XLB	0.000 (0.93)	0.703 (27.71)***	-0.813 (-0.66)	32.42%	384.01***
XLK	-0.000 (-0.77)	1.440 (58.13)***	0.833 (0.69)	67.96%	1,694.99***
XLU	0.000 (0.64)	0.526 (2.30)***	-1.315 (-1.17)	24.81%	264.46***

Table 5. Sensitivity of Sector Returns to Federal Funds Rate Target Increases Over the Sample Period from January 1, 1999 to May 11, 2005. (*t*-statistic in parentheses)

Notes to Table 5:

*	Significant at the 10% level
**	Significant at the 5% level
***	Significant at the 1% level

SPY	=	SPDR
XLY	=	Select Sector SPDR – Consumer Discretionary
XLP	=	Select Sector SPDR – Consumer Staples
XLE	=	Select Sector SPDR – Energy
XLF	=	Select Sector SPDR – Financial
XLV	=	Select Sector SPDR – Health Care
XLI	=	Select Sector SPDR – Industrial
XLB	=	Select Sector SPDR – Materials
XLK	=	Select Sector SPDR – Technology
XLU	=	Select Sector SPDR - Utilities

The coefficient β_1 in Table 5, which tests the relationship between the sector return and the market return, is once again most pronounced for the Industrial and Technology Sectors, with coefficients of 0.89 and 1.44 and adjusted R^2 values of 66.75% and 67.96%, respectively. The relationship is again weakest for the Energy and Utility Sectors, with β_1 coefficients of 0.50 and 0.53 and adjusted R^2 values of 17.41% and 24.81%, respectively.

As shown in Table 5, the β_2 coefficient, which tests the sensitivity of sector returns to increases in the federal funds target rate, is insignificant for all nine sectors. Consequently, an increase in the federal funds target rate, on average, has no significant impact on any one particular sector.

Table 6 presents the result from investigating the sensitivity of sector returns to decreases in the federal funds target rate. As in Tables 4 and 5, the Industrial and Technology sectors are most sensitive to market movements as measured by the S&P 500 SPDR; the Energy and Utility sectors are least sensitive to market movements.

	Intercept	R_{mt}	$\Delta NFFT$	Adj. R^2	F-value
XLY	0.000 (0.46)	0.934 (46.29)***	-1.490 (-2.32)**	57.40%	1,076.85***
XLP	0.000 (0.18)	0.478 (24.51)***	2.147 (3.46)***	27.56%	304.83***
XLE	0.000 (1.48)	0.503 (18.42)***	0.906 (1.04)	17.46%	169.95***
XLF	0.000 (0.77)	1.049 (42.05)***	-0.024 (-0.03)	52.53%	884.70***
XLV	0.000 (0.55)	0.773 (42.56)***	-0.868 (-1.50)	53.20%	908.73***
XLI	0.000 (0.90)	0.888 (56.64)***	0.234 (0.47)	66.75%	1,604.29***
XLB	0.000 (0.80)	0.702 (27.69)***	-0.582 (-0.72)	32.42%	384.08***
XLK	-0.000 (-0.93)	1.440 (58.27)***	-2.057 (-2.61)***	68.09%	1,704.91***
XLU	0.000 (0.71)	0.526 (23.02)***	1.454 (2.00)**	24.93%	266.19***

Table 6. Sensitivity of Sector Returns to Federal Funds Rate Target Decreases Over the Sample Period from January 1, 1999 to May 11, 2005. (*t*-statistic in parentheses)

Notes to Table 6:

*	Significant at the 10% level
**	Significant at the 5% level
***	Significant at the 1% level

SPY	=	SPDR
XLY	=	Select Sector SPDR – Consumer Discretionary
XLP	=	Select Sector SPDR – Consumer Staples
XLE	=	Select Sector SPDR – Energy
XLF	=	Select Sector SPDR – Financial
XLV	=	Select Sector SPDR – Health Care
XLI	=	Select Sector SPDR – Industrial
XLB	=	Select Sector SPDR – Materials
XLK	=	Select Sector SPDR – Technology
XLU	=	Select Sector SPDR - Utilities

As shown in Table 6, the coefficient θ_2, which measures the sensitivity of sector returns to increases in the federal funds target rate, has the expected negative and significant coefficient for the Consumer Discretionary and Technology sectors. This finding indicates that the negative relationship between federal funds target rate changes and these sectors' return is primarily driven by federal funds target rate decreases. For the Consumer Discretionary Sector, this implies that consumers are more willing to borrow when interest rates are lower to make discretionary purchases. Technologically-oriented companies are frequently highly indebted; the finding reported in Table 6 indicates that these companies' valuations increase as their cost of capital is reduced.

Table 6 also shows that the positive and significant relationship between federal funds target rate changes and Consumer Staples Sector returns is primarily driven by federal funds target rate decreases. Two possible explanations for this finding are that consumer staples firms are locked into long-term borrowing arrangements and are consequently unable to benefit from decreasing interest rates as market interest rates decline. Alternatively, it could be argued that consumers delay their purchases of certain consumer staples products when the Fed lowers interest rates to wait until that other interest rates (such as credit card rates) change in response.

Interestingly, the coefficient θ_2 in Table 6 is also positive and significant for the Utility Sector, even though there was no relationship between federal funds target rate changes and this sector's returns in Table 4. On average, Utility Sector returns decrease by 1.45% for every one percent decrease in the federal funds target rate. This result is surprising, since utility stocks are a natural beneficiary of falling interest rates, primarily because of the sector's capital intensity. Since utilities typically have very large fixed capital investment in their businesses, any change in borrowing costs has a much larger impact on their overall cost structure,

and hence profitability, than less capital-intensive stocks. Moreover, the Utility Sector pays very high dividends; historically, high-paying dividend stocks have outperformed lower-paying or no-dividend-paying stocks by a wide margin in falling rate environments.

One possible explanation for the positive relationship between Utility Sector returns and federal funds target rate changes documented in Table 6 is that utilities tend to have a lot of long-term debt on their balance sheets. Since eleven of the thirteen rate decrease occurred in 2001, and since four of those eleven decreases in the target rate occurred after September 11, 2001, utilities may have locked into new long-term debt rates too soon and were unable to take advantage of the lower rats that prevailed at the end of 2001. This is one possible explanation; we leave a full investigation of this issue to future research.

Conclusion

The objective of this paper is to investigate how equities of nine individual economic sectors are affected when monetary policy announcements in the form of federal funds target rate changes are made over the period January 1, 1999 to May 11, 2005. To our knowledge, a sector-analysis of monetary policy changes has not been performed in the existing literature. This sector-analysis is conducted over a recent time period, when the Federal Open Market Committee has adopted a policy of immediate disclosure of its federal funds target rate change, which should concentrate the market reaction closer to the time of the announcement.

When all changes in the federal funds target rate are considered, our results indicate that the Consumer Discretionary and Technology sectors' equity returns are negatively and significantly related to changes in the federal funds target rate. This negative relationship appears to be especially pronounced for decreases in the federal funds target rate, perhaps indicating that consumers spend more on discretionary items in a low interest rate environment, while technology companies' cost of capital is reduced.

An overall positive and significant relationship exists between equity returns in the Consumer Staples Sector and federal funds target rate changes, which is again concentrated in federal funds target rate decreases. This indicates that consumers may wait to purchase staple items until other interest rates in the economy, such as credit card rates, have decreased, or that the balance sheet composition of consumer staple companies may prevent them from taking advantage of the lower interest rates in the economy.

The most surprising finding of the present study is that Utility Sector returns tend to decrease in response to decreases in the federal funds target rate. However, one possible explanation for this finding is that utility firms were unable to take advantage of the lower interest rates that resulted from the Fed's actions after September 11, 2001 and that they had already locked into new long-term debt arrangements.

Overall, our results indicate that the relationship between equity returns and federal funds target rate changes documented in previous studies is more pronounced for some sectors in the economy, a finding we believe could drive the direction for future research that investigates the relationship between monetary policy and equity returns.

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