EFFECTS OF FEDERAL FUNDS TARGET RATE CHANGES ON STOCK PRICES

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ABSTRACT

It is well-known that financial markets respond quickly to the announcements of changes in the Federal Funds target rate. This paper examines the stock price reaction of individual stocks listed under the Dow Jones Industrial Average (DJIA) to Federal Funds target rate change announcements using daily stock returns over the period 1996-2007. We measure such reactions using an event-study methodology to analyze the impact of changes in the Federal Funds target rate on individual stock returns using several event windows. We group the DJIA 30 individual stocks into 8 sectors and analyze the reaction of each sector to changes in the Federal Funds target rate. Results indicate that, on average, the impact of a Federal Funds target rate decrease on stocks is positive while the reaction of a Federal Funds target rate increase is negative.

JEL: G14

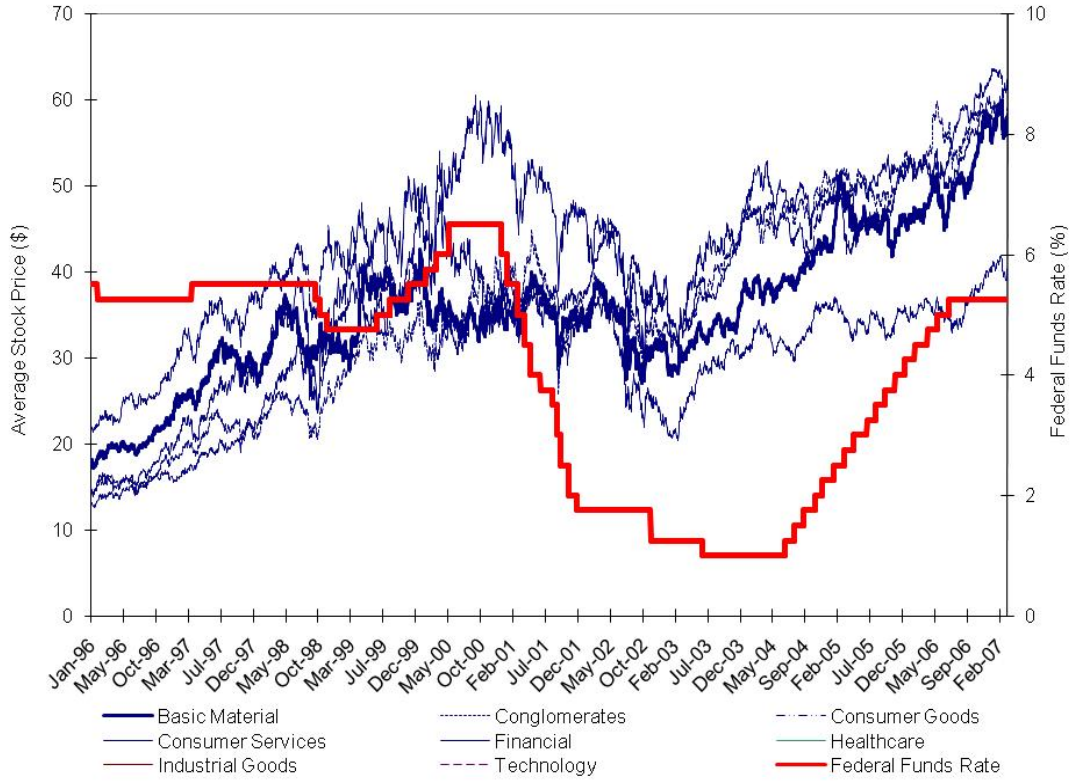
INTRODUCTION

This study investigates the effects of Federal Funds target rate changes on the stock performance of 30 companies listed under the Dow Jones Industrial Average (DJIA) over the years 1996-2007. Using an event-study framework, this study examines how the stock market responds to the expected financial performance of the firm at the announcement of Federal Funds target rate changes.
According to Rigobon and Sack (2002), the relationship between Federal Funds target rate changes and stock prices is an important topic for both monetary policy makers and financial market participants. From the perspective of monetary policymakers, having reliable estimates of the reaction of asset prices to the policy instrument is a critical step in formulating effective policy decisions. Much of the transmission of monetary policy comes through the influence of short-term interest rates on other asset prices, as it is the movements in these other asset prices including longer term interest rates and stock prices that determine private borrowing costs and changes in wealth, which in turn importantly influence real economic activity. From the perspective of financial market participants, monetary policy has a considerable influence on financial markets, as evidenced by the extensive attention that the Federal Reserve receives in the financial press. Thus, having accurate estimates of the responsiveness of asset prices to monetary policy is an important component of making effective investment decisions and formulating appropriate risk management strategies.

The Federal Open Market Committee (FOMC) is the main monetary policymaking arm of the Federal Reserve. This study considers the relationship between monetary policy and daily stock market volatility from both days around regularly scheduled meetings of FOMC and days of actual policy decisions involving the target level of the Federal Funds target rate. Since 1981, there have been eight regularly scheduled meetings of the FOMC per year, generally with six to eight weeks between meetings. Meeting dates for each year are announced to the public during the second half of the previous year. In this study we define the event day as the meeting day of the FOMC, regardless if a rate change is announced or not. Therefore, we examine whether the existence of regularly scheduled policy meetings per se has a measurable effect on stock market volatility.

Figure 1 shows the relationship between the Federal Funds target rate and the stock prices of eight major sectors of the 30 companies listed under the Dow Jones Industrial Average (DJIA) over the years 1996 though 2007. These eight sectors are defined in Appendix Table 1. It is not easy to identify any specific relationship between the Federal Funds target rate and the stock prices from Figure 1, although the correlation coefficient between the two variables is mostly negative and low. The correlation coefficients for the eight sectors are: Basic Material (-0.1085), Conglomerates (-0.3345), Consumer Goods (-0.2054), Consumer Services (0.0065), Financial (-0.1526), Healthcare (-0.2062), Industrial Goods (0.1608), and Technology (-0.0316).

Figure 1: Stock Prices and Federal Funds Target Rate, January 1996-March 2007



As Bernanke (2003) points out, there are two essentially equivalent ways of understanding why expectations of higher short-term real interest rates should lower stock prices. First, to value future dividends, an investor must discount them back to the present value; as higher interest rates make a given future dividend less valuable in today's dollars, higher interest rates reduce the value of a share of stock. Second, higher real interest rates make investments other than stocks, such as bonds, more attractive, raising the required return on stocks and reducing what investors are willing to pay for them. Under either interpretation, expectations of higher real interest rates are bad news for stocks.

The remainder of the paper is organized as follows: Section 2 briefly discusses the Federal Funds Target Rate. Section 3 provides a review of the existing literature on this topic. Section 4 gives a brief description of the event-study methodology. Section 5 outlines the data used and data sources. Section 6 discusses our analysis and findings while Section 7 offers some conclusions.

LITERATURE REVIEW

The Federal Reserve System is a federal agency established in 1913 to give the government some control over banking, which at that time was mostly unregulated. The Fed is a system of twelve district banks and twenty-five regional branches located across the United States. By law, the Fed is supposed to "promote effectively the goals of maximum employment, stable prices and moderate long-term interest rates" and this is accomplished through its influence over monetary policy. The most important tool for this objective is setting the Federal Funds target rate, which is the interest rate at which depository institutions lend balances at the Federal Reserve to other depository institutions overnight. As such, it is a market interest rate. The fed does not directly set the actual interest rate but rather establishes a target rate and performs open market operations to achieve the target.

Open market operations are the purchases and sales of U.S. Treasury and federal agency securities, and the short-term objectives are specified by the Federal Open Market Committee (FOMC). The Federal Reserve's objective for open market operations has varied over the years. During the 1980's, the focus gradually shifted toward attaining a specified level of Federal Funds target rate, but in 1995 the FOMC began to explicitly state its target level for the Federal Funds target rate. Since February 2000, the statement issued by the FOMC shortly after each of its meetings has included the Committee's assessment of the risks to the attainment of its long-run goals of price stability and sustainable economic growth. This transparency of objectives fuels speculation about future actions by the FOMC. If the FOMC is concerned about inflation and chooses to cool down the economy, it does so by increasing the fed funds target rate. This eventually makes borrowing by consumers and businesses more expensive, and thus, slows down economic activity. To stimulate a sluggish economy or thwart a recession, the Fed can add new money to the economy by reducing the Federal Funds target rate, thus, generating more money for banks to lend to businesses and consumers.

The Federal Funds target rate fluctuates hourly and is one of the country's most volatile rates. Changes in the Federal Funds target rate have a significant impact on other interest rates in the financial system and, consequently, on securities prices. Because coupon rates on newly issued bonds tend to reflect prevailing interest rates, previously purchased bonds generally are resold at a discount or premium, their prices moving inversely with the direction of interest rates. The stock market, in competition with the bond market for investor dollars, is also affected by interest rate changes. Again, this being an inverse relationship, when investors sell stocks to move into bonds, stock prices, in general, tend to fall. Also, an increase in interest rates makes it more expensive for businesses to borrow money. That, in turn, hurts corporate profits. As a result, in theory, stock prices tend to decrease when investors anticipate that corporate profits will fall. Conversely, as interest rates fall, stocks become relatively more attractive.

As Rigobon and Sack (2002) point out, there are two considerations that complicate the identification of the responsiveness of asset prices to monetary policy. First, short-term interest rates are simultaneously influenced by movements in asset prices, resulting in a difficult endogeneity problem. Second, a number of other variables, including news about the economic outlook, likely have an impact on both short-term interest rates and asset prices. Despite these difficulties, this study attempts to identify the reaction of stock prices to changes in monetary policy.

The general economics and finance literature links issues of security, returns, and predictability to changing business conditions without disputing the notion that events surprises are associated with short run changes in equity prices i.e., Carter and Simkins (2004), Boyd, Yoganathan and Hu (2001), D'Amico and Farka (2003). Scholars agree that in the short run, stock prices are inversely associated with monetary policy decisions, mirroring basic economic theory. As a result, there is much support for the premise that markets already incorporate on their own changes that can be anticipated, including anticipated changes

in monetary policy through Federal Funds target rate adjustments. Nevertheless, some issues are not completely explored, including the effect's severity as it relates to the magnitude of the unanticipated surprise, and whether or not monetary policy is the antecedent driver affecting stock prices or visa versa—a complex relationship due to the endogenous nature of monetary policy and free market interactions.

Relatively few papers to date have attempted to measure the equity market's reaction to monetary policy. Among recent papers exploring asset price responses to monetary policy actions--as proxied by changes in the target Federal Funds rate-- are Bernanke and Kuttner (2005), Bernanke (2003), Bomfim (2003), Bomfim and Reinhart (2000), Kuttner (2000), Roley and Sellon (1998), Thornton (1998), and Reinhart and Simin (1997). Chen et al. (1999) also examined monetary policy effects on stock market volatility, by studying the effect of discount rate decisions on stock market volatility. Previously, Castanias (1979) had also examined the relationship between discount rate decisions and the volatility of stock returns.

Bomfim (2003) looking at how the actual interest rate decisions of policy makers affect stock market volatility found that the element of surprise in such decisions, in the short run, tends to boost stock market volatility significantly--with positive surprises, i.e., higher-than-expected values of the target Federal Funds rate tend to have a larger effect on volatility than negative surprises.

Bernanke (2003) and Bernanke and Kuttner (2005) analyzed the impact of changes in monetary policy on equity prices with the objective of measuring the average reaction of the stock market. They found that the effects of unanticipated monetary policy actions on expected excess returns account for the largest part of the response of stock prices. They also found some evidence of a stronger stock price response to changes in rates that are expected to be more permanent or that represent a reversal in the direction of rate changes.

In a study by Patelis (1997), analysis of the stock market reactions to monetary policy made two conclusions. First, that monetary conditions enhance the ability to explain time series variation in stock and bond returns and, second, that the significant information for security returns contained in refined monetary policy indicators is evident only when it is conditioned on a broad indicator of the Fed's overall policy stance.

Thorbecke (1997) investigated how industry stock return data respond to monetary policy shocks. Thorbecke measured monetary policy by innovations in the Federal Funds target rate and by an event study on Federal Reserve policy change. In every case, he found indications that expansionary policy increases ex-post stock returns.

Craine and Martin (2004) studied daily monetary policy data to estimate the response of security prices--bond yields and equity returns–to exogenous monetary policy surprises. Their empirical results showed a classical textbook response of the yield curve to a monetary surprise in that short maturity yields rise and long maturity yields are unaffected. They also find that the equity market, which they claim is ignored in most studies and textbooks, is quantitatively the most important channel for short run monetary policy. They conclude that the wealth effect from a monetary surprise in the equity market dwarfs the wealth effect in the debt markets.

Rigobon and Sack (2002) show that the response of asset prices to changes in monetary policy can be identified based on the increase in the variance of policy shocks that occurs on days of FOMC meetings and of the Chairman's semi-annual monetary policy testimony to Congress. The results indicate that an increase in short-term interest rates results in a decline in stock prices and in an upward shift in the yield curve that becomes smaller at longer maturities.

Gurkaynak, Sack and Swanson (2004) investigate the effects of U.S. monetary policy on asset prices using a high frequency event-study analysis and find that these effects are not adequately captured by changes in the federal funds rate target alone. They recommend using two factors, namely, a "current federal funds rate target" factor and a "future path of policy" factor, with the latter closely associated with FOMC statements. They measure the effects of these two factors on bond yields and stock prices using a new intraday dataset going back to 1990. According to their estimates, both monetary policy actions and statements have important but differing effects on asset prices, with statements having a much greater impact on longer-term Treasury yields.

Studies by Jensen and Mercer (2002, 1996) demonstrate that proxies for monetary stringency increase the explained variation in stock returns. They find that three variables, beta, size, and book-to-market equity, contribute significantly to explaining cross-sectional returns in a three-factor model that includes the monetary sector.

In a study of interest rate changes on stock prices, Lobo (2000) finds that the target change announcements convey new information to the stock market. Risk aversion increases before the announcement of a rate change, and especially before the announcement of a joint target and discount rate change. The study also finds that the volatility estimates suggest that such joint rate changes send a clearer signal to the stock market about monetary policy objectives relative to unilateral target changes. The study's findings are consistent with overreaction in the wake of bad news (rate hikes), and point to a shift in volatility from before to after the rate change announcement since the adoption of the immediate disclosure policy of the Federal Open Market Committee in February 1994.

Kuttner (2001), for example, uses daily data to measure changes in Treasury yields as he explores the surprise component of FOMC monetary policy announcements. Cochrane and Piazzesi (2002) perform variations on this analysis.

Finally, Guo (2002) confirms the notion of significant stock price reaction to unanticipated changes in the Federal Funds target rate but not to anticipated ones. His study demonstrates that, consistent with the prediction of imperfect capital market theories, the estimated impact of monetary shocks is significantly larger for small stocks than for big stocks in the 1970's when business conditions were bad, but there is no size effect present in the 1990's when business conditions were typically good. The general findings of the body of literature exploring similar relationships on international markets is also consistent with the above referenced studies i.e., Stevenson (2002).

This study while using a methodology used by few authors such as Carter and Simkins (2004), Boyd, Yoganathan and Hu (2001), and D'Amico and Farka (2003), attempts to evaluate the effects of changes in Federal Funds Target Rate on stock returns of individual companies. In terms of the coverage of industries as well as the lengthy and more recent time period, this study may shed some lights on this important yet unsolved question associated with short run changes in equity prices.

METHODOLOGY

We use an event-study analysis to assess the short-term effects of 94 Federal Funds Target rate change announcements or non-announcements on the stock market returns of all 30 companies listed under the DJIA. Taking inspiration from the initial experimentation by Fama et al. (1969), this methodology is based on the idea that the stock market reacts immediately to announcements that are supposed to affect the future performance of the company.

In order to setup the event-study methodology, we have to specify the design of the study. To this end, we have to define what constitutes an event. Furthermore, we must clarify which period of time surrounding an event is of particular interest for our purposes (that is, we have to define the event window). Finally, we must spell out how we measure the impact of the changes in Federal Funds target rate. The event-study methodology, therefore, involves the following steps:

(1) identification of the events of interest and definition of the event window;
(2) selection of the sample set of firms to include in the analysis;
(3) prediction of a "normal" return during the event window in the absence of the event;
(4) estimation of the abnormal return within the event window, where the abnormal return is defined as the difference between the actual and predicted returns; and
(5) testing whether the abnormal return is statistically different from zero.

Several methods may be used to estimate abnormal returns: among them, the single-index model (constant mean return model), the market model and the capital asset price model ($CAPM$) are the most widely used.

To calculate the effect of an event, it is necessary to estimate what the return of the stock would have been, had the event not occurred. To do this, and to control for overall market effects, the return of the stock is regressed against the return of a market index. The estimated coefficients from that regression are used to calculate the predicted value of the stock over the time window in which the stock price is adjusted. The market model assumes a linear relationship between the return of any security to the return of the market portfolio:

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + e_{i,t} \qquad \text{with } E(e_{it}) = 0 \text{ and } Var(e_{i,t}) = \sigma_i^2 \tag{1}$$

where t is the time index, i = 1, 2, ,..., N stands for stock, $R_{i,t}$ and $R_{m,t}$ are the returns on stock i and the market portfolio respectively during period t, and $e_{i,t}$ is the error term for stock i. We used the Standard and Poor's 500 as the index of the market. The S&P 500 is a capitalization-weighted index based on a broad cross-section of the market and is commonly employed in prior event studies (Campbell, et al., 1997). The coefficients α_i and β_i are firm-dependent coefficients to be estimated. The return of the stock, rather than the price of the stock, is used to control for autocorrelation.

Equation (1), the market model, is generally estimated over a period which runs between 120 and 210 days prior to the event up to 10 days prior to the event. The event window in this study is defined as the period from 3 days prior to the event to 3 days after the event. That is, the event window is $t = [-3, 3]$. In this study, we estimate the market model for event days $t = -210$ to $t = -10$ relative to the event day, $t = 0$. We have defined the event day as the Federal Open Market Committee ($FOMC$) meeting day. Although the Federal Funds target rate has not been changed at every $FOMC$ meeting, stock prices tend to react in anticipation of rate change. During the period between January 2, 1996 and March 26, 2007, there were 94 $FOMC$ meetings. Of these 94 events, Federal Funds target rate was reduced 17 times, increased 24 times, and no rate change took place in 53 times. To avoid overlapping of data, we excluded a two-week period surrounding the event days. Therefore, the time period that we selected to estimate the market model did not include any effect of Federal Funds target rate changes. To estimate the expected return we used the data from $t = [-210, -10]$, 201 days of data. We used the coefficient estimates from this regression to predict the expected return over the $t = [-3, 3]$ time frame.

With the estimates of α_i and β_i from equation (1), one can predict a "normal" return during the days covered by the event window. The prediction error (the difference between the actual return and the predicted normal return), commonly referred to as the abnormal return (AR), is then calculated as:

$$AR_{i,t} = R_{i,t} - \hat{\alpha}_i - \hat{\beta}_i R_{m,t} \tag{2}$$

The null hypothesis often set forth in an event study is that an event did not significantly impact the firm. This hypothesis can be tested using abnormal returns over a period of time. The abnormal returns are simply the prediction errors of the model over the event window. Notice here, that AR are abnormal returns, that is, they are returns over and above that predicted by the general trend of the market on a given day. The assumptions of the methodology are that the abnormal returns are the result of the Federal Funds target rate change, and not some other random event occurring on the same day.

Specifically, cumulative abnormal returns (CAR) summed throughout the event period, can be tested to determine if they are statistically different from zero (Campbell, et al. 1997). Through the use of CAR it is possible to track abnormal returns occurring over a number of trading days. Since outcomes of many events are not immediately known, the CAR allows for consideration of abnormal returns over a predefined period of time. By considering abnormal returns that coincide with an event it is possible to establish the impact on CARs over several days and to capture the impact of an event as it unfolds over time.

Under the null hypothesis, the abnormal returns will be jointly normally determined with a zero conditional mean and conditional variance, $\text{var}(AR_{i,\tau})$:

$$\text{var}(AR_{i,\tau}) = \sigma_i^2 \left[1 + \frac{1}{T} + \frac{(R_{m,\tau} - \overline{R}_m)^2}{\sum_{t=1}^{T} \left(R_{m,t} - \overline{R}_m\right)^2} \right] \tag{3}$$

where T is the estimation period length (i.e. number of days used for estimation), $\overline{R}_m$ is the mean of the market portfolio, and σ_i^2 is the variance of the error from the estimated market model. The τ indicates observations within the event window, while the t indicates observations in the estimation interval. On the day of the event $\tau = 0$ and τ runs across the event window, which is -3 to 3 in this case. Notice then, that the standard error on any given day τ of the prediction interval is a function of how far the market return on that day is from the mean market return during the estimation interval.

For each individual event, one can estimate the abnormal return and relevant test statistics at each instant in time within the event window. However, in order to draw overall inference on the abnormal return observations for the event(s) of interest, one can also aggregate the abnormal returns. For any given subset of N events, the sampled aggregated abnormal returns (AAR_t) at each instant t within the event window is computed as

$$AAR_t = \frac{1}{N} \sum_{i=1}^{N} AR_{i,t} \tag{4}$$

For large T , the variance of AAR_t can be computed as

$$Var(AAR_t) = \frac{1}{N^2}\sum_{i=1}^{N} \text{var}(AR_{i,t}) \tag{5}$$

To test for the significance of AAR_t a Z (or t) test can be derived. In order to test for the persistence of the impact of the event during a period $(\tau_2 - \tau_1)$, the abnormal return can be added to obtain the cumulated abnormal returns $CAR_{i,(\tau_2-\tau_1)}$ for stock i over the period $(\tau_2 - \tau_1)$:

$$CAR_{i,(\tau_2-\tau_1)} = \sum_{t=\tau_1}^{\tau_2} AR_{i,t} \tag{6}$$

where $\tau_a \le \tau_1 < t < \tau_2 \le \tau_b \in$ event window, and τ_a and τ_b are the lower and upper limits of the event window, respectively. The variance of the cumulative abnormal return for stock i over the period $(\tau_2 - \tau_1)$ is

$$\text{var}\left[CAR_{i,(\tau_2-\tau_1)}\right] = \sum_{t=\tau_1}^{\tau_2} \text{var}(AR_{i,t}) \tag{7}$$

From these equations we can calculate the average CAR across all event days, and the variance of CAR. The resulting equations are:

$$\overline{CAR}_\tau = \frac{1}{N}\sum_{i=1}^{N} CAR_{i,\tau} \tag{8}$$

and

$$\text{var}\left[\overline{CAR}_\tau\right] = \frac{1}{N^2}\sum_{i=1}^{N} \text{var}\left[CAR_{i,\tau}\right] \tag{9}$$

To test the null hypothesis of zero cumulative abnormal return on any given day, one can formulate a Student's t test, where under the hypothesis of zero returns, is of the form:

$$t = \frac{\overline{CAR}_\tau}{\sqrt{\text{var}[\overline{CAR}_\tau]}} \sim t_{(N-1)} \tag{10}$$

Data

The data sets to be analyzed are the daily stock prices of all 30 companies listed in the Dow Jones Industrial Average (DJIA) and the data on Federal Funds target rates. The data cover a period of eleven years from January 2, 1996 to March 26, 2007 downloaded from http://finance.yahoo.com. These 30 companies encompass large capitalized stocks and are representative of all stocks traded on the American stock exchanges. These 30 companies were grouped into 8 sectors, taking the weighted averages using shares of each company as the weight, as shown in Appendix Table 1. The data on Federal Funds target rates are from the Federal Reserve Bank.

We define the event as a Federal Open Market Committee (FOMC) meeting day. We collected the data from the minutes of the FOMC meetings in the period between January 2, 1996, and March 26, 2007. During this period, there were 94 FOMC meetings. Of these 94 events, Federal Funds target rate was

reduced 17 times, increased 24 times, and no rate change took place in 53 times. Table 1 summarizes the mean, standard deviation, minimum, and maximum of the daily trading volumes of stocks, and the prices of stocks in the sample for each of the eight sectors.

Table 1: Average Daily Trading Volumes and Average Prices of Stocks in Sample

Sector		Mean	Standard Deviation	Minimum	Maximum
Basic Material	Volume	19,325,799	8,387,428	3,138,600	85,341,300
	Price	$35.63	$8.57	$17.17	$59.92
Conglomerates	Volume	26,515,194	11,370,962	5,517,800	118,337,800
	Price	$40.55	$13.94	$15.61	$67.77
Consumer Goods	Volume	24,639,386	11,154,576	2,771,800	164,201,300
	Price	$40.20	$8.83	$21.32	$63.61
Consumer Services	Volume	29,430,051	12,088,351	4,396,000	147,969,300
	Price	$32.15	$8.48	$13.97	$49.19
Finacial	Volume	31,749,228	13,703,051	5,846,000	186,370,200
	Price	$40.58	$12.18	$13.17	$60.59
Healthcare	Volume	31,182,915	18,695,312	4,780,600	345,932,900
	Price	$40.12	$8.89	$17.14	$54.31
Industrial Goods	Volume	10,993,944	5,276,869	1,516,200	94,222,800
	Price	$38.05	$12.58	$21.46	$74.95
Technology	Volume	163,623,329	52,666,281	29,251,600	729,317,600
	Price	$45.49	$13.38	$16.00	$73.84

Notes: The results are based on daily stock prices and volumes covering the period from January 2, 1996 to March 26, 2007. Source: Yahoo Finance Website (http://finance.yahoo.com/).

ANALYSIS AND FINDINGS

In our analysis, the market's reaction to 94 FOMC meetings with 41 Federal Funds target rate change events between 1996 and 2007 was examined. In order to better investigate markets' reactions, we defined an event window as the period from 3 days prior to the event to 3 days after the event. That is, the event window is $t = [-3, 3]$. In our effort to reduce other factors which may influence the stock price, we chose event windows close to the announcement day. Figures 2, 3 and 4 show the cumulative abnormal returns on the event day ($t = 0$) for a rate decrease, rate increase, and no rate change, respectively.

Table 2 shows the estimated average abnormal returns (AARs) observed for the 94 events in the sample and the test for significance of the effects are also provided. The AARs on each of the days in the 3-day window for each sector are given in the table to identify the sectors that are reacted most to the Federal Funds target rate change. The results in Table 2 indicate that the AARs are mostly positive and significant on the days the Federal Funds target rate was reduced. They are mostly negative and significant on the days the Federal Funds target rate was increased. However, we cannot identify any clear pattern of the market's response as the Federal Funds target rate is changed, because there is also evidence that the market reacted positively or negatively even if the funds target rate remained unchanged. When we focus on the event day ($t = 0$), of the eight sectors, four sectors reacted positively when the Federal Funds target rate was decreased, three sectors reacted positively when there was no change in the funds target rate, while three sectors reacted negatively when the funds target rate was increased.

Based on the results presented in Table 2, we can analyze the reaction of each of the eight sectors to changes in the Federal funds target rate. On the event day ($t = 0$), when the federal funds target rate was reduced, the basic material, conglomerates, consumer goods, and healthcare sectors reacted negatively. The basic material sector has the lowest AAR of -0.108. Likewise, on the same day, if the federal funds target rate remained unchanged, only the consumer goods, financial, and technology sectors reacted

positively and significantly. It is interesting to note that every single sector reacted significantly to no rate change. When the federal funds target rate was increased on the event day, stock prices of the conglomerates, consumer goods, and healthcare sectors reacted negatively while the other five sectors reacted positively.

Table 2: Average Abnormal Returns Related to Federal Funds Target Rate Changes

		Funds Rate Decrease		No Funds Rate Change		Funds Rate Increase	
Sector	Day	AAR	t-statistic	AAR	t-statistic	AAR	t-statistic
Basic Material	-3	0.074	0.48	-0.110	-1.27	0.114	0.89
	-2	0.025	0.17	0.253	2.94*	-0.161	-1.26
	-1	0.121	0.80	0.175	2.03***	0.178	1.39
	0	-0.363	-2.34**	0.015	0.18	-0.198	-1.55
	1	0.127	0.83	-0.073	-0.85	-0.152	-1.19
	2	0.143	0.94	0.061	0.71	0.000	0.00
	3	0.226	1.49	0.101	1.17	0.100	0.78
Conglomerates	-3	0.489	3.21*	-0.018	-0.21	0.006	0.05
	-2	-0.035	-0.23	0.153	1.78***	-0.023	-0.18
	-1	0.163	1.07	-0.012	-0.14	0.132	1.03
	0	-0.536	-3.46*	-0.043	-0.50	0.097	0.76
	1	0.249	1.63	-0.006	-0.07	-0.181	-1.42
	2	-0.196	-1.28	0.089	1.03	0.040	0.31
	3	0.113	0.74	-0.064	-0.75	-0.088	-0.69
Consumer Goods	-3	-0.201	-1.32	0.030	0.35	-0.351	-2.74**
	-2	0.094	0.62	-0.051	-0.60	-0.089	-0.70
	-1	0.688	4.53*	0.121	1.41	-0.054	-0.42
	0	-0.652	-4.20*	-0.027	-0.32	-0.248	-1.94**
	1	-0.011	-0.07	0.200	2.31**	0.100	0.79
	2	0.251	1.65	0.163	1.89***	-0.140	-1.09
	3	0.431	2.83*	-0.041	-0.47	-0.022	-0.17
Consumer Services	-3	0.126	0.83	0.018	0.21	-0.152	-1.19
	-2	0.496	3.26*	0.301	3.50*	0.025	0.20
	-1	-0.094	-0.62	-0.060	-0.69	0.151	1.18
	0	0.274	1.77***	0.059	0.69	-0.028	-0.22
	1	0.091	0.59	-0.005	-0.06	-0.127	-1.00
	2	-0.190	-1.25	0.200	2.32**	0.137	1.07
	3	-0.329	-2.16**	0.002	0.02	0.095	0.74
Financial	-3	0.200	1.31	0.210	2.44**	0.196	1.53
	-2	0.279	1.83***	0.011	0.13	0.251	1.96**
	-1	0.003	0.02	0.170	1.97***	0.212	1.66***
	0	0.522	3.37*	0.081	0.95	-0.013	-0.10
	1	-0.228	-1.49	0.174	2.02***	-0.354	-2.77**
	2	-0.486	-3.19*	-0.068	-0.79	0.112	0.87
	3	0.254	1.67***	-0.031	-0.37	0.038	0.29
Healthcare	-3	-0.088	-0.58	0.079	0.92	-0.164	-1.28
	-2	-0.310	-2.04**	-0.224	-2.61**	-0.035	-0.27
	-1	0.426	2.80*	0.178	2.06**	-0.146	-1.15
	0	-0.625	-4.03*	-0.051	-0.59	0.350	2.74**
	1	-0.441	-2.89*	0.098	1.13	0.182	1.43
	2	-0.132	-0.86	0.252	2.93*	-0.087	-0.68
	3	0.037	0.24	-0.011	-0.12	-0.361	-2.83*
Industrial Goods	-3	0.339	2.23**	-0.203	-2.35**	0.140	1.09
	-2	-0.217	-1.43	0.083	0.96	-0.226	-1.77***
	-1	-0.222	-1.46	-0.063	-0.73	-0.112	-0.88
	0	-0.362	-2.33**	0.071	0.82	0.136	1.07
	1	-0.787	-5.15*	0.013	0.15	-0.317	-2.49**
	2	0.035	0.23	0.214	2.49**	-0.313	-2.45**
	3	-0.412	-2.70*	-0.036	-0.42	-0.041	-0.32
Technology	-3	0.044	0.29	-0.122	-1.41	-0.071	-0.55
	-2	0.099	0.65	-0.052	-0.61	-0.031	-0.24
	-1	0.417	2.74*	-0.236	-2.74**	-0.082	-0.64
	0	0.273	1.76***	0.095	1.10	-0.020	-0.16
	1	0.597	3.91*	0.067	0.77	0.047	0.37
	2	0.133	0.88	-0.191	-2.22**	0.071	0.55
	3	0.222	1.46	0.262	3.04*	0.329	2.58**

*Note: Sector definitions are given in Appendix Table 1. *, **, and *** indicate the statistical significance at the 1%, 5%, or 10% level, respectively.*

The response of stock prices of the eight sectors can further be discussed focusing purely on the event day. Figures 2, 3, and 4 present the distribution of cumulative abnormal returns on the event day for all eight sectors combined. Based on the distribution pattern of the Figures 2, it is evident that Federal Funds rate reduction increases the stock prices (and thereby the returns). The majority of the observations are positive as can be seen from the height of the bars on the positive side. However, as Figure 3 shows, when there is an increase of the Federal Funds target rate, stock prices do not drop significantly. It is interesting to note, as evident from Figure 4, that stock prices tend to increase even if there is no change in the Federal Funds target rate.

Figure 2: Frequency Distribution of Cumulative Abnormal Returns of a Rate Decrease

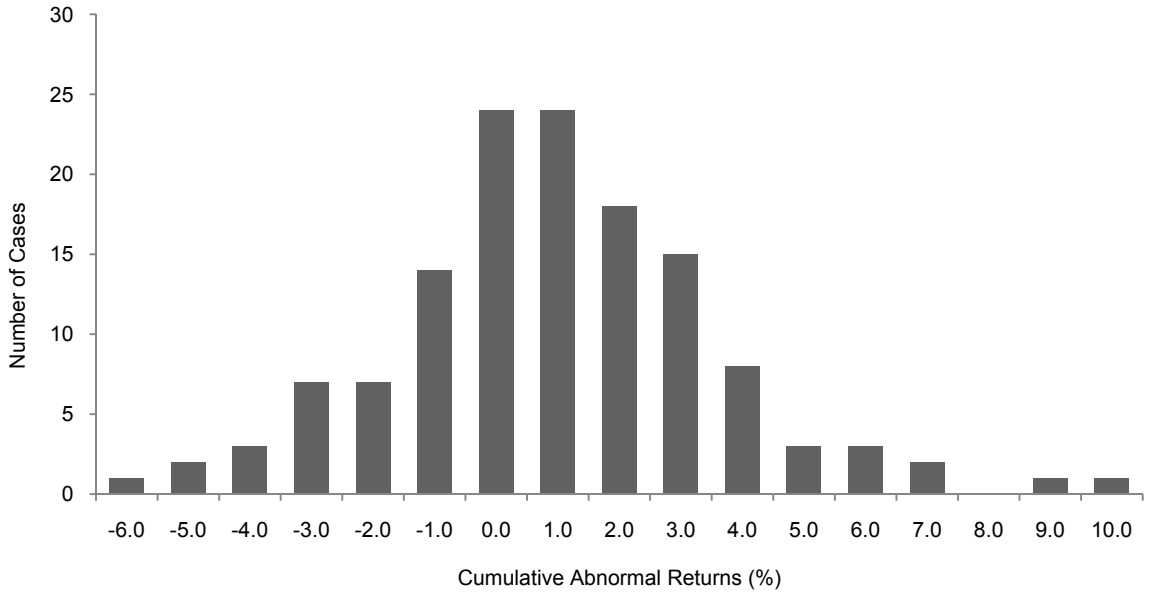


Figure 3: Frequency Distribution of Cumulative Abnormal Returns of a Rate Increase

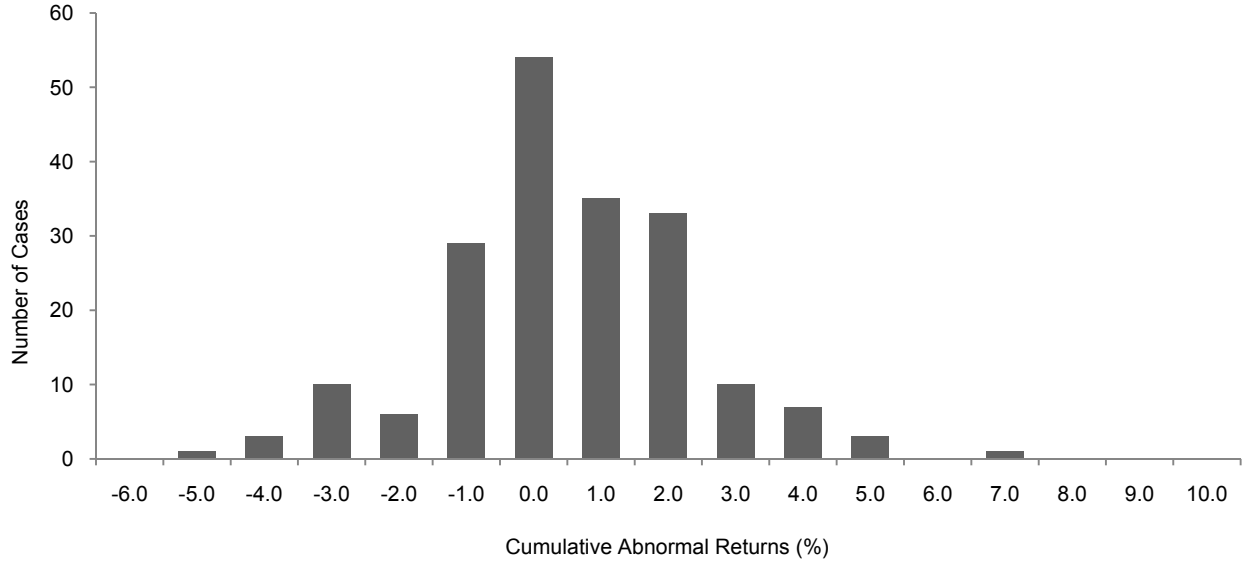
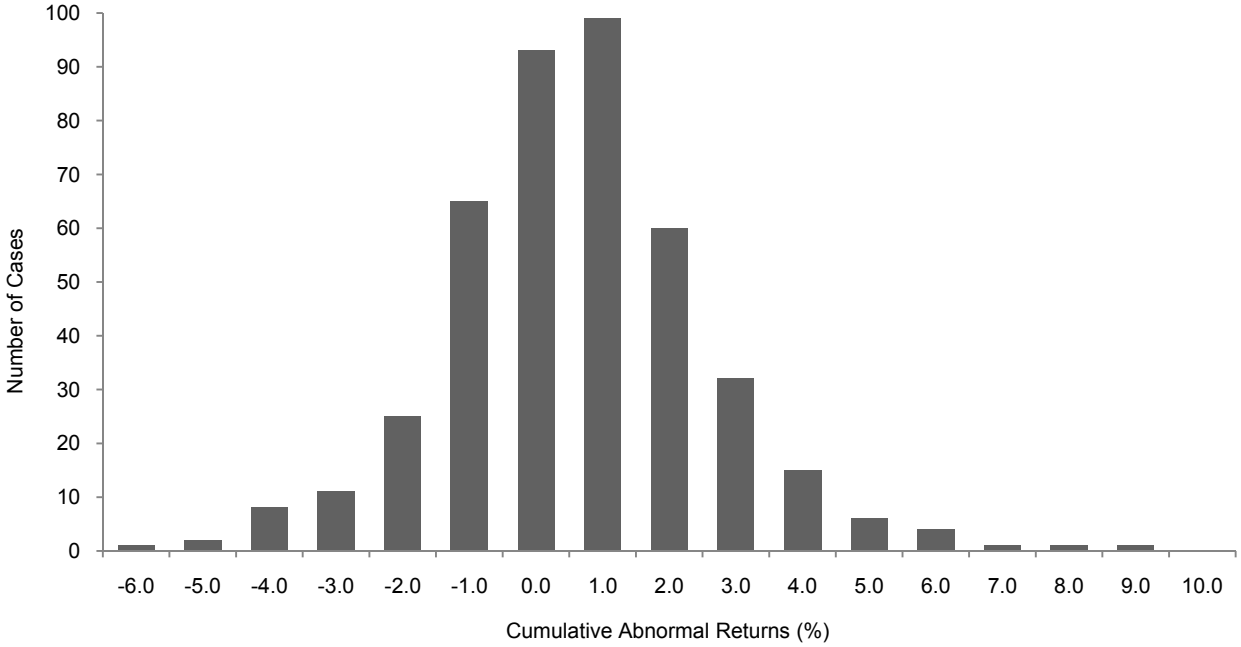


Figure 4: Frequency Distribution of Cumulative Abnormal Returns of a No Rate Change



When we focus on the event day ($t = 0$), of the eight sectors, three sectors reacted positively when the Federal Funds target rate was decreased, three sectors reacted positively when there was no change in the funds target rate, while three sectors reacted negatively when the funds target rate was increased.

Table 3 shows the estimated cumulative abnormal returns (CARs) observed for the 94 events in the sample and provides the test for significance of these effects. The CARs on each of the days in the 3-day window for each sector are given in the table to identify the sectors that are reacted most to the Federal Funds target rate change. The results in Table 3 indicate that the CARs are mostly positive and significant on the days the Federal Funds target rate was reduced. They are mostly negative and significant on the days the Federal Funds target rate was increased. However, we cannot identify any clear pattern of the market's response as the Federal Funds target rate is changed, because there is also evidence that market reacted positively or negatively even if the funds target rate remained unchanged.

SUMMARY AND CONCLUSIONS

Do the stock prices actually react to changes in the federal funds target rate? If so, how can investors and policy makers benefit from the significant relationship between the stock prices and the federal funds target rate? This study investigates the effects of Federal Funds target rate changes on the daily stock performance of 30 companies listed under the Dow Jones Industrial Average (DJIA) over the years 1996-2007. Using an event-study framework, this study examines how the stock market responds to the expected financial performance of the firm at the announcement of Federal Funds target rate changes.

Table 3: Cumulative Abnormal Returns Related to Federal Funds Target Rate Changes

		Funds Rate Decrease		No Funds Rate Change		Funds Rate Increase	
Sector	Day	CAR	t-statistic	CAR	t-statistic	CAR	t-statistic
Basic Material	-3	0.074	0.48	-0.110	-1.27	0.114	0.89
	-2	0.099	0.46	0.143	1.18	-0.046	-0.26
	-1	0.220	0.83	0.318	2.13**	0.131	0.59
	0	-0.143	-0.47	0.333	1.94***	-0.067	-0.26
	1	-0.016	-0.05	0.260	1.35	-0.218	-0.76
	2	0.127	0.34	0.321	1.52	-0.218	-0.70
	3	0.354	0.88	0.422	1.85***	-0.118	-0.35
Conglomerates	-3	0.489	3.21*	-0.018	-0.21	0.006	0.05
	-2	0.454	2.11**	0.135	1.11	-0.017	-0.10
	-1	0.617	2.34**	0.123	0.83	0.114	0.52
	0	0.081	0.26	0.081	0.47	0.212	0.83
	1	0.330	0.96	0.075	0.39	0.031	0.11
	2	0.134	0.36	0.163	0.77	0.071	0.23
	3	0.247	0.61	0.099	0.43	-0.017	-0.05
Consumer Goods	-3	-0.201	-1.32	0.030	0.35	-0.351	-2.74**
	-2	-0.107	-0.50	-0.021	-0.17	-0.440	-2.43**
	-1	0.582	2.21**	0.100	0.67	-0.495	-2.23**
	0	-0.070	-0.23	0.073	0.42	-0.743	-2.90*
	1	-0.081	-0.24	0.272	1.41	-0.643	-2.25**
	2	0.170	0.45	0.435	2.06**	-0.782	-2.50**
	3	0.601	1.49	0.394	1.73***	-0.804	-2.38**
Consumer Services	-3	0.126	0.83	0.018	0.21	-0.152	-1.19
	-2	0.622	2.89**	0.320	2.62**	-0.127	-0.70
	-1	0.528	2.00***	0.260	1.74***	0.023	0.11
	0	0.802	2.62**	0.319	1.85***	-0.005	-0.02
	1	0.893	2.61**	0.314	1.63	-0.132	-0.46
	2	0.703	1.88***	0.513	2.43**	0.005	0.02
	3	0.374	0.93	0.515	2.26**	0.100	0.30
Financial	-3	0.200	1.31	0.210	2.44**	0.196	1.53
	-2	0.478	2.22**	0.221	1.82**	0.447	2.47**
	-1	0.482	1.83***	0.391	2.62**	0.659	2.97**
	0	1.004	3.28*	0.473	2.74**	0.646	2.52**
	1	0.776	2.27**	0.647	3.36*	0.292	1.02
	2	0.290	0.78	0.578	2.74**	0.403	1.29
	3	0.544	1.35	0.547	2.40	0.441	1.30
Healthcare	-3	-0.088	-0.58	0.079	0.92	-0.164	-1.28
	-2	-0.398	-1.85***	-0.145	-1.19	-0.199	-1.10
	-1	0.028	0.11	0.033	0.22	-0.345	-1.56
	0	-0.597	-1.95***	-0.018	-0.11	0.005	0.02
	1	-1.038	-3.04*	0.080	0.41	0.187	0.65
	2	-1.170	-3.13*	0.331	1.57	0.100	0.32
	3	-1.133	-2.80**	0.321	1.41	-0.261	-0.77
Industrial Goods	-3	0.339	2.23**	-0.203	-2.35**	0.140	1.09
	-2	0.122	0.57	-0.120	-0.98	-0.087	-0.48
	-1	-0.100	-0.38	-0.183	-1.23	-0.199	-0.90
	0	-0.462	-1.51	-0.112	-0.65	-0.063	-0.25
	1	-1.249	-3.65*	-0.099	-0.52	-0.380	-1.33
	2	-1.214	-3.24*	0.115	0.54	-0.693	-2.21**
	3	-1.627	-4.03*	0.078	0.34	-0.734	-2.17**
Technology	-3	0.044	0.29	-0.122	-1.41	-0.071	-0.55
	-2	0.143	0.66	-0.174	-1.43	-0.101	-0.56
	-1	0.560	2.12**	-0.410	-2.75*	-0.183	-0.83
	0	0.833	2.72**	-0.315	-1.83**	-0.203	-0.79
	1	1.430	4.18*	-0.249	-1.29	-0.156	-0.55
	2	1.564	4.18*	-0.439	-2.08**	-0.086	-0.27
	3	1.785	4.42*	-0.177	-0.78	0.243	0.72

*Note: Sector definitions are given in Appendix Table 4. *, **, and *** indicate the statistical significance at the 1%, 5%, or 10% level, respectively.*

We define the event as a Federal Open Market Committee (FOMC) meeting day. We collected the data from the minutes of the FOMC meetings in the period between January 2, 1996, and March 26, 2007. During this period, there were 94 FOMC meetings. Of these 94 events, Federal Funds target rate was

reduced 17 times, increased 24 times, and no rate change took place in 53 times. In order to better investigate the markets' reactions, we defined an event window as the period from 3 days prior to the event to 3 days after the event. In our effort to reduce other factors which may influence the stock price, we chose event windows close to the announcement day.

The results indicate that the average abnormal returns (AARs) and cumulative abnormal returns (CARs) are mostly positive and significant on the days the Federal Funds target rate was reduced. They are mostly negative and significant on the days the Federal Funds target rate was increased. However, we cannot identify any clear pattern of the market's response as the Federal Funds target rate is changed, because there is also evidence that the market reacted positively or negatively even if the funds target rate remained unchanged. The results also indicate that the stock market reaction to changes in the Federal Funds target rate depends on the industry sector.

In conclusion, the changes in the Federal Funds target rate are found to have a significant effect on stock prices on and around the event days. This finding is consistent with the findings of previous studies on the relationship between the stock prices and the Federal Funds target rate.

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APPENDIX

Table 4: Dow Jones Industrial Average Component Weightings

Sector	Company Name	Ticker	ICB Subsector	Weight (%)
Basic Material (10.48%)	Alcoa Inc.	AA	Aluminum	2.25
	E.I. DuPont de Nemours & Co.	DD	Commodity Chemicals	3.24
	Exxon Mobil Corp.	XOM	Integrated Oil & Gas	4.99
Conglomerates (11.57%)	3 M Co.	MMM	Diversified Industrials	5.03
	General Electric Co.	GE	Diversified Industrials	2.29
	United Technologies Corp.	UTX	Aerospace	4.24
Consumer Goods (13.84%)	Altria Group Inc.	MO	Tobacco	4.52
	Coca Cola Co.	KO	Soft Drinks	3.18
	General Motors Corp.	GM	Automobiles	2.04
	Procter & Gamble Co.	PG	Nondurable Household Products	4.09
Consumer Services (10.78%)	Home Depot Inc.	HD	Home Improvement Retailers	2.44
	McDonalds Corp.	MCD	Restaurants & Bars	2.94
	Wal-Mart Stores Inc.	WMT	Broad-line Retailers	3.12
	Walt Disney Co.	DIS	Broadcasting & Entertainment	2.27
Financial (14.52%)	American Express Co.	AXP	Consumer Finance	3.63
	American International Group Inc.	AIG	Full Line Insurance	4.39
	Citigroup Inc.	C	Banks	3.34
	JPMorgan Chase &Co.	JPM	Banks	3.15
Healthcare (8.55%)	Johnson & Johnson	JNJ	Pharmaceuticals	3.94
	Merck & Co. Inc	MRK	Pharmaceuticals	2.95
	Pfizer Inc.	PFE	Pharmaceuticals	1.67
Industrial Goods (13.24%)	Boeing Co.	BA	Aerospace	5.84
	Caterpillar Inc.	CAT	Commercial Vehicles & Trucks	4.37
	Honeywell International Inc.	HON	Diversified Industrials	3.04
Technology (17.02)	AT&T Inc.	T	Fixed Line Telecommunications	2.58
	Hewlett Packard Co.	HPQ	Computer Hardware	2.66
	Intel Corp.	INTC	Semiconductors	1.25
	IBM Corp.	IBM	Computer Services	6.24
	Microsoft Corp.	MSFT	Software	1.81
	Verizon Communications Inc.	VZ	Fixed Line Telecommunications	2.48

Note: The percentages in parentheses are the sector weights as of April 15, 2007.
Source: Dow Jones Indexes (www.djindexes.com/mdsdx/index.cfm)