REACTION OF STOCK MARKET TO MONETARY POLICY SURPRISES

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by

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ABSTRACT

This paper provides an empirical analysis of stock market reactions to monetary policy surprises. Its principal objective is to understand the heterogeneous nature of this type of response by examining a set of possible explanatory factors. I find that a hypothetical unanticipated increase of 25 bps in the target Federal Reserve funds rate would result in a one-day decline of 1.3 percent in the prices of S&P 500 stocks. There is some evidence that factors such as sector and industry groups, firm size, and the foreign earnings exposure of a firm could affect the reaction reflected in its stock price. The severity of the equity market's response also appears to be associated with elements of the macroeconomic environment such as the level of prevailing interest rates and inflation expectations. Moreover, my results suggest that a lack of unanimity in the FOMC votes could curb the reaction of the stock market.

BIOGRAPHICAL SKETCH

Wellian Wiranto is a Master's of Science candidate in Applied Economics and Management at Cornell University. Before moving to Ithaca, NY, he was enjoying life in the more agreeable climate of Washington, D.C., where he spent two years working in the Research Department of the International Monetary Fund. He graduated from the University of Chicago in 2004 with a Bachelor of Arts degree in Economics, with significant coursework in Political Science and International Relations. He follows global political and economic affairs fervently which, he acknowledges, might be due to the exposure deficit he suffered while growing up on a small Indonesian island called Bintan. He enjoys cycling and tabulating his high golf scores. He loves to sketch architectural features and finds that paper plates make for an excellent medium. Last but not least, he is passionate about food and prefers it spicy and plentiful.

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I am grateful to Mr. Eswar Prasad. He has provided me with nurturing advice and valuable feedback throughout the process of completing this thesis. I thank Mr. Garrick Blalock, who is a member of my Special Committee. Moreover, I am obliged to Mr. Pipat Luengnaruemitchai, who kindled my interest in the subject.

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Introduction

A number of studies in the literature have documented the reaction of the stock market to monetary policy surprises. Bernanke and Kuttner (2004), for instance, found that a hypothetical unanticipated 25 bps cut in the target Federal Reserve (hereinafter "the Fed" or "Fed") funds rate is associated with about a one-percent increase in the broad stock index. In this paper, I share the principal motivation of these studies, which is to utilize such a market reaction as a quick, albeit imperfect, barometer for gauging the effect of a monetary policy decision.

Even though monetary policy aims to influence economic activities, such as the level of employment, economic growth, and inflation, the effects can surface (and be read) only over the long term. In contrast, equity markets can represent a more immediate indicator. The share price of a company's stock can be seen as discounted cash flow from future dividends, serving as a leading indicator of its earning prospects. Therefore, in aggregate, the degree to which share prices react to monetary policy changes could tell us how the expectation of future economic prospects among economic participants has been shifted by a rate change.

This paper is an empirical analysis of such reactions. More specifically, apart from studying the degree to which the equity market reacts to monetary policy, I focus on how heterogeneous such a reaction is. My hypothesis is that these reactions are affected by a host of factors, as follows. First, I look at factors such as sector and industry groups in which the company operates, followed by other defining characteristics of the firm such as size, degree of leverage, and exposure to foreign earnings. I also hope to analyze how the reaction of the market further varies depending on market expectations with respect to inflation and the prevailing interest rate environment. In addition, I ask whether the market responds differently when

there has been a split vote in a decision made by the Federal Open Market Committee (FOMC).

Before I proceed to an in-depth examination of these factors, however, I explore the dynamics of the effects of monetary policy on stock prices. It has been widely documented that a change in the rate itself has little noteworthy impact on stock prices. This is likely due to the fact that, since the stock market is inherently forward-looking, any expected shift in policy rates would have been priced in before the announcement date. To see the effects of target interest rate changes, we should really be looking at the "surprise" part, that is, the difference between actual and expected changes.

As a way of gauging the expected interest rate changes, I utilitze data from Bloomberg surveys of market analysts.[1] To represent the equity market, S&P 500 constituent stocks will be used, since this broad index comprises a wide spectrum of economic sectors. I am particularly interested in one-day changes in prices for each "event" represented by an FOMC monetary policy announcement, although I will examine whether such a reaction persists from beyond the first day to as far as the fifth trading day. I focus on one-day changes largely to circumvent a potential endogeneity problem.[2] All in all, my sample universe consists of 71 "events" of FOMC announcements, spanning the period between December 1998 and September 2007.

I estimate the reaction of the stock market to monetary policy surprises using a regression model that has a one-day change in the S&P constituent stock price as

[1] The next section, the literature review, contains extensive discussions of the pros and cons involved in a host of other measurements of market expectations of interest rate movement. The Bloomberg data has been trimmed by excluding any analyst opinion that is more than two standard deviations away from the mean, to account for the fact that market analysts have incentives to produce out-of-consensus forecasts.

[2] An endogeneity problem could arise because, over time, movement in equity prices has been shown to influence monetary policy decisions. Rigobon & Sack (2003), for instance, claim that a hypothetical 5-percent increase in the S&P 500 index could increase the likelihood of a 25 bps rate hike by about half.

the dependent variable and the unexpected change in the target Fed funds rate as the principal explanatory variable. Apart from this baseline model, I will be estimating modified models that enable me to examine whether the factors I have listed earlier have anything to do with the heterogeneous nature of the stock market reaction.

Estimates of the baseline model suggest that a hypothetical 25 bps increase in the target rate would result in a one-day decline of 1.3 percent in the prices of S&P 500 stocks. This reaction is largely in line with findings from other studies in the literature. Further results suggest that the reaction varies widely by sector. For instance, I have found that the reaction of the cyclical Consumer Discretionary sector is three times stronger than that of the non-cyclical Consumer Staples sector.

Stepping into the discussion of firm-level characteristics, results suggest that size plays some part. The smallest firms are the most sensitive to monetary policy surprises, perhaps due to their relatively greater dependence on external financing. This possibility is in keeping with the *credit channel* transmission mechanism proposed by Bernanke and Blinder (1992), which suggests that tighter monetary conditions have a strong impact on highly bank-dependent borrowers. I also see some evidence suggesting that firms with greater foreign earnings exposure react more readily to rate changes than the more domestically oriented ones, partly due to the knock-on effect of interest rates on the foreign exchange value of the US dollar.

Market reaction appears to be the strongest in a medium interest rate environment, with a quarter-point easing of the rate bringing about a two-percent increase in stock prices in one day. This effect is largely tempered in both low and high rates environments. This lends some credence to my view that markets are most comfortable when the prevailing rates have been hovering in the middle range, perhaps because the central bank enjoys relative ease of movement in loosening or tightening its monetary policy—something that is arguably too much of a luxury when rates have been high or low.

The level of inflation expectation seems to have an important bearing on market reactions as well. Surprise rate changes appear to have the strongest impact when the markets expect inflation to be low. In contrast, the effect is ten times weaker if the inflation expectation has been high. In fact, in some sectors, such as Information Technology and Industrials, which are relatively more sensitive to price pressures from rises in the costs of materials and wage demands, a surprise rate cut might even result in a *negative* change in stock prices.

Moreover, dissenting votes in an FOMC decision have a direct impact on stock prices. Anything less than a unanimous vote appears to directly result in a 0.5-percent one-day decline in stock prices. Moreover, there is some evidence that suggests that split votes within the FOMC also temper the reaction of stock prices to monetary policy surprises. The effect of a quarter-point surprise rate cut on stock prices now amounts to only 0.16 percent, compared with a nearly 1.3-percent effect following unanimous decisions.

The rest of the paper is organized in the following fashion. First, I look at a number of studies that have preceded this examination of the stock market's reaction to monetary policy. This is followed by a section looking at this reaction in greater detail. Here, I examine whether it is the unexpected element of a rate change alone that has a significant impact. Following that, I examine how persistent the impact of a surprise rate change is, by checking whether monetary policy surprises can explain cumulative percentage changes in stock prices of up to five days after each FOMC announcement. I turn my attention next to the heterogeneous response of the market, and begin to examine the list of factors that could explain this condition. Thereafter, the paper analyzes the impact of dissenting votes in FOMC decisions. The last section offers concluding inferences and remarks.

Literature Review

In this section, I provide an overview of studies that have examined the effect of monetary policy on stock prices. I start by reviewing studies that talk about the different channels of monetary policy transmission. After that, I discuss different methods through which some of the authors have tried to tease out market expectations related to any monetary policy change. Lastly, I review a limited number of studies of the effects of monetary policy on different sectors, rather than just on broad indices.

Channels of Monetary Policy Transmission

How does a policy decision on the part of the Federal Reserve affect the real economy and the actors within, such as firms? This sub-section examines some of the channels through which such an effect passes through to the markets.

One way such an effect might take place is through the so-called *credit channel* of monetary policy transmission. Essentially, this refers to how a decision by banks to reduce their credit supplies in a higher interest rate environment will directly impact firms who need these credit lines to finance their operations or undertake new investment opportunities. Bernanke and Blinder (1992) and Kashyap, Stein and Wilcox (1993), for example, show that tighter monetary conditions have a strong impact on highly bank-dependent borrowers, including firms with scarce cash reserves that do not have ready access to public bond and commercial paper markets.

Pursuing a separate line of reasoning, but still discussing credit constraints channels, Bernanke and Gertler (1989) and Kiyotaki and Moore (1997) argue for the importance of the *balance sheet* effect. They document a phenomenon in which interest rate hikes decrease the present value of loan collaterals, which Bernanke and

Gertler proxy by borrowers' net worth, cash flow, and liquid assets. Less attractive collateral in turn affects the perceived credit worthiness of borrowers.

Another way in which monetary policy affects firm-level performance is via the *demand* channel. Products and services provided by firms may now find fewer takers as the monetary environment tightens, since higher interest rates affect consumer sentiments and their spending patterns unfavorably.

One objective of this study is to explore the importance of these monetary policy transmission channels. For instance, I will be examining whether the prospects of highly leveraged firms are perceived more unfavorably than those of their peers are in terms of their share price performance, in the event of an unexpected monetary tightening.

Thus far I considered some of the ways in which monetary policy can affect firms' performance and, by extension, their share prices. I should note, however, that there is feedback that points in the other way as well. Rigobon and Sack (2003), for instance, show that a 5-percent increase in the S&P 500 index increases the likelihood of a 25bp tightening by about half. This magnitude, they argue, is roughly equal to the estimated impact of stock market movements on aggregate demand. They conclude that, although the Federal Reserve does respond to stock prices, it does so only to the extent warranted by their impact on the macroeconomy.

Indeed, Bernanke and Gertler (1999) argue for the case that central banks should respond to asset price volatility. In their view, the case for intervention becomes stronger when non-fundamental factors such as market psychology or a poor regulatory environment creep in. Such factors have a significant effect on the rest of the economy due to the wealth effect. More importantly, because of the presence of the balance sheet channel, some firms might suffer asymmetrically in terms of how much harder it is for them to obtain credit.

This suggests that there is an important endogeneity issue that might cloud any study that examines links between monetary policy and asset prices, since the former affects the latter, and vice-versa. However, since my study employs mainly one-day changes in stock prices in reaction to monetary policy announcements, endogeneity problems are not a major concern.

Capturing Market Expectations of Monetary Policy

To capture the effect of target interest rate changes, I should really be looking at the "surprise" part, that is, at the difference between actual and expected changes. The efficient markets hypothesis suggests that markets would have priced-in expected rate changes before any such announcements, with share prices already reflecting this prior expectation. Therefore, it would be the unexpected aspect of interest rate changes, if any, that would affect the markets on announcement days. If I can figure out what the *expected* change prior to each announcement is, I will be able to calculate what the *unexpected* change is, and proceed with my analysis.

It is with respect to the expected change that some contentions in the literature arise. For instance, Cochrane and Piazzesi (2002) used the change in term Eurodollar rates, while Rigobon and Sack (2002) utilized rates of Eurodollar futures instead. In turn, Bernanke and Kuttner (2005) argue that Eurodollar rates are good only for long-term expectations, since their settlement terms are one year or longer. Instead, they propose using Fed funds futures (which settle for the average Fed funds rates each month) as the best predictors of target funds changes, citing Gurkaynak et al. (2005), who use the same measure.

Within the group of studies that utilize Fed funds futures, the issue of timing plays an important role. How long prior to FOMC announcements should we be taking the reading of futures prices? Bernanke and Kuttner (2005) and Gurkaynak et

al. (2005) settled on the closing price of futures on the day prior to FOMC announcements. Wongswan (2005) argues that we should really be looking at the half hour prior to such announcements, which usually take place around 2:15 p.m. That way, he argues, we can perhaps account for any change in market sentiments that arise from new information in the early half of the day that might affect the FOMC's decisions.

Wongswan (2005) further asserts, moreover, that there are really two different surprises. One, which he terms the *target surprise*, is the mismatch between expected and announced rates for the immediate term. Second, a *path surprise* causes the "jolt" on longer-term expectations. He derives this result from Eurodollar futures, to capture any change in how the markets have perceived the Federal Reserve's longer-term policy outlook.

Are federal funds futures even good predictors? Some say no. Nosal (2001) and Piazessi and Swanson (2004) argue that Fed funds futures carry within them a risk premium, just like any other asset class would. Hence, we would need to adjust for this risk premium if we were to derive the correct market expectations. Nosal came up with an adjustment factor of 0.187 percent to correct for this bias, which is the average of differences between realized Fed funds futures and the Fed fund overnight rates on the expiration dates.

Moreover, there is an increasing discussion about using *options* on Fed funds futures as a gauge. Such options began trading on the Chicago Mercantile Exchange in March 2003, but the volumes traded are still much thinner than those of the futures market itself are. Despite that, Carlson et al. (2003) argue that options may provide a better measure of market expectations because trading in them reveals the *distribution* of market expectations.[3]

[3] Let us suppose that, on the day of, or perhaps half an hour before, the Fed's announcement on June 15, 2004, the Fed futures rate implies an expected rate of 1.275 (versus the pre-announcement 1.00).

Still, some others take a less quantitative route when reading market expectations. For instance, Ehrmann and Fratzscher (2004) use the polls of market participants run by Reuters. The limitation of this approach is that these polls are conducted on Fridays before FOMC announcements. If opinions change for one reason or another during the intervening period, the poll results become outdated.

I use data from polls of market participants that are conducted by Bloomberg. That these surveys are conducted on the days of announcements ameliorates the time-lapse problem associated with Reuters data. One of the disadvantages of this approach, however, is that my data, and thus my analysis, are only as good as the poll responders' ability to read, or perhaps even influence, prevailing opinions. To a certain extent, however, a large number of participants could help overcome this concern. Moreover, I employ cut-offs to weed out any analyst opinion that is too out of line, to limit the bias inherent in the well known analysts' incentive to make out-of-consensus predictions.

I have decided not to use other indicators of market expectations, such as Fed funds futures rates, partly due to data availability issues. Furthermore, as the jury is still out on which measures to use, or on what kind of correction, if any, should be applied to the data, I am hesitant to prefer one seemingly sophisticated measure to another.

Sectoral Views and Beyond

Sectors and industry groups can, to a significant extent, react differently to monetary policy movements. For instance, looking at the consumer goods sector,

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This shows that the market expects with some probability that the new rates will be increased by 50 b.p., by 25 b.p., or not at all. With futures, I cannot distinguish the distribution across these three expected outcomes. However, since options are traded on different strike prices (down to 6.25 basis points), I am able to tease out the distribution. (Incidentally, Bloomberg has a function that enables us to look at the implied probability of such a distribution. However, only forward expectations are shown, not historical ones.)

discretionary goods may be relatively more hurt by an unexpected rate hike than the staple goods sector, whose customers are less sensitive to rate-hike-induced slowdowns in demand. Another factor that might come into play includes how capital-intensive the sector is, since interest rate movements would affect funding costs. Because the exchange rate is likely to be affected by interest rate changes, sectors that are involved in tradable goods could be more prone to monetary policy effects as well.

By and large, only a small number of studies take an in-depth look at how each sector, or industry group, is affected differently by monetary policy. Ehrmann and Fratzscher (2004), whose estimation approach I build mine upon, is one of the latest examples. Looking at nine sectors to which S&P 500 members belong, and over 78 FOMC meeting dates from the years 1994 to 2003, they find that sectors such as Technology, Cyclical Consumer Goods, and Communication are affected most severely by monetary policy.

Bernanke and Kuttner (2003) offer another study that focuses on the US market. They find that, on average, a hypothetical unanticipated quarter-point rate cut leads to about a 1-percent change in the stock index, a change that is similar in magnitude to what I estimate. They propose that such a market response can be attributed largely to the effects of surprise monetary policy actions on expected excess returns on equity. Additionally, they find that sectors such as high-tech and telecommunications have a much stronger response to surprise rate movements than the overall market, in line with the results from Ehrmann and Fratzscher (2004) and my estimation.

My study will explore the role of sectors still further. Moreover, following Ehrmann and Fratzscher (2004)'s approach, I will also examine the role of firm-level characteristics in explaining the market's reaction to monetary policy surprises. In addition to revisiting the role of such characteristics as firm size and degree leverage,

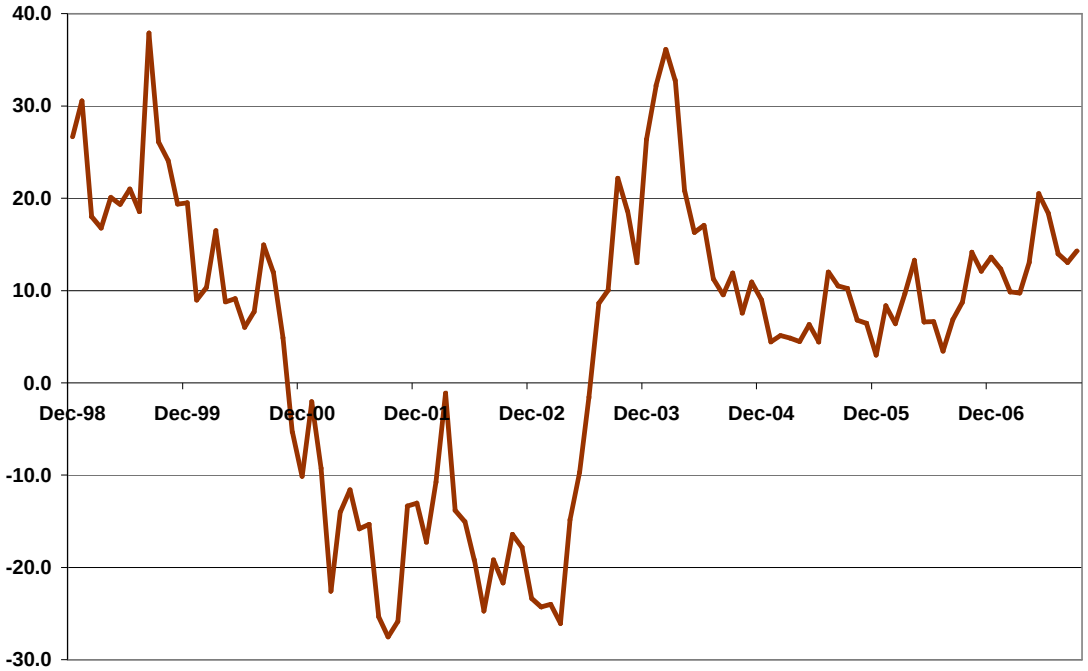
I will also analyze the potential role of foreign earnings exposure. I do not stop there, however. To the best of my knowledge, no previous study has looked at the question of whether the inflation expectation level or the prevailing interest rate environment affects the degree to which monetary policy surprises impact stock prices.

Data Description

In this section I provide further details on the sources and handling of key elements of my dataset. First, the dependent variable that I am interested in is the movement of stock prices. For that purpose, I track the price of S&P 500 constituent stocks. I do this because members of this index broadly represent the U.S. economy in terms of the sectors and industry groups that they represent. Data on stock prices are obtained from Datastream, for the period of December 1998 through September 2007. As we can see from figure 1, there is a wide range of movement of the S&P 500 index during this period. It encompasses the booming 'dotcom' era of the late 1990s, the subsequent bust beginning in the year 2000, as well as more recent developments.

A total of 468 stocks have consistently been members of the S&P 500 index during this period. On average, each stock is traded on 69.5 occasions out of the 71 FOMC announcement periods used in the dataset.

For my baseline analysis, I take the percentage change in the stock closing price from the day before and the day of FOMC announcements. In the next section, I examine whether the effect of monetary surprises on stock prices persist beyond the announcement day, for as much as five trading days thereafter. However, for the most part, my study will focus on the one-day change.



Source: CEIC and author's calculation. Note: Growth rate is calculated as year-on-year percentage change of S&P 500 index at the start of each month.

Figure 1: Growth Rate of the S&P 500 Index

This decision represents a compromise between two different time horizons. On the one hand, there are studies such as that of Wongswan (2005), which looks at changes in stock prices within much shorter half-hour intervals following FOMC announcements. While this approach would allow us to claim that the price movement is dominated by monetary policy announcements alone, it is also hard to argue that in such cases the dust has not settled yet. In keeping up with trading volatility, prices might overshoot in the short run. On the other hand, it is desirable to take longer-term readings in order to gauge whether a given policy has had any sustained impact. It is my view, however, that monetary policy can explain only a small part of the overall movement of stock prices in the longer term. I would not be able to control for the multitude of factors that affect stock prices beyond the announcement dates. I investigate this in greater detail in a later section.

Figure 2 shows us the target Fed funds rate during our sample period. Successive rate cuts brought the target rate from its high of 6.5 percent in the year 2000 to the lowest point of 1 percent before the end of 2003. A gradual tightening cycle began lifting the rates to around the 5-percent level by the end of 2006. In general, we notice that monetary easing occurs when economic growth is slowing. From figure 3, we can see that the economy shows signs of slowing from 2000, with real growth declining rapidly by the end of 2001. The economy began to rebound starting in 2002, and inflation started to creep up, as well. This prompted the cycle of gradual interest rate increases.

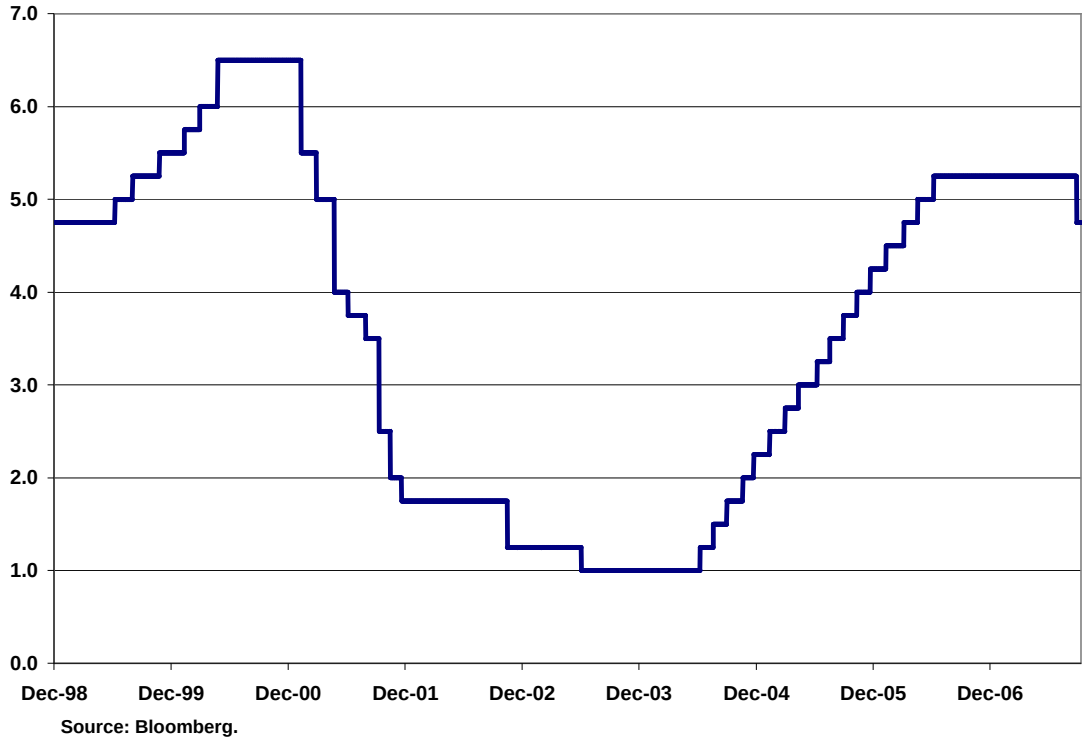
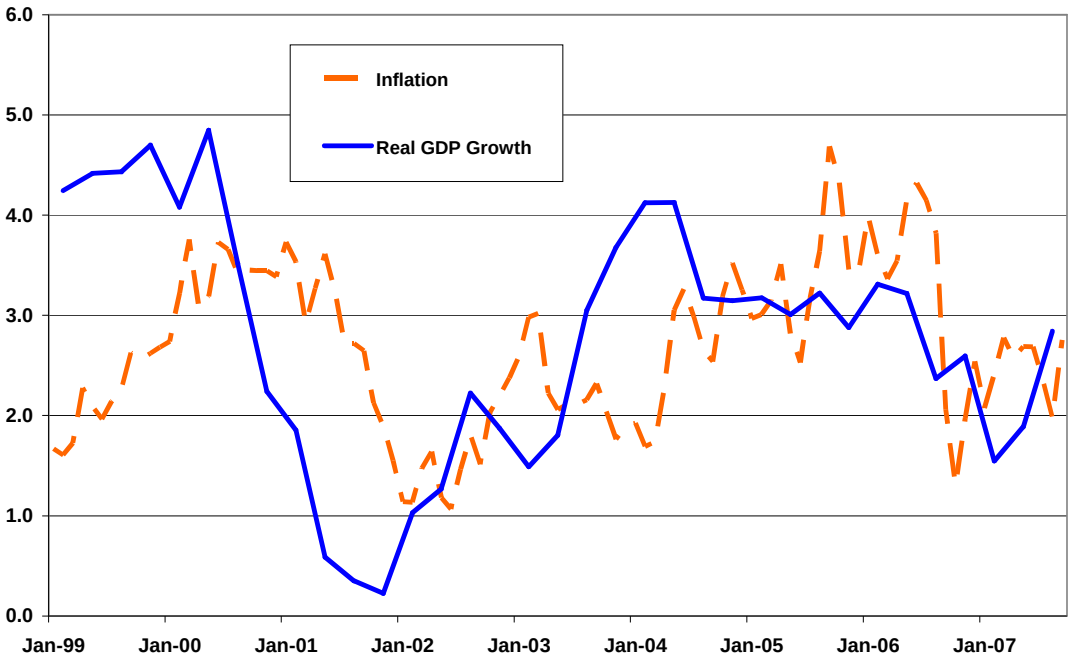


Figure 2: Target Fed Funds Rate (in percent)

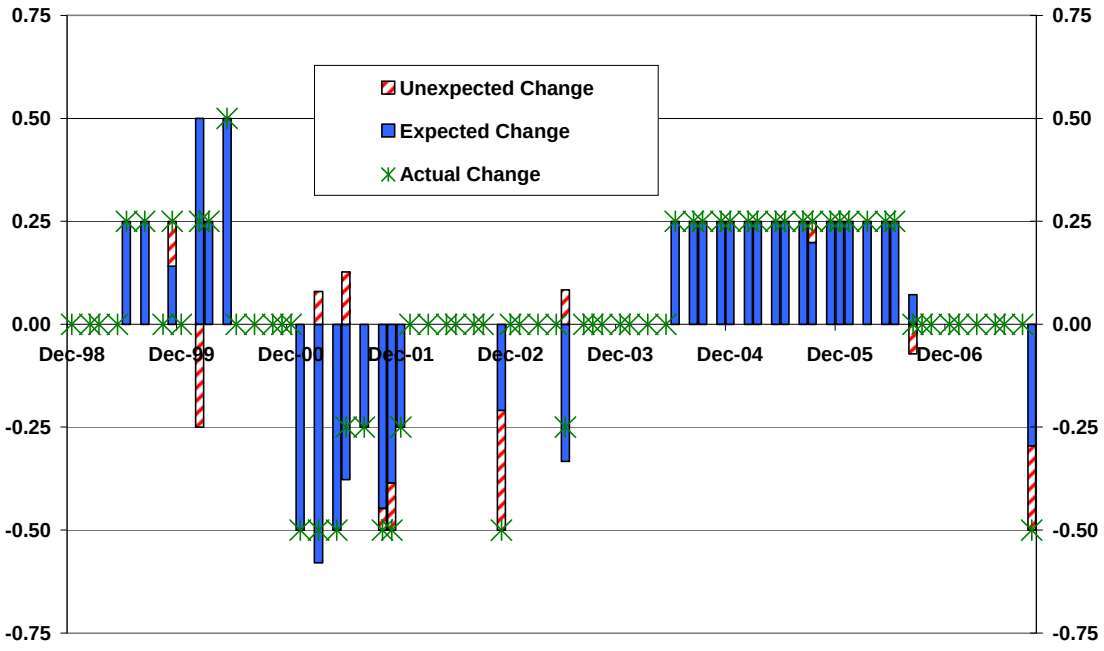
I should note however that, as my discussion develops, the rate change itself is not the main focus in this paper. I am most interested in the surprise element of such changes, and in particular its effect on stock prices on the days of FOMC announcements.



Source: CEIC and author's calculation. Notes: Real GDP growth data is derived as the year-on-year growth rate of quarterly constant price GDP numbers. Similarly, inflation is calculated as the year-on-year growth rate of monthly urban CPI data.

Figure 3: Growth and Inflation

My data on monetary policy surprises is derived by subtracting the expected change from the actual rate changes announced by the FOMC. The expected element of the change is taken to be the market expectations with respect to rate movements. For this, I have turned to analyst surveys that are conducted by Bloomberg. Moreover, I employ cut-offs, as I have indicated, to weed out any analyst opinion that is too far out of line so as to limit the inherent bias in analysts' incentive to make out-of-consensus predictions. I first trim the survey opinions to weed out any observation that is more than two standard deviations from the average. Then, I take the mean of this now-trimmed dataset to be the indicator of market expectations for each FOMC event. Figure 4 shows the decomposition of actual rate changes into the expected and unexpected elements.



Source: Bloomberg and author's calculations. Note: Actual changes in target Fed Funds Rate are denoted by the crosses. They can be decomposed into the expected and unexpected elements, as represented by the bar columns.

Figure 4. Decomposition of Changes in Target Fed Funds Rate

How Stocks React to Shifts in the Target Fed Funds Rate

In this section, I look at the immediate reaction of the stock market on the days of FOMC announcements. Since my ultimate aim is to gauge the response of the general economy, I chose stocks that make up the S&P 500 index, which represents a wide spectrum of economic sectors. By looking at one-day changes in prices, I attempt to isolate the direct impact of Fed policy rate shifts on stocks as much as possible.

Moreover, I examine target rate changes more closely. It has been widely documented that a change in the rate itself does not have any noteworthy impact on stock prices. This is likely due to the fact that, since the stock market is inherently

forward-looking, any expected shift in policy rates would have been priced in before the announcement days.

To see the effect of target interest rate changes, I should really be looking at the "surprise" part, that is, at the difference between actual and expected changes. The efficient market hypothesis suggests that markets would have priced in expected rate changes before announcements, with share prices already reflecting this prior expectation. Therefore, it would be the unexpected part of interest rate changes, if any, which would affect the markets on announcement days. Thus, if I can figure out what the *expected* change prior to each announcement is, I will be able to calculate what the *unexpected* change is, and proceed with my analysis.

As detailed in the literature review section above, there are many methods of measuring market expectations. In this study, I use data from Bloomberg surveys of market analysts. Bloomberg conducts surveys on scheduled FOMC meeting dates, and collates analysts' expectations of what the new target rates will be.

One of the disadvantages of this approach, however, is that my data, and thus my analysis, are only as good as the poll responders' ability to read, or perhaps even influence, prevailing opinions. Yet to a certain extent, a large number of participants could help overcome this concern. Moreover, as I have mentioned several times, I employ cut-offs to weed out any analyst opinion which is too far out of line, to limit the bias inherent in analysts' incentive to make out-of-consensus predictions.[4]

Having derived market expectations of what the new rates will be, I can thus decompose changes in policy rates as follows:

[4] For each survey date, I would trim the list of expected new rates by dropping any observation that is more than 2 standard deviations from the mean. The "corrected" market expectation is thus taken to be the mean of the trimmed responses.

$$FEDMOVE_t = EXP_t + UNEXP_t, \quad \text{(Equation 1)}$$

where FEDMOVE refers to changes in target Fed rates, EXP is the expected element of this change, while the remainder UNEXP refers to the unexpected component.

With that decomposition in mind, I set out to examine the following models:

$$r_{i,t} = \alpha + \eta.FEDMOVE_t + \varepsilon_{i,t} \quad \text{(Model 1)}$$

$$r_{i,t} = \alpha + \gamma.EXP_t + \beta.UNEXP_t + \varepsilon_{i,t} \quad \text{(Model 2A)}$$

where:

- r refers to the percentage change between closing day stock prices on each of the FOMC announcement dates and the day before
- *FEDMOVE* refers to a change in target Fed rates
- *EXP* refers to the expected change in target Fed rates
- *UNEXP* refers to the unexpected rate shift (a positive number means unexpected tightening), that is derived from the actual interest rate shift minus the expected change
- Subscript i refers to a changing firm-level dimension and t to the time dimension (for each of the FOMC announcement dates)

Model 1 examines the effect that changes in target Fed rates have on stock prices. On the other hand, the second model attempts to break this into the expected and unexpected components of the change. Moreover, both models 1 and 2A are subjected to two different types of regression. Unlike the first series, the second set of regressions would weigh the effects of each stock's market capitalization. The weighted regression acknowledges that bigger firms should have larger effects on the resultant coefficients. (I will discuss the effect of size, along with other firm characteristics, at greater length in a later section).

Table 1A: Breakdown of the Effects of Monetary Policy Changes on Stock Prices

	Unweighted		Weighted by Market Cap	
	coefficient	s.e.	coefficient	s.e.
Overall Change	-0.178***	[2.78]	0.456***	[2.78]
- Expected Element	0.160**	[2.53]	0.733***	[4.58]
- Unexpected Element	-5.165***	[19.68]	-4.955***	[7.50]

Notes: Dependent variable is the one-day percentage change in stock prices on each FOMC announcement event. This table shows the results of estimation models 1 and 2A. Number of asterisks next to regression coefficient denotes its significance level (: at 10%, **: at 5%, ***: at 1%). Standard errors are reported in square brackets.*

Let us turn our attention to the results as shown in Table 1A, first focusing on the first row of results. The overall change in the Fed target rate (corresponding to FEDMOVE in Model 1), appears to have a significant but negligible effect on stock prices. The coefficient suggests that for a 100 bps rate increase, I am likely to see less than a 0.2-percent drop in stock prices overall. Put another way, a 25 bps tightening by the Fed would have resulted in a mere 0.05-percent drop in the equity market. In the weighted regressions, the coefficient turns positive, albeit still negligible.

Likewise, the expected element of change looks to have statistically significant and yet negligible effects on stock prices. This appears to validate my view that market expectations have already been built into the share price movement prior to FOMC meetings. One can argue, for instance, that the effect of expected monetary policy movement on stock prices is merely a confirmation of the previously priced-in view and that it is negligible, as I have shown.

In contrast, the surprise element registers a much greater effect than either the change itself or the expected part of it. A hypothetical 25 bps unanticipated increase in the target Fed funds rate would result in a 1.29-percent one-day drop in share prices. I also witness a similar result for the weighted set of regressions. This effect is both highly significant and quantitatively important.

Putting the above results together, I deduce that share prices do not react much to the expected element of a policy rate shift or to the shift itself. Equity prices appear to be much more sensitive to a change that has not been previously anticipated. This conclusion serves as a springboard for the rest of this study. I now focus only on the unexpected element of target rate changes.

Does the Effect of Monetary Policy Surprises on the Stock Market Persist?

Here I examine in greater detail whether unexpected rate changes affect stock prices in a persistent manner, past the days of announcement. I suspect that monetary policy can explain only a small part of the overall movement of stock prices past the immediate impact on announcement days. Stock prices react to a multitude of other economic news and I would not be able to control for the numerous other factors that affect stock prices beyond the announcement dates.

To see whether there is indeed any persistent effect, I run a modified version of model 2 above. Instead of using a one-day change in stock prices as the dependent variable, I utilize a series of cumulative stock price changes that last up to five trading days:

$$r_{i,t+n} = \alpha + \gamma.EXP_t + \beta.UNEXP_t + \varepsilon_{i,t}\,, \qquad \text{(Model 2B)}$$

where *n* refers to the number of trading days after an FOMC announcement event.

Estimation results can be seen in Table 1B. Overall, there is evidence that suggests that an unanticipated monetary policy shock exhibits some effect on stock prices, beyond the day of announcement itself. However, unsurprisingly, this effect does not appear to be significant as time goes by. While a hypothetical 25 bps surprise rate cut gives a cumulative two-day change of around a 1.04-percent increase, the effect diminishes in both degree and significance by the third day.

Table 1B: Is the Effect of Monetary Policy Surprise on Stock Prices Persistent?

	Cumulative change in Stock Prices *n* days after FOMC announcement event			
	2	3	4	5
Unexpected Rate Change	-4.161***	-1.349***	1.377**	0.241
	[10.45]	[2.76]	[2.41]	[0.40]
R-squared value	0.01	0.00	0.00	0.01

Notes: Dependent variable is the cumulative percentage change in stock prices on each FOMC announcement event, for n days after the event. This table shows the estimation results of Model 2B. Number of asterisks next to regression coefficient denotes its significance level (: at 10%, **: at 5%, ***: at 1%). Standard errors are reported in square brackets.*

It is also worth noting that, as the R-squared value suggests, monetary policy begins to exhibit very negligible explanatory power with respect to cumulative changes in stock prices from the third day onward. This is not surprising. Whereas there is a significant and sizeable market reaction on the first and second day, the effect does not appear to persist beyond that. This is likely because, by the third day, the announcement is no longer a crucial factor that affects stock price movements, especially if I consider the multitude of factors that would influence its trajectory.

Heterogeneous Responses of Equity Prices

In this section, I attempt to explain how equity prices respond to monetary policy surprises. First, I note that it has been documented that share prices move in a heterogeneous fashion. That is, some shares are likely to register greater responses to the same external shock of a monetary policy surprise than others do. By examining the factors that can explain the dissimilar responses, I believe I can develop a better understanding of the impact that Fed rate policy has on the economy.

This section is broken up into five parts. The first looks at how different sectors and industry groups in the economy react differently to monetary policy surprises. The second subsection examines the role of firm characteristics in

explaining the heterogeneity. Next, I look at the question of whether components of the general economic environment, such as inflation expectations and prevailing interest rate levels, play any role in determining how share prices react. This is followed by a discussion of the roles of other macro-level indicators such as industrial production, the unemployment rate, and consumer confidence. Lastly, I examine whether split FOMC votes affect the market reaction.

Sectors and Industry Groups

Different sectors and industry groups in the economy can react quite differently to monetary policy movements. For instance, looking at the consumer goods sector, it is sensible to project that discretionary goods will be relatively more negatively affected by an unexpected rate hike than the staple goods sector, whose customers are less sensitive to rate hike-induced slowdowns in demand. Another factor that might come into play pertains to how capital-intensive the sector is, since interest rate movements would affect funding costs. Because the exchange rate is likely to be affected by interest rate changes, sectors that are involved in tradable goods could be more prone to monetary policy effects as well.

I run two separate models to examine the roles of sector and industry groups:

$$r_{i,t} = \alpha + \gamma.EXP_t + \beta.UNEXP_t + \varepsilon_{i,t} \qquad \text{(Model 3)}$$

$$r_{i,t} = \alpha + \gamma.EXP_t + \beta_1.UNEXP_t + \beta_2.UNEXP_t.x_i + \tau.x_i + \varepsilon_{i,t} \qquad \text{(Model 4)}$$

where:

- r refers to the percentage change between closing day stock prices on each of the FOMC announcement dates and the day before
- EXP refers to the amount of rate shift that has been expected by the market

- *UNEXP* refers to the unexpected rate shift (a positive number means unexpected tightening), that is derived from the actual interest rate shift minus the expected change
- *x* refers to dummies created to identify the GICS sector or industry group to which the firm belongs
- Subscript *i* refers to a changing firm-level dimension and *t* to the time dimension (for each of the FOMC announcement dates)

The first of the two is an OLS regression model first run for the entire panel, and then repeatedly for panel datasets consisting of each sector or industry group in turn. The results are reflected under "Overall Effect" on the left-hand panels of table 2 as β's. Model 4, on the other hand, is run for the entire panel dataset. By examining the whole panel at once, model 4 aims to determine how each sector/industry group moves *relative* to the entire markets. Conceptually, the β_2 terms from model 4 would be akin to the traditional *beta*, the measure of an individual stock's co-movement factor with a benchmark index, as suggested in a capital asset pricing model. This term is reflected in the right hand side of table 2 under the heading of "Difference to Average."

Having discussed the model specifications, I now turn my focus to the results as shown in table 2. Overall, I observe that unexpected interest rate cuts have a significant and positive effect on stock prices. This result suggests that each 100 bps of a hypothetical unexpected rate increase results in an average drop of 5.2 percent in stock prices. This finding is generally in line with suggestions in the literature. For instance, Ehrmann and Fratzscher (2004) find a 5.5-percent effect, while Bernanke and Kuttner (2003) record a 5.3-percent effect.

Table 2: Market Reaction to Monetary Policy by Sectors and Industry Groups

Sector & Industry Groups	Overall Effect		Difference to Average		R^2	Number of observations
	β	s.e.	β_2	s.e.		
Overall	*-5.165****	*[19.68]*			*0.02*	*32760*
Energy	-6.961***	[6.52]	-1.885*	[1.71]	0.03	2170
Materials	-6.117***	[6.10]	-0.940	[0.84]	0.04	1890
Industrials	-5.764***	[8.41]	-0.629	[0.85]	0.03	3640
Capital Goods	-6.549***	[8.01]	-1.367**	[2.51]	0.04	2380
Commercial Services & Supplies	-4.750***	[2.79]	0.383	[0.38]	0.02	630
Transportation	-3.810**	[2.25]	1.146	[1.06]	0.01	630
Consumer Discretionary	-5.371***	[9.01]	-0.259	[0.39]	0.02	5810
Automobiles & Components	-6.463**	[2.50]	-1.147	[0.75]	0.03	350
Consumer Durables & Apparel	-5.718***	[4.78]	-0.648	[0.87]	0.03	1610
Consumer Services	-3.565**	[2.56]	1.566*	[1.83]	0.01	910
Media	-4.386***	[3.78]	0.961	[1.36]	0.02	980
Retailing	-6.223***	[5.72]	-1.239*	[1.79]	0.03	1960
Consumer Staples	-1.717**	[2.55]	3.729***	[5.22]	0.00	2660
Food & Staples Retailing	-4.409**	[2.39]	0.933	[0.87]	0.01	630
Food, Beverage & Tobacco	-0.597	[0.81]	4.956***	[9.87]	0.00	1610
Household & Personal Products	-1.967	[1.48]	3.222***	[4.11]	0.01	420
Health Care	-4.194***	[5.12]	0.942	[1.11]	0.02	3360
Health Care Equipment & Services	-4.386***	[5.31]	0.877	[1.64]	0.02	1680
Pharmaceuticals, Biotechnology & Life Sciences	-4.002***	[2.81]	1.006	[1.19]	0.02	1680
Financials	-3.649***	[6.61]	1.601***	[2.61]	0.01	5740
Banks	-2.138**	[2.09]	3.171***	[4.87]	0.01	1750
Diversified Financials	-4.730***	[4.06]	0.149	[0.21]	0.02	1680
Insurance	-4.295***	[4.02]	1.230*	[1.83]	0.02	1400
Real Estate	-3.564***	[4.33]	1.831***	[3.26]	0.03	910
Information Technology	-8.340***	[9.27]	-3.675***	[4.04]	0.03	4690
Software & Services	-6.206***	[4.56]	-1.311	[1.64]	0.02	1750
Technology Hardware & Equipment	-8.445***	[5.06]	-3.483***	[3.59]	0.03	1680
Semiconductors & Semiconductor Equipment	-11.165***	[7.00]	-7.214***	[7.79]	0.04	1260
Telecommunication Services	-5.358***	[3.22]	0.748	[0.47]	0.02	490
Utilities	-3.976***	[4.41]	1.783*	[1.85]	0.02	2100

Notes: Dependent variable is the one-day percentage change in stock prices on each FOMC announcement event. Its reaction to monetary policy surprises is estimated by Models 3 and 4 in the paper. Number of asterisks next to regression coefficient denotes its significance level (: at 10%, **: at 5%, ***: at 1%). Robust standard errors are reported in square brackets.*

Next, I look at sector-based results in the same table, concentrating on the overall effects for each sector (rows in bold) on the left panel. Nearly all the sectors apparently react to monetary policy changes in a highly significant manner (at a 1-percent level). It is also noteworthy that the coefficients are negative across the board, suggesting that an unexpected tightening results in a general decrease in stock prices

on announcement days. Keep in mind that the same negative coefficient can also be signaling that any unexpected rate decrease (negative *UNEXP)* results in an increase in share price.

Furthermore, note that some sectors react more strongly than others do. It is not surprising, for instance, that the Consumer Discretionary sector exhibits a stronger reaction than the Consumer Staples one does. As the results suggest, an unexpected 100 bps rate cut would result in around a 5.4-percent jump in share prices of the cyclical, discretionary sector, while lifting the non-cyclical staples side by 1.7-percent. Energy and the IT sectors are among those that experience the greatest effects of any unexpected monetary policy changes, with the IT sector registering up to a 2.1-percent jump in one day, if there were to be a surprise rate cut of 25 bps.

Now, let us consider the results at the industry-group level. Within the IT sector, for example, results across industry groups can be differ considerably. The semiconductors industry group registers more than an 11-percent effect (at the 1-percent significance level), the highest among all the industry groups examined here. This could be because the relatively high impact of monetary policy on the IT sector is not due entirely to its being highly cyclical, but also partly its large portion of earnings from overseas. I will examine this line of thought more closely in the section on firm-level indicators. For a quick look, however, please turn to Table A1, where I show the distribution of firm-level indicators by sector. Under the heading of foreign sales ratio, you will find that the mean and median values for the IT sector far exceed the corresponding values for S&P 500 firms overall. This suggests that there might be a high degree of foreign exposure in this sector that could explain its relatively greater effect.

Let us shift our attention back to the results in table 2, but now focusing on the right-hand-side panel under the heading of "Difference to Average." Here, I have the chance to see whether each of the sectors or industry groups move differently, in a

significant manner, from the rest of the market. As mentioned earlier, the coefficients here are analogous to the *beta* suggested by the CAPM model.

Notice that the Consumer Staples sector shows a less-negative-than-average response to monetary policy movements, as compared with the conceptual *average* stock in the market. Moreover, the IT sector shows a more-negative-than-average response here, as well, to a significant extent. This suggests that the IT sector would be hit more severely by any unexpected tightening. On the other hand, it is also the sector that would benefit the most if rates were to come down more than previously expected. In comparison, although the Energy sector registers a more-negative-than-average response, it does so only at the 10-percent significance level, suggesting a weaker relationship.

Firm-Level Characteristics

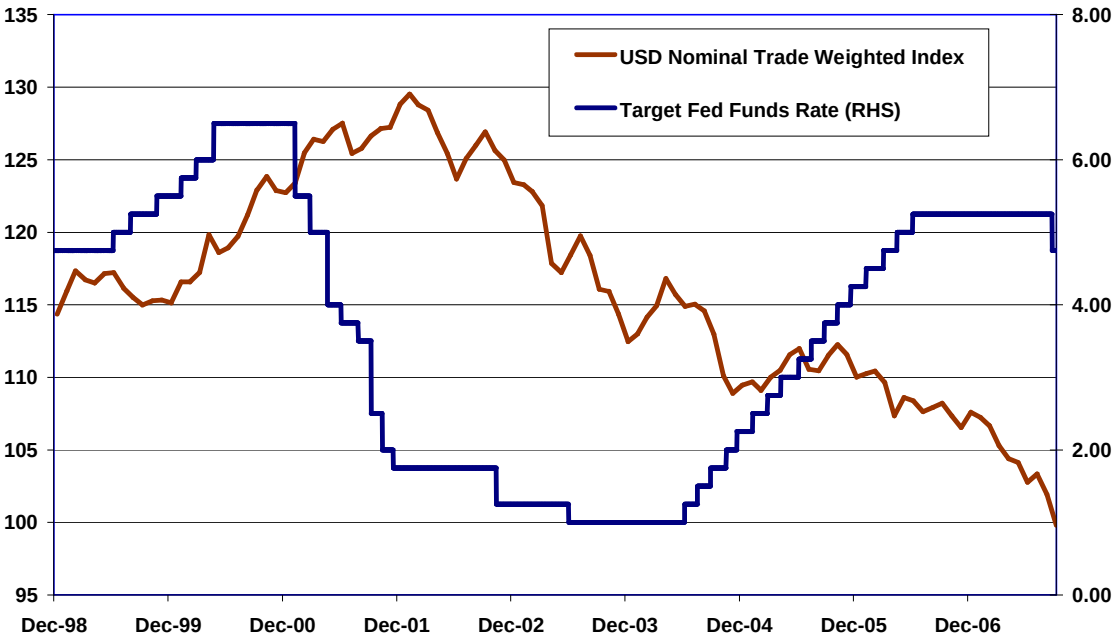
Here, I will attempt to determine some of the factors that can help to explain the asymmetric nature of monetary policy effects on different firms. One of these factors is the degree of financial constraints that a firm faces. Some firms might find that internally generated funds are enough to cover their investment needs. Others, however, will have to pursue a sourcing strategy to locate external funds. They may do so perhaps in debt markets and will therefore be more directly exposed to fluctuations in interest rates. I would expect to see a stronger effect of monetary policy surprises on stock prices in firms that depend heavily on external financing than in firms that do not.

There have been quite a number of studies of indicators that measure the degree to which a firm is financially constrained. Perez-Quiros and Timmermann (2000) use the size of firms as a proxy for financing constraints and find that smaller firms are more susceptible to monetary policy tightening and recessions than others

are. Factors other than size alone may, however, affect financing constraints. For instance, Kaplan and Zingales (1997), in their study of the link between investments and financing constraints, use a number of other more direct measures. One of these is a firm's cash-flow-to-income ratio, which indicates whether the firm has the potential to raise funds internally by using its own generated cash flows. A firm with a high cash-flow-to-income ratio, by this line of reasoning, would be less sensitive to monetary policy changes.

Other indicators in my model include market capitalization and revenue (measures of size), price-earnings ratio (a measure of how "expensive" a stock is relative to the firm's earnings), and market-to-book ratio (as a proxy for Tobin's q).

Most of the indicators above have been examined by Ehrmann and Fratzscher (2004) and are found to have some explanatory power in considering how monetary policy surprises affect stock prices.



Source: CEIC. Notes: USD Nominal Index indicates the value of the dollar relative to other currencies, weighted by the trading volume between the US and the respective countries. This index is set to the value 100 in January 1997.

Figure 5: Interest Rates and the U.S. Dollar

This study makes a distinctive contribution to the literature by examining the ratio of a firm's foreign sales to total sales. A country's interest rate level might have a significant impact on the exchange rate. (Figure 5 shows us the relationship between the target Fed funds rate and the trade-weighted value of the US dollar over the sample period.) If the interest rate is cut unexpectedly, it can be argued that currency will be subjected to unforeseen depreciation pressure as well. In turn, cheaper currency benefits firms that sell a good portion of their products or services overseas. Among other things, this enables them to compete on price more effectively, and perhaps provides a boost in sales. Moreover, if price and revenue levels remain steady, the same amount of foreign currency-denominated earnings now translates to a higher amount of local currencies—which means more dollars on the balance sheets.

One shortcoming that arises from including this indicator in my model is that I am able to obtain only five-year average foreign sales numbers from my database vendor. Since I obtained the data in October 2007, the numbers reported are those for fiscal year 2006. By extension, the number reflects the average for the fiscal years 2002 – 2006. I account for this shortcoming by culling my dataset down to the corresponding years of 2002 onward when I run the model for this indicator.

For the sake of completeness, I include this indicator for the entire dataset alongside all the other indicators. Doing this might appear to be rather puzzling at first. However, keep in mind that, in consideration of the way my model is set up (as detailed below), the basic assumption with this approach is that the degree of foreign exposure of each firm *relative* to other firms remains the same throughout the time period. That is to say, what I am dictating to the model is that a firm that is considered to be highly exposed relative to its peers in the 2002 – 2006 period has actually maintained this relative standing from the year 1999 onward.

For the foreign-sales-to-total-sales ratio, as well as for each of the other firm-level indicators, I classify firms according to where they stand relative to one another, at each FOMC announcement event.

There are two versions of cut-off points that I am using in the classification. The first one is the "33-66" classification, whereby a firm is classified as belonging to the "high" category in an indicator, say, Tobin's q, if it falls above the 66th percentile, and "low" when it falls below the 33rd percentile. The second version is the 10-90-percent classification, whereby the 10th and 90th percentiles are used as cut-off points instead. I should mention an issue associated with this "10-90" approach. The distribution of indicators such as the foreign sales ratio tends to have a heavy tail at the lower ends, since zero is the number reported by quite a large number of firms. In this case, zero can become the 10th percentile number, rendering the cut-off point ineffective.

With such considerations in mind, I set out to run the following model:

$$r_{i,t} = \alpha + \gamma.EXP_t + \beta_1.UNEXP_t + \sum_{z=1,2} \beta_{z,2}.UNEXP_t.x_{z,i,t} + \sum_{z=1,2} \tau_z.x_{z,i,t} + \varepsilon_{i,t}, \quad \text{(Model 5)}$$

where:

- r refers to the percentage change between closing day stock prices on each of the FOMC announcement dates and the day before
- *EXP* refers to the amount of rate shift that has been expected by the market
- *UNEXP* refers to the unexpected rate shift (a positive number means unexpected tightening), that is derived from the actual interest rate shift minus the expected change
- x_z is the dummy representing where the firm lies in the distribution of each firm-level indicator, at each FOMC announcement period (z=1 when a firm belongs to the "low" category, z=2 when the firm belongs to the "high" category; and the medium level is naturally coded and serves as the baseline case for this model)

- Subscript *i* refers to a changing firm-level dimension and *t* to the time dimension (for each of the FOMC announcement dates)

We can see the results in table 3. First, size helps to explain the asymmetric nature of firms' responses to monetary policy surprises, but only to a limited extent. For the average-sized firms, as indicated by both versions of a "medium" classification of market cap and revenue, the reactions to monetary policy surprises are largely in line with the 5-percent or so response registered for all stocks earlier in table 1. Less-capitalized firms react more favorably to any unexpected monetary easing, with the bottom 10-percent of firms registering up to a 2.1-percent increase in stock price for each hypothetical unexpected 25 bps cut in the interest rate. This finding lends some weight to the argument that size can serve as a proxy for financing constraints.

There is, however, little evidence to indicate that highly capitalized firms are sensitive to interest rate surprises at all. Arguably, bigger firms do not face the same kind of financing constraints as smaller firms, and thus do not enjoy the "relief" brought by lower interest rates as much as the rest of the pack. If that is true, any monetary policy change appears to be largely a non-event for this group.

I move on to examine the factor of internal financing capability, by looking at cash-flow-to-sales ratio. There is some evidence suggesting that unexpected monetary easing can be more beneficial to firms with limited internal financing capability (and thus more dependent on outside sources). On the flip side, interestingly enough, firms that exhibit the highest 10-percent of cash flow relative to their sales show significantly lower effects than the average firm does on similar occasions. Presumably, the markets might come to see the spirit of extreme self-reliance less favorably, now that external financing has become a relatively cheaper option, if the rates were to come down unexpectedly.

Table 3: Firm-level Indicators and the Effect of Monetary Policy Surprises

Indicator	33% - 67% Categorization		10% - 90% Categorization	
	$\beta_1 + \beta_{2,z}$	s.e.	$\beta_1 + \beta_{2,z}$	s.e.
Market Capitalization				
Low	-6.128*	[1.80]	-8.177***	[2.96]
Medium	-4.921***	[10.90]	-4.987***	[17.51]
High	-4.527	[0.65]	-3.862	[1.44]
Revenue				
Low	-5.755*	[1.66]	-5.051	[0.24]
Medium	-4.685***	[10.76]	-5.308***	[18.48]
High	-5.091	[0.65]	-4.217	[1.34]
Cashflow-to-Sales Ratio				
Low	-6.139**	[2.00]	-6.875	[1.63]
Medium	-4.859***	[10.74]	-5.234***	[18.41]
High	-4.582	[0.43]	-3.182**	[2.26]
Market-to-Book Ratio				
Low	-5.718	[1.61]	-7.536**	[2.14]
Medium	-4.680***	[11.30]	-4.955***	[18.05]
High	-5.221	[0.88]	-4.853	[0.12]
Price Earnings Ratio				
Low	-4.668	[0.20]	-5.355	[0.73]
Medium	-4.795***	[11.68]	-4.587***	[16.84]
High	-4.808	[0.02]	-5.551	[0.95]
Foreign Sales Ratio (2002-2007)				
Low	-7.186	[0.01]	.	.
Medium	-7.177***	[11.94]	-7.698***	[20.14]
High	-9.262**	[2.22]	-9.404	[0.96]
Foreign Sales Ratio (all years)				
Low	-4.427	[0.27]	.	.
Medium	-4.617***	[9.08]	-4.951***	[16.03]
High	-6.768***	[2.83]	-8.064**	[2.54]

Notes: Dependent variable is the one-day percentage change in stock prices on each FOMC announcement event. Its reaction to monetary policy surprises is estimated by Model 5 in the paper. Number of asterisks next to regression coefficient denotes its significance level (: at 10%, **: at 5%, ***: at 1%). Robust standard errors are reported in square brackets.*

I use market-to-book ratio as a proxy for Tobin's q, as a number of studies including Kaplan and Zingales (1997) and Ehrmann and Fratzscher (2004) have done. There is some ambiguity as to how best to read this number, in relation to my study. On the one hand, a low Tobin's q means low market value for a firm's assets. This affects the collateral, hence creditworthiness and, in turn, the degree to which a firm is constrained in seeking external funding. On the other hand, the same low Tobin's q

number might also indicate that there is a dearth of investment opportunities that are worth pursuing at that point in time. That translates to less need for investment funding to start with.

Such ambiguity in the impact of Tobin's q on a firm's financing constraints might help explain my results. Among the few significant results, the one that stands out is that the bottom 10 percent of Tobin's q members enjoys an extra 2.5-percent effect in their stock prices over and above the average member. To some extent, this shows that Tobin's q suggests more about a firm's credit channel constraints than it does about the lack of investment opportunities.

I do not find P/E ratio to be an important factor in explaining how one firm is affected more than others are by monetary policy surprises. This differs from Ehrmann (2004), who finds that firms with high P/E react more strongly than others do.

Next, I consider the foreign sales ratio, to see if it is a significant factor in explaining the effects of monetary policy surprises. For the years 2002 – 2007, the period in which the foreign sales data are available, I observe a significant coefficient for the top 33 percent of the most foreign-exposed firms. An unexpected rate increase has a higher impact on this group than on the average firms. Results suggest that the same hypothetical 25 bps rate cut would increase the stock prices of these firms by 0.5 percent more than it would those of others. For the case of a more liberal use of this ratio, I extend the relative standing of firms in 2002 – 2007 to cover the entire period of 1999 onward. I see similar results in this case, with the difference being only that the top 10 percent of such firms see a now-significant extra return, as well.

The results for this indicator are not particularly surprising. In fact, given data availability issues, I did not expect conclusive results. The inclusion of this variable is largely motivated by my view that foreign exposure should not be overlooked as a factor in examining how firms react to monetary policy surprises.

As a further thought on this issue, and perhaps as fodder for further research interests, I ought to include other measures as well in examining the role of foreign exposure to explain the impact of monetary policy surprises. For instance, the exchange rate effect impacts not only those firms that sell portions of their goods or services abroad. A currency that is experiencing depreciation pressure, for instance, has a negative impact on importing firms as well. Under such conditions these firms now have to deal with the cost of goods sold, which is higher in local currency terms than it was before.

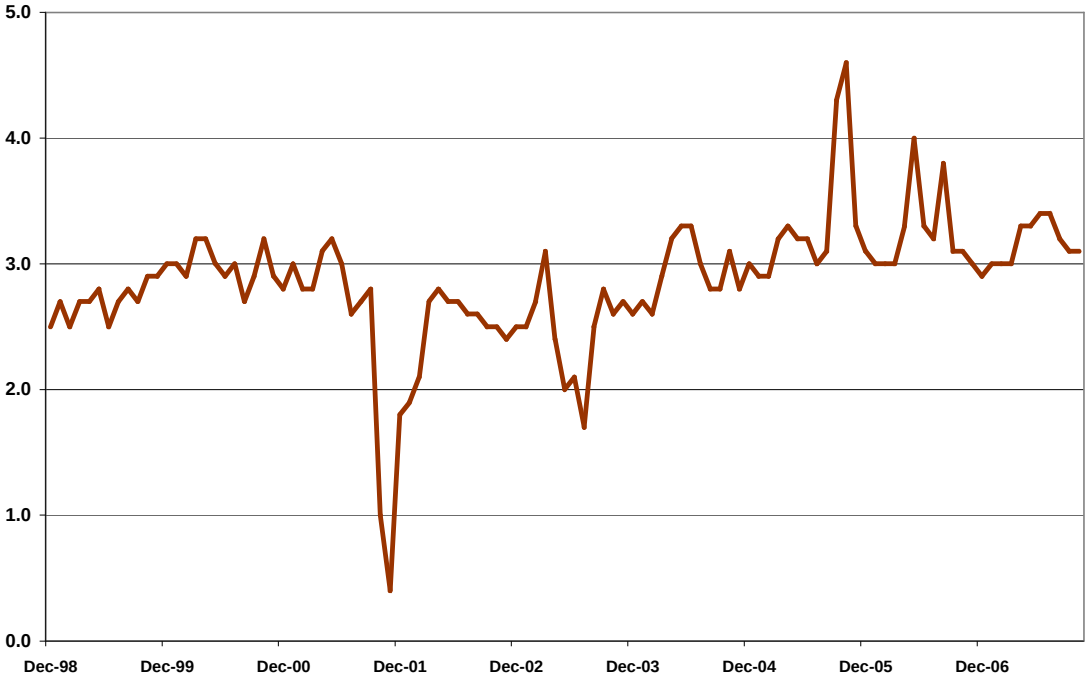
The Prevailing Interest Rate Environment and the Role of Inflation Expectations

In this section, I analyze whether the nature of stock market reactions to monetary policy surprises is affected by the prevailing interest rate and inflation expectations.

For instance, in a loose monetary environment, whereby the markets have been experiencing low interest rate level, a surprise rate cut would perhaps be less welcome than usual. Perhaps, there might be concern that there is going to be increasingly little room left for the Fed to maneuver should the economy shows further signs of distress. On the other hand, a previously tight monetary condition might have been kept at that level, with the purpose of keeping inflationary pressures in check. In that case, the positive impact of a surprise rate reduction on stock market might be largely tempered.

Inflation expectations might conceivably play a significant role in determining stock market reactions, as well. During episodes of high inflation expectations, economic agents including the markets would likely be more worried about any additional inflationary pressure that comes from growth-stimulating monetary policy loosening. Conversely, if the market expects inflation to be low, the growth-inducing

effect of an interest rate cut will be felt most acutely. Figure 6 shows us the development of the inflation expectation over the sample period, with the data showing a wide range from the low level of expectation of less than 1 percent in 2001 to the peak in 2005.



Source: CEIC and University of Michigan. Notes: Inflation expectation data comes from University of Michigan's surveys polling participants' expectation of inflation level one year ahead.

Figure 6: Inflation Expectations

To structure a model with which I can test out my arguments, I first generate a dummy to identify the interest rate environment that my agents are facing the day before FOMC announcements. For this purpose, I classify each observation into one of three categories—high, medium, or low—to characterize the prevailing interest rate environment. The categories are defined such that the middle third of the distribution of interest rates (i.e., 33 percent – 67 percent) fall into the "medium" category, the bottom third into the "low" category, and the top third into the "high"

category.[5] For the dataset panels that I am reviewing in this paper, the cut-off points are such that interest rates are "low" when they fall below two percent, and "high" when they are five percent or above.

I then run the following model repeatedly for each of my sector-based panels:

$$r_{i,t} = \alpha + \beta_1 .UNEXP_t + \sum_{z=1,2} \beta_{z,2} .UNEXP_t .x_{z,i,t} + \sum_{z=1,2} \tau_z .x_{z,i,t} + \varepsilon_{i,t} \qquad \text{(Model 6)}$$

where:

- *r* refers to the percentage change between closing day stock prices on each of the FOMC announcement dates and the day before
- *EXP* refers to the amount of rate shift that has been expected by the market
- *UNEXP* refers to the unexpected rate shift (a positive number means unexpected tightening), that is derived from the actual interest rate shift minus the expected change
- *x* refers to dummies created to identify the GICS sector or industry group in which the firm belongs to
- Subscript *i* refers to a changing firm-level dimension and *t* to the time dimension (for each of the FOMC announcement dates)
- *z* is a subscript representing the state of prevailing interest rate environment (z=1 when interest rate is deemed low, z=2 when rate has been considered high; and the medium level is naturally coded and serves as the baseline case for this model)

I repeat a similar procedure for studying the role of inflation expectations. Data for this are obtained from the commonly used benchmark survey done by the University of Michigan, whereby participants are asked to gauge what they think the inflation level will be 12 months forward. Akin to the prevailing interest rate, I split

[5] This structure is similar to Ehrmann & Fratzscher (2004)'s treatment of firm-level indicators in their models. I will be using this approach liberally as well in my examination of firm-level indicators in the next sub-section.

the inflation expectation data into three groups. However, because its distribution is heavily concentrated toward the mean of 2.9, I decided to shift the cutoff points such that anything below the 25th percentile is considered "low," anything above the 75th percentile is "high," with the remainder being "medium." Moreover, I estimate the degree to which the inflation expectation alters the effect of monetary policy surprises on stock prices using the model below:

$$r_{i,t} = \alpha + \beta_1 . UNEXP_t + \sum_{m=1,2} \beta_{m,2} . UNEXP_t . x_{m,i,t} + \sum_{m=1,2} \tau_m . x_{m,i,t} + \varepsilon_{i,t} \qquad \text{(Model 7)}$$

where:

- *r* refers to the percentage change between closing day stock prices on each of the FOMC announcement dates and the day before
- *EXP* refers to the amount of rate shift that has been expected by the market
- *UNEXP* refers to the unexpected rate shift (a positive number means unexpected tightening), that is derived from the actual interest rate shift minus the expected change
- *x* refers to dummies created to identify the GICS sector or industry group to which the firm belongs
- Subscript *i* refers to a changing firm-level dimension and *t* to the time dimension (for each of the FOMC announcement dates)
- *m* is a subscript representing the state of inflation expectation level (m=1 when inflation expectation is low, m=2 when it has been considered high; and the medium level is naturally coded and serves as the baseline case for this model)

Next, I turn my attention to the estimation results. Table 4 shows the results of running model 6, where I can infer how firms in each sector react to unexpected changes in monetary policy, depending on whether the prevailing interest rate environment has been high, average, or low relative to the overall condition during

the time period covered. The coefficients for each sector refer to the sums of β_1 (the coefficient of delta alone) and $\beta_{z,2}$ (the coefficient of the interaction term of delta and the interest rate environment).

Table 4: Effects of the Prevailing Interest Rate Environment on Market Reactions

Sector	Prevailing Interest Rate Environment			R^2	No. of obs.
	Low	Medium	High		
Overall					
$\beta_1 + \beta_{z,2}$	-5.657***	-8.057***	-4.000***	0.05	7955
s.e.	[3.39]	[14.40]	[5.93]		
Energy					
$\beta_1 + \beta_{z,2}$	-8.562**	-16.887***	-3.024***	0.04	2170
s.e.	[2.46]	[6.52]	[4.86]		
Materials					
$\beta_1 + \beta_{z,2}$	-9.378	-6.770***	-3.586	0.04	1890
s.e.	[1.21]	[3.97]	[1.33]		
Industrials					
$\beta_1 + \beta_{z,2}$	-7.403	-7.611***	-4.064*	0.03	3640
s.e.	[0.11]	[4.71]	[1.78]		
Consumer Discretionary					
$\beta_1 + \beta_{z,2}$	-3.847***	-11.156***	-4.847***	0.03	5810
s.e.	[4.85]	[8.75]	[3.93]		
Consumer Staples					
$\beta_1 + \beta_{z,2}$	0.344***	-6.782***	-1.781*	0.01	2660
s.e.	[3.00]	[2.93]	[1.95]		
Health Care					
$\beta_1 + \beta_{z,2}$	-6.978*	-3.877***	-2.277	0.02	3360
s.e.	[1.72]	[2.63]	[0.82]		
Financials					
$\beta_1 + \beta_{z,2}$	-0.935***	-6.371***	-4.840	0.02	5740
s.e.	[5.16]	[7.36]	[1.16]		
Information Technology					
$\beta_1 + \beta_{z,2}$	-11.353	-9.786***	-5.765*	0.03	4690
s.e.	[0.57]	[4.63]	[1.70]		
Telecommunication Services					
$\beta_1 + \beta_{z,2}$	-6.307	-4.409	-4.940	0.02	490
s.e.	[0.34]	[1.00]	[0.11]		
Utilities					
$\beta_1 + \beta_{z,2}$	-7.063**	-2.027	-2.298	0.02	2100
s.e.	[2.28]	[1.51]	[0.15]		

Notes: Dependent variable is the one-day percentage change in stock prices on each FOMC announcement event. This table shows the estimation results of Model 6. Number of asterisks next to regression coefficient denotes its significance level (: at 10%, **: at 5%, ***: at 1%). Robust standard errors are reported in square brackets.*

Overall, share prices react most strongly to monetary policy surprises in a medium interest rate environment, with this effect somewhat tempered in a low rate environment. In a medium rate environment, the results suggest that I ought to see around an 8-percent decrease in share prices from an unexpected 100 bps interest rate hike, which translates to a 2-percent decrease for every 25 bps in surprise tightening. When rates have been low, on the other hand, the effect decreases to about 5.7 percent. I see an even more measured reaction if the prevailing interest rate environment has been relatively high. On average, if rates have been high, I see only a 4.0-percent response to a 100 bps monetary policy shift.

Looking at table 4 across different sectors, I notice that an unexpected interest rate hike might even trigger an *increase* in stock prices when the rates are already quite low, as in the case of the Consumer Staples sector. The Financials sector, which registers up to a 6.4-percent rise in share prices for every unexpected 100 bps rate cut in a medium rates environment, sees this effect decreasing to less than 1 percent in a low rates environment. Generally speaking, for the majority of sectors, I see a smaller effect of monetary policy surprises in a low interest rates environment, than when rates are hovering in the middle range.

Across sectors, I do not see any negative coefficients for responses to monetary policy surprises in a high interest rate environment. On the other hand, the values of the responses are, more often than not, lower compared with those in a medium interest rate environment. Together, this suggests that markets still welcome any growth stimulus that comes from unexpected easing of the interest rate. Their responses in this case are generally more tempered, however, perhaps suggesting that markets remain quite cautious about the presence of inflationary risks.

I now turn my attention fully to the role of inflation expectations, by considering table 5, which contains the estimation results for model 7, more closely.

Table 5: Effects of Inflation Expectations on Market Reactions

Sector	Prevailing Inflation Expectation Environment			R^2	No. of obs.
	Low	Medium	High		
Overall					
β	-6.186***	-4.328***	-0.584***	0.02	32760
s.e.	[3.36]	[11.61]	[3.83]		
Energy					
β	-6.230	-7.159***	0.588**	0.03	2170
s.e.	[0.40]	[5.98]	[2.02]		
Materials					
β	-9.595**	-4.571***	0.126	0.05	1890
s.e.	[2.52]	[2.97]	[0.99]		
Industrials					
β	-8.299***	-4.604***	6.385***	0.03	3640
s.e.	[2.64]	[4.26]	[4.10]		
Consumer Discretionary					
β	-4.594	-5.547***	-3.136	0.02	5810
s.e.	[0.78]	[6.05]	[0.74]		
Consumer Staples					
β	-0.703	-2.172**	-9.401**	0.01	2660
s.e.	[1.12]	[2.04]	[2.33]		
Health Care					
β	-7.234***	-1.965	-3.456	0.02	3360
s.e.	[3.38]	[1.60]	[0.56]		
Financials					
β	-2.188**	-5.048***	3.411***	0.02	5740
s.e.	[2.55]	[5.50]	[4.77]		
Information Technology					
β	-11.271***	-4.806***	2.824***	0.05	4690
s.e.	[3.39]	[4.56]	[3.26]		
Telecommunication					
β	-5.498	-3.805*	-7.314	0.03	490
s.e.	[0.44]	[1.82]	[0.61]		
Utilities					
β	-8.903***	-1.151	-8.443***	0.04	2100
s.e.	[4.02]	[1.09]	[3.91]		

Notes: Dependent variable is the one-day percentage change in stock prices on each FOMC announcement event. This table shows the results of estimation of Model 7. Number of asterisks next to regression coefficient denotes its significance level (: at 10%, **: at 5%, ***: at 1%). Robust standard errors are reported in square brackets.*

First, let us focus on the overall segment for the whole S&P 500, with respect to which I notice that the largest effect is registered when the inflation expectation has been low. The result suggests that a 25 bps rate hike would decrease stock prices by 1.55 percent in one day. We could also say that stocks would go up by the same

degree if rates were cut rather than increased. This means that, during episodes of low inflation expectations, any surprise rate hike is mostly deplored, and any unexpected rate cut is most welcome.

In contrast to its large effect on stock prices during a low inflation expectation episode, a surprise monetary policy movement shows only a limited effect if inflation expectations have been high. As the estimation result suggests, stock prices barely move in such cases. An unexpected 25 bps rate hike would have resulted in a mere 0.15-percent one-day drop in prices, barely a tenth of the effect registered if inflation expectations had been low.

So far, I have discussed only the role that inflation expectations play in explaining the effects of monetary policy surprises on the *overall* stock market. It is interesting for us to examine the impact of inflation expectations across different sectors of the economy as well. Perhaps the first thing that comes to mind, as I scan the sector-by-sector estimation results in table 5, is that they are highly divergent.

During a period of high inflation expectations, there are even some sectors, such as Industrials and IT, that show positive coefficients. This runs counter to my earlier finding when I look at the effect on the overall S&P 500, whereby a negative coefficient suggests that rate hikes are detrimental to stock prices. In this case, however, at least for some sectors, rate hikes apparently result in higher stock prices. One way to read this would be that these sectors are highly sensitive to inflationary pressures. Industrials and IT, for example, would be quite sensitive to wage demands as well as the price of raw materials. Therefore, they are the sectors most likely to welcome any measure to combat inflation. For these sectors, the positive effect of rate-hike-induced inflation control more than outweighs the negative impact of the rate hike itself.

The Potential Role of Other Macro-Level Economic Indicators

Earlier, I explored the role of prevailing interest rate and inflation expectations in explaining the variation of stock market reactions to monetary policy surprises. It should be noted, however, that those two are by no means the only macro-level indicators that could matter. In this section, I explore the relevance of industrial production, the unemployment rate, and consumer confidence levels. The general intention is to control for the different states of the economy at various points in time, and ask whether the reaction of the stock market to surprise monetary policy changes depend on how well the economy is doing.

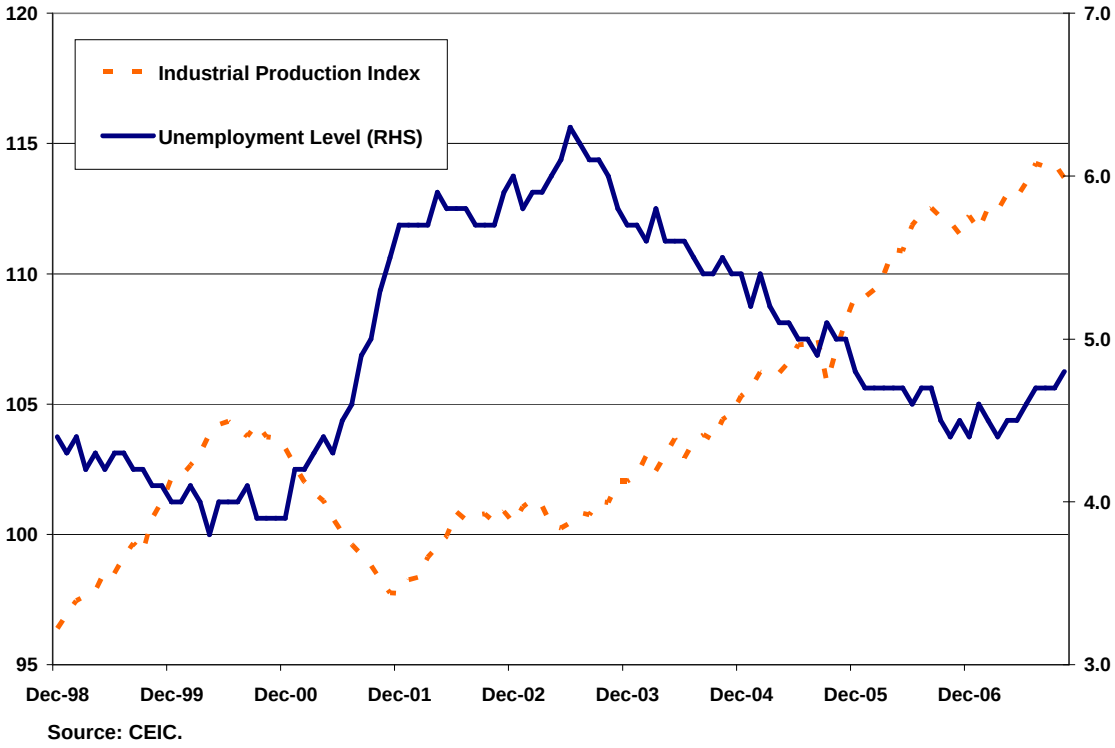
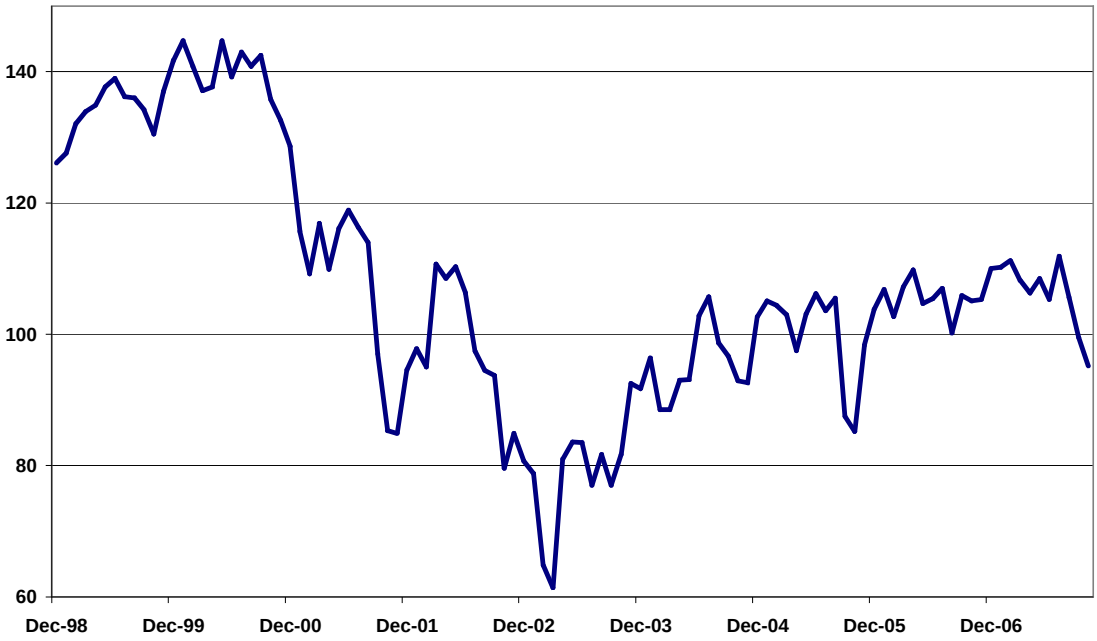


Figure 7: Industrial Production and the Unemployment Rate

For instance, the industrial production index signals the performance of manufacturing industries, a key part of the economy. The unemployment rate and the consumer confidence level are the other important indicators under consideration here. A high unemployment rate and a low consumer confidence level would have

signaled that the economy is in trouble. Arguably, the market would warmly welcome any unanticipated rate cut during such episodes, in the hope that the monetary easing could give the economy a shot in the arm. Figures 7 and 8 show us the trends for these indicators over the sample period.



Source: CEIC and University of Michigan. Notes: Consumer Confidence index is derived from Conference Board's surveys of consumer attitudes and buying intentions for six months hence. A higher reading means consumers feel more confident.

Figure 8: Consumer Confidence Index

To test whether these indicators have the expected effects, I have first classified each indicator into three tiers: the top, middle, and bottom thirds, in terms of value. For my analysis, I am attributing the latest available observations of the indicators with respect to each FOMC announcement event. In this case, the data on all three indicators are available on the first day of the month. For unemployment data, its *level* is used for tier classification. On the other hand, I am utilizing *changes* from preceding periods (month-to-month changes) for the consumer confidence and industrial production indicators. I then run regressions for the following model for each of the three indicators.

$$r_{i,t} = \alpha + \beta_1 .UNEXP_t + \sum_{z=1,2} \beta_{z,2} .UNEXP_t .x_{z,t} + \sum_{z=1,2} \tau_z .x_{z,t} + \varepsilon_{i,t} \qquad \text{(Model 7)}$$

where:

- *r* refers to the percentage change between closing day stock prices on each of the FOMC announcement dates and the day before
- *EXP* refers to the amount of rate shift that has been expected by the market
- *UNEXP* refers to the unexpected rate shift (a positive number means unexpected tightening), that is derived from the actual interest rate shift minus the expected change
- x_z is the dummy representing the distribution of macro-level indicators (Unemployment Level, Change in Consumer Confidence, Change in Industrial Production), for each FOMC announcement event (z=1 when the episode belongs to the "low" category, z=2 when it falls within the "high" category; and the medium level is naturally coded and serves as the baseline case for this model)
- Subscript *i* refers to a changing firm-level dimension and *t* to the time dimension (for each of the FOMC announcement dates)

Table 6 contains the results of this exercise. First, let us turn our attention to the Industrial Production indicator. Notice that the effect seems to be the strongest and most significant in the "Low" category, where industrial production has grown most slowly (or has even declined) compared with the previous period. During these episodes, a hypothetical unanticipated 25 bps rate cut would result in about a 2.5-percent increase in stock prices in one day, as compared with about an increase of 1.2 percent for the "Medium" category. This suggests that the market reacts most strongly to monetary policy surprises when industrial production shows signs of difficulties.

Table 6: Effects of Other Macro-Level Indicators on Market Reactions

Macro-Level Indicator	Classification	Degree of Market Reaction	R^2
Industrial Production	*Low*	-10.177 [8.20]***	0.02
	Medium	-4.579 [11.63]***	
	High	-3.670 [1.52]	
Unemployment Rate	*Low*	-4.694 [1.48]	0.02
	Medium	-3.600 [5.81]***	
	High	-6.133 [3.41]***	
Consumer Confidence	*Low*	-5.165 [1.35]	0.02
	Medium	-6.056 [11.74]***	
	High	-4.845 [1.79]*	

Notes: Dependent variable is the one-day percentage change in stock prices on each FOMC announcement event. Its reaction to monetary policy surprises is estimated by Model 8 in the paper. Number of asterisks denotes its significance level (: at 10%, **: at 5%, ***: at 1%). Standard errors are reported in square brackets.*

The notion that the market is most responsive when times are bad is supported also by results for the unemployment rate indicator. When the unemployment rate is relatively high, an unexpected 25 bps rate cut is significantly associated with a more than 1.5-percent increase in stock prices, as compared with an increase of less than 1 percent during a period of "Medium" level unemployment.

With regard to the consumer confidence indicator, there is no significant sign that the market reacts most strongly when consumer confidence has been relatively low. There is some evidence that the market response is weaker when consumer confidence has been high. However, this result is significant only at the 10-percent level.

The Effect of Dissenting Votes in the FOMC

In this section, I set out to analyze whether a lack of unanimity in FOMC decisions impacts the reaction of the stock market to monetary policy surprises. The FOMC makes its decisions based on a majority vote among its twelve members.[6] While this setup allows the committee to tap fully into the collective wisdom of its members, any lack of unanimity could cast a shadow over its ultimate decisions.

It is conceivable that the market might see dissenting votes as a sign of internal disagreement within the FOMC about the best course of action to undertake. Especially during times of uncertainty, when FOMC decisions are naturally under more intense scrutiny, the market comes to expect a semblance of clear direction and resolve from the policymakers—and split votes are not all that reassuring.

Here, I propose a model that could help us examine whether a split vote in the FOMC has any significant impact on the market, and if so, by how much.

$$r_{i,t} = \alpha + \gamma.EXP_t + \beta_1.UNEXP_t + \beta_2.UNEXP_t * DISSENT_t + \tau.DISSENT_t + \varepsilon_{i,t}$$

(Model 9)

where:

- *r* refers to the percentage change between closing day stock prices on each of the FOMC announcement dates and the day before
- *EXP* refers to the amount of rate shift that has been expected by the market
- *UNEXP* refers to the unexpected rate shift (a positive number means unexpected tightening), that is derived from the actual interest rate shift minus the expected change
- *DISSENT* is a dummy variable which takes the value of 1 if there are *any* dissenting FOMC votes, and 0 if the decision is unanimous

[6] The Federal Open Market Committee (FOMC) is a 12-member committee, which consists of the seven members of the Fed's Board of Governors; the president of the Federal Reserve Bank of New York; and, on a rotating basis, the presidents of four out of eleven other Reserve Banks.

- Subscript *i* refers to a changing firm-level dimension and *t* to the time dimension (for each of the FOMC announcement dates)

This model allows us to look at two separate effects. First, by including *DISSENT* as a standalone regressor dummy, I can see if a split vote affects stock prices directly. Next, with the interaction variable of *UNEXP*DISSENT*, I am able to examine if the split vote has any pass-through effect on how monetary policy surprises (unexpected rate shifts) affect stock prices.

Table 7: How Dissenting FOMC Votes Affect Market Reactions

Explanatory Variable	Effect on Stock Prices
Expected Change	0.101 [1.47]
Unexpected Change	-5.168 [17.37]***
Unexpected Change, Interacted with Dissent	4.515 [7.03]***
Dissent	-0.521 [14.32]***
R^2 No. of Observations	0.02 32760
Notes: Dependent variable is the one-day percentage change in stock prices on each FOMC announcement event. This table shows the results of estimation of Model 8. Number of asterisks next to regression coefficient denotes its significance level (: at 10%, **: at 5%, ***: at 1%). Robust standard errors are reported in square brackets.*	

The estimation results are presented in table 7. As suggested, *DISSENT* clearly has a direct effect on stock prices. It contributes to a more than 0.5-percent decline in prices. In other words, a unanimous FOMC decision would have been "worth" a 0.5-percent upside in stock prices. This shows that the market views any sign of a split vote within the FOMC negatively, perhaps due to the confusing signal that it sends.

Moreover, a split vote also presents a significant secondary effect on stock prices; it waters down the reaction substantially. A surprise 25 bps rate hike now

results in only a 0.16-percent decline in stock prices, compared with a nearly 1.3-percent drop during episodes of unanimous decisions. One explanation why a split vote results in a discounted reaction in stock prices could be that the market develops doubt over the Fed's resolve in keeping rates at the new level. If there is a member or two who think that the new interest rate level is not the "correct" one for the economy, there is perhaps a higher likelihood that the measure will be reversed in the near future.

Conclusion

This paper has analyzed the stock market's reaction to monetary policy surprises, using an event-study approach for data on S&P 500 constituents for the period between December 1998 and September 2007. I have found that a quarter-point unanticipated surprise rate cut would, on average, result in an increase of 1.3 percent in stock prices. This result is largely in line with findings in the literature, such as those of Bernanke and Kuttner (2005) and Ehrmann and Fratzscher (2004). My results also suggest that the stock market reacts substantially and significantly to target rate changes up to the second day after FOMC announcements, but not beyond that.

The main focus of my study, however, was to examine factors that could explain the asymmetric nature of the stock market response. Indeed, I have found that the strongest stock price reaction is exhibited by companies that are relatively small in market capitalization, more highly leveraged, or operate in cyclical sectors such as Consumer Discretionary and Information Technology. I have also found some evidence suggesting that firms with higher foreign earnings exposure react more to the rate change than the more domestically oriented ones, partly due to the knock-on effect of interest rates on the foreign exchange value of the US dollar.

I observe that monetary policy has the strongest impact in a medium interest rate environment, and when inflation expectations have been low. I conjecture that the market believes the central bank enjoys the greatest ease of movement in such an environment—with room for either higher or lower rate shifts and a lack of inflationary pressure on the horizon.

In contrast, the effect is highly diluted if inflation expectations have been high. Possibly, monetary easing has the potential to be inflationary in nature. This potential becomes especially pronounced in an environment characterized by high inflation expectations and acts to negate the stimulus, resulting in negligible net impact. In fact, in some sectors, such as Information Technology and Industrials, which are arguably more sensitive to price pressures from any rise in costs of materials and wage demands, a surprise rate cut even appears to result in a *drop* in stock prices.

I further found that the market favors unanimous decisions over split votes from the FOMC. My examination shows that dissenting votes have a direct impact on stock prices, bringing them down on average by a half-percent in one day. Moreover, it appears that the market reacts rather differently to a monetary policy surprise when the FOMC votes unanimously as compared with when there has been a split vote in its decision.

Overall, my results imply that stock prices react significantly to monetary policy surprises on the day of an FOMC announcement, and that this reaction is asymmetric across sectors, firm characteristics, and some indicators of factors in the macroeconomic environment such as the prevailing interest rate and the level of inflation expectations.

APPENDIX

Table A1: Distribution of Firm-Level Indicators by Sector

		Stock Returns	Market Cap	Cashflow-to-Sales	Market-to-Book	Price Earnings	Foreign Sales Ratio
Overall							
	Mean	0.30	21167	16.74	4.05	41.10	29.30
	Median	0.23	8322	14.72	2.73	20.60	27.09
	33rd percentile	-0.42	5198	10.79	2.02	16.70	14.79
	67th percentile	0.94	13573	19.95	3.73	26.10	41.08
Energy							
	Mean	0.37	23410	24.11	2.51	37.25	39.61
	Median	0.33	7730	16.38	2.20	17.50	35.05
	33rd percentile	-0.51	4636	11.86	1.79	12.00	25.73
	67th percentile	1.20	11974	25.38	2.78	26.30	59.98
Materials							
	Mean	0.33	9691	13.41	3.18	34.43	37.41
	Median	0.27	4716	12.26	2.52	20.30	39.52
	33rd percentile	-0.37	3555	10.21	1.99	17.40	22.90
	67th percentile	0.97	8803	14.90	3.19	24.70	49.62
Industrials							
	Mean	0.33	23819	12.25	3.37	38.79	29.75
	Median	0.26	9260	11.36	2.81	20.20	31.18
	33rd percentile	-0.34	6077	9.80	2.21	17.50	18.73
	67th percentile	0.96	14508	13.45	3.44	23.90	40.89
Consumer Discretionary							
	Mean	0.36	12415	11.52	4.22	33.85	23.19
	Median	0.27	6594	10.05	2.91	19.60	21.47
	33rd percentile	-0.42	4368	7.92	2.17	16.40	14.79
	67th percentile	1.03	10228	12.67	3.86	24.20	28.35
Consumer Staples							
	Mean	0.17	28744	11.15	7.96	26.55	32.84
	Median	0.13	12311	10.64	4.86	21.80	33.86
	33rd percentile	-0.40	8094	7.46	3.06	18.80	18.05
	67th percentile	0.70	18130	13.75	6.62	25.70	44.12
Health Care							
	Mean	0.29	26907	13.74	6.19	39.96	31.35
	Median	0.21	8051	17.91	4.32	26.90	38.25
	33rd percentile	-0.38	4822	11.46	3.22	22.50	21.09
	67th percentile	0.94	16356	21.58	5.60	34.20	42.99
Financials							
	Mean	0.25	21513	26.49	2.39	24.12	11.11
	Median	0.19	10004	24.02	1.97	16.40	2.18
	33rd percentile	-0.37	6529	19.32	1.65	13.80	0.00
	67th percentile	0.76	16728	29.25	2.47	20.40	10.55
Information Technology							
	Mean	0.50	28392	15.63	4.92	107.81	51.09
	Median	0.40	8572	18.21	3.80	33.40	53.46
	33rd percentile	-0.53	5425	12.88	2.83	26.40	44.70
	67th percentile	1.47	14475	24.76	5.00	45.80	62.33
Telecommunication Services							
	Mean	-0.21	43992	29.67	1.77	31.18	1.24
	Median	0.00	18306	30.38	2.08	18.50	0.00
	33rd percentile	-0.73	7680	26.94	1.51	15.50	0.00
	67th percentile	0.62	51774	32.56	2.73	24.60	3.72
Utilities							
	Mean	0.02	8770	18.40	1.78	18.42	8.25
	Median	0.11	6969	17.05	1.66	14.70	0.62
	33rd percentile	-0.45	4366	13.49	1.43	13.10	0.00
	67th percentile	0.68	9581	20.99	2.03	16.70	5.23

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