

UNSTABLE RELATIONSHIP BETWEEN THE FED'S MONETARY POLICY ACTIONS AND THE U.S. STOCK MARKET

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ABSTRACT

The stock market and target federal funds rate is positively related over the long run although the relationship is not stable with unstable time lags. This is consistent with the fact that the Fed usually raises the target interest rate when economic growth is strong and the stock market is in bullish trend, and cuts the interest rate when growth is declining and stock market is in bearish trend. The relationship is apparently negative between the two variables when the stock market was set lagging the interest rate by three years, which may imply an obvious time lag between the two variables. Granger causality tests show that the Fed raises interest rate after the stock market has been rising and cuts interest rate after the stock market has been declining. The relationship between monetary aggregate M1 and stock market is negative, and that between M2 and stock market is positive.

Keywords: monetary policy action, stock market trend, time lags

JEL classification: E44 E52, G1

INTRODUCTION

Economists have been trying to find and explain stock market's respond to the Fed's monetary policy actions. Kuttner (2001) and Bernanke and Kuttner (2005) find that investors react to surprise policy actions. Brown and Cliff (2005), Backer and Wurgler (2006, 2007), Kumar and Lee (2006) and Kurov (2010) show that investors' sentiment play a major role in stock market's reaction to monetary policy actions. Chen and Gu (2011) find that stock market declines immediately after regular Fed announcement on most of the announcement days when change in the target federal funds rate exactly meets the consensus estimate. These researches focus on short-run response of stock market to Fed action. Chen (2007), Basistha and Kurov (2008) and Kurov (2010) find that monetary policy actions have stronger impact on stock market in bearish market trends and in recessions.

However, the relationship between the Federal Reserve's monetary policy actions and stock market is not stable. The goals of the Federal Reserve System include economic growth, low unemployment rate, and price stability. The Fed's policy actions for these goals, such as

changing money supply and target interest rate of the federal funds, have shown apparent impacts on growth of the economy, inflation rate and unemployment rate. These impacts indirectly affect companies' profit and thus their stock prices. However, the effect of Fed action on these goal variables has time lags, e.g., Mishikin (2010) reports that Fed actions affect the economy with time lags of a year or longer, which makes measuring the effect even more difficult. The stock market usually leads economic cycle by several months. Although condition of the stock market is not explicitly a concern of the Fed, as Alan Greenspan said at a Congress hearing in 1999 that the stock market is not a consideration for the Fed's monetary policy even after he had said "over exuberance" about the stock market bobble in 1997, the Fed with Bernanke being the chairman may actually pay attention to stock market condition as increasingly more economists, including these at the Fed, have recognized the wealth effect of the stock market on consumer behavior and on the economy.

During the great bullish market period in the 1990s, The Fed raised the federal funds target rate from 1994 to June 1995, then reduced it moderately and kept the rate at around 5.25 percent until early 2000, even after the stock market crashed and started the great bearish period in March 2000, the Fed raised the rate to 6.5 percent and kept it through the rest of the year. Nine months later, the stock market had declined significantly, then the Fed started cutting the federal funds target rate in January 2001.

In this study we focus on exploring the long-run relationship between the federal funds target rate and the stock market from 1994 to March 2011, we also examine the relationship between monetary aggregates M1 and M2 and the stock market in the period although former Board of Governors chairman Alan Greenspan testified in congress that the Fed would no longer use any monetary aggregates as a guide for conducting monetary policy in January 1994. The purpose of this study is to find how close and with what time lags the Fed's policy actions and the stock market are related or the impact of the policy action on the stock market. The results of this study should provide investors with useful information for developing investment strategies.

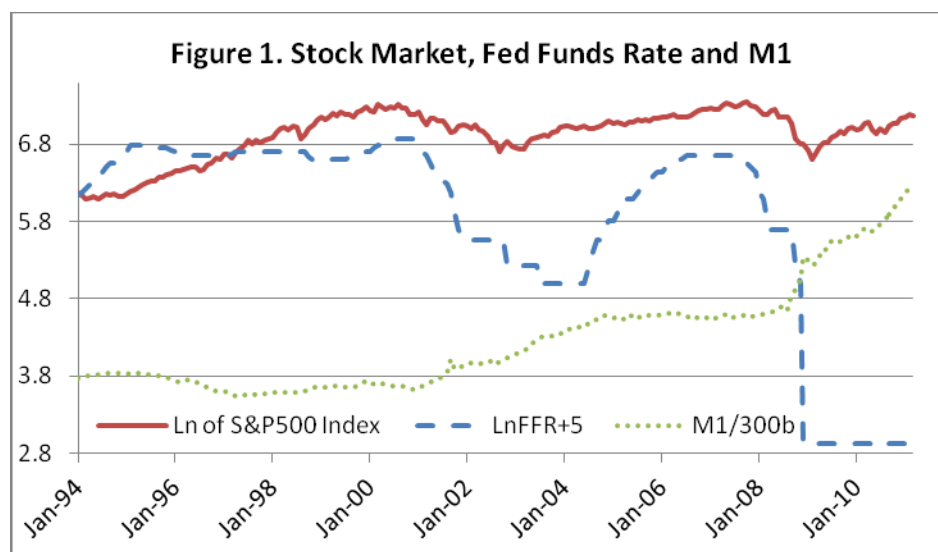
DATA

Data of the federal funds target rate and M1 and M2 is from the Feral Reserve Bank of New York. Data of the S&P 500 monthly Index is from Finance.Yahoo.com. Most of the times the Fed changes its federal funds rate target around the middle of the month, and occasionally change the rate twice in a month, so we calculate the time weighted average of the target rates and use it for the month.

THE ANALYSES

Generally over economic cycles, the stock market is growing when the economy is growing strongly, and the Fed raises the federal funds target rate; the stock market is declining

when the economy is in a recession, and the Fed cuts the interest rate. Obviously there is some time lag among the three variables although length of the time lag is not stable and hardly predictable. Thus, we may expect that the federal funds target rate is positively related to the S&P 500 Index. We display the three time series in Figure 1. In order to make the comparison more apparent, we adjusted the scale of the federal funds rate, the S&P 500 Index and M1, i.e., we took the natural logarithm of the index and of the federal funds rate, then add 5 to the logarithm of the federal funds rate, and adjust the scale of M1 by dividing the quantity with 300 billion. As depicted in Figure 1, one can see the relationship between the S&P 500 Index and the federal funds target rate is not stable and changes direction over time. This may indicate that the impact of the Fed's actions of federal funds on the economy hence the stock market is not simultaneous and the relationship is far from being perfect. Movements of the federal funds target rate and the S&P 500 Index are roughly in the same direction most of the time with obvious time lag. Movements of M1 and the stock index are not in the same direction most of the time although both time series are increasing in the long-run. Obviously the M1 aggregate increased much more than the stock index for the sample time period, and growth rate of M1 fluctuates significantly. Specifically, M1 declined and was relatively flat while the stock market was rising significantly from 1994 to March 2000, M1 increased but the stock index declined from April 2000 to September 2002, and M1 increased sharply but the stock market dropped sharply from 2008 to early 2009. M2 is basically mono-increasing from \$3480 billion to \$9112 billion over the sample time period, it can be expected to have a positive relationship with the stock market over the long-run, so we exclude it in the figure.



We conduct regression tests to reveal the relationship between the stock market and the Federal Reserve's policy action variables, namely, the target federal funds rate, M1 and M2.

$$S = \alpha + \beta_1FR + \beta_2M_1 + \beta_3M_2 + \varepsilon \tag{1}$$

where,

S = natural logarithm of the S&P 500 monthly Index

FR = the federal funds rate

M₁ and M₂ are the monetary aggregates, and

ε is the error term

The regression results are reported in Table 1. As shown in the table, the S&P 500 Index is significantly positively related with the federal funds rate, this relationship is obvious in Figure 1 for most of the time in the sample period, particularly from 1999 to 2008. The relationship between movements of the stock market and M1 is significantly negative, which can also be observed in Figure 1 for most of the time. The relationship between the index and M2 is significantly positive as M2 is almost mono-increasing and the stock market was moving upward much longer than moving downward in the period.

Table 1: REGRESSION OF THE S&P 500 INDEX ON FEDERAL FUNDS RATE AND MONETARY AGGREGATES					
Time	Intercept	FR	M1	M2	adj. R ²
t ₀	1043.658	70.274	-1.716	0.343	0.693
	(7.281)***	(8.687)***	(-11.159)***	(19.358)***	
t ₃₆	31.698	-3.909	-	-	0.154
	(6.513)***	(-5.659)***	-	-	

In order to find at what time lag the relationship between the stock market and the federal funds target rate is the most significant, we have conducted a series of regression tests,

$$S = \alpha + \beta FR_{t-i} + \varepsilon \tag{2}$$

where,

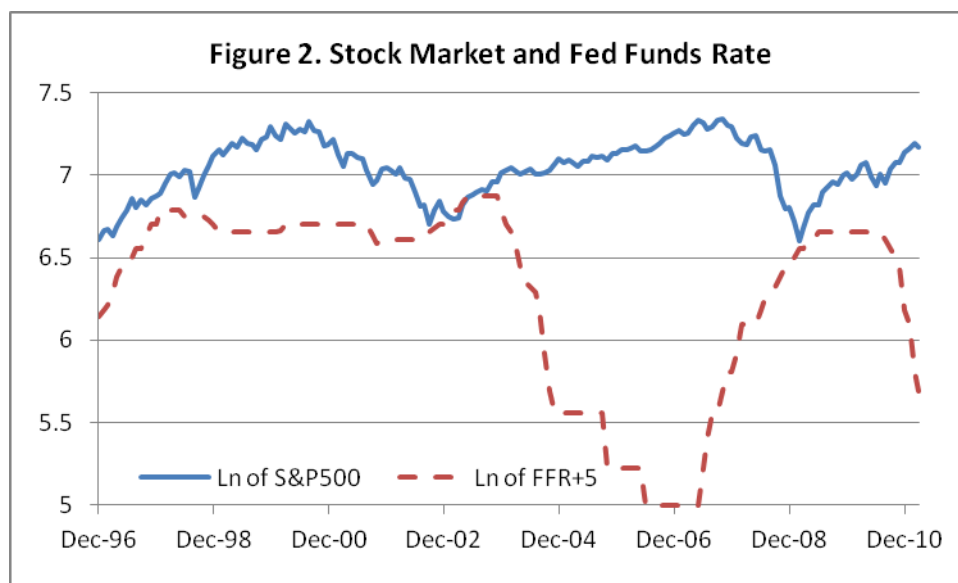
S = natural logarithm of the S&P 500 monthly Index

FR_{t-i} = the federal funds rate, i = 0...40

ε is the error term

The regression with t=0 results in a coefficient of -0.018, and a t-value of 1.033. The relationship is almost zero and insignificant, this result is because the relationship is not stable, there is uncertain time lag with the impact of Fed action and the economy, and regression analysis provides a coefficient that is the mean of positive and negative relations. The regression

results show the highest R-square, adjusted R-square, and absolute t-value with $i = 36$. As shown in Table 1, the coefficient is significantly negative, which indicates that the federal funds target rate is the most significantly negatively related to the 36-month-later S&P 500 Index. This pattern is apparent from 1998 as shown in Figure 2 where one can see that the federal funds target rate was declining from July 1995 to November 1998 and then increasing until December 2000, lagging roughly 36 months, the S&P 500 Index was increasing and then declining from late 1997 to late 2001. The negative relationship is even more apparent later. The federal funds target rate was declining from January 2001 and then rising from July 2004, and then declining from September 2007, three years later, the S&P 500 Index was rising and declining from October 2002 to early March 2009, and then rising from March 2009 to April 2011. This pattern implies that the stock market may enter into a bearish trend two to three years after the Fed started raising the federal funds rate in a cycle, and the stock market may enter into a bullish trend two years after the Fed started cutting the interest rate. However, there is no doubt that the time lag between the movements of the two variables is not stable.



The relationship between federal funds target rate and stock market as shown in the figures and as revealed in the regression analyses does not explain whether changes in the federal funds target rate cause stock market movement, or stock market trend leads Fed actions. To further explore the relationship we conduct Granger causality tests. Granger (1969) proposed a test to determine whether or not a series x_t “causes” changes in the series y_t . A critical implication of Granger causality tests is that they do not prove causality in the general sense; rather they illustrate Granger-causality. That is the use of Granger causality tests reveal whether or not current and or lagged values in the series x_t improve our ability to forecast changes in y_t .

The standard bi-variate Granger causality test is based on OLS regressions of the following two equations:

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \alpha_2 y_{t-2} + \dots + \alpha_p y_{t-p} + \beta_1 x_{t-1} + \beta_2 x_{t-2} + \dots + \beta_p x_{t-p} + u_t \quad (3)$$

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + \alpha_2 x_{t-2} + \dots + \alpha_p x_{t-p} + \beta_1 y_{t-1} + \beta_2 y_{t-2} + \dots + \beta_p y_{t-p} + u_t \quad (4)$$

The test for whether or not x Granger causes y is based on the results of an F-test on the joint hypothesis:

$$H_0: \beta_1 = \beta_2 = \dots = \beta_p = 0.$$

If the null hypothesis is rejected, we conclude that x Granger-causes y . The same test is also applied to test whether y Granger-causes x . From the above regressions there are four potential outcomes, i.e. x Granger-causes y , y Granger-causes x , or causality runs in both directions, and finally neither y Granger-causes x or vice versa. Perhaps the most useful results would be where causality runs in only one direction, which would imply for example that by knowing past values of x , the forecasts of y are improved.

There are two potential issues to be considered when using Granger-causality tests. First, the data for both series must be transformed to eliminate autocorrelation, for example, first differencing of each series. Second, the choice of lag length may play an important role. Generally, longer lag lengths are preferable to allow for the effect of all relevant past information on x (y) to have an effect on y (x). In our specific case the use of $p = 10$ includes the information from two full business weeks.

Results of the Granger-causality tests are reported in Tables 2, in order to save space we report results for 12-month lag only. The tests reveal that the S&P 500 Index Granger causes the target federal funds rate while the target federal funds rate does not Granger cause the S&P 500 Index. This indicates that the Fed changes its target federal funds rate following the stock market. As discussed above, the Fed raises the interest rate when growth of the U.S. economy is strong and the stock market is already in an upward trend, and cut the interest rate when growth of the economy is weak or the economy declines and the stock market is already in a downward trend.

Table 2: RESULTS OF PAIRWISE GRANGER CAUSALITY TEST				
Hypothesis	Lag	F-Statistic	Prob.	Result
FR does not Granger Cause S	12	0.97537	0.4743	Not reject
S does not Granger Cause FR	12	2.82102	0.0015	Reject

CONCLUSION

In this study we examine the relationship between the Federal Reserve's monetary policy actions and the U.S. stock market. We reveal that the federal funds target rate and the S&P 500 Index is positively related over the long run, but the relationship is not stable and with unstable time lags. This corresponds to the fact that the Fed raises the target interest rate when the U.S. economic growth is strong while the stock market is in a bullish trend and cuts the interest rate when the U.S. economic growth is declining while the stock market is in a bearish trend. There is an apparent negative relationship between the two variables when the stock market is set lagging the target interest rate by three years, this may imply an obvious time lag between the two variables. The implication for investors is that the stock market may enter into a bearish trend two to three years after the Fed started raising the federal funds rate in a cycle, and the stock market may enter into a bullish trend two years after the Fed started cutting the interest rate. The Granger causality tests reveal that the Fed's actions on the federal funds rate follow the stock market. The relationship between monetary aggregate M1 and the stock market is negative over the long run, and that between M2 and the stock market is positive because M2 is almost mono-increasing in the sample period. Results of this study imply that investors may consider Fed's actions on the federal funds target rate when developing their investment strategies, i.e., prepare to see a bearish market when the Fed has been raising interest rates for two years and prepare to ride on a bullish market when the Fed has been cutting interest rate for two years.

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