

The Fed Funds Rate and Interest Rate Elasticities

Kevin M. Bahr, Ph.D.
William E. Maas, J.D., C.P.A.

Abstract

The federal funds rate is an important, short-term interest rate which is targeted by the Federal Reserve to influence economic growth and inflation. The financial markets closely monitor the Federal Reserve's monetary policy and changes in the federal funds rate to gauge future economic performance. This research analyzes how changes in the federal funds rate affected the 1) yield curve, 2) 30-year fixed mortgage rate, and 3) spread between Aaa and Baa corporate bond yields. The purpose is to determine the rippling effect between changes in the federal funds rate and changes in interest rates that affect the cost of borrowing by firms, individuals, and the government. The empirical results indicate that when a basis point change of 25 points or more occurs to the fed funds rate, which is of a magnitude consistent with a change in Federal Reserve policy, a statistically significant, positively related change occurs in the one-month interest rate elasticities for the 3-Month Treasury rate, 1-year Treasury rate, 5-Year Treasury rate, 10-Year Treasury rate, and the 30-Year Mortgage rate.

I. Introduction

The Federal Reserve conducts monetary policy with the ultimate objectives of promoting economic growth with an acceptable amount of inflation. The Federal Reserve's primary tool for implementing monetary policy is through open market operations - purchases and sales of U.S. Treasury and federal agency securities. Although the goal of open market operations has historically varied, in the 1980s the focus gradually shifted toward attaining a specified level of the federal (fed) funds rate. The fed funds rate is the interest rate at which depository institutions lend balances at the Federal Reserve to other depository institutions overnight. In other words, it is a very short-term (overnight), market sensitive interest rate.

Thus, open market operations are used to target the fed funds rate, which in turn influences economic growth and inflation. To accomplish its economic objectives of economic growth and an acceptable level of inflation, the short-term objective for open market operations is specified by the Federal Open Market Committee (FOMC). Beginning in 1995, the FOMC began publicly announcing its target level for the fed funds rate. After its meetings, since February 2000, the FOMC has released the committee's assessment of the risks to the attainment of its long-run goals of price stability and economic growth. When the Federal Reserve determines a change in the targeted fed funds rate is necessary to accomplish its objectives, a change of 25 basis points or more will occur to the target rate. The focus of this research will be analyzing how other interest rates in the financial markets respond to a change in the fed funds rate caused by a change in Federal Reserve policy.

Kevin M. Bahr and William E. Maas are Associate Professors of Business at the University of Wisconsin – Stevens Point.

The fed funds rate has become a key economic variable used by the Federal Reserve to balance economic growth and inflation. Investors in the stock market closely monitor the Federal Reserve's policy of targeting the fed funds rate. Changes in the target rate can cause significant stock market reaction, such as the 2.9% increase in the S&P 500 which occurred following the Fed's decision to reduce its target on the fed funds rate by one-half percentage point on September 18, 2007. Although stock market reaction to changes in the fed funds rate is usually widely reported in the media, generally less attention is given to how changes in the fed funds rate affect other interest rates.

Given the economic importance of the fed funds rate, this paper will analyze how other interest rates in the financial markets typically react to changes in the fed funds rate. The objective is to determine how changes in the fed funds rate typically affect the cost of borrowing. Changes in the cost of borrowing are determined by analyzing changes in the yield curve, changes in the residential mortgage rate, and changes in the spread between corporate bonds.

II. The Literature

Existing research focuses on the effect changes in the fed funds rate has on asset prices, the mortgage markets, and variable rate debt instruments tied for instance to the prime rate, such as adjustable rate mortgages and credit cards. Bernanke and Kuttner (2005) found that an unanticipated rise in the fed funds rate by $\frac{1}{4}$ percent (25 basis points) results in one percent drop in stock prices. They used a six variable VAR using unanticipated fed funds rate changes as a variable to generate responses for excess returns. Taylor (2007) found that housing construction and mortgage financing volatility relative to trend has decreased since 1980 largely due to an improved monetary policy.

Flattening of the yield curve has been analyzed the past few years, as long-term interest rates did not increase in a historically consistent manner when the FOMC began monetary tightening in June 2004. WU (2006) researched how the conventional relationship between short-term and long-term interest rates appears to have broken down during the recent fed funds rate increases. He believes the yield flattening is likely related to the decreased volatility in real economic activity caused by increased globalization; while at the same time, the available pool of world savings is increasing, bringing additional loanable funds to increasingly open markets, helping to hold down real interest rates worldwide. Backus and Wright (2007) think the evidence points to a declining term premium as the primary source of the recent fall in long-term forward rates.

III. Data

To determine the relationship between changes in the fed funds rate and changes in other interest rates in the financial markets, interest rate elasticity is calculated. In each case, the one-month percentage change in a given interest rate is divided by the one-month percentage change in the effective fed funds rate. (The effective fed funds rate is a volume-weighted average of rates on trades arranged by major brokers. It is the market, rather than targeted, fed funds rate.) In effect, the interest rate elasticity is an arc elasticity that measures the one-month percentage change of a given interest rate relative to the one-month percentage change in the effective fed funds rate. Interest rate elasticities are calculated for the following variables: 1) 3-Month Treasury rate, 2) 1-year Treasury rate, 3) 5-Year Treasury rate, 4) 10-Year Treasury rate, 5) 30-

Year Mortgage rate, and 6) the basis point spread between Moody's Aaa and Baa Corporate Bond Yields. Elasticities are computed for the six variables under two scenarios: 1) the monthly interest rate elasticity for all periods in the analysis, and 2) the monthly interest rate elasticity for periods in which a significant change in the fed funds rate occurs. A significant change is defined as a 25 basis point change or greater. This corresponds to analyzing the impact of changes in Federal Reserve policy, as the Federal Reserve will change the targeted fed funds rate by 25 basis points or more.

To determine interest rate elasticities, monthly data from July, 1954 through December 2006 is used for the effective fed funds rate, the 3-Month Treasury Bill rate, the 5-Year Treasury rate, the 10-Year Treasury rate, and the basis point spread between Moody's Aaa and Baa Corporate Bond Yields. Monthly data from April, 1971 through December, 2006 is used for the 30-Year Conventional Mortgage Rate. In each case, the source of data is the Board of Governors of the Federal Reserve System.

Hypotheses

Given that the Federal Reserve changes the targeted fed funds rate by 25 basis points or more when a change in policy is needed to accomplish its objectives, the primary focus of this research is to determine how other interest rates in the financial markets typically react to significant changes in the fed funds rate. A significant change is defined in this research as a change of 25 basis points or more, which reflects a change in Federal Reserve policy. Hypotheses are developed and tested to determine if significant changes in the fed funds rate are associated with changes in the 1) yield curve, 2) 30-year fixed mortgage rate, and 3) spread between Aaa and Baa corporate bond yields. The purpose is to determine the rippling effect between changes in Federal Reserve policy and changes in interest rates in which affect the cost of borrowing by firms, individuals, and the government.

Six statistical tests are performed to determine the significance of a given interest rate elasticity.

Test 1

H_0 : 3 month treasury one-month interest rate elasticity = 0

H_a : 3 month treasury one-month interest rate elasticity > 0

Test 2

H_0 : 1-year treasury one-month interest rate elasticity = 0

H_a : 1-year treasury one-month interest rate elasticity > 0

Test 3

H_0 : 5-year treasury one-month interest rate elasticity = 0

H_a : 5-year treasury one-month interest rate elasticity > 0

Test 4

H_0 : 10-year treasury one-month interest rate elasticity = 0

H_a : 10-year treasury one-month interest rate elasticity > 0

Test 5

H_0 : Aaa/Baa spread one-month interest rate elasticity = 0

H_a : Aaa/Baa spread one-month interest rate elasticity > 0

Test 6

H_0 : 30-year mortgage one-month interest rate elasticity = 0

H_a : 30-year mortgage one-month interest rate elasticity > 0

In each case, the null hypothesis states that a significant change in the fed funds rate (defined as 25 basis points or more) will not have an effect on the given interest rate variable. The null hypothesis states that the one-month percentage change in the given interest rate variable relative to the one-month percentage change in the fed funds rate is equal to zero. In each case, given a significant change in the fed funds rate, the alternative hypothesis states that the one-month percentage change in the given interest rate variable relative to the one-month percentage change in the fed funds rate is greater than zero.

IV. Results

Table I shows one-month statistics for the variables being analyzed. The monthly mean, median, and standard deviation were calculated over the period July, 1954 through December 2006 for the fed funds rate, the 3-Month Treasury rate, the 5-Year Treasury rate, the 10-Year Treasury rate, and the basis point spread between Moody's Aaa and Baa Corporate Bond Yields. The monthly mean, median, and standard deviation were calculated over the period April, 1971 through December, 2006 for the 30-Year Mortgage Rate.

The mean and median for the fed funds rate were 5.70 and 5.25, respectively, with a standard deviation of 3.35. The 3 month treasury rate had a mean of 5.21 and median of 4.95, with a standard deviation of 2.79. The 1-year treasury rate had a mean of 5.79 and median of 5.45, with a standard deviation of 2.95. The mean and median for the 5-year treasury rate were 6.39 and 6.01, respectively, with a standard deviation of 2.73. The 10-year treasury rate had a mean of 6.59 and median of 6.20, with a standard deviation of 2.66. The spread between Aaa and Baa corporate bond yields had a mean of 0.95 and median of 0.83, with a standard deviation of 0.41. The mean and median for the 30-year mortgage rate was 9.28 and 8.76 respectively, with a standard deviation of 2.76. The table reflects that generally the yield curve slopes upward, with interest rates increasing as maturity increases. However, the table also indicates that short-term interest rates have greater volatility than long-term interest rates, as the standard deviations of 3-month and 1-year treasury interest rates are greater than the standard deviations of 5-year and 10-year treasury interest rates and the 30-year mortgage rate.

Table II shows the one-month interest rate elasticities for the six different interest rate variables relative to the fed funds rate over all periods. All monthly changes to the market fed funds rate are included in the analysis, including changes between 0 and 25 basis points. Thus, changes to the fed funds rate which occur irrespective of Federal Reserve policy are included in the analysis. The interest rate elasticity measures the one-month percentage change of a given interest rate variable relative to the one-month percentage change in the fed funds rate. The

analysis indicates that large standard deviations for the interest rate elasticity of each variable result when all periods are included in the analysis.

The mean interest rate elasticities are 0.92, 0.65, 0.48 and 0.37 for the 3-Month Treasury rate, 1-year Treasury rate, 5-Year Treasury rate, and 10-Year Treasury rate, respectively. Thus, a 10 percent change in the fed funds rate is associated with, on average, a 9.2 percent change in the 3-month Treasury rate, a 6.5 percent change in the 1-year Treasury rate, a 4.8 percent change in the 5-year Treasury rate, and a 3.7 percent change in the 10-year Treasury rate. However, using all time periods in the analysis returns relatively large standard deviations for the interest rate elasticities. The standard deviations are 4.67, 5.01, 5.35, and 4.60 for the 3-Month Treasury rate, 1-year Treasury rate, 5-Year Treasury rate, and 10-Year Treasury rate, respectively. The mean interest rate elasticities for the 30-Year Mortgage rate and the basis point spread between Moody's Aaa and Baa Corporate Bond Yields are 0.08 and 0.41, respectively, and the standard deviations of the interest rate elasticities are 9.17 and 3.15, respectively. The relatively large standard deviations for the interest rate elasticities reflect large movements which can occur in the interest rate variables, despite only small movements in the fed funds rate.

Table III shows the one-month interest rate elasticities for the six different interest rate variables when there is a significant change to the fed funds rate. A significant change is defined as a 25 basis point change or greater and is consistent with a change in Federal Reserve policy. Thus, the focus of Table 3 is to show the association between movements in the fed funds rate that are a magnitude consistent with a change in Federal Reserve policy and other interest rates variables. The results in Table 3 indicate that when a significant change occurs in the fed funds rate, a statistically significant change in the interest rate elasticity occurs for the 3-Month Treasury rate, 1-year Treasury rate, 5-Year Treasury rate, 10-Year Treasury rate, and 30-Year Mortgage rate. The statistical significance is indicated by the Z-test. In each case, the percentage change in the fed funds rate is positively related to the percentage change in each of the interest rates. The change in the interest rate elasticity for the basis point spread between Moody's Aaa and Baa Corporate Bond Yields is not statistically significant. The greatest changes occur for the short-term rates. A dramatic reduction in the standard deviation of each of the interest rate elasticities occurs relative to Table 2 when all periods were considered in the analysis.

The mean interest rate elasticity for the 3-month Treasury rate is 0.58; the mean interest rate elasticity of the 1-year Treasury rate is 0.59. Thus, a 10 percent change in the fed funds rate is associated with, on average, a 5.8 percent change in the 3-month Treasury rate and a 5.9 percent change in the 1-year Treasury rate. The standard deviation of the interest rate elasticity is 0.97 and 1.06 for the 3-month Treasury rate and the 1-year Treasury rate, respectively. The interest rate elasticities for the longer-term interest rates are lower relative to the short-term interest rates. The mean interest rate elasticities for the 5-Year Treasury rate and 10-Year Treasury rate are 0.34 and 0.23, respectively. Thus, a 10 percent change in the fed funds rate is associated with, on average, a 3.4 percent change in the 5-year Treasury rate and a 2.3 percent change in the 10-year Treasury rate. A 10 percent change in the fed funds rate is associated with, on average, a 2.4 percent change in the 30-year Mortgage rate, as indicated by the 0.24 mean interest rate elasticity for the 30-year Mortgage rate. The standard deviation of the interest rate elasticity is 0.91 for the 3-year Treasury rate, 0.79 for the 10-year Treasury rate, and 0.50 for the

30-Year Mortgage rate. When the time periods analyzed include only those periods in which a significant change in the fed funds occurs, the standard deviations of all the interest rate elasticities are greatly reduced.

V. Summary

The federal funds rate is an important, short-term interest rate which is targeted by the Federal Reserve to influence economic growth and inflation. The focus of this research was to analyze how significant changes in the fed funds rate affected the 1) yield curve, 2) 30-year fixed mortgage rate, and 3) spread between Aaa and Baa corporate bond yields. The purpose was to determine how changes in the federal funds rate were associated with changes in interest rates that affect the cost of borrowing by firms, individuals, and the government.

The research indicates that when a basis point change of 25 points or more occurs to the fed funds rate, which is of a magnitude consistent with a change in Federal Reserve policy, a statistically significant, positively related change occurs in the one-month interest rate elasticities for the 3-Month Treasury rate, 1-year Treasury rate, 5-Year Treasury rate, 10-Year Treasury rate, and the 30-Year Mortgage rate. The basis point spread between Moody's Aaa and Baa Corporate Bond Yields is not significantly affected. The mean interest rate elasticities are 0.58, 0.59, 0.34, and 0.23 for the 3-month Treasury rate, 1-year Treasury rate, 5-year Treasury rate, and 10-year Treasury rate, respectively. Thus, a 10 percent change in the fed funds rate is associated with, on average, changes of 5.8 percent, 5.9 percent, 3.4 percent, and 2.3 percent for the for the 3-month Treasury rate, 1-year Treasury rate, 5-year Treasury rate, and 10-year Treasury rate, respectively. The mean interest rate elasticity for the 30-year Mortgage rate is 0.24, which indicates that a 10 percent change in the fed funds rate is associated with, on average, a 2.4 percent change in the 30-year Mortgage rate.

TABLE I
Interest Rate Monthly Statistics

	<i>Effective Federal Funds Rate</i>	<i>3 Month Treasury Rate</i>	<i>1-year Treasury Rate</i>	<i>5-year Treasury Rate</i>	<i>10-year Treasury Rate</i>	<i>Aaa/Baa Spread</i>	<i>30-year Mortgage Rate</i>
Mean	5.70	5.21	5.79	6.39	6.59	0.95	9.28
Median	5.25	4.95	5.45	6.01	6.20	0.83	8.76
Standard Deviation	3.35	2.79	2.95	2.73	2.66	0.41	2.76
Number of Periods	630	630	630	630	630	630	429

TABLE II
One – Month Interest Rate Elasticities Relative to Federal Funds Rate: All Periods

		<i>3 Month Treasury Rate</i>	<i>1-year Treasury Rate</i>	<i>5-year Treasury Rate</i>	<i>10-year Treasury Rate</i>	<i>Aaa/Baa Spread</i>	<i>30-year Mortgage Rate</i>
Mean		0.92	0.65	0.48	0.37	0.08	0.41
Median		0.69	0.58	0.32	0.19	0.00	0.20
Standard Deviation		4.67	5.01	5.35	4.50	9.17	3.15

TABLE III
**One – Month Interest Rate Elasticities Relative to Federal Funds Rate:
 Periods in Which Significant Change Occurred in Federal Funds Rate**

		<i>3 Month Treasury Rate</i>	<i>1-year Treasury Rate</i>	<i>5-year Treasury Rate</i>	<i>10-year Treasury Rate</i>	<i>Aaa/Baa Spread</i>	<i>30-year Mortgage Rate</i>
Mean		0.58	0.59	0.34	0.23	0.02	0.24
Median		0.65	0.63	0.33	0.16	-0.04	0.18
Standard Deviation		0.97	1.06	0.91	0.79	2.03	0.50
Number of Periods		217	217	217	217	216	153
Z-test		0.000	0.000	0.000	0.000	0.443	0.000

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