Honors Capstone Projects and Theses   Honors College

5-1-2001

How Does an Acceleration in the Change of the Fed Funds Rate Compare With an Acceleration in the GDP

Rodolfo Bernal

Follow this and additional works at: https://louis.uah.edu/honors-capstones

Recommended Citation

Bernal, Rodolfo, "How Does an Acceleration in the Change of the Fed Funds Rate Compare With an Acceleration in the GDP" (2001). *Honors Capstone Projects and Theses*. 49.
https://louis.uah.edu/honors-capstones/49

Honors Senior Project
Approval

Form 3 – Submit with completed thesis. All signatures must be obtained.

Name of candidate: _Rodolfo Bernal_

Department: _Administrative Science_

Degree: _Finance_

Full title of project: _How does an acceleration in the change of the Fed Funds Rate compare with an acceleration in the GDP?_

Approved by:

_____   5-2-01
Project Advisor   Date

_____   5/3/1
Department Chair   Date

_____   _____
Honors Program Director for Honors Council   Date

3

University of Alabama in Huntsville

Honors Program Senior Project
Undergraduate

"How does an acceleration in the change of the Fed Funds Rate compare with an acceleration in the GDP?"

By: Rodolfo Bernal
Professor Advisor: Dr. Niles Schoening

Introduction

Organization of the Federal Reserve System

The Federal Reserve System was created by the Federal Reserve Act of 1913. Before this time, the economy of the nation was in the hands of the New York banks. After the bank panic of 1907 in which a bank failure ended in a chain reaction of bankrupt banks, it was evident that a central bank was needed –a lender of last resort (Mishkin 464). Under this basis, the Federal Reserve System was created. The Federal Reserve consists of the following: The Federal Reserve banks, the Board of Governors, the Federal Open Market Committee (FOMC), the Federal Advisory Council, and around 4000 member commercial banks in 1997. This paper will focus on the FOMC's monetary policy. The major tool used by the Fed to control the money supply is the Fed Funds rate. By using the Fed Funds, the Fed decreases the economy movement.

To organize the country, the Federal Reserve divided the United States into 12 districts. Five presidents of the twelve district banks have a vote in the Federal Open Market Committee. The president of the New York Fed always has a vote. The remaining eleven district banks take annual turns for the remaining four votes. The FOMC meets approximately every six weeks. Attending the meetings are the seven members of the Board of Governors, the president of the New York Fed, and the remaining four presidents of the other Federal Reserve banks. Although only five presidents have a vote, the other seven presidents attend the meetings to give their input. The chairman of the Board of Directors is selected within the board, and serves as the Chairman of the FOMC both for a period of four years. The seven Governors are

appointed by the President and approved by the Senate. To avoid any conflict of interest between politics and economy, each governor serves for a fourteen-year term.

Brief History of Monetary Policy

The FOMC has an important role in controlling the money supply. Flaws in Federal Reserve actions have led the economy into a recession in the past. For instance, a late action of increasing interest rates to stop a constantly increasing stock market, led the economy into a recession on August 1929. For the years of 1930-1935, bank panics were common. By March 1933, 25% of the money supply was gone (Mishkin 485). These disastrous results of controlling the money supply by using the discount rate made the Federal Reserve change its strategy to control the money supply.

The new strategy used from 1933 until 1938 was increasing the reserve requirement, which would control the money supply. By the end of 1935, banks had excess amounts of reserves, because they realized that by holding a great amount of reserves they would protect themselves from bank runs. However, the Fed feared that the amount in reserves would be loaned out increasing the money supply. To eliminate the advantage in reserves the Fed increased reserve requirements three times in 1937. This action lead to a decrease in money supply and subsequently a recession from 1937 until 1938. After this experience, the Fed did not want to use the reserve requirement as a primary tool to control money supply.

By 1941, the U.S. was entering into WWII, and government expenditures rose dramatically. To finance the war, the Department of the Treasury issued a massive amount of bonds paying the minimum interest possible (as low as 2½ %). To ensure that bond prices will not go down the Fed made an agreement with the Treasury to keep the

interest rate low. This policy worked until the Korean War started on 1950. The government had to increase the money supply, and with low interest rate, inflation was imminent. The Consumer Price Index (CPI) rose 8% the year after, and the Fed realized that it must increase the interest rate (Mishkin 487). After a meeting between the Fed and the Treasury, both agreed that the Fed should increase the interest rate but it must be increased gradually.

After the Fed was allowed to implement monetary policies, it began to use a new strategy. This one was called Money Market. The main strategy of the Fed was that by controlling the Free Reserves in the banking system, they would also control the money supply. However, this system proved to be inefficient since it led to an increase in money supply when the economy is doing well, and a decrease when the economy is going slow. For instance, if income increases, the expenditure increases and the interest rate increases. Banks are more willing to borrow money from the Fed to increase their ability to loan in a booming economy. The banks also are more willing to use excess reserves. At the end, the banking system's free reserves go down because everything is loaned up. After the Fed looks at the low levels of Free Reserves, they increase the monetary base, which will increase the money supply. At the end, the economy is booming and the Fed is increasing the money supply. A contraction of the economy will lead to an increase of Free Reserves, because the banks are more reluctant to loan when the Fed sees these increasing Free Reserves, the Fed decreases the monetary base and therefore the money supply (Mishkin 489).

During the 1970's, the Fed took a new approach. This new approach consists in setting desirable growth ranges for monetary aggregates. However, this new approach

soon caused some conflicts. Some of the ranges for monetary aggregates were not compatible with one another. For instance, an increase on the money supply will lead to an increase in the Fed Funds, but the Fed Funds will only be able to increase up to a desirable amount stated by the Fed. Once the Fed Funds Rate reaches its maximum, the Fed will not be able to increase it while M1 is still able to grow. In an aim to solve this problem, the Fed kept setting new tops and bottoms for the Fed Funds Rate. The objective of this policy was to achieve stable interest rates protecting the money market.

Once again, in 1979 the Fed changed its strategy. The new chairman decided to change the ways the Fed was handling the money supply. The new Fed policy was better known as anti-inflationary. The Fed shifted its attention from money supply to inflation. Between 1979 and 1982, the interest rate fluctuated from 5% to over 15% within 12 months! From 1979 to 1980, the interest rate went from 5% to over 15%. Once the economy started to slow down, the Fed dropped the interest rate. By the middle of the 1980's the interest rate went above 15% once again leading to the next recession of 1981-1982 (Mishkin 492).

After the economic trouble of 1982, the Fed decided to use borrowed reserves to control the money supply. Whenever the economy expands, the interest rate increases and banks are more willing to borrow. The Fed, to stabilize the interest rates, will purchase bonds at a higher premium therefore bringing down the interest rates. By buying bonds at a higher premium the Fed will increase the amount of money supply when the economy is booming. On the other hand, the same mechanism will decrease the money supply when the economy is slowing down. During the period of 1982-1990, the M1 and M2 were fluctuating drastically, so the desirable monetary targets began to

fail in predicting and controlling the monetary activity. Soon, economic activity did not correlate with the monetary aggregates. In 1993, the Fed disclosed that they will no longer use monetary aggregates to conduct monetary policy. From 1992 until today, the Fed began to use the Fed Funds to conduct monetary policy. From the period of 1992, the economy was slowing down due to a shortage in bank lending. To protect the economy from a further crisis, the Fed kept the Fed funds at 3% from 1992 to 1994. Once the economy started recovering, the Fed began to raise the Fed Funds Rate. Since 1994, the Fed announces any changes in the interest rate. This new policy of the Federal Reserve provides a faster response to their monetary policy. The current chairman of the Board of Governors (Alan Greenspan) believes that by using the Fed Funds Rate, the Fed can control inflation. By controlling inflation, market efficiency will adjust all the other variables.

Importance of the Fed Funds

The Federal Reserve has a long history of trying different methods of controlling the money supply. The current control method by using the Fed Funds Rate has been developed after many years of experience. By deciding to make public the change in interest rate, the economy reacts quicker than in previous years. However, while analyzing the trend of the GDP with respect to the interest rate, it seems that they are negatively related. This paper will focus on the analysis of the historical quarterly data collected of Fed Funds Rate and GDP for a period of 14 years. Although there is a visible negative comparison between the acceleration in the change of interest rate with the economy, an acceleration in the Fed Funds Rate will tend to decelerate the growth of

GDP more than a deceleration in the Fed Funds Rate would accelerate the growth in GDP.

Economic Literature

If the Federal Reserve uses the Fed Funds Rate to slow down the economy, that will imply that the Fed Funds Rate does affect economic output. But how does the Fed Funds Rate decrease output? Habib Ahmed from the University of Bahrain created a model to analyze the impact on monetary shocks and interest rates in the economy. According to him, working capital is one of the most effected areas in a company since it is the prime mover of cash flows and inventories. Companies use bank borrowing at the current market rate to finance receivables and inventories. Habib used his model to analyze the impact on borrowing to pay for labor and costs. Given a change in price and output produced by the firms, his model concluded that monetary shocks influence interest rate and therefore the supply side in the economy.

Canzoneri Matthew and Harris Dellas presented a model in which the central bank's monetary policy can affect the risk free rate, or the risk premium. They suggest that the risk free rate is related to consumption. If the rate of consumption goes up then the risk free rate must go up (to encourage savings). If the rate of consumption goes down, the risk free rate must go down (to discourage savings). On the other hand, when inflation levels go up lenders realize lower returns, therefore affecting the risk premium. Their model concluded that real interest rate tends to be lower under a money targeting policy than in a interest rate targeting policy since the interest rate targeting is more volatile while measuring inflation. Money targeting produces more stable inflation rate.

Joonsuk Chu and Ronald Ratti created a model to study if an anticipated expansionary or contractionary monetary policy affected output. The variables they used were: growth in M1, growth in monetary base, unemployment rate, growth rate of GDP, T-Bill rate, and government surplus. The time frame of their study was 1951-1992. They found that positive money-shocks had a zero effect on output, while negative money-shocks had a high impact on reducing output growth. A major finding was that an anticipated expansionary/contractionary monetary policy does effect output, and this makes the neutrality of money less likely.

They also studied Fed Funds Rate to measure monetary policy. A significant asymmetry between the Fed funds Rate and output was found. An increase in rate of real growth increased the change in the Fed Funds Rate for several quarters, while an increase in the rate of inflation increased the Fed Funds Rate for only two quarters.

Analyzing the Data

To analyze the comparison of the acceleration between the Fed Funds Rate and the GDP, I collected quarterly data of interest rates and GDP for a period of fourteen years (1987-2000). The Federal Reserve web site provided the data and the GDP data were provided by the Bureau of Economic Analysis web site.

The data was collected into Appendix A. In the first column, I placed the years that I am comparing. The years date from 1987 through 2000. This sample was collected because during this 14-year period the economy had a complete turnover, from the 1990-1991 recession to a booming in 1999 and an economy slowdown in 2000. In the second column, I placed the quarters, since my comparison looks for the effect of the Fed Funds Rate four quarters ahead. In the third column, I placed the quarterly percentage of the

Fed Funds Rate. I calculated the quarterly percentage by calculating a three-month average of the Fed Funds Rate from January through December of every year. In the fourth column, I calculated the first difference of the Fed Funds Rate [(Ending Value – Beginning Value) / (Beginning Value)]. This column gives me the rate of change, but to calculate the acceleration I need to calculate the change of the change. In the fourth column, I calculated the acceleration of the Fed Funds Rate [(Ending Percentage of Change – Beginning Percentage of Change) / (Beginning Percentage of Change)]. The next three columns are the GDP (in billions of dollars) quarterly, then the calculation of the rate of change of GDP and finally the calculation of the rate of change of the change to find the acceleration.

Once I calculated the acceleration for the Fed Funds Rate and the acceleration of the GDP by quarters, I proceeded to compare them. The next five columns in the table are numbered by quarters to indicate the comparison of the Fed Funds Rate and the GDP four quarters ahead, beginning at "Quarter 0," when the change in the acceleration of the Fed Funds Rate took place. The rows in these columns are filled out with a "+" or "-" sign. These two signs indicate if the Fed Funds Rate and the GDP are compared positively "+" or negatively "-."

After collecting the quarterly data, I took the first difference or percentage of change – [(Ending Value – Beginning Value) / (Beginning Value)] –of the Fed Funds Rate and GDP. At this point, I made a simple comparison, which measures direction. A plus (+) sign means that both (interest and GDP) have the same positive or negative change. A negative sign (-) means that while one of the two has a positive change, the other has a negative change (see Appendix A). By only identifying the direction, I neglect the value

of change. This gives a better picture of the direction for the analysis without focusing on any big or small value. To analyze the monetary policy impact on the GDP, the value of the interest rate in every quarter was compared with the next four quarters of the GDP. Finally, I added the signs by quarter to see what the comparison would be.

Once I designated the signs for the quarters, I proceeded to calculate the second difference of the two variables. I did this by calculating the rate of change of the change. In other words, applying the same formula –(Ending Value – Beginning Value)/Beginning value –to the change calculated before. By taking the second difference, I was then looking for a pattern in the acceleration of change between the two variables. At this point, by comparing the Fed Funds Rate and GDP using a plus and a minus sign, I could not find any relationship between the acceleration of the two.

After finding these results, I proceeded to be more specific about the comparison. Using a plus "+" sign when both variables are accelerating or decelerating could be deceptive. The economy might not react the same way when the economy is in an upward or downward trend. To eliminate the ambiguity, I introduced four variables. A positive comparison will now be divided in two, it can be "+,+" or "-,-." A negative comparison will now be "+,-" or "-,+" in which the first sign will represent the acceleration/deceleration change in the Fed Funds Rate and the second sign will represent the acceleration/deceleration of the GDP.

After adding the four signs per period, I could get a better picture of the acceleration/deceleration. At this point, I could find a pattern. Certainly, the economy does not react the same way when the Fed Funds Rate accelerates than when it decelerates. To give a better picture of my findings, I summarized the date in Appendix

A into Table A-1. This table is organized by quarter (first column), and then it shows how often the Fed Funds Rate and the GDP were positively or negatively related with its direction. Due to a limitation on the mathematical calculations and comparison analysis of the second difference, the sample provided 240 data points, or a period of 12 years. The comparison is projected four quarters ahead; therefore, the last comparison was how the acceleration in the Fed Funds Rate in 1999 compared with the acceleration in the GDP in 2000.

At the end of the zero quarter, the economy is in equilibrium. Once the Federal Reserve begins to adjust the interest rate, the economy could react in four different ways (two positives and two negatives). However, by the end of the

Table A-1

Fed Funds Rate Acceleration / GDP Acceleration					
Quarter	- / +	+ / -	- / -	+ / +	Total
0	10	12	13	13	48
I	12	14	11	11	48
II	12	14	11	11	48
III	11	13	12	12	48
IV	10	13	13	12	48
Total	55	66	60	59	240

fourth quarter it adjusts itself into equilibrium. The total numbers indicate that the economy is more likely to decelerate whenever the Fed Funds Rate accelerates (+,-). A deceleration in the Fed Funds Rate does not seem to accelerate the economy as much.

Now, further analysis has to be made to find out if this is always the case, or whether this happens because of specific market and economic conditions. The sample taken started with the recovery from the recession in the 1980's, and ended with an economic slow-down. During this period of time the Fed executed its monetary policies. At quarter zero, the economy did not move by a decrease in the acceleration of the Fed Funds Rate. On the other hand, it is hard to predict the economic effect that will take place in the same quarter. Once we enter into the next quarters, I found that the

negatively related numbers follow a concave curve, while the positively related follow a convex curve. While measuring the dispersion of the convex and concave curves, I found that the curve that presents the major dispersion is the one relating to a deceleration of the Fed Funds Rate and an acceleration of the GDP. This dispersion shows the high volatility of consumer spending. However, this analysis does present an equilibrium pattern within a fourteen-year period (1987-2000).

Seasonality of Interest Rates

While analyzing the data of the Fed Funds Rate and GDP, I found an interesting fact. A deceleration/acceleration of the Fed Funds Rate tends to have different impacts on different quarters. After taking the four possible results (positive or negative comparison) and adding the similar directions of the comparison in every quarter at time period zero, I found that each of the four possible impacts are more likely to happen on specific quarters.

On average, a deceleration in the Fed Funds Rate will accelerate the GDP in the fourth quarter. It is important to notice that November and December

Table B-1

Fed Funds Rate Acceleration (Deceleration) / GDP Acceleration (Deceleration)					
Quarter	- / +	+ / -	- / -	+ / +	Total
I	2	5	3	2	12
II	1	2	3	6	12
III	1	4	5	2	12
IV	6	1	2	3	12
Total	10	12	13	13	48

are months of high economic movement, and a deceleration of the Fed Funds Rate will increase the consumer spending bringing an incentive to increase production. The months of February and March are months of low economic movements, an increase of the Fed Funds Rate will decrease the propensity to spend and borrow.

The positive comparison tends to have a major effect in the middle of the year. For instance, an acceleration on the Fed Funds Rate will accelerate the GDP on the second quarter. Similarly, a deceleration on the Fed funds Rate on average will decelerate the GDP on the third quarter.

Conclusion

The acceleration of the Fed Funds Rate does relate to the acceleration in change of the GDP. However, on average the correct sign between the two will depend on the time frame. In the short term, the change in the Fed Funds Rate will tend to affect differently the change in the GDP in different quarters. Depending on the quarter, a change in the Fed Funds may have a positive or negative sign compared with the change in GDP. In the long term, the Fed funds Rate and GDP come to an equilibrium. The economy can follow an acceleration/deceleration concave or convex curve but always returns to a similar value. A decrease in the Fed Funds trends to boost the economy and presents the highest volatility. An increase of the Fed Funds tends to slow down the acceleration of the GDP in a more consistent way. It has the highest number in average and the lowest dispersion. It is more likely to happen than all the other possible outcomes.

Appendix A

Comparison Analysis of Federal Reserves Interest Rates
and Gross Domestic Product (GDP)

Year	Quarter	Feds Funds	Change	% Change	*GDP	Change	% Change	Comparison Quarters (2nd Difference)					Comparison Quarters (1st Difference)				
								0	I	II	III	IV	0	I	II	III	IV
1987	I	6.22			6013.3												
1987	II	6.65	6.91%		6077.2	1.06%							+	+	+	+	+
1987	III	6.84	2.86%	-58.67%	6128.1	0.84%	-21.18%	+	-	+	-	+	+	+	+	+	+
1987	IV	6.92	1.17%	-59.06%	6234.4	1.73%	107.11%	-	+	-	+	-	+	+	+	+	+
1988	I	6.66	-3.76%	-421.24%	6275.9	0.67%	-61.63%	+	-	+	-	+	-	-	-	-	-
1988	II	7.16	7.51%	299.82%	6349.8	1.18%	76.89%	+	-	+	-	-	+	+	+	+	+
1988	III	7.98	11.45%	52.55%	6382.3	0.51%	-56.53%	-	+	-	-	-	+	+	+	+	+
1988	IV	8.47	6.14%	-46.38%	6465.2	1.30%	153.78%	-	+	+	+	+	+	+	+	+	+
1989	I	9.44	11.45%	86.51%	6543.8	1.22%	-6.40%	-	-	-	-	+	+	+	+	+	+
1989	II	9.73	3.07%	-73.18%	6579.4	0.54%	-55.25%	+	+	+	-	+	+	+	+	+	+
1989	III	9.08	-6.68%	-317.46%	6610.6	0.47%	-12.83%	+	+	-	+	+	-	-	-	-	-
1989	IV	8.61	-5.18%	22.52%	6633.5	0.35%	-26.95%	-	+	-	-	-	-	-	-	+	+
1990	I	8.25	-4.18%	19.22%	6716.3	1.25%	260.32%	+	-	-	-	+	-	-	+	+	+
1990	II	8.24	-0.12%	97.10%	6731.7	0.23%	-81.63%	-	-	-	+	+	-	+	+	+	-
1990	III	8.16	-0.97%	-700.97%	6719.4	-0.18%	-179.69%	+	+	-	-	+	+	+	+	-	-
1990	IV	7.74	-5.15%	-430.15%	6664.2	-0.82%	-349.60%	+	-	-	+	-	+	+	-	-	-
1991	I	6.43	-16.93%	-228.83%	6631.4	-0.49%	40.09%	-	-	+	-	-	+	-	-	-	-
1991	II	5.86	-8.86%	47.62%	6668.5	0.56%	213.67%	+	-	+	+	+	-	-	-	-	-
1991	III	5.64	-3.75%	57.65%	6684.9	0.25%	-56.04%	-	+	+	+	-	-	-	-	-	-
1991	IV	4.82	-14.54%	-287.27%	6720.9	0.54%	118.97%	-	-	-	+	-	-	-	-	-	-
1992	I	4.02	-16.60%	-14.16%	6783.3	0.93%	72.40%	-	-	+	-	+	-	-	-	-	+
1992	II	3.77	-6.22%	62.53%	6846.8	0.94%	0.83%	+	-	+	-	+	-	-	-	+	-
1992	III	3.26	-13.53%	-117.53%	6899.7	0.77%	-17.47%	+	-	+	-	+	-	-	+	-	-
1992	IV	3.04	-6.75%	50.11%	6990.6	1.32%	70.52%	+	-	+	-	+	-	+	-	-	
1993	I	3.04	0.00%	100.00%	6988.7	-0.03%	-102.06%	-	+	-	+	-					
1993	II	3	-1.32%	******	7031.2	0.61%	2337.45%	-	+	-	+	-	-	-	-	-	-
1993	III	3.06	2.00%	252.00%	7062	0.44%	-27.97%	-	+	-	+	-	+	+	+	+	+
1993	IV	2.99	-2.29%	-214.38%	7168.7	1.51%	244.92%	-	+	-	+	-	-	-	-	-	-
1994	I	3.21	7.36%	421.64%	7229.4	0.85%	-43.96%	-	+	-	+	-	+	+	+	+	+
1994	II	3.94	22.74%	209.08%	7330.2	1.39%	64.67%	+	-	+	-	-	+	+	+	+	+
1994	III	4.49	13.96%	-38.62%	7370.2	0.55%	-60.86%	+	-	+	+	-	+	+	+	+	+
1994	IV	5.17	15.14%	8.49%	7461.1	1.23%	126.02%	+	-	-	+	+	+	+	+	+	+
1995	I	5.81	12.38%	-18.26%	7488.7	0.37%	-70.01%	+	+	-	-	+	+	+	+	+	+
1995	II	6.02	3.61%	-70.80%	7503.3	0.19%	-47.30%	+	-	-	+	-	+	+	+	+	+
1995	III	5.8	-3.65%	-201.11%	7561.4	0.77%	297.17%	-	-	+	-	+	-	-	-	-	-

Appendix A

Comparison Analysis of Federal Reserves Interest Rates
and Gross Domestic Product (GDP)

Year	Quarter	Feds Funds	Change	% Change	*GDP	Change	% Change	Comparison Quarters (2nd Difference)					Comparison Quarters (1st Difference)				
								0	I	II	III	IV	0	I	II	III	IV
1995	IV	5.72	-1.38%	62.26%	7621.9	0.80%	3.33%	+	-	+	-	+	-	-	-	-	-
1996	I	5.36	-6.29%	-356.29%	7676.4	0.72%	-10.63%	+	-	+	-	+	-	-	-	-	-
1996	II	5.24	-2.24%	64.43%	7802.9	1.65%	130.46%	+	-	+	-	+	-	-	-	-	-
1996	III	5.31	1.34%	159.67%	7841.9	0.50%	-69.67%	-	+	-	+	-	+	+	+	+	+
1996	IV	5.28	-0.56%	-142.29%	7931.3	1.14%	128.09%	-	+	-	+	+	-	-	-	-	-
1997	I	5.28	0.00%	100.00%	8016.4	1.07%	-5.88%	-	+	-	-	+					
1997	II	5.52	4.55%	******	8131.9	1.44%	34.28%	+	-	-	+	-	+	+	+	+	+
1997	III	5.53	0.18%	-96.01%	8216.6	1.04%	-27.71%	+	+	-	+	-	+	+	+	+	+
1997	IV	5.51	-0.36%	-299.64%	8272.9	0.69%	-34.22%	+	-	+	-	-	-	-	-	-	-
1998	I	5.52	0.18%	150.18%	8404.9	1.60%	132.86%	+	-	+	+	-	+	+	+	+	+
1998	II	5.5	-0.36%	-299.64%	8465.6	0.72%	-54.74%	+	-	-	+	+	-	-	-	-	-
1998	III	5.53	0.55%	250.55%	8537.6	0.85%	17.77%	+	+	-	-	+	+	+	+	+	+
1998	IV	4.86	-12.12%	-2321.22%	8654.5	1.37%	60.99%	-	+	+	-	-	-	-	-	-	-
1999	I	4.73	-2.67%	77.92%	8730	0.87%	-36.29%	-	-	+	+	-	-	-	-	-	-
1999	II	4.75	0.42%	115.81%	8783.2	0.61%	-30.15%	-	+	+	-	+	+	+	+	+	+
1999	III	5.09	7.16%	1592.84%	8905.8	1.40%	129.06%	+	+	-	+	-	+	+	+	+	+
1999	IV	5.31	4.32%	-39.62%	9084.1	2.00%	43.43%	-	+	-	+	+	+	+	+	+	+
2000	I	5.68	6.97%	61.21%	9191.8	1.19%	-40.78%										
2000	II	6.27	10.39%	49.07%	9318.9	1.38%	16.63%	+ 27	+ 23	+ 23	+ 25	+ 26	+ 26	+ 27	+ 27	+ 27	+ 26
2000	III	6.52	3.99%	-61.61%	9369.5	0.54%	-60.73%	- 23	- 27	- 27	- 25	- 24	- 23	- 22	- 22	- 22	- 23
2000	IV	6.47	-0.77%	-119.23%	9401.5	0.34%	-37.10%										

* Billions of chained dollars

Appendix B

Comparison Analysis of Federal Reserves Interest Rates
and Gross Domestic Product (GDP)

Year	Quarter	eds Fund	Change	% Change	*GDP	Change	% Change	Comparison Quarters (2nd Derivative)				
								0	I	II	III	IV
1987	I	6.22			6013.3							
1987	II	6.65	6.91%		6077.2	1.06%						
1987	III	6.84	2.86%	-58.67%	6128.1	0.84%	-21.18%	-/-	-/+	-/-	-/+	-/-
1987	IV	6.92	1.17%	-59.06%	6234.4	1.73%	107.11%	-/+	-/-	-/+	-/-	-/+
1988	I	6.66	-3.76%	-421.24%	6275.9	0.67%	-61.63%	-/-	-/+	-/-	-/+	-/-
1988	II	7.16	7.51%	299.82%	6349.8	1.18%	76.89%	+/+	+/-	+/+	+/-	+/-
1988	III	7.98	11.45%	52.55%	6382.3	0.51%	-56.53%	+/-	+/+	+/-	+/-	+/-
1988	IV	8.47	6.14%	-46.38%	6465.2	1.30%	153.78%	-/+	-/-	-/-	-/-	-/-
1989	I	9.44	11.45%	86.51%	6543.8	1.22%	-6.40%	+/-	+/-	+/-	+/-	+/+
1989	II	9.73	3.07%	-73.18%	6579.4	0.54%	-55.25%	-/-	-/-	-/-	-/+	-/-
1989	III	9.08	-6.68%	-317.46%	6610.6	0.47%	-12.83%	-/-	-/-	-/+	-/-	-/-
1989	IV	8.61	-5.18%	22.52%	6633.5	0.35%	-26.95%	+/-	+/+	+/-	+/-	+/-
1990	I	8.25	-4.18%	19.22%	6716.3	1.25%	260.32%	+/+	+/-	+/-	+/-	+/+
1990	II	8.24	-0.12%	97.10%	6731.7	0.23%	-81.63%	+/-	+/-	+/-	+/+	+/+
1990	III	8.16	-0.97%	-700.97%	6719.4	-0.18%	-179.69%	-/-	-/-	-/+	-/+	-/-
1990	IV	7.74	-5.15%	-430.15%	6664.2	-0.82%	-349.60%	-/-	-/+	-/+	-/-	-/+
1991	I	6.43	-16.93%	-228.83%	6631.4	-0.49%	40.09%	-/+	-/+	-/-	-/+	-/+
1991	II	5.86	-8.86%	47.62%	6668.5	0.56%	213.67%	+/+	+/-	+/+	+/+	+/+
1991	III	5.64	-3.75%	57.65%	6684.9	0.25%	-56.04%	+/-	+/+	+/+	+/+	+/-
1991	IV	4.82	-14.54%	-287.27%	6720.9	0.54%	118.97%	-/+	-/+	-/+	-/-	-/+
1992	I	4.02	-16.60%	-14.16%	6783.3	0.93%	72.40%	-/+	-/+	-/-	-/+	-/-
1992	II	3.77	-6.22%	62.53%	6846.8	0.94%	0.83%	+/+	+/-	+/+	+/-	+/+
1992	III	3.26	-13.53%	-117.53%	6899.7	0.77%	-17.47%	-/-	-/+	-/-	-/+	-/-
1992	IV	3.04	-6.75%	50.11%	6990.6	1.32%	70.52%	+/+	+/-	+/+	+/-	+/+
1993	I	3.04	0.00%	100.00%	6988.7	-0.03%	-102.06%	+/-	+/+	+/-	+/+	+/-
1993	II	3	-1.32%	******	7031.2	0.61%	2337.45%	-/+	-/-	-/+	-/-	-/+
1993	III	3.06	2.00%	252.00%	7062	0.44%	-27.97%	+/-	+/+	+/-	+/+	+/-
1993	IV	2.99	-2.29%	-214.38%	7168.7	1.51%	244.92%	-/+	-/-	-/+	-/-	-/+
1994	I	3.21	7.36%	421.64%	7229.4	0.85%	-43.96%	+/-	+/+	+/-	+/+	+/-

Appendix B

Comparison Analysis of Federal Reserves Interest Rates
and Gross Domestic Product (GDP)

Year	Quarter	eds Fund	Change	% Change	*GDP	Change	% Change	Comparison Quarters (2nd Derivative)				
								0	I	II	III	IV
1994	II	3.94	22.74%	209.08%	7330.2	1.39%	64.67%	+/+	+/-	+/+	+/-	+/-
1994	III	4.49	13.96%	-38.62%	7370.2	0.55%	-60.86%	-/-	-/+	-/-	-/-	-/+
1994	IV	5.17	15.14%	8.49%	7461.1	1.23%	126.02%	+/+	+/-	+/-	+/+	+/+
1995	I	5.81	12.38%	-18.26%	7488.7	0.37%	-70.01%	-/-	-/-	-/+	-/+	-/-
1995	II	6.02	3.61%	-70.80%	7503.3	0.19%	-47.30%	-/-	-/+	-/+	-/-	-/+
1995	III	5.8	-3.65%	-201.11%	7561.4	0.77%	297.17%	-/+	-/+	-/-	-/+	-/-
1995	IV	5.72	-1.38%	62.26%	7621.9	0.80%	3.33%	+/+	+/-	+/+	+/-	+/+
1996	I	5.36	-6.29%	-356.29%	7676.4	0.72%	-10.63%	-/-	-/+	-/-	-/+	-/-
1996	II	5.24	-2.24%	64.43%	7802.9	1.65%	130.46%	+/+	+/-	+/+	+/-	+/+
1996	III	5.31	1.34%	159.67%	7841.9	0.50%	-69.67%	+/-	+/+	+/-	+/+	+/-
1996	IV	5.28	-0.56%	-142.29%	7931.3	1.14%	128.09%	-/+	-/-	-/+	-/-	-/-
1997	I	5.28	0.00%	100.00%	8016.4	1.07%	-5.88%	+/-	+/+	+/-	+/-	+/+
1997	II	5.52	4.55%	******	8131.9	1.44%	34.28%	+/+	+/-	+/-	+/+	+/-
1997	III	5.53	0.18%	-96.01%	8216.6	1.04%	-27.71%	-/-	-/-	-/+	-/-	-/+
1997	IV	5.51	-0.36%	-299.64%	8272.9	0.69%	-34.22%	-/-	-/+	-/-	-/+	-/+
1998	I	5.52	0.18%	150.18%	8404.9	1.60%	132.86%	+/+	+/-	+/+	+/+	+/-
1998	II	5.5	-0.36%	-299.64%	8465.6	0.72%	-54.74%	-/-	-/+	-/+	-/-	-/-
1998	III	5.53	0.55%	250.55%	8537.6	0.85%	17.77%	+/+	+/+	+/-	+/-	+/+
1998	IV	4.86	-12.12%	-2321.22%	8654.5	1.37%	60.99%	-/+	-/-	-/-	-/+	-/+
1999	I	4.73	-2.67%	77.92%	8730	0.87%	-36.29%	+/-	+/-	+/+	+/+	+/-
1999	II	4.75	0.42%	115.81%	8783.2	0.61%	-30.15%	+/-	+/+	+/+	+/-	+/+
1999	III	5.09	7.16%	1592.84%	8905.8	1.40%	129.06%	+/+	+/+	+/-	+/+	+/-
1999	IV	5.31	4.32%	-39.62%	9084.1	2.00%	43.43%	-/+	-/-	-/+	-/-	-/-
2000	I	5.68	6.97%	61.21%	9191.8	1.19%	-40.78%	+/- = 12	+/- = 14	+/- = 14	+/- = 13	+/- = 13
2000	II	6.27	10.39%	49.07%	9318.9	1.38%	16.63%	-/+ = 10	-/+ = 12	-/+ = 12	-/+ = 11	-/+ = 10
2000	III	6.52	3.99%	-61.61%	9369.5	0.54%	-60.73%	+/+ = 13	+/+ = 11	+/+ = 11	+/+ = 12	+/+ = 12
2000	IV	6.47	-0.77%	-119.23%	9401.5	0.34%	-37.10%	-/- = 13	-/- = 11	-/- = 11	-/- = 12	-/- = 13

* Billions of chained dollars

Works Cited

Ahmed, Habib. "Responses in output to monetary shocks and the interest rate: a rational expectation model with working capital." <u>Economic Letters</u>. vol. 61, issue 3. Elsevier Science, S.A., Amsterdam, Neatherlands:1998. p.351-358.

Canzoneri, Matthew, and Harris Dellas. "Real interest rates and central bank operating procedures." <u>Journal of Monetary Economics</u>. vol. 42, issue 3, 12 October 1998. <http://www.sciencedirect.com> March 23, 2001. p.471-491.

Chu, Joonsuk, and Ronald Ratti. "On the Relevance of Distinctions Between Anticipated, Unanticipated Expansionary, and Unanticipated Contractionary Monetary Policy." <u>Journal of Economics and Business</u>. vol. 51, issue 2. Elsevier Science, Inc. New York, New York:1999. p.109-131.

Mishkin, Frederic S. <u>The Economics of Money, Banking, and Financial Markets</u>. 5th ed. Addison-Wesley, New York, New York: 1997. p.389-405, 458-494.