A Model for Predicting Federal Reserve Monetary Policy Actions

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1. The Recent Shift to Monetary Easing

Following six rate hikes from June 1999, the Federal Open Market Committee (FOMC) at its December 19, 2000 meeting abandoned an inclination toward future tightening, and shifted to an easing rather than neutral bias.

Then in an inter-meeting move on January 3, 2001, the FOMC cut the federal funds target rate from 6.5 percent to 6 percent, marking the first shift to an easing policy in 26 months since October 1998.

The move, which had been hinted at in Federal Reserve Chairman Alan Greenspan's December 5 speech and the FOMC's December 19 statement, came in response to Nasdaq's 7 percent decline in the new year's first trading session on January 2, and the release on the same day of the NAPM index, which fell to its lowest level in ten years.

The Federal Reserve Board's interest rate cuts have been interpreted not as a tentative response, but as the first of more rate cuts to turn around the economy.

This paper outlines Federal Reserve Chairman Alan Greenspan's approach to monetary policy management, and presents an analytical model for predicting future monetary policy actions.

2. Changes in the FRB's Monetary Policy Targets

(1) Volcker's Emphasis on Money Supply Stability

To better understand the FRB's monetary policy under Chairman Greenspan, we must examine the course of events dating back from his predecessor, Paul Volcker.

In October 1979, shortly after taking office, Mr. Volcker changed the FRB's policy target from the federal funds rate to unborrowed reserves (reserves held by banks, excluding borrowings from the FRB),

thus emphasizing the stability of the money supply. The shift reflected a traditional monetarist response to inflation following the second oil shock.

Money supply targets had been used prior to Mr. Volcker, but were less important than stabilizing the federal funds rate. As a result, the FRB had often reacted too slowly when tightening, causing the money supply to overshoot and thus aggravating inflationary pressures. Mr. Volcker took a strong anti-inflationary stance by controlling the money supply directly rather than relying on interest rate targets.

On the other hand, this meant accepting more volatility in the federal funds rate, which at one point rose to 22 percent. While the severe tightening brought down inflation, the unemployment rate sky-rocketed. Moreover, the economy's response was also volatile, having fallen into recession in 1980-81 (two consecutive quarters of negative growth) before recovering sharply.

The characteristics of the FRB's monetary policy under Mr. Volcker (October 1979 to August 1987) can be seen by comparing variances in the growth rates of money supply (M2) and real GDP. What we find is that money supply has a smaller variance (2.14) and hence is less volatile than real GDP (9.24). This is consistent with the view that the FRB under Mr. Volcker emphasized stability of the money supply over that of the real economy.

(2) Mr. Greenspan's Emphasis on Stabilizing the Economy

Shortly after taking office in August 1987, Mr. Greenspan's first test in office came soon with Black Monday in October. Mr. Greenspan responded to the stock market's plunge by cutting interest rates sharply, showing an inclination to consider indicators besides the money supply. His effective response earned him the confidence of the financial markets.

However, Mr. Greenspan at first also considered continuing the existing policy emphasis on money supply. In the credit crunch of 1991-93 which accompanied the S&L crisis, he continued to implement easing with the intention of stabilizing the supply of money.

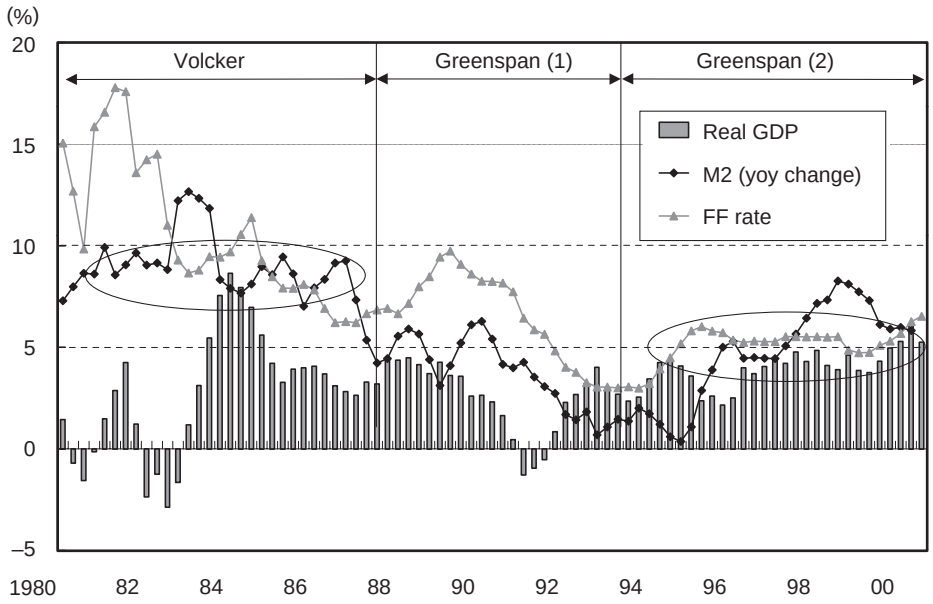
Mr. Greenspan's made a fundamental shift after his July 1993 Humphrey-Hawkins testimony to the Congress. In that testimony, Mr. Greenspan pointed to the declining correlation between the money supply and real economy, and stated his intention to reduce the role of money supply targets in favor of a comprehensive approach that would include other economic indicators. From then on, the FRB's monetary policy emphasized the economy's stability over that of the money supply, and the policy target was changed back to the federal funds rate.

In the first part of Mr. Greenspan's tenure, the variance in growth rates for the money supply and real GDP were 2.76 and 2.92 respectively, indicating that the FRB was monitoring both financial and real

markets. But from July 1993 to September 2000, the money supply variance increased to 5.94 while that of real GDP fell to 0.95. These empirical results corroborate the FRB's shift in emphasis to the economy's stability.

Thus in contrast to Mr. Volcker's orthodox monetarist approach, Mr. Greenspan's approach has been characterized by the use of diverse indicators for economic activity, inflation, and asset prices in implementing a discretionary and flexible monetary policy.

Figure 1 Shift in Monetary Policy Objective



(3) Diverse Methods Used to Stabilize the Economy

Moreover, since the U.S. stock market began rising in 1995, Mr. Greenspan has taken a keen interest in the impact of asset price fluctuations on the real economy, and has pursued economic stability not only by adjusting policy rates, but by announcing medium to long-term policy biases, and actively disseminating the FRB's views to the markets.

In particular, with respect to asset price volatility, Mr. Greenspan is concerned that the U.S. may repeat Japan's experience during the 1990s, wherein depressed asset prices delayed balance sheet adjustments by causing credit to contract. He is thus believed ready to carry out extensive easing as needed to avert any credit crunches.

Mr. Greenspan's flexibility and responsiveness are credited to his bottom-up approach to policy making, wherein he actively seeks the views of other board members and the Federal Reserve Banks (in the *Beige Book*). As a result, he is sensitive to economic developments and their implications, and bet-

ter able to formulate informed and responsive policies.

3. A Model for Monetary Policy Action

(1) The Qualitative Response Model

Mr. Greenspan's policy stance — emphasizing the stability of the economy over that of money supply, and monitoring a wide variety of economic indicators including asset prices — can be modeled with a qualitative response model.

In contrast to models that use continuous economic data, a qualitative response model the observed variables whether or not a particular action is taken. The model is effective in analyzing factors determining the behavior of economic actors.

For example, in purchasing a car, consumers must first make the decision to purchase; only then do they decide on the actual purchase amount based on income and other factors.

In deciding monetary policy, policy makers look at economic indicators and decide first of all whether to change interest rates, and then by how much. The qualitative response model analyzes the process of deciding whether or not to change interest rates.

(2) Probability of Monetary Policy Action

Using a type of qualitative response model called a friction model, below we estimate the probability of policy action by the FRB. A friction model is useful when economic actors do not respond immediately to changes, but instead wait until a threshold has been attained. In the car purchase example, the decision to purchase would be taken when monthly savings exceed the level necessary for purchase, or if the existing car's depreciation period has elapsed. Since the action in question does not occur smoothly in response to continuously changing conditions, the model is called a friction model.

This type of model is suited to simulating the monetary policy decision making process of the FRB. The FRB makes policy decisions through the Federal Open Market Committee (FOMC) based on a variety of economic indicators tracking economic conditions, inflation, stock prices and so forth. Rather than continuously adjusting interest rates at each meeting in response to changing conditions, the FOMC waits for conditions to reach a threshold level, and then moves the federal funds target rate in discrete steps of 0.25 or 0.5 percent.

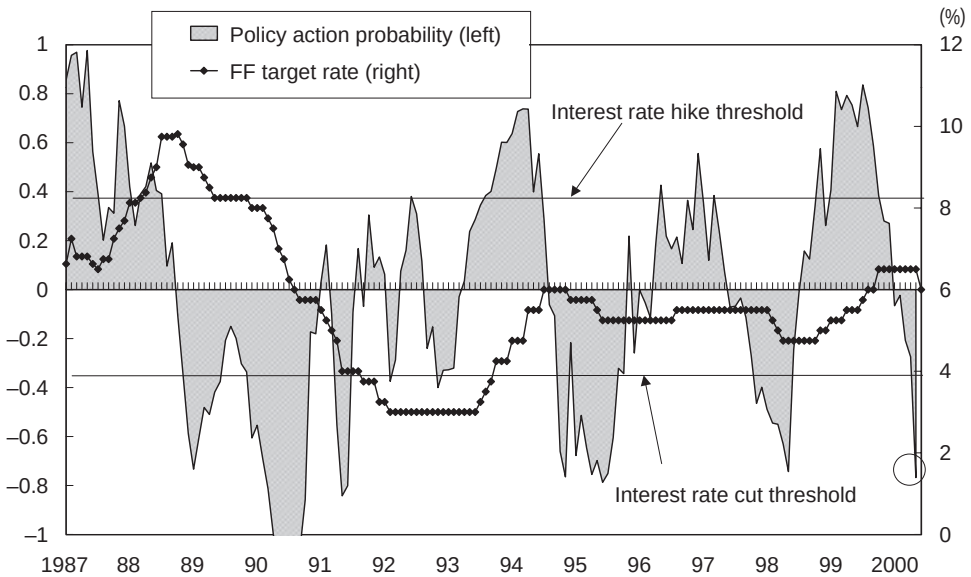
Our model estimates the probability of policy actions by tracking the size of actual interest rate moves against threshold values. The indicators identified as most instrumental in policy decisions are the NAPM index of purchasing orders, year on year change in the producer price index, and S&P 500 index.

Based on our estimation results from the time Mr. Greenspan took office in August 1987 to December 2000, the model shows a threshold value of 0.66 for policy moves. That is, the size of changes in the federal funds target rate is 0.66 percent. Since the smallest increment for a federal funds rate change is 0.25 percent, this means that an interest rate change at least 0.25 percent is implemented when the probability exceeds 38 percent (0.25 / 0.66 = 0.38).

In comparing actual rate target moves to the model's probability values, we found that whenever the probability exceeds either +0.38 or -0.38 percent, a policy move generally occurs (Figure 2).

Most recently, the probability plunged from 0.27 in November 2000 to -0.77 in December. Thus the model had already reflected changes in the economic environment that would affect policy decisions, and anticipated a shift to monetary easing.

Figure 2 Probability of Monetary Policy Action



(3) Key Indicators Affecting Policy

We next analyze the degree to which the key indicators affect the model's probability values. From the parameter values, the indicators in order of influence are the NAPM index, inflation, and stock prices. By contribution to changes in probability, once again it is the change in the NAPM index that plays the

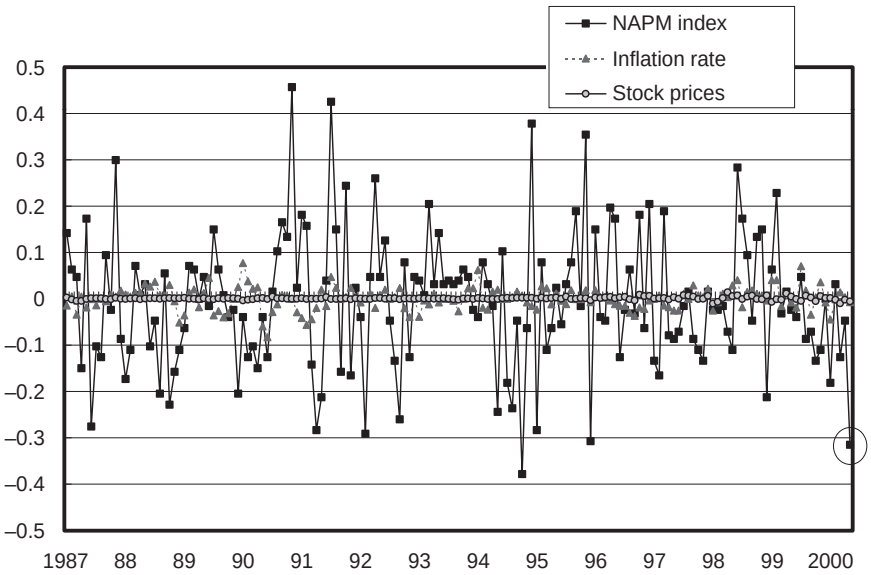
largest role. Indeed, the January inter-meeting rate cut is mainly attributed to the sharp decline in the NAPM index (Figure 3).

Considering that Mr. Greenspan's monetary policy objective is economic stability, the estimation results make sense. References to stock prices including the bubble, and statements about inflationary concerns with respect to oil prices and employment trends are consistent with the policy objective of sustainable economic growth, and the emphasis on variables corresponds with their perceived impact on the economy. Policy decisions clearly do not revolve around supporting the stock market or controlling inflation.

However, we should note that the contribution of stock price fluctuations to total probability fluctuations rose from a negligible 0.8 percent in August 1987 to 4.4 percent in December 2000. This supports the view that the FRB has become more concerned with the effect of asset price fluctuations on the real economy.

Th parameters for the threshold value for policy moves is statistically quite high. This reflects the consistency and firmness of Mr. Greenspan's policy stance.

Figure 3 Movement of Key Indicators Affecting Monetary Policy



4. The Model's 3-Month Lead Time

(1) Monetary Policy Action Signals

We next take the model's application one step further, and interpret the probability as a signal — thus when the value exceeds 0.38 or 0.76, the model is emitting a signal that the federal funds target rate will change 0.25 or 0.5 percent respectively. We then compare these signals against actual changes in target rates (Figure 4).

Of the 15 times when a signal appeared for the first time, the target rate was changed within three months in 11 cases. Moreover, the target rate was moved all nine times that the signal appeared for two consecutive months. However, the model failed to signal a policy action twice: from October 1987 to February 1988, when the FRB responded to credit instability accompanying Black Monday, and from July to September 1992, when a reflationary policy was taken (to achieve zero real interest rates) to combat the credit crunch, which was a structural problem. Since these cases can be explained by the monetary policy objective of achieving economic stability — which is exogenous to the model — the model appears on the whole to be successful in predicting actual policy actions.

According to the model, the three rate cutes from September 1998 were a response not only to financial crises — namely, Russia's financial crisis and the failure of the Long-Term Capital Management hedge fund — but to rate cut signals emitted by the real economy since June. In 2000, the model signaled 0.25 and 0.5 percent rate hikes until May, which corresponded with the rate hikes in February, March and May. No signal appeared from June to November; likewise, the federal funds rate was unchanged during this period. Then in December the model suddenly signaled a 0.5 percent rate cut. This signal is consistent with the FRB's sudden policy shift in December as well as the 0.5 percent inter-meeting rate hike in January.

(2) Evaluation and Enhancement of the Model

The model's results indicate that the FRB closely monitors economic indicators and at times implements policy changes even more responsively than estimated by the model. If the economy continues to signal a rate cut after January, the FOMC may implement additional rate cuts on January 31 or March 20, thus shifting to a full-fledged easing policy.

The model enjoys a high degree of objectivity and timeliness by using publicly available indicators without modification, and enabling probability estimates on a monthly basis. Future enhancements include increasing the model's lead time by using even more quickly available indicators, and introducing other factors such as credit tightness in financial markets (expansion of corporate bond spreads).

Figure 4 Signals Emitted by the Model and Actual Rate Moves