



BOARD OF GOVERNORS
OF THE
FEDERAL RESERVE SYSTEM
WASHINGTON, D. C. 20551

November 1, 1977

CONFIDENTIAL (FR)
CLASS II - FOMC

TO: Federal Open Market Committee

FROM: Arthur L. Broida *ALB*

Attached for your information is a memorandum from President Eastburn, transmitting a memorandum on the subject of interest rate forecasts prepared by Mr. Gillum of his staff.

The attachment is being distributed at Mr. Eastburn's request.

Attachment

FEDERAL RESERVE BANK OF PHILADELPHIA

PHILADELPHIA, PENNSYLVANIA 19105

OFFICE OF THE
PRESIDENT

October 28, 1977

CONFIDENTIAL (FR)
CLASS II - FOMC

TO: All Federal Reserve Bank Presidents and
Chairman Burns Governor Partee
Vice Chairman Gardner Governor Coldwell
Governor Wallich Governor Lilly
Governor Jackson

FROM: David P. Eastburn

At a recent meeting of the FOMC, I raised a question regarding interest rate forecasts made in the Bluebook compared with those made by market participants as estimated from yield curve data. In this connection, the staff at the Philadelphia Bank developed the attached memorandum. This memo discusses reasons for evaluating the accuracy of interest rate forecasts, presents some actual evaluations, and makes three recommendations.

One finding of the evaluation is that while errors for near-term forecasts are quite small, errors are substantial for more distant projections. The relatively large forecast misses for long-term projections are consistent with our experience. Over the period analyzed, the Philadelphia record has not been as good as either the market's or the Board staff's.

A second finding of the evaluation is that market forecasts are of higher quality than those reported in the Bluebook. The time period covered is too short to allow us to project this result into the future with much confidence. Nevertheless, my staff does conclude that because the market forecasts are at least no worse than those found in the Bluebook, the evaluation tends to support the view that markets are not irrational.

Based in part on our evaluations and in part on a growing academic literature which concludes that markets respond rationally to available data, the memorandum suggests "that the FOMC need not be so concerned as it has been about market reaction to short-run changes in monetary policy or to weekly information on the aggregates." The memorandum also makes two procedural recommendations. First, market forecasts as estimated from yield curve data should be included in the Bluebook. Second, forecast evaluations of the sort presented here should be updated periodically for the information of the Committee.

While I do not necessarily concur in all the conclusions and recommendations of the memorandum, I have found it thought-provoking. I have taken the liberty of distributing the memorandum in the hopes that members of the Committee will find it of value.

Attachment

FEDERAL RESERVE BANK OF PHILADELPHIA

This memorandum contains
CONFIDENTIAL (FR) information

Date: October 19, 1977
To: Ira Kaminow, Vice President and Economic Adviser
From: Gary Gillum, Senior Economist
Subject: BLUEBOOK AND U. S. TREASURY MARKET INTEREST-RATE
FORECASTS

INTRODUCTION AND SUMMARY OF CONCLUSIONS

This memorandum presents measures of the quality of Bluebook forecasts of the Federal funds rate and U.S. Treasury market forecasts of an overnight rate on Treasury securities. The period examined--October 1975 through August 1977--was determined by the period over which the Board staff has presented quarterly interest-rate forecasts in the Bluebook. Because only two years of data were used, the conclusions reached are tentative. The issues involved are important enough, however, to justify the present evaluation.

This forecast evaluation was undertaken for two reasons. First, in assessing the value of interest-rate forecasts as a guide for the FOMC in its deliberations, it is important to know something of our ability to make such forecasts accurately. Second, by judging the quality of U.S. Treasury market forecasts against the standard set by the staff, some light can be shed on the degree of economic rationality in financial markets. Members of the FOMC, among others, have expressed concern about the fragility of financial markets, explicitly or implicitly assuming that financial market participants often "overreact" or otherwise act irrationally. Market forecasts substantially inferior to staff forecasts would constitute confirming evidence for this view. On the other hand, evidence that the market forecasts are not inferior would lend support to the view that markets are rational.

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The results indicate that Bluebook and market forecast errors both tended to be small for near-term forecasts (as low as 6 basis points) but were quite substantial for longer term forecasts (ranging as high as 2 percentage points). Bluebook and market forecasts both tended to overpredict future rates, with overprediction becoming substantial for distant forecasts.

Judging by measures used in the memorandum, for the limited time period studied, Bluebook and Treasury market near-term forecasts were essentially equal in quality while, for longer forecast horizons, market forecasts were superior by as much as 75 basis points. This evidence adds further support to a growing literature that suggests financial market participants are efficient in making use of available information and, consequently, that the FOMC need not be so concerned as it has been about market reaction to short-run changes in monetary policy or to weekly information on the aggregates.

Because the Committee is concerned with financial stability, it might want to take market forecasts into account in making policy. Knowledge of market forecasts can give the Committee a better idea of market expectations and, therefore, of the magnitude and direction of interest-rate changes that might be expected to disturb the market. Thus, it is suggested that estimates of market forecasts of interest rates should be included in the Bluebook.

Finally, the short time period covered by this study necessarily limits confidence in its conclusions. Since these are important issues, where sound conclusions can be useful, there should be periodic updates of these forecast evaluations.

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WHY EVALUATE INTEREST-RATE FORECASTS

Evaluation of the nature and accuracy of interest-rate forecasts can shed light on a number of important economic issues. Two seem of particular relevance to the FOMC.

The Value of Staff Federal Funds Rate Forecasts. In discussing short-run policy, Committee members often make implicit or explicit projections of quarterly interest-rate patterns. For example, Committee members have discussed the question of "front-end loading" in the context of how much rates would have to rise later in a policy period in order to induce the slowdown in aggregate growth that projections indicate would be required. The weight the Committee should place on Bluebook interest-rate projections in making such decisions should depend on the accuracy of staff forecasts. Thus, an evaluation of the quality of Bluebook forecasts can provide an important input into the policymaking process.

Tests of Financial Market Rationality. A second reason for looking at the quality of Bluebook forecasts can be found in a long-standing controversy over how well financial markets function. In one view, financial markets, when left on their own, function rather inefficiently and are quite fragile. To one degree or another, market participants are said to be susceptible to fads, to use available information poorly in forming expectations about future interest rates, and to overreact to unexpected changes in the economic climate.¹

Staff and FOMC members, for instance, have voiced such concerns in a variety of ways. There have been frequent references in Committee discussions

¹A well-known statement of this view can be found in John Maynard Keynes, The General Theory of Employment, Interest and Money (New York: Harcourt, Brace and World, 1936), pp. 154-6.

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to what has been called financial market overreaction to new weekly data on the monetary aggregates. Interest rates have been said to have moved up or down excessively on the basis of Thursday afternoon publication of new data on the aggregates. Or, again, Committee members occasionally have expressed concern about "unnecessary" reversals in the Federal funds rate which presumably would needlessly confuse market participants about the thrust of monetary policy.² More generally, concern over market reactions to expected or unexpected financial events has led the FOMC to insulate the Federal funds rate from the effects of such shocks, unless changes in the funds rate have been deemed necessary to the achievement of other monetary policy goals such as one-year targets for the aggregates.

Another view of financial market behavior, however, argues that markets efficiently utilize all available information in forming interest-rate expectations. If this were not the case, it is argued, shrewd speculators could come into the market, exploit the weaknesses of present participants, make a profit, and in the process force market forecasts to become rational. In this view, financial markets are quite robust, and sharp changes in market interest rates merely reflect a rapid absorption of significant new information, not market overreaction.

These two hypotheses are not easy to test directly. Given the current state of the art, it is difficult to assess the degree of market rationality by examining individual historical episodes. First, in an uncertain world, rational market responses must be designed to perform best on average. It is inevitable that even appropriate market responses sometimes will turn

²This view also received emphasis in the Trading Desk's appraisal of the non-borrowed reserves experiment. See page 10 of the Desk's supporting staff paper to the Subcommittee on the Directive's appraisal (dated December 15, 1976).

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out to be wrong in hindsight while suboptimal policies, because of the outcome of random forces, will be right on occasion. A second problem with trying to assess market rationality directly on a case-by-case basis is that investigators have no way of knowing for certain whether they have any more insight into what is appropriate than market participants have.

Because of the difficulty of directly assessing the proper response to new information, researchers have taken an indirect approach. They have examined market prices and forecast errors over extended time periods to see whether market forecasts have violated any characteristics of rationality on average. Most studies have concluded that market forecasts are consistent with the rationality assumption.³

The present evaluation of the quality of Bluebook and Treasury market forecasts can also shed some light on the issue of economic rationality. Staff forecasts reflect seasoned judgment on the workings of financial markets and the economy as well as some "inside" knowledge of the workings of the FOMC. If the results indicate that Treasury market forecasts are as good as staff forecasts, that can be interpreted as evidence that the financial markets employ available information at least as efficiently (rationally) as the staff in making forecasts. Such a conclusion would have important implications for the conduct of monetary policy, as will be discussed later.

AN EVALUATION OF THE QUALITY OF THE FORECASTS

The quality of Bluebook and Treasury market forecasts can be discussed

³For a survey of this literature, see E. F. Fama, "Efficient Capital Markets: A Review of Theory and Empirical Work," Journal of Finance, May 1970, pp. 383-417. Additional support for the efficiency of the bill market recently has been provided in Fama, "Forward Rates as Predictors of Future Spot Rates," Journal of Financial Economics, October 1976, pp. 361-377. There remains some question as to the degree of market rationality as evidenced by the exchange between Fama and others in the American Economic Review, June 1977, pp. 469-496.

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in terms of summary measures of their forecast errors. Two measures are employed in the present paper--average error and average absolute error. Average error provides a measure of forecast bias--the degree to which the forecasts, on average, overpredict or underpredict the subsequent actual values. Average absolute error (which ignores the sign on the forecast error) provides a measure of the average size of errors. Two sets of forecasts may both be unbiased (on average, overpredictions balance underpredictions) but the poorer set will have larger average absolute errors, reflecting large average misses.

The forecasts used in this evaluation have been obtained as follows. Estimates of three alternative paths of the Federal funds rate for the remaining quarters of the current one-year target period have been included in Bluebooks since October 1975. From the three, that alternative which corresponded to the funds-rate range chosen by the Committee was selected as "the" staff forecast for inclusion in this study. The resulting set of forecasts is shown in Table A of Appendix I. Estimates of market forecasts of overnight Treasury interest rates have been extracted from the yield curve for a business day near the time of preparation of each Bluebook.⁴

⁴The actual overnight rate prevailing on that day was also estimated from the yield curve. Such a rate, which might be thought of as the interest rate on one-day Treasury bills, corresponds to the maturity of most Federal funds transactions. Even though this overnight rate and the Federal funds rate are determined in different financial markets, they should be fairly closely linked and, therefore, about equally difficult to forecast. In fact, over the period of investigation the correlation coefficient between the quarterly-average rates was 0.84 and the standard deviations of the two rates differed by 8 basis points, 0.37% to 0.29%.

The Federal funds rate could not have been substituted for the Treasury market rate without affecting the forecast results, however, since estimated overnight Treasury rates averaged 27 basis points below the corresponding Federal funds rates.

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(See Table B of Appendix I.) This approach is based upon the hypothesis that, at any point in time, the yield curve for U. S. Treasury securities implicitly reflects a market forecast of the future behavior of interest rates on Treasury securities.⁵

Measures of average errors and average absolute errors for both Bluebook and Treasury market forecasts are given in Table 1. These measures of forecast performance are calculated for each forecast horizon. For present purposes, the horizon has been defined as the number of months (with any fraction of months rounded upward) from the date on which the forecast was made to the beginning of the calendar quarter being forecasted. Thus a forecast of the 1977 second-quarter Federal funds rate made in January 1977 has a forecast horizon of 3 months. A forecast of the same quarter's funds rate made in March has a horizon of 1 month; made in April, 0 months; and in May, -1 month. In this manner, horizons of less than one month indicate that the forecast was based partly upon actual data.

Using average error as a measure of forecast quality, it can be observed that both Bluebook forecasts of the funds rate and market forecasts of the one-day bill rate showed some small bias for a horizon of -1 month (halfway through the calendar quarter being forecasted). Thus, the Bluebook overpredicted, on average, by 2 basis points while the market underpredicted, on average by 3 basis points. Bias in both sets of forecasts grew steadily as the forecast horizon was extended. The market's bias grew less rapidly than that of the staff projections, but still reached 135 basis points—a quite strong bias.

⁵See Appendix II for a further explanation of both this hypothesis and the techniques used to extract the forecasts.

Table 1

ERROR STATISTICS ON INTEREST-RATE FORECASTS IN THE BLUEBOOK (OF THE FEDERAL FUNDS RATE) AND IN THE YIELD CURVE OF U. S. TREASURY SECURITIES (ON OVER-NIGHT LOANS), OCTOBER 1975 TO AUGUST 1977.

<u>Number of Months Before Start of Quarter Being Forecasted</u>	<u>Average Error</u>		<u>Average Absolute Error</u>	
	<u>Bluebook</u> (in basis points)	<u>Treasury Market</u> (in basis points)	<u>Bluebook</u> (in basis points)	<u>Treasury Market</u> (in basis points)
-1	2	-3	7	10
0	14	5	26	18
1	24	20	43	31
2	67	31	67	40
3	95	45	104	57
4	109	77	109	91
5	139	74	139	74
6	159	82	159	98
7	174	115	174	133
8	214	117	214	117
9	209	135	209	135

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As for measures of accuracy, forecasts made midway through the forecasted quarter exhibited average absolute errors of 7 and 10 basis points for staff and market forecasts, respectively. These errors grew to 209 basis points and 135 basis points, respectively, for forecasts made 9 months prior to the start of the forecasted quarter.

At distant forecast horizons, both sets of forecasts showed average errors equal to their respective average absolute errors. This result occurred because all the forecasts at each such horizon were overpredictions of subsequent actual funds rates. The Treasury market's superior performance at distant forecast horizons thus is traceable largely to the lower bias in its forecasts.⁶

LIMITATIONS OF THE EVALUATION

Broadly, the results reflect the very considerable difficulty of making good interest-rate forecasts. However, there are some special characteristics of the forecasts and the time period of evaluation that necessitate some qualification of the results.

There would appear to be a source of bias in favor of the relative quality of Treasury market forecasts. Bluebook forecasts of future funds rates are forced to be conditional upon hitting the midpoint of the one-year M_1 growth target range while Treasury market forecasts are not so bound. As a result, any time the FOMC misses its aggregate target, the staff will be in error even if it forecasts the money-interest rate relationship perfectly. Since Treasury market forecasts are not conditional on a particular monetary growth rate,

⁶Other error measures, not reported here, indicate that the superior performance of Treasury market forecasts is not caused entirely by lower bias.

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market participants are free to select their best guess on monetary growth. This would give the markets an advantage over the staff.

Given the judgmental nature of the Bluebook forecasts, it is not possible to correct these forecasts for errors in the M_1 growth rate assumptions which underlie them. It is possible, however, to get a limited idea of whether or not this constraint actually has been a handicap. A test of this hypothesis, based upon the assumption that the demand for money balances is inversely related to the interest rate, is detailed in Appendix III. The results indicate that M_1 growth target misses cannot account for the size of Bluebook forecast errors. In fact, it is estimated that, if there has been no M_1 target misses, the average bias for forecast horizons of 7 to 9 months would have been 201 basis points--very close to what is reported in Table 1.

The shortness of the period of evaluation and the domination of that period by an apparent shift in the demand for money raise important questions about the generality of the results. Short time periods inevitably open the way to large errors in estimating the quality of forecasts. The apparent shift in the demand for money during this time period, an unexpected shock of sizeable magnitude, could well have had the effect of exacerbating these sampling problems and may account for the constant overprediction at longer forecast horizons. Consequently, the results presented in this memorandum may be misleading as to the forecasting abilities of both the Treasury securities market and the staff.

It also might be argued that the shifting demand for money has acted to distort the relative quality of the forecasts. It is possible,

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for instance, that the forecasting techniques used by the staff are less able to accommodate unexpected shifts in the demand for money and that, during periods of a stable demand function, the relative performance of the Bluebook would improve. Whether this possibility is, in fact, the case cannot be determined without further evidence; and, if true, it would still reflect a relative weakness in staff forecasting procedures.

Some might willingly concede a relative weakness in the staff's forecasting technique, however, but argue that the weak technique is mandated by the Committee. That is, the staff is required (quite reasonably) to make its interest rate forecast conditional upon specified monetary growth rates. If the link between monetary growth rates and interest rates is weak, however, the quality of interest-rate forecasts will suffer. Then, if better (alternative) interest-rate forecast techniques are available, market participants, who are not constrained and are concerned only with forecasting interest rates, will have a clear advantage over the staff. It is my casual impression that this argument is at least partially valid and may indeed account for the staff's relatively poorer performance over the period of evaluation. However, careful testing clearly is needed before this argument is fully accepted.

It is unlikely that the observed margin of superiority of Treasury market forecasts is a good estimate of the true margin. Nevertheless, based on our criterion, the current evidence is not inconsistent with the view that Treasury market forecasts are rational. Thus, the results reported in this memorandum are in agreement with the evidence collected by economists outside the System in support of the view that the Treasury bill market is efficiently using

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available information in making its forecasts.⁷

IMPLICATIONS AND RECOMMENDATIONS

The conclusion that Treasury market forecasts of Federal funds rates reflect rational market behavior has some rather important implications for monetary policymaking.

Robustness of Financial Markets. Economically rational markets are robust markets, able to absorb new information quickly and to adapt rapidly to unexpected shocks. Thus, it would seem appropriate in the formulation of monetary policy to view markets as rational unless specific information to the contrary is available. Rationality of markets implies, for example, that markets can comfortably absorb the publication of weekly aggregate numbers,⁸ fluctuations in funds rates, and other phenomena that have traditionally been of concern to the FOMC. What is presently identified as market "overreaction" to new information and policy changes in actuality may constitute a rational response to current policy procedures.⁹ The Trading Desk does alter policy in response to incoming weekly aggregate data, so it is logical for market participants to follow these data closely. Similarly, FOMC attempts to smooth the funds rate in the short run may lead to less frequent but bigger moves in that rate. Rationality suggests that market responses should mirror this pattern as participants come to expect

⁷See Richard Roll, The Behavior of Interest Rates (New York: Basic Books, Inc., 1970) and Fama (1976), loc. cit.

⁸As I interpret it, support for this point is provided in the Board staff memorandum of Leigh Ribble, "The Relationship Between Bill Rate Movements and the Weekly Release of M₁ Data," dated April 8, 1976.

⁹An especially cogent statement of this point is contained in the Supplementary Comment of Governor Wallich attached to the report of the Subcommittee on the Directive, "Reappraisal of Non-Borrowed Reserves on Basis of Staff Experiment," dated December 15, 1976.

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periods of steady funds rates followed by periods of large adjustments.

Market Forecasts in the Bluebook. Inclusion of market forecasts in the Bluebook may serve to give the FOMC a better idea of the likely impact of policy on financial markets.¹⁰ Market forecasts are based on participants' best guesses of the course of monetary policy, while staff forecasts project the rate pattern associated with each policy alternative. The difference between market and staff forecasts might serve, therefore, as an estimate of the extent to which the market would be surprised by the results associated with each policy alternative. Currently, there is a tendency to associate undisturbed financial markets with unchanged Federal funds rates (or other interest rates). Yet, presumably, the extent of market disruption attributable to monetary policy is linked to the extent to which policy comes as a surprise. Dealer positions, for example, are based on their expectations of the future course of rates. Unexpected declines in rates can be as costly to net short positions as unexpected increases in rates to net long positions. If this is so, then the Committee, in order to judge the potential costs in market disruption of attaining its one-year M_1 target, must have at hand a measure of market anticipations about interest rates. It then would be in a better position to judge whether, say, the projected increases in interest rates necessary to achieve its aggregate targets would be disruptive of the market.

¹⁰Some may be tempted to use the market forecast as a "second opinion" or as an alternative to the Bluebook forecast. One must be careful in doing so, however, because the monetary growth assumption, if any, which underlies the Treasury market forecast is unknown. Since it is the money-interest rate relationship which is of interest to the Committee, the usefulness of the market forecast is limited.

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APPENDIX I

TABLE A

SELECTED BLUEBOOK FORECASTS OF THE FEDERAL FUNDS RATE

Date of Forecast	Calendar Quarter Being Forecast:									
	1975	1976				1977				1978
	IV	I	II	III	IV	I	II	III	IV	I
10/75	6.25	7.75	8.5	9.0						
11/75	5.5	6.5	7.25	7.5						
12/75	5.375	5.75	6.75	7.25						
1/76		5.0	6.125	6.5	6.5					
2/76		4.75	5.25	6.0	6.75					
3/76		4.8	5.0	5.75	6.5					
4/76			5.0	5.75	6.5	7.0				
5/76			5.125	6.25	7.75	8.5				
6/76			5.25	6.0	7.5	8.0				
7/76				5.5	6.25	7.0	7.25			
8/76				5.25	5.75	6.5	7.25			
9/76				5.25	5.5	6.25	6.75			
10/76					5.125	5.5	6.0	6.5		
11/76					5.0	5.25	5.75	6.5		
12/76					4.875	4.625	5.25	6.0		
1/77						4.75	5.5	6.0	6.5	
2/77						4.75	5.5	6.0	6.5	
3/77						4.625	5.25	6.0	6.5	
4/77							4.875	5.5	6.25	6.5
5/77							5.125	6.0	6.75	7.0
6/77							5.125	5.75	6.5	6.75
7/77								5.875	6.125	6.25
8/77								5.875	6.5	6.875
Actual Federal Funds Rate:	5.41	4.83	5.20	5.28	4.88	4.66	5.15	5.82		

TABLE B

SELECTED U. S. TREASURY MARKET FORECASTS, AS EXTRACTED FROM THE YIELD CURVE,
OF THE TREASURY MARKET OVERNIGHT RATE.

Date of Forecast	Calendar Quarter Being Forecast:									
	1975	1976				1977				1978
	IV	I	II	III	IV	I	II	III	IV	I
10/75	5.95	6.41	6.61	7.07						
11/75	5.39	5.57	5.80	6.27						
12/75		5.67	6.72	6.80						
1/76		4.73	5.17	5.50	5.96					
2/76		4.64	5.03	5.54	5.87					
3/76			4.90	5.62	5.87					
4/76			4.80	5.27	5.73	6.01				
5/76			4.73	5.29	5.75	6.20				
6/76				5.69	6.23	6.74				
7/76				5.18	5.57	6.00	6.33			
8/76				5.13	5.34	5.86	6.19			
9/76					5.03	5.53	5.66			
10/76					4.87	5.06	5.29	5.48		
11/76					4.77	4.87	5.05	5.37		
12/76						4.32	4.32	4.75		
1/77						4.39	4.63	4.71	5.04	
2/77						4.46	4.97	5.37	5.78	
3/77							4.62	5.13	5.54	
4/77							4.51	4.83	5.33	5.75
5/77							4.53	4.89	5.34	5.64
6/77								4.96	5.52	5.70
7/77								5.01	5.25	5.56
8/77								5.12	5.60	6.05
Estimated Actual Overnight Rate:	5.27	4.83	4.85	5.08	4.73	4.40	4.68	5.20		

APPENDIX II

THE YIELD CURVE AND MARKET
EXPECTATIONS OF FUTURE INTEREST RATES

To see why the yield curve should reflect expectations of future interest rates, consider the investment alternatives available to an individual who must hold some amount of his wealth in U.S. Treasury securities for a period of two years. One alternative is to buy a Treasury note with two years remaining to maturity and hold the note to maturity. Another alternative is to buy a one-year Treasury bill, hold it to maturity, redeem it, and reinvest the proceeds in a second one-year Treasury bill which would also be held to maturity. Which alternative will be chosen will depend upon the known current yields on one-year Treasury bills and two-year notes plus the individual's expectation of the rate on a one-year Treasury bill issued one year from now.

Suppose that the one-year Treasury bill rate is 5% and the rate on two-year notes is 5.5%. If the individual chooses to buy the one-year Treasury bill, then it must be that he expects that the one-year bill rate one year from now will be 6% or higher (say 7%) so that his expected average yield on his investment will be 5.5% or higher $[(5\% + 7\%) \div 2 = 6\%]$. Successive one-year bills are then the more attractive investment. If the two-year note is chosen, then he must expect the one-year bill rate will be 6% or less. Thus the expected average yield on successive one-year bills will be 5.5% or lower, making them a less attractive investment than the two-year note.

If enough investors alter their holdings of Treasury securities based on their expectations about future interest rates, then prices (and yields) of Treasury securities will change in the market place until the hypothetical "average" investor in our example is indifferent between choosing a two-year

note and successive one-year bills. At that point, the yield on the two-year note fully reflects both the current yield on one-year bills and the average investor's expectation about one-year bill rates one year from now.

This example ignores all the costs of buying and selling securities and does not consider investment options such as buying a 10-year bond, holding it for two years, and then selling it. It also ignores the presence of a liquidity premium in interest rates, which is required to induce investors to hold longer rather than shorter maturity securities of otherwise equal attractiveness. Nevertheless, it does illustrate how expectations about the course of future interest rates can influence portfolio decisions which then feed back on current prices of Treasury securities to force current interest rates to reflect investor expectations.

If it is accepted that the yield curve reflects the expectations of market participants about the future course of interest rates, it is a two-step process to extract those expectations. First, the yield curve has to be estimated. In this study each yield curve has been estimated from a single day's data on U.S. Treasury securities using a technique due to McCulloch.¹ Then, once the yield curve has been estimated, the market forecast of future rates can be extracted, taking into account the necessary adjustment for a liquidity premium.²

¹A very flexible curve-fitting technique is used, along with bid and asked prices on all U.S. Treasury securities except "flower bonds." The personal income tax implications of the distinction between ordinary income and long-term capital gains also are taken into account. By taking advantage of the information on all Treasury securities, it should be possible to minimize the effect of noise in security prices on the estimates of market interest-rate forecasts. See J. H. McCulloch, "The Tax-Adjusted Yield Curve," Journal of Finance, June 1975, pp. 811-830.

²Forward rates, as extracted from yield curves in this study, have been corrected using liquidity premia estimated by J. H. McCulloch, "An Estimate of the Liquidity Premium," Journal of Political Economy, January/February 1975, p. 111.

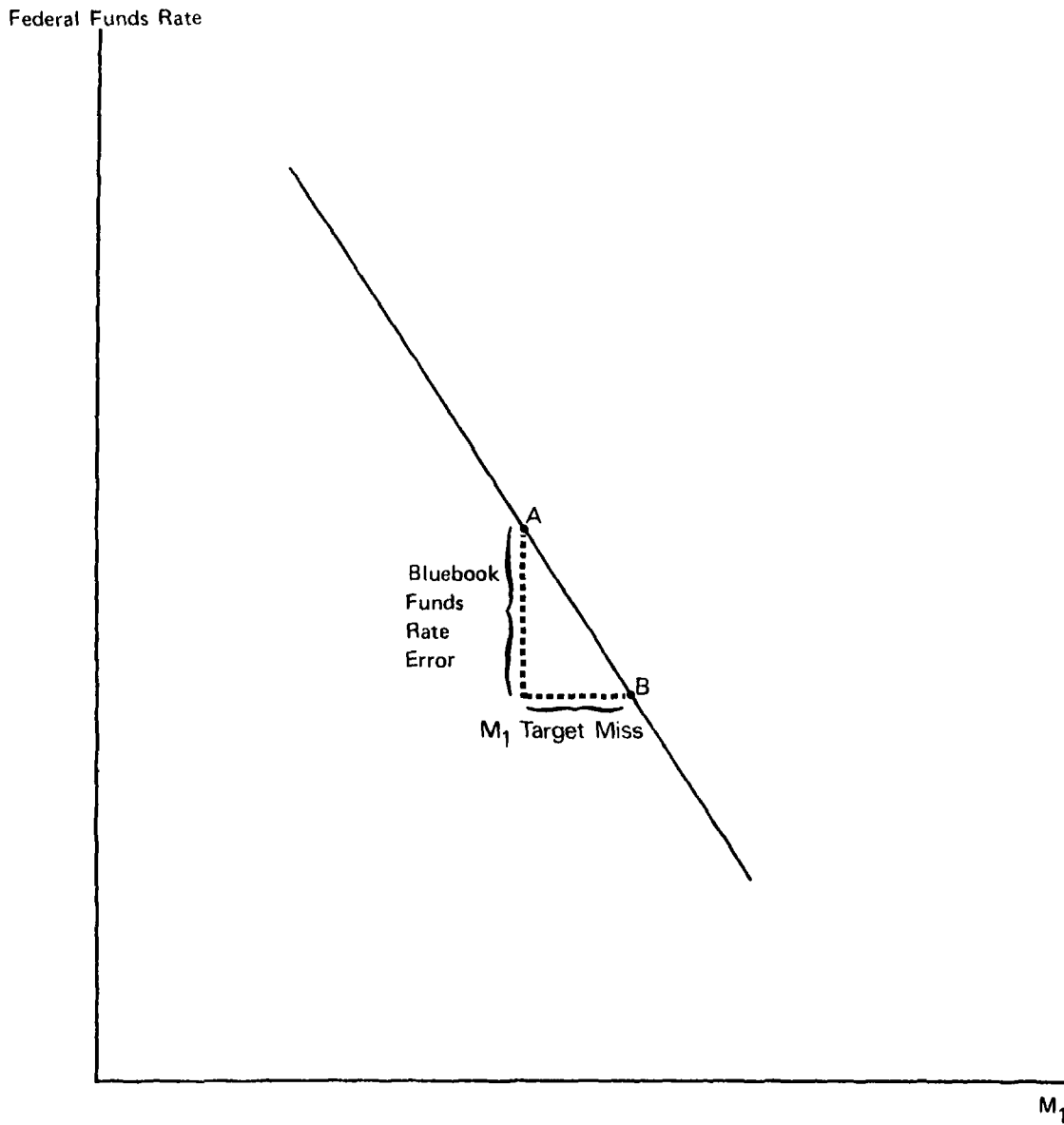
APPENDIX III

A TEST OF THE "COST" TO BLUEBOOK FORECAST
ACCURACY OF THE CONDITIONAL NATURE OF ITS FORECASTS.

The Board staff faces a handicap in its Bluebook forecasts of future Federal funds rates. It is required to make its forecasts under the assumption that the one-year M_1 growth target midpoint will be hit. The magnitude of the handicap depends upon the magnitude of the miss in hitting the target midpoint, but the exact mathematical relationship between the two is unknown.

Despite this lack of knowledge, however, it is possible to make a limited test of the hypothesis that errors in hitting the M_1 growth target have been at least partly responsible for the staff's forecasting errors. Consider, for example, the situation in Figure 1. At the time of preparation of a Bluebook, the staff knows the most recent month's level of M_1 and the funds rate. Given the existing one-year target for M_1 , given the expected strength in the economy, and given a particular pattern of change in the funds rate, the staff then can project the required level of the funds rate that must be achieved in the final quarter of the one-year target period. This funds rate, and the level of M_1 consistent with the target midpoint, are represented by point A. Now if the Committee were to choose to ignore its M_1 target and instead keep the funds rate constant, a point like B would result. Point B must be below and to the right of A, reflecting the usual shape of the demand-for- M_1 curve. That is, if actual M_1 growth is greater than assumed M_1 growth, a positive forecast error (forecast value minus actual value) for the funds rate will result.

FIGURE 1
A HYPOTHETICAL EXAMPLE ILLUSTRATING THE RELATIONSHIP
BETWEEN M_1 TARGET MISSES AND BLUEBOOK FUNDS-RATE FORECAST ERRORS



In Figure 1, the M_1 growth target error can be represented by the horizontal distance between A and B (the bottom leg of the triangle), the funds rate forecast error by the vertical distance between A and B (the upright leg of the triangle).

This limited test of the staff's handicap simply asks whether or not there is an observed negative relationship between the Federal funds rate forecast error and assumed minus actual M_1 growth (Figure 2). In fact, a fitted regression line has a slope of 0.40, displaying the wrong sign, and an R^2 of 0.25. The fitted line also indicates that, if the Committee had hit its M_1 growth target exactly, there would have been a funds rate forecast error of 201 basis points for a forecast horizon of 7 to 9 months.

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FIGURE 2
BLUEBOOK FUNDS-RATE FORECAST
ERRORS AND M₁ GROWTH TARGET MISSES

Bluebook Forecast Errors for
the Federal Funds Rate (in percent)

