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

June 18, 1976

CONFIDENTIAL (FR)
CLASS II FOMC

TO: Federal Open Market Committee

FROM: Arthur L. Broida ALB

The attached memorandum from Mr. Kalchbrenner to Mr. Axilrod discusses two questions involving monetary control and monetary aggregate forecasts that were raised at the March 29 special FOMC meeting.

Attachment

BOARD OF GOVERNORS
OF THE
FEDERAL RESERVE SYSTEM

Confidential (FR)
Class II-FOMC

Office Correspondence

Date June 15, 1976

To Mr. Axilrod

From J. Kalchbrenner

Subject: The effects of averaging single-month monetary aggregate forecast errors over longer periods, and the contribution to monthly forecasting errors of using forecasted rather than actual explanatory variables

Summary

At the special meeting of the FOMC held on March 29, 1976 to discuss procedures related to the Committee's instructions to the Trading Desk, two questions were raised that required further staff analysis:

1) While errors in forecasting monetary aggregates over a one-month period were large during 1975 for various reserve and money market techniques that were tested, improvements would be expected over a longer time horizon. What were the averages of the single-month forecast errors over longer periods?

2) For those forecasting equations for the monetary aggregates that rely on forecasts of such variables as personal income or business sales as explanatory variables, what is the effect on the performance of the equations when forecasted rather than actual values of the explanatory variables are used?

The Board staff has investigated these questions using the same forecasting techniques that were discussed during the special meeting. In addition, the forecasting record of the Board judgmental and bluebook forecasts was included. The summary statistics are reported below in terms of both dollars and annual percentage rates of change. Results are reported

using data currently available (as of April 1976) and using data that were available at the time the forecasts were made or would have been made. Forecasts were adjusted for benchmark revisions of the data where appropriate.

The results comparing the one-month prediction errors to the two, three and six-month averages of these errors are generally as expected. With few exceptions, the average errors decrease as the monthly errors are averaged over longer periods. For the best seven of the eleven equations that were used, the single-month-mean-absolute M1 forecast errors using data currently available ranged from $950 million to $1.479 billion (3.9 to 6.1 percent at annual rates) during 1975. These errors decline steadily as the averaging period is extended to a range of $295 million to $443 million (0.2 to 0.3 percent at annual rates) for the six-month moving average.

In terms of M1 forecasts based on data available at the time (including the judgmental and the bluebook forecasts), the one-month-mean-absolute errors ranged from $892 million to $1.420 billion (3.6 to 5.9 percent at annual rates). Averaged over a six month period, these errors also decline, and the range narrows to an almost insignificantly different $221 million to $402 million (0.15 to 0.27 percent at annual rates).

For the best seven of the eleven equations that were used, the range of the one-month-mean-absolute M2 forecast errors using data currently available was $840 million to $1.895 billion (1.6 to 3.5 percent at annual rates) during 1975. For the six-month moving averages,

this range was $284 million to $1.437 billion (0.09 to 0.045 percent at annual rates). In terms of the M2 forecasts based on data available at the time, the single-month forecast errors range was $1.492 billion to $2.356 billion (2.8 to 4.4 percent at annual rates). These errors declined and the range narrowed to $410 million to $1.074 billion (0.1 to 0.34 percent at annual rates) when expressed in terms of six-month moving averages.

The results of the investigation of the second questions were counter to expectations. Forecasts generated by two of the three equations that used projections of explanatory variables such as income and business sales were found to be insignificantly different from the forecasts generated with the same equations using data currently available. This finding held for forecasts of M1 and M2, and the root-mean-squared error or the mean-absolute error. For the third equation, the outcome corresponded to expectations; both the root-mean-squared error and the mean-absolute errors of M1 and M2 forecasts were greater when projections of the explanatory variables were used.

In the remainder of this memorandum, the results summarized above are set forth in greater detail. In addition, there is a review of the relative forecasting accuracy of the various techniques that were discussed at the special meeting with the addition of the Board judgmental and blue-book forecast records. Information is provided for both a longer sample period prior to 1975 and the 1975 experience.

Some Problems of Comparability

In constructing the comparisons of the forecasting accuracy of the techniques that were tested, it was not possible to obtain directly comparable error measures for several reasons. For example, sample periods differ among the equations because of different treatment of lagged variables or availability of data. In addition, the equations other than the reserve aggregate equations are based on seasonally adjusted data. The results for the latter are adjusted for the degrees of freedom lost in the seasonal adjustment procedure employed, but it is not possible to make a similar adjustment for the former. This imparts a probably significant downward bias to the standard errors of the equations using seasonally adjusted data. These problems affect comparison of the summary statistics shown for the sample periods, but not for the 1975 post-sample period.

Another element affecting the comparability of the error statistics and the appropriate annualization technique for the percentage error figures arises from the fact that the information available to the judgmental and econometric forecasters differs at the time the forecasts are made. For all of the econometric results, forecasts of the current (and succeeding months, which are not reported in the tables) are based on data available as of the end of the month immediately preceeding the forecast period. For the judgmental and bluebook forecasts, however, the forecast for the current month is made in the middle of that month when approximately two weeks of preliminary data are available. Since partial information is available

on half the monthly average to be forecast. The situation is biased in favor of the judgmental and bluebook forecasts for both the current month and the subsequent month.

The Effects of Averaging One-Month Forecast Errors Over Longer Periods

The following tables contain summary error statistics in terms of dollars and annualized percentage rates of change from several alternative methods of predicting levels of M1 and M2 based on data currently available and data available at the time the forecasts were made, or would have been made. Each table contains the single-month standard errors for the sample periods, the single-month error summary statistics for the 1975 post-sample, and two, three and six-month moving averages of the 1975 monthly prediction errors.

For purposes of comparison, the standard error of the estimate in the sample period and the root-mean-squared error (RMSE) in the post-sample period are approximately equivalent measures. The mean-absolute (MAE) and the mean errors (ME) are also included for the post-sample period. For each of the equations, the monthly prediction error on average would be expected to be within plus or minus the standard error two-thirds of the time.

Tables 1 and 2 contain summary statistics for the errors in predicting M1 and M2 respectively using currently available data (as of April 1976) for several estimated equations. Tables 3 and 4 contain the

equivalent summary statistics for the errors in predicting M1 and M2 using projections of explanatory variables for the estimated equations available at the time. In addition, Tables 3 and 4 contain the summary statistics for the Board judgmental and consensus bluebook forecasts made at the time. For the judgmental and bluebook forecasts and the forecasts of the version of the monthly model available at the time, first-published, rather than current, M1 and M2 data were used in deriving errors after adjustment for benchmark revisions where appropriate.

As noted during the March 29 meeting, Table 1 indicates that, of the estimated equations using data currently available, the nonborrowed and total base equations had the lowest errors (RMSE) in the 1975 post-sample period, followed by the equations relating money demand to interest rates and measures of income or business sales (the first three equations listed)[1/] and the other reserve aggregate equations respectively. For the M1 predictions, the root-mean-squared errors for 1975 were less than the standard errors for the two base equations, and exceed the standard errors by a range of $300 to $500 million (but are about the same in percentage terms) for the nonborrowed and total reserves equations. The performance of the RPD equations in the post-sample period worsened noticeably. For the demand-related equations--the monthly model, the Shadrack-Skinner and

1/ The Monthly Model relates M1 and M2 to short-term interest rates and personal income, the Shadrack-Skinner equation relates M1 and M2 to government deposits, business sales and the Federal funds rate, and the Federal Funds Rate equation explains M1 and M2 solely on the basis of a distributed lag of the Federal funds rate.

Federal funds equations--the standard errors within the sample period are about 3 1/2 per cent of M1 at an annual rate, but the post-sample errors are about one and one-half times as large.

The 1975 M1 prediction errors indicate relative stability of the various reserve and base equations (except RPD) outside the sample period, but with relatively large errors both within and outside the sample period. For the demand-related equations, the errors are small within the sample period, but fall within the range of the errors of the reserve and base equations outside the sample period. Further, the size of the root-mean-squared error of the demand-related equations relative to their standard errors of estimate indicates a marked deterioration in the stability of these equations during 1975. With a stable equation, a single-month prediction error on average would be expected to lie outside plus or minus one and one-half standard errors only thirteen per cent of the time.

The equations shown in Table 1 denoted by the term "with leads" include the current and subsequent month's reserve aggregates and money market interest rates as explanatory variables in order to account approximately for the effects of lagged reserve accounting. These equations are viewed as being supply-related projection equations. Estimated using non-seasonally adjusted data, the equations with lead variables fit the data better than the comparable equations without lead variables. But, after seasonal adjustment in a second stage, the equations with and without lead

variables perform about the same, indicating that the seasonal adjustment procedure plays a larger role for the equations without leads. It further appears that the seasonality in the errors of the equations without leads is largely related to seasonality in money demand.

During the 1975 post-sample period, the equations with leads exhibit significant bias as shown by the mean errors, which show monthly average underpredictions exceeding $1 billion for M1 and $2 billion for M2. Since the equations without leads show much less bias, this suggests that shifts in the supply relationships occurred during 1975 and these shifts were better reflected in the equations with leads. The other equations shown in Table 1 also indicate some bias, but the magnitudes are much smaller than the average errors of the equations with leads.

The results comparing the one-month prediction errors to the two, three and six-month moving averages of the single-month errors are as expected generally. Measured in terms of dollars or annual percentage rates, the summary statistics for the errors decline as the averaging period is lengthened. The reserve equations with leads are notable exceptions, having monthly errors typically of the same sign and largest in the middle two quarters of the year.

Except for the equations with leads and both of the RPD equations, the root-mean-squared errors and mean-absolute errors of the six-month moving average M1 errors are similar, with the mean-absolute error between

$300 and $450 million, or between two-tenths and three-tenths of one per cent at annual rates. In terms of these statistics, the nonborrowed base, Shadrack-Skinner, Federal funds rate and monthly model forecasts are best over three and six-month periods. In terms of the mean errors, the monthly model shows the least bias over these averaging intervals.

Table 2 contains the summary error statistics for M2 predictions based on the same equations and currently available data. Again the two base equations performed best in 1975 followed by the demand-related equations and the other reserve aggregate equations. For the M2 predictions, the deterioration in predictive performance between the sample and post-sample periods was less than for M1 in terms of annualized percentage errors. For the demand-related equations, the monthly model deteriorated somewhat less than the Shadrack-Skinner and Federal funds equations. In terms of annualized percent errors all of the reserve equations without leads, except RPD, did better in 1975 than over the period of fit, with the two base measures showing the most marked improvement. Both RPD equations and the other equations with lead variables deteriorated in 1975, though the nonborrowed reserves equation with leads did not do so significantly.

For the moving average measures included in Table 2, the results are once again as expected, with the errors generally declining as the averaging period lengthens. The two base equations, the Federal funds equations and the monthly model performed best in terms of root-mean-squared errors and mean-absolute errors for the three and six-month averaging intervals.

Table 3 contains the summary error statistics for the bluebook and the Board judgmental forecasts of M1 in addition to the results for the demand-related equations discussed previously. All of the results are based on data for the explanatory variables available at the time, including forecasts of interest rates, personal income and business sales, rather than on the final data for such series. During 1975, the (current) one-month bluebook forecasts were better than the forecasts from any of the other techniques shown in Table 1 or 3 in terms of mean-absolute errors, followed by the nonborrowed and total base equations (shown in Table 1). But, in terms of root-mean-squared errors, the nonborrowed base equation forecasts performed slightly better than the bluebook forecasts.

By comparison with the root-mean-squared errors through 1974, all of the forecasting techniques shown in Table 3 indicate a deterioration in performance during 1975, as was the case for the demand-related equations using data currently available. As indicated by the mean error statistics, the demand-related equations and the one-month ahead Bluebook and judgmental forecasts show an average monthly overprediction of between $425 and $625 million except for the $327 average overprediction for the current version of the monthly model. The current-month Bluebook and judgmental forecasts of M1 were nearly unbiased in 1975.

Table 3 indicates that averaging errors over longer intervals reduces the error as the averaging interval is lengthened as expected. The Bluebook current month forecasts are best in terms of root-mean-squared errors for the two and three-month moving average, but the Federal funds equation is superior in terms of the six-month moving average.

Table 4 contains the summary error statistics for the M2 predictions for the demand-related equations, the Bluebook and the judgmental forecasts using data available at the time. These summary statistics again indicate less deterioration in the 1975 forecasts of M2 than for M1 from the sample to post-sample periods. The monthly model forecast errors fall between the current month and the one-month ahead errors of the Bluebook, and were approximately equal to the judgmental errors in predicting the current month. The root-mean-squared errors of the Shadrack-Skinner and Federal funds rate equations were somewhat larger, exceeding $2 billion during 1975. Once again, the averaging process significantly reduces the errors for all of the forecasting techniques as the averaging interval is lengthened.

As indicated by the mean errors, the bias in predicting M2 for any of the forecasting techniques with the possible exception of the older version of the monthly model is quite small. All of the annualized percentage errors are less than 1 per cent, even for one-month errors, except that of the older monthly model equations.

The Contribution to Monthly Forecasting Errors From Using Forecasted Rather than Actual Explanatory Variables

As indicated, the results shown in Tables 3 and 4, based on the use of data available at the time, include forecasts of the explanatory variables used in the monthly model, the Shadrack-Skinner equation and the Federal funds rate equation. Comparison of Tables 1 and 3 indicates that the forecasts of the monthly model and the Federal funds rate equation

using projections of the explanatory variables were essentially as accurate as the forecasts using the actual, currently available data for the explanatory variables. For the Shadrack-Skinner equation, the performance of the equation using actual explanatory variables improves, but not markedly so.

A comparison of Tables 2 and 4 indicates that much the same result holds for the forecasts of M2 during 1975. The use of actual data, in addition to improving the performance of the Shadrack-Skinner equation, also improves the M2 forecasts of the Federal funds rate equation, but not by a great deal. There is little difference between the summary statistics for the current version of the monthly model using either set of data.

A review of evidence from earlier years for both M1 and M2 forecasts yielded the same conclusions. It does not appear to be the case, contrary to *a priori* expectations, that the use of forecasts of explanatory variables in conjunction with the use of these demand-related equations leads to demonstrably larger forecasting errors.

Table 1

1975 Errors in Predicting M1
Using Data Currently Available
(annualized percentage errors in parentheses)

	Standard Error of Estimate, 6901-7412 Sample Period	One Month Error			Two-Month Moving Average Error			Three-Month Moving Average Error			Six-Month Moving Average Error		
		RMSE	MAE	ME	RMSE	MAE	ME	RMSE	MAE	ME	RMSE	MAE	ME
Monthly Model	.669 [1] (3.4)	1.446 (6.0)	1.235 (5.1)	-.312 (-1.3)	.913 (1.9)	.791 (1.6)	-.116 (-0.2)	.760 (1.0)	.701 (1.0)	-.058 (-0.1)	.451 (0.3)	.366 (0.3)	.068 (0.0)
Shadrack-Skinner	.702 [2] (3.5)	1.486 (6.2)	1.364 (5.7)	-.479 (-2.0)	.979 (2.0)	.806 (1.7)	-.311 (-0.6)	.787 (1.1)	.723 (1.0)	-.252 (-0.3)	.419 (0.3)	.295 (0.2)	-.119 (-0.1)
Federal Funds Rate	.703 [3] (3.5)	1.445 (6.0)	1.299 (5.4)	-.619 (-2.6)	.836 (1.7)	.637 (1.3)	-.443 (-0.9)	.638 (0.9)	.547 (0.8)	-.411 (-0.6)	.415 (0.3)	.330 (0.2)	-.330 (-0.2)
Nonborrowed Reserves [4]	1.548 (7.8)	1.854 (7.7)	1.479 (6.1)	.172 (0.7)	1.482 (3.1)	1.269 (2.6)	.311 (0.6)	1.137 (1.6)	.997 (1.4)	.332 (0.5)	.464 (0.3)	.418 (0.3)	.418 (0.3)
Nonborrowed Reserves [5] (with leads)	1.514 (7.6)	1.872 (7.8)	1.555 (6.4)	1.332 (5.5)	1.696 (3.5)	1.427 (3.0)	1.345 (2.8)	1.572 (2.2)	1.354 (1.9)	1.354 (1.9)	1.318 (0.9)	1.312 (0.9)	1.312 (0.9)
Total Reserves [4]	1.430 (7.2)	1.791 (7.4)	1.232 (5.1)	-.228 (-.9)	1.461 (3.0)	1.003 (2.1)	-.130 (-0.3)	1.115 (1.5)	.784 (1.1)	-.032 (-0.0)	.501 (0.3)	.443 (0.3)	-.112 (0.1)
Total Reserves [5] (with leads)	1.387 (7.0)	1.880 (7.8)	1.587 (6.6)	1.479 (6.1)	1.769 (3.7)	1.538 (3.2)	1.538 (3.2)	1.758 (2.4)	1.563 (2.2)	1.563 (2.2)	1.740 (1.2)	1.681 (1.2)	1.681 (1.2)
Nonborrowed Base [4]	1.390 (7.0)	1.065 (4.4)	.950 (3.9)	-.502 (-2.1)	.868 (1.8)	.727 (1.5)	-.422 (-0.9)	.641 (0.9)	.528 (0.7)	-.355 (-0.5)	.419 (0.3)	.377 (0.3)	-.377 (-0.3)
Total Base [4]	1.273 (6.4)	1.200 (5.0)	.986 (4.1)	-.670 (-2.8)	.861 (1.8)	.692 (1.4)	-.545 (-1.1)	.647 (0.9)	.500 (0.7)	-.470 (-0.6)	.486 (0.3)	.438 (0.3)	-.438 (-0.3)

Table 1 (continued)

	Standard Error of Estimate, 6901-7412 Sample Period	One Month Error			Two-Month Moving Average Error			Three-Month Moving Average Error			Six-Month Moving Average Error		
		RMSE	MAE	ME	RMSE	MAE	ME	RMSE	MAE	ME	RMSE	MAE	ME
RPD 4/	1.320	1.907	1.499	.389	1.503	1.274	.571	1.214	1.111	.688	.965	.908	.849
	(6.6)	(7.9)	(6.2)	(1.6)	(3.1)	(2.6)	(1.2)	(1.7)	(1.5)	(0.9)	(0.7)	(0.6)	(0.6)
RPD 5/	1.357	2.328	2.176	1.817	2.248	2.027	2.026	2.252	2.102	2.102	2.304	2.263	2.263
(with leads)	(6.8)	(9.6)	(9.0)	(7.5)	(4.7)	(4.2)	(4.2)	(3.1)	(2.9)	(2.9)	(1.6)	(1.6)	(1.6)

1/ The sample periods for the monthly model's equations differ slightly from these intervals, and simulation was performed to attain comparable figures.

2/ Period of fit: 6908-7412.

3/ Period of fit: 6909-7412.

4/ Equation including current month reserves, money market rates, and the discount rate.

5/ Equation including current and next month reserves, money market rates, and the discount rate.

Table 2

1975 Errors in Predicting M2
Using Data Currently Available
(annualized percentage errors in parentheses)

	Standard Error of Estimate, 6901-7412 Sample Period	One Month Error			Two-Month Moving Average Error			Three-Month Moving Average Error			Six-Month Moving Average Error		
		RMSE	MAE	ME	RMSE	MAE	ME	RMSE	MAE	ME	RMSE	MAE	ME
Monthly Model	1.218[1] (3.0)	1.874 (3.5)	1.579 (3.0)	-.526 (-1.0)	1.374 (1.3)	1.154 (1.1)	-.335 (-0.3)	1.210 (0.8)	1.037 (0.6)	-.296 (-0.2)	.692 (0.2)	.526 (0.2)	-.104 (-0.0)
Shadrack-Skinner	1.222[2] (3.0)	2.222 (4.2)	1.895 (3.5)	-.027 (-0.0)	1.693 (1.6)	1.376 (1.3)	.129 (0.1)	1.453 (0.9)	1.244 (0.8)	.134 (0.1)	.898 (0.3)	.723 (0.2)	.315 (0.1)
Federal Funds Rate	1.089[3] (2.8)	1.933 (3.6)	1.638 (3.1)	-.492 (-0.9)	1.230 (1.2)	1.050 (1.0)	-.279 (-0.3)	.938 (0.6)	.805 (0.5)	-.262 (-0.2)	.490 (0.2)	.284 (0.1)	-.136 (-0.0)
Nonborrowed Reserves[4]	2.047 (5.1)	2.289 (4.3)	1.651 (3.1)	.864 (1.6)	1.980 (1.9)	1.504 (1.4)	1.076 (1.0)	1.742 (1.1)	1.385 (0.9)	1.163 (0.7)	1.484 (0.5)	1.437 (0.4)	1.437 (0.4)
Nonborrowed Reserves[5] (with leads)	1.802 (4.5)	2.603 (4.9)	2.136 (4.0)	2.136 (4.0)	2.484 (2.3)	2.155 (2.0)	2.155 (2.0)	2.420 (1.5)	2.187 (1.4)	2.187 (1.4)	2.252 (0.7)	2.231 (0.7)	2.231 (0.7)
Total Reserves[4]	1.903 (4.7)	2.152 (4.0)	1.695 (3.2)	0.785 (1.5)	1.915 (1.8)	1.533 (1.4)	.924 (0.9)	1.690 (1.1)	1.349 (0.8)	1.004 (0.6)	1.325 (0.4)	1.280 (0.4)	1.280 (0.4)
Total Reserves[5] (with leads)	1.621 (4.0)	2.802 (5.2)	2.315 (4.3)	2.315 (4.3)	2.747 (2.6)	2.359 (2.2)	2.359 (2.2)	2.706 (1.7)	2.371 (1.5)	2.371 (1.5)	2.667 (0.8)	2.576 (0.8)	2.576 (0.8)
Nonborrowed Base[4]	1.711 (4.3)	1.081 (2.0)	.840 (1.6)	.297 (0.6)	.919 (0.9)	.723 (0.7)	.379 (0.4)	.784 (0.5)	.620 (0.4)	.467 (0.3)	.593 (0.2)	.542 (0.2)	.542 (0.2)
Total Base[4]	1.620 (4.0)	1.173 (2.2)	.869 (1.6)	.182 (0.3)	.929 (0.9)	.651 (0.6)	.283 (0.3)	.790 (0.5)	.546 (0.3)	.342 (0.2)	.570 (0.2)	.517 (0.2)	.474 (0.1)

Table 2 (continued)

	Standard Error of Estimate, 6901-7412 Sample Period	One Month Error			Two-Month Moving Average Error			Three-Month Moving Average Error			Six-Month Moving Average Error		
		RMSE	MAE	ME	RMSE	MAE	ME	RMSE	MAE	ME	RMSE	MAE	ME
RPD 4/	1.682	2.574	2.049	1.383	2.313	1.941	1.608	2.156	1.836	1.707	2.049	2.003	2.003
	(4.2)	(4.8)	(3.8)	(2.6)	(2.2)	(1.8)	(1.5)	(1.3)	(1.1)	(1.1)	(0.6)	(0.6)	(0.6)
RPD 5/	1.414	3.161	2.774	2.640	3.159	2.829	2.829	3.155	2.890	2.890	3.207	3.143	3.143
(with leads)	(3.5)	(5.9)	(5.2)	(4.9)	(3.0)	(2.6)	(2.6)	(2.0)	(1.8)	(1.8)	(1.0)	(1.0)	(1.0)

1/ The sample periods for the monthly model's equations differ slightly from these intervals, and simulation was performed to attain comparable figures.

2/ Period of fit: 6908-7412.

3/ Period of fit: 6909-7412.

4/ Equation including current month reserves, money market rates, and the discount rate.

5/ Equation including current and next month reserves, money market rates, and the discount rate.

Table 3

1975 Errors in Predicting M1
Using Data Available at the Time
(annualized percentage errors in parentheses)

	RMSE Through 7412	One Month Error RMSE	One Month Error MAE	One Month Error ME	Two-Month Moving Average Error RMSE	Two-Month Moving Average Error MAE	Two-Month Moving Average Error ME	Three-Month Moving Average Error RMSE	Three-Month Moving Average Error MAE	Three-Month Moving Average Error ME	Six-Month Moving Average Error RMSE	Six-Month Moving Average Error MAE	Six-Month Moving Average Error ME
Monthly Model[1/]	.777 [3/]	1.409	1.220	-.327	.848	.739	-.140	.708	.642	-.091	.428	.338	.032
	(3.4)	(5.8)	(5.1)	(1.4)	(1.8)	(1.5)	(-0.3)	(1.0)	(0.9)	(-0.1)	(0.3)	(0.2)	(0.0)
Monthly Model[2/]	1.066 [3/]	1.755	1.542	-.558	.991	.864	-.373	.789	.670	-.307	.614	.481	-.395
	(4.7)	(7.2)	(6.3)	(-2.3)	(2.0)	(1.8)	(-0.8)	(1.1)	(0.9)	(-0.5)	(0.4)	(0.3)	(-0.3)
Shadrack-Skinner[1/]	.801 [3/]	1.726	1.420	-.561	1.237	1.048	-.345	1.016	.956	-.237	.500	.374	-.015
	(3.6)	(7.2)	(5.9)	(-2.3)	(2.6)	(2.2)	(-0.7)	(1.4)	(1.3)	(-0.3)	(0.3)	(0.2)	(0.0)
Federal Funds Rate[1/]	.719 [3/]	1.448	1.278	-.426	.821	.606	-.234	.622	.574	-.186	.333	.221	-.074
	(3.2)	(6.0)	(5.3)	(-1.8)	(1.7)	(1.3)	(-0.5)	(0.9)	(0.8)	(-0.3)	(0.2)	(0.2)	(0.0)
Bluebook Current Month	.762 [4/]	1.112	.892	-.025	.759	.659	.123	.563	.510	.163	.418	.350	.255
	(3.7)	(4.6)	(3.7)	(-0.1)	(1.6)	(1.4)	(0.3)	(0.8)	(0.7)	(0.2)	(0.3)	(0.2)	(0.2)
Bluebook One Month Ahead	1.419 [4/]	2.309	1.858	-.625	1.779	1.450	-.423	1.416	1.310	-.303	.737	.640	-.021
	(6.8)	(9.5)	(7.7)	(-2.6)	(3.7)	(3.0)	(-0.9)	(1.9)	(1.8)	(-0.4)	(0.5)	(0.4)	(-0.0)
Judgmental Current Month	.826 [5/]	1.304	1.117	-.017	.893	.741	.150	.637	.533	.227	.465	.402	.350
	(3.8)	(5.4)	(4.6)	(-0.1)	(1.8)	(1.5)	(0.3)	(0.9)	(0.7)	(0.3)	(0.3)	(0.3)	(0.2)
Judgmental One Month Ahead	1.452 [5/]	2.107	1.608	-.475	1.679	1.441	-.305	1.370	1.233	-.153	.657	.538	.224
	(6.7)	(8.7)	(6.6)	(-2.0)	(3.5)	(3.0)	(-0.6)	(1.9)	(1.7)	(-0.2)	(0.5)	(0.4)	(0.2)

Table 3 (continued)

1/ Using present version of the equation(s) with data available at the time.

2/ Using the equations available at the time with data available at the time.

3/ 7301-7412.

4/ 7101-7412.

5/ 7201-7412.

Table 4

1975 Errors in Predicting M2
Using Data Available at the Time
(annualized percentage errors in parentheses)

	RMSE Through 7412	One Month Error			Two-Month Moving Average Error			Three-Month Moving Average Error			Six-Month Moving Average Error		
		RMSE	MAE	ME	RMSE	MAE	ME	RMSE	MAE	ME	RMSE	MAE	ME
Monthly Model[1/]	1.317 [3/] (2.8)	1.901 (3.6)	1.549 (2.9)	-.487 (-0.9)	1.328 (1.2)	1.098 (1.0)	-.305 (-0.3)	1.147 (0.7)	.972 (0.6)	-.278 (-0.2)	.666 (0.2)	.487 (0.2)	-.081 (-0.0)
Monthly Model[2/]	1.583 [3/] (3.3)	2.498 (4.6)	2.233 (4.2)	-1.633 (-3.0)	1.744 (1.6)	1.523 (1.4)	-1.496 (-1.4)	1.657 (1.0)	1.580 (1.0)	-1.580 (-1.0)	1.603 (0.5)	1.579 (0.5)	-1.579 (-0.5)
Shadrack-Skinner[1/]	1.593 [3/] (3.3)	2.861 (5.4)	2.356 (4.4)	-.397 (-0.7)	2.365 (2.2)	2.024 (1.9)	-.076 (-0.1)	2.118 (1.3)	1.913 (1.2)	.103 (0.1)	1.233 (0.4)	1.074 (0.3)	.601 (0.2)
Federal Funds Rate[1/]	1.340 [3/] (2.8)	2.152 (4.0)	1.744 (3.3)	-.305 (-0.6)	1.316 (1.2)	1.045 (1.0)	-.081 (-0,1)	.985 (0.6)	.811 (0.5)	-.082 (-0.1)	.607 (0.2)	.410 (0.1)	.010 (0.0)
Bluebook Current Month	1.127 [4/] (2.6)	1.688 (3.1)	1.492 (2.8)	.175 (0.3)	1.289 (1.2)	1.027 (1.0)	.355 (0.3)	1.031 (0.6)	.937 (0.6)	.357 (0.2)	.772 (0.2)	.643 (0.2)	.471 (0.1)
Bluebook One Month Ahead	2.144 [5/] (4.9)	3.638 (6.8)	3.067 (5.7)	-.400 (-0.7)	2.884 (2.7)	2.423 (2.3)	-.132 (-0.1)	2.280 (1.4)	2.097 (1.3)	-.057 (-0.0)	1.264 (0.8)	1.069 (0.3)	.345 (0.1)
Judgmental Current Month	1.467 [6/] (3.2)	1.945 (3.6)	1.583 (2.9)	.450 (0.8)	1.448 (1.3)	1.250 (1.2)	.641 (0.6)	1.158 (0.7)	1.033 (0.6)	.627 (0.4)	.812 (0.3)	.771 (0.2)	.705 (0.2)
Judgmental One Month Ahead	2.244 [7/] (4.8)	3.422 (6.4)	3.017 (5.6)	.333 (0.6)	2.728 (2.5)	2.482 (2.3)	.527 (0.5)	2.242 (1.4)	1.970 (1.2)	0.590 (0.4)	1.467 (0.5)	1.148 (0.4)	1.024 (0.3)

Table 4 (continued)

1/ Using present version of the equation(s) with data available at the time.

2/ Using the equations available at the time with data available at the time.

3/ 7301-7412.

4/ 7102-7412.

5/ 7103-7412.

6/ 7206-7412.

7/ 7207-7412.