Indicators of Monetary Policy: An Evaluation of Five (*)

I. Introduction

The debate among economists continues over the question of how might the Federal Reserve System best carry out the primary objectives of monetary policy. Although both the policy maker and the monetary theorist generally agree that the primary objectives of monetary policy are a stable price level, a high rate of economic growth, a high level of employment and sustainable balance in international payments, agreement soon disappears when opinions are taken as to how these objectives should be best pursued in the day-to-day operations of the central bank.

This paper is concerned with the question of the appropriate variable that the central bank should use to measure its influence on aggregate demand.[1] More specifically, in the pursuit of its goal to stabilize the economy, what should be the indicator of monetary policy — a price variable such as a market interest rate or a quantity variable such as the growth in the money supply? The monetary indicators or "guide" variables frequently appear to give conflicting signs with respect to the direction of influence of the monetary policy actions on the economy. For example, if market anticipations of

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1 Much more thorough discussions of the indicator problems and issues are in K. Brunner and A. Meltzer, "The Nature of the Policy Problem", Chapter 1 in K. Brunner, ed., *Targets and Indicators of the Monetary Policy*, Chandler Pub., Co., 1970, and by the same authors, "The Meaning of Monetary Indicators", in G. Horwich, ed., *Monetary Process and Policy: A Symposium*, Irwin, Homewood, Illinois, 1967 and by T. Saving, "Monetary-Policy Targets and Indicators", *J.P.E.*, Suppl., Aug. 1967, pp. 446-56.

future inflation are revised upwards, market interest rates rise. The rise in interest rates suggests, to many observers, monetary tightness. However, if the growth in the money stock is accelerated simultaneously, other observers may conclude a condition of monetary ease. Conversely, if the money supply has been growing slowly for several months following a period of rapid monetary growth and inflation, interest rates may fall as credit demands subside when anticipations of future inflation are revised downwards. The falling structure of interest rates suggests easy money to some observers whereas, to other observers, the decline in the rate of growth of the money supply indicates a period of tightening monetary policy. This paper statistically re-examines the current popular monetary policy indicators. Section II defines the criteria used to evaluate the indicators, Section III indicates the estimation procedure employed, and Section IV presents the statistical results. A concluding section summarizes the findings.

II. Indicator Criteria

The indicator problem is to find an economic time series which will determine the direction and approximate magnitude of the effects that monetary policy actions exert on economic activity. If monetary policy actions are moving towards restraining economic activity, the indicator should reflect this fact. As a consequence, we can judge the relative quality of indicators by comparing how well they correlate with changes in economic activity. However, to be a good indicator, it must do more than this, but there is no general agreement on just what it must do. In this paper, we suggest and use five criteria.

First, in order to be useful as an indicator to the central bank, the indicator must be responsive to the monetary tools of the central bank. It is generally felt that both of the widely-used indicators, interest rates and the money stock, are highly responsive to open market operations, changes in reserve requirements, changes in the rediscount rate or other central bank tools.[2]

Second, in order to correctly interpret the effects, the indicator should have a theoretically unambiguous sign with economic activity.

2 See David Fand, "Some Issues in Monetary Economics", *Review*, Federal Reserve Bank of St. Louis, January 1970, pp. 10-27 and the references given there.

In this regard there is almost unanimous agreement that, *ceteris paribus*, interest rates are negatively and monetary quantities are positively related to economic activity.

Third, in order to be of practical use to the central bank, the indicator should be readily observable. On this criteria, both market rates of interest and the monetary quantities are readily available. Unfortunately, the two most recently advanced indicators, the monetary full employment interest rate (MFEIR)[3] and the neutralized money stock[4] are not observable but must be calculated. Because the MFEIR is defined as "the rate of interest which equates the demand for money with the supply of money at the full employment level of income" (Starleaf and Stephenson, p. 626), the LM curve must be estimated and at each point in time, it must be solved for the rate of interest where the LM curve crosses the full employment income level. The neutralized money stock is even more difficult to calculate. "First, a money stock identity is derived by substituting for the member-bank deposit component of the narrowly defined money stock. The money-stock identity includes exogenous components (the Federal Reserves' portfolio of government securities, Treasury cash holdings, and so on) and endogenous components... (borrowings from the Federal Reserve, the U.S. gold stock, currency outside banks, Federal Reserve float, member bank time deposits, and excess reserves). Second, regression equations explaining these endogenous components are estimated... Third, neutralized or 'exogenized' components are calculated by applying the computed regression coefficients to cycle-free or trend values of income and interest rates (explanatory variables of the endogenous components). Finally, the neutralized money stock is calculated by applying the coefficients in the money stock identity to the neutralized components". (Horwich and Hendershott, pp. 46-7). Because of the calculations involved, these indicators are not practical for use in the day-to-day operations of the central bank.

3 Dennis Starleaf and James Stephenson, "A Suggested Solution to the Monetary Indicator Problem: The Monetary Full Employment Interest Rate", *Journal of Finance*, September 1969, pp. 623-641.

4 Patric Hendershott, *The Neutralized Money Stock*, Richard D. Irwin, 1968. See also George Horvich and Patric Hendershott, "The Appropriate Indicators of Monetary Policy", Part II, *Savings and Residential Financing*, 1969, Conference Proceedings, Chicago, Ill., pp. 32-52.

Fourth, *ceteris paribus*, the shorter the time lag between changes in the indicator and corresponding changes in economic activity, the better the indicator. The literature on this question is quite large. There appears to be a well established long lag between the time that interest rates are changed and corresponding changes in expenditures occur. The empirical investment demand studies find the lag between interest rate changes and corresponding changes in investment expenditures to be well over a year and frequently more like sixteen to eighteen months.[5] On the other hand, the lag between monetary aggregates, like the money supply, and economic activity appears to be much shorter. In fact, most recent evidence suggests that this lag is extremely short.[6]

Fifth, there should be a high degree of statistical association (with the theoretically correct sign) between the indicator and economic activity. The evaluation of the empirical evidence presented in this paper, while concerned with the criteria of lags, gives the most weight to statistically significant coefficients of the correct sign.

III. The Statistical Procedure

The statistical tests of the monetary indicators will follow the general approach of the many recent studies on monetary-fiscal policy and use the single equation approach with the dynamic structure

5 See J. Kareken and R. Solow, "Lags in Monetary Policy", in *Stabilization Policies*, Prentice Hall, Englewood Cliffs, N.J., 1963. Other representative studies on the investment lag are: T. Mayer, "The Inflexibility of Monetary Policy", *Review of Economics and Statistics*, Nov. 1958, pp. 358-74, and D. W. Jorgenson and J. S. Stephenson, "The Time Structure of Investment Behavior in the United States Manufacturing, 1947-1960", *Review of Economics and Statistics*, Feb. 1967, pp. 16-27.

6 See V. A. Bonomo and C. Schotta, "Some Aspects of the Outside Lag in Effect of Monetary Policy: A Preliminary Report", *Proc. Am. Stat. Assoc.*, Aug. 1968, pp. 482-90, J. E. Tanner, "Lags in the Effects of Monetary Policy: A Statistical Investigation", *Amer. Econ. Rev.*, Dec. 1969, pp. 794-805. A. B. Laffer and R. D. Ranson, "A Formal Model of the Economy", *Jour. of Business*, July 1971, pp. 247-70, Paul Smith, "Lags in the Effects of Monetary Policy: A Comment", and Tanner's "Reply and Some Further Thoughts", *Amer. Econ. Rev.*, March 1972. Slightly longer lags were found by L. C. Anderson and J. L. Jordan, "Monetary and Fiscal Actions: A Test of Their Relative Importance in Economic Stabilization", *Review*, Federal Reserve Bank of St. Louis, Nov. 1968, pp. 11-21, and even Professor Friedman has considerably shortened his estimate of the lag to between 6 and 9 months (*Newsweek*, Dec. 22, 1969, p. 75). For a theoretical treatment of why lags from monetary aggregates to income are short, see D. P. Tucker, "Dynamic Income Adjustments to Money Supply Changes", *Amer Econ. Rev.*, June 1966, pp. 433-49. In contrast, the recent FRB-MIT macro model's estimates of the lags from money to income are considerably longer.

being estimated by Almon lags.[7] Although a properly specified structural simultaneous equation model would be preferred, the single equation approach is much simpler and, under the traditional assumptions, the resulting coefficients are "best linear unbiased estimates" of the reduced form. Nevertheless, we diverge from this approach in that we estimate for the exogenous shifts in the IS curve caused by changes in fiscal policy and in exports before we estimate the model for the monetary effects caused by changes in monetary policy. If the effects of the changes in the IS curve are orthogonal to the effects of changes in the LM curve (called "fiscal" and "monetary" effects, respectively), our answers would be identical to those obtained by the more traditional method which estimates for the fiscal and monetary effects by a single step multiple regression analysis. However, to the extent that collinearity exists between these effects, our approach would prejudice the results towards finding fiscal effects and against finding monetary effects.

Suppose that the relation between money and income is caused by the endogeneity in the monetary variable as many claim — e.g., a shift in the IS curve causes income to increase which then causes the money stock to increase — there would be a significant correlation between the money stock and economic activity because economic activity caused the money stock to change and not the other way around.[8] In addition, because the measured monetary and fiscal variables are so highly collinear, it is impossible to measure their separate contributions to the change in income. The technique of first estimating for shifts in the IS curve and then estimating for the monetary effects will not measure their separate contributions

7 See L. C. Anderson and J. L. Jordan, *op. cit.*, M. W. Keran, "Monetary and Fiscal Influences on Economic Activity - The Historical Evidence", *Review*, Fed. Res. Bank of St. Louis, Nov. 1969, and M. W. Keran, "Selecting a Monetary Indicator - Evidence from the United States and Other Developed Countries", *Review*, Fed. Res. Bank of St. Louis, Sept. 1970. The approach of Laffer and Ranson, *op. cit.*, is also similar in that changes in nominal GNP are predicted by a single equation model, but their dynamic structure is estimated by ordinary least squares using lagged explanatory variables.

8 The same argument is valid for the interest rate. Because large government deficits which tend to cause income to grow also cause interest rates to rise (small deficits or surpluses tend to dampen both income and interest rates), it is argued that the positive relation between interest rates and economic activity is a result of the common influence on both of fiscal policy. The argument runs that, had we properly accounted for the fiscal influence, we would have obtained the theoretically expected negative effect of interest rates on economic activity. The final step in the reasoning is that the more traditional approach is not an adequate test because of the multicollinearity.

better than the traditional method because it will tend to prejudice the results towards finding significant effects of the first variable measured and against finding significant effects of the second variable. However, if this close relationship between the monetary variables and income is not due to their endogenous dependence upon fiscal policy, this procedure will lead to the same results as the traditional method.

Consider the case where there is perfect collinearity between the fiscal and monetary effects. Then, estimating first for the fiscal influence on income and then for the monetary influence would suggest no significant monetary effects because they are picked up in the first step which measures the fiscal effects. Conversely, in this perfectly collinear case, if the monetary effects were measured first and then the fiscal effects were measured, the results would suggest no significant fiscal effects. In contrast, consider the case where the monetary and fiscal policies are totally independent. In this case our measurement of the fiscal and monetary effects would be independent of which order they are measured. Unfortunately, the fiscal and monetary variables are not independent of each other and to the extent they are not, our results would tend to be towards finding significant fiscal effects on income and against finding significant monetary effects. However, and to foretell the empirical section, in the past there has been enough independent monetary effects on income so that statistically significant parameter estimates of the monetary variables can be made. Consequently, even though we tend to prejudice against the monetary variable, they remain significant.[9] We feel this procedure is preferable to the alternative procedure which estimates the effects in one step and permits one variable to "rob the effects of the other". Because we don't know which variable is the "robber" in the one step procedure, we cannot, *a priori*, say how the results are prejudiced. However, in the two

9 Because the traditional approach includes both fiscal and monetary effects in one equation, that approach is prejudiced against the relatively less statistically significant influence. Consequently, past research has generally found more statistically significant monetary effects than fiscal effects. See ANDERSON and JORDAN, *op. cit.*, 1968. On the other hand, our method prejudices towards finding significant fiscal and against finding significant monetary effects in relation to the degree that the two effects are correlated. However, the statistical results in Section IV show all indicators with the more general lag distributions explain between 15 and 20 per cent of the variance in the dependent variable and most lagged explanatory variables have signicant coefficients. Consequently, the prejudice against statistical significance in the monetary variables does not appear to be a major problem.

step procedure, the direction of prejudice is clear — for the fiscal effects and against the monetary effects.

Our research strategy is clear: our first step is to obtain the "best" estimates of the fiscal effects and, then, what is left unexplained is used in step two to obtain estimates of the monetary effects. Each step of the estimation procedure uses Almon distributed lag variables and a grid of polynomials up to degree five and lags up to nine quarters is searched. For the experiments, all data are first differences of seasonally adjusted quarterly series.

In order to account for the "fiscal" effects we employed series on full employment government expenditures, full employment taxes, and actual exports. Our best equation (produced as Table 1) involved

TABLE 1

FISCAL AND EXPORT INFLUENCES ON AGGREGATE DEMAND (1948-66)
Quarterly First Differences

$$\Delta Y_t = a + \sum_{i=0}^{8} b_i G_{t-i} + \sum_{j=0}^{8} c_j T_{t-j} + \sum_{k=0}^{8} d_k X_k$$

Time Period	Full Employment Government Expenditures	« t » value	Full Employment Taxes	« t » value	Exports	« t » value
t	.729	3.0	.224	0.8	.901	1.6
t−1	.415	2.6	− .242	1.1	.147	.4
t−2	.244	1.6	− .576	2.3	− .166	.5
t−3	.176	1.3	− .781	3.3	− .166	.5
t−4	.171	1.4	− .860	4.1	.016	.1
t−5	.191	1.4	− .817	4.1	.254	.9
t−6	.195	1.3	− .656	3.4	.416	1.4
t−7	.144	1.2	− .383	2.6	.375	1.5
t−8	.000	.0	.000	.0	.000	.0
Sum	2.266		−4.089		1.777	
R^2 = .379	D. W = 1.526					

a polynomial lag distribution of degree three with a distributed lag of seven quarters. For first differences of quarterly GNP, the R^2 is quite good but the Durbin-Watson statistic suggests that the error terms are probably not random. In the next section, attempts to explain this residual error will be made by using alternative monetary indicators.

IV. Evidence on Alternative Indicators

In this section we compare the performance of five different monetary indicators: the market interest rate (prime commercial paper 90 day rate), the monetary full employment interest rate,[10] the money supply (the narrow definition, currency plus demand deposits), the neutralized money supply,[11] and the monetary base.[12] The results of the tests are given in Tables 2-6.[13]

Each table is composed of three parts. The first part presents the results of imposing a first degree polynomial lag constraint on the coefficients with the lag between 3 quarters and 9 quarters chosen

10 The MFEIR is from Starleaf and Stephenson, *op. cit.*, however, their technique was criticized by P. Hendershott, "The Full Employment Interest Rate and the Neutralized Money Stock: Comment", *Journal of Finance*, March 1971, pp. 127-136. Because Hendershott does not assume that the authorities can control the money supply (S and S assume they can), Hendershott re-estimates the full employment interest rate by using a money supply function which makes the money stock endogenous. However, the Hendershott full employment interest rate and the observed commercial paper rate have "striking... similarity of their movement... the major turning points of the rates are coincidental... Moreover, the short-run full employment commercial paper rate exhibits identical turning points. It would... appear that the observed commercial paper rate has been a reasonably accurate indicator of major policy reversals", pp. 133-34.

For the counter argument, see D.R. Starleaf and J.A. Stephenson, "The Full Employment Interest Rate and the Neutralized Money Stock: Reply", *Journal of Finance*, March 1971, pp. 137-143.

11 Because there was an error in Hendershott's original calculation of the neutralized money stock, the "modified" neutralized money stock was used which does not contain the error. See Horwich and Hendershott, *op. cit.*, p. 47, footnote 20. The modified-neutralized money stock "differs from the neutralized money stock in that the impact of the business cycle is not removed from the gold reserves component (i.e., gold reserves are treated as exogenous)", Hendershott, *op. cit.*, p. 132.

12 Only a passing reference is made to a popular indicator, free reserves, in this study because its use as an indicator depends upon the banks' liquidity preference function. At high interest rates, banks want to be "loaned up" and free reserves are low. However, at low interest rates, banks wish to hold excess cash balances and free reservers are high. Consequently, free reserves and the market rate of interest are similar indicators of monetary policy. See A. James Meigs, *Free Reserves and the Money Supply*, Chicago: University of Chicago Press, 1962.

13 For another study which uses similar techniques to compare interest rates and the money stock, see M.W. Keran, "Selecting a Monetary Indicator-Evidence from the United States and Other Developed Countries", *Review*, Fed. Res. Bank of St. Louis, Sept. 1970, pp. 8-19; see also M.J. Hamburger, "Indicators of Monetary Policy: The Arguments and the Evidence", *American Economic Review*, May 1970, pp. 32-39. Comparison of money stock and interest rate indicators within the context of simultaneous equations models are made in R. Holbrook and H. Shapiro, "The Choice of Optimal Intermediate Economic Targets", *American Economic Review*, May 1970, pp. 40-46 and R. Zecher, "Implications of Four Econometric Models for the Indicators Issue", *American Economic Review*, May 1970, pp. 47-54.

Table 2

MARKET RATE OF INTEREST

(Effect on Current Changes in Aggregate Demand from Current and Past Changes in the Interest Rate After Allowing for Fiscal Effects)

Degree 1 Constraint			Degree 3 Constraint		
Lag in Quarters	Coefficient	« t » value	Lag in Quarters	Coefficient	« t » value
0	+2.28	2.2	0	+3.54	2.4
1	+1.72	2.2	1	+1.25	1.5
2	+1.14	2.2	2	− .47	.5
3	+ .57	2.2	3	−1.54	2.0
			4	−1.87	2.0
			5	−1.40	1.5
Sum of Coefficients +5.72			Sum of Coefficients −0.478		
R^2=0.0698 D.W.=1.599			R^2=0.173 D.W.=1.727		

Comments: Generally positive coefficients up to two quarter lags and then negative through to the eight quarter lag. Consequently, the lag to the desired direction effects is substantial but, given enough time, the sum of the coefficients becomes negative.

Table 2'

FREE RESERVES

(Effect on Current Changes in Aggregate Demand from Current and Past Changes in Free Reserves after Allowing for Fiscal Effects)

Degree 1 Constraint			Degree 2 Constraint		
Lag in Quarters	Coefficient	« t » value	Lag in Quarters	Coefficient	« t » value
0	−.396	2.4	0	−.39	2.3
1	−.297	2.4	1	−.17	1.3
2	−.198	2.4	2	−.01	0.0
3	−.099	2.4	3	+.12	0.9
			4	+.19	1.4
			5	+.21	1.7
			6	+.19	1.9
			7	+.12	2.0
Sum of Coefficients −.99			Sum of Coefficients +.26		
R_2=.080 D.W.=1.621			R^2=.110 D.W.=1.708		

Comments: Generally negative coefficients for first two or three quarters and then positive through eight quarters lag. Consequently, like the interest rate indicator, the free reserves indicator in the short run is perverse but given enough time the positive effects dominate the perverse negative effects.

TABLE 3

MONETARY FULL EMPLOYMENT INTEREST RATE

(Effect on Current Changes in Aggregate Demand from Current and Past Changes in the MFEIR after Allowing for Fiscal Effects)

(1952-64)

Degree 1 Constraint			Degree 2 Constraint		
Lag in Quarters	Coefficient	« t » value	Lag in Quarters	Coefficient	« t » value
0	−4.38	2.3	0	1.64	0.3
1	−3.75	2.3	1	−3.33	1.7
2	−3.13	2.3	2	−5.97	2.7
3	−2.50	2.3	3	−6.30	2.3
4	−1.88	2.3	4	−4.31	2.1
5	−1.25	2.3			
6	− .63	2.3			
Sum of Coefficients −17.5			Sum of Coefficients −18.3		
R^2=0.120 D. W.=1.687			R^2=0.195 D. W.=1.765		

Comments: The zero lag coefficient is insignificant but the coefficients in the one to five quarter lags were negative and significant. Additional lags were mostly positive and insignificant. The total weights were distinctly negative.

such that the R^2 is maximized. This lag distribution, being linear, imposes the constraint that all lag coefficients have the same sign. The second part presents the results of an experiment where the Almon variables yield both a relatively high, but representative, R^2 and a lag distribution which is relatively consistent with the majority of the experiments performed. The third part, comment, summarizes in words the general results of the experiments performed with the monetary indicator in question.

The statistical results do not give an unambiguous picture. The first degree constraints produce R^2 statistics from .038 for the neutralized money supply to .148 for the observed money stock. Consistent with the explanatory power, the "t" statistics are lowest for the neutralized money supply (1.2) and highest for the observed money stock (2.9). The market interest rate, the monetary full employment rate and the monetary base lie in between with "t" values of 2.2, 2.3, and 1.7 respectively. Unfortunately, the observed interest rate, even though significant, is plagued with the wrong sign under the linear lag distribution constraint. All other variables have the theoretically correct sign.

TABLE 4

MONEY SUPPLY

(Effect on Current Changes in Aggregate Demand from Current and Past Changes in Currency plus Demand Deposits after Allowing for Fiscal Effects)

(1952-64)

Degree 1 Constraint			Degree 3 Constraint		
Lag in Quarters	Coefficient	« t » value	Lag in Quarters	Coefficient	« t » value
0	1.08	2.87	0	.54	.8
1	.86	2.87	1	.85	2.8
2	.65	2.87	2	.81	2.3
3	.43	2.87	3	.53	1.6
4	.22	2.87	4	.15	.5
			5	−.22	.7
			6	−.45	1.1
			7	−.42	1.2
Sum of Coefficients 3.25			Sum of Coefficients 1.78		
R^2=0.148 D. W.=1.752			R^2=0.196 D. W.=1.851		

(1948-66 Period)

Degree 2 Constraint			Degree 3 Constraint		
Lag in Quarters	Coefficient	« t » value	Lag in Quarters	Coefficient	« t » value
0	1.17	3.0	0	.28	0.5
1	.68	2.8	1	.82	3.4
2	.30	1.7	2	.82	2.9
3	.01	0.0	3	.46	1.8
4	− .19	0.9	4	−.06	.3
5	− .29	1.4	5	−.56	2.4
6	− .29	1.7	6	−.84	2.8
7	− .19	1.8	7	−.72	2.8
Sum of Coefficients 1.207			Sum of Coefficients .19		
R_2=0.124 D. W.=1.724			R^2=0.191 D. W.=1.845		

Comments: The coefficients are positive at first and then become negative in about four or five quarters. Nevertheless, the total effects were always positive.

TABLE 5

NEUTRALIZED MONEY SUPPLY

(Effect on Current Changes in Aggregate Demand Resulting from Current and Past Changes in the Neutralized Money Supply after Allowing for Fiscal Effects)

(1952-64)

Degree 1 Constraint			Degree 2 Constraint			Degree 4 Constraint		
Lag in Quarters	Coefficient	« t » value	Lag in Quarters	Coefficient	« t » value	Lag in Quarters	Coefficient	« t » value
0	.32	1.2	0	−.28	.8	0	−.18	.3
1	.28	1.2	1	.11	.5	1	−.16	.5
2	.23	1.2	2	.39	2.1	2	.26	.9
3	.18	1.2	3	.55	2.8	3	.66	2.9
4	.14	1.2	4	.59	2.9	4	.77	2.9
5	.09	1.2	5	.51	2.9	5	.53	2.1
	.045	1.2	6	.32	2.9	6	.08	.3
						7	−.27	.8
Sum of Coefficients 1.29			Sum of Coefficients 2.19			Sum of Coefficients 1.68		
R^2=0.038 D. W.=1.577			R^2=0.181 D. W.=1.829			R^2=0.216 D. W.=1.833		

Comments: Coefficients at first are negative, then become positive and significant in the 2-5 quarter lag range and then again turn negative. The total weights are always positive.

TABLE 6

MONETARY BASE

(Effect on Current Changes in Aggregate Demand from Current and Past Changes in the Monetary Base after Allowing for Fiscal Effects)

Degree 1 Constraint			Degree 4 Constraint		
Lag in Quarters	Coefficient	« t » value	Lag in Quarters	Coefficient	« t » value
0	1.49	1.7	0	.05	.02
1	1.22	1.7	1	2.92	2.0
2	.75	1.7	2	3.66	2.9
3	.37	1.7	3	2.341	1.8
			4	− .34	.3
			5	−3.05	2.7
			6	−3.80	2.5
Sum of Coefficients 3.74			Sum of Coefficients 1.77		
R^2=0.042 D. W.=1.596			R^2=.153 D. W.=1.769		

Comments: At lag equals zero, coefficient generally near zero and lag at 2 to 3 quarters coefficients peak and at lags in the 5, 6 and 7 quarter range the coefficients were negative. However, the sum of the weights are always positive.

However, when the more general lag distribution obtained from employing higher order polynomials which allows the coefficients to alternate in sign is used, additional lags produce the desired negative coefficients for the market rate of interest. While this allows us to obtain a better hold on the market interest rate indicator, the MFEIR and neutralized money supply indicators become more confusing. The current coefficients on both the MFEIR and the neutralized money supply indicators become insignificant as they take on theoretically incorrect signs. The two indicators which maintain theoretically correct signs even in the current periods under the more general lag distributions are the observed money stock and the monetary base. Their effects are remarkably similar. The lag coefficients are positive for the first three to five quarters and then become negative.

When we look at the lags implied by these more general distributions, we also find wider discrepancies. Because of the incorrect signs in the initial period (s) in the observed market rate of interest, the MFEIR and the neutralized money stock, the lags are longer than those implied by the observed monetary stock or base. In fact, because the observed interest rate has perverse signs through at least $t-1$, the statistics suggest it would take over five quarters to have the theoretically correct effects outweigh the perverse ones. This contrasts to slightly more than one quarter for the MFEIR, slightly more than two quarters for the neutralized money stock and less than one quarter for the money stock.

These statistical tests suggest that the worst indicator of monetary policy is the market rate of interest. Considerably better indicators are the neutralized money stock and the monetary full employment interest rate. These perform about equally well and their choice appears to depend upon whether the authorities prefer to be quantity or price watchers.[14] At the top of the list of the indicators tested are the money stock and the monetary base. Only these variables consistently yielded theoretically correct signs.

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14 These terms are not original with me but were used by RICHARD ZECHER, *op. cit.*, 1970.

V. Summary and Conclusions

This paper has attempted to evaluate the performance of five monetary indicators: a short term market rate of interest, a monetary full employment rate of interest, the money supply, the neutralized money supply and the monetary base.

Although five criteria are used to evaluate the indicators: the degree to which the central bank can control the variable, the "observableness" of the variable, the consistency of a theoretically correct sign associated with the variable, the degree of statistical association the variable has with aggregate demand and the length of the lag between changes in the variable and theoretically correct changes in aggregate demand; most emphasis was placed on the last three criteria. The results suggest that the market rate of interest is

TABLE 7*

RATINGS OF MONETARY INDICATORS
(Rated between groups in order of overall quality but quality within each group is very similar)

ACCEPTABLE - Very Good

Monetary Base

Much above average in exogeneity, theoretically correct signs with a short lag, observable with a higher degree of statistical association. *A Best Bet.*

Money Stock

Average in exogeneity, much above average in shortness of lag, theoretically correct sign, observable with a very high degree of statistical association.

ACCEPTABLE - Good

Monetary Full Employment Interest Rate

Average length of lag, perverse current sign, not observable but has a high degree of statistical association, average exogeneity.

Neutralized Money Stock

Average in length of lag, perverse current signs, not observable but has a high degree of explanatory power, much above average in exogeneity.

UNACCEPTABLE

Market Rate of Interest

Perverse effect for first year. Can be reversed in second year but implies an extremely long lag. Observable, much below average in exogeneity but has high degree of statistical association.

* Any coincidence between the form and wording of this table to ratings done by Consumers Union and published in *Consumers Reports* is purely intentional.

the poorest indicator of those tested. Much better indicators are the MFEIR and the neutralized money supply. Unfortunately, because neither is observable directly, they cannot be closely watched in the day-to-day operations of a central bank. The two most reliable indicators are the observed money stock and the monetary base. On a statistical comparison the results suggest a slight edge to the money stock. However, because the monetary base is more directly under the control of the Federal Reserve System than is the money stock, the edge appears to go to the base. A summary of the ratings appears in Table 7.

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