Selection of a Monetary Aggregate For Economic Stabilization

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IN recent years there has been growing acceptance of the view that controlling the growth of monetary aggregates is a useful strategy for purposes of economic stabilization. In particular, it is argued that the probability of achieving the desired growth of nominal gross national product (also referred to as income) can be improved by controlling growth of the monetary aggregates. Thus, assuming that in the long run real GNP grows at a constant rate determined by growth of the labor force and productivity, then controlling the long-run growth of nominal GNP would be an effective means of controlling the rate of inflation.

Monetary aggregates consist of various combinations of short-term, highly liquid, financial assets held by the private sector. Exhibit I defines seven of the most prominently mentioned measures. The aggregates labeled M_1 through M_6 have been viewed by various analysts as constituting a temporary abode of purchasing power or as a means for carrying out transactions. The monetary base is generally viewed as both the dominant factor determining M_1 and M_2 and as being under direct control of the Federal Reserve System. Since M_2 constitutes a major portion of M_3 through M_6, the monetary base is a major factor affecting these aggregates, but the relationship is not as close.

Exhibit I

Monetary Aggregates

MB	Monetary base, defined as Federal Reserve Credit, nation's gold stock, and Treasury currency outstanding less Treasury deposits at Reserve Banks, Treasury cash, and other deposits and accounts at Reserve Banks plus reserve adjustment magnitude.
M_1	Demand deposits and currency held by the nonbank public.
M_2	M_1 plus time and savings deposits at commercial banks less large, negotiable certificates of deposit.
M_3	M_2 plus deposits at mutual savings banks and shares of savings and loan associations.[1]
M_4	M_2 plus large, negotiable certificates of deposit.
M_5	M_2 plus large, negotiable certificates of deposit and deposits at mutual savings banks and shares of savings and loan associations.[1]
M_6	Total liquid assets defined as M_3 plus large, negotiable certificates of deposit, commercial paper, savings bonds, short-term U.S. Government securities, and credit union shares.

[1]On April 3, 1975, the Board of Governors of the Federal Reserve System redefined M_3 and M_5 to include credit union shares. The data used in this article conform to the old definitions and do not include credit union shares.

Accepting this monetary aggregate view for the conduct of economic stabilization policy, there remains the question of which one of the monetary aggregates has the most predictable effect on nominal GNP. One generally accepted criterion for selecting a monetary aggregate is to choose the one which produces the smallest error in forecasting nominal GNP. Another criterion is to choose the aggregate over which monetary authorities have the best control. In making the ultimate selection, both criteria would have to be considered; this article, however, is concerned only with the first one — forecasting.

Two approaches have been used in this regard. One examines the relative stabilities among the various ratios of GNP to each aggregate, referred to as income velocities. This indirect approach asserts that the aggregate which has the smallest variability in its income velocity can be expected to forecast nominal GNP with the smallest error. The other approach uses a model of nominal GNP determination. In this approach, forecasts of nominal GNP are made using various aggregates, and the one which forecasts with the smallest error is directly ascertained.

INDIRECT VELOCITY APPROACH

Milton Friedman, using the indirect velocity approach, has argued the case for choosing M_2 over M_1 as the appropriate monetary aggregate for economic stabilization.[1] His analysis runs as follows:

> It is a tautology, or identity, that *Growth Rate of Nominal Income = Growth Rate of Money plus Growth Rate of Velocity*, provided that velocity is defined consistently with whatever concept of money is employed.
>
> If velocity (defined as income divided by the quantity of money) were a 'will-of-the-wisp' that fluctuated all over the lot in an unpredictable fashion — as the naïve Keynesians initially asserted — this tautology would be of no use. However, velocity is not a 'will-of-the-wisp.' It behaves in a consistent and fairly predictable way.

Friedman then analyzed the period from 1948 to 1972:

> . . . the velocity of M_1 has had a decided upward trend throughout the period, though with a sharp deceleration after 1966, and a suspicious acceleration in 1972. Using M_1 to judge desired monetary growth requires forecasting the likely secular growth in its velocity, and we have no very satisfactory basis for doing so.
>
> The velocity of M_2 had a more moderate upward trend before 1962, but has displayed no appreciable trend in either direction since. It has been extraordinarily stable. Of the 44 quarterly values for the years 1962 through 1972, the highest is 2.43, the lowest, 2.29, a difference from high to low of 6%, or ±3% about the mean value of 2.36. In striking contrast, the velocity of M_1 went from 2.19 in 1962 to 4.72 in 1972.

On the basis of this analysis, he concluded:

> The greater stability [long-run] of the velocity of M_2 than of the velocity of M_1 suggests that it is safer to specify monetary objectives in terms of M_2 than in terms of M_1, since doing so requires no allowance for an uncertain secular trend in velocity.

Friedman then observed:

> The advantage of no trend might be offset if the velocity of M_2 were more variable over short periods than the velocity of M_1 after allowance for trend. But this is not the case. Numerous studies we have made for recent years and also for the whole period since 1914 (when reliable estimates of M_1 first became available) demonstrate that, if anything, the velocity of M_2 is less variable over short periods than the velocity of M_1.
>
> Of course, there is no guarantee that the velocity of M_2 will not depart from its recent relatively constant level, but neither theory nor the past historical behavior of the velocity of M_2 gives any reason to expect a sudden or large departure.

Long-run Variability of Velocity

The long-run variability of velocity is ascertained by examining movements in the level of velocity over long periods of time. The accompanying chart presents the ratio of nominal GNP to each monetary aggregate for the period 1952-1973.[2] The beginning date was selected to eliminate the period of the Federal Reserve/Treasury Accord, which was included in Friedman's analysis of M_1 and M_2 velocities.

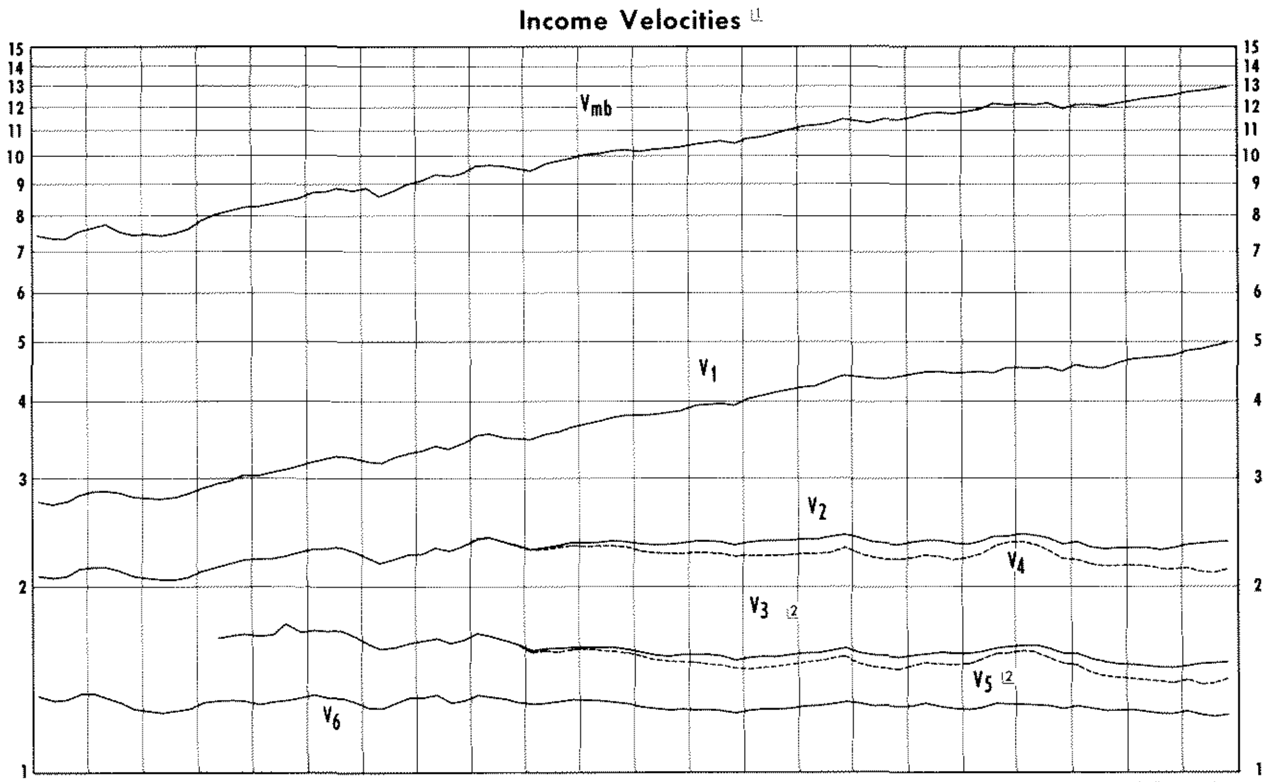
An examination of the chart indicates that V_{mb} and V_1 both have pronounced upward trends over the whole period, but that a break in their trends occurred after the fourth quarter of 1966 (Table I). The trend of V_{mb} changed from an average 3.0 percent annual rate to an average 1.8 percent rate, and the trend of V_1 changed from an average 3.2 percent annual rate to an average 1.8 percent rate. While over the whole period the trend growths of V_2 and V_4 are much less than those of V_{mb} and V_1, a break in their trends also occurred (Table I). V_2 grew at an average 1.2 percent annual rate to the fourth quarter of 1961, and then remained unchanged through fourth quarter 1973. V_4 grew at an average 1.1 percent annual rate to the end of 1961, and subsequently decreased at an average 0.8 percent annual rate. Income velocities V_3, V_5 and V_6 have slightly negative trend growth rates with no discernable breaks.

Two statistical measures of variability of a time series are the standard deviation and the coefficient of variation, which is the ratio of the standard deviation to the mean. This latter measure allows a comparison of the variability of series which have different magnitudes. The larger the values of these measures, the greater is the variability of the series.

Table II presents the long-run variability of these velocity measures for the period 1952 to 1973. According to the coefficients of variation the levels of V_{mb} and V_1 have, by far, the greatest variability for the whole period. The velocity measure with the smallest variability in its level for the whole period is V_6.

[1]Milton Friedman, "How Much Monetary Growth," *The Morgan Guaranty Survey* (February 1973), pp. 5-10.

[2]Except for GNP divided by M_3 and M_5; data for M_3 and M_5 are available only from the second quarter of 1955.



[1] Ratio of nominal GNP to each monetary aggregate.
[2] Data are available beginning second quarter 1955.

When consideration is given to the changes in the trends of four of the velocity measures the relative rankings of long-run variability are little changed. In the period before the various breaks in the trends, V_6 had the smallest long-run variability and V_{mb} and V_1 the largest. After the break in trend, V_2 had the smallest long-run variability.

The preceding analysis of long-run variability in the levels of various measures of income velocity is misleading because the coefficients of variation are greatly influenced by the existence of trend movements. A measure of velocity with a pronounced trend will have a larger coefficient of variation (the ratio of its standard deviation to its mean) than a measure of velocity with no trend. A more appropriate procedure is to eliminate the trend from the data. The analysis in the next section takes this adjustment into consideration.

Table I

Velocity Growth: Selected Periods
(Compounded Annual Rates of Change)

Velocity	I/1952 to IV/1973	Sub-period One: Dates	Sub-period One: Growth	Sub-period Two: Dates	Sub-period Two: Growth
V_{mb}	2.6%	I/52 to IV/66	3.0%	IV/66 to IV/73	1.8%
V_1	2.8	I/52 to IV/66	3.2	IV/66 to IV/73	1.8
V_2	0.6	I/52 to IV/61	1.2	IV/61 to IV/73	0.0
V_3*	–0.5	—	—	—	—
V_4	0.1	I/52 to IV/61	1.1	IV/61 to IV/73	–0.8
V_5*	–0.8	—	—	—	—
V_6	–0.3	—	—	—	—

*Begins II/1955.

Short-run Variability of Velocity

The short-run variability of a measure of velocity is analyzed by using quarter-to-quarter percent changes (at annual rates) and the moving average of these changes over four quarters and eight quarters. The two periods for averaging are selected on the basis of frequently proposed time horizons for economic stabilization. The standard deviations of these three types of change are used as comparative measures of short-run variability. Since the standard deviation measures variability around the mean and since the mean, in the case of percent changes, is the average growth rate, the standard deviation is a measure of the variability

Table II

Long-Run Variability of Velocity
(Levels of Velocity)

Velocity Measure	1952-1973 Standard Deviation	1952-1973 Coefficient of Variation	Sub-period One[1] Standard Deviation	Sub-period One[1] Coefficient of Variation	Sub-period Two[1] Standard Deviation	Sub-period Two[1] Coefficient of Variation
V_{mb}	1.687	.167	1.217	.132	.438	.036
V_1	.675	.178	.475	.139	.170	.037
V_2	.101	.044	.102	.046	.032	.014
V_3[2]	.057	.036	.057	.036	.057	.036
V_4	.084	.038	.101	.045	.066	.029
V_5[2]	.084	.054	.084	.054	.084	.054
V_6	.025	.019	.025	.019	.025	.019

[1]See Table I for delineation of sub-periods for each measure of velocity. There are no sub-periods for V_3, V_5, and V_6; therefore, values for the whole periods are reported.
[2]Begins II/1955.

of percent changes in velocity relative to the trend growth rate.

Table III presents the various standard deviations of quarterly percent changes in the seven measures of velocity. According to the data, V_1 and V_6 have the smallest quarterly variability for the whole period. When the time horizon is extended to four and to eight quarters, the differences in variability among the seven measures of velocity are narrowed considerably. Over a four-quarter period V_1 and V_6 have the smallest average quarterly variability, and over an eight-quarter period V_{mb}, V_1, and V_6 have the smallest average quarterly variability.

When consideration is given to the breaks in the trend growth rates (Table III), V_6 has the smallest short-run quarterly variability in sub-period I, and V_{mb}, V_1, and V_2 have the smallest in sub-period II. When quarterly percent changes are averaged over four quarters, V_6 has the smallest short-run variability in sub-period I, while in sub-period II, V_{mb} and V_1 have the smallest. Averaging over eight quarters the smallest variability occurs for V_1 and V_6 in sub-period I, and for V_{mb}, V_1, V_2, and V_6 in sub-period II.

Conclusions From Analysis of Velocity

As mentioned earlier, it has frequently been asserted that the monetary aggregate with the smallest variability in its income velocity can be expected to forecast nominal GNP with the smallest error. Based on this assertion, the analysis of long-run variability of velocity suggests that M_6 (total liquid assets) would forecast nominal GNP with the smallest error. Its velocity had virtually no trend in the period from 1952 to 1973 and no break in trend. Moreover, in all but one instance, V_6 has the smallest long-run variability. On the other hand, M_1 and the monetary base would be expected to forecast nominal GNP with the largest error, since a substantial break occurred in their trends of velocity and they have the largest long-run variability in velocity. These conclusions, however, are misleading because of trend movements in several of the measures of velocity.

The analysis of the relative short-run variability in the seven measures of velocity, which adjusts for trend, indicates that over intervals of time relevant for economic stabilization, M_6 could be expected to yield consistently smaller errors in forecasting nominal GNP. In all cases but one, V_6 had the smallest short-run variability. There is, however, little superiority of M_6 over monetary base, M_1, and M_2.[3]

[3]Evidence from the period 1952 to 1973 does not support Friedman's contention that at the present time M_2 is preferred over M_1 for economic stabilization. A change in the trend growth of both V_1 and V_2 occurred, but at different dates. In addition, the magnitude of the two changes were almost identical — a reduction of 1.4 percentage points for V_1 and 1.2 percentage points for V_2. It thus appears that the trend

Table III

Short-Run Variability of Velocity
(Standard Deviation of Percent Changes in Velocity at Annual Rates)

Velocity	1952 to 1973 Quarterly Change	1952 to 1973 Average Quarterly Change 4-quarters	1952 to 1973 Average Quarterly Change 8-quarters	Sub-period One[1] Quarterly Change	Sub-period One[1] Average Quarterly Change 4-quarters	Sub-period One[1] Average Quarterly Change 8-quarters	Sub-period Two[1] Quarterly Change	Sub-period Two[1] Average Quarterly Change 4-quarters	Sub-period Two[1] Average Quarterly Change 8-quarters
V_{mb}	4.0%	2.4%	1.2%	4.4%	2.4%	1.6%	3.2%	1.6%	1.2%
V_1	3.6	2.0	1.2	4.0	2.4	1.2	3.2	1.6	1.2
V_2	4.4	2.8	1.6	5.2	3.6	2.0	3.2	2.0	1.2
V_3[2]	4.0	2.4	1.6	4.0	2.4	1.6	4.0	2.4	1.6
V_4	4.8	3.2	2.0	5.2	3.6	2.0	4.0	2.8	1.6
V_5[2]	4.4	2.8	2.0	4.4	2.8	2.0	4.4	2.8	2.0
V_6	3.6	2.0	1.2	3.6	2.0	1.2	3.6	2.0	1.2

[1]See Table I for delineation of sub-periods for each measure of velocity. There are no sub-periods for V_3, V_5, and V_6; therefore, values for the whole period are reported.
[2]Begins II/1955.

Table IV

Estimated Regression Coefficients: I/1952 - IV/1973

	Constant	D1	D2	$\Delta \ln M_t$	$\Delta \ln Y_{t-1}$	$\Delta \ln Y_{t-2}$	$\Delta \ln Y_{t-3}$	$\Delta \ln Y_{t-4}$	R^2	D.W.	S.E.E.
M_1	0.810443*	–2.090492*	2.373832*	0.766833*	–0.621393*	–0.285813*	0.240580	–0.284408*	0.548997	2.194058	0.984013
M_2	0.690135*	–2.033680*	2.249027*	0.473700*	–0.530305*	–0.250326	0.202764	–0.288114*	0.501618	2.130834	1.034409
M_3	0.567848	–2.096168*	2.211760*	0.425942*	–0.523803*	–0.203384	0.194619	–0.282304*	0.505617	1.918353	0.946215
M_4[1]	0.840603*	–2.099962*	2.251406*	0.330737*	–0.516682*	–0.268521	0.221460	–0.290675*	0.485501	2.127847	1.051001
M_5[1]	0.726453	–2.136304*	2.208554*	0.321278*	–0.517067*	–0.216406	0.205449	–0.287788*	0.494804	1.931776	0.956506
M_6[2]	0.463706	–1.940179*	2.198319*	0.931527*	–0.721536*	–0.395751*	0.153216	–0.328165*	0.566716	2.131029	0.965395
MB	1.030204*	–2.031015*	2.095635*	0.541541*	–0.544434*	–0.267499	0.166300	–0.322441*	0.488028	2.192997	1.048418

[1]Begins III/1955.
[2]Begins II/1952.
*Coefficient is significant at the 5 percent level.

At best, the indirect velocity approach is a shortcut to the forecasting question. While the analysis of long-run variability of velocity suggests that M_6 would forecast nominal GNP with the smallest error, the analysis of short-run variability of velocity is inconclusive in this regard.

One additional point should be made — relative stability of velocity does not necessarily indicate that one monetary aggregate will forecast nominal GNP with a smaller error than will any other aggregate because high variability does not preclude predictability. Therefore, the direct forecasting approach would produce a more definitive test for selecting the appropriate monetary aggregate for economic stabilization.

DIRECT FORECASTING APPROACH

A monetary model of nominal income (GNP) determination is used to ascertain the relative forecasting ability of the seven monetary aggregates. The model was spelled out in detail in a previous article.[4] The basic feature of the model is that the change in the rate of change in nominal spending by households and business firms for newly produced goods and services is postulated to respond to the discrepancy between the rates of change in actual and desired nominal money balances. It is therefore distinguished from the more familiar post-Keynesian types of forecasting models. The empirical form of the model consists of three equations, which are presented in Exhibit II.

Exhibit II

(1) $$\Delta \ln Y_t^d - \Delta \ln Y_{t-1}^d = b_0 + b_1 \Delta \ln M_t + b_2 \sum_{i=1}^{4} w_i \Delta \ln Y_{t-i} + b_3 \Delta \ln r_t + b_4 D_1 + b_5 D_2 + \epsilon_t$$

(2) $$\Delta \ln Y_t = W(t) \Delta \ln Y_t^d + [1 - W(t)] \Delta \ln Z_t$$

(3) $$W_t = (1 - \delta) \frac{Y_{t-1}^d}{Y_{t-1}},$$ in which δ is the average ratio of imports to $Y^d + Z$ in sample period

$\Delta \ln Y_t^d - \Delta Y_{t-1}^d$	=	change in the rate of change in spending by households and business firms for product (measured by consumption plus investment).
b_0	=	response of spending by households and business firms to average rate of change in technical efficiency of the payments system.
$\Delta \ln M_t$	=	rate of change in a monetary aggregate.
$\sum_{i=1}^{4} w_i \Delta \ln Y_{t-i}$	=	weighted sum of past rates of change in nominal income (measured by nominal GNP).
$\Delta \ln r_t$	=	rate of change in nominal short-term interest rate (measured by the 4-6 months commercial paper rate).
$\Delta \ln Y_t$	=	rate of change in nominal income (measured by nominal GNP).
D_1	=	zero-one dummy variable for major strikes. One in 1959-II, 1964-IV and 1970-IV.
D_2	=	zero-one dummy variable. One in quarter following a major strike.
ϵ_t	=	a random error term.
$\Delta \ln Z_t$	=	rate of change in government spending plus foreign spending on domestic product (measured by National Income accounts for total government purchases of goods and services plus exports).

of V_2 is subject to as much uncertainty as that of V_1. The analysis of short-run changes in velocity also does not confirm Friedman's contention that V_2 is more stable than V_1.

[4]Leonall C. Andersen, "A Monetary Model of Nominal Income Determination," *Review* (June 1975). The model was developed using M_1 and M_2. When applying it to M_3 through M_6, it is postulated that in each case the change in the rate of change in spending responds to the discrepancy between the rate of change in actual and desired stocks. Other models could be developed based on different specifications and could be used to forecast nominal income. Thus, the forecasting results reported here are applicable only to the model presented.

Table V

Percent Errors in Simulated Level of GNP

Simulation Period Beginning I Q	M_1	M_2	M_3	M_4	M_5	M_6	MB
				Fourth Quarter			
1962	−1.68%	2.37%	0.27%	3.60%	1.08%	0.19%	−0.92%
1963	3.41	2.12	0.96	2.62	1.19	2.94	0.36
1964	−0.09	−1.74	−3.05	−1.49	−2.91	−2.11	−2.23
1965	2.66	3.88	2.57	3.51	2.37	0.26	0.49
1966	−1.20	−1.37	−3.62	−2.06	−3.89	−4.45	−2.02
1967	4.30	2.84	1.35	2.38	0.99	0.65	1.13
1968	1.92	−0.61	−1.85	−1.26	−2.16	−0.50	−1.07
1969	0.49	−1.92	−2.82	−3.46	−3.56	−2.48	−1.14
1970	1.51	0.10	−1.08	0.58	−0.54	−0.74	0.36
1971	3.26	3.66	3.97	2.59	2.53	2.91	1.82
1972	−1.45	−2.25	−2.64	−2.80	−3.23	−0.54	−2.72
1973	−1.93	−2.42	−2.98	−1.65	−2.47	−0.90	−2.15
1974	1.13	0.96	0.18	1.55	0.74	1.22	1.91
RMSE	2.24	2.28	3.69	2.45	2.38	1.99	1.59
Maximum Error	4.30	3.88	3.97	3.60	−3.89	−4.45	−2.72
				Eighth Quarter			
	M_1	M_2	M_3	M_4	M_5	M_6	MB
1962	1.67	5.59	0.73	8.50	2.54	3.25	−0.62
1963	4.78	0.96	−1.90	1.98	−1.46	0.53	−1.70
1964	1.89	0.50	−2.39	0.41	−2.32	−1.44	−2.70
1965	1.89	1.99	−3.37	0.53	−3.85	−4.33	−2.53
1966	2.25	0.23	−3.21	−0.80	−3.56	−2.72	−1.72
1967	7.28	2.01	−1.22	0.70	−1.96	0.26	−0.19
1968	3.13	−2.21	−4.40	−4.38	−5.38	−2.76	−2.00
1969	2.20	−1.54	−3.63	−2.13	−3.38	−2.26	0.15
1970	4.58	4.23	3.70	3.77	2.51	2.43	2.28
1971	2.08	1.79	2.59	0.10	−0.02	2.42	−0.81
1972	−3.68	−5.36	−6.34	−5.32	−6.63	−1.81	−5.29
1973	−1.56	−2.25	−3.86	−1.16	−2.96	−0.25	−0.95
RMSE	3.50	2.92	3.43	3.48	3.47	2.36	2.21
Maximum Error	7.28	5.59	−6.34	8.50	−6.63	−4.33	−5.29
				Twelfth Quarter			
	M_1	M_2	M_3	M_4	M_5	M_6	MB
1962	3.13	5.57	−1.50	9.94	−0.14	0.71	−2.66
1963	7.59	4.14	−0.56	5.01	−0.18	2.04	−2.08
1964	1.95	−1.10	−6.65	−2.10	−6.80	−6.30	−5.32
1965	5.86	4.50	−1.59	2.67	−2.10	−2.65	−1.76
1966	5.95	−0.38	−5.39	−2.05	−6.01	−3.97	−2.75
1967	9.43	0.75	−3.31	−2.27	−4.77	−1.96	−0.72
1968	5.01	−1.90	−5.00	−3.09	−5.01	−2.62	−0.78
1969	5.30	2.78	1.95	1.80	0.94	0.71	1.88
1970	3.63	2.27	2.45	1.25	−0.02	1.87	−0.41
1971	0.64	−0.77	−0.65	−1.88	−2.94	1.98	−3.00
1972	−3.52	−5.31	−7.21	−5.10	−7.25	−1.35	−4.52
RMSE	5.30	3.24	4.01	4.14	4.23	2.82	2.77
Maximum Error	9.43	5.57	−7.21	9.94	−7.25	−6.30	−5.32

Forecasting Procedure

The parameters of equation (1) are estimated by ordinary least squares using quarterly data.[5] Seven sets of equations were estimated, one for each monetary aggregate.[6] For each monetary aggregate, the parameters of equation (1) are estimated for the

[5]The interest rate was excluded. It is assumed that the indirect interest rate influence of changes in an aggregate on spending by households and business firms is reflected in the estimated parameters.

[6]The inclusion of the monetary base is justified by the identity $M_t = m_t MB_t$, in which m_t is the appropriate multiplier.

period from first quarter 1952 to fourth quarter 1961, except for M_3 and M_5 which begin in third quarter 1955 and M_6 which begins in second quarter 1952. The sample period is then extended by four quarters and the parameters are re-estimated. This procedure continues through the terminating quarter which is fourth quarter 1973. The parameter estimates for the longest sample period are reported in Table IV.[7]

Next, for each monetary aggregate, *ex ante* (beyond each sample period) dynamic simulations are conducted using the complete model. Actual values in the post-sample period of the exogenous variables — each monetary aggregate, total government spending on goods and services, and exports — are used. The lagged $\Delta \ln Y$ terms are generated internally. Of interest to this study are the simulated quarterly levels of nominal GNP. Although these simulations are not forecasts in the strict sense, they may be viewed as forecasts with knowledge of future movements in the three exogenous variables.

Forecasting Results

These simulation exercises are used to ascertain the comparative forecasting capabilities of the seven monetary aggregates using the specified model. Forecasts of nominal GNP using each monetary aggregate are developed for successive post-sample periods of four, eight, and twelve quarters. Forecast errors — the difference between predicted and actual quarterly levels of nominal GNP as a percent of actual GNP — are calculated for the fourth, eighth, and twelfth quarters of each post-sample period. These errors are reported in Table V.

Two types of forecast error are calculated for each monetary aggregate. One is the root-mean-squared error (RMSE) for each of the three sets of terminal quarters. This measure provides an indication of the average forecasting ability of each aggregate; the one with the smallest RMSE forecasts best, on average, the level of GNP. The other measure is the maximum error within each of the three sets of forecasts. The aggregate with the smallest maximum error is best if avoidance of large forecasting errors is desired. These two measures are presented in Table V.

On the basis of these simulations of the specified model, the monetary base appears to forecast the level of nominal GNP the best. Its RMSE is the smallest for each of the three simulated terminal quarters. In addition, it has the smallest maximum forecast error for the fourth and the twelfth quarters, and it has the second smallest maximum error for the eighth quarter.

CONCLUSIONS

This paper investigated one criterion for choosing a monetary aggregate for economic stabilization — the aggregate which forecasts nominal GNP with the smallest error. For time periods of general interest, the indirect income velocity approach produced rather inconclusive evidence regarding the choice of a monetary aggregate. Although this approach would reject M_3, M_4, and M_5, there was little basis for choosing among the other four aggregates. The direct forecasting approach based on the specified model, however, found that the monetary base forecasts the level of nominal GNP with the smallest root-mean-squared error in every case and with the smallest-maximum error in two out of three cases.

[7]The parameter estimates for all of the sample periods are available on request. The procedure of lengthening the sample period differs from another frequently used procedure of maintaining a moving, fixed length sample period. The argument for using this latter procedure is that it better captures changes in structure, that is, basic changes in the regression coefficients. The procedure used in this study is justified on the basis of tests which rejected the structural change hypothesis for equation (1) using M_1 and M_2. See Andersen, "A Monetary Model of Nominal Income Determination."