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BOARD OF GOVERNORS
OF THE
FEDERAL RESERVE SYSTEM

Office Correspondence

Date February 5, 1988

To Federal Open Market Committee

Subject Attached Paper on Monetary Base

From Donald L. Kohn

The attached paper is being distributed as background for discussion of the monetary base as a long-range policy objective. It examines the characteristics of the monetary base as an intermediate target for monetary policy, using techniques similar to those applied to M1-A, M1, and M2 in a memorandum sent in December to the Federal Open Market Committee.

Attachment

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CLASS I FOMC

2/5/88

THE MONETARY BASE AS AN INTERMEDIATE TARGET[1]

SUMMARY

This note analyzes certain properties of the monetary base as an intermediate monetary policy target. It was prepared as an addendum to a paper recently discussed by the Federal Open Market Committee.[2] The first section contains a description of the basic characteristics of the monetary base, and the next part describes the velocity performance of the base. The third section reports the results of analyses and simulations of econometric models with respect to interest and income elasticities and variances of income and prices from target paths.[3] Issues related to controllability of the base are reviewed in a final section.

The velocity analysis shows that the behavior of the base has been qualitatively similar to that of M1 in that its velocity during the 1980s has diverged considerably from its trend of the 1960s and 1970s. The econometric evidence suggests that, based on income and interest elasticities, the targeting properties of the base are fairly close to that of M1-A but somewhat superior to those of M1 and M2. However, the more complex analyses involving simulations of the MPS model indicate

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1. Prepared by Brian Madigan and David Small, Division of Monetary Affairs, Board of Governors of the Federal Reserve System. Donald Kohn, David Lindsey, and Richard Porter commented on this paper and Flint Brayton and Elizabeth Eberle assisted in preparing the analysis.
2. "An Evaluation of M1-A as an Indicator and Intermediate Target and Comparisons with M1 and M2", December 9, 1987, by Brian Madigan and David Small. Also see "Issues Related to Monetary Aggregate Targeting", memorandum to Federal Open Market Committee from Messrs. Kohn, Madigan, and Small, December 11, 1987.
3. The monetary data presented in this paper do not reflect the February 1988 benchmark and seasonal factor revisions.

somewhat smaller differences among the aggregates in their relations to ultimate economic variables, with fairly large misses in absolute terms for all the aggregates, but the results still tend to favor the base slightly.

THE MONETARY BASE

The monetary base consists of the monetary liabilities of the Federal Reserve and the Treasury. It is the sum of total deposits held by depository institutions with the Federal Reserve plus currency in circulation. This definition of the base reflects the demand for or "use" of the base. Its mirror image is the supply or "sources" of the base. This measure consists of Federal Reserve credit, that is, holdings of government securities, discounts and advances, Federal Reserve float, and other Federal Reserve assets, plus other sources. The other sources are the sum of the gold stock, special drawing rights, and Treasury currency outstanding, less Treasury and foreign deposits at the Federal Reserve, Treasury cash holdings, and certain miscellaneous items. If all assets and liabilities were measured contemporaneously, these two measures would be identical, as they essentially reflect the asset and liability sides of the Federal Reserve's balance sheet with certain adjustments.

There are two publicly-available measures of the monetary base, corresponding to the sources and uses concepts of the base. The differences arise mainly because of alternative treatments of vault cash. One measure is constructed by the Board and the other by the

Federal Reserve Bank of St. Louis. The Board measure is a uses concept; it divides the base into total reserves, the currency component of the money stock, and a residual item. The residual item is surplus vault cash of depository institutions--that is, vault cash in excess of reserve requirements--less that part of the vault cash holdings of thrift institutions that is already included in the currency component of M1, plus service-related balances.[4] The vault cash component of total reserves is lagged four weeks, reflecting its treatment in reserves. The St. Louis base is a sources concept; it treats all vault cash contemporaneously.[5] The measure constructed by the Board after adjustment for changes in reserve requirements and seasonal adjustment is used in charts 1 to 3.

About three-quarters of the monetary base consists of currency in the hands of the public; 23 percent is made up of reserves and service-related balances held by depository institutions; the small

4. Service-related balances comprise required clearing balances and adjustments to compensate for float. All service-related balances are excluded from the series when it is adjusted for changes in reserve requirements. All vault cash at thrift institutions will be excluded from M1 as a result of a minor redefinition of its currency component, effective February 1988.

5. There are two other differences between the Board base and the St. Louis base concerning seasonal adjustment and adjustments for changes in reserve requirements. St. Louis seasonally adjusts the whole base directly after adding a reserve adjustment magnitude (RAM) to account for regulatory changes in reserve requirements as well as changes in composition of deposits. The Board seasonally adjusts the currency, total reserves, and residual components separately, after multiplying the reserves and residual components by a break adjustment factor, and sums the three components. The Board's break adjustment method is intended to adjust only for changes in reserve requirements.

remaining balance represents surplus vault cash less vault cash held by thrift institutions included in M1.

Growth of the monetary base has been smoother than that of the other monetary aggregates, as suggested by chart 1. The average absolute change in growth of the adjusted monetary base from quarter to quarter was 1.3 percentage points between 1959 and 1987. Comparable values for M1-A, M1, and M2 were 4.7, 4.3, and 2.8 percentage points. The smooth growth of the base can, of course, be attributed to its large and relatively stable currency component. The average quarterly fluctuation of growth in currency in circulation between 1959 and 1987 was only 1.2 percentage points, while that of total reserve balances was 6.8 percentage points.

VELOCITY OF THE MONETARY BASE

Chart 2 shows that the velocity of the monetary base rose over most of the 1960s and 1970s.[6] Like V1, the velocity of the base peaked in the early 1980s and has declined on balance since then. Chart 3 shows that, in normalized terms, the velocity of the base behaved in a manner similar to that of V1, with relatively small deviations from trend over the 1960s and 1970s.[7] Between 1980 and 1987, the velocity of the base dropped about 20 percent below its earlier trend, compared with declines of about 28 percent for M1 and relatively small changes on

6. This section employs the Board measure of the monetary base seasonally adjusted and adjusted for changes in reserve requirements.
7. The velocity measures are normalized each quarter by dividing actual velocity by its trend estimated over the 1959 to 1979 period.

Chart 1

Levels of the Monetary Aggregates
(billions of dollars)

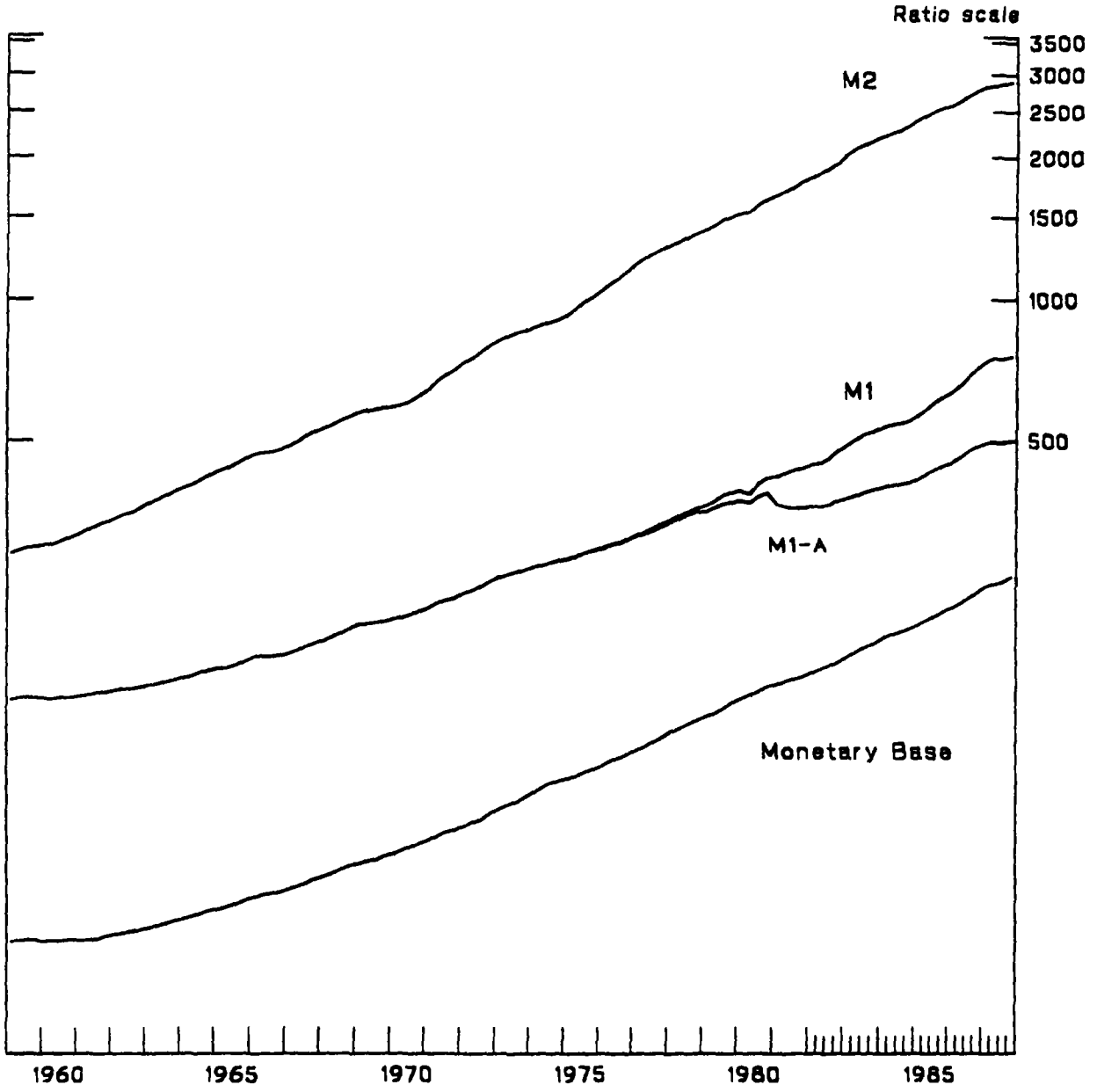


Chart 2

Velocities of the Monetary Aggregates

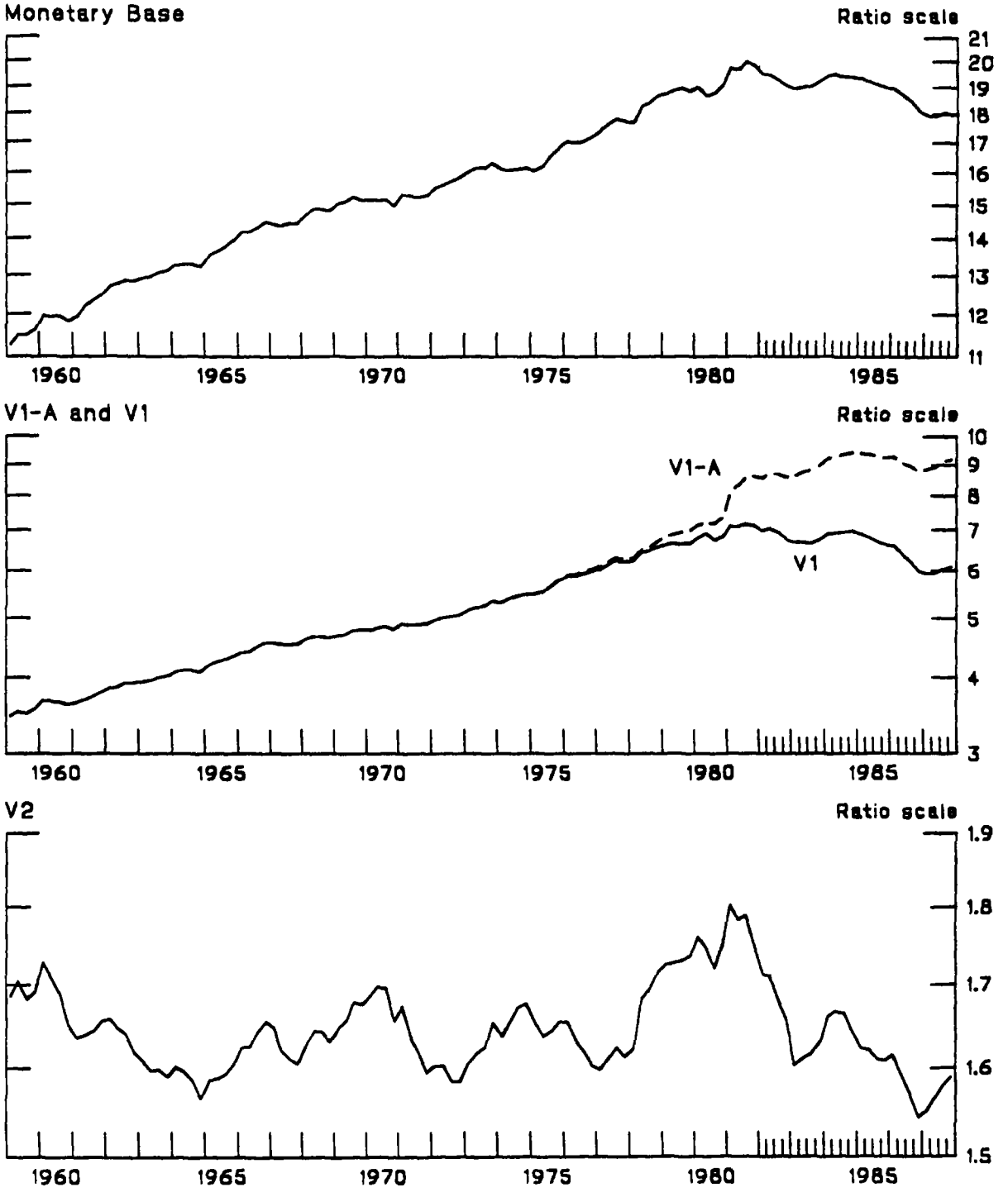
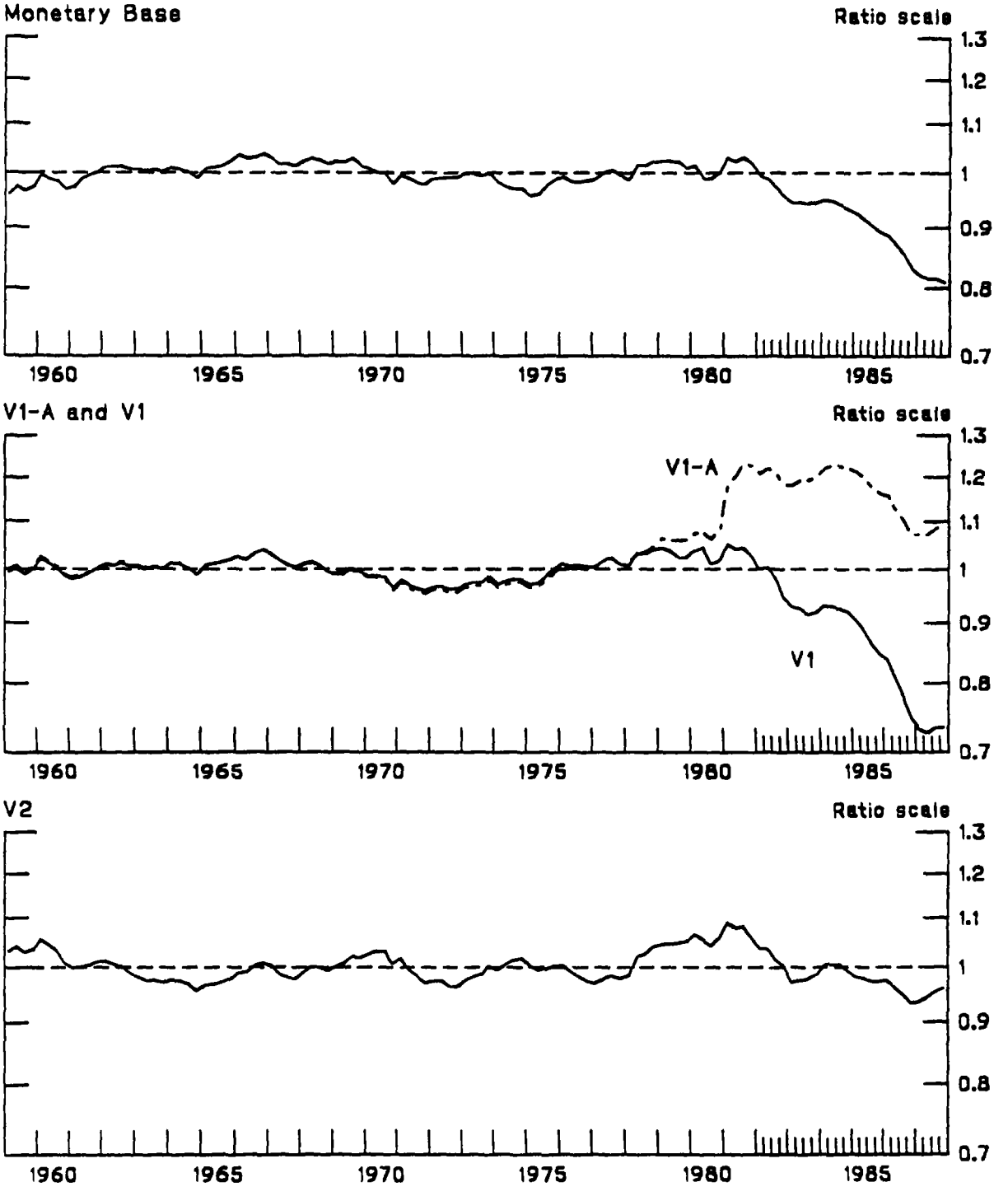


Chart 3

Normalized Velocities of the Monetary Agregegates



balance for M1-A and M2. The decline in base velocity over the 1980s has reflected more rapid growth both in currency and in reserves (adjusted for changes in reserve requirements) relative to income.

PROPERTIES OF THE BASE AS AN INTERMEDIATE TARGET

In analyzing the behavior of the monetary base and its relationship to economic activity, alternative approaches are possible. One method would involve directly estimating relationships among the monetary base, aggregate spending, and perhaps interest rates, in order to obtain demand equations or "St. Louis-type" reduced-form relationships. But questions are raised under this approach if one starts from the premise that the various components of the base are demanded for fairly distinct reasons and have differing behavioral characteristics, because the direct approach treats the base as homogeneous.

We have chosen to adopt a structural approach to analyzing the monetary base consistent with the approach taken in the papers previously distributed to the Committee. In this approach, the demand for the monetary base is derived from underlying demands for the monetary assets directly used by the public: currency, transactions deposits, and other reservable monetary assets. The derived demand approach permits us to apply to the base the criteria used in the previous paper's examination of M1-A, M1, and M2--estimated income and interest elasticities, demand forecast errors, and GNP and price targeting errors.

Some simplifying assumptions nevertheless were required to carry out the analysis. First, in order to avoid difficult questions relating to proper modeling of the vault cash residual, an alternative decomposition of the monetary base was used, along the lines of the St. Louis approach in treating all vault cash contemporaneously. Instead of separately modeling the currency component of M1, total reserves, and the vault cash residual, the monetary base was broken into currency in circulation and total reserve balances. The staff reestimated the parameters of its standard currency component model using currency in circulation as the dependent variable. (The estimated coefficients were close to those of the currency component model.)[8] It should be noted that this approach assumes that depository institutions' demands for vault cash are determined jointly with the public's demand for currency and by the same independent variables--spending and interest rates. In addition, changes in required reserves are assumed to feed through to required reserve balances dollar for dollar, rather than being partly absorbed in surplus vault cash.

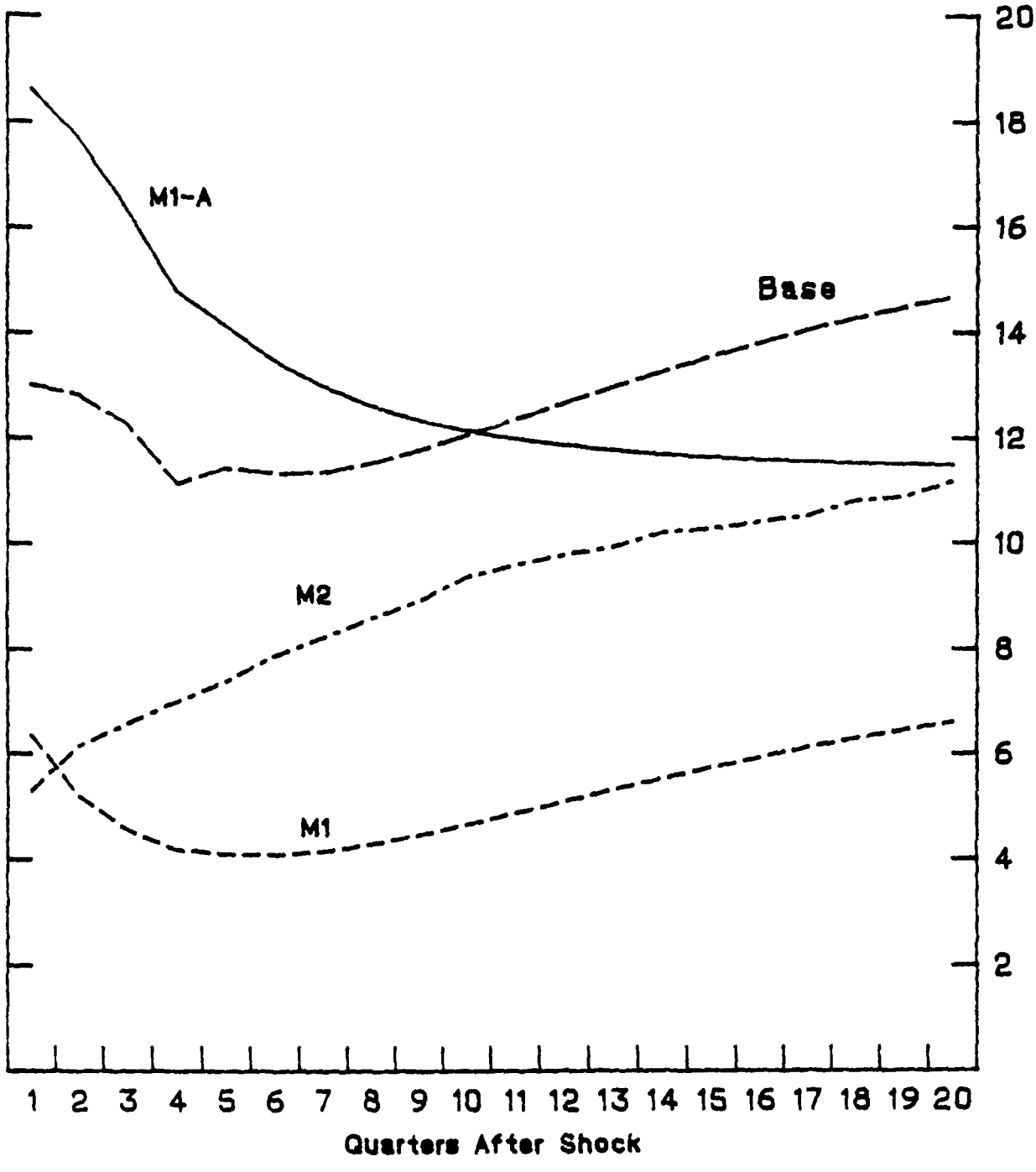
Finally, the demand for required reserves on only M1 transactions balances was modeled.[9] This is because quarterly structural models for the other variables that affect the demand for reserve balances--such as transactions deposits not in M1 (including U.S. government and interbank deposits), nonpersonal time deposits,

8. Currency in circulation was seasonally adjusted using an X-11 ARIMA procedure similar to that applied to the currency component.
9. Required reserves against M1 transactions deposits comprise about 75 percent of total required reserves.

Chart 4

RATIO OF INCOME ELASTICITY TO INTEREST ELASTICITY

(Absolute Value of Ratio)



net Eurocurrency liabilities, service-related balances, and excess reserves--are not available. Thus, the results presented below should be interpreted as assuming that, under a base targeting procedure, multiplier adjustments to the target path would be made to take account of fluctuations in these reserve-absorbing variables.[10] In effect, only the portion of the base consisting of currency in circulation and reserve balances against M1 would be targeted; changes due to the other factors would be fully accommodated.

Thus, the demand for the monetary base is represented as a weighted sum of the demand for currency in circulation and transactions deposits in M1. Currency receives a weight of unity and transactions deposits receive a weight equal to their estimated average aggregate marginal reserve requirement.[11] Through this series of adjustments and assumptions, the base constructed for this analysis is insulated from a variety of factors that would in practice make demand for it less predictable, perhaps biasing the results in favor of the base. The derived base equation and the underlying component equations are presented in the appendix.

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10. Multiplier adjustments are particularly feasible for required reserves on nonpersonal time deposits and Eurocurrency liabilities, because these requirements are met with a two maintenance period lag. Similarly, required clearing balances are met with a three week lag.
11. The demand equation is expressed in change terms from a base period. The marginal reserve ratio used was .085 and is based on disaggregated ratios estimated by Division staff for use in day-to-day forecasting of required reserves. An alternative approach involving direct estimation of the marginal reserve requirement also was taken. The qualitative results discussed below appeared rather insensitive to small differences in the reserve ratio between the alternatives.

Ratios of income to interest elasticities obtained under this approach are presented in chart 4. As noted in the previous paper, higher values of this ratio are desirable other things equal, at least in a static context, because higher values imply a stronger response of interest rates to a shock to spending, and these rate movements tend to damp the effects of such shocks on the economy. The chart shows that the values for the monetary base are fairly comparable to those for M1-A but considerably higher than those for M1 and M2. Over the first two years or so, values for the base are a little lower than those for M1-A, in part reflecting the relatively high interest elasticity and low income elasticity contributed by the other checkable deposit component, even when weighted by the marginal reserve requirement. (The interest and income elasticities are presented separately for selected time horizons in table 1.) In addition, though, the ratio for the base is held down over the first several quarters by a relatively weak estimated response of currency demand to income. Over a longer period of time, the declining interest elasticity of OCDs and the rising income elasticity of currency causes the ratio for the base to increase.

As noted in the previous memorandum, the elasticity-ratio analysis is limited in that it abstracts from unpredictable errors in the money demand functions as well as interactions of the monetary and real sectors and, in particular, from the lags of real spending to changes in interest rates.[12] In order to take account of these factors,

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12. Also, as noted in the previous memorandum, there is some evidence that the models understate the interest elasticity of demand deposits,
(Footnote continues on next page)

Table 1

Estimated Properties of the Monetary Aggregates

INTEREST ELASTICITIES[2]

Time Horizon	Base	M1-A	M1	M2
One quarter	-.04	-.03	-.12	-.06
Four quarters	-.08	-.07	-.25	-.13
Long run	-.06	-.09	-.11	-.07

1. For M1-A and M1, based on Board quarterly model: for M2 based on single-equation quarterly aggregate model.
2. With respect to the federal funds rate. Incorporates estimated responses of Treasury bill rates and deposit rates.

INCOME ELASTICITIES

Time Horizon	Base	M1-A	M1	M2[3]
One quarter	.47	.64	.76	.32
Four quarters	.92	1.02	1.02	.96
Long run[4]	.98	.99	.99	1.00

3. Incorporates estimated response of wealth to changes in income, both of which are used as scale variables in the M2 equation.
4. Long-run income elasticities for all components and aggregates, except those for currency and currency in circulation, are constrained to equal unity in the long-run.

TREND VELOCITY GROWTH
(percent)

Base	M1-A	M1	M2
.8	1.6	1.0	.2

the staff conducted simulation experiments with the MPS quarterly econometric model, which assumed a given monetary aggregate was controlled tightly on a quarterly basis along a target path. The target paths for money were established in the following way. The MPS model was first simulated with no shocks, to establish a baseline forecast of relatively stable prices and employment behavior. Then, using the demand models for the various monetary aggregates, target paths for the aggregates consistent with that stable behavior were derived, assuming no shocks to the money demand equations. Finally, the full model was simulated repeatedly using historical distributions of shocks to the money demand equations and the other MPS model equations.

The results of these simulations in terms of deviations of ultimate economic variables from baseline paths are reported in Table 2. The table shows estimated standard deviations of nominal GNP, prices, and real GNP from expected paths. The results for M1-A, M1, and M2 are nearly identical to those presented in the previous paper.

However, owing to explosive oscillations in interest rates under the monetary base targeting exercise, changes in the federal funds rate from quarter to quarter were limited to 500 basis points. (These oscillations can arise in a monetary targeting context when the interest elasticity of money demand is relatively small in the short run, but rises over time, while the elasticity of real spending with respect to interest rates increases appreciably with time.) The limit on interest

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(Footnote continued from previous page)
which would carry over to understating the interest elasticity of the base in this exercise.

Table 2

ESTIMATED STANDARD DEVIATIONS OF LEVELS OF NOMINAL GNP, PRICES, AND REAL GNP USING ALTERNATIVE INTERMEDIATE MONETARY TARGETS[1]
(percentage points)

	Base	M1-A	M1	M2
Nominal GNP				
4 quarters	1.8	1.9	1.9	2.0
8	2.1	2.4	2.7	2.9
12	2.7	2.9	3.4	3.6
16	3.5	3.6	4.2	4.7
20	5.0	3.6	4.3	6.1
GNP deflator				
4 quarters	.8	.9	1.0	.9
8	1.7	.9	2.0	2.0
12	2.4	2.8	3.1	3.2
16	2.7	3.3	4.0	4.0
20	3.1	3.5	4.8	4.6
Real GNP				
4 quarters	1.7	1.9	1.8	1.9
8	2.3	2.6	2.4	2.4
12	3.5	3.9	3.4	3.8
16	4.4	4.7	4.5	5.4
20	5.2	4.6	4.8	6.4
Memo: Interest rate variability[2]	3.7	3.3	2.1	n.a.

n.a.--not available.

1. Obtained from stochastic simulations of MPS model. Because of instrument instability, quarter-to-quarter fluctuations in the federal funds rate were constrained to be less than or equal to 500 basis points.

2. Mean absolute quarter-to-quarter changes in the federal funds rate after four quarters.

rate fluctuations was chosen so as to be effectively non-binding for the more interest-elastic aggregates, M1 and M2, but narrow enough to eliminate the interest instability problems of the base.

Over periods of one to two years, which are most relevant for policy targeting, the divergences of ultimate variables from expected paths for the monetary base appear relatively favorable. In general, the standard deviations using the base are of the same order of magnitude as those using the other aggregates, but are generally smallest.

Additional information on the issue of interest rate variability is presented in the memorandum item on table 2. It shows mean absolute quarter-to-quarter changes in the funds rate after four quarters. The variability indicated for M1 is relatively small, reflecting the comparatively high interest elasticity of demand for those aggregates, but in absolute terms the variability seems rather large at around 2-1/4 percentage points. The estimated rate variability for M1-A and the base is considerably higher--3-1/4 to 3-3/4 percentage points. This reflects the relatively low interest elasticity of those aggregates and their components. For comparison, the mean absolute quarterly average change in the federal funds rate between 1983 and 1987 was only about 50 basis points.

Another dimension of this analysis relates to the comparative stability of the various money demand equations. The previous paper noted that the apparent superiority of M1-A is undermined by the large errors that the demand deposit equation has experienced in recent years. Because required reserves on demand deposits feed through to the

monetary base, such misses in demand deposits could affect the stability of the monetary base equation. As table 3 shows, the errors in the demand deposit equation experienced in 1986 and 1987 did indeed lead to misses in the monetary base equation. However, the misses in the larger currency in circulation component were smaller than those for demand deposits, and thus the mean absolute errors in the 1985-87 period for the base were smaller than those for M1-A and comparable to those of M1 and M2.

CONTROLLABILITY OF THE BASE

Another issue is the controllability of the monetary base. Because the monetary base consists of items on the Federal Reserve's balance sheet, it is often claimed that the System can control its growth quite precisely. In fact, this claim is somewhat of an overstatement under long-standing institutional arrangements. For example, the System is unable to control currency growth directly under current policies, as the System supplies currency on demand to depository institutions. Thus, control of the base must take place through its reserves component: fluctuations in currency demand would need to be offset dollar for dollar by total reserves.[13] Moreover, the System is

13. In theory, the System could directly control the quantity of currency in circulation by supplying currency only when it chose. However, this likely would significantly alter the nature of the demand for currency--for example, precautionary demands probably would increase greatly, weakening the link between spending and currency. In addition, the price of currency in terms of reserve balances likely would fluctuate, in contrast to the current dollar-for-dollar exchange rate that is currently a result of System policies.

TABLE 3

MONEY DEMAND GROWTH RATE FORECAST ERRORS[1]
(percent)

	Base[2]	M1-A[3]	M1[4]	M2[5]
Summary Statistics for Quarterly Errors 1985:Q1 - 1987:Q4				
Root Mean Squared Error	2.1	2.8	2.2	1.8
Mean Absolute Error	1.5	1.9	1.4	1.4
Mean Error	.0	1.2	.8	-.4
Annual Errors				
1985	-.7	0	.3	-.1
1986	1.3	3.7	2.2	-.2
1987	-.6	-2.3	-1.3	-1.0

Summary Statistics for Quarterly Errors 1985:Q1 - 1987:Q4	CIC	DD	OCD
Root Mean Squared Error	2.2	5.6	3.8
Mean Absolute Error	1.5	4.0	3.1
Mean Error	.1	-.1	.1
Annual Errors			
1985	-.6	.2	1.1
1986	.9	5.4	-1.8
1987	-.1	-5.5	1.0

1. Based on long-run simulations starting in 1981:Q1.
2. Based on currency in circulation, demand deposit, and other checkable deposit equations, and an assumed marginal reserve ratio of .085 on transactions deposits. Excludes multiplier errors.
3. Based on the currency and demand deposit equations of the Board quarterly model. Both equations are estimated from 1961:Q1 - 1986:Q2.
4. Based on the currency, demand deposit and OCD equations of the Board quarterly model. The OCD equation is estimated over 1981:Q3 - 1986:Q3.
5. Based on an aggregate M2 equation estimated over 1968:Q1 - 1986:Q2.

not able to control total reserves precisely. The remaining two-day lag under the current contemporaneous reserve requirement structure means that the System must supply reserves in the last two days of a given maintenance period either in nonborrowed form or through the discount window to allow the banking system to satisfy its reserve requirements plus excess reserve demands.

Moreover, even without the two-day lag, the control mechanism would still be indirect so long as the discount window were open, with use constrained only by administrative pressure, as now. A decline in the nonborrowed base, accomplished through open market operations, would lead to a reduction in the total base only to the extent the associated rise in interest rates reduced the quantity of currency and reservable deposits demanded. To some extent, though, the rise in interest rates would induce more discount window borrowing, given the discount rate, necessitating therefore a multiple reduction in the nonborrowed base to induce a desired reduction in the total base. Since these money demand and borrowing relationships are imperfectly predictable, the total base, like the other monetary aggregates, is not susceptible to precise short-run control. Indeed, the nature of the control process in both cases is qualitatively similar under current institutional arrangements. Thus, a practical operating policy designed to control the monetary base would need to focus on the nonborrowed monetary base in the short run. However, over a longer targeting horizon such as a quarter or more, the total monetary base probably could be controlled

closely if the associated interest rate volatility were considered acceptable.

APPENDIX

Board Quarterly Model Money Demand Sector[1/]
[t-statistics in brackets]

(1) Currency

$$\Delta\log(CURR) = \underset{[-4.4]}{-1.5188} + \sum_{i=0}^{4} r_i \, RTBE_{-i} + \sum_{i=0}^{5} yc_i \, \log(EPCE)$$

$$+ \sum_{i=0} p_i \, \log(PEPCE)_{-i} \underset{[-3.2]}{- .0015} \, TYME + \underset{[15.3]}{1.3215} \, U_{-1} \underset{[-5.9]}{- .4989} \, U_{-2}$$

$\sum r_i = \underset{[-6.8]}{-.0054}$ $\quad \sum yc_i = \underset{[16.5]}{.8838}$ $\quad \sum p_i = 1$ [constrained]

$r_0 = -.0003$	$yc_0 = .0935$	$p_0 = .1630$
$r_1 = -.0018$	$yc_1 = .1399$	$p_1 = .1560$
$r_2 = -.0017$	$yc_2 = .2908$	$p_2 = .4284$
$r_3 = -.0008$	$yc_3 = .1297$	$p_3 = .2526$
$r_4 = -.0008$	$yc_4 = .1113$	
	$yc_5 = .1187$	

$\bar{R}^2 = .99998$
Durbin-Watson Statistic = 2.1553
Standard Error of Regression = .0026
Sample Period: 1961:Q1-1986:Q2
Estimated: 8/87

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1. All equations are single-stage error-correction specifications except Currency and Currency in Circulation.

(2) Currency in Circulation

$$\Delta\log(CIC) = \underset{[-4.4]}{-.0023} + \sum_{i=0}^{4} r_i \, RTBE_{-i} + \sum_{i=0}^{5} yc_i \, \log(EPCE)$$

$$+ \sum_{i=0}^{3} p_i \, \log(PEPCE)_{-i} \underset{[-4.3]}{- .0023} \, TYME \underset{[13.5]}{+ 1.263} \, U_{-1} \underset{[-4.1]}{- .384} \, U_{-2}$$

$\Sigma r_i = \underset{[-5.2]}{-.0041}$ $\quad \Sigma yc_i = \underset{[14.6]}{.945}$ $\quad \Sigma p_i = 1$ [constrained]

$r_0 = -.0001$ $\quad yc_0 = .1139$ $\quad p_0 = .1950$

$r_1 = -.0016$ $\quad yc_1 = .1959$ $\quad p_1 = .1696$

$r_2 = -.0013$ $\quad yc_2 = .2711$ $\quad p_2 = .4092$

$r_3 = -.0003$ $\quad yc_3 = .1099$ $\quad p_3 = .2262$

$r_4 = -.0007$ $\quad yc_4 = .0958$

$yc_5 = .1159$

$\bar{R}^2 = .99998$
Durbin-Watson Statistic = 2.1189
Standard Error of Regression = .0026
Sample Period: 1961:Q1-1986:Q2
Estimated: 1/88

(3) Demand Deposits

$$\Delta\log(DD) = \underset{[-2.5]}{-.1222} \underset{[-3.2]}{- .0183}\ \log(RTBE)_{-1}$$

$$\underset{[-2.5]}{- .1749}\ [\log(DD) - \log(EPCEN)]_{-1}$$

$$\underset{[-2.2]}{- .0010}\ TYME_{-1} \underset{[-2.7]}{- .0030}\ SHIFT_{-1}$$

$$\underset{[2.2]}{+ .1649}\ \log(1 - JNOWT)_{-1} + \sum_{i=0} dr_i\ \Delta\log(RTBE)_{-i}$$

$$+ \sum_{i=0} dy_i\ \Delta\log(EPCEN)_{-i} \underset{[-3.3]}{- .0089}\ \Delta SHIFT$$

$$\underset{[11.3]}{+ .8834}\ \Delta\log(1 - JNOWT) \underset{[2.5]}{+ .1535}\ \Delta\log(DD)_{-1}$$

$$\sum dr_i = \underset{[-3.4]}{-.0305} \qquad \sum dy_i = \underset{[13.6]}{.8465}$$

$$dr_0 = -.0081 \qquad dy_0 = .4868$$

$$dr_1 = -.0224 \qquad dy_2 = .1661$$

One convergence restriction is imposed on the estimates:

$$\sum_{i=0} dy_i + \text{coefficient on } \Delta\log(DD)_{-1} = 1$$

$\bar{R}^2 = .7671$
Durbin H Statistic = -.6331
Standard Error of Regression = .0068
Sample Period: 1961:Q1-1986:Q2
Estimated: 8/87

(4) OCDs

$$\Delta\log(OCD) = \underset{[-4.1]}{-.5083} \underset{[-4.0]}{- .0514}\ TAYLOG1_{-1}$$

$$\underset{[-4.2]}{- .2047}\ [\log(OCD) - \log(EPCEN)]_{-1}$$

$$\underset{[-2.3]}{- .0250}\ \Delta TAYLOG1 + \underset{[7.9]}{.8580}\ \Delta\log(EPCEN)$$

$$\underset{[1.3]}{+ .1420}\ \Delta\log(OCD)_{-1}$$

One convergence restriction is imposed on the estimates:
sum of coefficients on $\Delta\log(EPCEN)_{-1}$ and $\Delta\log(OCD)_{-1}$ = 1

$\bar{R}^2$ = .7835
Durbin H Statistic = -.9373
Standard Error of Regression = .1293
Sample Period: 1981:Q3-1986:Q3
Estimated: 8/87

Definitions (all variables on a quarterly average basis, all quarterly variables are seasonally adjusted.)

CICSA = currency in circulation

CURR = currency + travelers' checks

DD = demand deposits (business and consumer)

EPCE = personal consumption expenditures in 1982 dollars

EPCEN = personal consumption expenditures in current dollars

JNOWT = NOW account availability index (held in constant from 1985 onward)

OCD = other checkable deposits = M1 - currency and travelers' checks - demand deposits

PEPCE = deflator for personal consumption expenditures

ROCDE = own rate on OCDs (effective yield)

(ROCDQ is a weighted average of regular NOW and SuperNOW rates at banks and thrifts through 1986:Q2, with the weights being quantities of deposits lagged one quarter. Survey SuperNOW rates for 1986:Q1 and :Q2 were judgmentally adjusted upward by 22 and 12 basis points, respectively, to reflect blending/tainting with regular NOW rates. Starting in 1986:Q3, ROCDQ is a lagged-deposit weighted average of rates of all OCDs at banks and thrifts. ROCDE is simply ROCDQ converted to an effective yield basis.)

RTBE = rate on 3-month T-bills (effective yield)

RTBOCDE = RTBE - ROCDE (opportunity cost of OCDs)

SHIFT = 0 through 1974:Q2, 1 in 1974:Q3, increments by ones until reaching 10 in 1976:Q4, and remains at ten thereafter (a dummy variable for the "missing money")

TAYLOG1 = log(RTBOCDE) if RTBOCDE $\geq$ .75
= 1/.75 * RTBOCDE - 1 + log(.75) if RTBOCDE < .75
(becomes the first-order expansion of log for spreads less than .75)

TYME = time variable: 1947:Q1 = 1, increments by 1 each quarter

U = uncorrelated error term (coefficients are autoregressive parameters)

Quarterly Aggregate M2 Equation
(t-statistics in parentheses)

$$
\begin{aligned}
(5)\ \Delta\log(M2) = {} & -.0728 \underset{(-4.88)}{} - .0012\underset{(-2.52)}{}\ \text{TIME} + .0062\underset{(2.35)}{}\ \text{MMDADUM} \\
& -.0119\underset{(-6.62)}{}\ \text{TAYLOG}_{-1} \\
& -.1899\underset{(-5.18)}{}\ [\log(M2) - \log(GNP)] \\
& +.0776\underset{(1.22)}{}\ \Delta\log(GNP) \\
& -.0090\underset{(-5.06)}{}\ \Delta\text{TAYLOG} \\
& +\sum_{i=0}^{2} w_i\ \Delta\log(\text{WEALTH})_{-i} \\
& -.0156\underset{(-4.034)}{}\ \Delta\text{DUMMCON} \\
& +.0314\underset{(4.97)}{}\ \Delta\ \text{MMDADUM} \\
& +.493\underset{(6.47)}{}\ \Delta\text{Log}\ (M2)_{-1}
\end{aligned}
$$

$\Sigma_i w_i = .4292\underset{(5.64)}{}$, $w = .123\underset{(1.90)}{}$ $\quad w_i = .076\underset{(1.13)}{}$ $\quad w_2 = .231\underset{(3.64)}{}$

Restrictions: $\Sigma y_i + \Sigma w_i + dm = 1$

where dm = .429--the coefficient on lagged Δlog(M2).

Sample Period: 1968:1 - 1986:2
$\bar{R}$-squared: .669
Durbin-H statistic: .126
Standard Error of the Regression: .00478

Definitions

TAYLOG = RM2SP, if RM2SP ≥ SPLICE

$$= \frac{1}{\text{SPLICE}} * \text{RM2SP} - 1 + \log(\text{SPLICE}), \text{ if RM2SP} < \text{SPLICE}$$

splice = 0.5

RM2SP = RTBE - RM2E

RTBE = 3 month T-bill rate: effective rate

RM2E = deposit weighted average of deposit own-rates, with weights being stocks lagged one quarter. Deposit own-rates are as defined in quarterly model (ROCDE, RSTDE, RMMDAE, RMMFE, RSAVE) plus rates on overnight Euro and RPs, all on an effective basis

GNP = nominal GNP

DUMMCON = credit control dummy: equals 0 except for 1980:Q2 when it equals 1.

MMDADUM = MMDA dummy: equals 0 during 1982:Q3 and earlier. In 1982:Q4 it equals .1667; in 1983:Q1 and thereafter it equals 1.

WEALTH Excludes land and the stock market.

Derived Monetary Base Equation

$$(6)\quad BASE_t - BASE_0 = CIC_t - CIC_0 + .085(DD_t - DD_0 + OCD_t - OCD_{t-1})$$

where: subscript 0 indicates values as of 1984:Q4. CIC_t, DD_t, and OCD_t indicate values predicted by their respective equations.