MONETARY AGGREGATES AND ECONOMIC ACTIVITY

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ON-GOING RESEARCH PROJECTS UNDER UNDP-PIDS
MONETARY AND BANKING POLICIES PROJECT*

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* For details, see Mario C. Feranil, Project Manager, UNDP Assistance to PIDS Project.

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I. INTRODUCTION

The various five-year development plans prepared by the National Economic and Development Authority (NEDA) design monetary management in the Philippines as generally supportive of PLAN objectives. This strategy involves: first, the decision on growth rates of ultimate target variables of macro economic policy such as GNP, inflation rate, balance of payments; then the determination of the growth rates of monetary aggregates consistent with the growth rates of ultimate target variables; and finally, with growth rates of monetary aggregates as given, the adjustment of instruments by the Central Bank to keep the actual movements of monetary aggregates as close as possible to desired growth rates.

The 1978-82 Five-Year Development Plan succinctly states:

> "Throughout the 10-year period, the management of monetary policy is anticipated to be refined and strengthened further in support of PLAN objectives. In line with these objectives, domestic liquidity is targeted to expand from P56.7 billion in 1978 to P95.6 billion by 1982. Another five years later, it will reach the P217.4 billion mark. This assumes on the average, an annual growth rate of 17.6 percent for the first five years and 18.6 percent for the second half. These targeted rates of growth are consistent with the targeted real rates of economic growth and expected price, balance of payments and fiscal developments" (p.383)

From its various annual reports, the Central Bank has responded accordingly to the task assigned to it. For example, it states:

> "Monetary policy was expansionary in 1982 to help buoy the domestic economy in the face of a worldwide recession. Domestic credits increased to sustain growth in the productive sectors, although precautionary measures has to be taken to avert the resurgence of inflationary pressures. The changes in monetary aggregates were generally in line with targeted output and price increase." (Report to the President: Economic and Financial Development, January-December, 1982.)

The success of this strategy depends on two conditions. One, there exists a bundle of financial assets (monetary aggregate) which bears a close and predictable relationship to the ultimate target variables which policymakers seek to influence. In this case, the monetary aggregate can indicate what will happen to the ultimate target variables as a result of policy actions taken by the Central Bank. The second condition is that the monetary authority can control movements of this bundle by simply adjusting the instruments of monetary policy as it would be meaningless to target a variable over which the Central Bank has no control. The monetary aggregate that satisfies both conditions can then serve as an indicator of policy actions as well as movements of economic activity. In short, it can serve as an intermediate target of monetary policy.

Provided that the monetary aggregate chosen satisfies these two conditions the use of a monetary aggregate as an intermediate target of monetary policy has several advantages.[1/] For one thing, since reliable data on the ultimate target variables are not released quickly enough to guide policymakers in making short-term decisions, there is a need to look for a proxy variable that bears a close and stable relationship with the ultimate target variables and can be monitored on a timely basis. With the current operating procedure of the Central Bank, movements of a monetary aggregate are frequently monitored and information is made available with a much shorter time lag. If a monetary aggregate is consistently and predictably related to the pace of the ultimate target variables, then policymakers are readily given up-to-date information for short-term execution of policy. Moreover, the intermediate target variable can also provide information on current direction and effectiveness of monetary policy. In a sense, it gives a consistent signal on the degree of monetary restraint being exercised. Market participants, on the other hand, utilize this information in making judgements regarding investment and consumption.

1/ The importance of using monetary aggregates as an intermediate target of monetary policy is well discussed in economics literature. For example, see Bryant (1980, 1983), Kimelman (1981), Lawler (1981), Friedman (1977), and Carlson and Hein (1980).

Thus, the use of monetary aggregate as an intermediate target of monetary policy becomes very important. Monetary authorities should, therefore, strive to locate that bundle of financial assets which has a stable and predictable relationship with ultimate target variables and is controllable to a large extent. Traditionally, the movements of a narrow monetary aggregate, also called M1 (a currency in circulation plus demand deposits of money banks), was closely monitored, as it is believed that it has a stable link with aggregate economic activity.[2/] However, the rapid financial innovations that took place in the late 60s and 70s, particularly the emergence of deposit substitutes, raised doubts on the strength of the relationship between M1 and economic activity. This prompted the monetary authorities to also consider broader monetary aggregates, such as M2 (M1 + savings and time deposits of deposit money banks) and M3 (M2 + deposit substitutes of commercial banks).[3/] Target growth rates of these monetary aggregates have been determined and incorporated in the various five-year development plans.

[2/] Deposit money banks are composed of commercial banks and a part of the rural banking system accepting demand deposits. For a more detailed account of the evolution of the definition of M1, see Ono and Lamberte (1983).

[3/] The Monetary Board is empowered to formulate a definition of money supply and to change it whenever the need arises (see Sec. 65, R.A. 265 as amended by P.D. No.72).

A cursory look at the semestral growth rates of these three monetary aggregates for the period (1968-1980 is quite instructive (see Chart 1). There is a perceptible upward trend in the growth rates of these aggregates over this period, punctuated by wide fluctuations around that trend. The growth rates of these monetary aggregates have significantly diverged from each other, especially after 1972 when commercial banks were allowed to issue deposit substitutes. The conflicting behavior of these monetary aggregates send confusing signals on the degree of monetary restraint being exercised. Which one of them is given greater weight in policy decisions? The various CB annual reports do not give a definite answer. However, a comparison of target and actual levels of monetary aggregates gives some leads. Actual levels of M3 were closer to their targeted levels compared with those of M1 and M2, implying that M3 is given more importance relative to the other aggregates (see Table 1). But does it satisfy the two conditions for an intermediate target of monetary policy better than the other monetary aggregates? This issue has yet to be examined empirically.

One important recent development which is not taken into account in defining monetary aggregates, is the rapid growth of thrift banks and other non-deposit money banks

Chart 1

SEMESTRAL GROWTH RATES OF M1, M2 and M3

Symbol used is ____________ M1 (Moving Average)

Symbol used is .... M2 (Moving Average)

Symbol used is - - - - - - M3 (Moving Average)

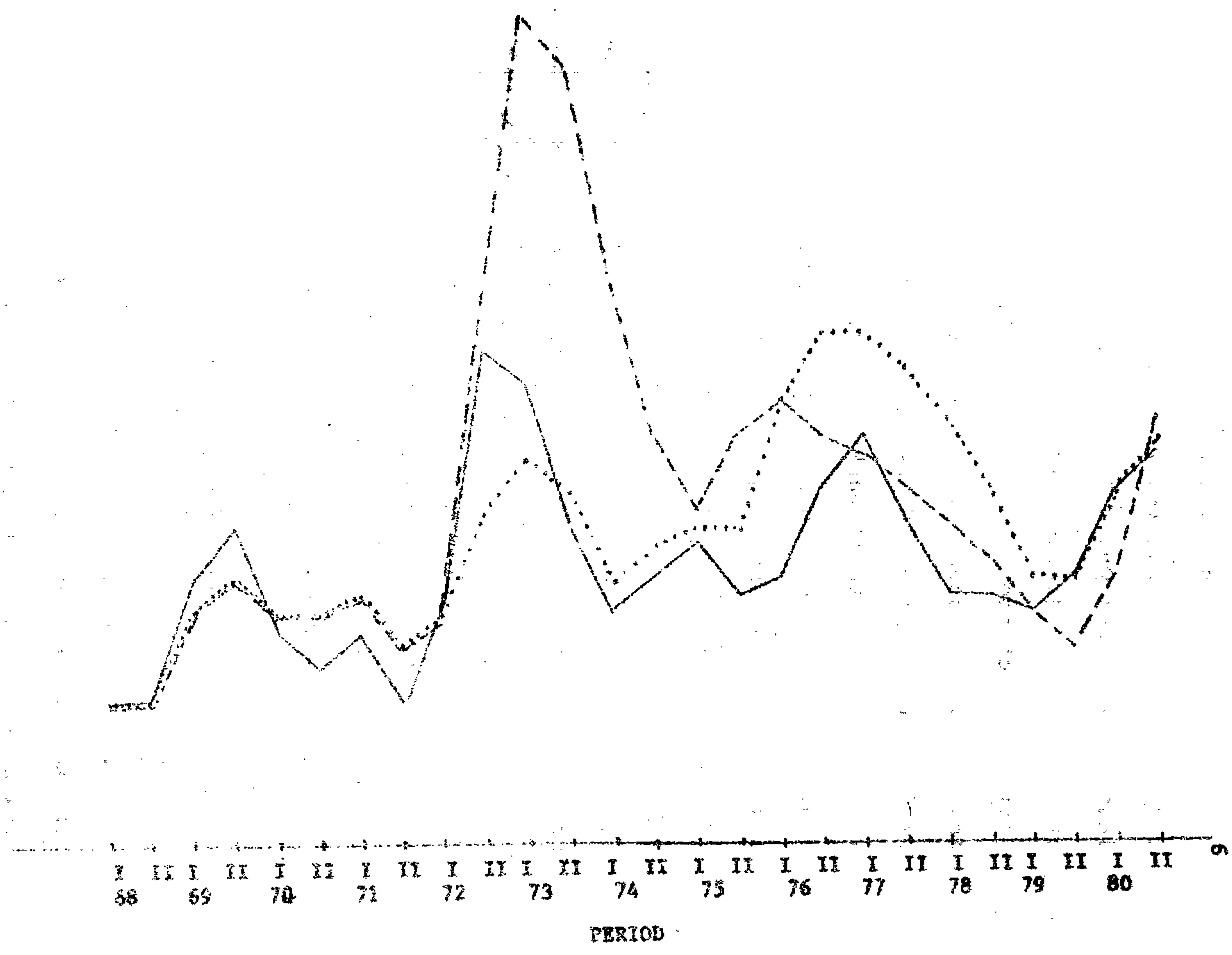

Table 1

A COMPARISON OF TARGETED AND ACTUAL LEVELS OF MONETARY AGGREGATES

YEAR	M1			M2			M3		
	Targets	Actual	Error (%)	Targets	Actual	Error (%)	Targets	Actual	Error (%)
1978	16,189	16,946	-4.47	37,026	40,344	-8.2	50,720	51,838	-2.16
1979	18,763	18,843	-0.42	43,635	45,409	-3.91	59,342	57,360	3.46
1980	21,746	22,538	-3.51	51,407	55,432	-7.26	69,468	67,803	2.46
1981	25,204	23,331	8.03	60,549	62,616	-3.30	81,233	78,539	3.43
1982	29,219	23,524	24.21	71,223	78,732	-9.4	95,043	95,298	-0.27

Sources: The targeted figures were obtained from the Five-Year Development Plan, 1978-1982, while the actual figures were taken from various issues of the C.B. Statistical Bulletin.

(see Table 2). In fact, some of them have become commercial banks, while the others have merged with other commercial banks. Their presence in the financial market further broadens the array of financial assets that are near-monies. Further, the 1986 reforms have reduced the functional differences among categories of banks and non-bank financial intermediaries which in effect contributes to the growing similarity and substitutability of financial liabilities among commercial banks and other financial institutions. In the recent more intense competition for generating deposit funds, thrift banks also participate in producing new types of financial assets in order to remain competitive.

These financial innovations, the rapid emergence of other financial institutions and changes in regulations may have significant impact on the payments process and, may also have obscured the link between the existing monetary aggregate measures and economic activity. Monetary policy might be rendered ineffective if part of the financial system that produces a seemingly endless array of money substitutes is ignored in defining monetary aggregates. To solve this problem, construction of monetary aggregates broader than the existing ones is needed. This can be done by including money substitutes produced by other financial institutions other than deposit money banks and examining their usefulness as intermediate targets of monetary policy.

Table 2
RATES OF GROWTH OF ASSETS OF PHILIPPINE FINANCIAL INSTITUTIONS
1975 - 1980
(In Percent)

Philippine Banking System	179.87
Commercial Banking System	174.60
Thrift Banks	395.98
Private Development Banks	323.86
Savings Banking System	417.06
Stock Savings and Loan Associations	388.44
Rural Banking	100.93
Specialized Government	182.79
All Non-Bank Financial Intermediaries	119.24
Investment Houses	80.29
Financing Companies	243.27
Securities Dealers/Brokers	-2.96
Investment Companies	150.39
Fund Managers	-36.47
Lending Investors	-17.57
Pawnshops	224.22

Source of Basic Data: Fact Book: Philippine Financial System, 1980.

This study tackles the issues raised above. Specifically, it attempts to ascertain the relationship between the various monetary aggregates and economic activity and the extent to which these aggregates can be controlled by the Central Bank.

In the next section, the components of various monetary aggregates and their growth rates are presented. Section III outlines the methods for selecting a monetary aggregate and presents the empirical results. The last section concludes the study and discusses some policy implications.

II. MONETARY AGGREGATES

The monetary aggregate and its rate of change occupies an important part in virtually all theories on the operations of the economy. From a theoretical point of view, the monetary aggregate that should be most closely related with economic activity is that which measures the stock of balances used for transaction purposes. In the Philippines, the Monetary System which is composed of the Monetary Authorities and Deposit Money Banks create financial assets which are used for making payments. This is called M1 which is defined as the sum of currency in circulation (= currency issue of the Central Bank *minus* cash held in vaults of the National Treasury and the commercial banking system) and peso deposits subject to check by the monetary system *excluding* National Government Deposits, interbank deposits and commercial banks' holdings of checks and other cash items, but *including* unused overdraft lines and managers' and cashiers' checks. Recent developments, however, revealed that other liquid assets can also substitute for this narrowly defined monetary aggregate, although the substitutability is less perfect and varies in degree according to types of financial assets. It is therefore necessary to construct other measures of the monetary aggregate that would reflect the varying degree of substitutability between the narrowly defined monetary aggregate and other liquid assets. The organizing principle underlying the construction of broader aggregates is the combination of similar kinds of monetary assets at each level of aggregation. The broader monetary aggregates are: M2, which is defined as the sum of M1 and savings and time deposits of deposit money banks excluding National Government deposits, and M3, which is defined as M2 plus deposit substitutes of deposit money banks (see Table 3).

The semestral growth rates of the three existing monetary aggregates for the period 1966:I to 1986:II are presented in Table 4. As expected, broader monetary aggregates posted higher growth rates than the narrowly defined monetary aggregate because of the presence of relatively attractive financial assets. Also, the growth rates of broader monetary aggregates have lower variability during the same period compared with the narrowly defined monetary aggregate, indicating that substitution among the components of these aggregates has taken place.[1/]

The rapid growth of other financial institutions which can produce money substitutes cannot be ignored. Thus, there should be much broader aggregates which would include

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1/ The degree of variability is measured by the coefficient of variation (C.V.).

Table 3
MONETARY AGGREGATES AND THEIR COMPONENTS
PHILIPPINES

COMPONENTS	CURRENT			ADDITIONAL MONETARY AGGREGATES			
	M1	M2	M3	M1A	M2A	M3A	M4A
A. Monetary Authorities							
Currency in Circulation	x	x	x	x	x	x	x
B. Deposit Money Banks*							
Demand Deposits	x	x	x				
Savings and Time Deposits		x	x				
Deposit Substitutes			x				
C. Commercial Banks							
Demand Deposits				x	x	x	x
Savings and Time Deposits					x	x	x
Deposit Substitutes						x	x
Marginal Deposits							x
D. Rural Banks							
Demand Deposits				x	x	x	x
Savings and Time Deposits					x	x	x
E. Thrift Banks							
Demand Deposits				x	x	x	x
Savings and Time Deposits					x	x	x
F. Non-Bank Financial Intermediaries							
Deposit Substitutes						x	x

*These consist of all commercial banks and rural banks accepting demand deposits.

Table 4

SEMESTRAL RATES OF GROWTH OF MONETARY AGGREGATES

		M1	M2	M3	M1A	M2A	M3A	M4A
1968:	I	-2.22	-0.66	-0.66	-5.26	0.19	0.99	1.82
	II	7.65	6.51	6.51	9.21	5.17	5.88	8.78
1969:	I	1.18	2.05	2.05	3.60	2.36	3.16	0.96
	II	17.99	12.93	12.93	19.25	13.12	13.98	12.40
1970:	I	-2.57	.53	0.53	-0.09	.1.72	4.66	3.88
	II	8.96	9.07	9.07	8.55	12.49	12.49	14.56
1971:	I	3.05	4.84	4.84	4.53	8.21	10.26	10.86
	II	7.04	6.59	6.59	9.36	9.78	11.68	11.32
1972:	I	-3.41	1.76	1.75	-0.11	3.54	6.50	6.06
	II	26.41	14.10	14.09	28.91	16.44	16.90	16.18
1973:	I	4.47	6.57	27.62	3.61	10.70	28.56	28.02
	II	14.80	14.65	21.76	17.53	17.72	16.99	18.90
1974:	I	-.32	1.30	14.01	5.43	7.57	17.30	17.20
	II	11.07	11.08	12.23	12.73	15.02	15.48	13.22
1975:	I	6.65	8.10	5.56	1.66	9.85	7.66	6.99
	II	7.37	6.19	12.88	8.27	10.60	13.74	13.71
1976:	I	3.88	13.12	11.86	0.60	8.23	6.71	6.54
	II	12.69	14.90	11.10	14.61	14.26	10.26	10.10
1977:	I	8.85	13.46	10.29	2.98	9.48	7.17	7.00
	II	13.65	14.58	10.96	16.31	13.67	10.60	10.52
1978:	I	-1.87	8.85	6.32	-2.36	9.18	6.76	7.24
	II	15.61	13.93	10.98	15.15	17.08	14.41	14.06
1979:	I	-2.62	.74	1.86	-2.03	7.77	7.55	8.12
	II	14.19	11.73	8.64	18.64	16.64	14.30	13.50
1980:	I	1.36	4.60	1.02	-6.53	7.05	5.99	6.21
	II	21.26	16.71	17.02	19.98	17.90	16.60	15.63
$\bar{X}$		7.50	8.39	9.30	7.86	10.22	11.00	20.92
S. D.		7.82	5.26	6.54	8.78	4.98	5.79	5.70
C.V.		104.44	62.64	70.36	111.61	48.74	52.61	52.00

money substitutes produced by other financial institutions aside from the existing monetary aggregates. The other financial institutions that should be included are the rural banks, thrift banks and non-bank financial intermediaries.[2/] Using the same principle outlined above, financial assets could be combined solely on the basis of how closely they substitute for transaction balances, regardless of which institution issues the financial assets and the interest rate associated with financial assets. This would help maintain historical consistency in the aggregates and at the same time, mitigate the effects of financial innovations and changes in regulations on the relationship between economic activity and monetary aggregates.

The additional monetary aggregates are basically similar to the existing ones except that corresponding deposit liabilities of other financial institutions are included. Thus, we have the following: M1A = currency in circulation plus demand deposits of commercial banks and thrift banks; M2A = M1A plus savings and time deposits of commercial banks, rural banks and thrift banks; and M3A = M2A plus deposit substitutes of commercial banks and non-bank financial intermediaries (see Table 3). The

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[2/] For a more detailed classification, see Fact Book: Philippine Financial System, 1981.

additional monetary aggregates are broader than their existing counterpart in the sense that they include broader array of financial assets and financial institutions. Still, a broader aggregate can be constructed by including marginal deposits of commercial banks. This is called M4A = M3A plus marginal deposits of commercial banks. Note that "NOW" accounts are excluded from the monetary aggregates because it was introduced only very recently and the amount is fairly small.[3/]

The relative importance of the deposit liabilities of thrift banks and non-bank financial intermediaries in the various monetary aggregates is shown in Table 5. Using broader aggregates (i.e., M3A and M4A), the share of deposits of thrift banks and deposit substitutes of non-bank financial intermediaries in the total amount of the aggregate is almost the same as the share of deposit substitutes of commercial banks.

To assess the impact of adding financial assets of other financial institutions to the appropriate existing monetary aggregates, we compare their growth rates.

3/ Thrift banks were allowed to accept "NOW" accounts in 1979. This authority was extended to commercial banks in 1981.

Table 5
RELATIVE IMPORTANCE OF DIFFERENT COMPONENTS OF MONETARY AGGREGATES, PHILIPPINES, 1980
(In Percent)

COMPONENTS	CURRENT			ADDITIONAL MONETARY AGGREGATES			
	M1	M2	M3	M1A	M2A	M3A	M4A
A. Monetary Authorities							
Currency in Circulation	45.20	18.40	15.00	44.00	10.30	8.30	8.10
B. Deposit Money Banks*							
Demand Deposits	54.80	22.30	18.20				
Savings and Time Deposits		59.30	48.50				
Deposit Substitutes			18.20				
C. Commercial Banks							
Demand Deposits				55.30	13.00	10.50	10.20
Savings and Time Deposits					60.80	49.00	47.80
Deposit Substitutes						10.10	9.90
Marginal Deposits							2.50
D. Rural Banks							
Demand Deposits				.06	.01	.01	.01
Savings and Time Deposits					2.10	1.70	1.63
E. Thrift Banks							
Demand Deposits				.70	.10	.10	.10
Savings and Time Deposits					13.60	11.00	10.70
F. Non-Bank Financial Intermediaries							
Deposit Substitutes						9.30	9.00

*These consist of all commercial banks and rural banks accepting demand deposits.

Sources: Unpublished statistics of the Department of Economic Research, Central Bank, and various issues of the CB Statistical Bulletin.

Divergence of their growth rates will imply that the additional monetary aggregates are different from existing ones. Chart 2 compares the semestral growth rates of M1A with those of M1. The growth rates of M1A closely resemble those of M1. Both have a very modest upward trend and a very similar average growth rate for the period (see Table 4). This is because the demand deposits of other financial institutions represent only a small proportion of total deposits.

Chart 3 shows the semestral growth rates of M2 and M2A. There are several interesting features in this chart. First, the growth rates of both aggregates have been increasing at a much faster rate compared with those of M1 and M1A. This can be attributed to the higher growth rates of savings and time deposits which are relatively more attractive financial assets than currency and demand deposits (see Appendices A.1 and A.2). The sustained increasing growth rates of savings and time deposits were aided by several factors, notably: the upward adjustment of interest rate ceilings, savings campaign launched by CB, and the shift induced by the 35 percent transactions tax imposed on deposit substitutes. Second, there is a conspicuous difference between the growth rates of M2 and M2A, indicating the significance of including deposits of other

Chart 2

SEMESTRAL GROWTH RATES OF M1 & M1A

Symbol used is ________ M1 (Moving Average)

Symbol used is _ _ _ _ _ M1A (Moving Average)

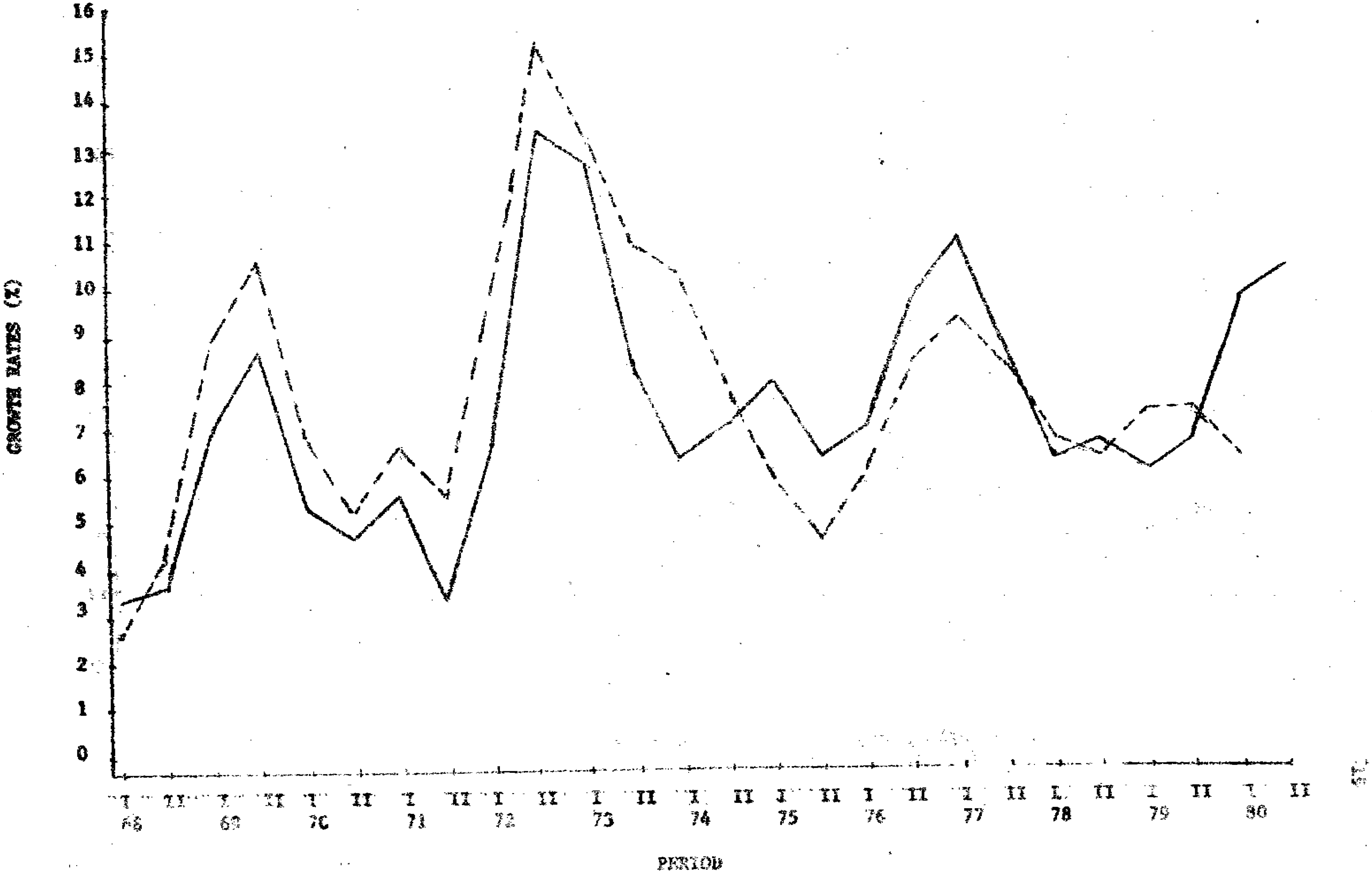
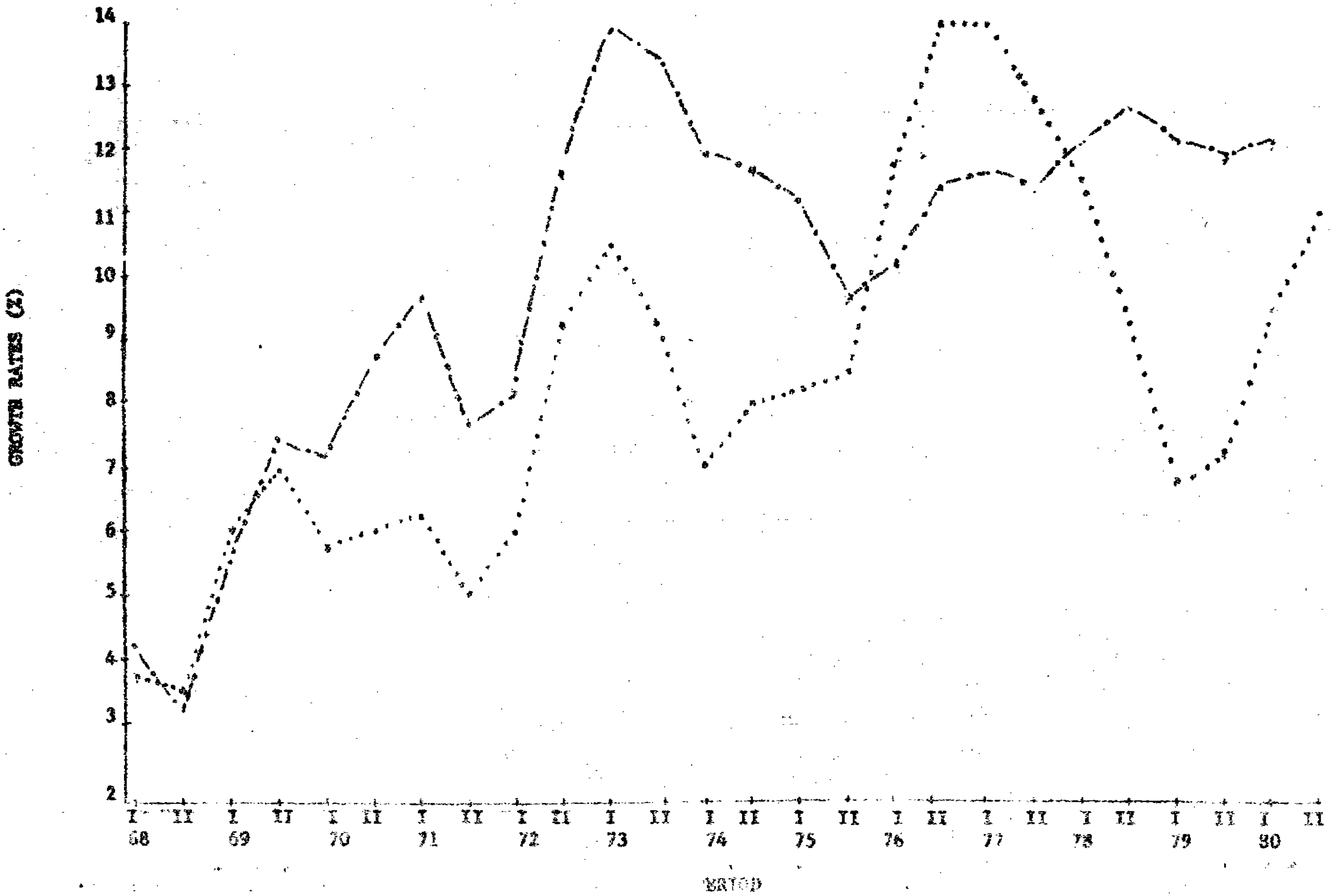


Chart 3

S[illegible]ESTRAL GROWTH RATES OF M2 AND M2A

Symbol used is ....M2 (Moving Average)
Symbol used is -.-.-.-.-.-.-M2A (Moving Average)



financial institutions to the existing aggregate. The growth rates of M2A are above those of M2 for most cases. The average growth rate of M2A over the 1966:I through 1984:II period is 16.22 percent, compared to 8.39 percent for M2. Thus, M2A is significantly different from M2.

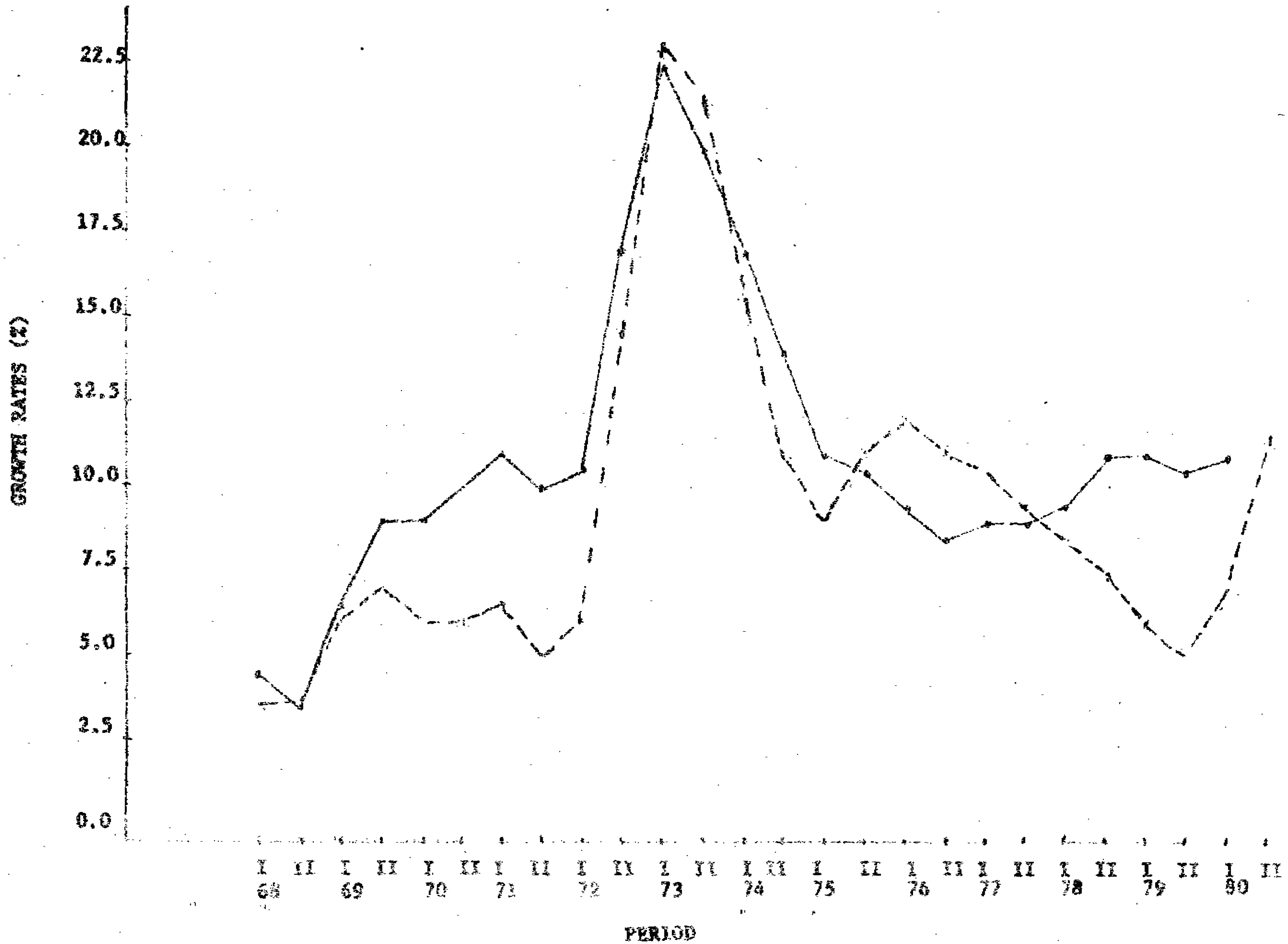
Finally, Chart 4 presents the growth rates of M3 and M3A. The whole period can be divided into two phases: Phase I, the period before 1973, and Phase II, the period after 1973. In Phase I, the growth rates of M3 were the same as those of M2 because during this period, commercial banks were not yet allowed to issue deposit substitutes. But M3A shows increasing growth rates because of the inclusion of deposit substitutes on non-bank financial intermediaries. The growth rates of M3A were above those of M3 in almost all cases during the first phase. In 1973, the year when the Central Bank permitted commercial banks to issue deposit substitutes to enable them to compete with non-bank financial intermediaries in raising funds from the public, the growth rates of both M3 and M3A increased tremendously (see Appendices A.1 and A.2). This was accompanied by remarkably high interest rates for deposit substitutes brought about by intense competition between commercial banks and non-bank financial intermediaries. The

Chart 4

SEMESTRAL GROWTH RATES OF M3 and M3A

Symbol used is _ _ _ _ _ _ M3 (Moving Average)

Symbol used is __________ M3A (Moving Average)



increasing growth rates of M3 and M3A were not sustained in Phase II, as growth rates of deposit substitutes of commercial banks and non-bank financial intermediaries slowed down because of regulations, especially the imposition of interest rate ceiling of 17 percent and the 35 percent transactions tax on deposit substitutes in 1977.

Note that during the whole period, the growth rates of M3A have considerably differed from those of M3. The average growth rate of M3A over 1958:I through 1988:II period is 11.6 percent, which is higher compared to the 9.36 percent average growth rate of M3. Moreover, M3A more readily captures the substitution among the financial assets of the different financial institutions that took place during the period. This can be inferred from its computed coefficient of variation which is markedly lower compared with that of M3 (see Table 4).

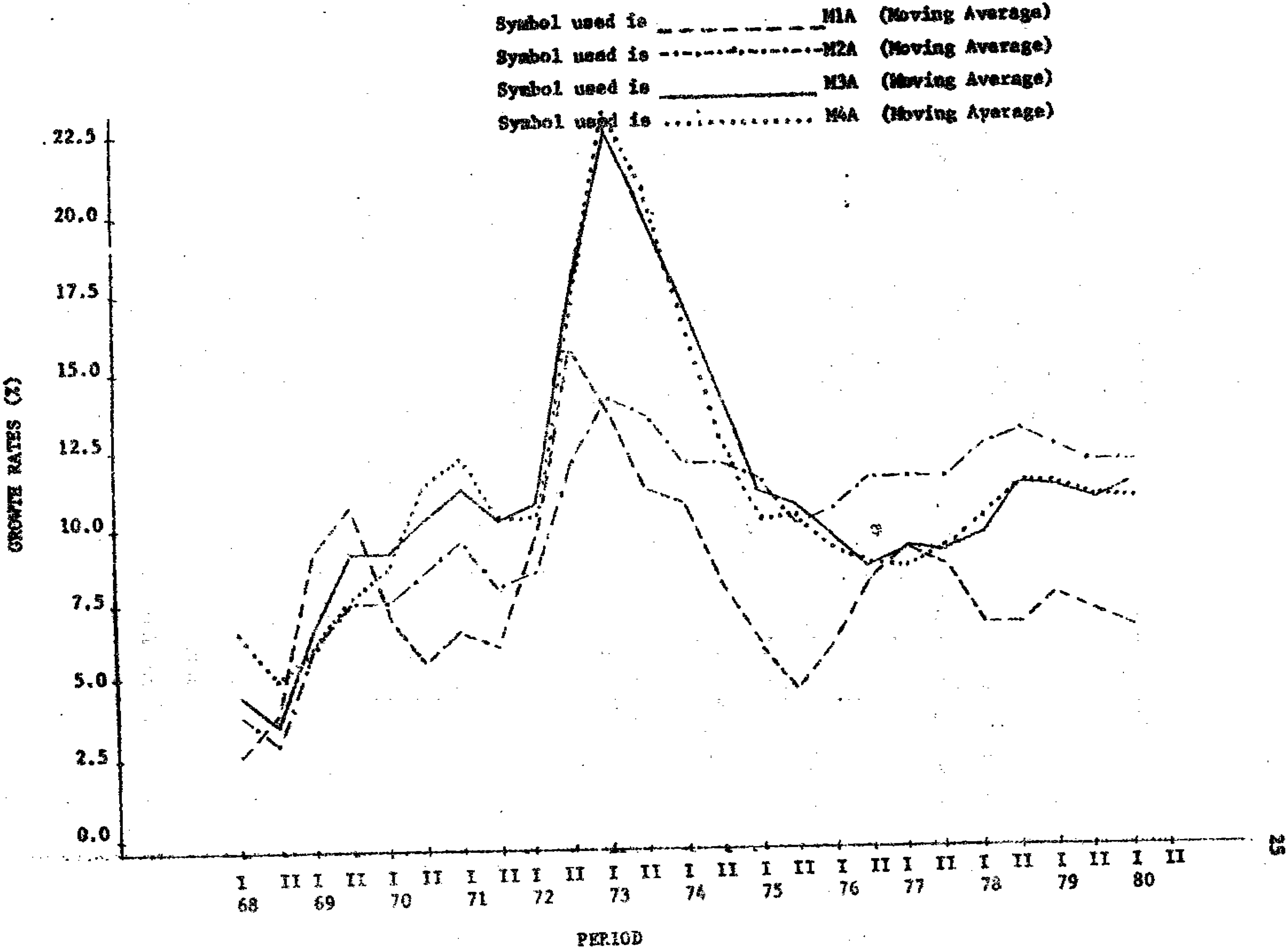
M4A which includes marginal deposits of commercial banks has no existing counterpart. Since marginal deposits are just a small proportion of total deposits, it is not therefore, surprising to see M4A's behavior patterned after M3A's.

The growth rates of additional monetary aggregates may be compared with each other, as shown in Chart 5. Several features are noteworthy. The growth rates of the four monetary aggregates show an upward trend, with M2A showing steeper trend line. They fluctuate around their respective trend lines, with M2A yielding less fluctuations compared with the other aggregates.[4/] The most notable feature is that the growth rates of the additional monetary aggregates have considerably diverged from each other, except the case of M3A and M4A.

4/ See also the computed coefficient of variations in Table 4.

Chart 5

SEMESTRAL GROWTH RATES OF M1A, M2A, M3A and M4A



III. MONETARY AGGREGATES AND ECONOMIC ACTIVITY

In a simple monetary framework, it is argued that the Central Bank determines the monetary base which influences monetary aggregates. The latter in turn, affect spending decisions, and can be indicators of economic activity. In this section, we examine the relationship between economic activity and the various monetary aggregates using reduced-form equations, and also determine to what extent these aggregates are controllable by the Central Bank.

A. Relationship Between Monetary Aggregates and Economic Activity

For purposes of this study, nominal GNP is used as an indicator of economic activity, it being the apparent channel by which monetary policy variables affect the economy. This is not, however, intended to discount other equally important targets of policy, such as balance of payments, inflation, employment, etc.

To ascertain the relationship between the various monetary aggregates and nominal GNP, a linear forecasting model can be used to forecast future values of nominal GNP.

The simplest model is that which uses past values of nominal GNP to forecast its future values. This may be expressed as:

$$\dot{Y}_t = a + \sum_{i=1}^{k} b_i \dot{Y}_{t-i} + e_t$$

where

$\dot{Y}_t$ = predicted growth rate of nominal GNP,

Y_{t-i} = past growth rates of nominal GNP (i=1,...,k),

e_t = the error term, and

a, b_i = parameters.

Can the use of known values of a monetary aggregate, however defined, substantially improve forecasts of GNP?[1/] If it can then the monetary aggregate serves as a good predictor of economic activity. The expanded linear forecasting model with a monetary aggregate as an additional explanatory variable may be written as:[2/]

$$\dot{Y} = \alpha + \sum_{i=1}^{k} \beta_i \dot{Y}_{t-i} + \sum_{i=1}^{k} \gamma_i \dot{M}_{t-i} + \varepsilon_t$$

where

Y_t = same as above

M_{t-i} = growth rate of a monetary aggregate

ε_t = error term, and α, β_i, γ_{t-i} = parameters

1/ From here on, GNP refers to nominal GNP, unless otherwise indicated.

2/ For a more detailed exposition of this model, see Granger and Newbold (1977).

To see the importance of adding a monetary aggregate variable in equation (1), the null hypothesis that i = 0, for all i, must be tested. This involves estimating equations (1) and (2) and using the F-statistic to test the null hypothesis. Semestral growth rates of GNP and the various monetary aggregates for the period 1967:II to 1986:II are used to test the hypothesis. One problem that must be dealt with in estimating equations (1) and (2) is choosing the appropriate lag length (k) for the predetermined variables through some experimental methods.[3/] The scarcity of our observations constrain us from experimenting with longer lag length, thus, we choose k = 2 arbitrarily. Equations (1) and (2) are then estimated using the OLS method. For equation (2), seven models which are identified by the monetary aggregate measure appearing as a predetermined variable are estimated.[4/]

The results of our hypothesis testing are summarized in Table 6. Except for the M2 equation, the results suggest that known values of the various monetary aggregates can significantly improve forecasts of Y.

3/ See Batten and Thorton (1983).

4/ Refer to Section II for the definition of the various monetary aggregates.

Table 6

RESULTS OF TESTING THE HYPOTHESIS THAT $\gamma = 0, \forall_i$

MODELS	F - Statistic
(1) $Y = f^1 (Y_{t-i}, M1_{t-i})$	6.0840*
(2) $Y = f^2 (Y_{t-i}, M2_{t-i})$	2.0746
(3) $Y = f^3 (Y_{t-i}, M3_{t-i})$	10.1673*
(4) $Y = f^4 (Y_{t-i}, M1A_{t-i})$	5.6468**
(5) $Y = f^5 (Y_{t-i}, M2A_{t-i})$	5.4427**
(6) $Y = f^6 (Y_{t-i}, M3A_{t-i})$	16.6824*
(7) $Y = f^7 (Y_{t-i}, M4A_{t-i})$	21.6270*

NOTE: * - Significant at 1% level; ** - significant at 10% level.

The computed F-statistics do not, however, indicate which monetary aggregate gives better forecasting results. Information on the standard error of the regression equations deal with this problem. Thus, we compare the standard errors of the regression equations (SEE) generated by the various monetary aggregates.

The SEE of equation (1) is used as a starting point. If M can improve forecast of Y, then the SEE of equation (2) will be lower than that of equation (1). Furthermore, given the seven monetary aggregate measures, the one which will yield the lowest SEE will likely be a good indicator of economic activity.

The parameter estimates and summary statistics of our forecasting equations are presented in Table 7. Using past values of Y alone does not give a good forecast of the future values of Y. The t-values of Y and Y are not statistically different from zero. The SEE of equation (1) is 5.66.

The last row of Table 7 shows the reduction in standard error for the equations using alternative measures of monetary aggregate in relation to that of equation (1). As expected, the addition of past values of M to equation (1)

Table 7
FORECASTING MODEL
(Dependant Variable: Y)

	Y_{t-i}	M1	M2	M3	M1A	M2A	M3A	M4A
Intercept	7.3540	2.0884	5.1133	5.2058	3.4076	2.4370	2.8360	2.1565
Y_{t-1}	0.1721 (0.33)	0.0502 (0.27)	0.1963 (0.92)	-0.1537 (-0.69)	0.0196 (0.09)	0.0829 (0.37)	-0.3249 (-1.56)	-0.3377 (-1.74)**
Y_{t-2}	0.0691 (0.33)	0.1626 (0.82)	0.0347 (0.41)	-0.0120 (-0.06)	0.0484 (0.25)	-0.0120 (-0.06)	-0.2177 (-1.20)	-0.2182 (-1.26)
M_{t-1}		0.4767 (2.42)***	0.3001 (1.31)	0.4824 (2.92)*	0.4281 (2.33)**	0.5413 (2.24)**	0.6123 (3.55)*	0.6107 (4.20)*
M_{t-2}		0.2949 (1.38)	-0.0666 (0.28)	0.1717 (0.82)	0.2953 (1.42)	0.0629 (0.23)	0.4738 (2.30)**	0.5280 (2.66)**
R^2	0.04	0.26	0.13	0.36	0.25	0.25	0.48	0.54
SEE	5.6600	5.1979	5.6503	4.8334	5.2421	5.2630	4.3832	4.1146
F	0.47	1.80	0.76	2.86*	1.69	1.63	4.56*	5.85*
D.W.	1.96	1.37	1.89	1.79	2.14	1.89	1.88	1.82
Change in SEE (%)		-8.16	-0.17	-14.60	-7.38	-7.01	-22.56	-27.30

NOTE: t-values in parentheses. * - Significant at 1% level; ** - Significant at 5% level; *** - Significant at 10% level.

reduces the forecast errors, but the extent of reduction varies among the different monetary aggregates. In particular, the reduction in SEE brought about by adding either M1, M2, M1A, or M2A to equation (1) is fairly small, suggesting that narrow monetary aggregates contain very little information about future economic activity. In contrast, the use of broader monetary aggregates can considerably improve forecasts of Y. In particular, the addition of M3 to equation (1) reduces SEE by 14.60 percent, M3A by 22.58 percent, and M4A by 27.30 percent. Moreover, only those equations which include either M3, M3A, or M4A as explanatory variables yield a significant F-statistic. These results clearly show that broader monetary aggregates predict future economic activity better.

While it is clear that broader monetary aggregates perform better in forecasting GNP on an in-sample comparison, it would be interesting to see how well they perform on the basis of out-of-sample forecasts. To do this, the equations are used to simulate the growth rate of GNP over the first and second semester of 1981.[5/] The simulation results (Table 8), show that all the equations

[5/] Although semestral data on GNP are already available for 1982, we did not include them since they are still advanced estimates.

Table [illegible]
SIMULATION RESULTS

(Model: [illegible])

	M1		M2		M3		M1A		M2A		M3A		M4A	
$\dot{Y}^a$	$\dot{Y}^s$	% Diff.	$\dot{Y}^s$	% Diff.	$\dot{Y}^s$	% Diff.	$\dot{Y}^s$	% Diff.	$\dot{Y}^s$	% Diff.	$\dot{Y}^s$	% Diff.	$\dot{Y}^s$	% Diff.
1981: I 5.30	14.32	169.45	12.61	139.27	11.95	117.27	10.71	96.73	13.27	141.27	10.43	89.64	9.54	73.45
II 8.3[illegible]	9.14	3.46	7.58	- 13.26	12.13	37.96	9.36	- 5.00	5.29	- 39.39	8.87	0.80	9.52	8.18
RMSE	5.39		5.10		5.13		3.70		6.03		3.49		2.90	

NOTE: $\dot{Y}^a_t$ - actual growth rate of nominal GNP.

$\dot{Y}^s_t$ - simulated growth rate of nominal GNP.

RMSE = [illegible]

overpredict the first semester growth rate of GNP by a wide margin. Among the seven equations, M3A and M4A equations give the lowest margin of error. In the second semester, all the equations yield estimates closer to the actual growth rates of GNP. Interestingly, M3A's estimate is almost similar to the actual growth rate of GNP.

Using the root mean square error (RMSE) as a criterion for evaluating the out-of-sample forecasting capability of the various equations, it is shown that M3A and M4A equations give the best forecasts for the semestral growth of GNP.

The forecasting model (i.e., equation (2)) regresses semestral growth rates of GNP on the past growth rates of the various monetary aggregates and GNP. The coefficients of the lagged values of Y are found to be not statistically different from zero. To further determine the relationship between GNP and the various monetary aggregates, GNP growth rates are regressed on the current and past growth rates of the various monetary aggregates alone. The model can be written as:

$$\dot{Y}_t = c + \sum_{i=0}^{k} b_i \dot{M}_{t-i} \qquad (3)$$

Equation (3) has been widely used in similar studies done in other countries, a ready reference for comparison of results.[6/] The OLS method is used to estimate the parameters of equation (3). No restrictions are imposed on the parameters. The Hildreth-Lu technique is resorted to whenever serious autocorrelation problems occur in the equations. We run regressions using lag lengths of 1, 2, 3 and 4 for the monetary variables, and the equation with a lag length of 3 appears to yield better results.

The parameter estimates and summary statistics are shown in Table 5. Note that only M1 and M2 equations do not yield significant F-statistics. However, the significance of the F-statistics of M1A?? and M2A equations, which are broader counterparts of M1 and M2 equations, underscores the importance of including similar financial assets produced by other financial institutions other than deposit money banks.

The explanatory power of the equations shows a pattern consistent with our *a priori* expectations. That is, M3, M3A, and M4A equations yield higher adjusted R^2's, indicating that the variation of the growth rates of broader

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6/ For example, see Cullison (1982), Davis (1979/1980) and Lawler (1981).

Table 9

RESULTS OF REGRESSING Y_t ON M_{t-i}, 3 LAGS

(Model: $Y_t = b_o + \sum_{i=0}^{3} b_i M_{t-i}$)

	M1	M2	M3	M1A	M2A	M3A	M4A
Intercept	-2.2238	6.3614	7.1977	-2.5236	-0.1006	3.2411	4.0742
M_t	0.3170 (1.58)	0.0242 (0.08)	0.0046 (0.03)	0.2932 (1.60)	0.4986 (1.50)	0.1650 (0.99)	0.1175 (0.72)
M_{t-1}	0.5991 (2.33)**	0.2702 (0.82)	0.5533 (3.34)*	0.4914 (2.55)**	1.0262 (3.42)*	0.6322 (3.50)*	0.6632 (3.96)*
M_{t-2}	0.4225 (1.80)**	-0.1429 (-0.45)	0.1429 (0.80)	0.3688 (2.02)***	-0.2190 (0.75)	0.2267 (1.52)	0.2398 (1.40)
M_{t-3}	0.4281 (2.12)**	-0.0233 (-0.08)	-0.3453 (-2.10)**	0.3752 (2.16)***	-0.4066 (-1.45)	-0.4410 (-2.27)**	-0.4315 (2.81)**
ΣM_{t-i}	1.7667	0.1282	0.3545	1.5286	0.8992	0.5829	0.5890
$\bar{R}^2$	0.2103	-0.0726	0.4022	0.3000	0.2700	0.6077	0.6204
SEE	4.8712	5.7420	4.3697	4.6724	4.7920	3.9502	3.7227
F	2.4646	0.6277	4.6999*	3.5772*	3.1669**	9.5200*	9.9879*
D.W.	1.8262	1.9800	2.01	1.8305	1.8918	1.9599	2.0331
rho	0.20	0.30	-0.10	-	-	-0.40	-0.30

NOTE: t-values in parentheses. * - significant at 1% level; ** - significant at 5% level; *** - significant at 10% level monetary aggregates explain a greater proportion of the variation of the GNP growth than do the narrowly defined monetary aggregates. These results are consistent with the results obtained earlier using equation (2). In terms of R^2, our results compare well with the results of similar studies done in other countries. For the U.S. economy, for example, Lawler (19[illegible]) found out that for the 1960:3Q through 1988:4Q period, the adjusted R^2 for M1-L, M2, M3 and L (total liquidity) are .41, .26, .23 and .33, respectively.[7/]

The sum of the coefficients ([illegible]) shown in Table 9 measures the extent to which GNP growth in semester t is affected by the current and past three semesters' growth in the various monetary aggregate measures. The results reveal that the cumulative impact of a 1 percentage-point increase in the growth of M1 or M1A yields a more than proportionate increase in the growth of GNP within one and a half years, while a similar change in the other broader aggregates leads to a less than proportionate increase in GNP growth. This means that GNP growth reacts more completely and rapidly to changes in the growth rates of M1 and M1A than to those of the broader aggregates.

7/ Care should be exercised in interpreting these comparisons since our definition for the various monetary aggregates are quite different from that of the U.S. For the latter, see <u>Voice</u> (19[illegible]).

The comparative forecasting capabilities of the seven monetary aggregates are further ascertained by using simulation exercises using out-of-sample observations, for instance, the first and the second semesters of 1981. For the serially correlated equations, the first-order serial correlation coefficient <u>rho</u> is taken into account in simulation. The findings which are presented in Table 10 generally support those shown in Table 8. That is, M3, M3A and M4A yield lower forecasting errors (RMSE) than narrowly defined monetary aggregates.

The overall results tend to show that economic activity has a closer and a relatively more predictable relationship with broader aggregates, namely M3, M3A and M4A, than with narrowly defined monetary aggregates.

The parameter estimates reported in Tables 7 and 9 were obtained using the OLS method. They are reliable with the assumption that monetary aggregates are exogenous with respect to GNP. But this assumption is rather questionable. Critics point to the possibility of a reverse causality, running from GNP to monetary aggregates, or perhaps of a bidirectional causality.[8/] In the case of the latter,

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8/ For example, see de Leeuw and Kalchbrenner (1969).

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[7/] Care should be exercised in interpreting these comparisons since our definition for the various monetary aggregates are quite different from that of the U.S. For the latter, see Volcker (1980).

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8/ For example, see de Leeuw and Kalchbrenner (1969).

Table 10
SIMULATION RESULTS

(Models: $\dot{Y}_t^n = c + \sum_{i=0}^{3} b_i \dot{M}_{t-i}$)

	M1		M2		M3		M1A		M2A		M3A		M4A	
$\dot{Y}^a$	$\dot{Y}^s$	% Diff.	$\dot{Y}^s$	% Diff.	$\dot{Y}^s$	% Diff.	$\dot{Y}^s$	% Diff.	$\dot{Y}^s$	% Diff.	$\dot{Y}^s$	% Diff.	$\dot{Y}^s$	% Diff.
1981: I 5.50	13.90	128.09	13.07	137.64	12.96	135.64	10.83	96.91	11.24	104.36	7.88	43.27	9.64	75.64
III 8.80	5.20	-40.91	6.19	- 29.56	15.13	71.93	2.68	-65.34	-11.68	-225.91	4.91	-44.20	7.96	- 9.34
RMSE	7.78		3.64		3.75		3.74		14.83		3.22		3.00	

NOTE: $\dot{Y}^a$ - actual growth rate of nominal GNP.

$\dot{Y}^s$ - simulated growth rate of nominal GNP.

RMSE - root mean square error.

results would be reliable only if a simultaneously determined model is utilized in place of the reduced form equation used above.

Apart from this statistical problem, reverse or bidirectional causality raises serious doubts on the strategy of using monetary aggregate as a variable that signals the current direction of monetary policy. If GNI is found to be exogenous to a monetary aggregate, then the latter will be rendered useless as an indicator of monetary actions since monetary authorities cannot determine whether changes in the monetary aggregate is due to the current changes in policy or to changes in GNI.

In the case of the Philippines, this problem can be resolved by subjecting the seven monetary aggregates to tests of exogeneity using both the Granger's and Sims' tests.[9]

[9] See Granger (1969) and Sims (1972).

The Granger test consists of estimating the following equations:

$$Y_t = \alpha_0 + \sum_{i=1}^{k} \alpha_i Y_{t-i} + \sum_{i=1}^{k} B_i M_{t-i} + \mu_t \qquad (4)$$

$$M_t = \alpha'_0 + \sum_{i=1}^{k} \alpha'_i Y_{t-i} + \sum_{i=1}^{k} B'_i M_{t-i} + \mu'_t \qquad (5)$$

Equations (4) and (5) obey the following assumptions:

(a) μ_t and μ'_t are uncorrelated;

(b) The information relevant to the prediction of Y and M is contained solely in their respective data series; and

(c) The time series Y and M are stationary.

Based on equations (4) and (5), causality runs from M to Y if the estimated $B_i \neq 0$, for all i, and the estimated $\alpha'_i = 0$, for all i. Conversely, unidirectional causation runs from Y to M if the estimated $B_i = 0$, for all i, and the estimates $\alpha'_i \neq 0$, for all i. Bidirectional causality exists if both the estimated $B_i \neq 0$, and $\alpha'_i \neq 0$, for all i.

The Sims test requires regressing both GNP on past, current and future values of the various monetary aggregates on the one hand and the various monetary aggregates on GNP, on the other. That is,

$$Y_t = \delta + \sum_{i=-m}^{k} \gamma_i M_{t-i} + \theta_t \qquad (6)$$

$$Mt = \delta' + \sum_{i=-m}^{k} \gamma'_i Y_{t-i} + \theta_t \qquad (7)$$

Unidirectional causality from M to Y requires that

$\gamma_i = 0$, for $i = -m, \ldots, -1$;

$\gamma_i \neq 0$, for $i = 1, \ldots, n$;

$\gamma'_i \neq 0$, for $i = -m, \ldots, -1$; and

$\gamma'_i = 0$, for $i = 1, \ldots n$.

On the other hand, unidirectional causality from Y to M requires that;

$\gamma_i \neq 0$, for $i = -m, \ldots, -1$;

$\gamma_i = 0$, for $i = 1, \ldots, n$;

$\gamma'_i \neq 0$, for $i = -m, \ldots, -1$ and

$\gamma'_i \neq 0$, for $i = 1, \ldots, n$.

The Sims test requires that the error terms be serially uncorrelated. This may be accomplished by filtering the data prior to estimation. A second-order linear filter $(1 - kL)^2$, where L is the lag operation and k is a constant, is used to filter the data. The value of k is determined by iterating over values from 0 to 1, at intervals of 0.1.[10] Equations (6) and (7) are then estimated using the prefiltered data. This process is repeated until a value of k is found which generates an uncorrelated autogressive error structure.

For the Granger-test regression, semestral growth rates of GNP and the various monetary aggregates for the period 1967:II to 1986:II are used. The Granger procedure tests the joint significance of the coefficients of the lagged GNP of equation (4) and of the lagged monetary aggregates of equation (5). The second column of the upper section of Table 11 reports the results of testing the hypothesis that the monetary aggregates are exogenous to GNP.[11] The F-statistics which are basically the same as those reported in Table 6 indicate that the coefficients of the lagged monetary aggregates variables are statistically significant

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10/ This procedure is elaborated in Mehra (1976).

11/ See Appendix E.1 for the parameter estimates of equations (4) and (5).

Table 11
F-STATISTICS FOR TEST OF EXOGENEITY

MODELS	GRANGER'S PROCEDURE	SIMS' PROCEDURE
(1) Y M1	6.0840*	0.2051
(2) Y M2	2.0766	1.4329
(3) Y M3	10.1673*	0.0364
(4) Y M1A	5.6468**	0.6915
(5) Y M2A	5.4427**	0.4601
(6) Y M3A	15.6824*	1.0478
(7) Y M4A	21.6270*	0.5833
(1) M1 Y	1.7625	3.0385
(2) M2 Y	2.2229	4.0607**
(3) M3 Y	1.9701	5.3042**
(4) M1A Y	1.4606	4.2372**
(5) M2A Y	0.9364	6.4652*
(6) M3A Y	2.3206	14.9316*
(7) M4A Y	2.3912	16.4253*

NOTE: GRANGER'S MODEL: $Y_t = G(Y_{t-2}, Y_{t-1}, M_{t-2}, M_{t-1})$

$M_t = G'(Y_{t-2}, Y_{t-1}, M_{t-2}, M_{t-1})$

SIMS' MODEL : $Y_t = S(M_{t-2}, M_{t-1}, M_t, M_{t+1}, M_{t+2})$

$M_t = S'(Y_{t-2}, Y_{t-1}, Y_t, Y_{t+1}, Y_{t+2})$

* - Significant at 1% level.
** - Significant at 5% level.

as a group, except in the case of M2. This means that M1, M3, M1A, M2A, M3A and M4A are statistically exogenous to GNP. To check whether bidirectional causality exists, the hypothesis that GNP is exogenous to the various monetary aggregates is also tested. Regression analysis is performed, this time making the various monetary aggregates as the dependent variables while GNP plays the independent variable. As may be observed from the second column of the lower section of Table 11, all computed F-statistics are not statistically significant. Thus, the hypothesis that GNP is exogenous to the various monetary aggregates may be rejected.

The Sims test further examines the exogeneity of the various monetary aggregates with respect to GNP. This is done by using semestral data from 1967 to 1984. All variables are expressed in logarithms. The Sims procedure tests the joint significance of the coefficients of the future values of variables appearing in equations (6) and (7).[12] The low and statistically insignificant computed F-statistics for all monetary aggregates shown on the last column of the upper section of Table 11 indicate that the coefficients of the future values of GNP are not

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[12] See Appendix B.2 for the parameter estimates of equations (6) and (7).

statistically significant as a group. This reaffirms earlier results obtained using the Granger test that the various monetary aggregates are exogenous to GNP. There is, however, a slight difference because M2 in the Sims test is shown to be statistically exogenous to GNP which was not the case in the Granger test.

Bidirectional causality is also ascertained using the Sims test. As indicated by the computed F-statistics shown in the last column of the lower section of Table 11, the coefficients of the future values of GNP are statistically significant as a group for each monetary aggregate, except M1. This suggests the absence of bidirectional causality in the case of M2, M3, M1A, M2A, M3A and M4A. Thus, except in the case of M1 and M2, the Granger and Sims test results agree that there is a unidirectional causation running from monetary aggregates to GNP. Note that the inconsistent results obtained for M1 and M2 disappear when their broader counterparts, M1A and M2A, are used. Again, this underscores the importance of including financial assets produced by non-bank financial institutions in defining monetary aggregates.

E. Controllability of Various Monetary Aggregates

Thus far, the monetary aggregates that move closely with economic activity have been determined. These findings, however, would be useless for policymakers unless the chosen aggregates are controllable by the Central Bank and are less subject to nonpolicy actions. Unfortunately, the defined monetary aggregate, is not a part of the set of policy instruments of the Central Bank, and is therefore, not directly controllable. But the Central Bank can indirectly influence movements of the aggregate through some policy actions reflected in changes of the monetary base. The monetary base is composed of bank reserves (Bank deposits with the Central Bank and currency and coins held in banks' vaults) and currency in circulation.[13/]

The link between the monetary aggregate and the monetary base is summarized in equation (8):

$$M = m \cdot MB \qquad (8)$$

whereby, the monetary aggregate (M) is the product of the money multiplier (m) and the monetary base (MB). The equation can be rewritten in additive form,

$$\ln M = \ln m + \ln MB \qquad (9)$$

13/ The role of bank reserves and currency in circulation in money creation are not discussed here. An excellent discussion on this can be found in Balbach (1981).

That is, changes in M is related to changes in m and MB. Equation (5) decomposes changes of the monetary aggregate into two: those which are caused by changes in the money multiplier and those which are due to changes in the monetary base.

The monetary base is assumed to be completely determined by Central Bank actions.[14/] On the other hand, the money multiplier which is the summary of the behavior of financial intermediaries and nonfinancial private sector is to a large extent beyond the control of the Central Bank. Financial intermediaries and the nonfinancial private sector decide on the form of financial assets they will hold. For example, financial intermediaries may hold excess reserves or may lend the extra reserves to the public. The nonfinancial private sector may choose to hold deposits or cash, or a combination of both. Each of these decisions determines a particular value of a multiplier which, in turn, helps determine the magnitude of a particular

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14/ This hypothesis may be subjected to a test. It is possible that the monetary base cannot be controlled, that is, if the Central Bank pursues a policy of supplying reserves whenever there is a demand, and/or if the balance sheet items which are not subject to Central Bank discretionary actions dominate those which are subject to Central Bank discretionary actions. Testing the said hypothesis, however, is not done here and should be pursued in future studies.

aggregate. Thus, given a particular change in the monetary base, varying decisions of financial intermediaries and the nonfinancial private sector on the form of financial assets they will hold will result in different growth patterns for the monetary aggregate. This indeed poses a problem for the Central Bank, for if the money multiplier is highly volatile and unpredictable, then movements of the monetary aggregate cannot be wholly influenced by the Central Bank despite its tight control over the monetary base. In contrast, if the rate of change of the money multiplier remains constant over time, then the Central Bank can control movements of the monetary aggregate through the monetary base.

To assess the degree by which the various monetary aggregates are controllable by the Central Bank, the rate of change of the money multiplier is assumed to be constant over time. The movement of the monetary aggregate can then be directly related to changes in the monetary base. Closer relationship between the aggregate and the base is interpreted here as greater controllability of the said aggregate. This is summarized in the following simple linear model.[15/]

$$\ln M^*_t = \beta^*_0 + \beta^*_1 \ln MB_t \qquad (10)$$

15/ See Tatom (1979) and Hafer (1981) for details of this model.

where M^*_t is the equilibrium level of a monetary aggregate. It is possible that changes in MB will not immediately result in the equilibrium level for M. Thus, the following adjustment process can, therefore, be incorporated:

$$\ln M_t - \ln M_{t-1} = \lambda (\ln M^*_t - \ln M_{t-1}) \qquad (11)$$

Equation (11) specifies that the change in M will respond only partially to the difference between M^*_t and the past value of M, the rate of response being a function of the coefficient λ. Combining equation (10) and (11), rearranging terms, and expressing the result in terms of first difference, the final equation to be estimated is thus:

$$\Delta \ln M_t = \beta_0 + \beta_1 \Delta \ln MB_t + \beta_2 \Delta \ln M_{t-1} \qquad (12)$$

From the estimated parameters of equation (12), the following parameters can be derived:

$$= 1 - \beta_2$$

$$\beta^*_0 = \frac{\beta_0}{1 - \beta_2} \qquad (13)$$

$$\beta^*_1 = \frac{\beta_1}{1 - \beta_2}$$

Estimating equation (12) requires data on M and MB. Since data on the various monetary aggregates are available, what is needed is information on MB. The monetary base can be derived from the balance sheet of the monetary authorities. A simplified balance sheet of the monetary authorities is presented in Table 12. The balance sheet may be rewritten as

$$MB = (FA - FL) + (COG - GD) + (COB - CBCI) \qquad (14)$$

A change in any of the items on the right hand side of equation (14) would lead to a change in the monetary base. It should be pointed out that the tighter Central Bank control over the items on the right-hand side of the equation means greater control over the monetary base.

The magnitude of the monetary base, which is also called reserve money (RM), is reported in the <u>Philippine Financial Statistics</u> published quarterly by the Central Bank. The Central Bank's method of arriving at the figures for the monetary base or reserve money deserves some comments. Banks are required to hold reserves for their deposit liabilities and these are kept either at the Central Bank or in their own vaults. Statistics reveal that total reserves (required reserves + excess reserves) are almost equal to required reserves. What is important to point out

Table 12

SIMPLIFIED BALANCE SHEET OF THE MONETARY AUTHORITIES

ASSETS	LIABILITIES
1. Foreign Assets (FA)	5. Monetary Base (MB)
2. Claims on Government (COG)	5.1 Currency Held by the Public
2.1 National Government Less: Treasury IMF Account	5.2 Currency Held in Banks' Vaults
2.2 Local Government	5.3 Deposits of Deposit Money Banks
2.3 Semi-Government Entities	
3. Claims on Banks (COB)	6. Government Deposit (GD)
4. Other Assets (OA)	7. CBCI Issues (CBCI)
	8. Foreign Liabilities (FL)
	9. Other Liabilities (OL)

is that some government securities earning not more than 4 percent annually are eligible as reserves. Because of their relative attractiveness, eligible government securities oftentimes constitute about 50 percent of the total required reserves of banks. Despite their magnitude, eligible government securities which form part of total reserves are not included in the current definition of monetary base. In addition, the reserves alloted for deposit substitutes are not reflected in the current definition of monetary base. Thus, the figures for the monetary base reported in the Philippine Financial Statistics seriously underestimate the actual figures, and as such, they are not useful for the purpose of this study.

Another method of estimating the monetary base that would include reserves in the form of eligible government securities and reserves for deposit substitutes is, thefore, proposed. This is outlined in the following equation:

$$MB = CC + RR_{DM} + ER_{DM} \quad (15)$$

where: CC = currency in circulation;

RR_{DM} = required reserves for demand deposits, savings deposits, time deposits and deposit substitutes of deposit money banks; and

ER_{DM} = excess reserves of deposit money banks.

Data on CC are available from the Statistical Bulletin. With regard to RR, only the required reserves for demand deposits, savings deposits and time deposits of deposit money banks are reported. To obtain the required reserves for deposit substitutes, the following formula may be used:

$$RR_{ds} = r_{ds} \cdot DS \qquad (16)$$

where: RR_{ds} = required reserves for deposit substitutes;

r_{ds} = reserve requirement ratio against deposit subsitutes; and

DS = level of deposit substitutes.

The reserve requirement ratio (r_{ds}) has been changing, starting from 1 percent in 1973 to 20 percent in 1988. In the computation for RR_{ds}, this changing reserve requirement ratio is considered.

Since we have introduced con

encompass deposit liabilities of both deposit money banks and nondeposit money banks, it is also necessary to come up with an adjusted monetary base which would include reserves of both types of financial institutions. The adjusted monetary base is defined as:

$$MBA = MB + RR_{OB} + ER_{OB} \qquad (17)$$

where: MBA = adjusted monetary base;

RR_{OB} = required reserves for demand deposits, savings deposits, time deposits and deposit substitutes of other banks;

ER_{OB} = excess reserves of other banks; and

bE = as defined in equation (15).

Data on RR_{OB} are not available, thus, an alternative would be to estimate them using the formula:

$$RR_{OB} = \sum_{i} \sum_{j} rr_{ij} \cdot D_{ij} \tag{18}$$

where: D_{ij} = the level of the ith type of deposit of the jth type of bank;

r_{ij} = the reserves requirement ratio of the ith type of deposit of the jth type of bank.

It is to be noted that the reserve requirement ratio (rr) varies according to type of deposits. For the same type of deposit, say savings deposits, the rr also varies according to type of financial institutions. As shown in equation (18), these factors are taken into consideration in computing for the RR_{OB}. There is no way of determining excess reserves of other banks (ER_{OB}). However, it is likely that these are very minimal, and it may be safe to assume that ER_{OB} is zero.

Equation (12) is estimated using quarterly data for the period 1965:2 through 1980:4. The data base is presented in Appendix C. Seven regression equations are estimated, one for each monetary aggregate. For the existing aggregates, M1, M2 and M3, the monetary base (MB) defined in equation (15) is the independent variable, while for the additional monetary aggregates, M1A, M2A, M3A and M4A, the adjusted monetary base (MBA) given in equation (17) is the independent variable. The OLS method is utilized to estimate all equations. Ordinarily, the value of λ should be constrained between zero and one before estimation. No such *a priori* constraint, however, is made in this study.

The estimated parameters and summary statistics are presented in Table 13. All equations do not show a statistically significant first-order autocorrelation. The computed F-statistic is significant for all equations, indicating the plausibility of the model.

A number of interesting results can be gathered from Table 13. The equations of the three existing aggregates alone show that the monetary base moves with M1 more closely than with M2 and M3. The variation of the base accounts for about 72 percent of the variation of M1. The

Table 13
REGRESSION RESULTS: MONETARY AGGREGATES AND MONETARY BASE
1969:2 - 1980:4

	M1	M2	M3	M1A	M2A	M3A	M4A
β_0	0.0061	0.0143	0.0077	0.0074	0.0381	0.0338	0.0298
	(1.05)	(2.52)**	(1.27)**	(1.06)**	(4.86)*	(3.77)*	(3.38)*
β_1	0.6361	0.4028	0.3766	0.8334	0.3536	0.2906	0.2984
	(10.50)*	(8.73)*	(7.34)*	(10.49)*	(5.98)*	(4.32)*	(4.39)*
β_2	0.1316	0.2641	0.5070	-0.1656	-0.0444	0.1580	0.2082
	(1.55)	(2.68)*	(5.35)*	(-2.08)**	(-0.38)	(1.23)	(1.64)
λ	0.8684	0.7359	0.4930	1.1656	1.0444	0.7094	0.7918
	(86.84)*	(27.81)*	(10.28)*	(82.42)*	(60.30)*	(35.47)*	(29.93)*
β_1^*	0.7325	0.5474	0.7639	0.7150	0.3386	0.4096	0.3769
	(7.02)*	(5.06)*	(4.00)*	(7.11)*	(4.34)*	(3.96)*	(3.31)*
ρ	-0.1572	-0.0816	-0.0689	-0.1103	-0.1413	-0.0174	-0.0668
d	2.2853	2.1529	2.1374	2.1650	2.2366	2.0235	2.1180
h	-1.2023	-0.7105	-0.6200	-0.6741	-1.3502	-0.1683	-0.8122

Table 13 (Cont'd...)

	M1	M2	M3	M1A	M2A	M3A	M4A
SEE	0.0269	0.0201	0.0229	0.0321	0.0235	0.0275	0.0279
R^2	0.7150	0.6348	0.6246	0.7514	0.4798	0.3001	0.3113
F	55.18*	38.23*	36.60*	66.50*	20.29*	9.43*	9.94*

NOTE: t - values in parentheses. d is the Durbin-Watson statistic. h is the Durbin h - statistic. * - significant at 1% level; ** - significant at 5% level The t - values for λ and B_2^* are derived using the procedure outlined in the Kmenta (1971).

explanatory power of the base drops modestly to 64 percent for M2, and to 62 percent for M3.

The implied point elasticities indicate how responsive are the aggregates to changes of the monetary base. Results show that contrary to common expectations, M3 appears to be more sensitive than M1 and M2 to changes in the monetary base. A 1.6 percentage-point increase in the growth rate of the base would lead to a .76 percentage-point increase in the growth rate of M3. The estimated elasticity of M1 is slightly lower than M3, while that of M2 is considerably lower than M3.

The estimated λ for M1, M2 and M3 indicates that the broader the aggregate, the longer is the lagged adjustment process. The equilibrium adjustment process for a change in the monetary base is only .49 for M3 as compared to .67 and .76 for M1 and M2, respectively. This may be due to some factors, like lack of knowledge and/or technical constraint, which would account for the slower adjustment process of M3. It is to be noted that up to this time, the Central Bank does not include required reserves for deposit substitutes which are fairly significant components of M3 in arriving at the monetary base.

Among the additional monetary aggregates, results show that the adjusted monetary base is strongly correlated with M1A than with M2A, M3A and M4A. The variation of the adjusted monetary base explains for about 75 percent of the total variation of M1A. But its explanatory power substantially drops to .48 with M2A, to .36 with M3A, and to .31 with M4A.

The implied point elasticity between changes in the growth rate of the adjusted monetary base and changes in the growth of M1A is comparable to the implied elasticities between changes in the growth rate of the monetary base and changes in the growth rates of existing aggregates. A 1.6 percentage-point change in the growth rate of the adjusted monetary base would result in a .72 change in the M1A growth rate. In contrast, the implied elasticities of M2A, M3A and M4A are fairly small, indicating that these aggregates are less sensitive to changes in the adjusted monetary base.

The estimated for the additional monetary aggregates suggest that the equilibrium adjustment process for a change in the adjusted monetary base will be completed in less than a quarter for M1A, about a quarter for M2A, and more than a quarter for M3A and M4A. Again, this shows that the broader aggregate has the longer lagged adjustment process.

The results so far point out that the controllability of M1, M1A, and M3 is greater than that of the other aggregates, as judged by the value of K and the degree of responsiveness of the aggregates with respect to the base. However, this conclusion is arrived at using in-sample observations. A more important test of controllability of the aggregates pertains to the out-of-sample forecasting capability of the equations reported in Table 13. The equations are then used to forecast growth rates of the various aggregates for the four quarters of 1981 and 1982. The results are summarized in Table 14.

Note that the RMSE's of M2, M3 and M1A are lower than the standard error of their respective regression equations (SEE), while that of M1 is about the same as its SEE. This indicates that M1, M2, M3 and M1A equations yield more accurate forecasting results. Thus, the simulation results indicate adequate control of these aggregates through the monetary base. In contrast, the RMSE is considerably higher than the SEE for the M2A, M3A and M4A equations. In addition, the RMSE's of M2A, M3A and M4A equations are substantially higher than

Table 14

SIMULATION RESULTS: MONETARY AGGREGATES AND MONETARY BASE

PERIOD	M1		M2		M3		M1A		M2A		M3A		M4A	
	M_t^a	M_t^s	M_t^a	M_t^s	M_t^a	M_t^s	M_t^a	M_t^s	M_t^a	M_t^s	M_t^a	M_t^s	M_t^a	M_t^s
1981: 1	-.02390	-.01622	.00319	.01144	.00770	.02561	-.05021	-.02600	.01164	.00094	.02135	.00166	.01882	.00182
2	-.02465	.00765	.03042	.01178	.03445	.01450	-.03683	.01016	.04072	.01330	[illegible]	[illegible]	[illegible]	[illegible]
3	-.00253	-.03[illegible]	.03134	-.00051	.03931	[illegible]	-.00614	-.07655	.03262	-.19131	.03178	-.08217	.02835	-.09[illegible]
4	.04146	[illegible]	.0[illegible]325	.04[illegible]	.03278	.02492	.04163	.04574	.0[illegible]	.03730	-.08217	.05039	.03027	.02929
1982: 1	.02025	-.0[illegible]	[illegible]	[illegible]	.029[illegible]	[illegible]	.00421	.00934	[illegible]	[illegible]	.04129	.09029	.03866	.08847
2	.00750	[illegible]	.0213[illegible]	[illegible]	.02050	.01955	.01512	.00245	.03755	.01930	.05139	.01702	.05154	.01653
3	.05033	-.0[illegible]	.0252[illegible]	[illegible]	.06242	.016[illegible]0	.0[illegible]	.02663	.03463	.00565	.03435	.00540	.03104	.00429
4	.04705	[illegible]	.0452[illegible]	.0[illegible]139	.03937	.02656	.05607	.05398	.06087	.04482	.05357	.02790	.05012	.03717
RMSE	.02745		.01220		.0175		.02219		.05568		.04919		.06714	

NOTE: M_t^a - actual quarterly change of the relevant monetary aggregate; M_t^s - simulated quarterly change of the relevant monetary aggregate. All variables are expressed in logarithms.
RMSE - root mean square error.

those of the other aggregates. These results imply poor control of these aggregates through the monetary base. Thus, much broader aggregates that include financial assets produced by nondeposit money banks will seriously undermine the effectiveness of monetary control.

The discussions above focused on the relative controllability of the various monetary aggregates. Given certain criteria, the aggregates over which the Central Bank has adequate control were singled out. Complete controllability of these aggregates, however, are impossible. As pointed out earlier, a monetary aggregate is determined at any given time not only by the behavior of the Central Bank, as reflected in the movements of the monetary base, but also by the behavior of the financial intermediaries and non-financial private sector, as summarized by the money multiplier.

In ascertaining the relationship between the base and the aggregates, it has been assumed that the rate of change of money multiplier remains constant over time. Although this may be the case over longer periods of time, it may not be true over shorter periods of time, like a quarter. Thus, short-run changes in the time path of the money multiplier can cause substantial deviation of the growth rate of the aggregate from a given base growth rate. This may show up in the estimated elasticity between changes in the aggregate and changes in the base, for if the rate of change of the money multiplier is indeed constant over time, the estimated elasticity would approach unity. Results, however, show that the estimated elasticities for all aggregates are markedly lower than one. The elasticity that is closest to unity is that of M3 which is .76. This suggests that the money multipliers for all aggregates have been volatile during the period of analysis. This could be an important source of control error.

Further, changes in the growth rate of the aggregate are apportioned between those originating from changes in the growth rate of the base and those resulting from the changes in the growth of the money multiplier. The results for the various monetary aggregates are shown in Charts 6 to 12. The actual changes in the growth rate of the relevant monetary aggregate are represented by the broken-line curves. The solid-line curves are the changes in the growth rate of the aggregate attributable to changes in the growth rate of base with the growth rate of the multiplier remaining constant. The dotted-line curves represent changes in the growth rate of the aggregate originating from changes in the growth of the multiplier without a change in

QUARTERLY GROWTH RATES OF M1, MB AND m_1, 1969:2-1980:4

Symbol used is _ _ _ _ _ M1

Symbol used is ________ MB

Symbol used is .... m_1

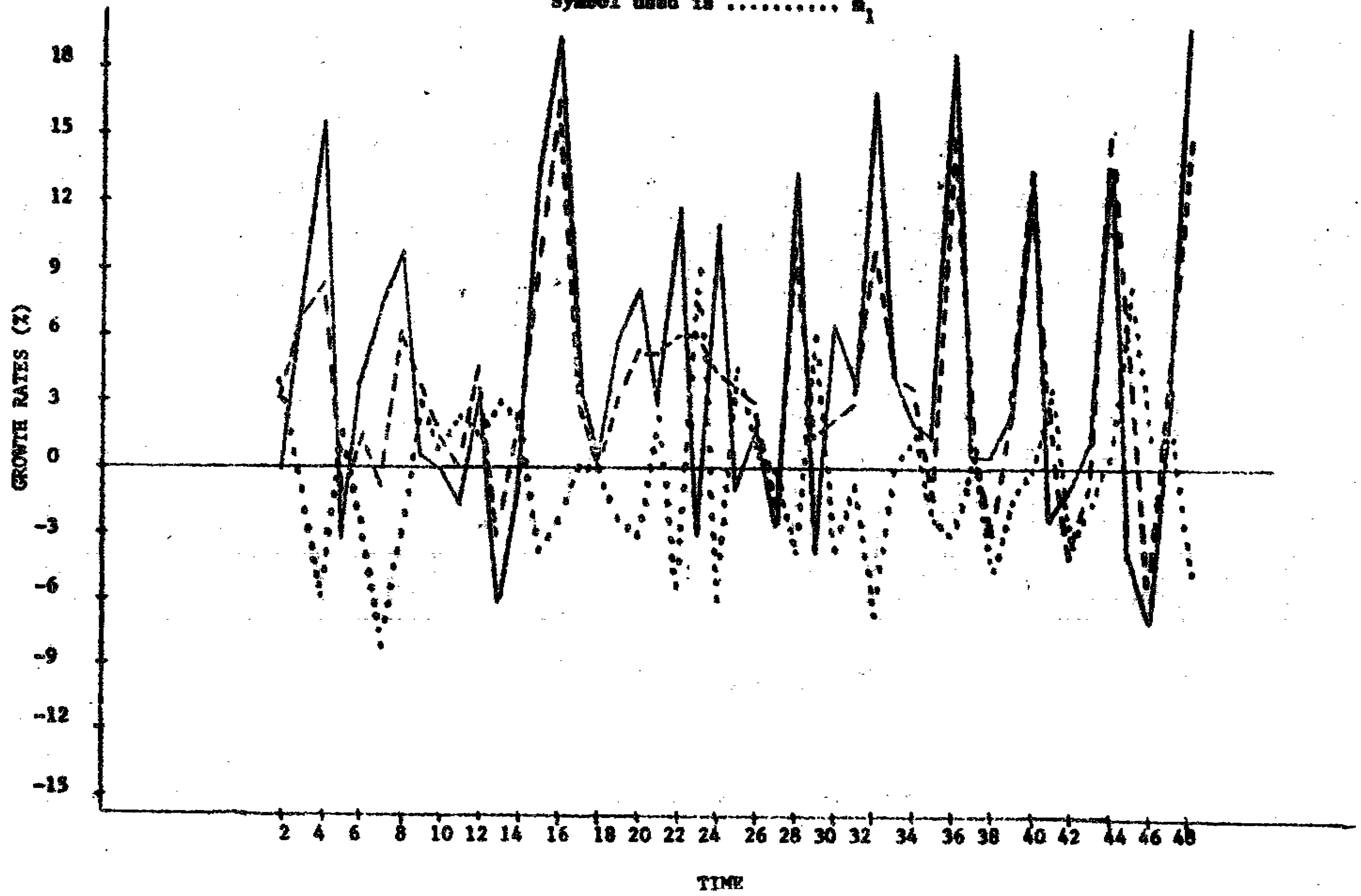


Chart 7

QUARTERLY GROWTH RATES OF M2, MB AND m_2, 1969:2-1980:4

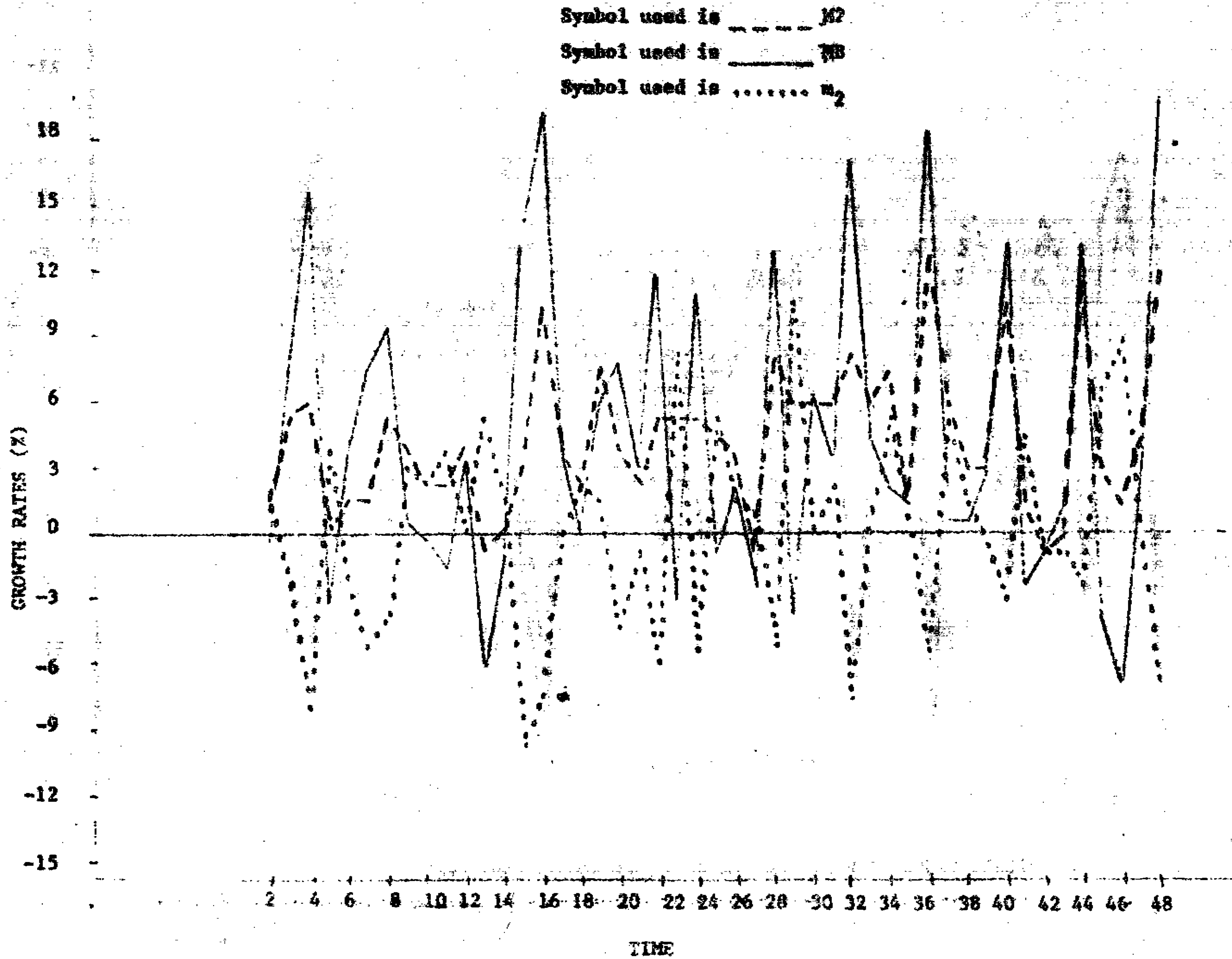


Chart 8

QUARTERLY GROWTH RATES OF M3, MB AND m_3, 1969:2-1980:4

Symbol used is ------ M3
Symbol used is ______ MB
Symbol used is .... m_3

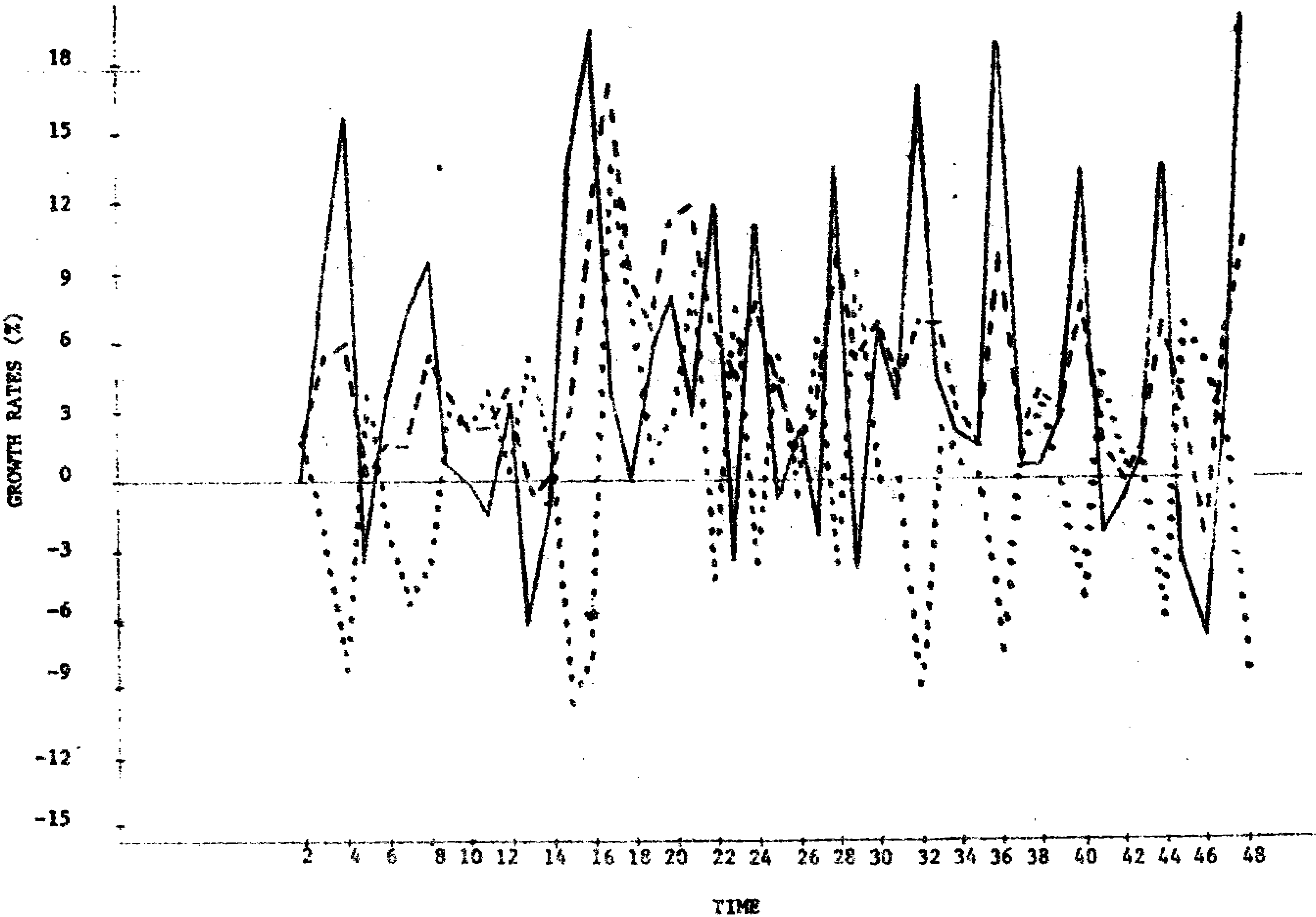
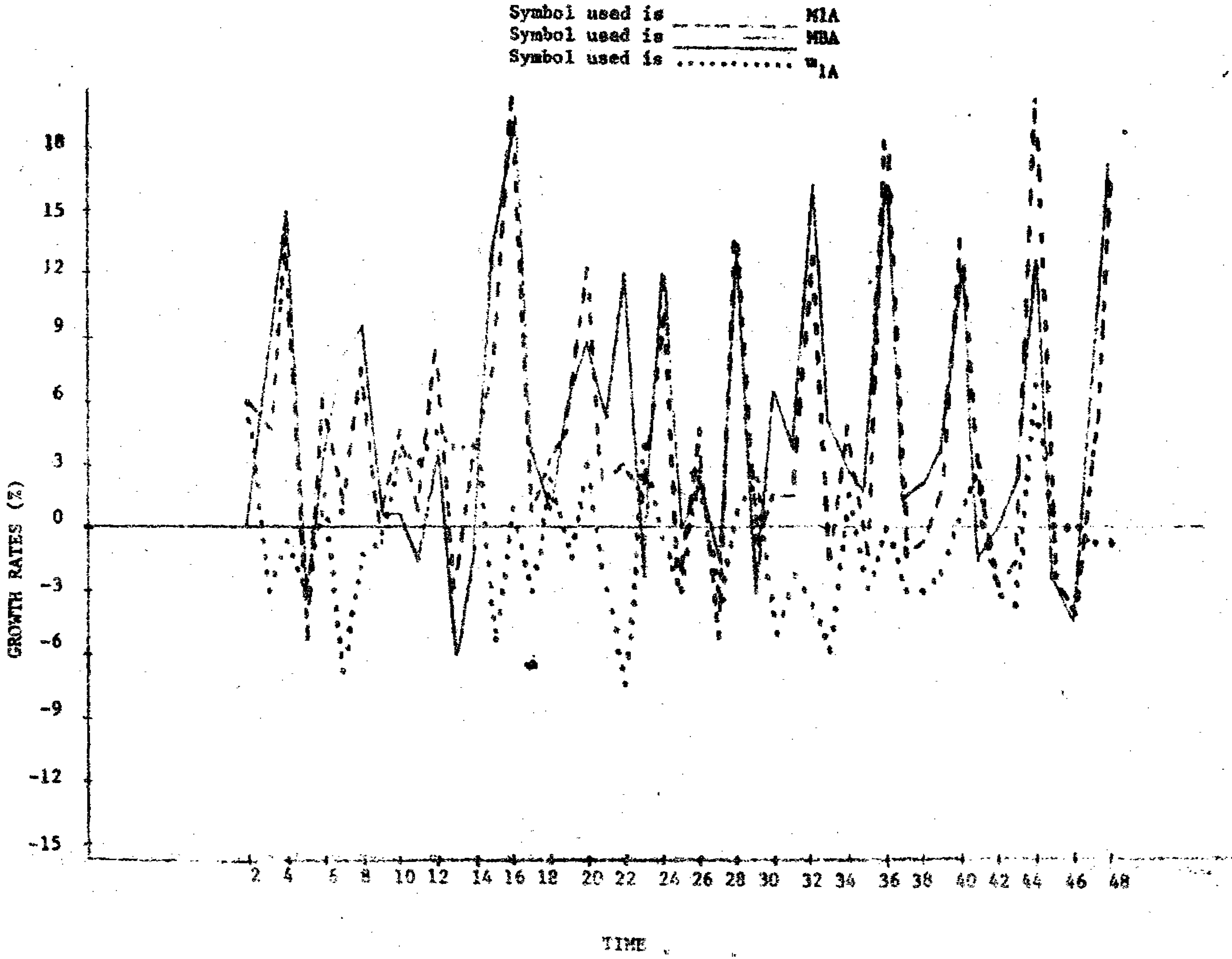


Chart 9

QUARTERLY GROWTH RATES OF M1A, MBA AND m_{1A}, 1969:2-1980:4



QUARTERLY GROWTH RATES OF M2A, MBA AND m_{2A}, 1969:2-1980:4

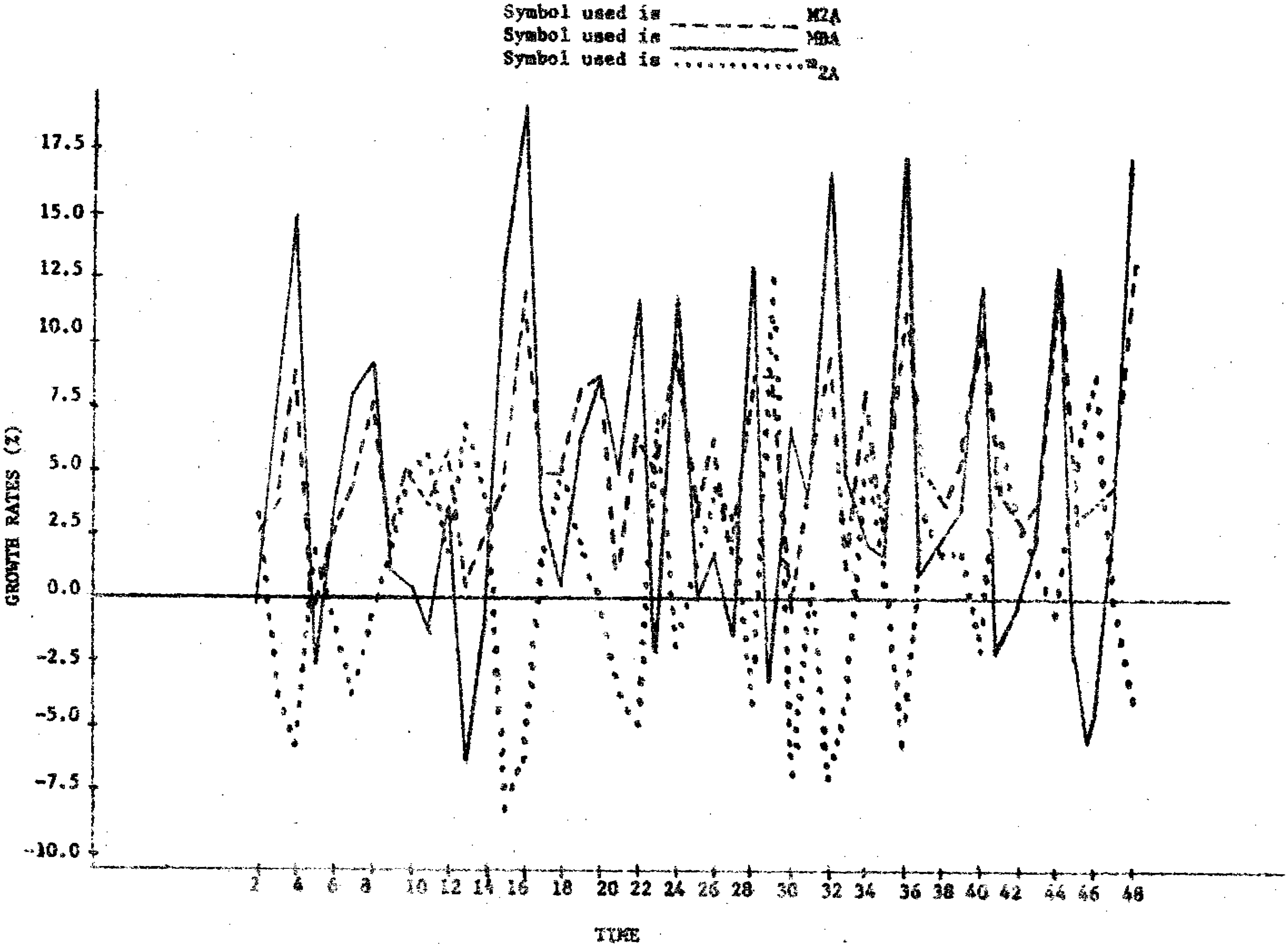
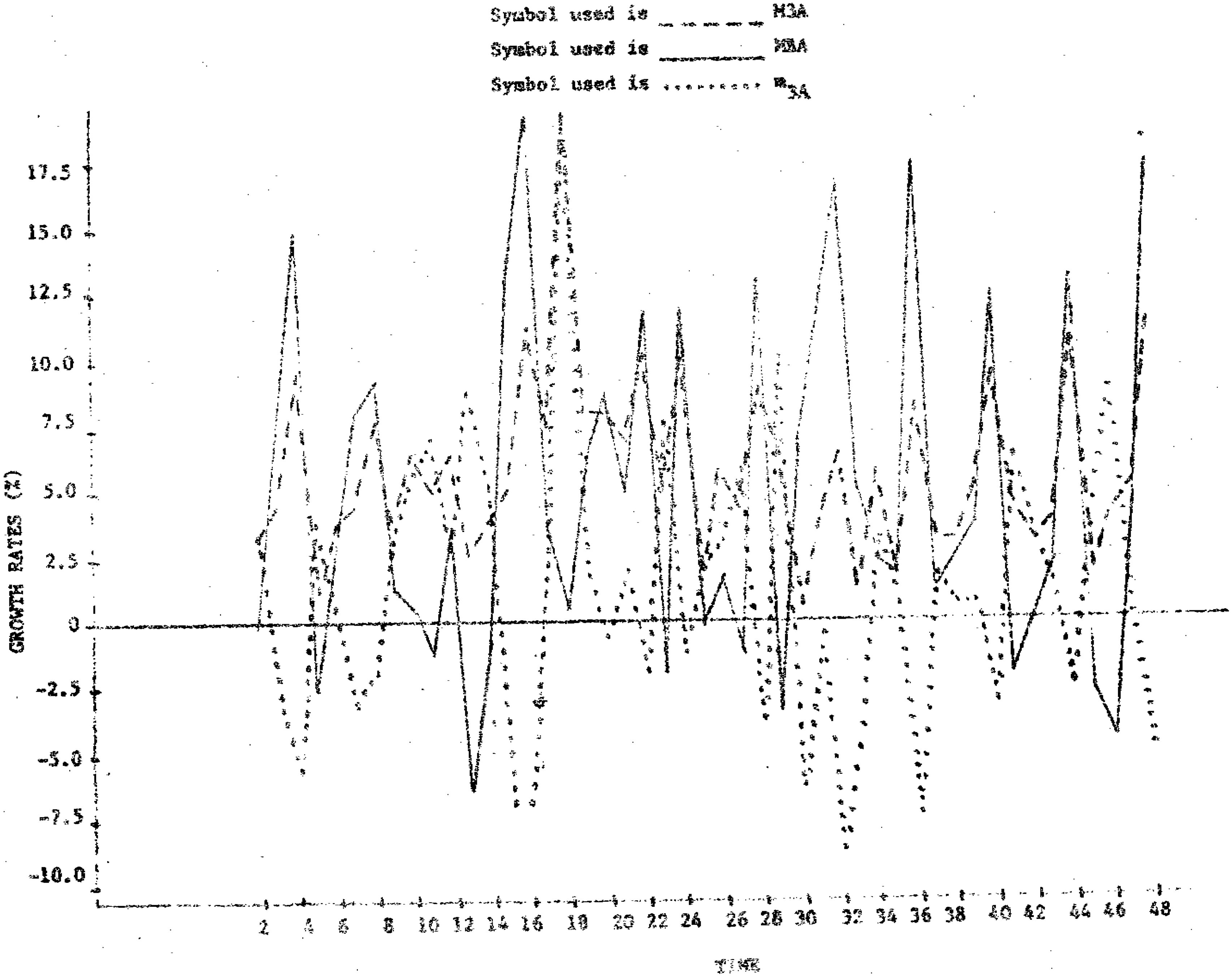
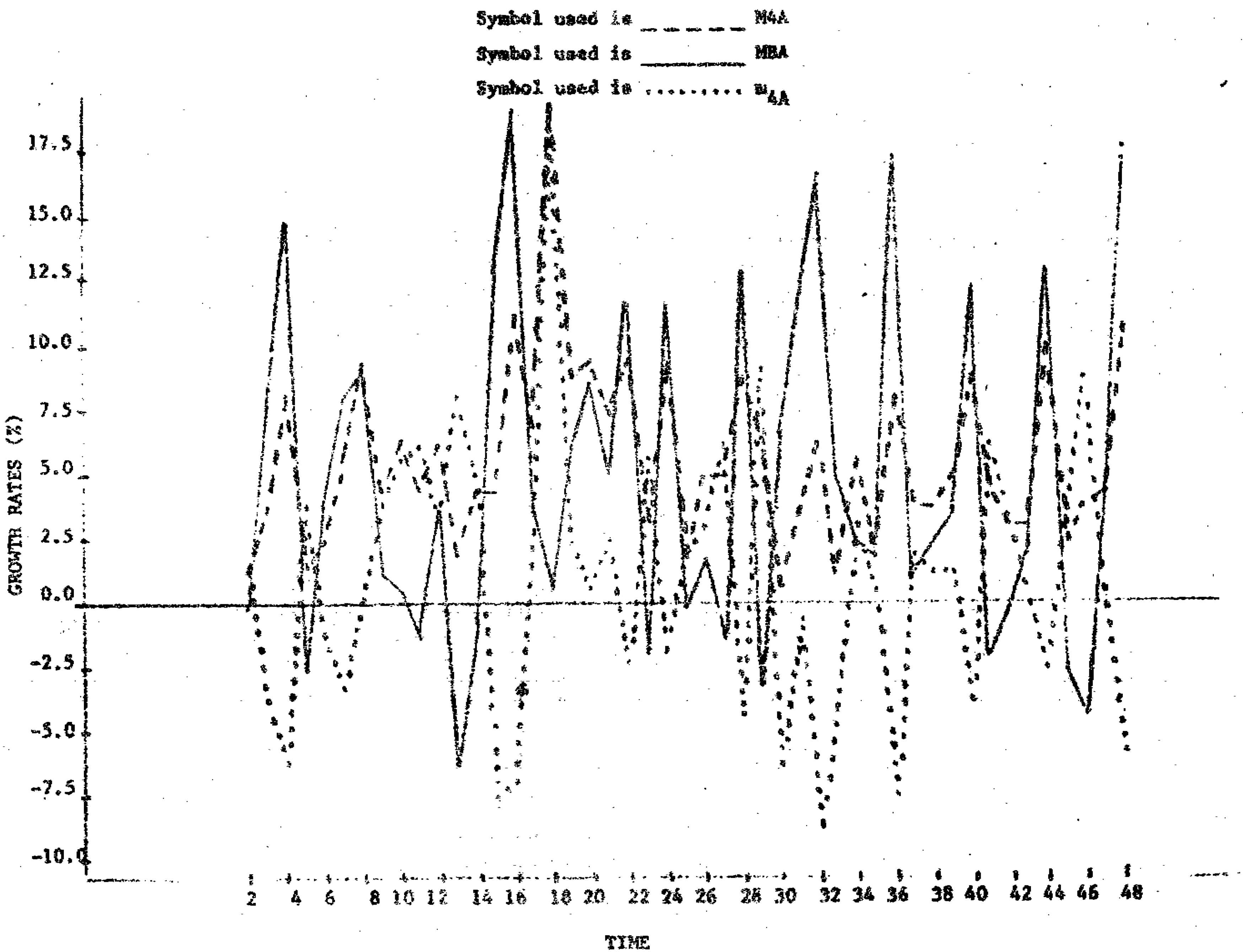


Chart 11

QUARTERLY GROWTH RATES OF M3A, MBA AND m_{3A}, 1969:2-1980:4



QUARTERLY GROWTH RATES OF M4A, MBA AND m_{4A}, 1969:2-1980:4



the growth rate of the base. It is clear from these charts that whenever the money multiplier alters its time path, the growth rate of the aggregate deviates from that of the base. Among the various aggregates, the money multipliers of M1, M3 and M1A appear to be less volatile compared to those of the other aggregates. It is not surprising then that relatively higher elasticities are obtained for M1, M3 and M1A.

IV. CONCLUSIONS AND RECOMMENDATIONS

This study has attempted to determine the monetary aggregate that could serve as an intermediate target of monetary policy. Two criteria for selecting that aggregate are used, namely: (1) the aggregate must bear a close and predictable relationship with economic activity, the ultimate target of monetary policy, and (2) it must reflect the policy actions of the Central Bank and not be highly sensitive to nonpolicy influences.

Three monetary aggregates are currently in use. These are: M1 (currency in circulation plus demand deposits of deposit money banks), M2 (M1 plus savings and time deposits of deposit money banks), and M3 (M2 plus deposit susbtitutes of deposit money banks). Annual target growth rates are defined for these aggregates. Recently, however, a number of developments such as financial innovations, the rapid emergence of other financial intermediaries and changes in regulations have occurred which may have a significant impact on the payments process and, perhaps, have obscured the link between existing monetary aggregate measures and economic activity. Thus, it was thought necessary to construct additional aggregates that would reflect these recent financial developments. In the construction of these additional aggregates, similar financial assets are combined together regardless of the financial institutions issuing them and the interest rate associated with them. The additional aggregates are: M1A (currency in circulation *plus* demand deposits of all financial institutions), M2A (M1A *plus* savings and time deposits of all financial institutions), and M3A (M2A *plus* deposit substitutes of commercial banks and non-bank financial intermediaries). The proposed additional monetary aggregates are basically similar to the existing ones except that corresponding deposit liabilities of non-deposit money banks are included in the former. M4A, which is M3A *plus* marginal deposits of commercial banks, was also constructed.

The semestral growth rates of the seven monetary aggregates have been investigated. There is a perceptible upward trend in the growth rates of those aggregates over the period 1967:II through 1986:II. Notably, the growth rates of the various monetary aggregates have diverged from each other. Thus, it is important to examine empirically which of the aggregates can serve as an indicator of economic activity and, at the same time, provide reliable signal of current policy actions.

To ascertain the relationship between GNP growth and the growth of the various monetary aggregates, regression analysis was performed using semestral data for the period 19[illegible]7:II through 1986:II. The evidence clearly indicates that broader monetary aggregates, specifically M3, M3A and M4A, predict future economic activity better than narrowly defined monetary aggregates. Further, M3A and M4A are found to have better forecasting capability than M3. This merely underscores the importance of much broader aggregates that include financial assets produced by non-deposit financial institutions in appropriately describing economic activity.

The degree of controllability of the various aggregates was examined. This exercise requires data on monetary base, the variable that represents Central Bank actions. The Central Bank method of arriving at estimates of the monetary base is, however, judged to be deficient. To remedy the deficiencies, an alternative method was proposed. This was used to construct a series of monetary base that includes only the reserves of deposit money banks and another series that includes reserves of all financial institutions.

Using quarterly data for the period 19[illegible]9:2 through 198[illegible]:4, results show that control on M1, M2, and M3 and M1A is fairly adequate. In contrast, much broader aggregates, such as M2A, M3A and M4A, that include a sizable proportion of deposit liabilities of non-deposit money banks seriously undermine the effectiveness of monetary control. This finding is hardly appealing to policymakers, especially since the least controllable aggregates -- M3A and M4A -- are those that appear to be strongly correlated with economic activity. However, policymakers are not completely without alternative. M3 also bears a close and predictable relationship with economic activity, although the relationship with economic activity is not as strong as M3A and M4A, and is found to be controllable to a large extent.

In Section I, it was shown that only the actual growth rates of M3 followed very closely its targeted growth rates, while those of M1 and M2 had substantially diverged from their targeted growth rates. This could hardly be a coincidence considering that among the existing aggregates, only M3 has sufficient capability to forecast future values of GNP quite reliably. That the Central Bank shows less concern about the deviation of the growth rates of M1 and M2 from their targeted growth rates can be defended by the results of this study. Perhaps, what is needed is a more explicit statement about which aggregate to use as an intermediate target of monetary policy so that market participants can be guided accordingly on the degree of monetary restraint being exercised by monetary authorities.

Although M3 is suggested here as an intermediate target, the Central Bank should not however lose sight of the movements of M3A and M4A in view of the growing importance of non-deposit money banks and of the policy to encourage merger among financial institutions. Perhaps, future changes in the measures for effective control of monetary aggregates should also address the issue of exercising greater control of broader aggregates.

Greater control on the aggregates must be given adequate attention. As revealed in this study, money multipliers have been quite volatile even for M3. This has somewhat weakened the direct relationship between the aggregates and the base. There are at least two ways to deal with this problem. . One is that the Central Bank may exert some efforts to stabilize the money multiplier. This requires applying some measures, such as imposing uniform reserve requirement ratio for all types of deposits regardless of the financial institution issuing them.

Another which is currently done by the Central Bank is imposing a ceiling on foreign exchange holdings of commercial banks. If the money multiplier can be successfully stabilized, then perhaps the growth rate of the base can be set equal to the desired growth rate of the selected aggregate.

The other approach proposed here does not require changes in regulatory environments. That is, the Central Bank may attempt to predict variations of the money multiplier so that it can initiate offsetting actions through the monetary base to achieve the desired growth rate of the aggregate. This is clearly illustrated in the following:

$$M = m \cdot MB$$

where M is the selected monetary aggregate, m, the money multiplier, and MB, the monetary base. If M^*_t is the desired level of the aggregate, and $\hat{m}_t$ is the predicted money multiplier, then the monetary base, MB^*_t , needed to achieve M^*_t , is

$$MB^*_t = \frac{M^*_t}{\hat{m}}$$

This approach, however, assumes that the monetary multiplier can be correctly predicted. Thus, it would be worthwhile to examine this possibility. Studies done in advanced economies about the possibility of predicting money multiplier through some methods showed some encouraging results.[1/] Since the monetary base is supposed to reflect Central Bank actions, it is worthwhile to determine whether management of the base is governed by considerations other than achieving monetary control. This is important in light of certain government policies that might have undermined monetary control through the base. For example, the Central Bank is bound to provide adequate funds to priority areas determined by government. Another is the sales (and purchases) of foreign exchange by the Central Bank which may be used mainly to stabilize the exchange rate, not control money. In addition, it is important to examine whether balance sheet items which are not subject to Central Bank discretionary actions dominate those which are subject to Central Bank discretionary actions.

1/ See Buttler et. al. (1979), Romboff (1977), Hafer and Hein (1982) and Balbach (1981).

The results and recommendations discussed here must, however, be taken with some caution. Many influences upon GNP growth have been excluded from the model. Their inclusion may alter the value of the coefficients of the monetary aggregate growth variables, especially if the latter are also proxies for excluded variables. Nevertheless, results of the study are still instructive.

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SEMESTRAL GROWTH RATES OF CURRENCY IN CIRCULATION
DEMAND DEPOSITS, SAVINGS AND TIME DEPOSITS AND
DEPOSIT SUBSTITUTES, DEPOSIT MONEY BANKS
(In Percent)

YEAR		Currency in Circulation	Demand Deposits	Savings and Time Deposits	Total Deposit Substitutes
1967	II	14.62	6.18	8.70	-
1968	I	-3.36	-1.23	1.03	-
	II	4.77	10.09	5.32	-
1969	I	-4.95	6.12	2.98	-
	II	25.38	12.66	7.61	-
1970	I	-4.01	-1.40	4.10	-
	II	18.48	1.50	9.19	-
1971	I	-0.58	6.37	6.76	-
	II	10.60	3.99	6.13	-
1972	I	-5.36	-1.65	0	-
	II	36.96	17.18	1.64	-
1973	I	-8.47	17.70	9.22	-
	II	9.80	18.78	14.47	57.36
1974	I	13.15	-10.55	3.49	60.90
	II	10.37	11.73	11.09	14.89
1975	I	-3.69	16.14	9.79	-0.15
	II	14.38	2.04	4.86	29.13
1976	I	-4.00	10.60	23.78	9.34
	II	23.97	4.34	17.04	3.24
1977	I	-2.62	18.95	17.74	3.00
	II	22.22	7.47	15.38	1.80
1978	I	-2.85	-1.07	17.96	-0.91
	II	24.48	8.47	12.74	1.75
1979	I	-4.93	-0.49	3.18	5.77
	II	18.71	10.20	10.04	-1.69
1980	I	-10.37	7.20	8.82	-12.58
	I	23.65	19.36	13.78	18.40
$\overline{X}$		8.01	7.43	9.14	12.68
S.D.		12.85	7.54	5.84	20.50
C.V.		160.33	101.47	63.92	161.62

SEMESTRAL GROWTH RATES OF CURRENCY IN CIRCULATION DEMAND DEPOSITS, SAVINGS AND TIME DEPOSITS AND DEPOSIT SUBSTITUTES, ALL BANKS
(In Percent)

YEAR		Currency in Circulation	Demand Deposits	Savings and Time Deposits	Total Deposit Substitutes
1967:	II	14.62	9.71	10.56	19.71
1968:	I	-3.36	-7.15	4.41	20.36
	II	4.77	14.06	2.32	3.23
1969:	I	-4.95	11.52	1.47	19.52
	II	25.38	14.27	8.35	29.03
1970:	I	-4.01	3.41	3.25	49.84
	II	18.48	0.32	15.72	12.51
1971:	I	-0.58	9.52	11.03	31.60
	II	10.60	8.25	10.03	28.03
1972:	I	-5.36	4.65	6.15	28.27
	II	36.96	22.31	8.03	19.64
1973:	I	-8.47	14.69	16.41	131.61
	II	9.80	23.20	17.06	14.96
1974:	I	13.15	0.40	9.09	44.77
	II	10.37	14.46	16.60	16.43
1975:	I	-3.69	5.44	15.32	3.12
	II	14.38	4.30	11.97	20.68
1976:	I	-4.00	3.85	12.57	3.64
	II	23.97	8.47	14.03	1.81
1977:	I	-2.62	7.18	12.79	1.69
	II	22.22	12.29	12.44	2.76
1978:	I	-2.85	-1.98	14.74	-0.07
	II	24.48	8.28	17.38	6.14

Appendix A.2 (Continued)

YEAR	Currency in Circulation	Demand Deposits	Savings and Time Deposits	Total Deposit Substitutes
1979: I	-4.93	0.43	11.70	6.81
II	18.71	18.58	15.93	7.16
1980: I	-10.37	-3.46	11.94	2.03
II	23.65	17.26	17.27	11.35
$\bar{X}$	8.01	8.31	11.48	19.88
S.D.	12.85	7.54	4.72	25.48
C.V.	160.33	90.77	41.08	128.21

REGRESSION RESULTS FOR THE GRANGER TEST

MODELS			α_0	α_1	α_2	β_1	β_2	R^2/F	D.W.
(1)	Y	M1:	2.0884	0.0582 (0.27)	0.1626 (0.82)	0.4767 (2.42)***	0.2949 (1.38)	0.26 1.80	1.97
(2)	Y	M2:	5.1133	0.1963 (0.90)	0.0847 (0.41)	0.3001 (1.31)	-0.0666 (0.28)	0.13 0.76	1.89
(3)	Y	M3:	5.2058	-0.1537 (-0.69)	-0.0120 (-0.06)	0.4824 (2.92)*	0.1717 (0.82)	0.36 2.86**	1.73
(4)	Y	M1A:	3.4076	0.0196 (0.09)	0.0484 (0.25)	0.4281 (2.33)**	0.2953 (1.42)	0.25 1.69	2.14
(5)	Y	M2A:	2.4370	0.0829 (0.37)	-0.0120 (-0.06)	0.5413 (2.24)**	0.0629 (0.23)	0.25 1.63	1.89
(6)	Y	M3A:	2.8360	-0.3249 (-1.56)	-0.2177 (-1.20)	0.6123 (3.55)*	0.4738 (2.30)**	0.48 4.56*	1.88
(7)	Y	M4A:	2.1565	-0.3377 (-1.74)**	-0.2182 (-1.26)	0.6107 (4.20)*	0.5280 (2.66)**	0.54 5.85*	1.82
(8)	M1	Y:	11.5494	-0.3040 (-1.24)	-0.0248 (-0.11)	-0.4708 (-2.09)**	0.3665 (1.50)	0.52 5.52*	1.75
(9)	M2	Y:	6.4488	-0.2426 (-1.49)	0.0379 (0.24)	-0.1214 (-0.70)	0.6298 (3.46)*	0.42 3.68**	1.80
(10)	M3	Y:	9.1725	0.2432 (-0.87)	0.4437 (-1.84)***	0.2334 (1.13)	0.5154 (1.96)***	0.27 1.87	1.54
(11)	M1A	Y:	10.8414	-0.0822 (-0.33)	0.2312 (-1.08)	-0.4225 (-2.67)***	0.4401 (1.90)***	0.63 8.48*	1.92

Appendix A.2 (Continued)

YEAR	Currency in Circulation	Demand Deposits	Savings and Time Deposits	Total Deposit Substitutes
1979: I	-4.93	0.43	11.70	6.81
II	18.71	18.58	15.93	7.16
1980: I	-10.37	-3.46	11.94	2.03
II	23.65	17.26	17.27	11.35
$\bar{X}$	8.01	8.31	11.48	19.88
S.D.	12.85	7.54	4.72	25.48
C.V.	160.33	90.77	41.08	128.21

REGRESSION RESULTS FOR THE SIMS TEST

MODELS	δ	λ_2	λ_1	λ_0	λ_1	λ_{t+2}	SEE/F	D.W./k
1) Y M1	-0.20439	0.18893 (0.85)	0.72185 (3.68)*	0.26430 (1.27)	-0.02145 (-0.11)	0.12292 (0.56)	.04833 43.48*	2.09 .5
2) Y M2	0.11998	0.01433 (0.05)	0.70286 (2.52)**	0.21017 (0.68)	-0.11799 (-0.43)	0.21434 (0.75)	.05320 14.76*	2.01 .6
3) Y M3	0.62820	0.11392 (0.57)	0.4244 (1.92)***	0.29114 (1.30)	0.04759 (0.22)	0.02655 (0.14)	0.04686 95.14*	1.97 .4
4) Y M1A	-0.06611	0.21879 (1.08)	0.71609 (3.67)*	0.39694 (1.75)***	-0.02937 (-0.15)	-0.09773 (-0.47)	0.04218 118.12 *	2.07 .4
5) Y M2A	0.45681	-0.04677 (-0.11)	1.02835 (2.93)*	0.40916 (1.11)	-0.39931 (-1.17)	-0.09817 (-0.23)	.04338 54.74*	2.10 .5
6) Y M3A	1.22032	0.07531 (0.41)	0.42614 (1.98)***	0.43208 (1.83)	0.12755 (0.61)	-0.25862 (-1.40)	0.03694 284.36*	1.94 .3
7) Y M4A	1.48533	0.02442 (0.14)	0.40674 (1.74)***	0.50970 (2.15)**	0.06323 (0.26)	-0.19137 (-1.02)	0.03622 302.38	1.91 .2
8) M1 Y	0.73679	0.55652 (2.00)***	-0.22805 (-0.56)	-0.35857 (-0.93)	0.87190 (2.05)***	-0.06158 (-0.21)	0.05930 271.78*	1.57 0
9) M2 Y	-0.11761	0.44413 (1.81)***	-0.07490 (-0.31)	0.00233 (0.01)	0.70377 (2.80)*	-0.11549 (-0.47)	.05522 30.07*	1.99 .5
10) M3 Y	-0.74388	0.08482 (0.40)	0.04418 (0.20)	0.30372 (1.31)	0.63068 (2.76)*	0.05610 (0.26)	0.04609 121.20 *	2.01 .4
11) M1A Y	0.04591	0.05315 (0.23)	0.229 .8 (0.67	-0.24671 (-0.76)	0.63851 (1.79)***	0.16825 (0.69)	0.0497 452.4f *	2.76 0

Cont'd...

REGRESSION RESULTS FOR THE GRANGER TEST

MODELS	α_0	α_1	α_2	β_1	β_2	R^2/F	D.W.
(12) M2A Y:	5.3457	-0.1142 (-0.74)	-0.0800 (-0.59)	-0.0380 (-0.23)	0.7400 (4.00)*	0.51 5.29*	1.98
(13) M3A Y:	7.5635	-0.0854 (-0.36)	-0.4482 (-2.15)**	0.2315 (1.17)	0.5716 (2.41)**	0.34 2.51	1.99
(14) M4A Y:	7.7362	-0.1444 (-0.62)	-0.4945 (-2.39)**	0.1823 (1.05)	0.6751 (2.84)*	0.36 2.80	1.67

NOTE: The equations estimated are:

$$Y_t = \alpha_0 + \sum_{i=1}^{2} \alpha_i \; Y_{t-i} + \sum_{i=1}^{2} \beta_i \; M_{t-i}$$

$$M_t = \alpha'_0 + \sum_{i=1}^{2} \alpha'_i \; Y_{t-i} + \sum_{i=1}^{2} \beta'_i \; M_{t-i}$$

t-values in parentheses. * - Significant values at 1% level; ** - Significant at 5% level; *** - Significant at 10% level.

Continuation

PERIOD	M1	M2	M3	M1A	M2A	M3A	M4A	MB	MBA
74:1	7639	14347	20206	8932	21181	30375	32586	6419	6842
2	8110	15099	21602	9217	22563	33318	35553	7188	7660
3	8601	15918	22553	9356	23652	34961	36767	6980	7496
4	9008	16772	24242	10390	25952	38474	40255	7791	8378
75:1	9348	17506	25278	10088	26780	39274	40951	7741	8372
2	9607	18132	25590	10562	28508	41421	43068	7916	8540
3	9395	17812	26381	10044	29043	43283	45100	7720	8430
4	10315	19254	28886	11435	31529	47112	48972	8779	9560
76:1	10500	20477	30332	11313	34322	50108	51972	8458	9257
2	10715	21780	32311	11503	34123	50273	52175	8998	9904
3	11022	23074	33573	11695	35744	52040	53981	9316	10301
4	12075	25025	35897	13184	38988	55431	57443	10915	12036
77:1	12634	26484	38453	13028	39436	56076	58081	11443	12634
2	13145	28393	39591	13577	42682	59403	61461	11691	12978
3	12970	28917	40051	13412	43704	60657	62752	11824	13191
4	14938	32532	43931	15792	48518	65702	67924	14010	15485
78:1	15164	34468	45064	15524	50919	67914	70292	14133	15717
2	14656	35409	46705	15420	52971	70141	72839	14270	16083
3	14940	36559	48103	15675	55928	73522	76408	14717	16712
4	16946	40343	51837	17756	62021	80246	83083	16688	18852
79:1	17183	40987	52763	17907	64809	83563	86861	16262	18521
2	16502	40643	52800	17396	66839	86305	89833	16197	18572
3	16403	40756	53672	17148	69311	89438	92649	16392	18981
4	18844	45409	57360	20638	77958	98817	101961	18651	21458

Continuation

PERIOD	M1	M2	M3	M1A	M2A	M3A	M4A	MB	MBA
80:1	19685	46796	59141	20140	80263	100838	104352	17985	20930
2	18587	47496	57944	19290	83454	104737	108291	16726	19996
3	19606	49521	61224	19885	86871	109736	112951	17388	20830
4	22538	53432	67803	23145	98392	122091	125217	20906	24436

cont'd...

REGRESSION RESULTS FOR THE SIMS TEST

MODELS		δ	λ_{t-2}	λ_{t-1}	λ_0	λ_1	λ_2	SEE/F	D.W./k
12) M2A	Y	-0.78747	0.33541 (1.70)	0.11984 (0.58)	0.00239 (0.01)	0.67490 (3.14)*	0.01779 (0.09)	.04327 144.30*	2.08 .4
13) M3A	Y	-1.97100	0.05433 (0.38)	0.25598 (1.46)	0.18902 (1.11)	0.47958 (2.60)*	0.27180 (1.83)	0.03090 1060.84*	2.08 .2
14) M4A	Y	-1.84270	0.02366 (0.17)	0.20635 (1.23)	0.24636 (1.52)	0.51503 (2.93)*	0.24417 (1.73)	.02946 1140.16*	2.06 .2

NOTES: Only the SEE is reported since the $\bar{R}^2$ exceeds .99 in most equations.

k is the value used to construct the second-order linear filter.

t values are in parentheses. The equations estimated are:

$$Y_t = \lambda_0 + \lambda_2 M_{t-2} + \lambda_1 + \lambda_o M_t + \lambda_1 M_{t+1} + \lambda_2 M_{t+2}$$

$$M_t = \lambda'_0 + \gamma'_2 Y_{t-2} + \gamma'_1 Y_{t-1} + \gamma'_o Y_t + \gamma'_1 Y_{t+1} + \gamma'_2 Y_{t+2}$$

* - Significant at 1% level; ** - Significant at 5% level; *** - Significant at 10% level.

DATA BASE: MONETARY AGGREGATES AND MONETARY BASE: QUARTERLY (1969:2 - 1980:4)

PERIOD	M1	M2	M3	M1A	M2A	M3A	M4A	MB	MBA
69:2	3870	7705	7705	3771	8685	9181	9801	2743	2795
3	4136	8114	8114	3930	9020	9588	10164	2959	3014
4	4492	8619	8619	4497	9822	10462	11014	3414	3474
70:1	4412	8635	8635	4246	9766	10566	11154	3304	3386
2	4283	8779	8779	4493	9991	10950	11441	3435	3518
3	4439	8932	8932	4526	10430	11449	11990	3598	3808
4	4897	9388	9388	4877	11239	12318	13107	4049	4168
71:1	4880	9718	9718	4873	11550	12800	13701	4078	4209
2	4936	9944	9944	5098	12162	13582	14530	4092	4230
3	4944	10146	10146	5153	12639	14258	15181	4021	4164
4	5179	10494	10494	5575	13351	15169	16175	4159	4310
72:1	5010	10382	10382	5424	13458	15533	16440	3898	4054
2	5076	10391	10391	5569	13823	16155	17155	3655	4017
3	5543	10712	10712	5979	14420	16981	17940	4369	4547
4	6470	11871	11871	7179	16096	19986	19931	5247	5419
73:1	6704	12309	13945	7231	16946	20288	21340	5430	5610
2	6712	12612	15179	7438	17818	24280	25515	5439	5632
3	6524	13529	16204	7783	19287	26232	27733	5754	5986
4	7267	14022	18063	8742	20976	28405	30336	6245	6517