On Finding Determinants of Money-Stock Cycles

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1. INTRODUCTION

THE PUBLIC CAN ALTER the money stock by exchanging currency for bank deposits or bank deposits for currency. In a study that is related to *A Monetary History* by Friedman and Schwartz [3; 2, p. xxvii] and that is still cited in reference to the determination of money-stock cycles, Phillip Cagan found that these actions by the public regarding its currency and bank deposit holdings were an important source of cycles in money stock [2, p. 26]. For all eighteen money-stock cycles he analyzed, movements in the currency ratio accounted for 46 percent of cyclical money-stock movement. For six nonwar cycles from 1918 to 1953, it accounted for 56 percent of that movement. Given the stress that Cagan placed on currency as a cause of money-stock cycles, it is intriguing that other studies of money-stock determination since Cagan's have not concluded that the public's currency-deposit decision is a major source of money-stock instability [1, 4, 5, 6, 7].

There are at least three possible reasons for this discrepancy. First, many of Cagan's results are based on data from 1865 to 1953. It may be that there were shifts in the public's currency behavior as a result of institutional changes such as the establishment of the FDIC; thus, Cagan reported a phenomenon that is no longer important.[1] Second, it may be that currency plays an important role in cycles of the

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[1]Friedman and Schwartz [3, p. 685] suggested that currency behavior shifted as a result of the establishment of the FDIC.

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broad definition of money, M2, which Cagan used in his analysis, but that it does not have the same importance in determination of cycles in M1. And third, it may be that different results are due to different procedures that have been used to analyze money-stock cycles. Perhaps for some reason Cagan's procedure distorts the contributions of the proximate determinants, especially the role of currency.

This article asks which of these three possibilities explains why Cagan's conclusions regarding currency as a source of money-stock cycles have not been repeated in subsequent studies. It uses Cagan's procedure to analyze M1 and M2 data for five cycles from 1948 to 1975 to see whether the currency ratio contributed differently to these most recent M2 cycles, as compared to those cycles that Cagan analyzed, and to M2 cycles as compared to M1 cycles. An alternative way to answer these questions might be to develop and employ some "better" method—one, for example, that would allow testing of hypotheses, which Cagan's method does not allow. This alternative was not taken in the belief that the most instructive way to examine the strengths and limitations of Cagan's procedure was to use it on new M2 data and on data for M1.

2. PROCEDURE

The procedure Cagan used to analyze the determination of cyclical movements is not a commonly used procedure. In explaining what results were obtained with this procedure for the period from 1948 to 1975, I will briefly summarize it.

At the base of Cagan's procedure is an identity that links money stock ($M = C + D$) to three determinants: high-powered money ($H = C + R$), the reserve ratio (R/D) and the currency ratio (C/M) [2, p. 12]:

$$M = H/[(C/M) + (R/D) + (C/M)(R/D)] . \tag{1}$$

Taking logarithms of this equation and then differentiating it with respect to time produces another identity, which allows one to decompose changes in money stock to changes in its determinants [2, p. 17]:

$$\frac{d \log_e M}{dt} = \frac{d \log_e H}{dt} + \frac{M}{H}\left(1 - \frac{R}{D}\right)\frac{d(-C/M)}{dt} + \frac{M}{H}\left(1 - \frac{C}{M}\right)\frac{d(-R/D)}{dt} . \tag{2}$$

An approximation error is introduced when this equation is used with discrete data [2, p. 18].

Using equation (2) to calculate contributions of the three determinants to stages of five cycles in M2 from 1948 to 1975 results in Table 1. Money-stock cycles were chosen to correspond to National Bureau of Economic Research reference cycles. The peaks and troughs of monetary cycles were chosen by finding months near reference-cycle turning points for which rates of change were extreme. Each expansion and

TABLE 1

AVERAGE RATE OF CHANGE IN M2 AND SOURCES

Specific Cycle Stage		Average Rate of Change in Money Contributed by			
Number	Dates	Total	High-Powered Money	Currency Ratio	Reserve Ratio
I	Oct 48 Jan 49	−1.9	−3.4	1.2	0.3
II	Dec 48 Oct 49	−0.2	−10.9	1.0	9.8
III	Oct 49 Aug 50	3.5	0.6	2.7	0.2
IV	Aug 50 Jun 51	3.0	9.9	0.3	−7.2
V	May 51 Aug 51	5.1	3.4	−0.5	2.2
VI	Jul 51 Apr 52	5.2	4.1	0.7	0.4
VII	Apr 52 Jan 53	4.4	4.0	−0.2	0.6
VIII	Jan 53 Oct 53	3.0	−1.9	0.5	4.4
IX } I	Sept 53 Dec 53	2.8	−1.3	2.0	2.1
II	Nov 53 Apr 54	2.5	0.3	2.0	0.2
III	Apr 54 Sep 54	5.6	−7.0	3.5	9.1
IV	Sep 54 Jan 55	6.3	3.0	2.5	0.8
V	Dec 54 Mar 55	4.0	0.3	1.2	2.5
VI	Feb 55 Jan 56	1.7	0.9	0.0	0.7
VII	Jan 56 Dec 56	2.0	1.5	0.4	0.1
VIII	Dec 56 Oct 57	2.7	−0.1	1.1	1.7
IX } I	Sep 57 Dec 57	0.8	0.6	0.4	−0.1
II	Nov 57 May 58	6.6	−1.5	3.3	4.8
III	May 58 Nov 58	6.2	1.6	2.4	2.2
IV	Nov 58 May 59	4.3	2.4	0.4	1.5
V	Apr 59 Jul 59	4.0	1.1	−0.1	2.9
VI	Jun 59 Oct 59	0.0	0.1	0.0	−0.1
VII	Oct 59 Feb 60	−1.7	−2.7	−0.3	1.4
VIII	Feb 60 May 60	0.4	0.5	−0.5	0.4
IX } I	Apr 60 Jul 60	3.4	1.8	1.7	−0.2
II	Jun 60 Apr 63	5.9	1.1	1.7	3.0
III	Apr 63 Jan 66	7.1	5.2	0.8	1.0
IV	Jan 66 Nov 68	7.9	6.1	1.1	0.6
V	Oct 68 Jan 69	9.7	7.6	1.3	0.9
VI	Dec 68 Apr 69	5.0	3.3	−0.3	2.0
VII	Apr 69 Aug 69	0.5	5.2	−3.5	−1.2
VIII	Aug 69 Dec 69	1.8	3.1	−2.3	1.0
IX } I	Nov 69 Feb 70	−0.1	2.9	−3.0	0.0
II	Jan 70 Jan 71	8.6	6.1	1.2	1.3
III	Jan 71 Dec 71	10.6	6.7	2.1	1.8
IV	Dec 71 Nov 72	10.6	3.1	1.9	5.6
V	Oct 72 Jan 73	10.6	−4.7	0.4	14.9
VI	Dec 72 Aug 73	8.1	10.1	0.4	−2.4
VII	Aug 73 Apr 74	8.8	8.9	−0.5	0.4
VIII	Apr 74 Dec 74	6.1	7.7	−1.8	0.2
IX	Nov 74 Feb 75	5.1	0.5	−1.5	6.1

NOTE: Total may not equal sum of parts because of approximation error and rounding error. Sources of data are given at the end of the paper.

contraction phase was divided into three periods of equal length.[2] To these six periods were added the peak stage and the trough stages at each end to give nine stages for each cycle. Table 1 is an extension of Table F.1, "Contributions of the Three Determinants to Matched Specific Cycles in the Rate of Change in the Money Stock, 1877–1953" in Cagan's study [2, pp. 322–25]. The first cycle in Table 1 overlaps

[2]Cagan was not able to do this for his earliest cycles due to data limitations.

TABLE 2
CONTRIBUTIONS OF DETERMINANTS TO NINE STAGES OF SPECIFIC CYCLES IN TREND-ADJUSTED RATE OF CHANGE IN M2, 1948-75

Specific Cycle Stage	Total	High-Powered Money	Currency Ratio	Reserve Ratio
I	−15.7	−8.8	−0.4	−6.6
II	2.6	−14.3	6.5	10.4
III	12.2	−2.2	8.7	5.7
IV	11.3	15.2	3.4	−7.3
V	12.6	−1.7	−0.5	14.8
VI	−0.8	9.2	−2.0	−8.0
VII	−6.7	7.5	−6.9	−7.3
VIII	−6.8	−0.1	−5.8	−1.0
IX	−8.7	−4.8	−3.1	−0.8

SOURCE: Derived from Table I.

the last cycle listed in Cagan's Table F.1, but because data here are from different sources, the rates of change are slightly different. (See Sources of Data below.)

To obtain the relative cyclical importance of each determinant, one must first trend-adjust the data for each cycle. This is done by subtracting from each series the mean of that series over the cycle, that is, by finding the deviations from the cyclical means. Summing these deviations by each stage of the cycle produces Table 2, showing M2 results for the five cycles from 1948 to 1975, and Table 3, showing M1 results for the same period.[3] Note that though the length of stages varied considerably from cycle to cycle, this summation weights them all equally. The M1 results were obtained by replacing M2 with M1 in equation (2) and substituting demand deposits for demand plus time deposits. Since the dates used in the M1 cycles were the same as those of the M2 cycles, the form of equation (2) requires that differences in contributions of the reserve and currency ratios account for any differences in rates of change between M1 and M2. Tables 2 and 3 show this; the column of trend-adjusted contributions of high-powered money is the same in both.

TABLE 3
CONTRIBUTIONS OF DETERMINANTS TO NINE STAGES OF SPECIFIC CYCLES IN TREND-ADJUSTED RATE OF CHANGE IN M1, 1948-75

Specific Cycle Stage	Total	High-Powered Money	Currency Ratio	Reserve Ratio
I	−15.8	−8.8	0.0	−7.0
II	−5.8	−14.3	1.9	6.5
III	10.3	−2.2	6.9	5.6
IV	14.6	15.2	4.4	−5.1
V	18.0	−1.7	2.0	17.7
VI	2.2	9.2	−0.5	−6.5
VII	−3.4	7.5	−4.7	−6.1
VIII	−7.0	−0.1	−5.2	−1.7
IX	−13.1	−4.8	−4.9	−3.4

[3]If all columns in Tables 2 and 3 are divided by the first column and then the entire matrix multiplied by 100, tables showing the relative contribution of determinants to stages in cycles in trend-adjusted rate of change in money stock are formed. This is the manner in which Cagan presented M2 results. [2, Table 3, p. 25].

Finally, from these trend-adjusted contributions to the stages, denoted $\bar{m}_s$, $\bar{h}_s$, $\bar{c}_s$, and $\bar{r}_s$, one can compute an overall measure of relative contribution of determinants to specific cycles in the trend-adjusted rate of change in money stock using the formula [2, p. 26]

$$\text{relative contribution} = \frac{\sum_{\text{stages}} \bar{h}_s \ (\text{sign of } \bar{m}_s)}{\sum_{\text{stages}} |\bar{m}_s|} \tag{3}$$

and similarly for $\bar{c}_s$ and $\bar{r}_s$. Table 4 shows the results of this procedure for both M2 and M1. Because Cagan's results were computed using five stages of the cycle (the odd numbered stages), both five and nine stage results are shown.

TABLE 4
RELATIVE CONTRIBUTIONS OF DETERMINANTS TO FIVE SPECIFIC CYCLES IN TREND-ADJUSTED RATE OF CHANGE IN THE MONEY STOCK, 1948–75 (in percent)

	Total	High-Powered Money	Currency Ratio	Reserve Ratio
M2, nine stages	100	−8	47	61
M2, five stages	100	4	33	63
M1, nine stages	100	45	29	26
M1, five stages	100	4	31	66

SOURCE: Derived from Tables 2 and 3 using equation (3).

3. RESULTS, 1948–75

Whenever time deposits grow at a different rate than M1, there will be a divergence in M1 and M2 growth rates and, in terms of equation (2), the sources of M1 and M2 change will differ. Time deposits grew more rapidly than M1 during the period 1948–75, especially during the last half of this period. Table 5 examines sources of trend growth for M1 and M2 both for 1948–75 and for subperiods corresponding to the first three and last two cycles. The sources of monetary growth are quite different in the two subperiods. Also, the two ratios make an important contribution to M2 growth form 1960 to 1975, but not to M1 growth. This divergence in M1 and M2 results happens mostly because the denominators of M2 ratios include time deposits. Of less importance, the rapid growth in time deposits tended to raise the reserves-to-demand-deposit ratio because time deposits required support from reserves that were not available to support demand deposits. This effect was at least partially offset, however, by a reduction in reverse requirements for time deposits.

Turning to the cyclical results of Table 4, three items deserve further comment: (1) the currency ratio appears to be an important source of money-stock cycles; (2) M1 and M2 results are quite similar; and (3) the role of the reserve ratio as a source of monetary cycles is far larger than found by Cagan.

The large contribution by the currency ratio to cycles in M1 and M2 indicates that Cagan did not capture a phenomenon that no longer exists. Cagan found that the

TABLE 5
SOURCES OF RATE OF CHANGE IN MONEY STOCK: AVERAGES FOR SELECTED PERIODS, OCTOBER 1948 TO FEBRUARY 1975

	M2	High-Powered Money	Currency Ratio	Reserve Ratio
Oct 48–Feb 75	5.4	3.1	1.0	1.6
Oct 48–Jul 60	3.1	0.4	1.0	1.6
Apr 60–Feb 75	7.3	5.1	0.8	1.4
	M1	**High-Powered Money**	**Currency Ratio**	**Reserve Ratio**
Oct 48–Feb 75	3.5	3.1	−0.1	0.5
Oct 48–Jul 60	2.1	0.4	0.5	1.2
Apr 60–Feb 75	4.6	5.1	−0.6	0.1

SOURCE: Same as Table 1. Totals may not equal sum of parts because of approximation and rounding errors. For comparison to Cagan's results, see [2, p. 19].

currency ratio accounted for 46 percent of cylical movements in all eighteen money-stock cycles that he investigated. For five post-World-War II cycles the currency ratio accounts for 47 percent of that movement when nine stages are used and 33 percent when five stages are used. The importance of the currency ratio diminishes for cycles in M1, where it accounts for 29 percent of the movement if nine stages are used and 31 percent if five stages are used. Thus the suggestions that Cagan's currency-ratio results are due to institutional factors that have since changed, or to his use of a broad rather than a narrow definition of money, are not supported.

M1 and M2 results in Table 4 are almost identical when five stages are used, but not when nine stages are used. The reason for the dissimilarity in nine-stage results can be seen by comparing Tables 2 and 3. The trend-adjusted money stock M2 has opposite signs than trend-adjusted M1 when summed over stages II and VI. These sign changes are important when using equation (3) and, because nine-stage results include stages II and VI, they account for the dissimilarity.

Computing the cyclical contributions of Table 4 for the subperiods of Table 5 does not reveal a change in pattern similar to that in the sources of trend growth.

The importance of the reserve ratio and high-powered money as sources of recent money-stock cycles is substantially different from that which Cagan found. Cagan [2, p. 26] found that the role of the reserve ratio was large relative to that of high-powered money in cycles prior to 1913, but that after 1913 these roles were reversed. In no case did he find that the reserve ratio could account for more than 50 percent of the cyclical movement, as is the case in the five cycles since 1948. The negative sign for contribution of high-powered money is not unprecedented—for seven mild cycles, 1877 to 1913, high-powered money had a contribution of −6. But the low or negative figures shown in Table 4 are not results one anticipates from past studies of money-stock determination.

The major reason for the large relative contributions of the reserve ratio shown in Table 4 is that changes in reserve requirements became more common after 1948 and these changes tended to be cyclical, that is, most of the lowering of requirements occurred in stages II through V and much of the increase occurred in stages VI through IX. Changes in reserve requirements occurred in sixteen of the forty-five

stages used to form Tables 2 and 3, nine times in stages II through V, and seven in stages VI through IX. Only once in the early stages was there an increase in reserve requirements, in January–February of 1951. Seven other changes during these stages lowered reserve requirements, and one change was a mixed change, that is, an increase of some requirements and a decrease of others. The two stages most affected by these changes were stages II and V. In four of the five cycles, there were decreases in stage II. There was only one change in a fifth stage, the adoption of the new reserve requirement schedule in November of 1972, but it dominated the fifth stages of the other cycles in the computation of Tables 2 and 3. In later stages there were three increases, one mixed change, and three decreases. The decreases were in July 1953, in December 1974–February 1975, and in December 1959 (when some vault cash was allowed to count as member bank reserves).

It is very difficult to isolate the effect of these policy changes on relative contributions reported in Table 4 because the contributions are based on deviations from cyclical means, and a policy change affects the mean. Nonetheless, it is clear from examining the deviations that policy changes can explain well over one-half of the size of the reserve-ratio contribution in Table 4. Further, it is these policy changes that create the great dissimiliarity between results in Table 4 and those Cagan found for all eighteen cycles he examined from 1877 to 1953 [2, p. 26].

Though the original justification for treating the reserve ratio as one of three determinants of money-stock cycles was that it captured the actions of commercial banks (while high-powered money captured the actions of the Federal Reserve and the currency ratio those of the public) [2, p. 42; 3, pp. 50–3], the actions of the banks seem to have had little effect on either the cyclical or trend movements of the reserve ratio since 1948. This cannot be said of the actions of the Federal Reserve or the public; both have had substantial effect on the reserve ratio. Banks influence the reserve ratio only in their decisions regarding vault cash and excess reserves (though one can argue that the rapid growth in nonmember deposits since the late 1950s was the result of decisions of the banks, not of the public). Since November 1960, decisions about vault cash have been of minor importance because all vault cash of member banks counts as reserves. Excess reserves gradually decreased during the 1950s and 1960s, and while they had some procyclical movement, the size of that movement was small relative to the short-run fluctuations in the money stock [4, p. 117; 6, p. 129]. (The same cannot be said of free reserves, which had a much larger procyclical movement during the 1950s, but most of that movement was due to changes in member-bank borrowings, not in excess reserves [5, pp. 137–8; 6, p. 146]. Though it is determined in large part by commercial banks, member bank borrowing is included as part of high-powered money, not in the reserve ratio.)

4. INTERDEPENDENCE

Cagan realized that there might be interdependence between determinants. Looking at correlations between contributions of the determinants to five stages of specific cycles in the trend-adjusted rate of change in money stock, he found relatively

little correlation between the ratios, and small (but statistically significant at the 0.01 level when sixteen nonwar cycles, 1877–1953, were considered), negative correlations between high-powered money and the two ratios [2, p. 34]. As a result, he concluded that high-powered money had had a larger role, and the two ratios smaller roles than his preliminary results had given him [2, p. 41].

Given the results in Table 4, it is not surprising that the amount of interdependence has increased tremendously in the period since World War II. Table 6 shows correlation coefficients between contributions of the determinants to nine stages of specific cycles in the trend-adjusted rate of change in money stock, defined both as M1 and M2. Almost all correlation between high-powered money and the reserve ratio is due to changes in reserve requirements that were directly offset by the Federal Reserve with open market operations or indirectly by its failure to offset changes in other sources of high-powered money. Recomputing reserve-ratio-to-high-powered-money correlations in Table 6, using the twenty-nine stages in which there were no changes in legal reserve requirements, reduces the correlation to -0.01 in M2 results and to -0.02 in M1 results.

TABLE 6
CORRELATIONS BETWEEN CONTRIBUTIONS OF DETERMINANTS TO NINE STAGES OF SPECIFIC CYCLES IN TREND-ADJUSTED RATE OF CHANGE IN MONEY STOCK

	R_{hc}	R_{hr}	R_{cr}
Five Cycles, 1948–75, M2	−0.12	−0.83*	0.27
Five Cycles, 1948–75, M1	−0.12	−0.81*	0.31

NOTE: Based on forty-five observations.
*Significantly different from zero at the 0.01 level.

5. WHAT OTHER STUDIES HAVE DONE DIFFERENTLY

Some studies of money stock have not used the currency ratio as a money-stock determinant but have examined changes in the dollar amount of currency in circulation [4, 6]. This decision about how to treat currency reflects a difference in assumption about what behavior is neutral, which can substantially influence results. Use of a currency ratio implies the assumption that the numerator and denominator should change proportionally. As long as the change is proportional, the ratio remains constant and no change in money stock will be attributed to it. Use of dollar amounts implies the assumption that deposits and currency are separate components with the only link in their behavior being the fact that currency can be used as bank reserves.

The divergence of results that can be obtained by using a dollar-valued determinant rather than a ratio can be illustrated by a hypothetical example. Suppose demand deposits held by the public drop by 10 percent, but currency holdings of the public drop by only 5 percent. If the role of currency is examined in dollar terms, the change in currency will appear as a variable that dampens a decline in the money stock caused by other forces. This result appears because currency enters the money-stock process

in a dual role. It is counted dollar-for-dollar as money, but its numerically larger role is as a competing use of reserve funds. Thus the 5 percent decline in currency would release reserves to banks which could then engage in a multiple expansion of demand deposits.

If currency enters as a ratio, however, the currency-to-deposit ratio will rise. This will be interpreted as meaning that movements in currency were one of the forces causing the decline in the money stock. Use of a currency ratio in studying short-term fluctuations in the money stock means that any flows that would occur if the ratio remained constant are to be disregarded. These flows are considered to be caused by changes in money stock, and thus have no causal importance.

The procyclical movement in the currency ratio is due primarily to movements in the denominator rather than the numerator. This can be seen visually in Figure 1 which graphs actual and hypothetical currency ratios quarterly from 1947 through 1975. The denominator of the hypothetical ratio remains historical demand deposits, but the numerator is a trend movement of currency obtained from a fifteen-quarter moving average. The close similarity of short-run, cyclical movements indicates that little of that movement is caused by short-run variations in currency. Instead, it is due to fluctuations in demand deposits which were not reflected in currency movements. Those who do not use the currency ratio to capture the importance of the public's currency decisions, but who look at money stock as composed of two separate parts, deposits and currency, will be led to try to explain why deposits move cyclically. In explaining the cyclical movement of deposits, currency will not only play an unimportant role, but will tend to dampen cyclical fluctuations (e.g., [4, p. 103–17]).

In addition, results from Cagan's procedures are difficult to compare to results from approaches that statistically estimate a reduced-form equation. The numbers obtained

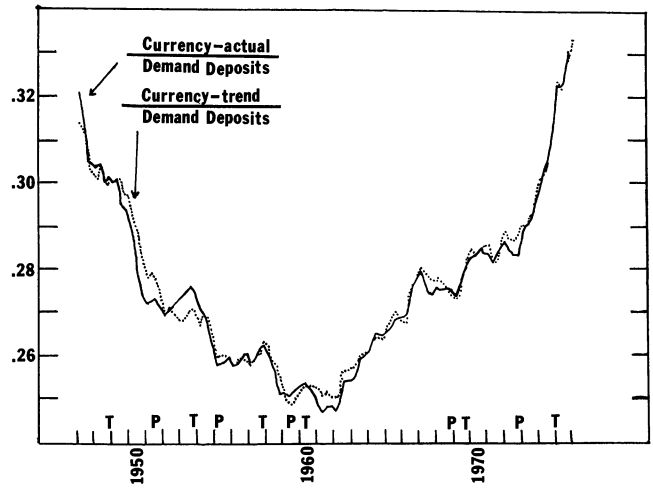

Fig. 1. Currency Ratios, 1947–75

in Table 4 cannot be used to test hypotheses or form confidence intervals. When Table 4 shows that the currency ratio contributes forty-seven to trend-adjusted rate of change in M2, this means that 47 percent of the mean deviation of cyclical M2 movements, isolated by procedures described above, would be eliminated if there had been no cyclical movement in currency ratio, other factors remaining the same. This is an arithmetic consequence that tells us nothing definite about behavior. It may, however, suggest hypotheses that might be tested using other procedures.

Finally, other studies have obtained different results because they have focused on short-term rather than cyclical money movements. Taking logarithms and differentiating with respect to time, as equation (2) does, yields percentage rates of change. An examination of short-term changes can begin by asking what factors cause the variation in these percentage rates. If one does not subtract cyclical means from data in Table 1 and does not sum these data by cycle, but instead used equation (3) to sum over the individual forty-one stages in Table 1, one finds that the contributions to money stock by determinant are fifty-eight for high-powered money, fourteen for currency ratio, and twenty-eight for reserve ratio. This procedure, and these results, seem to correspond more closely to other studies that have not found currency ratio to be important. The great difference between these numbers and those in Table 4 occurs because expressing variables as deviations from cyclical averages changes many values in Table 1 from positive to negative, and the sign of determinant is vital in computing contributions.

6. CONCLUDING COMMENTS

The procedure that Cagan used in his study involved the manipulation of an identity rather than a statistical testing of economic hypotheses. The frequency with which his work has been cited indicates that many have found this manipulation informative or suggestive. Results obtained from this procedure when it is used on more recent data seem less suggestive, in large part because a separation of money-stock determinants into high-powered money, reserve ratio, and currency ratio, as a method of capturing the influences of the monetary authority, the banking system, and the public, respectively, seems not to be a useful decomposition during the period since World War II. For example, most of the changes in the reserve ratio were caused by reserve requirement changes of the Federal Reserve, or by decisions by the public regarding the ratio of time to demand deposits it wished to hold. Changes in high-powered money can reflect a number of factors other than the actions of the Federal Reserve including decisions of banks to borrow reserves. As a result, the procedure used in this article seems to be mostly capturing offsetting movements and not movements that one could call sources of the cycles. Thus the procedure by itself seems to contribute little to an understanding of why money-stock cycles, highly and positively correlated with business activity, existed at all in a period in which the Federal Reserve claimed to be engaged in stabilizing activity.

SOURCES OF DATA

1. Money Stock. After 1959 data for both M1 and M2 are from "Historical Money Stock Data" (February 22, 1977, and April 14, 1978), a statistical release of the Federal Reserve System. From 1947 through 1958, data are from "Revision of the Money Stock," *Federal Reserve Bulletin*, December, 1970 (pp. 887–909) and June, 1964 (pp. 679–92). Prior to 1959, M2 was found by adding M1 to time deposits adjusted. Though Cagan used end-of-month data in computing changes in stages I, V, and IX [2, p. 325], I have used monthly averages.

2. High-Powered Money. This series was formed by adding member-bank reserves held at the Federal Reserve to currency. Sources were *Supplement to Banking and Monetary Statistics* (Board of Governors of the Federal Reserve System, 1962) and various issues of the Federal Reserve Bulletin. Data were seasonally adjusted using seasonal weights from the Federal Reserve Bank of Saint Louis.

3. Currency Ratios. These series were formed either by dividing currency held by the public by money stock or by demand deposits. Sources for these series are the same as in (1).

4. Reserve Ratios. Bank reserves were computed by subtracting currency held by the public from high-powered money. Some currency is held by banks that are not members of the Federal Reserve System; this procedure included it (as well as some items held by the U.S. Treasury). Deposits were computed by subtracting currency held by the public from money stock. Sources are as in (1) and (2).

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