Are the Preliminary Week-to-Week Fluctuations in M1 Biased?

COURTENAY C. STONE and JEFFREY B. C. OLSON

THE preliminary seasonally adjusted estimate for weekly M1 — the money stock consisting of currency in the hands of the public and net private demand deposits — released each Thursday afternoon by the Federal Reserve has become one of the most eagerly awaited, widely publicized, and closely watched of all economic statistics. Changes in stock prices, movements in interest rates, variations in the volume of trading on financial markets — even fluctuations in the foreign-exchange value of the U.S. dollar — are frequently cited as consequences of the public's reactions to the week-to-week changes reported for the money stock. The impact attributable to the publication of these weekly money numbers has been described, with only slight hyperbole, by one economist as follows:

> Each Thursday has become a Day of Judgement of anticipatory trembling over the latest Fed report on money supplies. Each set of weekly statistics is combed as heralding a new wave of the business cycle, a new round of inflation, a new course of stock prices, and a new state of the economy ahead. Civilization itself appears to hang in the balance.[1]

The attention devoted to these numbers recently motivated the Chairman of the Board of Governors of the Federal Reserve System to wish that "we could get away from the habit in this country of looking at those [money supply] figures every Thursday and assuming that the world is going up or down based on a weekly figure."[2]

The growing popularity of this "habit" is puzzling to many economists for a variety of reasons. First, and perhaps most important, week-to-week fluctuations in M1 are irrelevant for assessing the impact of money growth on employment, output and prices. Only the longer-run variations in M1 growth — over periods of several quarters or more — are generally considered to have significant effects on aggregate economic behavior. One-week growth in the money stock per se simply does not matter unless it can be used as a guide to the longer-term money stock movements.

Second, as the period decreases over which the money stock growth rates are calculated, the greater is the influence of purely random events on the individual growth rates — and the greater is the likelihood of obtaining misleading results when using these growth rates to estimate the longer-run M1 fluctuations. An illustration of this problem appears in Table I which shows the means and standard deviations for annualized short-run growth rates of preliminary seasonally adjusted M1 for the 1971-77 period. Comparison of the standard deviations, year by year, across the alternative short-run M1 growth rates indicates that the one-week growth rates are more volatile than the one-month growth rates, which, in turn, display greater variation than the two-month growth rates. This greater variation around the mean growth rate

Table I

Means and Standard Deviations for Preliminary Seasonally Adjusted Short-Run M1 Growth Rates: 1971-77

	One-Week Growth Rates		One-Month Growth Rates		Two-Month Growth Rates	
Period	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
1971	6.4%	25.2%	6.1%	6.5%	6.3%	5.5%
1972	7.5	24.1	8.0	4.9	7.5	3.2
1973	8.7	35.7	5.6	5.1	5.4	4.1
1974	5.2	29.8	4.9	4.5	5.1	3.0
1975	4.6	25.8	4.7	7.7	4.7	5.4
1976	5.0	26.9	5.6	5.2	5.2	3.3
1977	7.2	29.9	7.2	6.6	7.3	3.8

Sources: The preliminary M1 data series used for computing the one-week growth rates were obtained from the initial estimates published in the Federal Reserve Statistical Release H.6. The one- and two-month growth rates are from Alfred Broaddus and Timothy Q. Cook, "Some Factors Affecting Short-Run Growth Rates of the Money Supply," Federal Reserve Bank of Richmond *Economic Review* (November/December 1977), p. 4.

[1]Sidney Weintraub, "Wall Street's Mindless Affair with Tight Money," Challenge (January/February 1978), p. 35.

[2]G. William Miller, "Hearings," *Second Meeting on the Conduct of Monetary Policy*, U.S. Congress, Senate, Committee on Banking, Housing and Urban Affairs, 95th Cong., 2nd sess., April 25, 1978, p. 153.

demonstrates how the impact of random events, which tends to "wash out" over longer periods, can mislead those who want to use the short-run growth rates to estimate the longer-term growth in M1. For example, the preliminary rate of money growth for 1977 was about 7.2 percent regardless of which short-run money growth estimates are used. Yet, one-third of the week-to-week M1 growth rates during that year were either less than –22.7 percent or greater than 37.1 percent. This wider variation in the one-week growth rates makes it difficult to decipher the underlying longer-run trend growth in M1 using the weekly money data.

Finally, preliminary estimates of the money stock are subject to substantial revisions over an extended period of time after their initial public release. Comparison of the means and standard deviations for the finally revised one-week growth rates of seasonally adjusted M1 for 1971-77, shown in Table II, with the equivalent statistics for the preliminary one-week growth rates in Table I provides an initial indication of the impact of the money stock revision process. The average one-week M1 growth rates were revised upward for three of the seven years; four of the seven mean M1 growth rates declined as a consequence of these revisions. Moreover, the volatility displayed by the one-week growth rates was substantially reduced as a result of the revisions. Because of the sizable effect of the revision process on the initially published growth rates for seasonally adjusted M1, the preliminary one-week growth rates for M1 may provide unreliable estimates of the actual movement in the money stock *even on a week-by-week basis.* If the preliminary weekly money growth rates are biased, using them to estimate the longer-run growth in the money stock is even more troublesome.

The purpose of this article is to describe the nature of the bias that exists in using the preliminary money stock fluctuations to estimate the actual money stock movement on a week-to-week basis. As such, it investigates the extent to which the preliminary money stock estimates released each Thursday provide reliable information about the actual *weekly* growth in M1.

This article demonstrates that the most widely cited of the money estimates, those for preliminary seasonally adjusted M1, are generally unreliable guides to the actual weekly growth in the money stock. Therefore, whatever explains the popular mystique associated with the Thursday release of the weekly money estimate, it does not appear to be due to its usefulness in providing accurate information about the actual week-to-week growth in seasonally adjusted money.

Table II

Means and Standard Deviations for Finally Revised Seasonally Adjusted One-Week M1 Growth Rates: 1971-77

	One-Week Growth Rates	
Period	Mean	Standard Deviation
1971	6.2%	7.4%
1972	9.0	6.1
1973	5.6	9.1
1974	4.2	6.7
1975	4.5	11.5
1976	6.1	11.0
1977	7.5	9.3

Source: The finally revised M1 series incorporates all revisions up to, and including, those appearing in the September 21, 1978 Federal Reserve Statistical Release H.6.

Revising the Preliminary Money Stock Estimates

Although many economic data series remain virtually unchanged once they are collected and published, the money stock series are not among these. Exhibit I reproduces the first page of the Federal Reserve Statistical Release H.6 — the initial public source of the preliminary weekly money stock estimates — for Thursday, November 2, 1978 to show one example of how the revision process affects the weekly M1 numbers.

There are several points to consider in Exhibit I. First, although the H.6 release is dated November 2, the most recent weekly money stock figures shown are those for the week ending on Wednesday, October 25; the weekly money stock is reported with a lag of eight days. Second, the H.6 release contains estimates for five different definitions of the money stock, M1 through M5.[3] Because M1 is the most commonly cited money stock in the reports linking weekly money fluctuations to financial market activity, only M1 will be discussed in this article. Third, although financial analysts concentrate primarily on the behavior of the seasonally adjusted money stock, the H.6 release includes estimates for both seasonally adjusted (SA) and not seasonally adjusted (NSA) weekly M1. Both are stud-

[3]Beginning with the November 16, 1978 H.6 release, an additional money stock measure, M1+, is now being published.

Exhibit 1

A REPRODUCTION OF THE FEDERAL RESERVE STATISTICAL RELEASE H.6

MONEY STOCK MEASURES
In Billions of Dollars

For Immediate Release
Nov. 2, 1978

Date	M_1 Currency Plus Demand Deposits[1]	M_2 M_1 Plus Time Deposits at Commercial Banks Other Than Large CD's[2]	M_3 M_2 Plus Deposits at Nonbank Thrift Institutions[3]	M_4 M_2 Plus Large Negotiable CD's[4]	M_5 M_3 Plus Large Negotiable CD's[5]	M_1 Currency Plus Demand Deposits[1]	M_2 M_1 Plus Time Deposits at Commercial Banks Other Than Large CD's[2]	M_3 M_2 Plus Deposits at Nonbank Thrift Institutions[3]	M_4 M_2 Plus Large Negotiable CD's[4]	M_5 M_3 Plus Large Negotiable CD's[5]
	Seasonally Adjusted					Not Seasonally Adjusted				
1977 — SEPT.	333.0	795.1	1344.9	858.9	1408.7	331.1	791.3	1339.7	856.7	1405.1
OCT.	335.9	801.4	1357.9	867.8	1424.3	335.2	798.7	1353.0	867.1	1421.3
NOV.	336.2	805.4	1367.1	876.3	1438.0	338.4	802.8	1360.1	874.4	1431.7
DEC.	338.5	809.5	1376.1	883.5	1450.1	348.2	814.9	1377.5	890.9	1453.4
1978 — JAN.	341.7	815.9	1386.6	892.2	1462.9	347.5	820.6	1389.0	897.0	1465.4
FEB.	341.8	819.1	1393.1	898.5	1472.5	335.9	813.9	1386.0	890.8	1462.9
MAR.	342.9	822.6	1400.3	904.7	1482.3	338.2	821.1	1400.2	901.4	1480.5
APR.	348.5	830.3	1411.4	913.7	1494.9	350.9	836.6	1421.2	917.9	1502.6
MAY	350.6	835.2	1419.9	922.2	1506.9	345.3	833.6	1420.3	918.2	1505.0
JUNE	352.8	840.6	1429.8	927.3	1516.5	351.7	842.0	1435.2	928.3	1521.5
JULY	354.2	846.2	1440.9	933.6	1528.3	356.0	848.7	1447.9	936.0	1535.2
AUG.	356.7	853.5	1455.1	939.8	1541.4	354.2	850.8	1452.9	938.8	1541.0
SEPT.	360.9	r 862.4	r 1472.0	r 950.5	r 1560.1	358.8	r 858.4	r 1466.4	r 948.7	r 1556.7
WEEK ENDING:										
1978 — AUG. 30	355.5	854.3		940.9		350.0	848.0		936.8	
SEPT. 6	361.4	861.3		948.8		360.3	859.4		948.7	
13	360.5	861.7		950.3		362.4	861.9		952.1	
20	361.1	862.6		951.8		360.3	858.8		949.5	
27	361.8	864.1		951.7		353.0	852.6		943.3	
OCT. 4	360.2	864.5		951.4		360.5	862.5		953.1	
11	r 364.3	869.4		955.8		r 364.9	868.6		958.4	
18 P	r 364.3	r 869.3		r 956.3		r 364.8	r 868.0		r 957.7	
25 P	358.9	865.7		954.3		356.1	860.2		951.0	

[1]Includes (1) demand deposits at all commercial banks other than those due to domestic commercial banks and the U.S. Government, less cash items in the process of collection and F.R. Float; (2) foreign demand balances at F.R. Banks; and (3) currency outside the treasury, F.R. Banks and vaults of all commercial banks.

[2]Includes, in addition to currency and demand deposits, savings deposits, time deposits open account, and time certificates of deposits other than negotiable time certificates of deposit issued in denominations of $100,000 or more by large weekly reporting commercial banks.

[3]Includes M_2, plus the average of the beginning and end of month deposits of mutual savings bank, savings and loan shares, and credit union shares.

[4]Includes M_2, plus negotiable time certificates of deposit issued in denominations of $100,000 or more.

[5]Includes M_3, plus negotiable time certificates of deposit issued in denominations of $100,000 or more.

P — Preliminary; R — Revised

ied in this article. Fourth, the two most recent weeks' numbers are clearly designated as preliminary (as indicated by the "P" following their dates) to show that they are still being checked for processing errors. Finally, the previous two weeks' M1 numbers have been revised to correct an error detected since the previous H.6 release was published.

Although processing errors in the estimation of M1 occur irregularly, there are two standard revisions

that regularly affect the initially reported M1 numbers — benchmark revisions and changes in the seasonal adjustment factors.[4] Benchmark revisions in the money stock occur because, unlike the member bank data on vault cash and demand deposits which are available to the Federal Reserve each week, data for the majority of nonmember banks are reported to the Federal Reserve infrequently and then only for a one-week period.[5] Because weekly data for the periods between the nonmember banks' reporting dates must be estimated to obtain the preliminary weekly money figures, the money stock numbers are "subsequently revised as more information becomes available, in order to 'benchmark' the estimated weekly data to the few weeks of actual nonmember bank data."[6] As a consequence of the correction of processing errors and incorporation of the benchmark changes, the preliminary not seasonally adjusted M1 estimates are revised into final estimates of the NSA money stock over a period of months after their initial publication. These "final" NSA M1 estimates are subject to yet further revision over a period of years whenever previously undetected processing errors are discovered or definitional changes occur.[7]

The seasonally adjusted money stock is obtained by separately adjusting the currency and demand deposit components of NSA M1 to take account of seasonal patterns in money holdings.[8] Therefore, in addition to being subject to benchmark revisions and correction of processing errors (which change the underlying NSA money stock components), the preliminary SA money stock is also subject to revision if the initial seasonal factors used to obtain the seasonally adjusted M1 series are found subsequently to be inaccurate. The process of "firming up" the seasonal factors takes at least four years after the initial SA money stock numbers are publicly released.

The money stock revision process represents a continuously ongoing attempt to produce more accurate money stock data. Consequently, the finally revised money stock numbers are not necessarily "final". They are always subject to the possibility of additional future revision. However, if the revision process produces more reliable money stock data by correcting all known sources of error, the most recently revised money stock figures can be thought of as the best current estimates of the actual or "true" money stock. In the following discussion, the actual, or underlying, money stock is defined as the finally revised money stock incorporating all revisions up to, and including, those published in the September 21, 1978 Federal Reserve Statistical Release H.6, which contains the most recent benchmark revisions.

Measuring the Reliability of the Preliminary Weekly Fluctuations in M1

Because the weekly money stock estimates undergo a series of revisions after their initial release, questions concerning the reliability of the preliminary fluctuations in weekly M1 naturally arise. How closely do the preliminary weekly changes in M1, as derived from the H.6 releases, conform to the actual money stock changes after incorporating all corrections and revisions? Do the growth rates computed from the initially reported M1 numbers provide reliable estimates of the actual weekly growth in the money stock?

The evidence from the 1970s suggests that the preliminary money stock estimates are significantly affected by the revisions that occur after they first appear in the H.6 releases. During the 1971-77 period, over 99 percent of the preliminary weekly money numbers were altered by subsequent revisions. The impact of these revisions on the week-to-week fluctuations in M1 can be determined by comparing the preliminary weekly change (or rate of growth) with the final change (or rate of growth) in M1 after all revisions have been incorporated. Table III presents summary statistics for this comparison using the NSA weekly money stock series for the 1971-77 period. Table IV presents similar results for the SA money stock. The absolute value, rather than the arithmetic value, of the difference between the final and the preliminary changes (ΔM) or annual rates of growth ($\%\Delta M$) is used to focus on the magnitude of the discrepancy between the initially reported weekly changes or growth rates in the money stock and their finally revised values.

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[4] In this article, the term "processing errors" is used to indicate all revisions except benchmark revisions and changes due to reestimation of seasonal factors.

[5] Currently, FDIC-insured nonmember bank data are reported four times each year while data for noninsured nonmember banks are reported twice each year. For detailed explanations of the benchmark revision process, see Darwin Beck and Joseph Sedransk, "Revision of the Money Stock Measures and Member Bank Reserves and Deposits," Federal Reserve *Bulletin* (February 1974), pp. 81-89, and Richard W. Lang, "Benchmark Revisions of the Money Stock and Ranges of Money Stock Growth," this *Review* (June 1978), pp. 11-19.

[6] Lang, "Benchmark Revisions," p. 11.

[7] Recently, for example, the money stock was revised back to mid-1975 to correct a bias discovered in the cash items adjustment. See the September 21, 1978 Federal Reserve Statistical Release H.6.

[8] For extended treatment of the seasonal adjustment of the money stock, see Thomas A. Lawler, "Seasonal Adjustment of the Money Stock: Problems and Policy Implications," Federal Reserve Bank of Richmond *Economic Review* (November/December 1977), pp. 19-27.

Table III

Means and Standard Deviations for Absolute Differences Between Finally Revised and Initially Reported Weekly Not Seasonally Adjusted M1 Fluctuations: 1971-77

	NSA M1 Changes (billions of dollars) Final ΔM1 minus Preliminary ΔM1		NSA M1 Growth Rates (annual percentage rates) Final %ΔM1 minus Preliminary %ΔM1	
Period	Mean Absolute Difference	Standard Deviation	Mean Absolute Difference	Standard Deviation
1971	$ .38	$ .32	8.6%	7.4%
1972	.36	.30	7.5	6.3
1973	.35	1.25	6.9	24.9
1974	.40	.40	7.5	7.5
1975	.34	.28	6.2	5.0
1976	.35	.32	5.9	5.3
1977	.26	.26	4.1	4.2
1971-77	.35	.55	6.7	10.9

Table IV

Means and Standard Deviations for Absolute Differences Between Finally Revised and Initially Reported Weekly Seasonally Adjusted M1 Fluctuations: 1971-77

	SA M1 Changes (billions of dollars) Final ΔM1 minus Preliminary ΔM1		SA M1 Growth Rates (annual percentage rates) Final %ΔM1 minus Preliminary %ΔM1	
Period	Mean Absolute Difference	Standard Deviation	Mean Absolute Difference	Standard Deviation
1971	$ .74	$ .67	17.1%	15.7%
1972	.83	.66	18.1	14.3
1973	1.16	1.16	23.3	23.7
1974	1.17	.81	21.8	15.1
1975	.95	.64	16.9	11.5
1976	1.03	.79	17.6	13.5
1977	1.28	.83	20.6	13.2
1971-77	1.02	.82	19.4	15.7

Comparison of the results shown in Tables III and IV yields two general conclusions about the effects of the revision process on the initially published week-to-week fluctuations in M1. First, the mean absolute differences are sufficiently large enough, given their standard errors, to be significantly different from zero.[9] Therefore, the revisions in the money stock series have had a significant impact on the initially reported weekly movements in M1.

Second, the money stock revisions have had a more substantial impact on the SA money stock fluctuations than on the NSA money stock movements. The mean absolute difference between the final and the preliminary weekly changes or rates of growth in SA M1 ranges from approximately two to five times the equivalent difference in NSA M1, depending upon the year of comparison.

For the 1971-77 period as a whole, the mean absolute difference between the final and preliminary week-to-week changes in SA M1 was $1.02 billion; between the final and preliminary weekly growth rates, the mean absolute difference was 19.35 percent. Thus, during this period, the final weekly change in SA M1 differed in absolute value from its preliminary estimate by slightly more than $1 billion, on average, each week. Similarly, the final weekly growth in SA M1 varied, on average, about 19 percent each week from the preliminary growth rate.

Over the same period, these differences for the NSA money stock fluctuations were roughly one-third as large. The mean absolute difference for week-to-week changes in NSA M1 was $.35 billion; for weekly growth rates, it was 6.67 percent.

Another assessment of the reliability of the preliminary changes reported for M1 can be obtained from the estimation of the following equation:

$$(1) \qquad \Delta M1_t = \alpha_0 + \alpha_1 \Delta M1P_t$$

where $\Delta M1_t$ designates the actual change in M1 from week t-1 to week t based on the most recently revised M1 data and $\Delta M1P_t$ designates the preliminary weekly change derived from the weekly M1 numbers initially reported for week t-1 and week t. If the preliminary week-to-week changes in M1 ($\Delta M1P$) provide unbiased estimates of the underlying changes in the money stock ($\Delta M1$), we would expect the estimates to show that $\alpha_0 = 0$ and $\alpha_1 = 1$, or, alternatively, that $\Delta M1_t = \Delta M1P_t$.

A similar test for growth rates can be obtained by estimation of the equation:

$$(2) \qquad \%\Delta M1_t = \beta_0 + \beta_1 \%\Delta M1P_t$$

where $\%\Delta M1_t$ designates the actual annualized percentage growth rate in M1 from week t-1 to week t based on the most recently revised M1 data and $\%\Delta M1P_t$ designates the preliminary annualized percentage growth rate derived from the weekly M1

[9]Standard errors are obtained by dividing the standard deviations by the square root of the number of weeks in the year. The mean absolute differences are all significantly greater than zero at the 5 percent level.

numbers initially reported for the respective weeks.[10] Again, if the preliminary growth rates yield unbiased estimates of the underlying growth rates, we would expect the estimates to show that $\beta_0 = 0$ and $\beta_1 = 1$, or, alternatively, that $\%\Delta M1_t = \%\Delta M1P_t$.

Finally, if the preliminary changes in M1 are to be useful in estimating the actual changes in the money stock, the closer these two variables are related, the better. The $\bar{R}^2$ statistic calculated from the estimated relationship represents one measure of the closeness between the preliminary and the actual fluctuations in M1.[11] Each $\bar{R}^2$ shows, approximately, the proportion of the total variation in the actual M1 fluctuations that is associated with the fluctuations in the preliminary M1 series. To the extent that the initially published M1 fluctuations closely parallel the actual movement in the money stock after all computational errors have been corrected and the necessary revisions have been incorporated, the $\bar{R}^2$ would be expected to have a value close to one. If the preliminary M1 fluctuations do not closely anticipate the actual changes in M1 after all necessary adjustments have taken place, the $\bar{R}^2$ will have a value closer to zero. Thus, the closer the value of the $\bar{R}^2$ is to one for the estimated relationship, the closer these variables are correlated.

Assessing the Reliability of the Preliminary Not Seasonally Adjusted M1 Fluctuations

Table V shows the results obtained from estimating the above relationships between preliminary and final weekly NSA M1 fluctuations over the period 1971-77. What do these tell us about the reliability of the preliminary changes reported for weekly NSA M1? First, the preliminary weekly changes and rates of growth in the initially reported NSA M1 appear to provide reasonably reliable estimates of the actual weekly changes occurring in the NSA money stock — despite the existence of various processing errors and benchmark revisions. The estimated coefficients for NSA M1 over the entire 1971-77 period, displayed in the next to the last row in Table V, show that, if the one-week change in NSA M1 was initially reported as $5 billion, for example, after all processing errors are corrected and benchmark revisions have been made, the actual change would be estimated to be $5.04 billion. Similarly, if the one-week growth in NSA M1 was initially reported as 10 percent, for example, the estimate for the actual rate of growth in NSA M1 is 9.82 percent.[12]

Table V

Tests for Bias in the Preliminary One-Week Not Seasonally Adjusted M1 Fluctuations

	Equation 1: $\Delta M1_t = \alpha_0 + \alpha_1 \Delta M1P_t$			Equation 2: $\%\Delta M1_t = \beta_0 + \beta_1 \%\Delta M1P_t$		
Period	α_0	α_1**	$\bar{R}^2$	β_0	β_1**	$\bar{R}^2$
1971	.00	1.01	.95	.02	.98	.95
1972	.08	1.03	.97	1.58	1.00	.97
1973	– .11	.94	.79	–2.08	.93	.78
1974	– .07	1.04	.97	–1.36	1.04	.97
1975	– .01	1.03	.98	– .19	1.03	.98
1976	.04	1.02	.99	.60	1.02	.99
1977	.03	1.00	.99	.50	.99	.99
1971-77	– .01	1.01	.96	– .18	1.00	.96
Unbiased Values	0.00	1.00	1.00	0.00	1.00	1.00

**All α_1 and β_1 coefficients are significantly different from zero at the 5 percent level.

#Denotes α_0 or β_0 coefficient significantly different from zero at the 5 percent level.

* Denotes α_1 or β_1 coefficient significantly different from one at the 5 percent level.

The reason that the preliminary changes and growth rates in the NSA M1 so closely match the actual changes and growth rates is that the estimated coefficients do not differ significantly from those values necessary to assure that the initially reported fluctuations in M1 are unbiased (repeated in the bottom row of Table V). All of the α_0 and β_0 estimates are numerically close to zero and none is significantly different from zero statistically. Similarly, all of the α_1 and β_1 estimates are numerically close to one and none is significantly different from one. Overall, the results indicate that the week-to-week changes between the revised NSA M1 numbers remain essentially the same as those initially calculated from the preliminary NSA money stock numbers.

The $\bar{R}^2$ statistics for the NSA weekly money stock relationships over the 1971-77 period indicate that the initial changes and growth rates reported for NSA M1 closely track the actual movements in NSA M1 despite the existence of processing errors and benchmark revisions. Roughly 96 percent of the variation in the actual week-to-week changes in NSA M1 are anticipated by the movement in the preliminary

[10] $\%\Delta M1_t = 5200\ (\Delta \ln M1_t)$ and $\%\Delta M1P_t = 5200\ (\Delta \ln M1P_t)$.

[11] The $\bar{R}^2$ statistic is the coefficient of determination adjusted for degrees of freedom.

[12] $\Delta M1 = -.01 + 1.01(5) = 5.04$; $\%\Delta M1 = -.18 + 1.00(10) = 9.82$.

changes reported for NSA M1 for the 1971-77 period as a whole. Similarly, the fluctuations in the initially reported annualized growth rates for NSA M1 account for 96 percent of the actual movement in the rate of growth of NSA M1 over the entire period. Year-by-year analysis confirms the closeness of the relationship between the initial and the final NSA M1 fluctuations. These results indicate that the preliminary changes and growth rates reported in NSA M1 provide reasonably accurate estimates of the actual changes occurring in the money stock.

On the Reliability of the Preliminary Seasonally Adjusted M1 Fluctuations

The results from estimating the relationships for changes and rates of growth between preliminary and final seasonally adjusted M1, as shown in Table VI, indicate that the initially published SA money fluctuations do not provide accurate estimates of the actual movements occurring in the money stock after all revisions have been made. Using the results for the entire 1971-77 period, presented in the next to last row of Table VI, if the preliminary change in SA M1 was $5 billion, for example, the estimate of the actual change that will be reported, after all processing error corrections, benchmark revisions and seasonal factor changes have been incorporated, is only $1.12 billion. Similarly, if the initially reported growth rate in SA M1 was 10 percent, for example, the estimate for the actual rate of growth in weekly SA M1 is only 6.73 percent.

What accounts for the wide disparity between the preliminary changes and the final changes in the SA money stock? First, compare the estimated coefficients for the SA money stock relationships in Table VI with the values necessary to assure their reliability as shown in the bottom row of Table VI. Not only are the various estimates of α_0 and β_0 numerically greater than zero, they are all statistically significantly different from zero. This means that, even if the preliminary M1 change was reported as zero, the estimate of actual change that will be reported after all revisions have been made is not zero, but rather ranges from $.18 to $.40 billion, depending upon the year of comparison, with an estimate of $.27 billion for the period as a whole. Similarly, if the weekly growth rate was initially announced as zero percent (that is, the preliminary SA money stock was unchanged from the previous week), the estimate is that M1 had actually grown by more than 5 percent for that week, using the results for the 1971-77 period. Second, none of the α_1 and β_1 estimates is close to one numerically and all

Table VI

Tests for Bias in the Preliminary One-Week Seasonally Adjusted M1 Fluctuations

	Equation 1: $\Delta M1_t = \alpha_0 + \alpha_1 \Delta M1P_t$			Equation 2: $\%\Delta M1_t = \beta_0 + \beta_1 \%\Delta M1P_t$		
Period	α_0	α_1**	$\bar{R}^2$	β_0	β_1**	$\bar{R}^2$
1971	.24 #	.12 *	.13	5.48 #	.11 *	.14
1972	.40 #	.08 *	.07	8.42 #	.07 *	.06
1973	.24 #	.10 *	.13	4.71 #	.10 *	.13
1974	.19 #	.12 *	.29	3.53 #	.12 *	.29
1975	.18 #	.28 *	.39	3.17 #	.28 *	.38
1976	.29 #	.24 *	.34	4.89 #	.24 *	.34
1977	.38 #	.21 *	.44	5.99 #	.21 *	.44
1971-77	.27 #	.17 *	.28	5.13 #	.16 *	.25
Unbiased Values	0.00	1.00	1.00	0.00	1.00	1.00

**All α_1 and β_1 coefficients are significantly different from zero at the 5 percent level.

# Denotes α_0 or β_0 coefficient significantly different from zero at the 5 percent level.

* Denotes α_1 or β_1 coefficient significantly different from one at the 5 percent level.

are significantly less than one statistically. Thus, it is clear that the final changes (or growth rates) in weekly SA M1 are only slightly related to the preliminary changes (or growth rates).

The relatively poor correspondence between the preliminary and the final fluctuations in SA M1 is also shown by the value of the $\bar{R}^2$ statistics for the relationships which range from .06 to .44, depending upon the year of comparison. Only about 28 percent of the actual fluctuations in the changes in M1, and only 25 percent of the actual movement in M1 growth rates, are associated with the movements in the respective preliminary SA money stock estimates over the entire period. Put somewhat differently, more than 70 percent of the actual variations in weekly SA M1 changes and growth rates are *not* directly related to the variations in the preliminary M1 estimates for the 1971-77 period as a whole.

Since the seasonal adjustment process requires at least four years before the seasonal factors are considered final, only the earlier years, 1971-73, can be considered "fully" revised for seasonal purposes. Thus, it can be argued that the more recent of these $\bar{R}^2$ statistics are misleadingly high — that the finally revised changes and growth rates in SA M1 are even less closely related to the preliminary SA M1 movements than these $\bar{R}^2$ estimates indicate. Note that the

$\bar{R}^2$ statistics for the earlier years are the lowest in Table VI. The SA M1 estimates for the later years, 1974-77, are still undergoing seasonal revisions and will continue to do so for several more years. Therefore, the $\bar{R}^2$ value shown in Table VI for each of these later years are likely to be reduced when additional revisions occur. Consequently, the values of $\bar{R}^2$ shown for the later years, and for the 1971-77 period taken as a whole, probably overstate the closeness of the relationship between the initial movements and the finally revised SA M1 fluctuations.

Why are the preliminary weekly SA M1 fluctuations unreliable while the preliminary NSA M1 changes accurately forecast the actual week-to-week changes in the NSA money stock? One approach to answering this question is to assess the importance of the different factors which cause the revisions in the preliminary money stock numbers. The preliminary SA M1 numbers are affected by the same processing errors and benchmark revisions that affect the preliminary NSA M1 numbers. In addition, they are affected by revisions of the seasonal factors. Since the preliminary NSA M1 fluctuations do not generally appear to be unreliable, the problem with the initial SA M1 numbers apparently is created by the revisions produced in reestimation of seasonal factors.

The differential impact of processing errors and benchmark revisions, compared to those errors resulting from reestimation of seasonal factors, can be determined by analyzing the error associated with using the preliminary rate of growth in weekly SA M1 as an estimate of the actual rate of growth in the SA money stock. Defining the "estimation error" to be the difference between the actual and the preliminary weekly rates of growth, the estimation error for SA M1 can be shown to equal the sum of the estimation errors for NSA M1 and the seasonal adjustment factors. Analysis of these errors for the 1971-77 period shows that the estimation error associated with the preliminary weekly growth rates in the seasonal factors accounts for approximately 70 percent of the estimation error in SA M1 growth rates.[13] The preliminary weekly SA M1 fluctuations provide generally unreliable guides to the movement in the actual money stock for any given week because the reestimation of seasonal factors introduces considerably more erratic revisions than do the correction of reporting errors and benchmark revisions.

Conclusion

The week-to-week fluctuations in the preliminary seasonally adjusted M1, as reported each Thursday by the Federal Reserve, provide biased and generally unreliable information about the underlying weekly growth in the seasonally adjusted money stock. Earlier studies have commented on this problem for the preliminary monthly and quarterly seasonally adjusted money stock estimates.[14] Moreover, the Federal Reserve is sufficiently troubled by the lack of correspondence between the preliminary and actual money growth rates that it has recently established a committee to study the seasonal adjustment process.

Economists, by and large, have tended to ignore this issue because these extremely short-run variations in money are irrelevant for assessing the impact of money growth on employment, output and prices. It is only the longer-run fluctuations in money growth — over a period of several quarters or more — that generally are considered to influence these economic variables.

The unreliability of the preliminary weekly growth rates in the seasonally adjusted money stock only poses a problem if financial market traders and monetary policy authorities believe these rates accurately portray the underlying longer-term growth in money. Whatever explains the current fascination with the preliminary week-to-week fluctuations in the seasonally adjusted money numbers, it clearly does not result from their usefulness in detecting the actual week-to-week growth in the seasonally adjusted money stock.

[13] If ESAM1, ENSAM1, and ESF represent the estimation errors for SA M1, NSA M1, and the seasonal factors, respectively, it can be shown that ESAM1 = ENSAM1 + ESF. Consequently, VAR(ESAM1) = VAR(ENSAM1) + VAR (ESF) + 2 COV(ENSAM1, ESF). For the 1971-77 period, the latter equation had the following values: 623.7 = 164.4 + 556.6 + 2(−48.7).

[14] See, for example, William Poole and Charles Lieberman, "Improving Monetary Control," *Brookings Papers on Economic Activity*, (2: 1972), pp. 293-335; Report of the Advisory Committee on Monetary Statistics, "Improving the Monetary Aggregates," Board of Governors of the Federal Reserve System (Washington, D.C., 1976); Alfred Broaddus and Timothy Q. Cook, "Some Factors Affecting Short-Run Growth Rates of the Money Supply," Federal Reserve Bank of Richmond *Economic Review* (November/December 1977), pp. 2-18; Herbert M. Kaufman and Raymond E. Lombra, "Short-Run Variations in the Money Stock," *Southern Economic Journal* (April 1977), pp. 1515-27; and Robert D. Laurent, "Effects of Seasonal Adjustment on the Money Stock," Federal Reserve Bank of Chicago *Economic Perspective* (September/October 1978), pp. 12-17.