THE BEHAVIOR OF THE M1 DEMAND FUNCTION IN THE EARLY 1980s

Robert L. Hetzel

Introduction

Since the last half of 1982, the rate of inflation has been below the rate that would have been predicted on the basis of the historical relationship between the rate of growth of M1 and the rate of inflation. This fact indicates that a rightward shift in the public's M1 demand function has occurred. Two alternative explanations of the nature of this shift are exposited in the first part of this article. Both explanations assume that the shift is associated with the deregulation of the financial system in the early 1980s. One explanation assumes that there was a onetime permanent change in the character of the public's M1 demand function. The other assumes that shifts will occur in the public's M1 demand function while the public adjusts to the deregulation of the financial system; however, after this adjustment is completed, the M1 demand function will reassume its pre-1980s characteristics.

The breakdown of the prohibition of the payment of interest on the checkable deposits of consumers has been associated with the introduction of various kinds of interest-bearing transactions accounts, known as other checkable deposits (OCDs). The first explanation offered for the recent behavior of the public's M1 demand turns on the fact that M1 now includes instruments suitable for saving, as well as for effecting transactions. In the spirit of this first explanation, it is conjectured that the public's M1 demand function has come to resemble permanently its demand function for M2 as formerly defined, which included savings, as well as transactions, balances. (This explanation is suggested by Friedman and Schwartz (1983/1984) and is referred to below as the Friedman/Schwartz hypothesis.) The second explanation offered turns on the fact that the new interest-bearing checkable deposits require minimum balances. In the spirit of the second explanation, it is conjectured that consumers, in the process of establishing new OCD accounts, make onetime transfers of funds from savings accounts in order to satisfy these minimum balance requirements. (This explanation is suggested by Cook and Rowe (1984) and is referred to below as the initial balance hypothesis.)

Both of these hypotheses predict a rightward shift in the public's M1 demand function in the early 1980s. It is, therefore, not possible currently to use the behavior of the public's real M1 balances in order to discriminate between them. With the passage of time and the subsidence of new deregulation affecting transactions balances, their implications for the behavior of the public's real M1 balances diverge. This latter fact is exploited below in order to make two sets of predictions of inflation for 1985, given an assumption about the rate of growth of M1 and given the assumption that the rate at which new OCDs are being introduced falls to a low level sustainable in the long run. Given the validity of this latter assumption, these contrasting predictions of inflation should offer evidence during 1985 useful in discriminating between the two hypotheses discussed here and, therefore, useful in assessing the contemporaneous character of the public's M1 demand function.

Two Alternative M1 Demand Functions

Especially after the nationwide introduction of interest-bearing NOW accounts in January 1981, M1 has comprised deposits suitable for saving as well as for effecting transactions. In this respect, M1 is now similar to M2 as defined prior to January 1980.[1] The choice of an M1 demand function that takes account of the current presence in M1 of interest-bearing

[1] In 1980, M1 was redefined to include the various new kinds of interest-bearing checkable deposits offered to consumers, NOW and ATS accounts and credit union share drafts. In January 1983, Super NOW accounts were authorized and added to the definition of M1. Also in 1980, the monetary aggregate M2 was redefined. Before 1980, M2, in addition to currency and demand deposits, comprised savings and small time deposits of banks plus time certificates of deposits other than the large negotiable certificates of deposit of large banks. After 1980, small time and savings deposits at depository institutions other than banks, money market mutual fund shares, and overnight Eurodollar deposits and overnight repurchase agreements were added to the definition of M2.

checkable deposits is motivated by a suggestion of Milton Friedman and Anna Schwartz (1983/1984). Friedman and Schwartz have contended that the construction of a money series with consistent economic properties is better achieved by splicing the recent M1 time series, which includes interest-bearing checkable deposits, with the historical time series for old M2, rather than with the historical time series for M1, which excludes interest-bearing deposits.

The relationship of a particular definition of money to macroeconomic variables like the expenditure of the public and the level of market rates of interest is summarized by a money demand function. The introduction into M1 of instruments suitable for saving can reasonably be conjectured to have altered the parameters that characterize the M1 demand function in a way that moves them toward the values of the parameters that characterize the old M2 demand function. In particular, it is plausible that the current demand function for M1 would exhibit, relative to its pre-1981 behavior, a lower trend rate of decline in the demand for M1 and higher interest rate and income elasticities of demand for M1. If this conjecture is correct, the characteristics of the public's current M1 demand function probably lie in between those of the pre-1981 M1 demand function and those of the former old M2 demand function.[2] With the passage of time, economists will be able to estimate the characteristics of the current M1 demand function with data that start in January 1981. At present, not enough time has elapsed in order to make this estimation feasible. Consequently, in order to give the Friedman/Schwartz hypothesis content, the somewhat arbitrary decision is made that the introduction of interest-bearing checkable deposits into the definition of M1 has caused the public's current M1 demand function to become identical to its former old M2 demand function.

In the above spirit, the following simple empirical evaluation is performed in this article. A money demand regression equation is estimated that highlights the relationship between the rate of growth of the money supply and inflation. When this regression is estimated through the 1970s with M1 and simulated for the early 1980s with M1, inflation is overpredicted. When this regression is estimated through the 1970s with old M2, however, and then simulated for the early 1980s with M1, inflation is reasonably well predicted. These results provide empirical support for the Friedman/Schwartz hypothesis.

These same results, however, are also consistent with the initial balance hypothesis about the rightward shift in M1 demand. This hypothesis emphasizes the transfer of funds from savings accounts to meet minimum balance requirements assumed to accompany the opening of new OCD accounts. As long as the transitional period persists during which the public is opening new OCD accounts in response to deregulation, the public's demand for real M1 balances will be unusually strong. After this transitional period, however, the public's M1 demand should return to normal. The relationship that existed prior to the 1980s between the rate of growth of M1 and the rate of inflation should again serve as a basis for predicting the rate of inflation.

Consequently, as pointed out in the introduction, after this transitional period, predictions of inflation will differ depending upon the validity of the Friedman/Schwartz or initial balance hypotheses. Again, these hypotheses are that the public's M1 demand function has come to resemble permanently its former old M2 demand function or, alternatively, that the public's M1 demand function will reassume its previous characteristics once consumers have had time to adjust to the removal of interest-rate ceilings. On the basis of these different hypotheses, two divergent sets of predictions for inflation are made for 1985. The actual behavior of inflation in 1985 should, therefore, aid in discriminating between these hypotheses. Before these predictions are presented, the form of the money demand regression equations used to predict inflation is discussed. The ability of these regression equations to predict, recent inflation is also described.

Estimating Money Demand Functions

Money demand regression equations usually employ the ratio of nominal money to the price level as the dependent variable. Entering these two variables as a ratio, however, constrains the functional form very considerably. A less constraining functional form is employed here that makes the price level the dependent variable, while a distributed lag on present and past money becomes an independent variable, along with the real expenditure of the public and an

[2] Current M1 does not include the time and savings deposits at commercial banks that were in old M2 (although it does include some deposits at thrift institutions that were not included in old M2). Also, the introduction of MMDAs decreases the attractiveness of OCDs as savings vehicles. On a priori grounds, it appears that old M2 served as a vehicle for saving to a greater extent than M1 does now. This line of reasoning suggests that the characteristics of the contemporaneous M1 demand function lie in between the former M1 and former old M2 demand functions.

interest rate. A similiar functional form was originally used by Harberger (1963) and more recently has been advanced by Laidler (1982, chap. 2), Fama (1982), and Coats (1982). A discussion of this form of money demand regression equation is presented in the preceding article in this Review, "A Monetarist Money Demand Function," and in Hetzel (1984).

The regression equation is shown below in first-differenced form. P is the price level; R the nominal rate of interest; Y real expenditure of the public; M nominal money; and N population. Also, A is the first difference operator; ln the natural logarithm; and u an error term. The trend rate of growth of the demand for money is a, while the respective sums of the b_i and c_i are the elasticity of the demand for real money balances with respect to the nominal rate of interest and real income, respectively. Regression equation (1) is estimated under the assumption that nominal money, M, is given. The behavior of the price level, P, therefore, determines the behavior of real money balances.

$$(1) \quad \Delta \ln P = a + \sum_{i=0}^{-n1} b_i \Delta \ln R_i - \sum_{i=0}^{-n2} c_i \Delta \ln (Y/N)_i + \sum_{i=0}^{-n3} d_i \Delta \ln (M/N)_i + u$$

The estimation employs first differences of the natural logarithms of quarterly average observations, multiplied by 400. Equation (1) then represents a regression of the annualized quarterly inflation rate on a constant and on contemporaneous and lagged annualized quarterly percentage changes in the nominal rate of interest, in real expenditure per capita, and in nominal money balances per capita. The interest rate is the 4-6 month commercial paper rate. Real expenditure is gross domestic purchases in 1972 dollars.[3] Estimation is by ordinary least squares over the interval from 1952Q1 to 1979Q4.[4] The estimation results using M1 are displayed in Table I in a form that shows the sum of the estimated distributed-lag coefficients.[5]

The estimated constant term indicates a trend rate of decrease in the demand for M1 of about 2 percent per year. The sum of the estimated coefficients on the interest rate terms indicates a small, but statistically-significant, interest elasticity of the demand for M1. The sum of the estimated coefficients on the real expenditure terms indicates a real expenditure or income elasticity of the demand for M1 of about .5.

Table I

REGRESSION OF INFLATION ON M1 GROWTH

Δln P	constant	Δln R	Δln Y	Δln M1
	2.19	.045	−.55	.97
	(.40)	(.013)	(.15)	(.10)

Range = 1952Q1 to 1979Q4 NOB = 111

NOV = 25 RSQ = .48 SER = 1.44

D-W = 2.18

Notes: M1 is M1; R the 4-6 month commercial paper rate; Y gross domestic purchases in 1972 dollars; P the implicit gross domestic purchases deflator. M and Y ore divided by the total population of the United States including armed forces overseas. Δ is a first difference operator; ln the natural logarithm. NOB is the number of observations; NOV the number of variables estimated; RSQ the corrected R-squared; SER the standard error of the regression equation; D-W the Durbin-Watson statistic. First-differenced variables are multiplied by 400. Estimation uses simple distributed lags. The sum of the estimated coefficients is shown, with the standard error of the sum in parentheses.

R comprises 6 contemporaneous and lagged values; Y, 7 such values; and M1, 10 such values. Estimation performed with Cochrane-Orcutt procedure. First-order autoregressive parameter estimated as .41 with standard error of .08.

a Gross domestic purchases (GDP) equals gross national product (GNP) less exports plus imports. GDP is a better measure of expenditure by U. S. residents than GNP. Recently, the rise in the U. S. current account deficit has caused GDP to grow faster than GNP. The price level employed is the implicit GDP deflator. This index is more representative of the prices paid by U. S. residents than the GNP implicit price deflator because it excludes export prices and includes import prices. Recently, the GNP deflator has risen more rapidly than the GDP deflator because of the rise in the foreign-exchange value of the dollar and the fall in the price of imported oil.

[4] The end date was chosen in order to employ an interval of estimation identical to the interval used in estimation with old M2. The old M2 series is available only through 1979Q4. The estimation employs M1 as redefined in early 1980 to include other checkable deposits. Other checkable deposits grew from close to zero in 1975 to 4.3 percent of redefined M1 in 1979Q4. (This percentage grew rapidly after the nationwide introduction of NOW accounts in 1981Q1. In 1981Q4, it was 17 percent.) By ending the estimation in 1979Q4, similar estimation results are produced using M1 defined to include and exclude other checkable deposits.

[5] The regression employs simple distributed lags with lag lengths chosen in order to maximize the corrected R-squared statistic. Examination of the autocorrelation and partial autocorrelation function of the residuals indicated that the errors are generated by a first-order autoregressive process. The estimation, therefore, was performed with a Cochrane-Orcutt procedure.

The negative coefficient on real expenditures indicates that a one percent increase in real expenditure or income would, for a given level of M1, produce a decline in the price level (an increase in real M1 balances) of about .5 percent. As indicated by the fact that the estimated coefficient on M1 is insignificantly different from one, a one percentage point change in the rate of growth of M1 produces a one percentage point change in the rate of inflation.

The results of estimating the money demand regression equation (1) with M2 as defined formerly (old M2) are displayed in Table II. The endpoint of the interval of estimation, 1952Q1 to 1979Q4, coincides with the discontinuance of publication of the old M2 series. The major differences in results from estimation with old M2, rather than with M1, are a smaller estimated trend rate of decline in money demand (a smaller constant term) and an increased income elasticity of money demand (a sum of coefficients larger in magnitude on the real expenditure terms). These differences result from the inclusion in old M2 of instruments used by consumers as saving vehicles, that is, small time and savings deposits at commercial banks.

Within-sample errors in predicting calendar year inflation rates are shown in Table III. The errors are generally smaller for predictions made with old M2 than with M1. With old M2, only two calendar year errors exceed 1.5 percentage points (1963, 1964), while with M1 five calendar year errors exceed 1.5 percentage points (1952, 1953, 1964, 1974, 1976) and two exceed two percentage points (1952, 1974). For M1, the root mean square of the calendar year errors from 1952 through 1979 is 1.1, while the mean absolute error is .87. For M2, the root mean square of the calendar year errors from 1952 through 1979 is .89, while the mean absolute error is .74.

Table II

REGRESSION OF INFLATION ON OLD M2 GROWTH

Δln P	constant	Δln R	Δln Y	Δln M2
	.76	.073	−.94	.96
	(.46)	(.013)	(.16)	(.087)

Range = 1952Q1 to 1979Q4 NOB = 111
NOV = 29 RSQ = .58 SER = 1.31
D-W = 2.04

Notes: M2 is old M2, that is, as defined before, Jan. 1980. R comprises 6 contemporaneous and lagged values; Y, 11 such values; and M2, 10 such values. Estimation performed with Cochrane-Orcutt procedure. First-order autoregressive parameter estimated as .41 with standard error of .09. Otherwise, see first paragraph of notes to Table I.

The Recent Behavior of M1 Demand

Regression equation (1), estimated with M1 as shown in Table I, was simulated with M1 over the out-of-sample period 1980Q1 through 1984Q3. The percentage error in predicting the price level is reported in the first column of Table IV.[6] The pre-

[6] Because the regression is estimated in percentage change form, in order to recover predictions in level form, it is necessary to cumulate percentage changes from a base level for 1979Q4. The base level used was the actual price level for 1979Q4. In the simulation, the sum of the coefficients on the per capita money growth variable was constrained to equal one. Imposition of this constraint affected the regression equation reported in Table I only very slightly. The predictions were made without use of the information contained in the autocorrelation of the error term.

Table III

ERRORS IN PREDICTING CALENDAR YEAR INFLATION RATES

	M1 est.	M2 est.		M1 est.	M2 est.
1952	−2.2	1.2	1966	.5	.4
1953	−.18	.3	1967	−.6	−1.0
1954	−.5	.2	1968	1.0	−.8
1955	.5	1.0	1969	−1.3	−.3
1956	.6	.5	1970	−1.2	−.2
1957	.2	.0	1971	.1	.0
1958	1.0	.3	1972	−.5	−.8
1959	.9	−.4	1973	−.5	−1.3
1960	.2	.4	1974	2.6	1.1
1961	−.3	−.1	1975	.2	−1.1
1962	1.4	.8	1976	1.6	.2
1963	−.7	−1.6	1977	1.3	1.1
1964	−1.7	−1.7	1978	.2	1.4
1965	−.5	−.9	1979	.1	1.4

Notes: Errors ore actual minus predicted values of calendar year inflation rates of the gross domestic purchases implicit price deflator. Calendar year inflation rates are calculated using successive fourth quarter levels. Predictions used in calculating the errors in columns labeled M1 est. and M2 est. ore made with regression equations estimated with M1 (Table I) and M2 (Table II), respectively, No use was made of the information contained in the positively correlated regression errors in predicting the price level.

Table IV

POST-SAMPLE SIMULATION RESULTS: PERCENTAGE ERROR IN PREDICTING THE PRICE LEVEL

	Regression Estimated with M1	Regression Estimated with Old M2
1980Q1	.1	—
1980Q2	.4	—
1980Q3	.2	—
1980Q4	.1	—
1981Q1	.4	.9
1981Q2	−.6	−.6
1981Q3	−.6	0.1
1981Q4	.0	.6
1982Q1	−1.1	.2
1982Q2	1.9	−.8
1982Q3	−2.1	.3
1982Q4	−3.8	−1.5
1983Q1	−5.0	−2.0
1983Q2	−6.3	−2.4
1983Q3	−7.5	−3.2
1983Q4	−8.6	−3.6
1984Q1	−8.9	−3.0
1984Q2	−9.6	−3.4
1984Q3	−9.8	−2.9

Notes: Errors are calculated as the difference between the actual and predicted level, divided by the predicted level, of the implicit price deflator for gross domestic, purchases. The predicted values used in calculating the errors in column 1 were generated using the regression equation estimated with M1 and summarized in Table I. This regression was simulated out of sample with the M1 series. The predicted values used in calculating the errors in column 2 were generated using the regression equation estimated with old M2 and summarized in Table II. This regression was also simulated out of sample with the M1 series. No use was made of the positively autocorrelated regression errors, so the simulations are completely dynamic in character.

dicted price level exceeds the actual price level by an ever-increasing amount over the post-estimation, period.[7] By 1984Q3, the predicted price level exceeds the actual price level by about 10 percent. As measured by the money demand regression equation (1), this overprediction of the price level indicates a rightward shift in the public's M1 demand function.

If the Friedman/Schwartz hypothesis is correct that the phasing out of the prohibition of payment of interest on consumer demand deposits has caused M1 to come to resemble M2 as formerly defined, then the demand for M1 in the early 1980s can be understood as behaving like the demand for old M2 prior to the 1980s. In this spirit, regression equation (l), estimated with old M2 as shown in Table II, was simulated with M1 over the out-of-sample period 1981Q1 to 1984Q3.[8] The percentage error in predicting the price level is reported in the second column of Table IV. The predictions appear reasonably accurate. After about four years, the price level is over predicted by 2.9 percent.

Most of the error in predicting the price level over this period occurs in 1983. From 1982Q4 to 1983Q4, the predicted inflation rate exceeded the actual inflation rate by 2.1 percentage points. As revealed by Table III, the magnitude of the error exceeds the magnitude of the calendar year error produced from the within-sample simulations for all years for estimation with old M2, but is smaller for two years for estimation with M1. The error for 1983 may be related to the introduction in January 1983 of Super NOW accounts. The inflation rate, however, begins to be overpredicted in 1982Q4, rather than in 1983Q1. Alternatively, the historically high rates of growth of M1 in 1982Q4, 1983Q1, and 1983Q2 in combination with the severely depressed level of economic activity may have produced a transitory level of excess real balances, as measured by regression equation (1).[9] This explanation is consistent with

[7] This fact casts doubt on an explanation for the rightward shift in the public's M1 demand function common in 1982. It was argued that the 1982 recession increased uncertainty and, consequently, increased the public's precautionary demand for M1. As measured by the M1 demand function estimated from 1952Q1 to 1979Q4, the public's M1 demand function continued to shift rightward after the recovery began in 1982Q4, however. According to the above explanation, the recovery, by reducing economic uncertainty, should have ended, and even reversed, the rightward shift begun in 1982.

[8] The out-of-sample simulation begins in 1981Q1 because of the assumption that it was the nationwide introduction of NOW accounts in 1981Q1 that caused the behavior of the public with respect to M1, to come to resemble its former behavior with respect to old M2. The estimated regression equation is modified slightly by constraining the coefficients to sum to one. No use is made of the information contained in the autocorrelated errors. In order to recover predictions in level form, percentage changes are cumulated from the actual 1980Q4 value of the price level.

[9] What is meant by the expression "excess real balances" is that some of the adjustment to the unusually high rates of growth of M1 was accounted for by variables other than those included in regression equation (1). In particular, individuals and businesses may have drawn down the level of trade credit that they ordinarily extend among themselves.

the reduction in the overprediction of the price level that appears from Table IV to have started in 1984Q3.

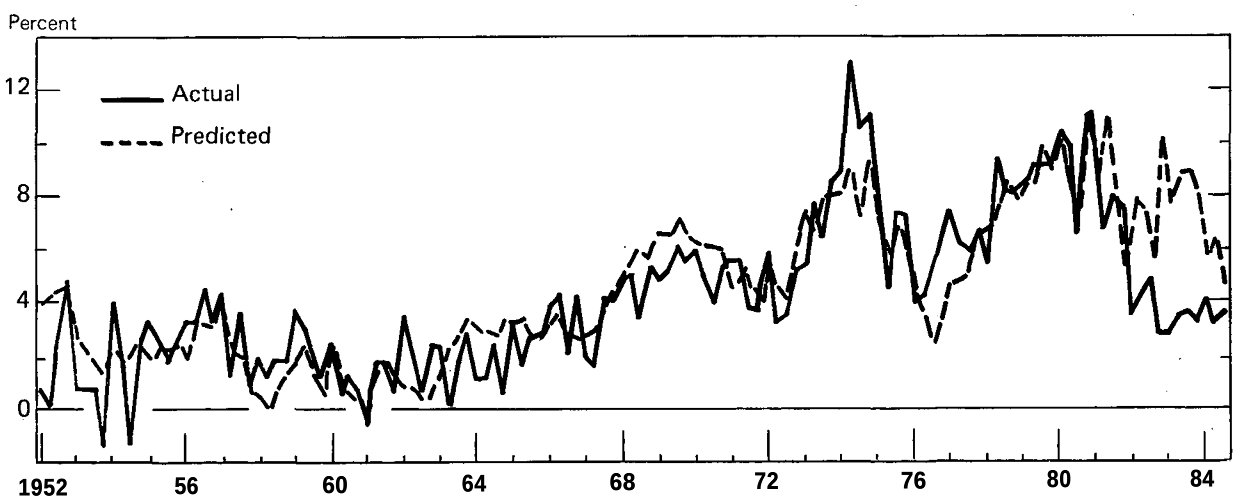
If the Friedman/Schwartz hypothesis is valid, the recent inflation rate has been low relative to historically high rates of' growth of M1 in 1982 and 1983 only in part because of the increased demand for M1 due to a decrease in the cost of holding M1 caused by the fall in market rates and an increase in the own marginal rate of return on M1. More important influences in retarding inflation have been the lowering of the trend rate of decline in the demand for M1 and the increased income elasticity of demand for M1. This latter factor has combined with high rates of growth of real expenditure since 1982Q1 to keep the rate of inflation low relative to money growth. Also, the fact that the recent behavior of inflation is reasonably well predicted under the assumption that the public's behavior toward M1 since 1981Q1 resembles its former behavior toward old M2 suggests that there was a one-time change in the character of the M1 demand function in response to financial innovation, with this function approximately stable before and after the change.

An attempt to implement empirically the initial balance hypothesis was less successful. A shift-adjusted M1 series was constructed that begins in 1981Q1. A minimum balance requirement of $500 and $2500 was assumed for NOW accounts and Super NOWs, respectively. It was also assumed that all of the minimum balance requirements on these deposits is met by shifting funds from savings accounts. Shift-adjusted M1 was then constructed by subtracting from M1 an estimate of that part of NOW and Super NOW accounts represented by minimum balance requirements. Regression equation (1), estimated with M1 as shown in Table I, was then simulated from 1980Q1 through 1984Q3 with this shift-adjusted M1 series. The overprediction of the price level of about 10 percent shown in column 1 of Table IV was reduced only about three percentage points. (An attempt to use a cost variable in the regression that accounted for the increase in the own rate of return on M1 that occurred due to the explicit payment of interest on NOWs and Super NOWs helped only marginally.) The initial balance hypothesis thus requires that consumers, when opening new OCD accounts, transfer into these accounts an amount from savings deposits that exceeds the minimum balance requirements. This latter assumption appears plausible.

The results presented above are summarized in Charts 1 and 2. Both charts display actual, annualized quarterly inflation rates from 1952Q1 to 1984Q3. In Chart 1, this series is predicted by the regression equation fitted with M1 (Table I) and simulated

Chart 1

ACTUAL AND PREDICTED INFLATION: PREDICTED INFLATION FROM REGRESSION FITTED WITH M1



Notes: Solid line plots the actual, annualized, quarterly percentage growth rates, continuously compounded, of the implicit gross domestic purchases deflator. The dotted line plots predicted values from a regression equation fitted with M1. From 1952Q1 to 1979Q4, predictions are within sample; from 1980Q1 to 1984Q3, they are out of sample.

with M1.[10] From 1952Q1 to 1979Q4, these predictions are within sample; and from 1980Q1 to 1984Q3, they are out of sample. The within-sample predictions appear reasonably accurate.[11] Beginning in 1982, however, inflation is overpredicted to a significant degree. This overprediction indicates a rightward shift in the public's M1 demand function, at least as measured by regression equation (1).

In Chart 2, the quarterly inflation rate is predicted by the regression equation fitted with M2 (Table II).[12] From 1952Q1 to 1979Q4, these predictions are within sample; and from 1981Q1 to 1984Q3, they are out of sample. Within sample, the regression was simulated with M2, but out of sample, it was simulated with M1. The within-sample predictions are reasonably accurate. In the out-of-sample period, the downward trend in the inflation rate that begins in 1981 is predicted, although inflation is overpredicted in 1983.

Predicting Inflation

The Friedman/Schwartz hypothesis implies that the deregulation of the financial system in the early 1980s has altered permanently the characteristics of M1. The initial balance hypothesis implies that the inclusion in M1 of instruments suitable for consumer saving has caused only a onetime rightward shift in the M1 demand function; for example, the constant term in the money demand regression equation (1) has experienced. a temporary reduction. After the initial adjustment by the public to financial deregu-

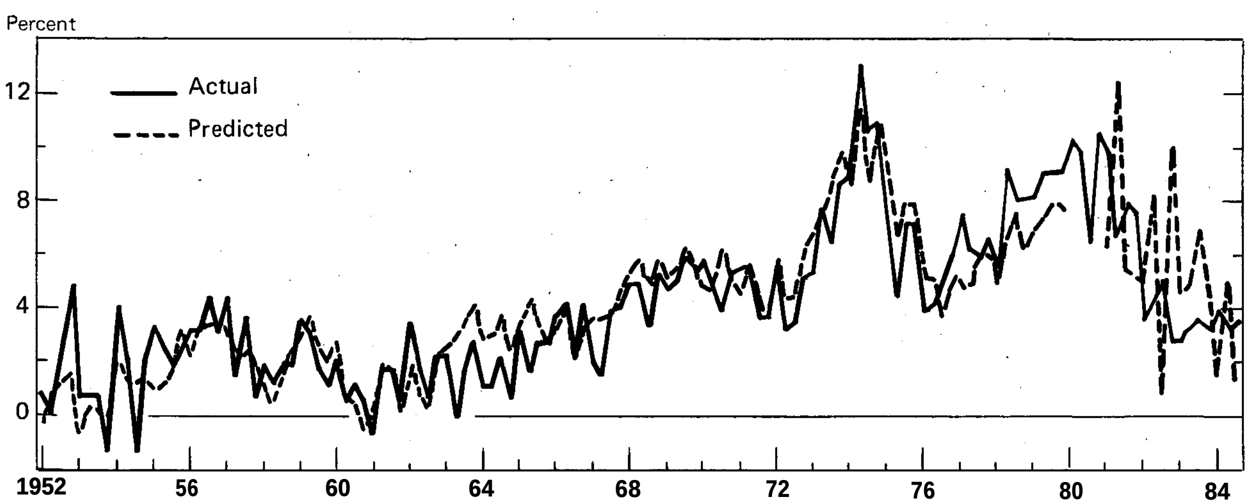
[10] The estimated regression equation is modified slightly by constraining the coefficients on money to sum to one. Predictions do not make use of the information contained in the autocorrelated errors.

[11] From 1955 through 1960 and from 1974 through 1978, inflation is somewhat underpredicted. This underprediction indicates a moderate leftward shift in the M1 demand function. The reduction in M1 demand may have been caused, in the first instance, by the significant increase in competition for consumer deposits associated with the increase in the importance of the thrift industry. The reduction in M1 demand may have been caused, in the second instance, by the increase in the importance of cash management techniques prompted by the high level of nominal rates on interest in the 1970s. Dummy variables were incorporated in regression equation (1) in order to estimate the magnitude of these shifts (but were not used in any of the results reported in the paper). The magnitude of these shifts is small relative to changes in the rate of growth of M1. Although the public's M1 demand function did exhibit shifts between 1952 and 1979, the moderate magnitude of these shifts relative to changes in the rate of growth of M1 suggests the usefulness of the view of inflation as a monetary phenomenon.

[12] See note 10 above.

Chart 2

**ACTUAL AND PREDICTED INFLATION:
PREDICTED INFLATION FROM REGRESSION FITTED WITH OLD M2**



Notes: Solid line plots the actual, annualized, quarterly percentage growth rates, continuously compounded, of the implicit gross domestic purchases deflator. The dotted line plots predicted values from a regression equation fitted with old M2. From 1952Q1 to 1979Q4, the simulations are within sample and are performed with old M2. From 1981Q1 to 1984Q3, the simulations are out of sample and are performed with M1.

lation, the M1 demand function will again exhibit its pre-1981 characteristics. Only with the passage of time can these two competing hypotheses be tested. Two sets of predictions of future inflation are made below in order to aid in discriminating between these hypotheses in 1985.

First, the inflation rate is predicted for 1984Q4 and for 1985 under the assumption that the public's M1 demand function will henceforth reassume its pre-1981 character. Specifically, inflation is predicted by simulating with M1 the regression equation estimated with M1 through 1979Q4 (reported in Table I).[13] Second, the inflation rate is predicted under the assumption that the characteristics of M1 as currently defined will resemble those of M2 as formerly defined. Specifically, inflation is predicted by simulating with M1 the regression equation estimated with old M2 through 1979Q4 (reported in Table II).[14]

Predictions of future inflation are conditional upon the future values assumed for the pertinent explanatory variables. It is assumed that the paper rate will not change. It is assumed that for 1984Q4 through 1985Q4 per capita real gross domestic expenditure will grow at an annualized rate of 2 percent. (This figure is virtually the historical growth rate for this series between the two business cycle troughs 1949Q4 and 1982Q4.) Also, it is assumed that M1 will grow at the midpoint of its current four-quarter target range for 1984Q4, 6 percent, and at the midpoint of its tentative target range for 1985, 5.5 percent. Over the decade from 1974 through 1983, the rate of growth of population was virtually one percent per year. Under the assumption that population will continue to grow at this rate, a rate of growth of 5 percent is assumed for per capita M1 for 1984Q4, and a rate of growth of 4.5 percent for 1985.

The two sets of simulations described above are reported in Table V. They are, of course, conditional predictions and will need to be adjusted in light of the actual behavior of the explanatory variables like per capita growth in M1. The important point is that the predictions diverge. By the end of 1985, the predicted rate of inflation is three percentage points higher under the assumption that the public's M1 demand function has reverted to its pre-1981 character than under the assumption that it has come to resemble the former old M2 function.[15] The behavior of the actual inflation rate will, therefore, offer evidence on whether the current characteristics of the M1 demand function have reverted to the pre-1981 characteristics or have changed permanently to reflect the inclusion in M1 of assets with a savings, as well as a transactions, property. Assuming that the Federal Reserve System achieves a rate of growth of M1 equal to the midpoint of its target range, and that the rate at which new OCDs are introduced subsides,. an inflation rate in 1985 around six percent will favor the initial balance hypothesis, while an inflation rate around three percent will favor the Friedman/ Schwartz hypothesis.[16]

[13] The coefficients on money are constrained to sum to one.

[14] See note 13 above.

[15] The high rates of real expenditure through 1984Q3 depress the predicted inflation rates. Because the coefficients on real expenditure in the regression estimated with M2 are relatively large in magnitude, this depressing effect is larger for predictions made with this regression. Also, the depressing effects last longer for predictions made with this regression because the distributed lag relationship between inflation and growth in real expenditure is relatively long.

[16] Note that if the initial balance hypothesis is correct, inflation should actually be somewhat higher than six percent. In January 1985, the legal minimum balance requirement on Super NOWs is scheduled to be reduced from $2,500 to $1,000. According to the logic of this hypothesis, this reduction should cause a leftward shift in the public's M1 demand function as funds previously used to satisfy minimum balance requirements are moved back into savings instruments. For a given rate of growth of M1, the inflation rate should be temporarily higher.

Table V

PREDICTIONS OF FUTURE INFLATION RATES

	Regression Estimated with M1	Regression Estimated with Old M2
1984Q4	4.5	1.0
1985Q1	5.0	2.4
1985Q2	4.8	2.3
1985Q3	5.6	2.7
1985Q4	5.7	2.7

Notes: Predictions in column 1 are mode with regression equation (1) estimated with M1 from 1952Q1 to 1979Q4 and simulated with M1. Predictions in column 2 are made with regression equation (1) estimated with old M2 from 1952Q1 to 1979Q4 and simulated with M1.

An Alternative Explanation of M1 Demand

The exposition in this article has concentrated on two alternative explanations for the recent behavior of M1 demand because of the author's belief that the data on M1 demand that will become available in 1985 will allow one to discriminate between these explanations. In this section; a third explanation for M1 demand is discussed. Discrimination between this last explanation and alternative explanations of M1 demand will require additional observations for periods over which interest rates move significantly. The strength in M1 demand in 1982 and 1983 could be explained by a rise in the interest elasticity of the demand for real M1 balances (Brayton 1983) in combination with the significant drop in the level of market rates of interest relative to the own rate on OCDs (Judd 1983 and Judd and Motley 1984). The rise in the interest elasticity of M1 demand could have been caused by the appearance of substitutes for M1 like money market mutual funds and money market deposit accounts (Dotsey 1981/1982). An explanation of the behavior of M1 demand in this spirit requires that regression equation (1) be modified in order to take account of the own rate of return on M1. Construction of this latter variable is discussed below.

In the case of consumer demand deposits, as opposed to corporate demand deposits, circumvention of the prohibition of the payment of interest on demand deposits is a cumbrous procedure. Implicit interest has been paid on consumer demand deposits by offering check clearing services below cost. This arrangement allows consumer demand deposits to offer a positive average return. Consumers can increase the return yielded on their demand deposit balances by using them more intensively, that is, by writing a greater number of checks for a given average balance. They can not, however, increase the return yielded by- their deposits by holding a larger balance. Specifically, while the implicit average yield on consumer demand deposits is positive, the implicit marginal yield is zero (Offenbacher 1982). The introduction of explicit payment of interest on OCDs has caused the marginal own yield on these deposits to become positive. A marginal own rate of return on M1 could be constructed as a weighted average of the marginal own rates of return of the various components of M1. The own rate of return on consumer demand deposits and on currency would be zero; the own rate of return on OCDs would be an average of the explicit rates paid on these deposits; and the own rate of return on corporate demand deposits would be, a market rate of interest reduced by a factor that accounts for the tax levied by non-interest-bearing required reserves.[17]

A cost variable that would allow for the maximum effect on the demand for money in 1982 and 1983 of the fall in market rates and the increase in the own rate on M1 is the spread between a short-term interest rate, for example, the rate of interest on 3-month Treasury bills, and the own rate of return on M1 (Brayton 1983). This spread measures the cost of holding M1 balances, that. is; the cost of utilizing the monetary services rendered by M1.[18] The hypothesis of this section builds on the fact that the percentage decline in this spread exceeded the percentage decline in market rates and also on the conjecture that the magnitude of the coefficient on such a variable increased in the 1980s. The increased demand for M1 in 1982 and 1983 is, then, accounted for by the fall in market rates of interest, both absolutely and relative to the own rate of return on M1. This fall, in combination with a heightened sensitivity of M1 demand to spreads between market rates and own rates on M1, caused an increase in M1 demand. Evidence useful for evaluating the above hypothesis will become available when major movements in the cost of holding M1, as measured by the cost variable described above, occur. At such a time, a money demand regression equation of the kind estimated in Table I, that is, one exhibiting only minimal interest-rate elasticity, will produce prediction errors for real M1 balances that are negatively correlated with the movement in market rates.

Implications for Policy

The character of the public's M1 demand function possesses important implications for monetary policy. An illustration of this fact concerns the value of the noninflationary trend rate of growth of M1. If the Friedman/Schwartz hypothesis is correct, the decrease in the trend rate of decline in the demand for M1 and the increase in the income elasticity of de-

[17] The division of demand deposits between corporate and consumer deposits, necessary in order to construct the own rate of return on M1 as suggested, is only available beginning in the 1970s in the Board of Governors Demand Deposit Ownership Survey. For this reason, it was not possible to incorporate an own rate of return variable into the money demand regression equation (1), estimation of which carried out for the period beginning in 1952Q1.

[18] In principle, a long-term rate of interest minus the own rate of return on M1 should enter also. Given the correlation in the movement of long and short rates, entering both variables would not add significant explanatory power to the right-hand variables in a regression equation.

mand for M1 will lower the inflation rate associated with any given rate of growth of M1. The noninflationary trend rate of growth of M1 can be solved for from regression equation (1) by determining what rate of growth of money is compatible with zero inflation, given estimates for the secular behavior of the interest rate, real expenditure, and population growth, and given the relevant parameter estimates.[19] If the Friedman/Schwartz hypothesis is correct that M1 now possesses the characteristics of old M2, the noninflationary rate of growth of M1 rose after 1981 about two percentage points to a current level slightly in excess of two percent per year.

[19] It is assumed here that there will be no secular change in the level of the interest rate. It is assumed that the secular rate of growth of real per capita gross domestic expenditure will be two percent, the virtual actual average between the business cycle troughs in 1949Q4 and 1982Q4. Also, it is assumed that population growth will be one percent per year. the virtual-actual average over the decade from-1974 to 1983. With respect to parameter estimates, it is assumed that the sum of the coefficients on money is one. The other key parameter estimates are the secular rate of decline in the demand for M1 and the elasticity of the demand for M1 with respect to the real expenditure of the public. These estimates are taken to be the constant term (.76) and the sum of the estimated coefficients on the real expenditure term (-.94) that are reported for estimation of (1) in Table II (again under the assumption that the demand function for M1 now resembles that for old M2).

Summary

Two competing hypotheses have been exposited in this article concerning the nature of the public's M1 demand function in the 1980s. They were chosen because of the likelihood that observations on the behavior of the public's demand for real M1 balances in 1985 will offer evidence on their validity. The first hypothesis, labeled the Friedman/Schwartz hypothesis, predicts a lower rate of inflation in 1985 than the second hypothesis, labeled the initial balance hypothesis. A third hypothesis was also exposited. Evidence relevant for assessing its validity will become available in 1985 if a major movement in market rates of interest occurs. Knowledge of the nature of the public's M1 demand function is important in order to assess the impact on the expenditure of the public of a particular rate of growth in M1. This knowledge is also important in order to determine the value of the noninflationary rate of growth of M1.

References

Brayton, Flint; Terry Farr; and Richard Porter. "Alternative Money Demand Specifications and Recent Growth in M1." Board of Governors of the Federal Reserve System (May 23, 1983), mimeographed.

Coats, Warren L., Jr. "Modeling the Short-Run Demand for Money with Exogenous Supply." *Economic Inquiry* (April 1982), pp. 222-239.

Cook, Timothy Q., and Timothy D. Rowe. "What Are OCDs." Federal Reserve Bank of Richmond (November 1984), mimeographed.

Dotsey, Michael; Steven Englander; and John C. Partlan. "Money Market Mutual Funds and Monetary Control." *Quarterly Review*, Federal Reserve Bank of New York (Winter 1981/1982), pp. 9-17.

Fama, Eugene F. "Inflation, Output, and Money." *Journal of Business* (April 1982), pp. 201-231.

Harberger, Arnold C. "The Dynamics of Inflation in Chile" in *Measurement in Economics*. Stanford, CA: Stanford University Press, 1963.

Hetzel, Robert L. "Estimating Money Demand Functions." *Journal of Money, Credit, and Banking* (May 1984), pp. 185-193.

Judd, John P. "The Recent Decline in Velocity: Instability in Money Demand or Inflation?" *Economic Review*, Federal Reserve Bank of San Francisco (Spring 1983), pp. 12-19.

———— and Brian Motley. "The 'Great Velocity Decline' of 1982-83: A Comparative Analysis of M1 and M2." *Economic Review*, Federal Reserve Bank of San Francisco (Summer 1984), pp. 56-68.

Laidler, David. *Monetarist Perspective*. Cambridge : Harvard University Press, 1982.

Offenbacher, Edward; Paul Spindt; and Clif Wilson. "Recent. Behavior of the Divisia Monetary Aggregates." Board of Governors of the Federal Reserve System (April 9, 1982), mimeographed.

Schwartz, Anna J. "Monetary Issues." *NBER Reporter* (Winter 1983/4), pp. 14-18.