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The Behavior of Money and the Economy in 1982-83

John P. Judd and Rose McElhattan*

In 1982, M1 velocity unexpectedly declined at a 5-percent rate in contrast to its 3-percent average rate of increase over the previous twenty years. As a result, the Federal Reserve de-emphasized M1 in its conduct of monetary policy, and allowed that monetary aggregate to grow at a rapid 8½-percent rate for the year compared to its target range of 2½ to 5½ percent. But even with this change in policy, nominal income rose only moderately and real income declined.

A paper in the Spring *Economic Review* assessed what went "wrong" with velocity in 1982.[1] One possibility it considered was that the public's demand to hold money balances "shifted" upward in the sense that, for given interest rates, income, and prices, the public wanted to hold more money than historical relationships would have predicted. However, the article presented evidence from the San Francisco money market model suggesting that the demand for M1 was stable, and that the decline in velocity largely is explained by the sharp parallel drop in short-term interest rates and inflation in 1982. In sum, the drop in interest rates raised the quantity of money demanded by the public, and the Federal Reserve responded by allowing money to grow faster than originally targeted. This drop in interest rates was roughly equal in size to the surprisingly sharp decline in inflation that occurred in 1982. Thus, the declines in nominal interest rates and inflation meant that inflation-adjusted, or *real*, short-term interest rates remained high and depressed total spending in the economy. As a result, GNP grew very slowly or declined. The combination of fast M1 growth and slow income growth meant that velocity actually fell. Thus the earlier article presented evidence that the decline in velocity was consistent with a stable demand for money relationship, representing an increase in the quantity of money demanded because of lower interest rates and inflation, rather than an unstable money demand function.

This analysis suggests that a good deal of the growth in M1 over 1982 and early 1983 did not have a stimulatory effect on aggregate demand because it represented an increase in the quantity of money demanded, rather than an autonomous increase in the supply of money. In other words, effective money growth—effective in the sense of measuring the thrust of monetary policy—was lower than actual, or measured, money growth during the period. We attempted to measure this effective growth by subtracting from measured M1 an estimate of the increase in the public's demand for M1 caused by the decline in short-term interest rates that paralleled the decline in inflation. This estimate came from the M1 demand equation in the San Francisco money market model. The results suggest that whereas measured M1 increased at a rapid 11 percent rate over 1982/Q3-1983/Q1, adjusted M1 grew at only a 1½ percent rate.

If the analysis behind these estimates were correct, adjusted M1 should be a better indicator of monetary policy in 1982-1983 than measured M1. To see if this is the case, the FRBSF Research Department's macroeconomic model (which predicts real GNP and inflation from reduced-form equations on M1 and other variables), was simulated over the period 1982/Q1-1983/Q2 using adjusted M1 and, alternatively, actual M1. The results of this experiment confirmed the above analysis of events in 1982-83. Simulations of velocity, real GNP and inflation using adjusted M1 were more accurate than those using measured M1, which yielded large over-forecasts of all three macroeconomic variables.

*Research Officer and Senior Economist, respectively, Federal Reserve Bank of San Francisco. Research assistance was provided by Elizabeth Christensen, Thomas Iben and David Murray.

These results have an important policy implication. They suggest that although monetary policy was quite restrictive in 1982, it became moderately expansionary in 1983/Q1 and highly expansionary in 1983/Q2. The money market model suggests that the public's demand for money had fully adjusted to the new lower levels of interest rates by the first quarter of 1983, while money growth continued to grow rapidly. It expanded, for example, at a fast 12½ percent rate in the second quarter of 1983. With the adjustments in money demand over, one could expect the growth in velocity to revert to a more commonly observed range. Such a rebound in velocity suggests that it would be desirable for M1 growth to slow down in the last half of 1983. Otherwise, there would be hefty increases in spending which ultimately would threaten to increase the rate of inflation.

The remainder of this paper is divided into four sections. Section I briefly reviews the discussion in the earlier paper on what went "wrong" with velocity in 1982-83. The estimates of adjusted M1 growth are presented in Section II. Section III contains a discussion of the simulations of macroeconomic variables. Finally, conclusions and policy implications are presented in Section IV.

I. What Went "Wrong" with Velocity in 1982-83?

One possible explanation for the unexpected change in velocity in 1982 is that there was an upward shift in the public's demand for money, that is, that increasing quantities of M1 were demanded by the public for given levels of prices, real GNP and interest rates. This alleged shift has been attributed to a precautionary motive for holding money caused by the economic uncertainty of the recession.[2] This would be a plausible hypothesis if the evidence showed that the demand for M1 did shift upward in 1982. However, simulations of the M1-demand equation in the San Francisco Money Market Model[3] suggest that the demand for M1 was stable. The M1 equation predicted annualized growth of 10.2 percent in 1982/Q1-1983/Q1 when actual growth was 10.3 percent. (*Ex ante* forecasts made during the year produced nearly identical results.) Thus, the rapid M1 growth can nearly all be "explained" by the determinants of M1 demand; these results provide no indication of a shift in the money demand relationship.

If the demand for M1 did not shift, what explains the rapid growth of that aggregate in the period considered? An analysis of the simulations indicates that the largest contributions were made by the declines in the commercial paper rate in the third and fourth quarters. These drops by themselves caused M1 to grow an annual rate of about 11.8 percent between August 1982 and February 1983, compared to a contribution of a 0.4 percent rate of decline in M1 over the preceding seven months. Apparently, most of the sharp increase in M1 growth between 1982/Q2 and 1983/Q1 is explained by the drop in nominal interest rates.

Lower Inflation

Given that the demand for M1 does not appear to have shifted, an alternative explanation of the decline in velocity in 1982 is required. The Federal Reserve Bank of San Francisco staff has argued that the unexpectedly rapid decline in inflation provides an explanation.[4] This explanation rests on the distinction between nominal, or market interest rates, and real, or inflation-adjusted interest rates. The level of spending on goods and services depends on the real rate of interest. In contrast, the public's demand for M1 depends on the nominal rate of interest. To illustrate the significance of this dichotomy for developments in 1982-83, assume that the rate of inflation falls and that this is reflected in an equal decline in nominal interest rates. In this circumstance, the real rate of interest would be unchanged, implying that the decline in nominal interest rates would *not* stimulate additional growth in real GNP. However, the public's demand for money would grow more rapidly, for a time, in response to the drop in nominal interest rates. As a result, money growth would accelerate in comparison to GNP growth, implying a decline in the growth of velocity.

This stylized scenario is a rough approximation to the events that occurred in 1982 as whole.[5] The GNP deflator rose at an 8.9 percent rate in 1981, then fell suddenly to a 4.4 percent rate in 1982, for a decline of 4.5 percentage points in the rate of infla-

tion. The commercial paper rate fell about the same amount, dropping 4.1 percentage points from 12.9 percent in the fourth quarter of 1981 to 8.8 percent in the fourth quarter of 1982. The very rapid growth in M1 associated with the drop in nominal interest rates did not stimulate the economy because real interest rates were not reduced substantially for the year as a whole. Thus, real GNP over this period fell on average at a 0.9 percent rate.

II. Adjusted M1 Growth

In the midst of a decline in velocity as large as that in 1982, growth in M1 obviously would not be a good indicator of the impact of monetary policy. A macroeconomic model that exploits the historical relationship between money and income would likely have over-predicted nominal income and, thus, velocity in 1982. The analysis in the preceeding section suggests a way to correct for this problem by adjusting the growth in M1 downward, and then using the adjusted M1 growth rates to predict income on the basis of historical money-to-income relationships.

How should these M1-adjustments be calculated? A significant part of the desired adjustment should be calculated as the growth in M1 caused by a drop in nominal interest rates that paralleled the drop in inflation. Since interest rates and inflation both declined by about the same amount, we calculated the adjustment as the M1 growth due to the full drop in interest rates in the last half of 1982. We then subtracted these adjustments from actual M1 growth to obtain what can be called *adjusted M1 growth*.

The figures for adjusted M1 growth are presented in Table 1 on a quarterly average basis. Two aspects of the figures are worth emphasizing. First, the adjustments are quite large in 1982/Q3-1983/Q1, and convert rapid measured M1 growth of 11.1 percent into very slow growth in adjusted M1 of 1.7 percent. Second, the decline in interest rates in the latter part of 1982 affected M1 growth only temporarily, specifically for three quarters. Because money growth will rise relative to GNP growth only as long as the public's demand for money is stimulated by *declines* in interest rates, the effects on money growth dissipate once interest rates stabilize at new lower levels. The exact timing depends on the lags in the demand for money.

The M1-demand equation used suggests that interest rates affect the public's demand for money for about six months. According to the equation, a one-time decline in the commercial paper rate in any given month causes M1 to accelerate relative to GNP (that is, causes velocity growth to fall) contemporaneously and for the next five months. This suggests that M1 growth induced by the decline in interest rates in 1982 should have played itself out by the second quarter of 1983. In fact, the commercial paper rate fell sharply in the third and fourth quarters of 1982. By the second quarter of 1983, these interest rate changes should have had only minor effects on M1 growth, and should not have required any adjustment in that growth after the first quarter. Thus this analysis suggests that the rapid measured M1 growth in the second quarter accurately indicated the thrust of policy in that quarter.

Table 1
Growth in M1 at Annualized Rates
(Quarterly Average Basis)

	Measured	Adjustments	Adjusted M1 Growth
1982/Q1	10.5	0.0	10.5
Q2	3.2	0.0	3.2
Q3	6.1	-5.4	0.7
Q4	13.1	-14.7	− 1.6
1983/Q1	14.1	-8.2	5.9
Q2	12.3	0.0	12.3

III. Using Adjusted M1 in Macroeconomic Simulations

The unusual experience with inflation and velocity in 1982 and early 1983 resulted in large errors from macroeconomic forecasting models in general. Many models, including that of the FRBSF, were thrown off-track, and overestimated actual velocity, real GNP and inflation during that period. If the above explanation for the macroeconomic developments of the past year and a half were correct, adjusted M1 should be a significantly more accurate indicator of monetary policy than actual M1. One way to check the validity of the M1-adjustments, and therefore the underlying explanation of events in 1982-83, is to use them in the FRBSF Research Department's macro-model to simulate events over the 1982-83 period.

The model is a reduced form representation of the U.S. economy and includes equations for real GNP growth and inflation as functions of M1 and the high employment deficit.[6] Velocity is not estimated directly but is obtained by subtracting (exogenous) M1 growth from the sum of the predicted growth in real GNP and predicted inflation.

The model was estimated over 1966-81, and then simulated over 1982/Q1-1983/Q2 with measured M1 and, alternatively, with adjusted M1 to see which yielded results closer to the actual events of the period. As shown in the charts below, adjusted M1 produces simulated values for inflation, real GNP and velocity that are reasonably close to actual developments, whereas actual M1 produces large over-forecasts.

Chart 1 shows actual velocity and dynamic model simulations with observed and adjusted M1. With observed M1, the model follows the general pattern of velocity from mid-1966 until 1982. The 1982-83 period is unusual in that the model substantially overestimated velocity for a *sustained* period of time. Historically, when large simulation errors occurred, they abated within one to two quarters. Thus, the recent errors made with actual M1 are unusual because of their size and because they persisted so long. In contrast, the M1 adjusted simulations produce errors well within the range of those experienced in the past. The same observations hold for the real GNP and inflation simulations (not shown). Using adjusted M1 improved the model's simulation accuracy not only for nominal GNP (and thus velocity), but also for the split between inflation and real GNP growth.[7]

Charts 2 through 4 show a detailed view of actual

Chart 1

M1 Velocity

1966:2–1983:2

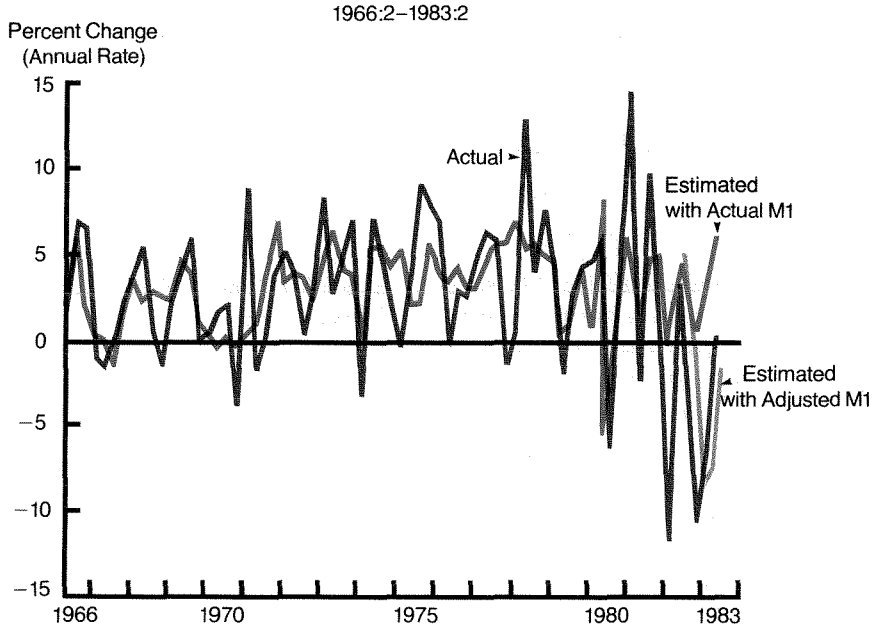


Chart 2

M1 Velocity

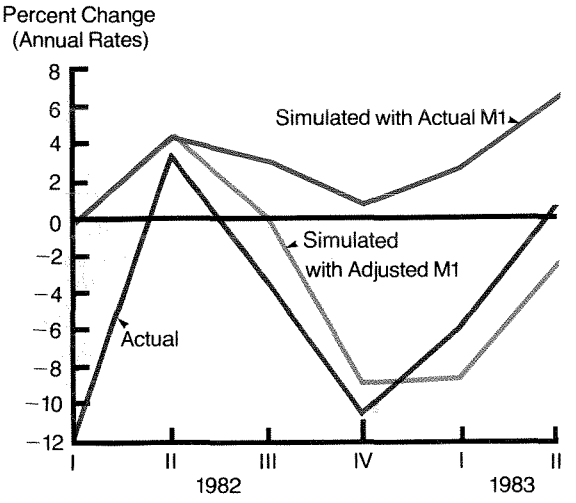
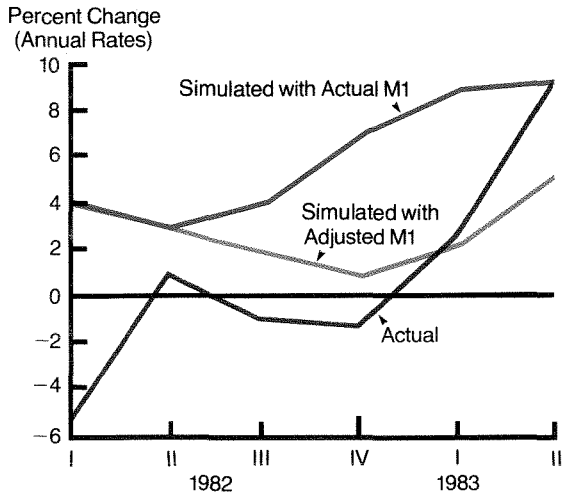


Chart 3

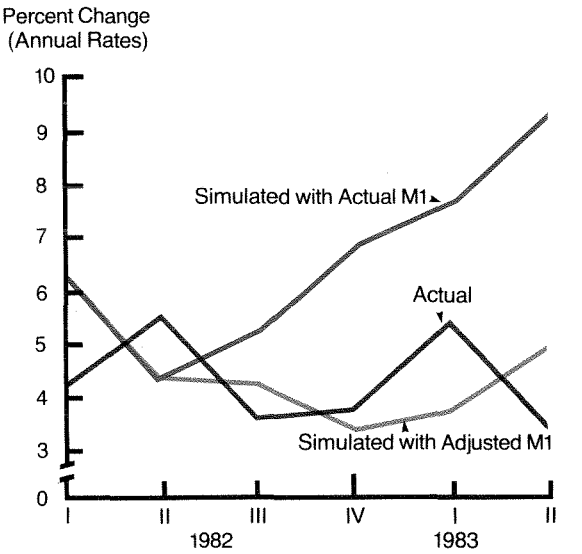
Real GNP



and model simulations of velocity, real GNP growth and inflation from 1982/Q1 to 1983/Q2. The simulated values for velocity growth in Chart 2 using observed M1 are much higher than actual values for the entire period. In contrast, the simulation with adjusted M1 closely follows the actual course of

Chart 4

GNP Implicit Price Deflator—Inflation Rates



velocity and captures both the dramatic decline in velocity in the second half of 1982 and the increase during the first half of 1983. The model still makes a larger error in 1982/Q1, but, overall, forecast errors for the growth rate of velocity were reduced from an average overforecast of 8.2 percentage points between 1982/Q3 and 1983/Q2 with actual M1 to 0.2 percentage points with adjusted M1.

The model forecasts of real GNP considerably overstated the strength in the economy in 1982 and early 1983. In contrast, the simulations with adjusted M1 tracked actual activity more closely, with the exception of 1983/Q2 in which adjusted M1 underestimates the strength of the economy. On average, both simulations overforecasted real GNP growth in the period 1982/Q3-1983/Q2. But the average forecast error was only 0.2 percentage points with adjusted M1 in contrast to 5.0 percentage points with actual M1. Similar observations apply to inflation. Forecast errors were reduced from an average overforecast of 3.2 percentage points in the case of simulations with actual M1 to 0.01 percentage point with adjusted M1 during 1982/Q3-1983/Q2.

IV. Policy Implications

The conclusion that the behavior of velocity in 1982 may be attributed to the (surprisingly) sharp drop in inflation and nominal interest rates has an important implication for monetary policy in 1983. With this explanation, there is good reason to believe that velocity will return to more commonly observed rates of change in the second half of 1983. As noted earlier, the 1982 decline in interest rates

should affect M1 growth (and thus velocity growth) only temporarily. Money will rise relative to GNP only as long as the public's demand for money is stimulated by *declines* in interest rates. Once interest rates stabilize at new lower levels, the effects on money growth should dissipate according to the lags in the demand for money. Thus, by the second quarter of 1983, these interest rate changes should have only minor effects on M1 growth and velocity. This implies that M1 growth needs to be reduced substantially from its 12-percent rate in the second quarter to avoid a highly expansionary effect.

In July 1983, the Federal Reserve announced a revision in the 1983 target range for M1. It replaced the original 1983 range of 4 to 8 percent for the entire year with a 5 to 9 percent range for the second half of 1983. By establishing a second quarter base, the Federal Reserve accommodated the rapid 12 percent growth in M1 in the second quarter. If M1 were to grow at the 9 percent upper boundary of its new range, for example, average M1 growth over the period 1983/Q1-1983/Q4 would be ten percent.

The macroeconomic model was simulated assuming 9 percent M1 growth in the second half of 1983, followed by growth of 8 percent in 1984 (the upper boundary of the 4 to 8 percent range tentatively established for that year by the FOMC) and 7 percent in 1985. The figures represent a gradual reduction in M1 growth in 1984-85 that is consistent with a policy of minimizing the adverse effects of lower money growth on the economy. Our simulation suggests that the rate of inflation would be 5½ percent in the second half of this year, followed by increases to 6½ percent and 7½ percent in 1984 and 1985 respectively. If M1 growth were held to the 7 percent mid-point of the range for the second half of this year, followed by growth of 6 percent in 1984 and 5 percent in 1985, the inflation rate would be held to about 5 percent over the entire period.

Thus, a substantial slowdown in M1 growth appears to be required over the next several years to hold the underlying rate of inflation at its present level. Moreover, the simulation suggests that even with this slower M1 growth, aggregate demand is likely to increase rapidly enough to sustain a recovery. Velocity is estimated to grow at 4½ percent rate in the last half of 1983 and 1984, leaving room for real GNP to grow at a 5½ percent rate.

FOOTNOTES

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

2. This possibility is raised, for example, in "Record of Policy Actions of the Federal Open Market Committee", meeting held on August 24, 1982.

3. The model is presented in John P. Judd, "A Monthly Model of the Money and Bank Loan Markets", **Working Papers in Applied Economic Theory and Econometrics**, Number 83-01, Federal Reserve Bank of San Francisco, May 1983.

4. See Michael W. Keran, "Velocity and Monetary Policy in 1982, **Weekly Letter**, Federal Reserve Bank of San Francisco, March 18, 1983.

5. Inflation fell early in 1982, whereas interest rates fell in the third quarter. This consideration complicates the explanation of events without altering the fundamental explanation given in the text. See the article cited in footnote 1 for a discussion of these points.

6. A feature of the model, which is not generally found in other reduced form models, is that both real GNP and inflation react in a cyclical manner to changes in monetary policy. Ultimately only the level of prices and the inflation rate are affected by changes in money. This property is often referred to as the neutrality of money. In particular, about two years after an initial change in monetary growth, inflation will overshoot its sustainable, long-run value and then slowly return to that value within the next two-to-three years. The reason for this is that following a permanent change in money growth, inflation initially will change more slowly than the money supply. Consequently, the public's holdings of real money balances will be disturbed leading to adjustments in the public's holdings of both real and financial assets. For instance, it takes about two years before a decrease in money growth is matched by a decrease in the inflation rate, according to the model. But by that time, real money balances are far below their longer-term desired value. The continued adjustment in real money balances will sustain cyclical movement in both inflation and real GNP until both nominal and real quantities are at their new, longer-run values consistent with the lower monetary growth.

Rose McElhattan, "The Response of Real Output and Inflation to Monetary Policy", **Economic Review**, Federal Reserve Bank of San Francisco, Summer 1981, pp. 45-70, and "On Federal Deficits and their Economic Impact", **Economic Review**, Federal Reserve Bank of San Francisco, Summer 1982 pp. 6-17.

7. OPEC price shocks have been important determinants of short-term changes in the overall rate of inflation. The inflation model allows for this in 1974 and 1975, but does not include the substantial oil price increases in 1979 and 1980 when the relative price of oil increased around 15 percent and 30 percent, respectively. This exclusion is related to the relatively large under forecasts of inflation during that time. On the other hand, real oil prices declined about 5 percent in 1982 and no doubt have been responsible for some of the overforecast of inflation in that year.