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The Recent Decline in Velocity: Instability in Money Demand or Inflation?

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In 1979, the Federal Reserve embarked on a long-run strategy of monetary policy designed to reduce the rate of inflation gradually over a number of years. The idea behind this "gradualist" policy was to reduce growth in the monetary aggregates, especially M1, slowly enough over several years to win the battle against inflation in the long-run with the smallest possible adverse effects on output and employment in the interim period. To this end, the Federal Open Market Committee gradually reduced its annual growth-rate target ranges for the monetary aggregates each year from 1980 through 1982. The range for M1, for example, reached 2½-5½ percent in 1982 in comparison to actual M1 growth of 7½ percent in 1979.

For this approach to work as intended, the velocity of M1 (the ratio of nominal income to M1) must grow at a relatively constant rate on a year-by-year basis. If, for example, velocity growth were absolutely constant, a 1-percent reduction in M1 growth each year would translate into a 1-percent reduction in growth in the aggregate demand for goods services, as measured by nominal GNP. This smooth, gradual reduction in nominal GNP would be consistent with the goal of reducing inflation without creating substantial unemployment and idle capacity. However, gradual reductions in money growth rates would not necessarily be consistent with these macroeconomic goals if the growth in velocity fluctuated widely on a year-to-year basis. In such a case, aggregate demand also would fluctuate widely.

Prior to 1982, a case could be made that yearly M1-velocity growth was sufficiently stable to support a gradualist policy. However, in 1982 M1-velocity unexpectedly declined at a 4.7 percent rate; this compares to its 2.8 percent average rate of increase over the previous twenty years. In response, the Federal Reserve chose to depart from its long-run strategy of gradual reductions in the growth of monetary aggregates. It allowed M1 to accelerate sharply to an average growth rate of 8½ percent in 1982, well above the 5½ percent upper boundary of its 1982 target range. Even at this higher M1 growth rate, nominal income increased by only 3.5 percent and real income declined 0.9 percent.

The purpose of this paper is to assess what went "wrong" with velocity in 1982. One possible explanation is 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 predict. Evidence based on data from the 1970s, however, suggests that the demand for M1 was stable, and that the declines in velocity in 1982 are explained mainly by the sharp drop in nominal short-term interest rates in that year. This drop in nominal rates was roughly equal in size to the surprisingly sharp decline in inflation, and meant that inflation-adjusted, or *real* short-term interest rates remained high. These high real interest rates helped depress total spending in the economy and caused GNP to grow very slowly or to decline. At the same time, lower nominal interest rates increased money demand, causing M1 growth to surge. The combination of fast M1-growth and slow income growth meant that velocity actually fell. The surprising behavior of velocity in 1982, therefore, appears to be related more to an unexpectedly large decline in inflation and short-term interest rates than to any instability in money demand.

The remainder of this paper is organized as follows: Section I presents the empirical evidence concerning the behavior of money demand. Section II describes how the behavior of inflation and interest rates may have accounted for the surprising movements in velocity and other economic variables in 1982; and Section III presents the policy implications of this finding.

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I. Did the Demand for Money Shift?

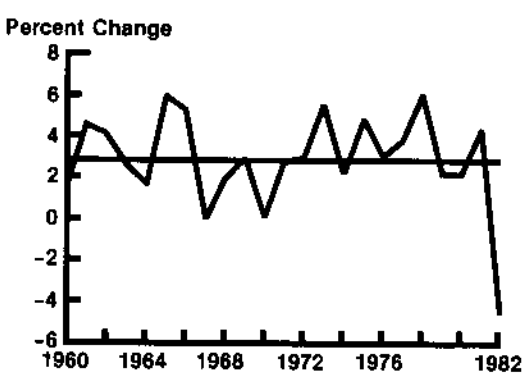
The problem faced by policymakers in 1982 is amply illustrated by Chart 1, which shows annual growth rates in the velocity of M1. The average growth rate from 1960 through 1981 was 2.8 percent, with a standard deviation of 2.3 percent. In 1982, velocity fell sharply at a 4.7-percent rate. This decline is over 3 standard deviations from the average and represents highly unusual behavior for the series.

One possible explanation for this unexpected change in velocity 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.[1] Proponents of this view argue that some precautionary demands that showed up in an increase in passbook savings accounts in previous business cycles most likely appeared as an increase in the NOW-account component of M1 in 1982. Authorized for offering on a nationwide basis in January 1981, NOW accounts are counted as M1 and, because they pay passbook rates of interest with checking privileges, most likely attracted some of the precautionary balances that used to be held in savings accounts.[2]

This would be a plausible hypothesis *if* the evidence showed that the demand for M1 did shift upward in 1982. However, the evidence presented in this paper argues that the demand for M1 was stable, that is, that growth in M1 was consistent with the observed relationships in the 1970s between money, on the one hand, and prices, income and interest rates on the other.

Chart 1

Annual Changes in Velocity: 1960 - 1982



The evidence is based upon simulations using an M1-demand equation similar to the one in the San Francisco money market model (Table 1.)[3] The equation specifies M1 as a function of the six-month commercial paper rate, nominal personal income, and the change in total commerical bank loans outstanding. The first two arguments in the equation are commonly-used representations of the interest rate, price, and income variables suggested by the conventional theory of the demand for money. (Prices and income are combined in nominal personal income.)

The third variable—the change in bank loans—is not used in conventional specifications.[4] It reflects the view that transactions money balances (checking accounts) act as buffer stock between receipts and spending and that unplanned receipts and disbursements cause checking accounts to rise and fall temporarily. Although in principle these temporary imbalances could be immediately removed, in practice, they may persist for a time because of portfolio adjustment costs. Changes in the supply of transactions deposits created as banks extend or call loans are therefore a potentially important source of fluctuations in observed money balances. The estimation results of the San Francisco model suggest that this is in fact an empirically important effect.

The evidence presented below, however, does not depend on this difference from conventional specifications. The buffer-stock variable plays an insignificant role in explaining the events of 1982 as a whole because growth in bank loans was relatively slow and steady that year.[5]

The equation in Table 1 was used to determine if M1 growth in the period from January 1982 to March 1983 was consistent or inconsistent with historical relationships between M1 and the determinants of M1 demand. This was done by estimating the equation from July 1976 through December 1981, and then dynamically simulating it over the period in question. (A similar experiment was conducted with an equation estimated with data from January 1971 through December 1981.) We then

Table 1
M1 Demand Equation*

$$\ln M1 = A1 + A2*CHBL + A3*\ln PI + A4*\ln CPRT + A5*TIME + A6*TIME2 + A7*TIME3$$

LAG	A1	A2	A3	A4	A5	A6	A7
0	−1.31	0.71	0.11	−0.059	0.0070	−0.0017	0.000061
1		0.65	0.22	−0.041			
2		0.56	0.27	−0.027			
3		0.45	0.25	−0.015			
4		0.32	0.15	−0.007			
5		0.17		−0.002			
SUM	−1.31	2.86	1.00**	−0.15	0.007	−0.0017	0.000061
	(−51.2)	(3.28)		(−13.83)	(1.29)	(−1.41)	(0.92)

$R^2 = 0.998$
SER = 0.0044
DW = 1.96
AUTO1 = 1.43 (13.67)
AUTO2 = −0.58 (−5.95)
Estimation Period: August 1976-December 1981.

Definitions of Variables

CHBL = change in the log of total loans of commercial banks, including loan sales to affiliates, and adjusted for the introduction of international banking facilities.
PI = nominal personal income.
CPRT = six-month commercial paper rate.
TIME = zero in August 1976-December 1980; 1,2,3,...12 in January-December 1981. (Frozen at 12 for simulation in Table 2.) Included to capture the effects of the introduction of nationwide NOW accounts.
TIME2 = $(TIME)^2$
TIME3 = $(TIME)^3$

* Second-degree Almon lag distributions used for A2, A3, A4. Instrumental variables used for lnCPRT. Student-t statistics in parentheses.

** Sum of lag distribution restricted to unity. Unrestricted estimates of coefficients on log of prices and log of real income both insignificantly different from unity at 95 percent level.

Table 2
M1 Growth at Annual Rates*

	Actual	Dynamic Simulation	Ex Ante Forecast
1982/Q1	7.3	5.5	6.5
1982/Q2	4.3	5.1	6.1
1982/Q3	8.6	11.9	7.1
1982/Q4	13.0	15.9	17.4
1983/Q1	16.1	10.5	12.5
Average for the period	10.3	10.2	9.9

* Calculated as the annualized percent change of the last month in a quarter over the last month in the previous quarter.

** Three-month ahead forecasts made in the middle of the first month of forecast period using the San Francisco money market model. See John P. Judd, "A Monthly Model of the Money and Bank Loan Markets," *Working Papers in Applied Economic Theory and Econometrics*, Number 8301, Federal Reserve Bank of San Francisco, May 1983.

compared the simulated M1-growth over the period to actual growth. If the demand for M1 shifted upward during this period, as some observers have suggested, the equation should "underforecast" M1 growth.

The results of the simulation experiment are presented in Table 2. Column 1 shows that actual M1 growth over the simulation period was 10.3 percent (at an annual rate). The M1 equation predicted growth of 10.2 percent, suggesting that rapid M1 growth can nearly all be "explained" by the determinants of M1 demand. (When the equation in Table 1 is estimated over January 1971 through December 1981, the average growth simulated for the period from the first quarter of 1982 through the first quarter of 1983 is 10.9 percent.) Moreover, this simulation accurately captured the pattern of growth over the period. M1 grew at a moderate 5.8-percent rate in the first two quarters of 1982, then accelerated to 12.6 percent in the next three quarters. The simulated growth of M1 for these two periods is 5.3 and 12.8 percent, respectively.

The final column of Table 2 shows ex ante M1 forecasts made with the full San Francisco money market model. This model includes equations for M1 and the markets for bank reserves and bank loans. It is a set of simultaneous equations that forecast M1, the commercial paper rate, bank loans and other variables for given levels of income, prices, the discount rate and nonborrowed reserves. Each entry in column 3 represents a three-month ahead forecast made prior to the availability of data pertaining to the quarter being forecast. For example, the forecast for the first quarter of 1982 was made in mid-January 1982, while that for the second quarter of 1982 was made in mid-April 1982. Column 3 thus contains forecasts of M1 based on *forecasted* values of interest rates, income, and bank loans, whereas the simulations in column 2 take these explanatory variables at their actual values. The ex-ante forecasts put average M1 growth over the five-quarter period at 9.9 percent, making it possible to have predicted the rapid M1 growth in that period. Thus on a three-month-ahead basis, M1 growth from the first quarter of 1982 to the first quarter of 1983 was not a surprise. It was consistent with available information on the behavior of widely recognized determinants of M1 growth.

If the demand for M1 did not shift, what explains the rapid growth of that aggregate in the period being considered? An answer is provided in Table 3, which separates the simulated M1 growth in Table 2 into three categories: growth due to changes in the commercial paper rate, personal income, and bank loans. The figures in column 3 suggest that bank loans had little to do with *average* M1 growth over the period, and that on balance they caused a small decline in M1. Changes in nominal personal income contributed a fairly steady 4.9 percent to average M1 growth. The largest contributions are

Table 3
Decomposition of Dynamic Simulation of M1 in Table 2
(Annualized Growth Rates)*

	M1 Growth Due to**		
	Commercial Paper Rate	Nominal Personal Income	Change in Bank Loans
1982/Q1	− 1.7	3.1	2.4
1982/Q2	− 0.3	5.0	−0.5
1982/Q3	9.3	6.9	−2.8
1982/Q4	14.9	4.8	−2.9
1983/Q1	4.4	4.5	1.2
Average for the period	5.3	4.9	−0.5

* Calculated as last month in quarter over last month in previous quarter.

** The three columns below do not add up to the simulated values for M1 in any given quarter (Table 2) because the simulated equation (Table 1) has an auto-correlation correction.

made by the declines in the commercial paper rate in the third and fourth quarters. These drops by themselves caused M1 to grow at an annual rate of about 9½ percent between the third quarter of 1982 and the first quarter of 1983.[6] Apparently, most of the sharp decline in velocity in this period is explained by the drop in interest rates.

These results raise a question as to why velocity did not decline sharply in the past when interest rates fell. For example, short-term interest rates fell sharply from 1974 through 1975, but velocity did not decline. (See Chart 1.) A partial answer lies in the widely documented shift in the demand for M1 in the period 1974 to 1976.[7] Apparently in response to financial innovation, the public's demand for money shifted down by about 10 percent between mid-1974 and 1976. This downward money demand shift *raised* velocity growth by roughly 1½ percent in 1974, 4½ percent in 1975, and 3 percent in 1976.[8] After making a downward adjustment for this money demand instability, velocity growth would have been between −0.7 and +0.3 percent in the three years. Although a full analysis of episodes prior to 1982 is beyond the scope of this article, it is reasonable to conclude that velocity also would have behaved "strangely" following the 1974–75 interest rate decline had it not been for the coincidental occurrence of a large downward shift in M1 demand.[9] It is an interesting "twist" of the conventional wisdom on the relationship between money demand and velocity that velocity was "stable" in 1974–75 when money demand shifted, whereas velocity was "unstable" in 1982–83 when money demand apparently did not shift.

On the basis of the analysis in this section, it seems fair to reach the following conclusions. First, the public's demand for money did not appear to shift in the period from the first quarter of 1982 to the first quarter of 1983. Second, the rapid M1 growth in that period is explained by the moderate growth in nominal income and the large decline in short-term interest rates. Moreover, the money demand estimates indicate that without the large decrease in interest rates, M1 growth most likely would have stayed within the 2½–5½ percent target range established for 1982.

II. The Decline in 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 research staff at the Federal Reserve Bank of San Francisco has argued that the unusually rapid decline in inflation provides a partial explanation.[10] This explanation draws on the conventional distinction between nominal, or market interest rates, and real, or inflation-adjusted interest rates. Economic theory argues that the level of spending on goods and services depends on the *real* rate of interest, that is, the nominal interest rate minus the expected rate of inflation. In contrast, as theory also argues, the public's demand for M1 depends on the nominal rate of interest. To illustrate the significance of this dichotomy for developments in 1982, assume that the rate of inflation falls and that the Federal Reserve allows this to be 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 the aggregate demand for goods and services. 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 relative to GNP growth, implying a decline in the growth of velocity.[11]

This stylized scenario is a rough approximation to the events that occurred in 1982 as a whole. The GNP deflator rose at an 8.9 percent rate in 1981 (see Table 4), then fell suddenly to a 4.4 percent rate in 1982, for a decline of 4.5 percent in the rate of inflation. The commercial paper rate fell by about the same amount, dropping from 12.9 percent in the fourth quarter of 1981 to 8.8 percent in the fourth quarter of 1982 for a decline of 4.1 percent. The very rapid growth in M1 associated with the drop in *nominal* interest rates, however, did not provide a great deal of stimulus to the economy because *real* interest rates were not reduced substantially. Thus, real GNP in 1982 fell on average at a 0.9 percent rate.

The preceding analysis discussed developments over 1982 *as a whole*. The explanation for the pattern of developments *within the year* is more complex. The year can be divided into two segments: the first half, when short-term interest rates stayed at a high plateau of 13 to 14 percent, and the second half, when rates fell to a lower plateau. Velocity declined in both periods for somewhat different, but related reasons.

The sharp decline in the rate of inflation in 1982 occurred early in the year. At that time, M1 was above its annual range and the Federal Reserve was gradually bringing that aggregate back toward its upper boundary. Nominal short-term interest rates were therefore relatively high; combined with low inflation, they produced high real short-term interest rates that contributed to a continuation of the weakness in the economy that had prevailed in 1981. A fall in nominal income in the first quarter of 1982 contributed to the decline in velocity in that quarter.

In the second half of 1982, in response to the weak economy, the Federal Reserve adopted a more accommodative posture toward supplying reserves. Nominal interest rates (which also benefitted from reductions in the discount rate) declined, and M1 accelerated. As explained earlier, velocity fell in the next three quarters in a predictable response to lower nominal interest rates, and GNP remained weak despite the rapid M1 growth.

Given that the 1982 decline in velocity seems consistent with standard macroeconomic theory, why was this decline so surprising as 1982 unfolded? The Federal Reserve clearly did not anticipate the events of 1982 or it would not have set a 2½–5½ percent annual target range for the year. The major economic forecasters were also surprised as is evident in a survey by the FRBSF staff of ten macroeconomic forecasts made early in 1982 for the year 1982.[12] On average, these forecasters believed that M1 growth of about 5 to 6 percent in 1982 would produce nominal income growth in the 9 to 11 percent range. Their forecasts implied a growth in velocity of around 4 to 5 percent.

What went wrong with these forecasts? One possibility lies in their over-predictions of inflation. The predictions of the ten forecasters were that the rate of inflation (as measured by the GNP deflator) would decrease by about 1 to 2 percentage points in 1982 compared to 1981. As noted earlier, inflation actually fell by 4.5 percentage points. If the forecasters had known that inflation would fall so sharply, they may have anticipated that there would be strong pressure for nominal interest rates to fall, which in turn would imply lower growth in velocity. The events in 1982 were a surprise, therefore, not because the demand for M1 shifted but at least partially because the rate of inflation dropped suddenly and by a large amount.

Table 4
Selected Economic Data

	Growth in Real GNP*	Growth in GNP Deflator*	Growth in Velocity*	Six-month Commercial Paper Rate**
1981/QI	7.7	10.5	13.3	14.5
QII	−1.5	6.7	− 3.7	15.4
QIII	2.2	8.7	7.7	16.2
QIV	−5.4	8.5	− 0.2	12.9
1982/QI	−5.2	4.2	−11.3	13.7
QII	2.1	4.5	3.4	13.5
QIII	0.7	4.9	− 0.5	11.6
QIV	−1.1	3.7	−10.1	8.8
1983/QI	3.1	5.7	− 5.1	8.3

* Annual rates of change calculated from average of monthly figures.

** Averages of monthly figures.

III. Policy Implications

The conclusion that the surprising behavior of velocity in 1982 may have been related to a sharp drop in inflation and nominal interest rates, and not to a shift in the demand for M1, has an important implication for policy in 1983. If the demand for money had been unstable between the first quarters of 1982 and 1983, there would be good reason for concern that the instability would continue for an indefinite period into the future. However, under the inflation/interest rate explanation, there is good reason to believe that velocity will return to more normal behavior at least by mid-year.

It is important to recognize that the 1982 decline in interest rates should affect M1 growth (and thus velocity growth) only temporarily. 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. Once interest rates stabilize at their new lower levels, the effects on money growth should dissipate according to the lags in the demand for money.

The equation in Table 1 suggests that interest rates affect M1 demand for six months. 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 result suggests that M1-growth induced by the decline in interest rates in 1982 should play itself out in the second quarter of 1983. As shown in Table 4, 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 be having only minor effects on M1 growth. This conclusion implies that the velocity of M1 should behave more normally and that M1 should be taken more seriously as an indicator in the second half of 1983.

This conclusion also raises the issue of whether it would be advisable for the Federal Open Market Committee to return to the strict targeting of monetary aggregates. Unfortunately, this is too broad a question to be answered in this article. The answer depends not only on the considerations discussed above, but also on possible distorting effects of recent interest rate deregulation on money demand.[13] However, the discussion above does imply that the factors causing the unusual behavior observed in velocity between the first quarters of 1982 and 1983 are not likely to continue into the second half of 1983. It would be risky, therefore, to ignore M1-growth when setting monetary policy for the remainder of the year.

FOOTNOTES

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

2. This perceived shift of funds led the Federal Reserve to "shift-adjust" M1 in 1981. See Barbara A. Bennett, "Shift-Adjustments to the Monetary Aggregates," *Economic Review*, Federal Reserve Bank of San Francisco, Spring 1982, pp. 6–18.

3. The equation in Table 1 uses M1 as the dependent variable, whereas the SF model has separate equations for transactions deposits and currency in the hands of the public. See John P. Judd, "A Monthly Model of the Money and Bank Loan Markets," Working Papers in Applied Economic Theory and Econometrics, Number 8301, Federal Reserve Bank of San Francisco, May 1983.

4. See John P. Judd and John L. Scadding, "What Do Money Market Models Tell Us About How To Implement Monetary Policy?—Reply," *Journal of Money, Credit and Banking*, November 1982, Part 2, pp. 868–877.

5. Since the San Francisco model predictions depend on its conventional arguments, conventional money market models may produce similar predictions in 1982.

6. The simulations in Table 3 were repeated with the estimated interest elasticity raised by one standard error and lowered by one standard error. The higher (in absolute value) elasticity yielded average growth for the period of 11.6 percent, while the lower elasticity yielded growth of 9.1 percent.

7. See John P. Judd and John L. Scadding, "The Search for a Stable Money Demand Function: A Survey of the Post-1973 Literature," *Journal of Economic Literature*, September 1982, pp. 993–1023.

8. See Richard D. Porter, Thomas D. Simpson and Eileen Mauskopf, "Financial Innovation and the Monetary Aggregates," *Brookings Papers on Economic Activity*, 1979:I, p. 214.

9. Another possibility is that the interest sensitivity of M1 demand has increased since 1974. Estimates of the long-run interest elasticity of M1 for the June 1965 to May 1974 sample period are only −.05, about ⅓ the post 1975 estimates reported in Table 1. On the other hand, when the equation in Table 1 is estimated over a sample period including the 1970s (January 1971–December 1982), the long-run interest elasticity is −.143, very close to the results in Table 1. The issue of possible changes in the interest elasticity of M1 demand appears to be unresolved. The salient point for the analysis in this paper is that on the basis of data for the 1970s through 1981, behavior of velocity in 1982 is consistent with a stable M1 demand equation.

10. This explanation is advanced in Michael W. Keran, "Velocity and Monetary Policy in 1982," *Weekly Letter*, Federal Reserve Bank of San Francisco, March 18, 1983.

11. In formal terms, I have in mind an IS/LM model, derived in terms of the nominal rate of interest, in which the LM curve is infinitely elastic at a given nominal interest rate. A drop in the rate of expected inflation would cause (ceteris peribus) the IS-curve to shift to the left, reducing real GNP. An equal drop in the nominal interest rate would move down along the IS curve until the original level of real income was restored. At the same time, the public's demand for M1 would rise in response to the drop in nominal interest rates, and velocity would fall.

12. The forecasters surveyed include Data Resources, Chase Econometrics, UCLA Business Forecasting Project, Bank of America, Evans Econometrics, Georgia State University Forecasting Project, Security National Bank, Wharton Econometrics, Claremont Economics Institute, and the Reagan Administration.

13. For a discussion of these issues, see John P. Judd, *Weekly Letter*, Federal Reserve Bank of San Francisco: "New Deposits," January 21, 1983; "Is M1 Ruined?—Part I," March 25, 1983; Is M1 Ruined?—Part II," April 1, 1983.