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Whither Money Demand?

IN AN ARTICLE IN THE previous issue of *Brookings Papers on Economic Activity*, I argued that uncertainty about the relationship of money demand to income is one of the key issues in assessing current monetary policy.¹ The purpose of this report is to discuss this relationship in greater detail.

I argued in the earlier paper that if the income elasticity of the demand for money were less than unity—contrary to the unitary elasticity assumption in the FRB-MIT-Penn model underlying that paper—then a lower rate of monetary growth would be consistent with a vigorous economic expansion. For example, the required money growth in those simulations averaged about 7 percent in 1970–73 under the assumption of a unitary income elasticity of demand. If the income elasticity were 0.85 instead of 1.0, then the 7 percent figure would be revised to about 6 percent. But a fact barely mentioned in the earlier paper—the high correlation between estimates of the income and interest elasticities of the demand for money makes this whole issue of even greater importance than I had recognized.² As I shall demonstrate below, one can, using postwar data, support the

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1. "Gradualism: A Mid-Course View," Brookings Papers on Economic Activity (2:1970), pp. 271–95.

2. This correlation must be sharply distinguished from the correlation between income and interest elasticity that depends on the definition of the money stock. M_2 (broadly defined money) produces a higher estimate of the income elasticity and a lower view that both elasticities are relatively high, or both relatively low, but not the view that one is high and the other low.

If the income elasticity is indeed 0.85, then the interest elasticity is lower than previously estimated. The effect of the lower interest elasticity on required monetary growth depends on whether rates are rising or falling. When rates are falling, for example, a lower interest elasticity of demand calls for lower monetary growth because less money is absorbed by declining rates.

In a period of rising interest rates, the uncertainties about the two elasticities would be pulling in opposite directions, thereby reducing the policy uncertainty concerning the appropriate rate of monetary growth. But at the present time, with interest rates falling, uncertainty over the properties of the money demand function leads to especially great uncertainty over the proper monetary policy—defined in terms of the rate of growth of the money stock.

The plan of this report is first to examine estimates of the income and interest elasticities in order to document the interdependence of the estimates based upon postwar data. Estimates relying on annual data for 1929 through 1969 appear to be more reliable than estimates relying on postwar data alone. These annual estimates suggest an income elasticity of about 0.85 and a long-term interest elasticity of about -0.7. Following this discussion is an examination of the effects of five different income elasticity constraints on the complicated type of money demand function employed in the FRB-MIT-Penn model. The second section of the paper then examines the question of whether the estimates of the interest elasticity are generally biased in an upward direction, quite apart from any bias due to the assumption of too high an income elasticity. Neither of two crude methods of approaching this issue suggests that there is any significant bias.

Evidence on Income and Interest Elasticities

Estimation of a simple demand for money function provides evidence on the sizes of income and interest elasticities and on the relationship of the

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estimate of the interest elasticity than does the M_1 definition (see note 7 below). The correlation of elasticity estimates discussed here is a function of the statistical problem of obtaining the estimates and not a function of the definition of money. The M_1 definition, which excludes time deposits, is used throughout this report.

estimates.³ The empirical work reported below relies on a simple demand for money function of the Latané type,⁴ which has been found to work quite well over a long span of time and which readily permits experimentation with modified forms of the function. While Latané assumed that the income elasticity was unity, this function may be easily modified to permit an estimate of the income elasticity of demand.

Consider first a demand for money function of the form

(1)
$$\log\left(\frac{M}{P}\right) = \log a + g \log\left(\frac{Y}{P}\right) + b \log r,$$

where

M = the narrowly defined money stock

Y = nominal GNP

P = the GNP deflator

r = the Aaa corporate bond yield⁵

g = the income elasticity of demand

b = the interest elasticity of demand.

Since M/P, Y/P, and r are jointly determined variables, there are clearly econometric problems in estimating equation (1) through ordinary least-squares estimation. In an effort to assess the significance of the bias from this source, while adhering to this method, several alternative forms of (1) have been estimated, which, it can be hoped, will bracket the true parameter values.

3. All of the empirical work in this paper was performed on the money stock series before the extensive revisions announced in late November 1970. While the dollar amounts of these revisions are largest for 1970 data, beyond the sample period used in this paper, the revisions extend back to 1959 and therefore would affect the empirical results reported here to an unknown extent.

4. Henry A. Latané, "Cash Balances and the Interest Rate: A Pragmatic Approach," *Review of Economics and Statistics*, Vol. 36 (November 1954), pp. 456–60; "Income Velocity and Interest Rates: A Pragmatic Approach," *Review of Economics and Statistics*, Vol. 42 (November 1960), pp. 445–49.

5. There are two advantages to using the Aaa corporate bond yield. First, and most important, before 1940 U.S. government securities were wholly or partially tax exempt, thus requiring the investigator to use corporate securities to obtain a consistent interest rate series if data both before and after 1940 are to be analyzed. Second, the theoretical argument for using a long-term interest rate is that changes in money-holding behavior are likely to be a result of changes in interest rate presumably better reflects longer-run expectations than does the short-term rate.

Equation (1) has been estimated using both quarterly data for the years 1947–69 and annual data for the years 1929–69 in the form shown above and a variety of transformations. The resulting estimates of income and interest elasticities, as well as the transformations, are reported in Table 1. The (a) equations, which delete the price level variable, have less theoretical validity than the others, but are reported because errors in the GNP deflator may bias the other results.

Equation	Income elasticity	Interest elasticity	R ²	DW
		Quarterly dat	a, 1947–69	
(1)	0.118	-0.054	0.174	0.062
(1a)	0.337	0.098	0.975	0.085
(2)	1.572	-1.275	0.906	0.106
(2a)	0.493	-0.113	0.975	0.063
(3)	2.810	-2.564	0.901	0.119
(3a)	-0.390	1.156	0.928	0.164
(4)	-0.078	0.111	0.982	0.065
(4a)	0.258	0.205	0.992	0.115
		Annual data	, <i>1929–6</i> 9	
(1)	0.845	-0.657	0.955	0.522
(1a)	0.917	-0.652	0.987	0.501
(2)	0.883	-0.676	0.957	0.528
(2a)	0.929	-0.663	0.988	0.510
(3)	0.869	-0.815	0.812	0.520
(3a)	0.933	-0.824	0.800	0.498
(4)	0.635	-0.554	0.441	0.175
(4a)	0.785	-0.523	0.415	0.146

Table	1.	Alternative	Estimates	of	Income	and	Interest	Elasticities	of	the
Dema	nd :	for Money								

Source: Derived by the author from equations (1) through (4a) described below and in the text. Basic data are from *Federal Reserve Bulletin*, various issues. See note 3, above. All estimates are based on ordinary least squares.

(1)	$\log\left(\frac{M}{P}\right) = \log a + g \log\left(\frac{Y}{P}\right) + b \log r$
(2)	$\log\left(\frac{Y}{P}\right) = -\frac{\log a}{g} + \frac{1}{g}\log\left(\frac{M}{P}\right) - \frac{b}{g}\log r$
(3)	$\log r = -\frac{\log a}{b} - \frac{g}{b} \log \left(\frac{Y}{P}\right) + \frac{1}{b} \log \left(\frac{M}{P}\right)$
(4)	$\log\left(\frac{Y}{P}\right) = \frac{\log a}{1-g} + \frac{1}{1-g}\log\left(\frac{Y}{M}\right) + \frac{b}{1-g}\log r$

Equations (1a)-(4a) correspond to (1)-(4), respectively, except that the price level variable has been deleted.

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The most striking aspect of these results is the great variability of the estimates obtained from quarterly data for 1947–69 while the annual data for 1929–69 provide fairly consistent results.⁶ From the annual data one might conclude that the income elasticity is about 0.85 while the interest elasticity is about -0.7.⁷ The interdependence of the estimates is clear from both sets of data: The tendency is for either both of the elasticities to be high or both low (in absolute value).

The erratic and in some cases nonsensical estimates from the quarterly data press home an important lesson. Using postwar data alone, it is impossible to obtain a satisfactory estimate of the demand for money function. Real income and nominal interest rates have risen almost continuously in the postwar period, while the real stock of money—the narrowly defined money stock divided by the GNP deflator—has risen only 3.3 percent over the *entire* 1947–69 period (0.18 percent compounded per year). Thus the postwar data provide essentially no basis for determining how much of the postwar increase in velocity is to be assigned to the rising level of interest rates and how much to an income elasticity of less than one.

The impossibility of relying on postwar data alone can be seen in Figure 1, which shows the results, using quarterly data for 1947–69, of estimating the interest elasticity with various constraints on the income elasticity.⁸ In the figure the value of g, the constrained income elasticity, is on the horizontal axis, and on the vertical axis are two estimates of the interest elasticity obtained from the two ways of running the regression, and R^2 , the measure of goodness of fit. A striking aspect of these results is that the goodness of fit is practically unchanged over an extremely wide range of income elasticities.

Since postwar data alone are unreliable, it seems necessary to give considerable weight to the 1929–69 estimates in Table 1. As noted above, these estimates point to an income elasticity of about 0.85. Without introducing

6. The use of annual data for 1947–69 leads to about the same estimates as does the use of quarterly data for the same period.

7. "One can say that, if the period 1892–1960 is considered, the elasticity of demand for money (M₂) with respect to the short rate of interest appears to have varied between roughly -0.12 and -0.15 and, with respect to the long rate of interest, between -0.2 and -0.6. (If M₁ is used instead the relevant elasticities are -0.17 to -0.20 and -0.5 to -0.8.)" David E. W. Laidler, *The Demand for Money: Theories and Evidence* (International Textbook Co., 1969), p. 105.

8. The procedure used was to define a modified velocity measure $Z_q = (Y/P)^q/(M/P)$, and then to regress $\log Z_q$ on $\log r$ and $\log r$ on $\log Z_q$ to provide two estimates of the interest velocity.



Figure 1. Effect of Income Elasticity Constraint on Estimated Interest Elasticity of the Demand for Money

Income elasticity

Source: Based on quarterly data for 1947-69. Derived by author as described in text and note 8 above. Basic data are from *Federal Reserve Bulletin*, various issues. See note 3, above.

either alternative definitions of the money stock or dynamic considerations, these estimates are probably about as reliable as any that can be obtained at the present time. It would, of course, be desirable to examine an even longer time period, but the national income statistics are not nearly as reliable before 1929 as after that year. Confidence in these estimates is strengthened by the fact that, over the 1929–69 period as a whole, fluctuations in interest rates are large relative to trend, whereas the reverse is true

in the 1947–69 period. Furthermore, the 1929–69 period covers an extraordinarily wide range of experience: Depression and wartime inflation both occur in this sample period. Figure 1 demonstrates that when the income elasticity is constrained to equal 0.9, the estimate of the interest elasticity using postwar data is very similar to—though perhaps a bit higher than—the estimate using annual data for 1929–69.

What faces the investigator, then, is the absolute necessity of relying on a priori restrictions if postwar quarterly data are to be used. An example of such an approach is the money demand function in the FRB-MIT-Penn model. In the model the a priori restriction involves constraining the income elasticity to be unity, and then estimating the dynamics and interest elasticity under this constraint.

Given the results above based on a simple Latané type of money demand function, one can explore the effects of different income elasticity constraints on the demand for money function used in the FRB-MIT-Penn model. The structure underlying this money demand function involves the standard stock-adjustment model.⁹

The estimates of the coefficients of the demand for demand deposits are reported in Table 2 for various income elasticity constraints. (Currency demand is a simple function of nominal personal consumption expenditures and the interest rate on passbook savings accounts in commercial banks.) The coefficient estimates of equation (6) for income elasticity g of 1.0, shown in Table 2, are essentially those used for the demand deposits equation in the model simulations in my earlier paper, apart from some minor differences due to data revisions.

The results are clearly very similar to those in Table 1. The lower the income elasticity constraint, the lower (in absolute value) are the elasticities for the bill rate and time deposit rate.

9. The two equations in the stock-adjustment model are:

$$\log\left(\frac{D}{P}\right)^{*} = \log a + g \log\left(\frac{Y}{P}\right) + b_{1} \log r_{B} + b_{2} \log r_{T} + b_{3} \Delta \log r_{D}$$
$$\log\left(\frac{D}{P}\right) = \log\left(\frac{D_{-1}}{P}\right) + \lambda \left[\log\left(\frac{D}{P}\right)^{*} - \log\left(\frac{D_{-1}}{P}\right)\right].$$

An asterisk indicates the desired stock, r_B is the three-month Treasury bill rate, r_T is the average rate on commercial bank passbook savings accounts, r_D is the Federal Reserve discount rate, D is demand deposits, Y is GNP, and P is the GNP deflator. These two equations may be solved to obtain equations (5) and (6), shown in Table 2.

		Elasticity			Serial			
Income elasticity	Three-month Treasury bill rate	Time deposit rate	Change in discount rate	Adjustment coefficient	coefficient (rho)	R²	$R^2 for$ rho = 0	
			Equatio	т (5)				
0.8	-0.148	-0.168	0.153	0.196	0.490	0.9984	0.9978	
0.9	-0.180	-0.180	0.180	0.161	0.474	0.9987	0.9983	
1.0	-0.213	-0.184	0.206	0.136	0.462	0.9990	0.9987	
1.1	-0.250	-0.190	0.241	0.116	0.453	0.9992	0.9989	
1.2	-0.284	-0.196	0.265	0.102	0.446	0.9993	0.9991	
			Equatio	n (6)				
0.8	-0.223	-0.130	0.278	0.425	0.771	0.9482	0.8088	
6.0	-0.253	-0.150	0.312	0.381	0.764	0.9488	0.8074	
1.0	-0.287	-0.167	0.351	0.342	0.762	0.9491	0.8036	
1.1	-0.322	-0.182	0.391	0.309	0.762	0.9492	0.7994	
1.2	-0.357	-0.196	0.432	0.282	0.762	0.9493	0.7954	
Note: These estimate	es assumed a rho transfoi	rmation that remov	/ed serial correlation 1	from the residuals. Th	he period of estima	ttion is 1955:1-190	69:4.	
	(5) $\log \frac{(D/P)}{(Y/P)^{g}}$	$= (1 - \lambda) \log \frac{1}{2}$	$rac{D_{-1}/P}{(Y/P)^{ heta}} + \lambda \log a$	$+ \lambda b_1 \log r_B + \lambda$	$b_2 \log r_T + \lambda b_3$	$\Delta \log r_D$		
	(6) $\log r_B$	$= -\frac{\log a}{b_1} + \frac{1}{\lambda l}$	$\frac{1}{b_1} \log \frac{(D/P)}{(Y/P)^g} - \frac{1}{C}$	$\frac{1-\lambda}{\lambda b_1} \log \frac{(D_{-1}/l)}{(Y/P)}$	$\left(\frac{p}{p}\right) - \frac{b_2}{b_1}\log r_T$ -	$-rac{b_3}{b_1}\Delta \log r_D$		

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If it is assumed that in the long run the time deposit rate is some (possibly fractional) multiple of the bill rate, then the elasticities for the time deposit rate and bill rate may be added to obtain a total interest elasticity. For equations (5) and (6), respectively, this total elasticity for g = 1.0 is -0.397 and -0.454, while for g = 0.8 the figures are -0.316 and -0.353. These elasticities are lower than those reported above for the Aaa corporate bond yield, but since short-term interest rates fluctuate far more than long-term interest rates, this result should be expected. The coefficient on the change in the discount rate that enters the regression. In this formulation, therefore, a change in the discount rate has an impact effect but no permanent effect.

Further Analysis of the Interest Elasticity

How much upward bias in the estimated interest elasticity results from this formulation of the demand for money function? An interest elasticity that is in fact near zero has three important implications: (1) Such factors as fiscal policy, investment anticipations, and consumer confidence will have essentially no impact on national income; given the money supply, changes in these factors will merely shift the composition of the gross national product. (2) The income elasticity will probably also be below previous estimates, and if it is as low as, say, 0.6, then the long-run norm for monetary growth will be 3 percent or less, rather than the 4 to 5 percent now widely accepted. (3) If the demand for money function is stable, a sustained growth in the money stock at a 5 to 6 percent annual rate will mean vigorous, and perhaps inflationary, economic expansion.

An upward bias in the estimated interest elasticity could stem from the implicit assumption in all of the equations discussed above that the interest rate paid on demand deposits is zero. Given this assumption, the market rate of interest in the demand function correctly measures the opportunity cost of holding demand deposits with zero yield.

While explicit interest on demand deposits is forbidden by law, service charges, which amount to negative interest, are permitted. Furthermore, implicit interest, which is of greater importance, may be paid in any number of forms: preferential loan terms for depositors, the construction of a larger number of banks and bank branches, and longer banking hours the last two providing a yield in convenience. Fluctuations in service charges and in implicit interest are to be expected, and would probably reflect fluctuations in market rates of interest. Thus the spread between market rates and implicit deposit rates has probably not changed as much as market rates alone. If it has not changed at all, then the interest elasticity estimated above is entirely spurious.

While presumably no one would quarrel with this general analysis, the size of the effects remains an issue of great importance. But since implicit interest may be paid in a variety of ways, most of which are not susceptible to precise measurement, it is extremely difficult to obtain evidence on its significance and in turn on any bias it introduces into estimates of the interest elasticity. In the absence of a series on implicit deposit interest rates, the problem must be approached indirectly. The two types of indirect evidence examined in this section are offered in the belief that some evidence, however tentative, is better than none.

The first approach is based on the observation, documented in the first section of this paper and by many other investigators, that interest rates consistently are found to be significant in explaining money demand. But is it possible that the interest rate variable does not genuinely belong in the money demand function, but rather is serving as a proxy, systematically picking up the effects of variables that ought to be included, but are not? If so, what are these other effects? The major argument would have to be that these other effects involve the dynamics of the money demand function.

The construction of a complete theoretical argument to explain how the dynamics of the money demand function could lead to spurious estimates of the interest elasticity is well beyond the scope of this paper. But one conceivable argument can be sketched out in general terms. Suppose, for example, that the demand for money is independent of interest rates but depends on current and lagged income, such that the elasticity with respect to current income alone is less than the total income elasticity. In such a world, if the rate of growth of the money stock jumps suddenly, income must initially jump especially sharply to generate the required money demand. But the sharp jump in income represents a business boom and so interest rates are pushed up by the heavy borrowing that typically accompanies a boom. The simultaneous increases in real income, velocity, and interest rates that typically occur in a period of rapid business expansion would then be explained without resort to a significant interest elas-

ticity in the demand for money function.¹⁰ If this argument is correct, then lags in the demand for money function are the missing factors whose effects are being picked up by the interest rate in the equations above. And once the missing factors are successfully accounted for, the interest rate variable should have no further role to play—that is, its regression coefficient should be driven down to zero.

This line of reasoning is the basis for the following crude test. Suppose lagged money terms are introduced into the money-income function, since the lagged income terms in this function depend in turn on lagged values of the money stock. Then, if the estimated interest elasticity is merely picking up the dynamics of the money demand function, the inclusion of the lagged money terms should reduce the estimated interest rate coefficient. Indeed, to the extent that changes in the money stock are the major cause of income fluctuations, the inclusion of lagged terms should reduce the regression coefficient of the interest rate even though it really belongs in the demand for money function.

Table 3, using annual data from 1933 to 1969, shows the results of adding lagged money stock variables. No evidence develops of a significant reduction in the regression coefficient of the Aaa corporate bond yield in regressions of income on the bond yield and current and lagged money. From this evidence, if the interest elasticity of the demand for money is indeed much smaller than the estimates, some other mechanism must be at work.

The foregoing is the first method of searching indirectly for evidence of the importance of implicit interest in the demand for money function—an examination of the implications for relationships among income, money, and interest on the assumption that it is, in fact, significant. Another method of testing for implicit interest is to analyze the likely effects on bank earnings of its presence or absence. In its absence, bank earnings should rise and fall as market interest rates rise and fall. This matter is not easy to investigate because of both data and conceptual problems. Nevertheless, a crude analysis of bank earnings in the 1965–69 period of rapidly rising interest rates is attempted; its results are shown in Table 4.

Row (1) shows the change in the annual average of three-month Treasury bill rates since 1964, and row (2), demand deposits for December of each preceding year. The assumption is that the banks can earn the increased

^{10.} This argument is basically of the same type as that presented in Milton Friedman, "The Demand for Money: Some Theoretical and Empirical Results," *Journal of Political Economy*, Vol. 67 (August 1959), pp. 327–51.

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Denendent	Manev		Log of interest		Money	variable (lag	in years)		Sum of money stock		
variable	variable	Constant	rate	0	I	2	£	4	coefficients	R^2	МП
Log of	Log of	0.087	0.791	1.100	•	•	:	÷	1.100	0.959	0.466
real GNP	real money supply	(1.204) 0.486	(14.093) 0.811	(24.767) 1.488	-0.370	:	:		1.118	0.961	0.576
	•	(0.646)	(14.344)	(5.773)	(-1.528)						
		0.052	0.809	1.520	-0.453	0.053	:	÷	1.120	0.960	0.590
		(0.661)	(13.815)	(4.857)	(-0.871)	(0.182)					
		0.066	0.800	1.458	-0.258	-0.273	0.190	:	1.117	0.959	0.614
		(0.802)	(13.199)	(4.406)	(-0.423)	(-0.455)	(0.623)				
		0.095	0.781	1.535	-0.508	0.245	-0.606	0.457	1.123	0.961	0.772
		(1.146)	(12.891)	(4.681)	(-0.820)	(0.361)	(-1.010)	(1.531)			
Log of	Log of	-0.109	0.749	1.060	÷	:	÷	:	1.060	0.989	0.454
GNP	money	(-1.038)	(12.960)	(47.102)							
	supply	-0.191	0.769	1.384	-0.317	:	•	:	1.067	0.989	0.465
		(-1.596)	(13.046)	(5.823)	(-1.372)						
		-0.194	0.763	1.469	-0.498	0.099	:	÷	1.070	0.989	0.479
		(-1.594)	(12.050)	(4.061)	(-0.798)	(0.313)					
		-0.174	0.742	1.339	-0.039	-0.558	0.332	:	1.074	0.989	0.516
		(-1.408)	(11.178)	(3.487)	(-0.051)	(-0.771)	(1.009)				
		-0.155	0.708	1.356	-0.301	0.252	-0.809	0.574	1.072	0.989	0.637
		(-1.230)	(10.572)	(3.683)	(-0.397)	(0.304)	(-1.146)	(1.811)			
Source: Deri Note: The n	ved by author by r umbers in parenthe	method describe eses are <i>t</i> -ratios.	ed in text. Basi	ic data are fro	om Federal Res	erve Bulletin, va	rious issues. See	e note 3, abo	ove.		

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Item in calculation	1965	1966	1961	1968	6961
(1) Treasury bill rate—change since 1964 (percentage points)	0.41	1.31	0.76	1.79	3.10
(2) Demand deposits (billions of dollars) ^a	125.1	130.4	132.1	141.3	151.4
(3) Assumed increased interest earnings on demand deposits					
(millions of dollars) ^b	436.0	1,452.0	853.4	2,149.9	3,989.4
(4) Treasury bill rate minus time deposit rate—change since 1964					
(percentage points)	0.28	0.92	0.26	1.15	2.34
(5) Time deposits minus large certificates of deposit (billions of dollars) ^a	114.0	130.6	143.0	163.0	181.0
(6) Assumed increased interest earnings on time deposits					
(millions of dollars) ^e	303.2	1, 141.4	353.2	1,780.8	4,023.6
(7) Total assumed increased earnings (millions of dollars) ^d	739.2	2,593.4	1,206.6	3,930.7	8,013.0
(8) Net current operating earnings of insured commercial banks—					
change since 1964 (millions of dollars) ^e	204.1	819.6	1,101.0	1,997.2	3,224.8
(9) Net income of insured commercial banks before related taxes—					
change since 1964 (millions of dollars) ^f	112.1	282.4	887.2	1,261.2	n.a.
(10) Inflation allowance (millions of dollars) ^g	129.0	313.4	540.6	829.3	1,185.4
(11) Current earnings with inflation allowance (millions of dollars) ^b	333.1	1,133.0	1,641.6	2,826.5	4,410.2
(12) Net income with inflation allowance (millions of dollars) ¹	241.1	595.8	1,427.8	2,090.5	n.a.
Sources: Rows (1) and (2)—Federal Reserve Bulletin, Vol. 55 (October 1969), p. A-17, and V (October 1970), n. A-33, and ununihished estimates of time denosit rates from Federal Reserve	Vol. 56 (Octob Bank of Chics	er 1970), pp. A-1	7 and A-33; rov	v (4)—Federal Recommendation	sserve Bulletin

(8) and (9)—*Annual Report of the Federal Deposit Insurance Corporation*, 1969, pp. 276-77; row (10)—noninterst expense of banks in 1964 from *Annual Report of the FDIC*, 1969, pp. 276-77; row (10)—noninterst expense of banks in 1964 from *Annual Report of the FDIC*, 1969, pp. 276-77; now (10)—0011101100, 1969, and 1970), Table 8.1. n.a. Not available.

a. December of preceding year.
b. Row (1) times row (2) times 0.85; assumes 85 percent of demand deposits are available for lending.
c. Row (4) times row (5) times 0.95; assumes 95 percent of time deposits are available for lending.
d. Sum of rows (3) and (6).

Net current operating earnings for 1969 are not strictly comparable with earlier data, but were calculated by adding back two expense items—interest on capital notes and debentures, and provision for loan losses—not deducted in computing net current operating earnings before 1969.
 f. Includes capital gains and losses on security sales and provisions for loan losses generally exceeding actual losses.
 See text for explanation.
 h. Sum of rows (9) and (10).
 i. Sum of rows (9) and (10).

interest of row (1) when lending out these deposits. These extra earnings are shown in row (3), with the assumption that about 85 percent of the demand deposits are available for lending, while roughly 15 percent must be held as reserves. Rows (4), (5), and (6) provide similar figures for time deposits. Large certificates of deposit (CDs) are excluded from this calculation on the grounds that they are competitive with other money market instruments so that banks do not earn excess profits on them. Interest ceilings on CDs are assumed not to be effective since CDs apparently run off quickly when their ceiling rate is below other money market rates. Row (7) is the sum of the calculated bonus to banks from higher interest rates.

Rows (8) and (9) provide two measures of the change in bank earnings since 1964. The figures in row (8) are probably more appropriate than those in row (9) since the latter include capital gains and losses on security sales and provisions for loan losses that generally exceed actual losses. Row (10) reports an attempt to allow for the fact that, without inflation, earnings would have risen even more than indicated by rows (8) and (9). Row (10) was calculated by multiplying the noninterest expenses of banks in 1964 by the percentage increase in the GNP deflator since 1964. Some allowance of this type is clearly necessary since cost inflation tends to reduce earnings below what would otherwise be the case.¹¹

From row (7) and row (11) it can be seen that bank earnings have been somewhat below what would have been expected if the prohibition of interest on demand deposits and the ceiling on time deposits were fully effective. Yet the difference between row (7) and row (11) is not so large as to suggest that implicit interest is paid to a significant extent in the short run.

This analysis of bank earnings is at best rough and ready, but it makes clear that bank earnings expanded dramatically in the late 1960s, indi-

11. In principle, however, an allowance working in the other direction is also needed since, even without an increase in market interest rates, bank earnings would presumably have grown over this period as deposits grew. It might be assumed that banks would earn the same profits per additional dollar of deposits added after 1964 as they earned in that year. But without separate estimates of the profitability of demand and time deposits this calculation cannot be made. Even if the appropriate figures were known, this adjustment is suspect since banks' marginal profit rate is probably below their average profit rate. Indeed, in the period 1960–63, when interest rates were essentially unchanged, bank earnings were also essentially unchanged even though there was substantial deposit growth. For the bank earnings data, 1960–68, see *Annual Report of the Federal Deposit Insurance Corporation, 1968*, Table 112.

cating that the prohibition of interest on demand deposits and the regulation of interest rates on time deposits is at least partially effective.

These results suggest that, to the extent implicit interest is paid, its rate is only a fraction of the market rate. It can be shown that if implicit interest is paid in such a way that the implicit interest rate is a constant fraction of the market interest rate—for example, implicit interest is 1 percent when market interest is 4 percent, 2 percent when market interest is 8 percent, and so forth—then failure to put the implicit deposit rate into the regressions does not lead to a bias in the estimated interest elasticity.¹² In this case the market interest rate alone is a satisfactory index of the spread between the market rate and the implicit deposit rate.

Both pieces of indirect evidence examined in this section point in the same direction. If implicit interest is paid to any significant extent, its rate may well be a roughly constant fraction of the market interest rate. If this argument is correct, then there is no reason to believe that the estimates of the interest elasticity presented above are biased in any particular direction.

Summary and Conclusions

This paper began with the observation that the nature of the demand for money function is likely to be of great importance for monetary policy over the next few years. Considerable uncertainty surrounds the income and interest elasticities of demand, and in a period of falling interest rates, greatly amplifies uncertainty over the appropriate rate of monetary growth.

On the basis of the admittedly crude evidence reported in this paper, it would appear that both income and interest elasticities may be a little below those assumed in the simulations reported in my earlier paper. This conclusion implies that the required rates of money growth will be somewhat lower than the previous analysis indicated.

But the tenuous nature of this conclusion should not be forgotten. One might argue, as I would not, that data prior to 1947, or even 1950, are of

^{12.} Suppose the interest rate term in the demand for money function has the form $b \log (r_M - r_D)$, where b is the interest elasticity and r_M and r_D are the market and deposit interest rates, respectively. Then, if $r_D = ar_M$, where a is a constant, $b \log (r_M - r_D) = b \log (1 - a) + b \log r_M$. But this expression is exactly the form used in the regressions, since $b \log (1 - a)$ is simply a constant, which ends up as part of the total constant term of the regression.

questionable relevance to the current situation; but there is essentially no possibility of reliably estimating the income and interest elasticities on the basis of postwar data alone. The additional year of data that will be available a year from now may provide far more information than one would ordinarily expect from only one more year of data, especially if short-term interest rates remain near or below current levels and long-term rates continue to decline. In this situation, special care in updating estimates of the demand for money function would seem to be fully warranted.

Discussion

WARREN SMITH SUGGESTED that William Poole's results in the report had an important bearing on the arguments for a money-oriented monetary policy that Poole had developed in earlier work. The case for money being superior to interest rates as a policy target rests on the proposition that the financial sector of the economy is better understood than the real sector. That is a shaky argument, and Poole's empirical findings help to show the large extent of our uncertainty about what the demand for money is and how it behaves. The Poole paper thus reinforced Smith's preference for interest rate targets in the formulation of monetary policy. In addition, Smith pointed out, the argument for the money stock as a target assumes that changes in monetary policy are sufficiently infrequent to enable changes in interest rates during the intervals between policy adjustments to exert a significant stabilizing effect on economic activity. In a regime in which open market policy is made every three weeks, this is surely not the case. Franco Modigliani felt that Smith's case for an interest rate target is very sensible in a period in which changes in price expectations are not important. But in periods when price expectations are strongly responsive to current price performance, more attention must be paid to monetary aggregates. Looking at nominal interest rates alone, one could be seriously misled. For example, if it turns out that observed interest rates are higher than expected, but prices are also rising faster than expected, real interest rates may be lower.

Barry Bosworth found it hard to believe that price expectations are as volatile in the short run as Modigliani had implied. To Bosworth, the

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short-run movements in nominal interest rates must represent primarily movements in the real rate of interest, rather than changes in price expectations. Smith agreed with Modigliani that inflationary expectations created problems in conducting monetary policy, but he was skeptical that these could be avoided by choosing monetary aggregates as targets. Presumably, changing price expectations will shift the demand for money and other liquid assets. Both Modigliani and Poole saw no evidence that the demand for money (in the narrow sense) is directly influenced by price expectations; that is, nominal interest rates belong in the money demand functions.

Poole stressed that the uncertainties about financial and real relationships were a relative matter. He considered our uncertainties about investment demand to be far greater than those relating to money demand. Poole agreed with Smith that interest rates must not be ignored. But he argued: "Generally, I would interpret an unexpected decline in interest rates primarily as evidence that demand in the real sector is weaker than anticipated rather than that monetary policy has become more expansionary."