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The Demand for Money by the Household Sector: Some Empirical Results

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The household sector in the United States is the largest holder of money, defined as including currency in circulation plus adjusted demand deposits. Most of the work on the demand for money has dealt with estimating its economy wide functions. Studies that deal with the household sector either analyze it within the framework of an inventory optimization approach[1] or restrict the households to a small set of the financial markets.[2] However, maximization of utility by the households requires that all financial markets in which consumers usually operate be included. In a dynamic framework it is possible that households may switch from one market to another depending upon favorable or unfavorable institutional change, change in expectations about the future course of economic activity or a change in available yields. Thus the purpose of this study is to analyze household behavior within the framework of established financial markets in which households usually participate. In addition, the basic demand equation is dynamically simulated to study changes in the household behavior. The dynamic simulation helps to analyze the effect of general economic and institutional changes, operating through their impact on the permanent income and asset yields, to change the demand for money.

This study uses the household sector's flow of funds quarterly data for the period 1953_{IV} to 1978_{IV}. All data are seasonally adjusted. Part I of the paper deals with the specification of the demand for money function. Part II is devoted to the empirical results. Part III summarizes the results.

I

It is postulated that the household sector holds a given amount of money for transaction purposes. The transactions variable is measured by real permanent disposable income Y_p. The choice of permanent, rather than current income was made on familiar theoretical grounds. Empirically, little difference was found when current income was substituted for permanent income.[3] Besides holding money to undertake transactions, households also hold near-monies in the form of time/savings accounts in commercial

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[1]See, for example, R. J. Barro and A. M. Santomero, "Household Money Holdings and the Demand Deposit Rate," *Journal of Money, Credit and Banking*, May, 1972; A. M. Santomero, "A Model of the Demand for Money by Households," *Journal of Finance*, March, 1974.

[2]M. J. Hamburger, "The Demand for Money by Households, Money Substitutes, and Monetary Policy," *Journal of Political Economy*, December, 1966; T. H. Lee, "Substitutability of Non-Bank Intermediary Liabilities for Money: The Empirical Evidence," *Journal of Finance*, September, 1966.

[3]On this point see, S. M. Goldfeld, "The Demand for Money Revisited," *Brookings Papers on Economic Activity*, No. 3, 1973, p. 628, Table 20.

banks, mutual saving banks, saving and loan associations and credit unions. These accounts are largely held in the form of passbook accounts subject to withdrawal without notice.[4] Households are the largest holders of these accounts. Legal ceilings exist on the interest rate which financial institutions can pay on such accounts. Compared with other markets described below, the time/savings deposit market is attractive to households because of convenience in making withdrawals/deposits without broker's fees and the safety provided by the FDIC and FSLIC or in the case of credit unions, by the National Credit Union Association. Furthermore, household resources are not used in collecting information, as is the case with stock and bond markets. Thus time/savings deposits are the closest substitute of money. Changes in the interest rates paid on these deposits relative to the yield on other assets should affect the demand for money.

The second major market in which households operate is the bond market. The instruments in this market vary greatly in terms of the price and default risks. These instruments also carry different maturity dates. In addition, there are usually brokers' fees in buying and selling bonds. Households invest in bonds with the usual prospect that the net return on bonds will be higher than on alternative assets. Since there is such a wide array of bonds available in terms of maturity and default risk, this analysis uses U. S. government 3–5 year bond rate (RB). The use of this rate does not imply that households preclude buying short-term or long-term bonds but that RB performed empirically better than Treasury Bill yield or AAA bond yield or U. S. long-term bond yield. The maturity structure of the bond market has been declining and the use of RB may simply capture this phenomenon better than other rates.

[4]Legally the holder of these accounts is required to give prior notice, but this requirement is seldom enforced.

The final market considered in this study is the market for equities. The demand for money will be affected if households participate in this market. The relevant yield in this market is taken to be the dividend price ratio. Households may also participate in other financial markets which may affect the demand for money. Investments in the form of life insurance, mutual funds, and institutional arrangements, for example, pension plans and social security benefits may also affect the stock of money which households hold. None of these are explicitly considered here for the principal reason that most of the assets of these institutions consist of stocks and bonds whose yields are already included in the basic demand equation for money for the household sector. Thus the demand for money in log-linear form for the household sector may be written as

$$\ell n\, M_t^* = b_0 + b_1\, \ell n\, Y_p + b_2\, \ell n\, RT + b_3\, \ell n\, RB + b_4\, \ell n\, RE + \eta_t. \quad (1)$$

M_t^* is the desired stock of real (1958 prices) money balances, defined as currency in circulation plus demand deposits adjusted for the household sector. Y_p is real disposable permanent income.[5] RT, RB, and RE are the interest rates on time deposits, yield on intermediate term (3–5 year) U. S. government bonds, and dividend price ratio on common stocks respectively.[6] η_t is the structural disturbance term which is assumed to have zero expectation.

[5]Data for real (1958 = 100) disposable income were taken from various issues of the *Survey of Current Business*. Permanent disposable income, Y_p, (in 1958 prices) is defined as

$$Y_p(T) = \beta \int_{-\infty}^{T} e^{(\beta-\alpha)}\,(t - T)\, Yd\,(t)\, dt$$

where α is the rate of growth of real Yd (disposable income) and β is the adjustment coefficient. We employed the same discrete approximation used by Milton Friedman, *A Theory of Consumption Function*, (Princeton University Press, 1957, pp. 144–145). Several series of Y_p, each corresponding to a different value of β were computed. By successively substituting one such series for another in the demand for money equation, we chose the one with the adjustment coefficient (β) equal to 0.15, since it provided the best fit.

Since the adjustment between actual and desired money balances may not be complete within a given quarter, a partial adjustment mechanism is predicated in which actual money holdings are assumed to adjust logarithmetically to the gap between desired holdings and the previous quarter's actual holdings; that is,

$$\ell n\, M_t - \ell n\, M_{t-1} = \alpha(\ell n\, M_t^* - \ell n\, M_{t-1}) \quad (2)$$

where α is the coefficient of adjustment. Substituting (2) into (1) yields the money demand equation in terms of observable variables:

$$\ell n\, M_t = \alpha\, b_0 + \alpha\, b_1\, \ell n\, Y_p + \alpha\, b_2\, \ell n\, RT + \alpha\, b_3\, \ell n\, RB + \alpha\, b_4\, \ell n\, RE + (1 - \alpha)\, \ell n\, M_{t-1} + \alpha\, \eta_t \quad (3)$$

If all the adjustment between desired and actual money holdings is completed within each quarter, the value of α would be one. This means that the model directly tests the extent to which the adjustment takes place.

II

Preliminary results using ordinary least squares showed the presence of negative serial correlation. Assuming a first order autoregressive disturbance structure, the Cochrane-Orcutt technique was used to reduce the level of serial correlation in order to improve the efficiency of the estimates.[7] The results of fitting equation (3) are presented in Table 1. Columns 3 to 12 give the estimates of equation (3) for the period 1953_{IV} to the fourth quarter given in column 2. Column 13 records the root mean square error of a four quarter forecast based on the corresponding equation. Thus, the four quarter forecast is for the year following the year given in column 2. Similarly, column 14 records the RMSE of the forecast for the period beginning with one year after the year given in column 2 and ending in 1978_{IV}. The following important observations can be made with respect to the statistical estimates presented in Table 1.

First, all the explanatory variables included in our specification display correct signs and, except for RE, are statistically significant. The coefficients of RE in equations for the years 1970–1973 are not significant at the five per cent level. The coefficient of RE is one-half or less for the years 1970–1973 compared to the relevant value for 1969. A possible explanation for these years could be made in the following way. The tight money policy pursued in 1969–1970 and the subsequent liquidity crisis leading to a major downturn in the stock market seems to have induced households to switch from equities to savings deposits or to increase the income elasticity of money. The switch to savings deposits was also caused by the change in January 1970 in Regulation Q which increased the maximum rates paid on saving deposits. Rising unemployment and adverse expectational effects caused by the 1969–1970 recession and the general state of uncertainty induced households to hold a larger amount of money for a given level of income. This shows itself in a higher value of the coefficient of Y_p compared to pre-1968 years.

Second, proper specification of the demand function for money should include, in addition to the transactions variable, Y_p, the yield or interest rate on alternative assets. The demand for money is affected not only by the traditional money substitutes savings/time deposits but also by other assets which are subject to price risk, namely, bonds and stocks.

Third, Table 1 confirms the hypothesis that money is but one of a number of financial

[6]Data on M, RB, and RE are taken from various issues of the *Federal Reserve Bulletin*. Data on RT was supplied by the Federal Reserve Board.

[7]The values of the serial correlation coefficient and the D. W. statistics are given in Table I. In the presence of the lagged dependent variable, the D. W. is biased towards 2.0.

TABLE I Demand Equations for Money for the Household Sector
Sensonally Adjusted, Quarterly Data, 1953_{IV}–1978_{IV}

			Regression Coefficients, & ( ) standard errors									Root mean-squared error	
No. *(1)*	*Period** *(2)*	*Intercept* *(3)*	*ln* Y_p *(4)*	*ln RT* *(5)*	*ln RB* *(6)*	*ln RE* *(7)*	*ln* M_{t-1} *(8)*	*ρ* *(9)*	R^2 *(10)*	*DW* *(11)*	*SE* *(12)*	*Four quarter** forecast* *(13)*	*Full Period*** forecast* *(14)*
1.	1964	−.0537	0.2293	−0.0430	−0.0399	−0.0401	0.8561	−.81	.926	1.59	.0119	.011	.027
		(.379)	(.088)	(.021)	(.007)	(.013)	(.053)						
2.	1965	−.7787	0.2709	−0.0531	−0.0396	−0.0357	0.8485	−.76	.955	1.57	.0125	.021	.033
		(.257)	(.075)	(.018)	(.008)	(.013)	(.057)						
3.	1966	−.6239	0.2837	−0.0531	−0.0441	−0.0397	0.7969	−.70	.961	1.65	.0139	.025	.028
		(.213)	(.077)	(.018)	(.009)	(.013)	(.064)						
4.	1967	−.7648	0.3107	−0.0605	−0.0433	−0.0371	0.7939	−.72	.973	1.63	.0142	.024	.031
		(.172)	(.072)	(.017)	(.009)	(.013)	(.063)						
5.	1968	−.8152	0.3115	−0.0623	−0.0429	−0.0385	0.8054	−.71	.981	1.66	.0144	.038	.034
		(.169)	(.074)	(.017)	(.009)	(.013)	(.062)						
6.	1969	−.8220	0.3519	−0.0683	−0.0499	−0.0433	0.7567	−.72	.985	1.67	.0148	.034	.030
		(.172)	(.072)	(.017)	(.008)	(.013)	(.058)						
7.	1970	−.9451	0.3910	−0.0734	−0.0479	−0.0245[a]	0.7272	−.66	.984	1.62	.0164	.028	.033
		(.192)	(.082)	(.019)	(.009)	(.013)	(.066)						
8.	1971	−.8389	0.3691	−0.0679	−0.0441	−0.0229[a]	0.7295	−.67	.987	1.66	.0165	.023	.033
		(.178)	(.079)	(.019)	(.009)	(.013)	(.066)						
9.	1972	−.7313	0.3395	−0.0595	−0.0399	−0.0166[b]	0.7396	−.67	.989	1.61	.0164	.019	.035
		(.163)	(.077)	(.018)	(.009)	(.012)	(.065)						
10.	1973	−.7264	0.3542	−0.0616	−0.0405	−0.0167[b]	0.7191	−.66	.991	1.57	.0164	.044	.044
		(.158)	(.075)	(.018)	(.009)	(.012)	(.064)						
11.	1974	−.4670	0.2605	−0.0473	−0.0377	−0.0476	0.7913	−.61	.989	1.48	.0185	.031	.041
		(.169)	(.083)	(.020)	(.010)	(.012)	(.071)						
12.	1975	−.6700	0.3010	−0.0517	−0.0409	−0.0418	0.7807	−.62	.990	1.76	.0163	.022	.040
		(.189)	(.076)	(.017)	(.008)	(.013)	(.064)						
13.	1976	−.5701	0.3208	−0.0580	−0.0418	−0.0319	0.796	−.58	.991	1.84	.0157	.020	.044
		(.016)	(.071)	(.019)	(.007)	(.011)	(.058)						
14.	1977	−.5800	0.3307	−0.0517	−0.0427	−0.0401	0.801	−.61	.994	1.81	.0166	.040	.040
		(.015)	(.068)	(.017)	(.007)	(.010)	(.056)						
15.	1978	−.5602	0.3204	−0.0562	−0.0436	−0.0406	0.805	−.58	.993	1.86	.0158		
		(.013)	(.059)	(.016)	(.008)	(.009)	(.058)						

*Each sample period begins with 1953 IV and terminates with the fourth quarter of the year given in column 2.

**This column gives the RMSE (in logs of billions of 1958 dollars) for the four quarters following the year given in the corresponding row.

***This column gives the RMSE (in logs of billions of 1958 dollars) for the period which starts with one year after the year given in the corresponding row and the total sample period ending in 1978 IV. For example, row 12, column 13 gives the RMSE for the year 1976 and column 14 gives the RMSE for the period 1976-I to 1978-IV.

[a]Statistically significant at 10 percent level.

[b]Statistically significant at 20 percent level.

R^2 is the coefficient of determination, DW is Durbin-Watson statistic, and SE is the standard error of the regression estimate. ρ is the value of the first order serial correlation coefficient. These statistics refer to the period given in column 2.

assets. A lowering in the yield of one type of asset will lead investors to shift to other assets. This is true not only of substitution between money and savings type of deposits but also between money and risk bearing assets, particularly stocks. This negates Tobin's contention that equities are not substitutable for money because of price risk.[8] For example, if the monetary authority uses open market sales to lower the yield on bonds it may cause households to switch to alternative assets. Alternatively, a lowering of the ceiling on interest rates paid on savings deposits by the monetary authority may force households to switch to bonds or equities. Although the households are slow in adjusting actual to desired money balances, as shown by the coefficient of M_{t-1}, the speed of adjustment does increase slightly after 1969 when yield differentials between various categories of assets became slightly larger.

Besides the explanatory variable mentioned above, proper specification of the demand function for money requires a lagged value of the money stock. The adjustment between the actual and desired money balances is given by one minus the coefficient of M_{t-1}. The value of one minus the coefficient starts at a low level of 0.1439 in 1964, steadily increases to 0.2809 in 1973,[9] and then decreases to 0.195 in 1978. A possible explanation of this phenomenon lies in the upward shift of the term structure of interest rates and the increased awareness of it on the part of the public. Higher interest rates may induce the public to adjust its actual to desired balances at a faster rate. The long-run elasticity of the parameters can be found by dividing the short-run elasticities given in Table 1 by one minus the coefficient of the lagged money variable. For example, for the total sample period, 1953_{IV} to 1978_{IV}, given in row 15 the long-run elasticities are as follows: 1.64 for Y_p, 0.288 for RT, 0.224 for RB and 0.208 for RE. Similar calculations recorded in Table 2 for other sample periods show that the long-run elasticities vary considerably.

TABLE 2 Long-Run Elasticities

No.	Period 1953-IV to	Y_p	RT	RB	RE
1.	1964-IV	1.59	−.299	−.277	−.279
2.	1965-IV	1.79	−.350	−.261	−.236
3.	1966-IV	1.40	−.261	−.217	−.195
4.	1967-IV	1.51	−.294	−.210	−.180
5.	1968-IV	1.60	−.320	−.220	−.198
6.	1969-IV	1.45	−.281	−.205	−.178
7.	1970-IV	1.43	−.269	−.176	−.090
8.	1971-IV	1.36	−.251	−.163	−.085
9.	1972-IV	1.30	−.228	−.153	−.064
10.	1973-IV	1.26	−.219	−.144	−.059
11.	1974-IV	1.25	−.227	−.181	−.228
12.	1975-IV	1.37	−.236	−.187	−.191
13.	1976-IV	1.57	−.284	−.205	−.156
14.	1977-IV	1.66	−.260	−.215	−.202
15.	1978-IV	1.64	−.288	−.224	−.208

NOTE: Long-run elasticities are calculated by dividing the short-run elasticities given in Table I by one minus the coefficient of the lagged money variable.

Tests not reported here which used interest rates on savings and loan associations, mutual savings banks, or yields on short-term bills or long-term bonds, or alternative formulations of the yield on stocks, provided poorer forecast results. It is possible to determine a demand equation for money for a given sample which may include alternative variables, but the tracking ability of such equations is poorer than the results presented in Table 1. Column 13, records the forecast for one year subsequent to the basic equation and findings for the sample period to the fourth quarter of 1978 are given in column 14. In general the RMSEs given in column 13 or 14 are fairly small. This indicates that the basic equation is well specified.[10]

[8]J. Tobin, "Money, Capital and Other Stores of Value," *American Economic Review*, May, 1961, p. 34

[9]For the economy wide demand for money function, Goldfeld found a value of 0.283 for the period 1952_{II} to 1972_{IV}. See Goldfeld, *op.cit.*, pp. 582–583.

Also see G. S. Laumas and Y. P. Mehra, "The Stability of the Demand for Money Function: The Evidence from Quarterly Data, "*Review of Economics & Statistics*, November, 1976; and G. S. Laumas and David E. Spencer, "The Stability of the Demand for Money: Evidence from the Post-1973 period, "*Review of Economics & Statistics*, August, 1980.

III

Use of a fairly general specification of the demand for money function for the household sector made it possible to show how the household behavior varies over time.[11] The variations are mostly of a short-run nature and are caused by changes in interest rates or yields. Effective monetary policy requires that these changes be taken into account.

[10]No serious problem of multicollinearity was encountered inspite of our including two interest rates and a dividend yield. Demand for money equations which include an interest rate and the dividend yield are also estimated by Michael J. Hamburger, "Behavior of the Money Stock: Is There a Puzzle?" *Journal of Monetary Economics*, 3, 1977, pp. 265–88.

[11]It should be pointed out that the evidence provided in this paper indicates that the forecasting errors in the controversial post-1973 period are lower for the household sector compared to the economy-wide functions. On this point see, Stephen M. Goldfeld, "The Case of the Missing Money," *Brookings Papers on Economic Activity*, 3, 1976, p. 715; and G. S. Laumas and D. E. Spencer, *op.cit.*