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The Demand For Money In The Recent Period

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The demand for money function is an important fundamental relationship in macroeconomic theory and policy. The stability of this relationship is essential for the successful conduct of the monetary policy. In recent years, a number of studies[1] indicate that the "conventional" demand for money (defined as M1) function, which was stable in the pre-1973 period, shifted. Most studies have been devoted to analyzing the causes of this temporal instability of the demand for money function. In this paper, we accept the general consensus that there was a shift in the function in 1973 and undertake to provide estimates of the demand for money for the pre-1973 and the post-1973 sample periods in order to pinpoint the parameters which have shifted. The analysis employs the varying parameter estimation technique and uses the United States seasonally adjusted quarterly data for the period 1952-I to 1979-IV.[2] The major conclusion of this paper is that a stable demand function exists for the post-1973 period and that the values of the parameters for the recent period are substantially different from those of the pre-1973 period. In Section I, we present the conventional specification of the demand for money and describe briefly the stability test. Section II contains the empirical results and their implications.

I

A synthesis of the previous studies of the demand for money suggests that the desired demand for real money balances can be specified as a positive function of real income and a negative function of the opportunity cost of holding money. Formally, the demand for money function in log-linear[3] form can be written as

$$\ln M_t^* = \beta_0 + \beta_1 \ln Y_t + \beta_2 \ln R_t + \eta_t \quad (1)$$

here M_t^* is the desired stock of real Ml defined to include currency in circulation and demand deposits adjusted; Y_t is real GNP (or YP_t – real permanent GNP in Table II); R_t is the yield on 4–6 month prime commercial paper; and η_t is the stochastic disturbance term. Ml and GNP were deflated using the implicit GNP deflator (1972 = 100). YP_t are the permanent values of GNP in 1972 prices.

Since the adjustment between desired and actual money balances may not be completed within a given quarter, a partial adjustment mechanism is specified in which actual money balances are adjusted logarithmetically to the gap between desired balances and last period's

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[1]The original studies are by Goldfeld (1976) and Enzler, Johnson, and Paulus (1976). Further studies which analyze the shift are: Boughton (1981); Friedman (1978); Garcia and Pak (1979); Hamburger (1977); Hein (1980); Hafer and Hein (1979); Heller and Khan (1979); Laumas and Spencer (1980); Portor, Simpson, and Manskopf (1979).

[2]This is the latest period for which consistent data on Ml is available.

[3]For justification of this functional form, see Zarembka (1968).

actual balances (Feige, 1967); that is

$$\ln M_t - \ln M_{t-1} = \alpha(\ln M^* - \ln M_{t-1}) \quad (2)$$

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

$$\ln M_t = \alpha\beta_0 + \alpha\beta_1 \ln Y_t + \alpha\beta_2 \ln R_t + (1 - \alpha) \ln M_{t-1} + \alpha\eta_t \quad (3)$$

Equation (3) is estimated using the varying parameter regression technique proposed by Cooley and Prescott. This technique has been described in detail by Cooley and Prescott (1976), and by Laumas and Mehra (1976). This technique is based on the premise that the parameter vector in an econometric relationship may be subject to sequential variations over time due to structural changes, specification errors, problems of aggregation, or institutional change. These factors may result in "transitory" or "permanent" shifts in the function. An econometric relationship is stable if the parameters are not subject to permanent changes over time. A brief description of the procedure is given below:

$$M_t = X_t \beta_t \quad (4)$$

where M_t denotes the t^{th} observation on the log value of real Ml, X_t is a four component column vector consisting of the four explanatory variables including the constant for t^{th} observation, and β_t is a four component vector of unknown parameters assumed to be subject to sequential variation. The parameters, β_t, are assumed to be adaptive and subject to permanent and transitory variations over time of the type

$$\beta_t = \beta_t^P + U_t \text{ and} \quad (5)$$
$$\beta_t^P = \beta_{t-1}^P + V_t$$

where the superscript P denotes the permanent component of the parameter. The stochastic variates U_t and V_t are assumed normally, identically, and independently distributed with respect to each parameter and have the covariance structure of the form

$$\text{Cov}(U_t) = (1 - \gamma)\,\sigma^2\Sigma_U \quad (6)$$
$$\text{Cov}(V_t) = \gamma\sigma^2\Sigma_V$$

If we assume that permanent changes and transitory changes are equally important, we may assume $\Sigma U = \Sigma V$. Given this assumption, and basing the estimation on the realization of the parameter values one period past the sample period, the maximum likelihood estimates for β, σ^2, and γ are obtained (see Cooley and Prescott, 1976, p. 171). The parameter γ which indicates the magnitude of the permanent change in the parameter process is a measure of the stability of the structural relationship, $0 \leq \gamma \leq 1$ (see Cooley and Prescott, 1976, p. 171). If γ is closer to 1, permanent changes are large relative to transitory changes, and the model is unstable. Obviously, if $\gamma = 0$, then $\text{Cov}(V_t) = 0$ and the model is stable.

Since we have assumed $\Sigma U = \Sigma V = \Sigma$, several ranges of the values of the diagonal elements are used. These are:

$$\Sigma_1 = \text{diag}(1.0, 0, 0, 0)$$
$$\Sigma_2 = \text{diag}(1.0, 0.1, 0.1, 0.1)$$
$$\Sigma_3 = \text{diag}(1.0, 0.5, 0.5, 0.5)$$
$$\Sigma_4 = \text{diag}(1, 1, 1, 1)$$

It is expected that the range of variation in the parameter vector β provided by these four specifications is rich enough to include the actual values.

II

Presented in Tables I and II are the maximum likelihood estimates of the parameter vector β, σ^2 and γ for equation (3). In Table I, the income constraint is represented by real GNP, Y_t, while in Table II real permanent GNP, YP_t, replaces real GNP. The results are very similar whether we use Y_t or YP_t. All the explanatory variables included in the different

TABLE 1. Maximum Likelihood Estimates of the Demand Function for Money
$\ln M_t = \delta_0 + \delta_1 \ln Y_t + \delta_2 \ln R_t + \delta_3 \ln M_{t-1}$

Σ	*Regression Coefficients and ( ) Standard Errors*	$\hat{\sigma}^2$	$\hat{\gamma}$	Z
	1974-I to 1979-IV			
Σ_1	$\ln M_t = 0.0115 + 0.0471 \ln Y_t - 0.0186 \ln R_t + 0.8804 \ln M_{t-1}$	.481	0.0	0.0
	(.1150) (.0229) (.0059) (.0819)		(.0065)	
Σ_2	$\ln M_t = 0.0046 + 0.0506 \ln Y_t - 0.0189 \ln R_t + 0.8829 \ln M_{t-1}$	.217	0.0	0.0
	(.1127) (.0250) (.0058) (.0819)		(.0065)	
Σ_3	$\ln M_t = 0.0012 + 0.0503 \ln Y_t - 0.0190 \ln R_t + 0.8839 \ln M_{t-1}$	.068	0.0	0.0
	(.1111) (.0240) (.0058) (.0817)		(.0065)	
Σ_4	$\ln M_t = 0.0005 + 0.0505 \ln Y_t - 0.0190 \ln R_t + 0.8841 \ln M_{t-1}$	.0035	0.0	0.0
	(.1097) (.0241) (.0057) (.0809)		(.000004)	
	1952-I to 1973-IV			
Σ_1	$\ln M_t = -0.0275 + 0.0446 \ln Y_t - 0.0175 \ln R_t + 0.9476 \ln M_{t-1}$	.367	0.0	0.0
	(.0125) (.0076) (.0029) (.0241)		(.00045)	
Σ_2	$\ln M_t = -0.0274 + 0.0432 \ln Y_t - 0.0169 \ln R_t + 0.9506 \ln M_{t-1}$	.214	0.0	0.0
	(.0126) (.0075) (.0029) (.0236)		(.00046)	
Σ_3	$\ln M_t = -0.0271 + 0.0418 \ln Y_t - 0.0165 \ln R_t + 0.9527 \ln M_{t-1}$	.083	0.0	0.0
	(.0127) (.0074) (.0028) (.0233)		(.00046)	
Σ_4	$\ln M_t = -0.0269 + 0.0415 \ln Y_t - 0.0163 \ln R_t + 0.9532 \ln M_{t-1}$	.047	0.0	0.0
	(.0128) (.0073) (.0029) (.0232)		(.00046)	

Note: $\hat{\sigma}^2$ is $10^{-4} \times$ the value reported above. Each of the above specifications of the demand for money is estimated by using the seasonally adjusted quarterly data for the respective sample periods. Z is the test of the null hypothesis that the stochastic processes underlying the unknown parameter vectors are stable but random. $\Sigma_1 = (1.0, 0, 0, 0)$, $\Sigma_2 = (1.0, 0.1, 0.1, 0.1)$, $\Sigma_3 = (1.0, 0.5, 0.5, 0.5)$ and $\Sigma_4 = (1, 1, 1, 1)$.

specifications of the demand for money for the two sample periods have the expected signs and are statistically significant. The following important observations can be made with respect to the statistical estimates presented in Table I.

With regard to the important issue of stability, the null hypothesis that $\gamma = 0$, and, therefore, the parameter vector is not subject to permanent changes is accepted for all the specifications for the two sample periods. Naturally, when the two periods are combined and the sample size is from 1952-I to 1979-IV, none of the specifications provided stable results.[4] This confirms the conclusion reached earlier by Goldfeld (1976) and Enzler *et. al.* (1976).

Comparing the two sample periods in Tables I and II, one can notice major changes in the values of the constant term and the coefficients of M_{t-1}. In the recent period, the constant term is positive, but not statistically significant. In the earlier period the constant term is negative and statistically significant. This implies a basic underlying change in the behavior of the public. In the recent period, the public is holding a higher level of average money balances for given values of other parameters. At the same time the public's speed of adjustment between desired and actual money balances is faster in the recent period compared to the earlier period. This can be seen by comparing the coefficient of ln M_{t-1} which is about .88 implying an adjustment of about 12 percent in the 1974–79 period and an adjustment of about 5 percent in the 1952–73 period.

A further implication of this change in the speed of adjustment is that the long-run income and interest rate elasticities are lower in the recent period. The long-run income elasticity ranges between .39 to .43 (depend-

[4]These results can be obtained from the author.

TABLE 2. Maximum Likelihood Estimates of the Demand Function for Money
$\ln M_t = \beta_0 + \beta_1 YP_t + \beta_2 \ln R_t + \beta_3 \ln M_{t-1}$

Σ	*Regression Coefficients and ( ) Standard Errors*	$\hat{\sigma}^2$	$\hat{\gamma}$	Z
	1974-I to 1979-IV			
Σ_1	$\ln M_t = -0.2520 + 0.535 \ln YP_t - 0.0190 \ln R_t + 0.8843 \ln M_{t-1}$	.5126	0.0	0.0
	(.3416) (.0211) (.0068) (.0943)		(0.0065)	
Σ_2	$\ln M_t = -0.2625 + 0.0548 \ln YP_t - 0.0192 \ln R_t + 0.8864 \ln M_{t-1}$	.0760	0.0	0.0
	(.3367) (.0205) (.0068) (.0936)		(0.0065)	
Σ_3	$\ln M_t = -0.2639 + 0.0550 \ln YP_t - 0.0192 \ln R_t + 0.8867 \ln M_{t-1}$	.0179	0.0	0.0
	(.3380) (.0207) (.0068) (.0940)		(0.0065)	
Σ_4	$\ln M_t = -0.2641 + 0.0550 \ln YP_t - 0.0192 \ln R_t + 0.8867 \ln M_{t-1}$	.0088	0.0	0.0
	(.3376) (.0206) (.0068) (.0939)		(0.0065)	
	1952-I to 1973-IV			
Σ_1	$\ln M_t = -0.2179 + 0.0412 \ln YP_t - 0.0164 \ln R_t + 0.9580 \ln M_{t-1}$	.3852	0.0	0.0
	(.0384) (.0077) (.0029) (.0241)		(0.0004)	
Σ_2	$\ln M_t = -0.2134 + 0.0402 \ln YP_t - 0.0161 \ln R_t + 0.9600 \ln M_{t-1}$	.0680	0.0	0.0
	(.0383) (.0076) (.0030) (.0240)		(0.0005)	
Σ_3	$\ln M_t = -0.2126 + 0.0400 \ln YP_t - 0.0160 \ln R_t + 0.9604 \ln M_{t-1}$	.0157	0.0	0.0
	(.0381) (.0076) (.0029) (.0238)		(0.0005)	
Σ_4	$\ln M_t = -0.2125 + 0.0400 \ln YP_t - 0.0160 \ln R_t + 0.9604 \ln M_{t-1}$	.0080	0.0	0.0
	(.0380) (.0076) (.0029) (.0238)		(0.0005)	

Note: The remarks given below Table I apply here also.

ing on the Σ specification) and the interest elasticity between .156 to .164 in the recent period. In contrast to this, earlier period's long-run income elasticity ranges between .85 and .89 and interest elasticity between .33 and .35. These results do not change whether we use Y_t or YP_t. Thus the obvious inference is that for each of the sub-periods "permanent income and current income appear to be equally valid constraints and yield equally stable demand functions for money" (Laumas and Mehra, 1976). Additionally, one can notice small differences in the short-run income and interest rate elasticities between the two periods.

These findings have important implications for the conduct of monetary policy. In recent years, a great deal of research has been done on the causes of the shift in the demand for money function. The purpose of this paper is to use a fairly robust technique (see Garbade, 1977) to estimate the demand for money. The results indicate that after the shift, the demand for money has been a stable function. The values of the parameters are different from the earlier period. These findings should be taken into account in formulating monetary policy. The analysis rejects the view of a constantly shifting demand for money and affirms the use of monetary policy as a useful tool for economic stabilization.

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