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 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 1952:4 to 1979:4. 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 form can be written as

$$M^t = a_0 + b_1 Y + b_2 R_{t-1} + \varepsilon_t$$

Here $M^t$ is the desired stock of real M1 defined to include currency in circulation and demand deposits adjusted; $Y$ is real GNP (or $Y^t$ - real permanent GNP in Table II); $R_{t-1}$ is the yield on 4-6 month prime commercial paper; and $\varepsilon_t$ is the stochastic distortion term. M1 and GNP were deflated using the implicit GNP deflator (1972 = 100); $Y^t$ 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 logarithmically to the gap between desired balances and last period's balances.

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1The original studies are by Goldfield (1976) and Fetter, Johnson, and Paula (1978). Further studies which analyze the shift are: Bouchoux (1981); Friedman (1978); Grivsko and Pah (1979); Hamburger (1977); Heise (1980); Hesse and Heise (1979); Hoffa and Khaz (1979); Laumas and Spencer (1980); Porter, Simpson, and Musgrave (1979).

2This is the latest period for which consistent data on M1 is available.

3For justification of this functional form, see Zarembka (1968).
actual balances (Feige, 1967); that is
\[
\ln M_t - \ln M_{t-1} = \alpha \left( \ln M^* - \ln M_{t-1} \right)
\]
where \( \alpha \) is the coefficient of adjustment. Sub- 
stituting (2) into (1) yields the money demand equation in terms of observable variables:
\[
\ln M_t = \alpha \delta_0 + \alpha \delta_1 \ln Y_t + \alpha \delta_2 \ln R_t + \alpha \delta_3 + \alpha \delta_4 \ln M_{t-1}
\]
Equation (3) is estimated using the varying parameter regression technique proposed 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 relation- 
ship may be subject to sequential varia-

tions 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 descrip-
tion of the procedure is given below:
\[ M_t = X_t \beta_t \]
(4)
where \( M_t \) denotes the \( t \)th observation on the log 
value of real M1, \( X_t \) is a four component 
column vector consisting of the four explana-
tory variables including the constant for \( t \)th 
observation, and \( \beta_t \) is a four component 
vector of unknown parameters assumed to be subject to 
sequential variation. The \( \beta_t \), are 
assumed to be adaptive and subject to 
permanent and transitory variations over time 
of the type
\[
\beta_t = \beta^*_t + \Upsilon_t \quad \text{and} \quad \beta^*_t = \beta^*_0 + \Pi_t
\]
where the superscript \( P \) denotes the per-
manent component of the parameter. The 
sto
castic variables \( \Upsilon_t \) and \( \Pi_t \) are assumed 
normally, identically, and independently dis-
tributed with respect to each parameter and 
and have the covariance structure of the form
\[
\text{Cov}(U_t) = (1 - \gamma) \sigma^2 \Sigma_u
\]
\[
\text{Cov}(V_t) = \gamma \sigma^2 \Sigma_v
\]
If we assume that permanent changes and 
transitory changes are equally important, we 
may assume \( \Sigma_u = \Sigma_v \). Given this assumption, and 
looking to the estimation of the realization of 
the parameter values one period past the 
sample period, the maximum likelihood esti-
mates for \( \beta^*_0, \gamma \), and \( \sigma \) are obtained (see Cooley and 
Prescott, 1976, p. 171). The parameter \( \gamma \) which 
indicates the magnitude of the permanent 
change in the parameter process is a 
measure of the stability of the structural rela-
tionship, \( 0 < \gamma < 1 \) (see Cooley and 
Prescott, 1976, p. 171). If \( \gamma \) is closer to 1, permanent 
changes are large relative to transitory 
changes, and the model is unstable. Obviou-

sly, 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:
\[
\Sigma = \text{diag}(1, 0, 0, 0)
\]
\[
\Sigma = \text{diag}(1, 0.1, 0.1, 0.1)
\]
\[
\Sigma = \text{diag}(1, 0.5, 0.5, 0.5)
\]
\[
\Sigma = \text{diag}(1, 1, 1, 1)
\]
It is expected that the range of variation in 
the parameter vector \( \beta \) provided by these four 
specifications is rich enough to include 
the actual values.

II
Presented in Tables I and II are the maxi-

mum likelihood estimates of the parameter 
vector \( \beta, \varepsilon \), and for equation (3). In 
Table I, the income constraint is represented by 
real GNP, \( Y_t \), while in Table II real perma-
nent GNP, \( Y^*_t \), replaces real GNP. The results 
are similarly valid whether we use \( Y_t \) or \( Y^*_t \). All the 
explanatory variables included in the different 

\[ \text{coefficients of } M_{t-1} \text{. In the recent period, } \]

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 
\( M_{t-1} \), which is about .88 implying an adjust-
ment 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-

\[ \text{coefficients of } M_{t-1} \text{. In the recent period, the } \]

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in the recent period. The long-run income 
elasticity ranges between .39 to .43 (depend-
### TABLE 2. Maximum Likelihood Estimates of the Demand Function for Money  
\[ M_t = \beta_0 + yP_t + \beta_1 R_t + \beta_2 L_t + \varepsilon_t \]  
\[ M_{t-1} \]

<table>
<thead>
<tr>
<th>Variable</th>
<th>Regression Coefficients (1) Standard Errors</th>
<th>( \beta )</th>
<th>( \gamma )</th>
<th>( \varepsilon )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1974-I to 1979-IV</td>
<td>( \beta_0 = -0.2539 + 0.535 ) ( \ln P_t )</td>
<td>( -0.0199 + 0.8083 ) ( \ln M_{t-1} )</td>
<td>0.526</td>
<td>0.0</td>
</tr>
<tr>
<td>( \varepsilon )</td>
<td>( 0.0006 ) )</td>
<td>( 0.0006 ) )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1975-I</td>
<td>( \beta_0 = -0.6256 + 0.5584 ) ( \ln P_t )</td>
<td>( -0.0197 + 0.8164 ) ( \ln M_{t-1} )</td>
<td>0.710</td>
<td>0.0</td>
</tr>
<tr>
<td>( \varepsilon )</td>
<td>( 0.0006 ) )</td>
<td>( 0.0006 ) )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1976-I</td>
<td>( \beta_0 = -0.2656 + 0.5520 ) ( \ln P_t )</td>
<td>( -0.0197 + 0.8867 ) ( \ln M_{t-1} )</td>
<td>0.179</td>
<td>0.0</td>
</tr>
<tr>
<td>( \varepsilon )</td>
<td>( 0.0006 ) )</td>
<td>( 0.0006 ) )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1977-I</td>
<td>( \beta_0 = -0.2661 + 0.5510 ) ( \ln P_t )</td>
<td>( -0.0197 + 0.8867 ) ( \ln M_{t-1} )</td>
<td>0.096</td>
<td>0.0</td>
</tr>
<tr>
<td>( \varepsilon )</td>
<td>( 0.0006 ) )</td>
<td>( 0.0006 ) )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1978-I</td>
<td>( \beta_0 = -0.2179 + 0.6412 ) ( \ln P_t )</td>
<td>( -0.0164 + 0.7900 ) ( \ln M_{t-1} )</td>
<td>3.852</td>
<td>0.0</td>
</tr>
<tr>
<td>( \varepsilon )</td>
<td>( 0.0004 ) )</td>
<td>( 0.0004 ) )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1979-I</td>
<td>( \beta_0 = -0.2134 + 0.6803 ) ( \ln P_t )</td>
<td>( -0.0161 + 0.6900 ) ( \ln M_{t-1} )</td>
<td>0.680</td>
<td>0.0</td>
</tr>
<tr>
<td>( \varepsilon )</td>
<td>( 0.0005 ) )</td>
<td>( 0.0005 ) )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1980-I</td>
<td>( \beta_0 = -0.2126 + 0.5921 ) ( \ln P_t )</td>
<td>( -0.0161 + 0.9604 ) ( \ln M_{t-1} )</td>
<td>0.017</td>
<td>0.0</td>
</tr>
<tr>
<td>( \varepsilon )</td>
<td>( 0.0005 ) )</td>
<td>( 0.0005 ) )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1981-I</td>
<td>( \beta_0 = -0.2125 + 0.4940 ) ( \ln P_t )</td>
<td>( -0.0160 + 0.9604 ) ( \ln M_{t-1} )</td>
<td>0.080</td>
<td>0.0</td>
</tr>
<tr>
<td>( \varepsilon )</td>
<td>( 0.0005 ) )</td>
<td>( 0.0005 ) )</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The remarks given below Table 1 apply here also.

The values of the parameters are different from the earlier period. These findings show that the demand for money can 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.

**References**


