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Estimation of Money Demand and Money Supply Functions for Pakistan: A Simultaneous-equations Approach

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I. INTRODUCTION

The role of monetary sector in determining the level of key macro-economic variables like income, employment and prices is well established in the economics literature. The importance of monetary economics has inspired many economists to undertake research in this field and most of their work on Pakistan relates to empirical estimation of the two key relationships in the monetary sector, namely, demand and supply functions for money.

The stock of money in an economy is determined by the interaction of the forces of demand and supply. But, unfortunately, empirical work in Pakistan pertains to separate estimations of demand and supply functions. For example, Abe *et al.* [1], Akhtar [2], Khan [7; 8; 9], Mangla [10] and Nisar and Aslam [14] have estimated only money demand function, using alternative specifications. The supply side influences on money stock are, however, ignored in these studies. On the other hand, Hamdani [5] and Mangla [11] have estimated money supply functions based on a variety of models, but have not taken into account the demand side of the money market. Another shortcoming of the above-mentioned studies is that they have employed the Ordinary-Least-Squares (OLS) method of estimation, which in the presence of simultaneity, leads to biased and inconsistent estimates [20]. Two different studies by Naqvi *et al.* [12; 13] have taken care of a major drawback of the previous studies; instead of using the OLS method of estimation, they have applied the Two-Stage Least-Squares (2SLS) procedure to estimate money supply and money demand equations. In this way, although they obtained consistent estimates of the coefficients, simultaneous estimation of these two equations was still not done.

Considering the fact that money stock in an economy is not explained by a single money demand or money supply equation but is determined by the mutual interaction of both demand and supply factors, in the present study we intend to

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specify a simple three-equation model of Pakistan's money market, incorporating both demand and supply functions. Then, using the 2SLS estimation procedure, we will estimate these equations. In the third stage, we shall evaluate the superiority of a simultaneous-equation model over the models which only take into account either demand or supply side of the money market. This will be done by comparing within-the-sample forecasts of these models.

The plan of the paper is as follows. In Section II we specify the model. Data and methodology are discussed in Section III. The results of estimation and comparison of historical forecasts of money stock obtained from different models are the subject matter of Section IV. Finally, the main findings and conclusions of this study are summarized in Section V.

II. SPECIFICATION OF THE MODEL

A simple model consisting of a demand for and a supply of money equation, along with an equilibrium condition, is constructed below.

The Demand for Money Function

Monetary theory suggests that the demand for money is in fact demand for real money balances because it is not the nominal quantity of money but the real purchasing power which counts. Conventionally, the demand for real money balances is expressed as a Cobb-Douglas-type function of a scale variable (usually current or permanent income) and one or more interest-rate variables. The general form of the equation is of the following type.

$$(M^d/p)_t = A(Y/p)_t^{\alpha_1} \; r_t^{\alpha_2} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \text{(i)}$$

where

M^d = Nominal quantity of money demanded;
P = Price level (assumed to be given);
Y = Nominal current income;
r = Some measure of interest rate; and
t = Time subscript.

For estimation purposes, Equation (i) can be transformed into a simpler form by taking logarithm of both of its sides. The resulting equation will be:

$$\log (M^d/p)_t = \log A + \alpha_1 \log (Y/p)_t + \alpha_2 \log r_t \quad \ldots \quad \ldots \quad \text{(ii)}$$

Another method of transformation is suggested by Teigen [19] which states that if Equation (i) expanded with the help of Taylor series, we get the following outcome.[1]

$$(M^d/P)_t = \theta_0 + \theta_1 (Y/P)_t \cdot r_t + \theta_2 (Y/P)_t \quad \ldots \quad \ldots \quad \ldots \quad \text{(iii)}$$

If a lagged real-money-stock variable is introduced as a predetermined variable in Equations (ii) and (iii), the following demand-for-money equations will result.

$$\log (M^d/P)_t = \alpha_0 + \alpha_1 \log (Y/P)_t \; \alpha_2 \log r_t + \alpha_3 \log (M^d/P)_{t-1} \quad \ldots \quad \text{(iv)}$$

$$(M^d/P)_t = \theta_0 + \theta_1 (Y/P_t) r_t + \theta_2 (Y/P)_t + \theta_3 (M^d/P)_{t-1} \quad \ldots \quad \text{(v)}$$

The lagged dependent variable in the demand-for-money equation is generally introduced by assuming partial adjustment of the actual money-stock to the desired level.[2]

The Supply of Money Function

The specification of money supply function resembles the famous Brunner and Meltzer [3] and Butkiewicz [4] types of formulation in which the supply of nominal money is made a function of monetary base, ratio of currency to demand deposits and interest rate. In linear form, the equation looks like

$$M_t^s = \gamma_0 + \gamma_1 MB_t + \gamma_2 \left(\frac{CC}{DD}\right)_t + \gamma_3 r_t \quad \ldots \quad \ldots \quad \text{(vi)}$$

where

M^s = Nominal money supply;
MB = Monetary base; and
(CC/DD) = Ratio of currency to demand deposits.

The logarithmic version of Equation (vi) will be

$$\log M_t^s = \beta_0 + \beta_1 \log MB_t + \beta_2 \log \left(\frac{CC}{DD}\right)_t + \beta_3 \log r_t \quad \ldots \quad \ldots \quad \text{(vii)}$$

[1] For detailed derivation, see Teigen [19; pp. 485-486, footnote 14]. While many studies can be found for Pakistan which have estimated the double log-linear form – Equation (ii) it seems that none has so far tried the Teigen-type equation.

[2] In Equation (v), the appearance of lag can also be explained through an adaptive-expectations model. See Thomas [20, p. 298].

After specification of the demand and supply equations, the system is closed by introducing an equlibrium condition. This condition simply states that in equilibrium the quantity of money demanded is equal to the quantity of money supplied, i.e.

$$M_t^d = M_t^s = M_t \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad \text{(viii)}$$

Combining various specifications of demand and supply equations discussed above, we can develop several models for Pakistan's money market. In the following we report two money market models which will be used for estimation and forecasting purposes. To make matters a little easier, we have combined log-linear money demand function with log-linear money supply function, while the Teigen-type money demand function is combined with linear money supply function. The two models are as follows.

Model I

MONEY DEMAND:

$$(M^d/p)_t = \theta_0 + \theta_1 (Y/p)_t r_t + \theta_2 (Y/p)_t + \theta_3 (M^d/p)_{t-1}$$

MONEY SUPPLY:

$$M_t^s = \gamma_0 + \gamma_1 MB_t + \gamma_2 (CC/DD)_t + \gamma_3 r_t$$

EQUILIBRIUM CONDITION:

$$M_t^d = M_t^s = M_t$$

Model II

MONEY DEMAND:

$$\text{Log} (M^d/p)_t = \alpha_0 + \alpha_1 \log (Y/p)_t + \alpha_2 \log r_t + \alpha_3 \log (M^d/p)_{t-1}$$

MONEY SUPPLY:

$$\log M_t^s = \beta_0 + \beta_1 \log MB_t + \beta_2 \log (CC/DD)_t + \beta_3 \log r_t$$

EQUILIBRIUM CONDITION:

$$M_t^d = M_t^s = M_t$$

In these models we have not attempted to incorporate the interlinkages between real and monetary sectors simply because it would amount to specifying an elaborate macro-econometric model, which, of course, is beyond the scope of the present study.

In the following sections we proceed to estimate these models and compare their predictive performance with single-equation models.

III. DATA AND METHODOLOGY

Data Sources and Associated Problems

The data used in this study cover the period from 1959-60 to 1983-84. For the purpose of estimation, money stock is defined as the sum of currency held by public and demand deposits in scheduled banks. For the period prior to 1971, the disaggregated data on this variable are taken from Kemal *et al.* [6] and for the period after 1971 from various issues of the *Bulletin* [17]. Three different types of interest rates have been tried in this study. These are average interest rate on time deposits (TDR), call-money rate (CMR), and average rate of interest on bank advances (AR).[3] The data on the two former series are gathered from [12] and [15], while the series for average rate of interest on bank advances is calculated from the data reported in [17] and from various issues of the *Report on Currency and Finance* [18]. The income variable used in this study is GNP. Data on this variable are taken from the *Pakistan Economic Survey 1984-85* [15]. Implicit GNP deflators are also calculated from the same *Survey* and are used to deflate nominal variables.

For monetary base, two different concepts are used in this study. While unadjusted monetary base (MB1) is defined as the sum of currency held by public vault cash and total bank reserves, the adjusted monetary base (MB2) is obtained by subtracting from MB1 the borrowings of commercial banks from the State Bank of Pakistan. The vault cash in Pakistan is held by commercial banks to meet daily transactions, and the level of banks' transactions depends on the amount of deposits in the banks, besides other things. It may be noted that the data on vault cash prior to 1971-72 are available only in combined form for the whole of Pakistan, which at that time also included former East Pakistan. We have now separated the data for the present Pakistan (former West Pakistan) from East Pakistan (now Bangladesh) by assuming that the vault cash held in the former West Pakistan (the present Pakistan) was in proportion to the sum of demand and time deposits in that part of the country. For demand and time deposits, separate data for East and West Pakistan are available in [6].

[3]It is important to note that the different interest rates available in Pakistan are highly correlated, e.g. the correlation of CMR with TDR and AR is found to be 0.91 and 0.96 respectively. Secondly, these interest rates differ from one another only by mark-ups.

Total bank reserves are the sum of statutory reserves and excess reserves. Since statutory reserve requirements were the same for both East and West Pakistan, the data on this variable could be divided between the two parts according to the proportion of deposits. In case of excess reserves, this method may involve some error but it is likely to be very small. Therefore, total reserves are divided between the two parts according to their respective proportions of deposits.

Finally, the ratio of currency to demand deposits is calculated on the basis of the data on currency and demand deposits available in [6] and [17].

Methodological Issues

As a first step, the two models mentioned in the previous section will be estimated with the help of OLS and 2SLS estimation procedures. Cochrane-Orcutt iterative procedure will also be applied to take care of the problem of autocorrelation, if and when it will be present.

In the second step, fitted values of the money demand and money supply functions obtained from the 2SLS procedure will be compared with the fitted values obtained from the OLS procedure to see whether simultaneity was a problem or not. In the third step, these estimated models will be used to obtain within-the-sample forecasts of nominal money-stock which is a target variable for policy-makers. An equilibrium solution will also be obtained and it is expected that the equilibrium solution will give better forecasts than single equation solutions. The predictive accuracy of these simultaneous-equation models will be assessed by comparing the forecast values with the actual values of money stock. The statistics used for this purpose will be the Theil Inequality Coefficient (TIC). Remember that the closer the value of TIC to zero, the better the forecasting performance.[4]

IV. ESTIMATION RESULTS

This section is devoted to the analysis and comparison of regression and forecasting results obtained after applying the OLS and 2SLS procedures of estimation on the two models reported above. Although a number of alternative specifications were tried for all the equations of the two models, the estimates reported here are those which were considered to be the best on the basis of standard statistics.[5]

Regression Results

Table 1 reports the estimated equations of Model I, while Table 2 gives the elasticity estimates calculated from the two estimation techniques.

[4] See Pindyck and Rubinfeld [16] for details.

[5] The estimates of other specifications are available from the authors.

Table 1

OLS and 2SLS Estimates of Model I

Mode of Estimation	Dependent Variable	Constant	Right-hand Side Variables	$\bar{R}^2$	D.W.	F
OLS			**Demand for Money Equation**			
	(M/p)	−1471.85 (−1.49)	$-0.005\ (Y/p)\ CMR + 0.28\ (Y/p) + 0.27\ (M/p)_{-1}$ (−1.51) (3.16) (1.17)	0.93	1.71	93.51
			Supply of Money Equation			
	M	9208.27 (3.71)	$1.68\ MB1 - 10236.8\ (CC/DD) + 189.32\ CMR$ (54.33) (−4.18) (1.13)	0.99	1.84	904.40
2SLS			**Demand for Money Equation**			
	(M/p)	−955.59 (−0.78)	$-0.003\ (Y/p)\ CMR + 0.20\ (Y/p) + 0.46\ (M/p)_{-1}$ (1.75) (1.84)	0.96	1.66	159.10
			Supply of Money Equation			
	M	9381.50 (3.43)	$1.68\ MB1 - 11164.9\ (CC/DD) + 287.79\ CMR$ (63.37) (−4.66) (1.33)	0.995	1.86	1465.24
			Equilibrium Condition			
			$M^d = M^s = M$			

Notes: 1. Figures in parentheses are *t*-values.
2. The symbols used in the above equations are defined as follows:
- M/p = Real Money Balances (in million rupees).
- M = Nominal Stock of Money (in million rupees).
- Y/p = Real Income (in million rupees).
- CMR = Call-Money Rate (percent).
- $MB1$ = Unadjusted Monetary Base.
- CC/DD = Currency to Demand Deposits Ratio.

Table 2

Estimates of Various Demand and Supply Elasticities for Model I

Elasticity of → ↓	With Respect to			
	(Y/p)	CMR	MB1	(CC/DD)
Demand for Real Money Balances (M^d/p)				
(i) Short-run (*OLS*)	1.19	–0.15		
(ii) Short-run (2*SLS*)	0.83	–0.08		
(iii) Long-run (*OLS*)	1.64	–0.20		
(iv) Long-run (2*SLS*)	1.53	–0.15		
Supply of Money (M^s)				
(i) *OLS*		0.04	0.96	–0.37
(ii) 2*SLS*		0.07	0.96	–0.40

The OLS estimates of the coefficients of the money demand function show that they are significantly different from zero at the 85–99-percent level of confidence and bear expected signs. The associated value of the adjusted R^2 is high, and the Durbin-Watson statistic shows absence of autocorrelation. When the same equation is estimated by 2SLS, the *t*-values in absolute terms for all the coefficients decrease with the exception of the lagged dependent variable. The value of the adjusted R^2 has increased and the Durbin-Watson statistics still shows no autocorrelation.

The OLS estimates of money supply function show that all variables are significant at the 85–99-percent level of confidence, with correct signs. The adjusted R^2 of the equation is 0.992, and the Durbin-Watson statistic shows absence of autocorrelation. When this equation is estimated by 2SLS procedure, all the *t*-values, except that of the intercept, are improved.

Table 2 shows that both the short-run and the long-run elasticities of money demand with respect to income obtained from OLS estimates are greater than unity. This indicates the presence of diseconomies of scale in money holdings. This finding conforms to the findings of earlier studies by Khan [7; 8] and Mangla [10]. On the other hand, the 2SLS estimates show that economies of scale are present in the short run. This result is in agreement with the earlier 2SLS results of Naqvi *et al.* [12]. The estimates of interest rate elasticity are all less than unity. These elasticities, obtained from the equations estimated by the 2SLS method, show some difference from those obtained from the equations estimated by the OLS method.

The elasticity of money supply with respect to the monetary base is not very sensitive to the methods of estimation. It stayed at 0.96 in both the cases. However, interest rate elasticity and the elasticity with respect to the ratio of currency to demand deposits are slightly greater (in absolute terms) for the 2SLS procedure than for the OLS procedure.

Both these findings reveal that there is a notable difference in the estimates obtained by the OLS procedure and by the 2SLS procedure, which suggests that the bias introduced by the application of the OLS procedure is not negligible.

Estimated equations of Model II are reported in Table 3. The money demand equation estimated by the OLS method shows that the explanatory variables have the expected signs and are significant at the 90–99-percent level of confidence. The adjusted R^2 and the Durbin-Watson statistics also have satisfactory values. The same equation, when estimated by the 2SLS procedure, shows that while the *t*-values for all the variables except that for the coefficient of lagged variable have decreased, the adjusted R^2 has shown some improvement.

The money supply equation estimated by the OLS procedure indicates that all the variables are significant at the 99-percent level of confidence, with correct signs. While the adjusted R^2 is high, the Durbin-Watson statistic is inconclusive. Application of the 2SLS procedure did not change the overall complexion of the equation.

Table 4 shows that although the values of income elasticity with respect to money stock are slightly different for the OLS and 2SLS estimates, these indicate that economies of scale are present only in the short run and not in the long run.[6] While short-run interest rate elasticities are –0.16 and –0.17 for OLS and 2SLS procedures respectively, the long-run elasticities are –0.25 and –0.30 respectively. In each case, these elasticity estimates are less than unity.

Table 4 also shows that the elasticity of money supply with respect to monetary base and (*CC/DD*) did not change much when the method of estimation was changed. However, for interest rate the elasticity estimate shows a change from 0.20 to 0.31 in the two estimation procedures.

A comparison of the estimates of Model I and Model II leads us to believe that the latter has some superiority over the former in the case of Pakistan.

Forecasting Results

In the previous sections, we argued that the use of a single demand or supply equation estimated by the OLS method to study the behaviour of money stock in the economy not only leads to biased and inconsistent estimates of regression

[6]As Naqvi *et al.* [12] have pointed out, this may be due to the increasing demand for money to match the secular monetization of Pakistan's economy.

Table 3

OLS and 2SLS Estimates of Model II

Mode of Estimation	Dependent Variable	Constant	Right-hand Side Variables			Key Statistics $\bar{R}^2$	D.W.	F
OLS			**Demand for Money Equation**					
	$\log(M/p)$	−2.66 (−2.26)	$0.84 \log(Y/p)$ (3.01)	$-0.16 \log CMR$ (−1.76)	$+0.36 \log(M/p)_{-1}$ (1.65)	0.94	1.78	112.32
			Supply of Money Equation					
	$\log M$	0.76 (2.79)	$0.97 \log MB2$ (29.09)	$-0.38 \log(CC/DD)$ (−3.72)	$+0.20 \log CMR$ (2.99)	0.987 0.987	1.18	549.36
2SLS			**Demand for Money Equation**					
	$\text{Log}(M/p)$	−2.49 (−5.51)	$0.76 \log(Y/p)$ (2.18)	$-0.17 \log CMR$ (−1.09)	$+0.44 \log(M/p)_{-1}$ (1.88)	0.96	1.75	165.04
			Supply of Money Equation					
	$\log M$	0.78 (4.04)	$0.94 \log MB2$ (29.60)	$-0.35 \log(CC/DD)$ (−3.53)	$+0.31 \log CMR$ (2.87)	0.995	0.81	1565.99
			Equilibrium Condition					
			$M^d = M^s = M$					

Notes:
1. Figures in the parentheses are *t*-values.
2. The symbols used in the above equations are defined as follows:

M/p = Real Money Balances (in million rupees)
M = Nominal Stock of Money (in million rupees).
Y/p = Real Income (in million rupees).
CMR = Call-Money Rate (percent).
MB2 = Adjusted Monetary Base (in million rupees).
CC/DD = Currency to Demand Deposits Ratio.

Table 4

Estimates of various Demand and Supply Elasticities of Model II

Elasticity of → ↓	With Respect to			
	(Y/p)	*CMR*	*MB2*	(CC/DD)
Demand for Real Money Balances (M^d/p)				
(i) Short-run (*OLS*)	0.84	−0.16		
(ii) Short-run (*2SLS*)	0.76	−0.17		
(iii) Long-run (*OLS*)	1.32	−0.25		
(iv) Long-run (*2SLS*)	1.36	−0.30		
Supply of Money (M^s)				
(i) *OLS*		0.20	0.97	−0.38
(ii) *2SLS*		0.31	0.94	−0.35

coefficients but also disregards the fact that the level of money stock in the economy is determined by the interaction of both demand and supply. In this section we try to further substantiate our argument by comparing forecasting ability of the single-equation demand as well as supply functions estimated by the OLS method with that of simultaneous-equation models estimated by the 2SLS procedure.

To evaluate the ability of various models to forecast money stock, we have compared the actual series of nominal money stock with that predicted by these models. The statistics used to compare the predictive performance of the various models is the Theil Inequality Coefficient (TIC). For both the models, viz. Model I and Model II, we have first obtained within-the-sample forecasts separately from demand and supply equations estimated by the OLS and 2SLS methods and calculated the associated values of TIC. Then the demand and supply equations estimated by the 2SLS method are simultaneously solved to get an equilibrium value of money stock. Historical forecasts of money stock are then obtained from this solution. TIC values are also calculated for these forecasts, and are presented in Table 5.

A glance at Table 5 makes it obvious that of the ten reported cases for Model I and Model II, the TIC values calculated for the equilibrium solution of the simultaneous system of equations estimated by 2SLS are better (except in one case) than the TIC values obtained from OLS or 2SLS estimates of a single demand or supply equation. This means that the ability of the simultaneous-equation model

Table 5

Theil Inequality Coefficients Obtained for Different Forecasts from Model I and Model II for the Period from 1959-60 to 1983-84

Method of Estimation	Theil Inequality Coefficients	
	Model I	Model II
Demand Equations		
OLS	0.06	0.005
2SLS	0.03	0.003
Supply Equations		
OLS	0.018	0.005
2SLS	0.009	0.006
Simultaneous Solution of Demand and Supply Equations estimated by *2SLS*	0.011	0.002

to track the actual historical behaviour of money stock is better than that of single-equation models. This supports our earlier claim that the level of money stock in the economy is neither completely demand-determined nor totally determined by supply factors. Rather it is determined by the mutual interaction of both demand and supply forces operating in the money market.

Table 5 also tells us that the forecasting performance of Model II is better than that of Model I.

V. CONCLUDING REMARKS

On the basis of the above analysis, it is clear that all the equations estimated for Model I and Model II are statistically very sound. Almost all the estimated coefficients are significant and bear the correct signs. All the equations successfully pass the 'goodness of fit' test as the adjusted R^2 is more than 0.93 in every case, and, except one equation, all the equations are free from autocorrelation. The forecasting performance of these models, as shown by the TIC values reported in Table 5, reveal that the margin of error for simultaneous solution is less than one percent for Model II and around one percent for Model I. On the other hand, for single-equation models, the forecasting error is less than one percent for Model II, and not more than 6 percent for Model I. This is an excellent showing for a developing country like Pakistan. Along with the above-mentioned virtues of the two models, the following two points are also worth mentioning.

Firstly, this study shows that the values of the estimated coefficients and the elasticities obtained by the equations estimated by the OLS procedure are, in general, different from those obtained with the 2SLS estimation procedure. The difference is particularly large in the case of short-run income elasticity of money demand obtained from Model II. Furthermore, both the short-run and long-run income and interest rate elasticities of money demand for Model I calculated on the basis of these two estimation techniques, are not close to each other. Similarly, interest rate elasticities of money supply obtained from Model II for the two procedures are also different from each other. This provides considerable support to the belief that the estimation of these equations by the OLS procedure involves a substantial amount of simultaneity bias.

Secondly, the forecasting exercise also shows that a simultaneous-equation model performs significantly better than the single-equation model in terms of its forecasting ability. For the present study, this is true for both Model I and Model II.

On the basis of the findings of the present study, we can safely conclude that the specification of money market in terms of a simultaneous-equation system is an improvement over the methodologies of the previous studies which have employed a single money demand or money supply equation, and most of which have used the OLS method of estimation.

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Comments on "Estimation of Money Demand and Money Supply Functions for Pakistan: A Simultaneous-equations Approach"

The paper aims at developing a simultaneous model of demand and supply to study the behaviour of Pakistan's money market and thus claims to be an improvement upon the single-equation models estimated earlier in this area. From the theoretical point of view, the paper is well motivated. Of course, in the presence of simultaneity, the simultaneous approach does have superiority over the single-equation model and, in the same fashion the two-stage least-squares estimation procedure is superior to the ordinary least squares.

However, before applying such a model to a particular economy, one must make sure that the financial structure prevailing in that economy does allow money supply to be determined behaviourally by market forces. Unfortunately, under the existing arrangements, monetary expansion in Pakistan is determined exogenously by the State Bank through the Credit Plan each year. This negates justification for estimating a supply function and hence using a simultaneous approach. At the most, one can work with a money-multiplier-type of technical relation to establish a link between expansion in total money and that in base or high-powered money. Alternatively, one can look into the rationale of the Credit Plan. Estimating a money supply function with interest rate as one of the explanatory variables, however, is totally unwarranted.

Now, looking at the demand side, the authors have adopted the Keynesian general demand for money function and estimated it under two specifications, linear Teigen equation and simple log-linear equation, both having real income, interest rate, and lagged dependent variable as regressors. Two theoretical issues emerge in this context.

(1) It remains completely unexplained why the lagged dependent variable has been included. The partial-adjustment mechanism, which serves as a basis for inclusion of this variable in most of the econometric work, has been rejected by the authors as it conflicts with the hypothesis they want to test in the paper, namely, money supply is not demand-determined. Then, contrary to the usual practice of using the lagged dependent variable as an instrument for estimating the equation containing Friedman's permanent income, the authors use permanent income as a means to introduce lagged variable. It seems quite strange that while being so insistent on including this variable, the authors have nowhere in the paper provided any rationale for doing so or any interpretation of its estimated coefficient or the

conditions under which this coefficient has been used for computing the long-run elasticities.

(2) The second issue relates to the use of interest rate in the demand-for-money function. It is justified to do so, provided the interest rate is a market-determined variable and the financial market is fairly developed so as to allow portfolio adjustments on the lines required for interest rate elasticity of demand for money to be significant. Again, unfortunately, in our case the financial market is very limited and the interest rate is an administered price, which, once fixed by the monetary authorities, tends to be constant over a substantial time period. Under these circumstances, it is not very meaningful to use interest rate in the demand function. This is also supported by the findings of the paper where the interest rate coefficient under both the models and with both the estimation procedures is statistically insignificant at the standard 95-percent confidence level. As an alternative, following the general practice in the case of developing countries, expected rate of inflation could have been used as the prime determinant of the opportunity cost of holding money.

Besides such theoretical issues, there are some issues related to the estimation and results of the demand function.

(a) In the estimation, the authors use a long time-series covering the 1960–84 period. Apart from the measurement error introduced in the data by arbitrarily allocating the combined money data for the whole of Pakistan between East and West Pakistan prior to 1971, this period entails a structural shift in Pakistan's economy as a result of the separation of East Pakistan. I wonder if, in their estimation, the authors have made any attempt to account for this shift.

(b) I also wonder if the authors, while running regressions, have made any transformation of the monetary data (a stock variable) with a view to relating it to the income data (a flow variable).

(c) In the linear equation, all the coefficients, except that of real income, are statistically insignificant. Yet the authors go on to compute elasticities from these coefficients, which obviously have no meaning.

(d) The reported income elasticities of demand for money of 1.53 in Model I and of 1.36 in Model II are unreasonably high in comparison with the representative elasticities that can be culled from the literature. The authors' conclusion that economies of scale are present only in the short run and not in the long run is a bit hasty one and does not seem to be correct. Basically, the elasticity estimates are biased, as they include the effect of monetization that occurred in Pakistan during the period under review. In order to derive a precise income-effect on demand for money, the monetization effect needs to be separated out. In this context, I would like to refer to a recent work on money demand in Latin America by Darrat [1] who, after allowing for monetization, found the long-run income elasticity to be 0.61 for Brazil, 0.92 for Chile, 1.09 for Colombia, and 1.31 for Peru.

(e) Lastly, because there seems to be a lot more room for improvement, the findings of the paper in its present form have little practical utility for policy-makers. The utility is further eroded by the indecisiveness of the authors as to which one among the several is the best estimate of the parameters. They report as many as eight estimates of income elasticity, which, because of having considerable dispersion, leave the readers in bewilderment.

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