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The Demand for Money in Pakistan: Some Further Results

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This paper thoroughly analyses the demand aspect of the money market and examines the determinants of the demand for money in Pakistan over the period extending from 1959-60 to 1977-78. Besides income and rate of interest on time deposits, the expected rate of inflation and degree of monetization appear to be the most important explanatory variables in the demand for money in Pakistan. The estimated function did not exhibit marked instability and can, therefore, be used for forecasting the money stock.

Money has an important influence on the level of economic activity. It plays a significant role in the determination of income, employment and prices. In pursuing a meaningful policy regarding money supply, the demand for money plays an important role. It is, therefore, necessary to find out the determinants of the demand for money because it is only on the basis of such knowledge that monetary policy can be pursued effectively.

The conduct of monetary policy in Pakistan should make it clear that demand for money has never been explicitly taken into consideration in determining the size of the money supply. For instance, high-powered money expansion has been mainly determined by the Government sector's borrowings for budgetary support and commodity operations. Credit expansion, which forms an integral part of money supply, is controlled by the Government through maximum limits set on advances for specific investment, but in practice such limits have nearly always been exceeded by a significant margin. This is an unsatisfactory state of affairs, for unless we have a fairly accurate estimate of the demand for money in the economy, optimal money supply cannot be determined. The results of the present study should therefore be particularly interesting for policy making. The demand aspect of the money market

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has been thoroughly analysed here and an attempt made to estimate the demand for money in Pakistan over the 1959-60 to 1977-78 period.

To identify the determinants of demand for money in the pre-1971 Pakistan, which also included East Pakistan (now Bangladesh), a number of studies have been made [1; 3; 34; 36]. Nevertheless, there are several good reasons for embarking on yet another such empirical effort. In the first instance, since all these studies estimated the money-demand function for approximately the same time period ending in 1970 or 1971, the policy implications suggested by them are not very relevant now as the structure of the economy has changed considerably since 1971. Secondly, Pakistan experienced a significant acceleration in the rate of inflation during the Seventies. And, finally, all earlier studies wholly ignored the growing monetization of Pakistan's economy – undoubtedly an important explanatory variable in the context of developing economies, and, therefore, in the context of Pakistan.

The plan of this study is as follows. Section I discusses the basic issues in the demand for money. The money-demand function in conventional as well as in extended form is analysed in Section II. A summary of the findings is reported in Section III. Section IV contains major policy implications of this study. Our main conclusions are given in Section V. A note comparing this study's main features with those of earlier studies is given as an appendix to the paper.

I. BASIC ISSUES

The basic issues involved in an estimation of the demand for money are of two types: (i) economic and (ii) technical. The main economic issues are as follows:[1]

(i) What should be the appropriate scale variable: income, permanent income or wealth?

(ii) Is the rate of interest an important explanatory variable? If yes, then which interest rate or rates should be used as an opportunity cost of holding money?

(iii) Are there any economies of scale in cash holding?

(iv) Do inflationary expectations have an independent role in the demand-for-money function?

(v) Does the growing monetization of the economy have any impact on the demand for money?

(vi) What sorts of lags appear to be present in the adjustment of money holdings and what rationale can be offered to explain those lags?

(vii) Has the demand function for money in Pakistan remained stable during the 1959-60 to 1977-78 period?

The technical issues concern the problems of serial correlation and simultaneous-

[1]The issues listed here are taken from Goldfeld [19].

equations bias in the demand for money. All these matters require an elaborate exposition and form the subject-matter of the present study.

The money-demand function has been widely used in both developed and developing countries. However, considerable controversy still envelops the issue of selecting an appropriate scale variable as an argument of the demand function. Economic theory offers little guidance because it is an empirical matter. The selection of the current income may suggest greater emphasis on the transaction motive for cash-balance holdings, whereas wealth or permanent income places greater emphasis on the asset-portfolio behaviour.[2] Empirical evidences with respect to scale variables are also very controversial. See, for example, [16; 30; 31; 32; 33; 34]. Since the choice of the appropriate scale variable is an empirical issue and the previous findings on it are controversial, we have used alternatively measured and permanent incomes in both nominal and real terms as a scale variable.[3]

The importance of the rate of interest in the demand-for-money function has been firmly established, at least theoretically. However, there is no agreement as to which interest rate is the relevant measure of the opportunity cost of holding money. Some writers, like Brunner and Meltzer [10], argue that long-term interest rate is more suitable while others, like Bronferbrenner and Mayer [9], Laidler [29], and Heller [23], argue in favour of short-term interest rate. The studies done by Gujrati [21], Adekunle [2], Singh [38], Wong [40] and Khan [28] show that in developing countries the virtual non-existence of a well-developed money market and the fact that interest rate is not determined by the free play of the market but is controlled by authorities, do not enable one to determine whether the interest rate affects the demand for money or not. In order to investigate whether interest rate plays any significant role in money-demand function in Pakistan, we have used inter-bank call-money rate (r_c), the annual yield on long-term Government bonds (r_g), and rate of interest on time deposits (r_T).

The effect of inflationary expectations on the demand for money seems to be controversial. On a strict transactions view of the demand for money, a variable measuring anticipated inflation seems to have no place.[4] On the other hand, in theoretical writings on demand-for-money function in the Chicago tradition, money serves as an alternative for physical goods, and the expected rate of inflation is given a prominent role.[5] This approach has been buttressed by empirical evidence from hyper-inflations. P. Cagan [11], studying the case of hyper-inflation, argued that the quantity of real cash balances tends to decline in contrast to its behaviour in mild inflation. His hypothesis is that changes in the real cash balances in hyper-inflation result from variations in the expected rate of inflation. Pakistan also experienced a

[2]See Feige and Pearce [14].

[3]Data on wealth are not available in Pakistan.

[4]As Ando and Shell [4] explain, inflationary expectations will be reflected to some extent in nominal interest rates and thus will indirectly affect the demand for money.

[5]See, for example, the various studies in Friedman [18].

very high rate of inflation during the post-1971 period.[6] It would be useful to analyse the effect of inflationary expectations on the demand for money in Pakistan.

As far as economies of scale in cash holding are concerned, they have a clear economic significance. An income elasticity greater than unity suggests the absence of economies of scale while that less than unity suggests their presence.[7] Empirical evidence with respect to economies of scale in cash holding is very controversial – see, for example, [7; 16; 29; 34; 39].

Monetization of economy is a continuous process in developing economies, invariably leading to increases in the demand for money in the economy. In the context of developing economies, the growing monetization of economy is an important determinant in the demand-for-money function. However, in earlier studies on Pakistan [1; 3; 34; 36] its impact on the demand for money was completely ignored.

One of the important issues in money-demand function is that of lags in adjustment between actual and desired money balances. Specifically, the issue is whether adjustment is instantaneous or whether it is lagged. And if it has lags, what are the factors causing them. Perhaps the most crucial and important issue in the estimation of any demand function is that of the stability of historically estimated relationship. A stable money-demand function is necessary for an effective monetary policy, particularly when the function is to be used for forecasting money stock. If the historically estimated function is found stable, it makes the job of the policy-maker much easier to forecast optimal money stock. This issue, which has not been examined previously in any great detail, will receive particular emphasis in this paper.

The technical issues, as mentioned above, deal with the problems of serial correlation and simultaneous-equation bias. To avoid the simultaneous-equation bias, it is generally assumed that money market is always in equilibrium and the variables which appear in the demand function do not belong to the money-supply function. We have made the same assumptions here and have applied the least-squares method, using a single-equation model, to estimate the demand for money. In the estimation of the money-demand function, one generally comes across the problem of serial correlation because of the time series data. In this paper wherever we face this problem, we adjust it by using Cochrane-Orcutt techniques.

II. THE MONEY-DEMAND FUNCTION

A. Conventional Form

In recent years, the conventional form of money-demand function has been used extensively in both developed and less developed countries to investigate the

[6] This was particularly so during 1973-74 and 1974-75 when the annual rate of inflation was as high as nearly 30 percent.

[7] Basically, the concept of 'economies of scale' has been used in industry but Baumol [7] and Tobin [39] introduced this term in the money-demand function also.

determinants of the demand for money. In this section we will examine whether the conventional form of money-demand function is still sufficient to investigate the determinants of demand for money or whether some more variables need to be examined in the context of our economy. Conventionally, the demand for money is a function of income (or permanent income) and the rate of interest, and can be written as

$$M_t^* = A\ Y_t^{a_1} R_t^{a_2} \tag{1}$$

where M* is the desired money balance, Y is either GNP or permanent income, R is the interest rate[8] and t represents time. a_1 and a_2 are income and interest rate elasticities respectively. We expect $a_1 > 0$ and $a_2 < 0$. Equation (1) is written in logarithmic form as

$$\ln M_t^* = a_0 + a_1 \ln Y_t + a_2 \ln R_t \tag{2}$$

In the empirical studies on demand for money, the choice of M_1 or M_2 as the dependent variable is controversial. Therefore, in this paper we have used both the narrow definition (i.e. M_1, consisting of currency in circulation and demand deposits) and the broader definition (i.e. M_2, comprised of currency in circulation, demand deposits and time deposits).[9] Similarly, we have estimated the function in both nominal and real terms.[10] In order to estimate the money-demand function in real terms, we have deflated the relevant variables by the implicit GNP deflator.[11] The analysis in this paper has been carried out on the basis of annual data[12] for the period 1959-60 to 1977-78. The annual data on components of money stock are taken from [27].

Since we have used both measured and permanent incomes as a scale variable, we need a permanent income series. Such series have been used for several studies in

[8] Ideally, it might have been better to use more than one interest rate or the entire term structure of interest rates. See Heller and Khan [24] for details. But due to high correlation among the interest rates we are constrained to use single rate of interest.

[9] In an unpublished study made at the Pakistan Institute of Development Economics, it was found that the degree of substitution exists between M_1 and time deposits, and, therefore, M_2 can also be used as a dependent variable.

[10] When the variables are defined in real terms, it is generally assumed that money illusion is absent.

[11] Consumer Price Index (CPI) series separately for West Pakistan are not available for the period 1959-60 to 1970-71. Therefore, our analysis has been carried out with the GNP deflator as the relevant variable for the expected rate of inflation.

[12] It might have been better to use quarterly data, because then it would have been possible to determine the lags involved in adjustment and also the seasonal pattern of demand which could be most helpful in policy formulation. But quarterly data are not available and consequently we had to depend on annual observations.

the money-demand function. See, for example, [16; 19; 29; 34]. For our analysis, we have calculated the permanent income series by fitting the equation[13]

$$Y_t = a_0 + a_1 Y_{t-1} + a_2 Y_{t-2} + a_3 t \qquad (3)$$

(a) Nominal Money-Demand Function

The estimates of equation (2) in nominal term corresponding to M_1 and M_2 definitions are reported in Table 1. Let us first discuss our results corresponding to the M_1 definition. The table shows that income and interest-rate elasticities possess the anticipated signs and the coefficients of Y (measured income) and Y_p (permanent income) are significantly different from zero. It is interesting to note that there is no significant difference between the permanent-income and measured-income elasticities. Judged by the size of the significant level reported in Table 1, the estimate of this important parameter (income) has strong economic implications. The income elasticities state that a one-percent increase in GNP or permanent income leads to an increase of about 1.04 – 1.11 percent increase in the demand for money in the economy.

The interest-rate variable, although it possessed the anticipated negative sign, is statistically insignificant, implying that it does not have any impact on the nominal money holdings.

Results corresponding to the M_2 definition are very similar to those corresponding to the M_1 definition reported above. The rate of interest is statistically insignificant while the income elasticities are highly significant. Similarly, there is no marked difference in the estimated coefficients of measured and permanent incomes which range from 0.90 to 1.09 and from 1.01 to 1.07 respectively. On the basis of these results one cannot definitely say whether the economies of scale in cash holding exist or not.

(b) Real Money-Demand Function

We estimated equation (2) in real terms also, and the results corresponding to both M_1 and M_2 definitions are reported in Table 2. The coefficients of measured income (y) and permanent income (y_p) possess the anticipated signs, are statistically significant, and are quite close to each other. However, the income elasticities of measured and permanent incomes estimated in real terms are significantly higher than the ones obtained through the estimation of equation (2) in nominal term. The elasticity increases to 1.44 for measured income and to 0.99 for permanent income.

[13] Mangla [34], following Rousser and Laumas [37], defined the permanent income in the following way, giving declining weights through time.

$$Y_{pt} = .4Y_t + .3Y_{t-1} + .2Y_{t-2} + .1Y_{t-3}$$

This permanent-income series is entirely arbitrary, has no time trend and has no visible relation to income.

Table 1

Estimated Coefficients of Nominal Money-Demand Function

No. of Equation	Dependent Variable	Constant (C)	Y	Y_p	r_c	r_T	R^2	DW	F
1	M_1	−1.47	1.02		−0.03		0.99	1.32	1208.34
		(−6.32)*	(42.8)*		(−1.15)				
2	M_1	−2.26	1.11			−0.19	0.99	1.31	1152.65
		(−1.48)*	(7.21)*			(−0.73)			
3	M_1	−0.79		1.04	−0.07		0.97	1.79	228.76
		(−2.75)*		(17.25)*	(−1.09)				
4	M_1	−0.74		1.04		−0.08	0.79	1.73	210.07
		(−1.09)		(5.57)*		(−0.24)			
5	M_2	−1.97	1.09		−0.02		0.98	1.42	680.32
		(−5.87)*	(31.99)*		(−0.60)				
6	M_2	−0.49	0.90			0.31	0.98	1.29	694.71
		(−0.29)	(4.21)*			(0.84)			
7	M_2	−0.73		1.07	−0.08		0.98	1.80	355.26
		(−3.32)*		(21.53)*	(−1.41)				
8	M_2	−0.55		1.01		0.02	0.98	1.82	307.18
		(−0.94)		(6.40)*		(0.06)			

Note: 1. All the equations are estimated in the log-linear form. C is the intercept term, Y is the nominal GNP, Y_p is the nominal permanent income, r_c is the inter-bank call-money rate and r_T is the rate of interest on time deposits.

2. The t-values are given in parentheses and a star (*) indicates that coefficients are statistically significant at the 95-percent confidence level.

3. R^2 was also calculated but as its value was invariably very close to that of R^2, it has not been given here.

Table 2

Estimated Coefficients of Real Money-Demand Function

No. of Equation	Dependent Variable	Constant (C)	y	y_p	r_c	r_T	R^2	DW	F
1	m_1	−6.48 (−12.1)*	1.06 (19.4)*		−0.03 (−1.34)		0.96	1.39	263.35
2	m_1	−9.93 (−5.18)*	1.44 (6.33)*			−0.31 (−2.02)*	0.97	1.59	267.84
3	m_1	−2.57 (−3.48)*		0.99 (6.00)*	−0.05 (−0.74)		0.78	1.76	23.13
4	m_2	−15.17 (−8.24)*	2.02 (10.01)*			−0.59 (−3.95)*	0.98	1.85	434.43
5	m_2	−2.96 (−4.70)*		1.11 (7.91)*	−0.06 (−0.99)		0.86	1.86	40.05
6	m_2	−8.43 (−12.87)*	1.28 (19.28)*		−0.03 (−1.14)		0.97	1.37	234.04

Note: 1. All the equations are estimated in the log-linear form. y is the real income, i.e. GNP is divided by the implicit GNP deflator. y_p is the real permanent income. Rest of the variables are as defined in Table 1.
2. The t-values are given in parentheses and a star (*) indicates that coefficients are statistically significant at the 95-percent confidence level.
3. $\bar{R}^2$ was also calculated but as its value was invariably very close to that of R^2, it has not been given here.

This is important for the policy-maker because an elimination of the price effect from the function increases the income elasticity considerably.

The rate of interest on time deposits shows a statistically significant negative relationship with the demand for money.[14] It may be noted that when the function was specified in nominal term, the interest rate turned out to be statistically insignificant. It is important to note that this result shows that money holding in Pakistan is sensitive to interest rate.

The income elasticities increase significantly when M_1 is replaced by M_2. The elasticity increases to 2.02 for measured income and to 1.11 for permanent income. Interest rate remains a significant variable in influencing the demand for money which strengthens our earlier finding that money holdings in Pakistan are sensitive to interest rate.

The estimates of equation (2) give us long-run income and interest rate elasticities. However, we are also interested to see how long the actual money stock takes to adjust itself to the desired level. In order to estimate the speed of adjustment we have specified a partial-adjustment mechanism: the adjustment between the desired and the actual money balances is not instantaneous. Since the discrepancy between what people would like to hold and what they actually hold is only partially eliminated, we may write the adjustment function[15] as

$$(M_t/M_{t-1}) = (M_t^*/M_{t-1})^\lambda \tag{4}$$

where M_t is the actual money balances at time t and M_{t-1} is the actual money balances at time (t−1) period. λ is the coefficient of adjustment where $0 \leqslant \lambda \leqslant 1$. Equation (4) in logarithmic form is as under:

$$\ln M_t - \ln M_{t-1} = \lambda(\ln M_t^* - \ln M_{t-1}) \tag{5}$$

There is an important distinction between nominal adjustment and real adjustment mechanisms, as pointed out by Goldfeld [20]. Following Goldfeld, we write equation (5) in both real and nominal terms as

$$\ln m_t - \ln m_{t-1} = \lambda(\ln m_t^* - \ln m_{t-1}) \tag{6}$$

and $$\ln M_t - \ln M_{t-1} = \lambda(\ln M_t^* - \ln M_{t-1}) \tag{7}$$

where m is the actual real money stock and $M_t^* = m_t^* P_t$ or $m_t^* = M_t^*/P_t$.

Combining equation (2) in real terms with equation (7) yields

[14]We also tried r_g (annual yield of Government bond). Though it was statistically significant, it possessed the wrong sign. The results of regression incorporating r_g are therefore excluded.

[15]For details on this, see Feige [13].

$$\ln M_t = \lambda a_o + \lambda a_1 \ln Y_t + \lambda a_2 \ln R_t + (1-\lambda) \ln M_{t-1} \quad (8)$$

and combining equation (2) in real terms with equation (7) yields

$$\ln (M_t/P_t) = \lambda a_0 + \lambda a_1 \ln y_t + \lambda a_2 \ln R_t + (1-\lambda) \ln (M_{t-1}/P_t) \quad (9)$$

It may be noted that if we combine equation (2) in real terms with equation (6) we get equation (9) with the difference that the lagged dependent variable is: m_{t-1} equals M_{t-1}/P_{t-1} instead of M_{t-1}/P_t. In the real-adjustment version, deflating lagged nominal money balances by lagged prices implies that a reduction of the lagged value of the nominal money stock due to rising prices is subject to immediate adjustment. In the nominal-adjustment version, deflating lagged nominal-money balances by current prices implies that such a reduction is subject to partial or lagged adjustment.[16] Therefore, Goldfeld argues that the use of nominal-adjustment mechanism is more plausible than that of the real-adjustment model.

We estimated both equations (8) and (9) to take into account the partial-adjustment mechanism in both nominal and real terms and the results are reported in Tables 3 and 4 respectively. In Table 3, we have reported the estimated coefficients of the nominal-money demand based on equation (8), corresponding to the M_1 and M_2 definitions. The coefficient of lagged money supply is statistically insignificant. The coefficient of adjustment[17] (λ) is close to unity, implying that the actual money balances adjust themselves to the desired level of money balances within one year. Consequently, short-run income and interest-rate elasticities are not very different from the long-run elasticities.

Table 4 reports the estimated coefficients of the real money-demand function based on equation (9), corresponding to the M_1 and M_2 definitions of money. The lagged money supply variable in the real demand fuction is statistically significant, suggesting a lag in the adjustment. The coefficient of adjustment (λ) ranges from 0.47 to 0.53 for M_1 and from 0.36 to 0.50 for M_2. These results suggest that the long-run elasticities are in general two to three times the short-run elasticities.

B. Extended Form

To this point we have used the widely studied conventional money-demand function in the long run and the short run with income and rate of interest as argument. Although this form of demand function performed well in explaining the demand for money in Pakistan, yet there are certain factors peculiar to particular economies which may also influence the money-demand function, and a failure to accommodate such factors may vitiate the results in some cases.

[16] The nominal adjustment mechanism discussed here is also used in the MPS (MIT-Penn Social Sciences Research Council) demand deposits equation. See [25].

[17] The co-efficient of adjustment (λ) is obtained from (1 minus co-efficient of M_{t-1}).

Table 3

Estimated Coefficients of Nominal Money-Demand Function

No. of Equation	Dependent Variable	Constant (C)	Y	Y_p	r_c	r_T	Lagged Variable	R^2	DW	F
1	M_1	−1.45	1.01		−0.04		0.0004	0.99	1.42	766.59
		(−5.89)*	(38.1)*		(−1.22)		(0.47)			
2	M_1	−2.45	1.14			−0.24	0.003	0.99	1.35	726.38
		(−1.78)*	(6.63)*			(−0.79)	(0.35)			
3	M_1	−1.95		1.07	−0.04		0.004	0.99	1.28	1245.92
		(−9.61)*		(48.6)*	(−1.69)		(0.57)			
4	M_1	−2.70		1.16		−0.18	0.002	0.99	1.10	1087.19
		(−2.47)*		(8.55)*		(−0.77)	(0.24)			
5	M_2	−1.36	1.07		−0.04		0.02	0.98	1.10	720.79
		(−5.51)*	(29.5)*		(1.11)		(1.37)			
6	M_2	−2.40		1.14	−0.05		0.01	0.99	1.003	720.79
		(−8.29)*		(36.2)*	(−1.47)		(1.63)			

Note: 1. All the variables are defined in Table 1.
2. The t-values are given in parentheses and a star (*) indicates that coefficients are statistically significant at the 95-percent confidence level.
3. R^2 was also calculated but as its value was invariably very close to that of R^2, it has not been given here.

Table 4

Estimated Coefficients of Real Money-Demand Function

No. of Equation	Dependent Variable	Constant (C)	y	y_p	r_c	r_T	Lagged Variable	R^2	DW	F
1	m_1	−3.66 (−3.61)*	0.56 (3.39)*		−0.03 (−1.40)		0.53 (3.08)*	0.98	1.64	198.10
2	m_1	−5.27 (−1.80)*	0.76 (1.98)*			−0.12 (−0.69)	0.47 (2.13)*	0.97	1.71	179.29
3	m_1	−3.73 (−3.95)*		0.58 (3.72)*	−0.04 (−1.56)		0.51 (3.04)*	0.98	1.52	216.60
4	m_2	−3.60 (−3.26)*	0.53 (3.18)*		−0.03 (−1.19)		0.64 (4.64)*	0.98	1.38	303.70
5	m_2	−7.28 (−2.02)*	0.98 (2.14)*			−0.23 (−1.18)	0.50 (2.49)*	0.98	1.63	302.96
6	m_2	−3.52 (−3.38)*		0.52 (3.30)*	−0.03 (−1.28)		0.64 (4.80)*	0.98	1.19	313.50

Note: 1. All the variables are defined in Tables 1 and 2.
2. The t-values are given in parentheses and a star (*) indicates that coefficients are statistically significant at the 95-percent confidence level.
3. $\bar{R}^2$ was also calculated but as its value was invariably very close to that of R^2, it has not been given here.

(a) Expected Rate of Inflation

It is reasonable to expect that the expected rate of inflation should be an important influence on the demand for money in Pakistan, particularly during the Seventies when a two-digit inflation prevailed. In this sub-section we shall examine whether inflationary expectations have played an independent role in the demand-for-money function.

Equation (2) is accordingly modified to include an expected rate of inflation, $\dot{P} = \frac{dp}{dt}$, which, following Goldfeld [19], is defined as

$$\dot{P}_t = \frac{P_t - P_{t-1}}{P_{t-1}}$$

On modification, our equation (2) can be written as

$$\ln M_t^* = a_0 + a_1 \ln y_t + a_2 \ln R_t + a_3 \ln \dot{P}_t \qquad (10)$$

We estimated equation (10) in both nominal and real terms. The expected rate of inflation turned out to be a statistically insignificant variable in the money-demand function. As will be seen later, the main reason for this result is that during the time period covered in this analysis the rate of inflation was low. Inflation as an argument in the money-demand function is important when it is relatively high.

(b) Monetization

Monetization of the economy is continuously expanding in developing countries. It should, therefore, be an important determinant of growth in the demand for money over time. To capture the "monetization effect", we have extended the set of explanatory variables by adding another variable, bank branches (B). The modified relation is

$$\ln M_t^* = a_0 + a_1 \ln y_t + a_2 \ln R_t + a_3 \ln \dot{P} + a_4 \ln B \qquad (11)$$

We estimated equation (11) in both nominal and real terms and the regression results corresponding to M_1 and M_2 definitions are reported in Table 5 which shows that the bank-branches variable has the expected positive sign and is significantly different from zero. This is because in the early stage of development there prevailed a significant preference for cash in Pakistan, but the growth of the banking habit over time, the opening of new bank branches within the country, and the payment of reasonable rates on time deposits have led to the growth of the demand and time deposits respectively. Since demand and time deposits are also components of money stock, their growth over time also increases the demand for money because

Table 5

Estimated Coefficients of Nominal and Real Money-Demand Functions with Bank Branches

No. of Equation	Dependent Variable	Constant (C)	Y or y	Y_p or y_p	r_c	r_T	B	R^2	DW	F
1	M_1	–3.46 (–3.58)*	1.18 (10.2)*			–0.71 (–2.93)*	0.17 (3.76)*	0.99	1.81	1399.58
2	M_2	–2.52 (–2.52)*	1.03 (8.51)*			–0.55 (–2.22)*	0.29 (6.12)*	0.99	1.21	1529.92
3	M_2	–2.65 (–5.20)*		0.98 (16.81)*		–0.47 (–4.00)*	0.34 (12.21)*	0.99	1.68	4922.62
4	M_2	–0.31 (–2.17)*		0.79 (13.26)*	–0.04 (–1.26)		0.27 (5.40)*	0.99	1.49	760.79
5	m_2	–6.35 (–7.96)*		0.88 (9.73)*		–0.50 (–7.78)*	0.36 (11.40)*	0.99	1.74	975.19

Note: 1. All the equations are estimated in the log-linear form. B is the number of bank branches. Rest of the variables are defined in Tables 1 and 2.
2. The t-values are given in parentheses and a star (*) indicates that coefficients are statistically significant at the 95-percent confidence level.
3. $\bar{R}^2$ was also calculated but as its value was invariably very close to that of R^2, it has not been given here.

demand and time deposits may be used for transaction and precautionary motives respectively. Furthermore, the inclusion of the variable into the specification of money-demand function has improved the results. Both income and interest-rate elasticities increased considerably.

Stability Test

We will now turn to an examination of the stability of the money-demand function which may be used for forecasting money stock. An historically estimated function that is stable over time is of profound help to the policy-makers in forecasting money stock. It is, therefore, important to examine the stability of the estimated function.

We will now present various tests of the stability of the demand for money. In order to investigate whether a structural shift in Pakistan's economy has taken place or not due to the 1971 debacle we conduct covariance analysis, i.e.

$$\ln M_t^* = \alpha_0 + \alpha_1 \ln Y_t + \alpha_2 \ln R_t + \alpha_3 D + \alpha_4 D(\ln Y_t) + \alpha_5 D(\ln R_t) \qquad (12)$$

where D is the dummy variable, giving zero to the 1959-71 period and one to the 1971-78 period. It is important to note that dummy variables are both additive and multiplicative to allow for differential intercept and differential slopes respectively. We estimated equation (12) in both nominal and real terms, using alternatively rate of interest and expected rate of inflation as the opportunity cost of holding money corresponding to the M_1 and M_2 definitions and reported in Tables 6 and 7 respectively. These tables show that both the intercept and the slope of the function between the two time periods, viz. pre-1971 years and post-1971 period, differ significantly. These results suggest a structural shift in the economy which may be attributed to two main factors. Firstly, the year 1971 saw the disintegration of the country. Before 1971 the country consisted of two wings which were economically very much interdependent but the breakaway of one wing of the country necessitated a restructuring of the economy of the residuary wing, West Pakistan (now Pakistan). Secondly, the inflation rate which was very low until 1971 increased to well above ten percent after 1972. This study shows that the estimated coefficient of the expected rate of inflation was insignificant for the period 1959-60 to 1970-71 while it turned out to be statistically significant in the second period.[18]

These results suggest that there had been a structural shift in 1971, but for forecasting we have to be sure that the function was stable during the 1971-78 period. Since we have a limited number of observations after 1971, the analysis of covariance is not possible. We have, therefore, used a relatively weaker test – Chow test – which reveals that the function is stable. It follows that the function relating to the 1971-78 period can be used for forecasting money supply.

[18]It may be noted that when interest rate is taken as the opportunity cost of holding money, both the intercept and the slopes were statistically insignificant.

Table 6

Estimated Coefficients of Nominal Money-Demand by Analysis of Covariance

No. of Equation	Dependent Variable	Constant (C)	Y	Y_p	$\dot{P}$	D	D(Y)	$D(Y_p)$	$D(\dot{P})$	R^2	DW	F
1	M_1	−1.42 (−4.35)*	1.01 (31.15)*		0.05 (2.07)*	1.41 (2.79)*	−0.08 (−1.79)*		−0.18 (−5.75)*	0.99	1.99	1490.00
2	M_1	−1.52 (−4.35)*		1.02 (29.48)*	0.02 (2.77)*	0.93 (1.87)*		−0.06 (−1.18)	−0.08 (−2.54)*	0.99	1.21	1337.21
3	M_2	−3.55 (−9.41)*	1.24 (33.49)*		0.01 (1.47)	3.69 (6.33)*	−0.29 (−5.61)*		−0.19 (−5.27)*	0.99	1.73	1318.05
4	M_2	−3.66 (−8.45)*		1.26 (29.41)*	0.02 (2.09)*	3.19 (4.66)*	−0.27 (−4.44)*		−0.09 (−2.27)*	0.99	0.88	1020.63

Note: 1. D=1 for 1971-78.
2. $\dot{P}$ is the expected rate of inflation. Rest of the variables are defined in Table 1.
3. The t-values are given in parentheses and a star (*) indicates that coefficients are statistically significant at the 95-percent confidence level.
4. $\bar{R}^2$ was also calculated but as its value was invariably very close to that of R^2, it has not been given here.

Table 7

Estimated Coefficients of Real Money-Demand by Analysis of Covariance

No. of Equation	Dependent Variable	Constant (C)	y	y_p	$\dot{P}$	D	D(y)	$D(y_p)$	$D(\dot{P})$	R^2	DW	F
1	m_1	−6.12 (−12.9)*	1.01 (21.4)*		0.01 (2.11)*	4.29 (2.83)*	−0.35 (−2.51)*		−0.18 (−5.96)*	0.99	1.93	301.89
2	m_2	−6.34 (−11.2)*		1.04 (18.3)*	0.01 (1.61)	3.73 (1.98)*		−0.31 (−1.76)*	−0.17 (−4.78)*	0.98	1.25	223.03
3	m_2	−9.45 (−18.5)*	1.38 (27.02)*		0.01 (1.75)*	6.85 (4.27)*	−0.61 (−4.01)*		−0.19 (−5.88)*	0.99	1.89	387.94
4	m_2	−9.74 (−14.78)*		1.41 (21.37)*	0.01 (1.61)	6.36 (2.90)*		−0.57 (−2.75)*	−0.18 (−4.31)*	0.98	1.04	244.13

Note: 1. D=1 for 1971-78.
2. All the variables are defined in Tables 1, 2 and 6.
3. The t-values are given in parentheses and a star (*) indicates that coefficients are statistically significant at the 95-percent confidence level.
4. $\bar{R}^2$ was also calculated but as its value was invariably very close to that of R^2, it has not been given here.

III. A SUMMING UP

In the process of sequentially examining each of the issues set forth at the beginning of this paper, a considerable amount of information has been generated concerning the nature of the demand for money in Pakistan. This section presents a summary of these findings.

The apparent sturdiness of the conventional form of the money-demand function has been scrutinized in Pakistan's context. The study shows that the conventional equation performs well and yields sensible interest and income elasticities. It is found that the measured-income and permanent-income elasticities are exceedingly close to each other. Hence there is nothing to choose between measured income and permanent income as a scale variable in the money-demand function, though the measured income is slightly better. As regards the economies of scale in cash holdings, our study does not provide any conclusive evidence about their existence or absence because the income elasticity ranges between 0.79 and 2.02.

The debate in the literature over interest rates initially centred on whether any interest rate really mattered. In recent years, with this question settled, discussion has turned to the appropriate rate or rates to be included in the money-demand function. This is an empirical issue and cannot be decided by an *a priori* reasoning alone. Our study shows clearly that the demand for money is sensitive to the changes in interest rate. The rate of interest on time deposits is found to be a significant explanatory variable in the money-demand function.

On the overall performance of the conventional equation, the real money-demand function performed better than the nominal money-demand function. This is not surprising as people are mainly interested in the services that money provides and not in the absolute nominal sum of money. In other words, by and large, people do not suffer from money illusion.

As regards lags in the adjustment of money holdings, it is found that the actual money balances adjust to the desired level within one year when money-demand function is estimated in nominal form. This is because an increase in the price level induces an immediate increase in nominal money holdings to equate the real value of last period's nominal money holdings to the currently desired level. Since the adjustment coefficient is close to unity, the short-run and the long-run income and interest rate elasticities are very close to each other. On the other hand, when the money-demand function is estimated in real terms, the actual and desired money balances adjust only partially. The adjustment coefficient ranges from 0.36 to 0.53 depending upon the definition of money. This is because when price level increases the realization of its impact on money holdings in real term takes time. As a result, we have time lags in adjustment between the actual and desired money holdings. Since the discrepancy between the actual and desired money holdings is not

eliminated in one year, the short-run and the long-run income and interest rate elasticities differ considerably. In general, the long-run elasticities are 2-3 times as great as the short-run elasticities.

The question of the stability of the function has also been examined. In the first instance, the covariance analysis shows that the economy experienced a structural shift in 1971. Both the intercept and the slopes are statistically significant. This structural shift in the economy is attributed to two main factors: (i) the break-away of one part of the country, and (ii) the high rate of inflation during the Seventies. In the second instance, in order to investigate whether the function estimated for the period from 1959-60 to 1977-78 displays any marked instability and whether this historically estimated function can be used for forecasting, we performed the Chow test. The test revealed that the function exhibited no marked instabilities and that the function could be used for forecasting money stock.

While the conventional equation performs well, it is nevertheless possible to improve on it. An addition of a number of variables, e.g. the effect of the expected rate of inflation and the impact of monetization on the demand for money, appears to improve the performance of the standard formulation. As regards the effect of the expected rate of inflation on the demand for money, we did not find it to be significant for the 1959-71 period because inflation was very low until 1971. However, we did find its impact on money demand to be significant for the post-1971 years when the inflation rate was well above ten percent.

The growing monetization of the economy seems to be an important explanatory variable in money-demand function in the context of developing economies. Monetization increases the demand for money in the economy. Our study found that this variable had a significant impact on the demand for money. Therefore, besides income and interest rates, the policy-makers should also take into consideration the effect of the expected rate of inflation and the impact of monetization as determinants of the money-demand function.

IV. POLICY IMPLICATIONS

It has always been implicitly assumed by monetary authorities in Pakistan that money supply can be determined in isolation from the demand for money. Apart from credit expansion to private and public sectors, money expansion in Pakistan has been mainly determined by the Government sector borrowings for budgetary support and commodity operations. As a result, money supply expanded at a compound growth rate of 18.3 percent during the Seventies. The high rate of monetary expansion was the result of not maintaining a definite relationship between monetary creation and increase in national output.[19] For an appropriate monetary policy, it is

[19] The money supply must grow at the same rate as nominal income ($\dot{Y}$), i.e. it should follow the rule

$$\dot{M} = \dot{Y} = \dot{y} + \dot{P}$$

where $\dot{y}$ is the growth of real GNP, and $\dot{P}$ is the expected rate of inflation. $\dot{M} > \dot{Y}$ builds inflationary pressure and $\dot{M} < \dot{Y}$ leads to stagnation. See Branson [8].

necessary to analyse the demand side of the money market also. One ought to know what the desired demand for money is in the economy corresponding to the changes in national income and interest rate so that money supply can be expanded accordingly. The findings of this paper provide a tentative answer to this question. It would certainly have been more helpful to the policy-makers if we had studied the demand for money by using quarterly data. Such data, however, were not available.

In Table 8 below, we report the relevant elasticities of income, interest rate and monetization which can be extremely useful in determining the total demand for money in the economy.

Table 8

Estimates of Elasticity of Money Demand

Dependent Variables	Elasticity of Money Demand with Respect to			
	Y	Y_p	B	r_T
M_1	1.18	1.04	0.17	–0.18 to –0.71
m_1	1.44	–	–	–0.31
M_2	1.03	0.98	0.29 to 0.34	–0.47 to –0.55
m_2	2.02	–	–	–0.59

These elasticities explain how a one-percent increase in national income or interest rate or bank branches will affect the demand for money stock in the economy. For instance, if GNP (in real terms) increases by one percent, the money stock, defined broadly (in real terms), should increase by 2.02 percent. Similarly, if the rate of interest on time deposits (r_T) increases by one percent, the money stock, defined broadly (in real terms), should decrease by 0.59 percent. As far as the effect of monetization is concerned, a one-percent increase in bank branches would lead to an increase of 29 percent to 34 percent in demand for money stock, defined broadly (in nominal terms). Once the policy-maker determines the total demand for money in the economy, the money supply could be expanded accordingly.

V. CONCLUSIONS

In this paper we have re-examined the demand for money in Pakistan and have found income, rate of interest on time deposits, the expected rate of inflation and degree of monetization to be the most important explanatory variables which explain 99 percent of the variation in the demand for money. We did not find any evidence supporting the argument that permanent income was a better explanatory variable than measured income in the demand-for-money function. This is due to the fact

that there is no difference in permanent and measured incomes in Pakistan because of the low per capita income and the agro-based character of Pakistan's economy. As regards the economies of scale in cash holdings, our study does not provide any conclusive evidence for their existence or their absence.

As far as the rate of interest is concerned, we have found that interest rate does affect the demand for money and that the rate of interest on time deposits is a significant explanatory variable in the demand-for-money function.

As far as the expected rate of inflation is concerned, we did not find its impact on demand for money to be significant for the 1959-71 period because inflation was very low until 1971. However, we did find its impact on money demand to be significant after 1971 because the inflation rate was well above ten percent. In addition, conventional equation exhibits no marked instabilities.

Finally, the actual money balances adjust themselves to the desired level within one year when money-demand function is estimated in nominal terms. On the other hand, when the money-demand function is estimated in real terms, the actual and desired money balances adjust only partially. The adjustment coefficient ranges from 0.36 to 0.53, depending upon the definition of money.

Appendix

A COMPARISON OF THE FINDINGS OF THIS STUDY WITH THOSE OF OTHER STUDIES

It is interesting and useful to compare our results with those of earlier similar studies on Pakistan. Our findings contradict those of the earlier studies in many respects. A tabular survey of the previous findings on Pakistan is presented in the table below. Mangla [34] in his study found marked differences in income elasticities for measured and permanent incomes. On the basis of his findings, he claimed that permanent income was a better explanatory variable than measured income. Our finding reverses that of Mangla, as we did not find significant differences between measured-income and permanent-income elasticities. Support for our finding is provided by Laumas [30], Adekunle [2], Mammen [33] and Liu [32]. They all found that permanent-income and measured-income elasticities were very close to each other for the Indian economy. On the basis of this result, they argued that measured income could substitute permanent income in the context of underdeveloped countries. They believed that unanimity in the coefficients of the measured and permanent incomes was due mainly to an agriculture-based economy with a low level of per capita income. Several economists have anticipated this result on an *a priori* basis.[1]

Our finding also contradicts another of Mangla's findings that r_c (inter-bank call-money rate) is a significant variable because we did not find this rate significantly affecting the demand for money.

As far as the expected rate of inflation is concerned, only Abe *et al.* [1] found this variable significantly affecting the demand for money. It is surprising to us because the time-period covered by them experienced a very low rate of inflation. Our finding is contradictory to theirs because we did not find the expected rate of inflation to be a significant variable in the demand for money in the analysis of the whole period (1959-60 to 1977-78). However, we did find that this variable significantly affected the money-demand function in the post-1971 period when the rate of inflation was well above ten percent.

As regards the economies of scale in cash holdings, our study does not provide any conclusive evidence about their existence or absence while Mangla's finding rejected their presence categorically.

[1]For example, Irving Fisher [15, pp. 94-95] once observed; "a small income implies a keen appreciation of future wants as well as of immediate wants. Poverty bears down heavily on all parts of a man's life, both that which is immediate and that which is remote. But it enhances the utility of immediate income more than that of future income. This result is partly rational, because of the importance of supplying present needs of keeping up the continuity of present life and the ability to cope with the future, and partly irrational because the pressures of the present need blind one to the needs of the future". Zellner [41, pp. 565] and Lokanathan [31, pp. 28-29] have offered similar views.

Appendix

Table 1

Tabular Survey of the Previous Findings on Pakistan's Money-Demand Functions

No. of Equation	Author	Dependent Variables	C	Y	Y_p	y	y_p	r_c	r_g	$\dot{P}$	Lagged Variable	R^2	DW	F	Period
1	Mangla	M_1	−9.77 (3.42)*	1.80 (5.77)					−0.62 (−.645)			0.98	1.27	304.1	1958-71
2	Mangla	M_1	−4.45 (3.50)*	1.27 (9.88)*				−0.16 (−1.70)				0.97	1.35	306.1	1958-71
3	Mangla	m_1	−6.42 (−1.96)*			1.39 (4.28)*			0.48 (3.65)*			0.93	1.13	75.3	1958-71
4	Mangla	m_1	−4.66 (−4.10)*			1.53 (7.34)*		−0.18 (−2.06)*				0.94	1.34	44.8	1958-71
5	Mangla	m_1	−12.30 (−6.19)*				2.88 (8.66)*	.009 (.238)				0.95	1.50	99.6	1958-71
6	Akhtar	m_1	−4.288			1.471 (6.799)*		−0.142 (−1.557)		0.034 (1.573)		0.962	0.911	–	1958-70
7	Akhtar	m_2	−6.812			1.943 (9.645)*		−0.111 (−1.311)		0.027 (1.352)		0.984	0.983	–	1958-70
8	Abe *et al.*	$\frac{m_1}{N}$	−2.075 (−1.648)			0.621 (3.141)*		−1.418 (−1.413)		−0.916 (−3.087)*	0.652 (6.659)*	0.922	2.062	41.49	1958-70

Note: 1. C is the intercept term. Y and Y_p are the nominal GNP and nominal permanent income respectively. y is the real GNP and y_p is the real permanent income. r_c and r_g are the inter-bank call-money rate and Government bond rate respectively. $\dot{P}$ is the expected rate of inflation.

2. The t-values are given in parentheses and a star (*) indicates that coefficients are significant at the 95-percent confidence level.

3. $\bar{R}^2$ was also calculated but as its value was invariably very close to that of R^2, it has not been given here.

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